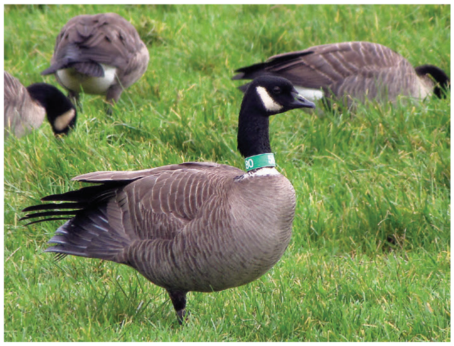
U.S. Fish & Wildlife Service

Nestucca Bay National Wildlife Refuge

Comprehensive Conservation Plan



A Vision of Conservation

Coastal prairie, wooded uplands, managed pastures, and salt marsh provide a mosaic of habitats for fish and wildlife at Nestucca Bay National Wildlife Refuge. The verdant pastures lining Nestucca Bay are a winter haven for thousands of Canada geese while the restored tidal marshes are nursery habitat for salmonids.

Through refuge trails and overlooks and hands-on environmental education programs we will strive to inspire visitors to act wisely to preserve the wide diversity of healthy habitats and the abundance of wildlife that characterize the Refuge.

Deep in Neskowin Marsh rare sedge fen, shrub carr, and sphagnum bogs are surrounded by a forested lagg and shelter endemic plants. The rich soils of the marsh, with their alternating layers of peat and sand, harbor a well preserved history of tsunami activity. With minimal human influence, the rare habitats of the marsh will continue to recover and evolve.

Working together with our partners, friends, and volunteers, the future of this Refuge will reflect a commitment to adapt to the realities of climate change and a dedication to wildlife conservation.

Comprehensive Conservation Plans provide long-term guidance for management decisions and set forth goals, objectives, and strategies needed to accomplish refuge purposes and identify the Service's best estimate of future needs. These plans detail program planning levels that are sometimes substantially above current budget allocations and, as such, are primarily for Service strategic planning and program prioritization purposes. The plans do not constitute a commitment for staffing increases, operational and maintenance increases, or funding for future land acquisition.

Pileated woodpeckers
© Ram Papish

Nestucca Bay
National Wildlife Refuge

Comprehensive Conservation Plan

Prepared by:
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April 2013

Approved: ______________________________ Dec. 21, 2012
Regional Director, Region 1 — Date
Acting Portland, Oregon

U.S. Fish and Wildlife Service
Nestucca Bay National Wildlife Refuge
Comprehensive Conservation Plan
Approval Submission

In accordance with the National Wildlife Refuge System Administration Act, as amended, the U.S. Fish and Wildlife Service completed a Comprehensive Conservation Plan (CCP) for Nestucca Bay National Wildlife Refuge. The purpose of this CCP is to specify a management direction for the Refuge for the next 15 years. The goals, objectives, and strategies for improving Refuge conditions – including the types of habitat we will provide, partnership opportunities, and management actions needed to achieve desired future conditions – are described in the CCP. The Service's preferred alternative for managing the Refuge is described in this CCP and the environmental consequences of implementing the CCP were described in the Draft CCP and Environmental Assessment.

This CCP is submitted for the Regional Director's approval by:

Rebecca G. Chuck Acting — 12/18/12
Roy Lowe, Project Leader — Date
Oregon Coast National Wildlife Refuge Complex

Concur: — 12/18/12
Bob Flores — Date
Refuge Supervisor

Concur: Robin L. West — 12-19-12
Robin West — Date
Regional Chief, National Wildlife Refuge System

Finding of No Significant Impact
for the
Nestucca Bay National Wildlife Refuge
Comprehensive Conservation Plan
Tillamook County, Oregon

The U.S. Fish and Wildlife Service (Service) has completed a Comprehensive Conservation Plan (CCP) and Environmental Assessment (EA) for Nestucca Bay National Wildlife Refuge (Refuge). The CCP will guide management of the Refuge for 15 years. The CCP/EA describes our proposals for managing the Refuge and their effects on the human environment under three alternatives, including the no action alternative.

Decision

Based on our comprehensive review and analysis in the CCP/EA, we selected Alternative C for implementation, because it will guide management of the Refuge in a manner that:

- Achieves the mission of the National Wildlife Refuge System, and the purposes, vision, and goals of the Refuge.
- Maintains and restores the ecological integrity of the Refuge's habitats and populations.
- Addresses the important issues identified during the CCP scoping process.
- Addresses the legal mandates of the Service and the Refuge.
- Is consistent with the scientific principles of sound wildlife management and endangered species recovery.
- Facilitates priority public uses appropriate and compatible with the Refuge's purposes and the Refuge System mission.

Summary of the Actions to be Implemented

Implementing the selected alternative will have no significant impacts on the environmental resources identified in the CCP/EA. Refuge management under the selected alternative will protect, maintain, and enhance habitat for priority species and resources of concern, and improve the public's opportunities to enjoy wildlife-dependent recreation.

Under Alternative C, an emphasis on protecting and maintaining lowland pasture, estuarine, coastal bog, stream-riparian, and forested habitats would remain. All lowland pastures would continue to be managed for wintering goose habitat through cooperative farming agreements with local farmers. Additionally, an increased level of active habitat management, monitoring, and restoration would also be implemented. The 25-acre restoration of former coastal prairie on Cannery Hill would be focused on specific life-history parameters needed by the threatened Oregon silverspot butterfly, with the goal of introducing a nonessential experimental population once habitat parameters specified in the Oregon Silverspot Butterfly Recovery Plan are reached. An additional 14 acres of upland grassland would also be restored to coastal prairie. A hydrological study would be conducted and used to guide the modification of the tsunami evacuation route through Neskowin Marsh to improve hydrology and accessibility. The Neskowin Marsh Unit would be proposed for designation as a Research Natural Area.

Wildlife observation and photography would be enhanced by the development of new trails at Cannery Hill and the Little Nestucca Restoration area. A goose observation deck and access path would also be constructed on Cannery Hill and a gravel parking lot would be created on the west end of the Little Nestucca Restoration area. Brooten Marsh would be opened to access for wildlife observation and photography year round.

A waterfowl hunting program would be established on Brooten Marsh (108 acres) and the mouth of the Little Nestucca River (33 acres), and clamming access would be allowed through Brooten Marsh. Bank fishing would be allowed on the east end of the Little Nestucca Restoration Area following the development of an access trail and gravel parking lot.

Environmental education efforts would be expanded through use of the Nature Discovery Backpack program, other partner-driven programs, and hiring of additional staff and volunteers. Interpretive signs and materials would be developed and added in conjunction with new trails at Cannery Hill and the Little Nestucca Restoration Area.

To accommodate increasing visitation to the refuge, the current refuge volunteer residence would be replaced with a bunkhouse and small administrative office. The Service would also remodel the north bay of the maintenance shop to accommodate two offices: one for maintenance staff and a second for the refuge Friends Group.

Other proposed actions under Alternative C include the consideration of climate change effects in all management; the reduction of the Refuge's carbon footprint; monitoring and control of invasive species; fire management; maintenance of existing structures; coordination with State, Tribal, and other partners to accomplish goals; cultural resources protection; volunteer opportunities; and the continuation of land protection within the approved Refuge boundary. All proposed actions are subject to funding availability.

Public Involvement and Changes Made to the Selected Alternative Based on Comments

We incorporated a variety of public involvement techniques in developing and reviewing the CCP/EA. This included two open houses, several planning updates, numerous meetings with partners and elected officials, and public review and comment on the Draft CCP/EA. The details of our public involvement program are described in the CCP in Appendix J.

Based on the public comments we received and considered, Alternative C as described in the CCP/EA has been slightly modified.

- The objective related to upland coastal prairie restoration has been reworded to "restore up to 25 acres of native prairie by 2028 through a phased restoration project."
- Clarification on the designation of the Neskowin Marsh Unit as a Research Natural Area has been added.
- Clarifications regarding the maintenance and modification of the Neskowin Marsh tsunami evacuation trail have been added.
- Wording regarding bank fishing has been changed from "actively pursuing opportunities" to "allow bank fishing on the east end of the Little Nestucca Restoration Area following development of access trail and gravel parking lot."
- Clarification about clamming being subject to Oregon Department of Fish and Wildlife and Oregon Department of Agriculture shellfish safety closures has been added.
- Under facilities management, an additional strategy to utilize habitat-appropriate native plants for landscaping has been added.

- The Compatibility Determination for wildlife observation, photography, interpretation, and environmental education was modified to improve clarity and consistency.
- Some maps were updated to reflect the above-referenced wording changes and clarifications.
- Some text changes were made to improve readability and clarity.

Conclusions

Based on review and evaluation of the information contained in the supporting references, I have determined that implementing Alternative C as the CCP for Nestucca Bay National Wildlife Refuge is not a major Federal action that would significantly affect the quality of the human environment within the meaning of section 102(2)(c) of the National Environmental Policy Act of 1969. Accordingly, we are not required to prepare an environmental impact statement.

Dec. 21, 2012

Acting Regional Director — Date

Supporting References

U.S. Fish and Wildlife Service. 2012. Nestucca Bay National Wildlife Refuge draft Comprehensive Conservation Plan and Environmental Assessment. U.S. Department of the Interior, Fish and Wildlife Service, Region 1, Portland, OR. 494 pp.

Note: This Finding of No Significant Impact and supporting references are available for public review at the Oregon Coast National Wildlife Refuge Complex, 2127 SE Marine Science Drive, Newport, Oregon 97365 and U.S. Fish and Wildlife Service, Division of Planning, Visitor Services, and Transportation, 911 NE 11th Avenue, Portland, Oregon, 97232. These documents can also be found on the Internet at http://www.fws.gov/oregoncoast/. Interested and affected parties are being notified of our decision.

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Introduction and Background

Roy W. Lowe/USFWS

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Chapter 1. Introduction and Background

1.1 Introduction

Nestucca Bay National Wildlife Refuge (NWR or Refuge) is managed by the U.S. Fish and Wildlife Service (USFWS or Service) as part of the National Wildlife Refuge System (NWRS or System). The Oregon Coast National Wildlife Refuge Complex (Complex) comprises six individual national wildlife refuges that span most of the coast of Oregon and support a rich diversity of wildlife habitats including coastal rocks, reefs, and islands; forested and grass-covered headlands; estuaries; and freshwater marshes. The six national wildlife refuges include Cape Meares, Oregon Islands, Three Arch Rocks, Bandon Marsh, Nestucca Bay, and Siletz Bay (Figure 1-1). This Comprehensive Conservation Plan (CCP) applies only to Nestucca Bay NWR. CCPs for Bandon Marsh and Siletz Bay NWRs are being developed concurrently, and the CCPs for the Complex's other three NWRs have been completed under a previous planning effort.

Nestucca Bay Refuge lands are located near Pacific City and Neskowin, in Tillamook County, Oregon (Figure 1-2). The Refuge was established in 1991 with the acquisition of a 370-acre dairy farm, and has since expanded to 1,010 acres, with an additional 2,500+ acres of private and state inholdings within the approved refuge boundary. Nestucca Bay Refuge was established to protect wintering habitat for the Aleutian Canada goose, which was originally federally listed as endangered in 1967 and delisted in 2001, and for the declining dusky Canada goose; and to protect diverse coastal wetland habitats and upland habitat buffers for a variety of migratory waterfowl, shorebirds, raptors, songbirds, anadromous fish, and other wildlife. In 2002, the Refuge was expanded to include the Neskowin Marsh Unit (currently at 228 acres) located about 2.5 miles south of the Nestucca Bay Unit. Neskowin Marsh incorporates unique freshwater wetland and bog habitats and wildlife resources not found within the original refuge boundary.

1.1.1 Nestucca Bay Unit

The Service originally proposed to establish the Nestucca Bay NWR by initially acquiring 370 acres of land, further seeking to acquire partial or whole interest in up to 3,926 acres of land, and cooperatively managing 400 acres of tidelands with the State of Oregon (USFWS 1993a). The Service's Land Protection Plan (1993a) described the lost wetland habitat caused by commercial and residential encroachments into coastal wetlands. As these pressures increased upon open bay and estuarine wetland habitats, there was a shift in use by many wetland-dependent wildlife species to diked, former tideland habitats. These diked wetlands, many of which are used for grazing, haying, or silage cutting, were becoming more important to wildlife, particularly migrating and wintering waterfowl. The Service's Concept Plan for Waterfowl Habitat Protection – Middle Upper Pacific Coast (USFWS 1989) identified the estuarine wetlands and diked former tidelands within the Nestucca estuary as a high priority for protection.

In 1990, when the proposal to establish the Refuge was under evaluation, the dairy pastures adjacent to Nestucca Bay provided wintering habitat used by one of the most diverse groups of geese found in Oregon, including dusky, Aleutian (then endangered), Taverner's, cackling, lesser, Vancouver, and western subspecies of Canada geese. Other than a small group of 40 to 60 wintering birds at Goat Island near Brookings, Oregon, the Nestucca Bay area was the only wintering area for dusky Canada geese on the Oregon coast, supporting an estimated population of 500. At the time, the dusky Canada goose population had seen drastic population declines over the previous two decades. A flock of about 100 Aleutian Canada geese, out of a total population estimated near 6,300, also wintered at Nestucca Bay. These geese had been using pastures adjacent to the bay during the day and roosting offshore on Haystack Rock (Oregon Islands NWR) at night; however, depredation complaints from dairy farmers led to hazing of dusky Canada geese which caused them to roost and feed on Haystack Rock during the day and return to the pastures at night. The remainder of the Aleutian Canada geese wintered in the central valley of California.

It was recognized and stated in the EA for the proposed refuge that refuge establishment was not anticipated to take lands out of active dairy production, as present dairy farming practices were largely compatible with habitat management goals for dusky and Aleutian Canada geese. It was and has continued to be the intent of the Service to ensure that these compatible practices continue to secure protection for this wintering habitat. Additional wildlife species listed as threatened at the time (and since delisted) utilizing the area proposed as Nestucca Bay NWR included bald eagles, California brown pelicans, and peregrine falcons.

1.1.2 Neskowin Marsh Unit

Following establishment of Nestucca Bay NWR, the rapid increase in residential, resort, and recreational development along the Oregon coast, and the resulting threats to the integrity of coastal ecosystems, led the Service to propose an expansion of the refuge boundary in 2000. The Service proposed the addition of the Neskowin Marsh Unit to the Nestucca Bay Refuge in response to an opportunity to acquire properties from willing sellers, in order to conserve the Neskowin Marsh complex and associated rare coastal bog ecosystem and assist in recovery of threatened and endangered species present in the area (USFWS 2000a). At the time of the proposal, Neskowin Marsh was the largest unprotected freshwater marsh remaining on the Oregon coast. The primary purpose for expanding the refuge boundary and establishing this refuge unit was to provide permanent protection to the exceptional biological values of this unique and outstanding coastal bog ecosystem.

1.2 Significance of the Refuge

Nestucca Bay Refuge provides important winter habitat for the formerly endangered Aleutian Canada goose and serves as an important overwintering site for up to 18% of the declining population of the dusky Canada goose. Other subspecies of white-cheeked geese, including Taverner’s, cackling, lesser, and western Canada geese, also use refuge pastures. The freshwater wetlands and estuarine habitats support thousands of migratory waterfowl and shorebirds. The riverine and estuarine habitats provide essential habitat for Chinook salmon, threatened coho salmon, chum salmon, steelhead trout, and coastal cutthroat trout. Mammals such as marsh shrews, Oregon voles, muskrats, beaver, mink, river otters, and raccoons are common in the marshes and wetter pastures and harbor seals forage over flooded tidal flats. Deer and elk graze the marsh and pasture grasses. Riparian forest patches and the valley forested wetlands support small mammals as well as many amphibians and reptiles such as long-toed and Pacific giant salamanders, rough-skinned newts, Pacific tree frogs, and garter snakes.

Forested areas on this Refuge are used as breeding habitat by neotropical songbirds including Swainson’s thrush, Wilson’s warbler, orange-crowned warbler, and western tanager. The forest is also used on a year-round basis by other songbirds including chestnut-backed chickadee, Pacific wren, golden-crowned kinglet, varied thrush, and song sparrow. The recently delisted California brown pelican uses the open waters within Nestucca Bay as foraging habitat in summer and early fall. Peregrine falcon observations are numerous from fall through spring. Cannery Hill, located on the upper portion of the Nestucca Bay Unit, has several bald eagle perching sites.

Habitats within the Neskowin Marsh Unit, located about 2.5 miles south of the Nestucca Bay Unit, include marsh, bogs, forested wetlands, upland shrub and meadows, and adjacent forested uplands. The bog communities are extremely specialized, and include sedge fen, shrub carr, and sphagnum bog. The marsh, originally a lake, formed when shifting sand blocked stream drainages. The area is underlain by peat, and a number of lakes, ponds, and pools scattered throughout the wetland are vestiges of a larger lake system in-filled by peat formation. This area now supports extensive shrub swamps (hooker willow, crabapple, and spirea), Sitka spruce swamp, Sitka sedge fern, and peatland with high-quality sphagnum fens interspersed with lakes, pools, and ponds. A forested lagg occurs along the northeast portion of the marsh. The marsh is one of the largest and highest-quality freshwater wetlands remaining on the coast of Oregon; the sphagnum fen is the second-largest known site on the coast, and it contains the largest known occurrence of acid-forming *Sphagnum fuscum* mire known on the coast (Christy and Brophy 2002).

The complexity of marsh, forested wetlands, and adjacent upland woodlands found within the Neskowin Marsh Unit provide important habitat for neotropical migratory songbirds birds such as yellow-rumped warbler, common yellowthroat, marsh wren, olive-sided flycatcher, and hermit thrush. Waterfowl use the marsh throughout the winter and in the fall and spring migration periods. Species commonly observed include mallard, wood duck, American wigeon, northern pintail, green-winged teal, ring-necked duck, lesser scaup, and bufflehead. Both mallard and wood duck are probable breeders at the marsh. A variety of other marsh dependent birds and waterbirds using the marsh include red-winged blackbird, great blue heron, green heron, Virginia rail, and sora. Mammals occurring at Neskowin Marsh include black-tailed deer, Roosevelt elk, black bear, river otter, and beaver. Anadromous fish, including Chinook salmon, threatened coho salmon, chum salmon, steelhead trout, and coastal cutthroat use Neskowin Creek for spawning and rearing, and juvenile coho salmon also use the marsh as off-channel overwintering habitat. In the spring, thousands of amphibians and numerous egg masses appear in the wetlands, indicating that the marsh is an important breeding area for red-legged frogs and northwestern salamanders. Peregrine falcons and bald eagles nest in the vicinity and use the wetland and surrounding upland habitat for hunting, foraging, and resting.

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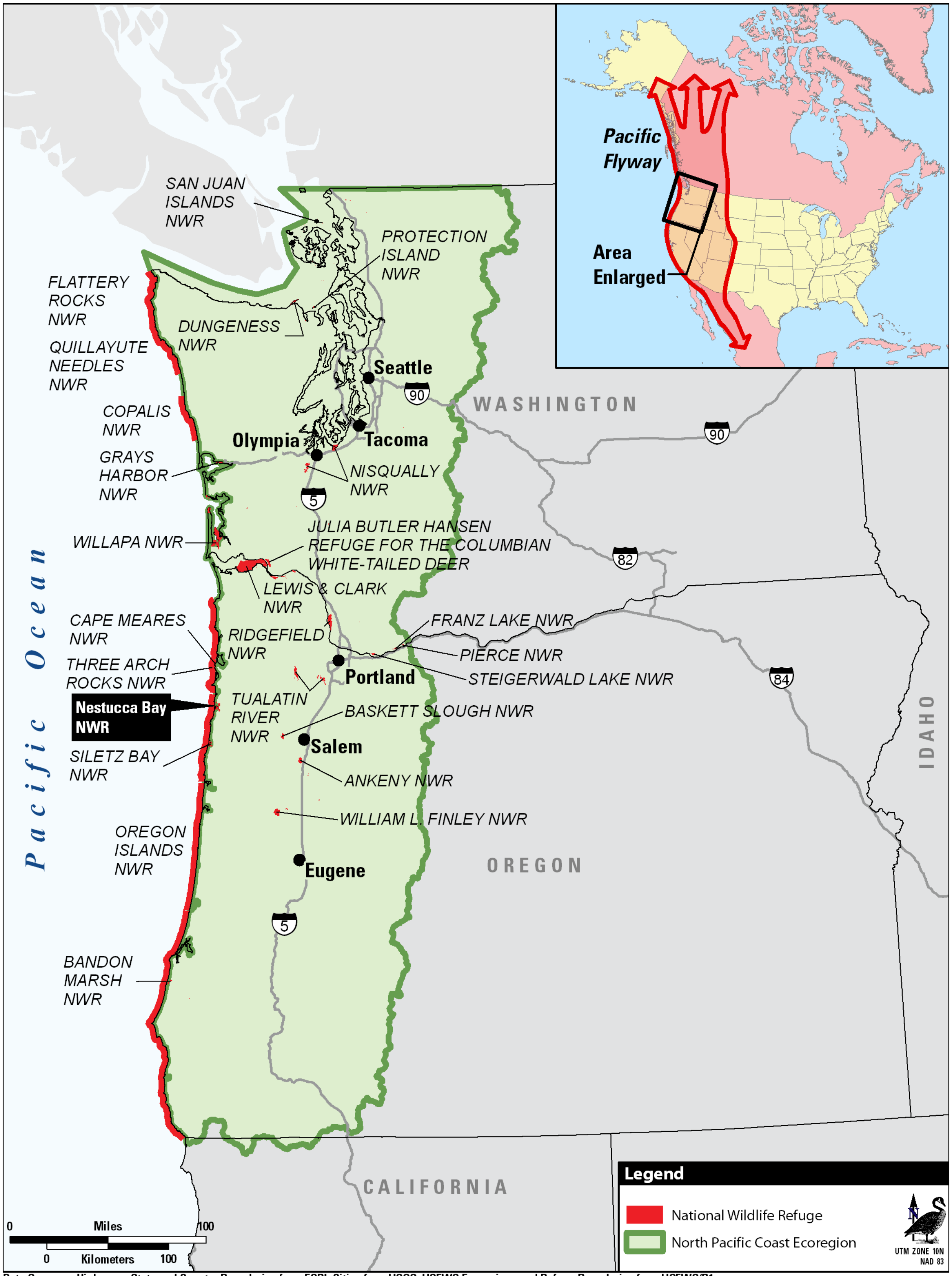
Figure 1-1. Regional context.



Data Sources: Highways, State and Country Boundaries from ESRI; Cities from USGS; USFWS Ecoregions and Refuge Boundaries from USFWS/R1

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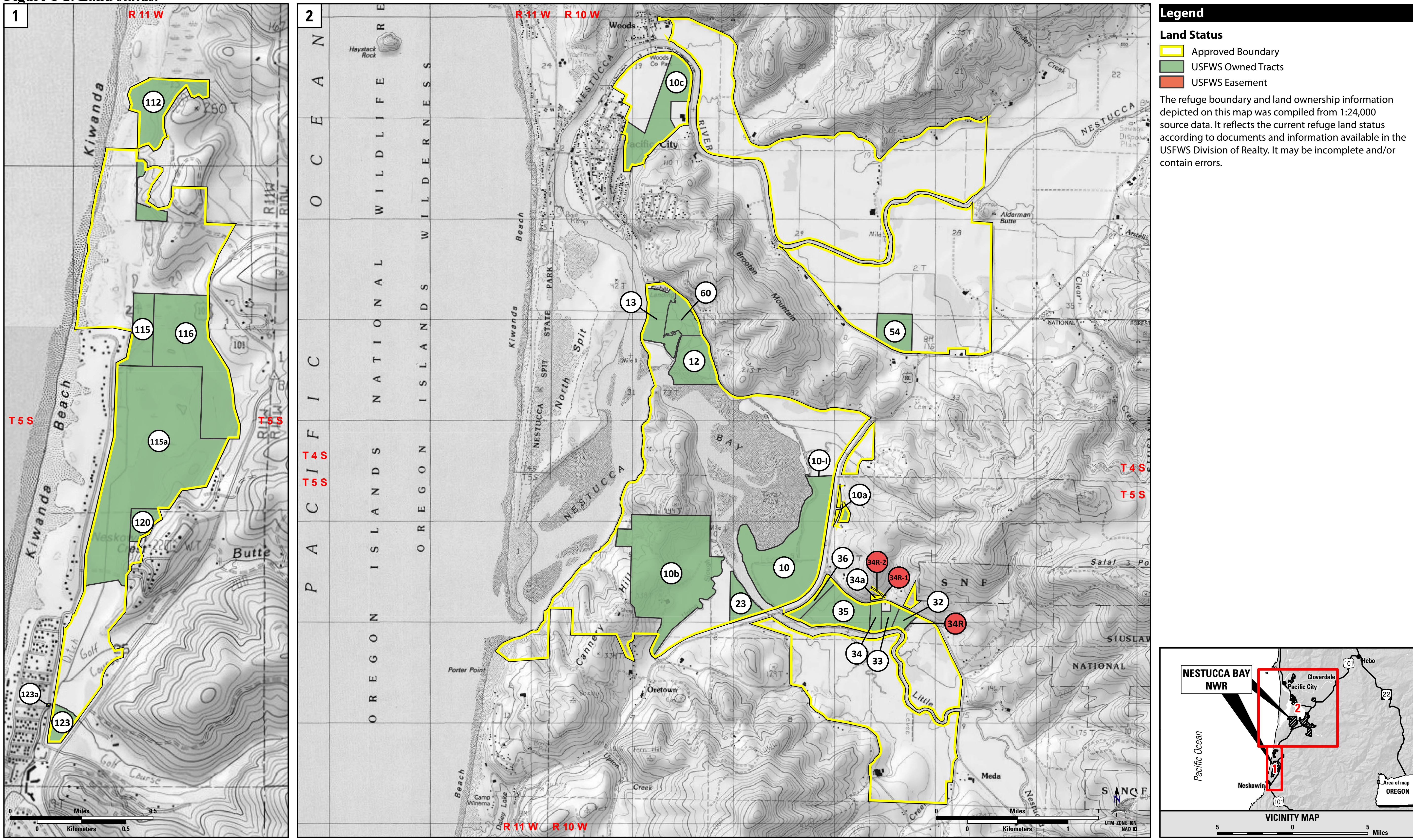
Figure 1-2. Land status.



Data Sources: Refuge Boundaries from USFWS/R1; 1:24,000 scale Topographic Map from USGS

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1.3 Proposed Action

We, the U.S. Fish and Wildlife Service (Service), manage wildlife refuges as part of the National Wildlife Refuge System. This document is the Refuge's Comprehensive Conservation Plan (CCP). A CCP sets forth management guidance for a refuge for a period of 15 years, as required by the National Wildlife Refuge System Administration Act (16 U.S.C. 688dd-688ee, et seq.) (Refuge Administration Act), as amended by the National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57). The Refuge Administration Act requires CCPs to identify and describe:

- The purposes of the refuge;
- The fish, wildlife, and plant populations, their habitats, and the archaeological and cultural values found on the refuge;
- Significant problems that may adversely affect wildlife populations and habitats and ways to correct or mitigate those problems;
- Areas suitable for administrative sites or visitor facilities and opportunities for fish- and wildlife-dependent recreation.

The Service developed and examined alternatives for future management of Nestucca Bay National Wildlife Refuge through the CCP process. These were presented in the Draft Comprehensive Conservation Plan and Environmental Assessment (USFWS 2012a). We developed and evaluated three alternatives for the CCP and selected Alternative C as the preferred alternative.

The goals, objectives, and strategies under the preferred alternative best achieve the purpose and need for the CCP while maintaining balance among the varied management needs and programs. Thus, the preferred alternative represents the most balanced approach for achieving the Refuge's purposes, vision, and goals; contributing to the Refuge System's mission; addressing relevant issues and mandates; and managing the Refuge consistently with sound principles of fish and wildlife management. The preferred alternative was slightly modified between the draft and final documents based upon comments received from the public or other agencies and organizations (see Appendix K). The Service's Regional Director for the Pacific Region made the final decision about the alternative to be implemented. For details on the specific components of management direction for the Refuge over the next 15 years, see Chapter 2.

1.4 Purpose and Need for Action

The purpose of developing the CCP is to provide the refuge manager with a 15-year management plan for the conservation of fish, wildlife, and plant resources and their related habitats, while providing opportunities for compatible, wildlife-dependent recreational uses. The CCP, when fully implemented, should achieve refuge purposes; help fulfill the Refuge System mission; maintain and, where appropriate, restore the ecological integrity of each refuge and the Refuge System; help achieve the goals of the National Wilderness Preservation System; and meet other mandates. The CCP must be specific to the planning unit and identify the overarching wildlife, public use, or management needs for the refuge (602 FW 3.4C1d).

The need for the CCP is to provide reasonable, scientifically-grounded guidance for ensuring that over a period of 15 years, Nestucca Bay NWR will achieve the following purposes:

- Enhance, maintain, and protect Refuge habitats (including lowland pastures; upland prairie and mixed upland grasslands; upland forests; forested wetlands; and estuarine, freshwater and stream-riparian habitats) and other lands for the benefit of migratory birds and other wildlife.
- Gather sufficient scientific information to guide responsible adaptive management decisions.
- Provide visitors compatible wildlife-dependent public use opportunities that foster an appreciation and understanding of the Refuge's fish, wildlife, plants, and their habitats, and have limited impacts to wildlife.
- Initiate and nurture relationships and develop cooperative opportunities to promote the importance of the Refuge's wildlife habitat, and support Refuge stewardship.
- Protect and manage the Refuge's cultural resources, and identify new ways to gain an understanding of the Refuge's history and cultural resources.

1.5 Legal and Policy Guidance

1.5.1 The U.S. Fish and Wildlife Service

All refuges are managed by the Service, an agency within the Department of the Interior. The Service is the principal Federal agency responsible for conserving, protecting, and enhancing the Nation's fish and wildlife populations and their habitats.

The mission of the Service is "working with others to conserve, protect, and enhance fish, wildlife, plants, and their habitats for the continuing benefit of the American people." Although we share this responsibility with other Federal, state, tribal, local, and private entities, the Service has specific trust responsibilities for migratory birds, endangered and threatened species, and certain anadromous fish and marine mammals. The Service has similar trust responsibilities for the lands and waters we administer to support the conservation and enhancement of fish, wildlife, plants, and their habitats. The Service also enforces Federal wildlife laws and international treaties for importing and exporting wildlife, assists with state fish and wildlife programs, and helps other countries develop wildlife conservation programs.

1.5.2 National Wildlife Refuge System

A refuge is managed as part of the National Wildlife Refuge System within a framework provided by legal and policy guidelines. The Refuge System is the world's largest network of public lands and waters set aside specifically for conserving wildlife and protecting ecosystems.

The needs of wildlife and their habitats come first on refuges, in contrast to other public lands that are managed for multiple uses. Refuges are guided by various Federal laws and executive orders, Service policies, and international treaties. Fundamental are the mission and goals of the Refuge System and the designated purposes of the refuge unit as described in establishing legislation, executive orders, or other documents establishing, authorizing, or expanding a refuge.

National Wildlife Refuge System Mission and Goals

The mission of the Refuge System is "to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans" (National Wildlife Refuge System Administration Act of 1966, as amended) (16 U.S.C. 668dd et seq.)

The goals of the Refuge System, as articulated in the Mission Goals and Purposes policy (601 FW 1) are:

- Conserve a diversity of fish, wildlife, and plants and their habitats, including species that are endangered or threatened with becoming endangered.
- Develop and maintain a network of habitats for migratory birds, anadromous and inter-jurisdictional fish, and marine mammal populations that is strategically distributed and carefully managed to meet important life history needs of these species across their ranges.
- Conserve those ecosystems, plant communities, wetlands of national or international significance, and landscapes and seascapes that are unique, rare, declining, or underrepresented in existing protection efforts.
- Provide and enhance opportunities to participate in compatible wildlife-dependent recreation (hunting, fishing, wildlife observation and photography, and environmental education and interpretation).
- Foster understanding and instill appreciation of the diversity and interconnectedness of fish, wildlife, and plants and their habitats.

Law and Policy Pertaining to the Refuge System

Refuges are guided by various Federal laws and executive orders, Service policies, and international treaties. Fundamental to the management of every refuge are the mission and goals of the Refuge System and the designated purposes of the refuge unit as described in establishing legislation, executive orders, or other documents establishing, authorizing, or expanding a refuge.

Key concepts and guidance of the Refuge System derive from the National Wildlife Refuge System Administration Act of 1966 (Administration Act) as amended (16 U.S.C. 668dd-668ee); the Refuge Recreation Act of 1962 as amended (16 U.S.C. 460k-460k-4); Title 50 of the Code of Federal Regulations; and the Service Manual. The Administration Act is implemented through regulations covering the Refuge System, published in Title 50, subchapter C of the Code of Federal Regulations and policies contained in the Service Manual. These regulations and policies govern general administration of units of the Refuge System.

Many other laws apply to the U.S. Fish and Wildlife Service and management of Refuge System lands. Examples include the Endangered Species Act of 1973, as amended, and the National Historic Preservation Act of 1966, as amended. Brief descriptions of laws pertinent to Nestucca Bay Refuge are included in this chapter. A complete list of laws pertaining to the Service and the Refuge System can be found at http://laws.fws.gov.

Refuge Recreation Act of 1962 (16 U.S.C. 460k-460k-4). The Refuge Recreation Act authorized the Secretary of the Interior to administer refuges, hatcheries, and other conservation areas for recreational use, when such uses do not interfere with the area's primary purposes. It provided for public use fees and permits, and penalties for violating regulations. It also authorized the acceptance of donated funds and real and personal property, to assist in carrying out its purposes. Enforcement provisions were amended in 1978 and 1984 to make violations misdemeanors in accordance with the uniform sentencing provisions of 18 U.S.C. 3551-3586.

National Wildlife Refuge System Administration Act (16 U.S.C. 668dd et seq.) as amended by the National Wildlife Refuge System Improvement Act (Public Law 105-57). Of all the laws governing activities on national wildlife refuges, the Refuge Administration Act exerts the greatest influence. The National Wildlife Refuge System Improvement Act of 1997 (Refuge Improvement Act) amended the Administration Act by defining a unifying mission for all refuges, including a new process for determining compatible uses on refuges, and requiring that each refuge be managed under a comprehensive conservation plan. Key provisions of the Refuge Administration Act follow.

- Comprehensive conservation planning. A CCP must be completed for each refuge by the year 2012, as is required by the Refuge Administration Act. Each CCP will be revised every 15 years or earlier if monitoring and evaluation determine that changes are needed to achieve the refuge's purposes, vision, goals, or objectives. The Refuge Administration Act also requires that CCPs be developed with the participation of the public. Public comments, issues, and concerns are considered during the development of a CCP, and together, with the formal guidance, can play a role in selecting the preferred alternative. Information on public involvement can be found in Appendix J. The CCP provides guidance in the form of goals, objectives, and strategies for refuge programs, but may lack some of the specifics needed for implementation. Therefore, step-down management plans will be developed for individual program areas as needed, following completion of the CCP. The step-down plans are founded on management goals, objectives and strategies outlined in a CCP, and require appropriate NEPA compliance.
- Wildlife conservation; biological diversity, integrity and environmental health. The Refuge Administration Act expressly states that the conservation of fish, wildlife and plants, and their habitats is the priority of Refuge System lands, and that the Secretary of the Interior shall ensure that the biological integrity, diversity, and environmental health of refuge lands are maintained. House Report 105–106 accompanying the Improvement Act states "… the fundamental mission of our System is wildlife conservation: wildlife and wildlife conservation must come first."
- Refuge purposes. Each refuge must be managed to fulfill the Refuge System mission and the specific purpose(s) for which the refuge was established. The purposes of a refuge are specified in or derived from the law, proclamation, executive order, agreement, public land order, donation document, or administrative memorandum establishing, authorizing, or expanding a refuge, refuge unit, or refuge subunit. When a conflict exists between the Refuge System mission and the purpose of an individual refuge, the refuge purpose may supersede the mission.
- Priority public uses on refuges. The Administration Act superseded some key provisions of the Refuge Recreation Act regarding compatibility, and also provided significant additional guidance regarding recreational and other public uses on units of the Refuge System. The Refuge Administration Act identifies six priority wildlife-dependent recreational uses. These uses are hunting, fishing, wildlife observation and photography, and environmental education and interpretation. The Service is to grant these six wildlife-dependent public uses special consideration during planning for, management of, and establishment and expansion of units of the Refuge System. When determined compatible on a refuge-specific basis, these six uses assume priority status among all uses of the refuge in question. The Service is to make extra efforts to facilitate priority wildlife-dependent public use opportunities.

Compatibility and Appropriate Refuge Uses Policies (603 FW 2 and 1). With few exceptions, lands and waters within the Refuge System are different from multiple-use public lands in that they are closed to all public access and use unless specifically and legally opened. No refuge use may be allowed or continued unless it is determined to be appropriate and compatible. Generally, an appropriate use is one that contributes to fulfilling the refuge purpose(s), the Refuge System mission, or goals or objectives described in a refuge management plan. A compatible use is a use that in the sound professional judgment of the refuge manager will not materially interfere with or detract from the fulfillment of the mission of the Refuge System or the purposes of the refuge.

The six wildlife-dependent recreational uses described in the Refuge Administration Act (hunting, fishing, wildlife observation and photography, and environmental education and interpretation) are defined as appropriate. When determined to be compatible, they receive priority consideration over other public uses in planning and management. Other non-wildlife-dependent uses on a refuge are reviewed by the refuge manager to determine if the uses are appropriate. If a use is determined appropriate, then a compatibility determination is completed.

When preparing a CCP, refuge managers must re-evaluate all general public, recreational, and economic uses (even those occurring to further refuge habitat management goals) occurring or proposed on a refuge for appropriateness and compatibility. Updated appropriate use and compatibility determinations for existing and planned uses for Nestucca Bay NWR are in Appendices A (Appropriateness) and B (Compatibility) of this CCP.

Biological Integrity, Diversity, and Environmental Health Policy (601 FW 3). The Refuge Administration Act directs the Service to "ensure that the biological integrity, diversity, and environmental health of the National Wildlife Refuge System are maintained for the benefit of present and future generations of Americans…" The policy is an additional directive for refuge managers to follow while achieving refuge purpose(s) and the Refuge System mission. It provides for the consideration and protection of a broad spectrum of native fish, wildlife, and habitat resources found on refuges and associated ecosystems. When evaluating the appropriate management direction for refuges (e.g., in compatibility determinations), refuge managers will use sound professional judgment to determine their refuge's contribution to biological integrity, diversity, and environmental health at multiple landscape scales. Sound professional judgment incorporates field experience, knowledge of refuge resources, an understanding of the refuge's role within an ecosystem, applicable laws, and best available science, including consultation with others both inside and outside the Service. The policy states that "the highest measure of biological integrity, diversity, and environmental health is viewed as those intact and self-sustaining habitats and wildlife populations that existed during historic conditions."

Wildlife-dependent Recreation Policies (605 FW 1-7). The Refuge Administration Act states that "compatible wildlife-dependent recreation is a legitimate and appropriate general public use of the System." A series of recreation policies provide additional guidance and requirements to consider after a recreational use has been determined to be compatible. These policies also establish a quality standard for visitor services on national wildlife refuges. Through these policies, we are to simultaneously enhance wildlife-dependent recreational opportunities, provide access to quality visitor experiences, and manage refuge resources to conserve fish, wildlife, plants, and their habitats. New and ongoing recreational uses should help visitors focus on wildlife and other natural resources, and provide an opportunity to display resource issues, management plans, and how the refuge contributes to the Refuge System and the Service's mission. The policies also require development of a visitor services plan.

1.5.3 Other Laws and Mandates

Many other Federal laws, executive orders, Service policies, and international treaties govern the Service and Refuge System lands. Examples include the Migratory Bird Treaty Act of 1918, Refuge Recreation Act of 1962, National Historic Preservation Act of 1966, and the Endangered Species Act of 1973. For additional information on laws and other mandates, a list and brief description of Federal laws of interest to the Service can be found in the Laws Digest at http://www.fws.gov/laws/Lawsdigest.html.

In addition, over the last few years, the Service has developed or revised numerous policies and Director's Orders to reflect the mandates and intent of the Refuge Administration Act. Some of these key policies include the Biological Integrity, Diversity, and Environmental Health Policy (601 FW 3); the Compatibility Policy (603 FW 2); the Comprehensive Conservation Planning Policy (602 FW 3); Mission, Goals, and Purposes (601 FW 1), Appropriate Refuge Uses (603 FW 1); Wildlife-Dependent Public Uses (605 FW 1); wilderness-related policies (610 FW 1-5) and the Director's Order for Coordination and Cooperative Work with State Fish and Wildlife Agency Representatives on Management of the National Wildlife Refuge System. These policies and others in draft or under development can be found at http://refuges.fws.gov/policymakers/nwrpolicies.html.

In developing a CCP, refuges must consider these broader laws and policies as well as Refuge System and ecosystem goals and visions. The CCP must be consistent with these and also with the refuge purpose.

1.6 Refuge Establishment and Purposes

1.6.1 Legal Significance of the Refuge Purpose

The purpose for which a refuge was established or acquired is of key importance in refuge planning. Purposes must form the foundation for management decisions. The refuge purposes are the driving force in the development of the refuge vision statements, goals, objectives, and strategies in a CCP and are critical to determining the compatibility of existing and planned refuge uses.

The purposes of a refuge are specified in or derived from the law, proclamation, executive order, agreement, public land order, donation document, or administrative memorandum establishing, authorizing, or expanding a refuge, refuge unit, or refuge subunit.

Unless the establishing law, order, or other document indicates otherwise, purposes dealing with the conservation, management, and restoration of fish, wildlife, plants, and the habitats on which they depend, take precedence over other purposes in the management and administration of any unit. Where a refuge has multiple purposes related to fish, wildlife, and plant conservation, the more specific purpose will take precedence in instances of conflict. When an additional unit is acquired under an authority different from the authority used to establish the original unit, the addition takes on the purpose(s) of the original unit, but the original unit does not take on the purpose(s) of the newer addition. When a conflict exists between the Refuge System mission and the purpose of an individual refuge, the refuge purpose may supersede the mission of the System.

1.6.2 Purpose and History of Refuge Establishment

Nestucca Bay NWR was established in 1991 under the authority of the Endangered Species Act of 1973, as amended (16 U.S.C. 1532-1544, 87 Stat. 884), "to conserve (a) fish or wildlife which are listed as endangered species or threatened species…or (b) plants"; the Fish and Wildlife Act of 1956, as amended (16 U.S.C. 742(a)-754) "for the development, advancement, management, conservation, and protection of fish and wildlife resources"; the Migratory Bird Conservation Act of 1929 (16 U.S.C. 715-715d) "for use as an inviolate sanctuary, or for any other management purpose, for migratory birds"; the Consolidated Farm and Rural Development Act [7 U.S.C. 2002], "for conservation purposes"; and the Emergency Wetlands Resources Act of 1986 [16 U.S.C. 39 100 Stat 3583], to accomplish "conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to fulfill international obligations contained in various migratory bird treaties and conventions." All of the tracts within the original Nestucca Bay Unit, with the exception of the Semidi (Martella) Tract (10c) and the Utter Tract (54), were purchased with funds authorized by the Land and Water Conservation Fund Act. The most recent acquisition, the Lyda Tract (23), was acquired with Migratory Bird Hunting and Conservation Stamp Act funds.

The Utter Tract was acquired through primary transfer from the Farm Service Agency under the authority of the Consolidated Farm and Rural Development Act (7 U.S.C. 2002), "for conservation purposes." The Semidi Tract was purchased with Federal Land Transaction Facilitation Act funds. The Federal Land Transaction Facilitation Act (FLTFA) of 2000 authorizes Department of Interior (DOI) and the U.S. Forest Service to use the proceeds from sales of Bureau of Land Management lands to acquire inholdings in federally designated areas, such as national wildlife refuges.

The Neskowin Marsh Unit was also established under authority of the Fish and Wildlife Act of 1956; the Endangered Species Act of 1973; and the Migratory Bird Conservation Act of 1929.

1.6.3 Land Status and Ownership

Following the identification of the Nestucca Bay estuary and associated diked former tidelands as important habitats for waterfowl (USFWS 1989), the Service became aware of the availability of property in the area which had been operated as a dairy farm for many years, but supported significant numbers of wintering geese. The property included diked wetland pastures used predominantly by dusky Canada geese, a species listed as sensitive and undergoing a serious population decline. In light of the Service emphasis on protecting coastal waterfowl habitat and the importance of Nestucca Bay habitats to the (then) endangered Aleutian Canada goose and dusky Canada goose, the Service decided to initiate a land protection program for those species and others (USFWS 1993a).

The project area included approximately 4,700 acres, of which some 4,300 were in private ownership and the remaining 400 acres consisted of State-owned tidelands. The study area included the dairy property, and the land protection proposal included both acquisition of conservation easements and fee title purchases. Fee title purchases were proposed on lands where active Service management or development of interpretive facilities seemed appropriate.

Local apprehension regarding the establishment of a refuge was centered around the concern that acquisition by the Federal government would result in a significant land-base loss to the dairy industry and a steep downturn to the dairy driven economy. After much discussion and negotiation with the dairy landowner representatives, the Service entered into a formal Memorandum of

Agreement (MOU) with the Nestucca Landowners Association at the time of refuge establishment. This agreement was included in the final Establishment EA, and the intentions stated within the agreement have been considered as management direction. In the Revised Final EA for Nestucca Bay NWR (01/1993), in which the approved refuge boundary was reduced to 3,060 acres, the Service emphasizes that acquisition was considered a mechanism for ensuring that the dairying practices which had supplied the migratory geese with high-quality wintering habitat would be continued for the long term. In developing the MOU, "the Service and dairy landowner representatives worked toward developing an understanding which would protect wintering goose habitat in the Nestucca Bay area while recognizing the importance of the dairy industry in meeting that objective." The MOU states that "Refuge lands will continue to be grazed as appropriate. … It is vital that the Refuge pastures be maintained in a shortgrass condition in order to support wintering geese."

In the intervening years since establishing the Refuge, the Service has acquired an additional 216 acres of diked wetland pastures within the original approved boundary of Nestucca Bay NWR. This included a transfer of 31 acres of lowland and upland pasture conveyed to the Service from the Farm Services Agency. A total of 346 acres of refuge pastures are now managed for geese, utilizing the services and expertise of local dairy operators through Cooperative Land Management Agreements.

Additional acquisitions to the original Nestucca Bay approved boundary have included formerly diked pastures that had reverted to muted tidal wetlands due to a non-functioning tidegate and dike breaches. These wetland tracts were not considered desirable as dairy pasture and they had reverted to jurisdictional tidal wetlands, and therefore were restored to full tidal action as part of the 82-acre Little Nestucca Tidal Marsh Restoration completed in 2007. Other acquisitions within the original boundary included intertidal marsh adjacent to state tidelands.

In 1998, the Service began the planning process to expand Nestucca Bay NWR through the addition of the Neskowin Marsh Unit to the Refuge. The acceleration of development along the Oregon coast, including new and planned housing developments adjacent to or overlooking Neskowin Marsh, caused concern on the part of the Service that further development in and around Neskowin Marsh could severely impact the unique and rare habitats found there. At the time of the proposal, Neskowin Marsh was the largest unprotected freshwater marsh remaining on the Oregon coast. The Service identified approximately 375 acres of land to be included within the approved boundary of the proposed Neskowin Marsh Unit. Implementation of this proposal expanded the refuge boundary from 3,060 acres to 3,435 acres to encompass the entire Neskowin Marsh complex, including the Neskowin Beach Golf Course (48 acres) and freshwater marsh just south of the golf course.

Since the establishment of the Neskowin Marsh Unit in 2002, 228 acres of wetland and adjacent uplands have been acquired within the Unit, including 27.5 acres of seasonally flooded marsh and adjacent coastal dune and riparian woodland which were donated by the Sycan B. Corporation for addition to the Neskowin Marsh Unit. The Sahhali Shores housing development by the Sycan B. Corporation bordered the Neskowin Marsh, with the planned homes situated on a steep slope above and to the southeast of the tract that was donated. This property was very important as a buffer to prevent further urban development from encroaching on Neskowin Marsh. A small portion of the donation tract was located outside (north of) the approved refuge boundary but because it was an integral part of the wetland complex, the boundary was adjusted through a Categorical Exclusion.

1.7 Relationship to Other Planning Efforts

When developing a CCP, the Service considers the goals and objectives of existing national, regional, state, and ecosystem plans and/or assessments. The CCP is expected to be consistent, as much as possible, with existing plans and assist in meeting their conservation goals and objectives (602 FW 3). This section summarizes some of the key plans reviewed by members of the core team while developing the CCP.

1.7.1 Refuge Plans

Key plans utilized for the original Nestucca Bay NWR include the Environmental Assessment for the proposed Nestucca Bay National Wildlife Refuge, produced in 1990 by the Service (USFWS 1990). This plan includes a history of the area and its various ownerships, the rationale for proposing its inclusion into the Refuge System, a description of historical and current uses and threats, detailed descriptions of wildlife and habitats included in the proposed refuge, and an evaluation of the biological, social, and economic effects of establishing this refuge. The Revised Final Environmental Assessment and Land Protection Plan for the Nestucca Bay National Wildlife Refuge and Cooperative Resource Management Area (USFWS 1993a), also included the rationale for amending the original EA, the revised acreage, and the Memorandum of Agreement established with the Nestucca Landowners Association.

The Nestucca Bay NWR Refuge Management Plan (USFWS 1993b) contains a detailed listing of establishing authorities as well as historical uses of the area, land ownership status, associated agreements and easements, and a description of habitat and wildlife resource changes through time, up to the date of publication. Goals, objectives and management strategies detailed in the Refuge Management Plan provided direction for the management of the new refuge and were utilized in developing updated goals and objectives for this CCP. Information useful for the Physical Environment (Chapter 3), Biological Environment (Chapter 4), and Socioeconomic Environment (Chapter 5) was found in the Wildland Fire Management Plan (USFWS 2004). The Fire Plan contains climate data, plant and wildlife species and community descriptions, refuge facilities and infrastructure information updated through 2004, information on wildfire risk and suppression options, and identification of sensitive habitats to be considered in planning for fire risk reduction and suppression actions. The Environmental Assessment and Public Use Plan for the Development of Public Use Program and Associated Facilities on Cannery Hill (USFWS 2007a) was consulted for specific information pertaining to the establishment of public use on Cannery Hill, including the need for action and a thorough evaluation of potential effects to wildlife, habitat, and the community.

The Preliminary Project Proposal for the Proposed Addition of the Neskowin Marsh Unit (USFWS 1997a) provided basic habitat and wildlife information as well as the relationship of the proposed addition to ecosystem management goals and objectives. The Environmental Assessment, Land Protection Plan, and Conceptual Management Plan for the Neskowin Marsh Unit Addition (USFWS 2000a) provided much greater detail on the unique biological resources of the marsh. This EA also contained an evaluation of the biological, social, and economic effects of establishing this new refuge unit.

1.7.2 Other Plans and Assessments

When developing a CCP, the Service considers the goals, objectives, strategies, and other information available in existing national, regional, and ecosystem plans, state fish and wildlife conservation plans, and other landscape-scale plans developed for the same watershed or ecosystem in which the refuges are located. To the extent possible, the CCP is expected to be consistent with the existing plans and assist in meeting their conservation goals and objectives. The following list identifies some of the key plans and assessments which were reviewed by members of the core team while developing the CCP.

- Birds of Conservation Concern (USFWS 2008a)
- Birds of Management Concern (BMC) – Region1 (USFWS 2005)
- Vegetation monitoring and mapping, 2008-2009: Little Nestucca tidal wetland restoration site, Nestucca Bay National Wildlife Refuge (Brophy 2010)
- Development of a Salt Marsh Assessment Tool to Monitor System Integrity and Provide Management Priorities for Wildlife Conservation in Response to a Hierarchy of Threats: Global Change, Invasive Species and Local Stressors (Guntenspergen et al. 2009)
- Rising to the Challenge: Strategic Plan for Responding to Accelerating Climate Change (USFWS 2010a)
- Strategic Plan for Inventories and Monitoring on National Wildlife Refuges: Adapting to Environmental Change (USFWS 2010b)
- Important Fish and Wildlife Habitats in Oregon (USFWS 1980)
- Nestucca Bay National Wildlife Refuge Remnant Prairie Site Assessment (Institute of Applied Ecology [IAE] 2011)
- Plant Communities and Succession in Oregon Coastal Salt Marshes (Jefferson 1975)
- Coastal Coho Habitat Factors for Decline and Protective Efforts in Oregon (National Marine Fisheries Service [NMFS] 1997a)
- Endangered and Threatened Species: Final Threatened Listing Determination, Final Protective Regulations, and Final Designation of Critical Habitat for the Oregon Coast Evolutionarily Significant Unit of Coho Salmon (National Oceanic and Atmospheric Administration [NOAA] 2008)
- North American Waterfowl Management Plan (NAWMP Plan Committee 2004)
- North American Waterbird Conservation Plan (Kushlan et al. 2002)
- Northern Pacific Coast Regional Shorebird Management Plan (Drut and Buchanan 2000)
- Oregon's Salt Marshes (Oberrecht 1997)
- Living with Nutria (Oregon Department of Fish and Wildlife [ODFW] 2011a)
- Oregon Biodiversity Information Center (ORBIC 2010)
- Pacific Flyway Management Plan for the Dusky Canada Goose (Pacific Flyway Council [PFC] 2008)
- Partners In Flight Species Assessment Database (PIF 2010)
- 2005 Survey for the Presence of Oregon Silverspot Butterfly, *Speyeria zerene hippolyta*, on the Clatsop Plains, Oregon (Patterson 2005)
- State of Oregon Conservation Strategy (ODFW 2006)
- White-cheeked Geese Surveys at Nestucca, Nehalem, and Tillamook Bays, Oregon 2010-11 (Stephensen and Horton 2011)
- Threatened, Endangered, and Candidate Fish and Wildlife Species in Oregon (ODFW 2012a)

- Identifying Resources of Concern and Management Priorities for a Refuge: A Handbook (USFWS 2008b)

1.8 Special Designation Lands

1.8.1 Important Bird Areas (IBA)

The Important Bird Areas (IBA) program is a global effort to identify the most important areas for maintaining bird populations and focusing conservation efforts on protecting these sites. Within the U.S., the program has been promoted and maintained by the American Bird Conservancy (ABC) and the National Audubon Society (Audubon). The ABC is coordinating the identification of nationally significant IBAs while Audubon is working to identify sites in individual states. Audubon is working within each state to identify a network of sites across the U.S. that provide critical habitat for birds. This effort recognizes that habitat loss and fragmentation are the most serious threats to birds across North America and around the world. By working through partnerships, principally the North American Bird Conservation Initiative, to identify those places that are critical to birds during some part of their life cycle (breeding, wintering, feeding, migrating), the intent is to minimize the effects that habitat loss and degradation have on bird populations. The IBA program has become a key component of many bird conservation efforts. More information is available at http://www.audubon.org/bird/iba/index.html.

The goals of the IBA program are to identify the sites that are the most essential for long-term conservation of birds and to take action to ensure the conservation of these sites (Cullinan 2001). An IBA is a site that provides essential habitat for one or more species of birds. The IBA selection process examines sites based on the presence and abundance of birds and/or the condition and quality of habitat. IBAs are chosen using standard biological criteria and expert ornithologists' review. All sites nominated as potential IBAs are rigorously evaluated to determine whether they meet the necessary qualifications. IBAs represent discrete sites, both aquatic and terrestrial, that are critically important to birds during their annual life cycle (e.g., breeding, migration, and/or wintering periods).

The 1,010-acre Nestucca Bay NWR IBA includes the Bay and the adjacent lowlands as well as Neskowin Marsh. This designated IBA contains a wealth of habitats including lowland pastures, grasslands, woodlands, tidal marsh and mudflats, freshwater bogs, and forested lagg. It is considered to be within the Northern Pacific Rainforest Bird Conservation Region. The ornithological significance of this IBA is centered around Nestucca Bay's importance to Aleutian and dusky Canada geese. Audubon Society's IBA website notes that during winter months the pastures around Nestucca Bay host the entire Semidi Islands population (about 145 birds) of Aleutian Canada geese (Federal Register 2001:Table 1, Roy Lowe personal communication), and from 8-16% of the entire dusky Canada goose population. The IBA description also notes that this is one of the few coastal wintering populations of dusky Canada geese.

1.9 Planning Process and Issue Identification

1.9.1 Planning Process

Planning Team: The core planning team for Nestucca Bay NWR consists of the project leader, deputy project leader, refuge manager, visitor services manager, wildlife biologist, and natural resource planner. An extended team consisting of biologists; cultural resource, public use, and realty specialists; economists; and law enforcement officers from the Regional Office, other Federal agencies, State agencies, the Confederated Tribe of the Grand Ronde, the Nature Conservancy, and a private environmental consultant assisted in the development of this CCP, particularly in providing comments at key milestones. The full list of core and extended team members and their roles is provided in Appendix I.

Resources of Concern: The planning process began when the planning team reviewed refuge purposes and considered other plans and reports, and sought input from Oregon State conservation agencies and non-governmental organizations. The planning team then identified the top priority species, groups, and communities for the Refuge. A comprehensive list of potential resources of concern was compiled based upon review of the plans referenced above, many of which highlight priority species or habitats for conservation. From this list, those species and habitats that are most representative of refuge purposes and habitats, BIDEH, as well as other FWS and ecosystem priorities, were chosen as priority resources of concern (habitat types) and focal resources (plant and animal species). This list was then provided to participants in the Wildlife and Habitat Review, which was held on the Refuge on March 17, 2010, and included the extended team as well as Oregon Department of Fish and Wildlife biologists. The participants raised important issues and provided feedback that was used to refine the Priority Resources of Concern table. This table includes focal species, also called conservation targets, which were selected as representatives or indicators for the overall condition of important refuge habitats. Most of the biological emphasis of the CCP is focused on protecting and restoring these species. See Appendix E for the Comprehensive Resources of Concern and Priority Resources of Concern.

Public Use Planning: Public use planning centered on developing goals, objectives and strategies around the six wildlife-dependent recreational uses that are defined in Service policy as priority, appropriate public uses for refuge lands. A Visitor Services Review for Nestucca Bay NWR was held on the Refuge on April 14, 2010, with representatives from the extended team and public use specialists from Oregon Parks and Recreation Department. A background document including existing uses and visitor facilities was provided to participants prior to the Visitor Services Review. The participants' input was used by the planning team to assess past, current, and future management issues surrounding public use while developing objectives and strategies during the Comprehensive Conservation Plan process. In addition, the Service hired a contractor to conduct a Facilities Review which provided insight and conceptual plans for the future of administrative and visitor facilities at Nestucca Bay NWR. This information was also incorporated into the alternatives and some ideas were included as strategies to achieve broader goals for future management of this Refuge.

Public Involvement: Public scoping began in November 2010 with a notice in the Federal Register [November 29, 2010, Volume 75, Number 228] and a public meeting November 30, 2010, in Pacific City. Public input was also solicited through distribution of planning updates to our mailing list and meetings with key stakeholder groups. The comments and suggestions made through this process helped further develop and refine the management alternatives for the CCP, including the preferred alternative. A second planning update containing preliminary draft alternatives was distributed in November 2011 and another public open house meeting was held on November 16, 2011, in Pacific City to explain the alternatives and take comments. The Nestucca Bay National Wildlife Refuge Draft Comprehensive Conservation Plan and Environmental Assessment (DCCP/EA) was issued for public review and comment on September 17, 2012. The availability of the plan was announced through a notice in the Federal Register [September 17, 2012, Volume 77, Number 180] and via direct contact with approximately 600 people on our mailing list. The plan was made available for downloading on the Oregon Coast National Wildlife Refuge Complex Planning website and was made available upon request in CD or printed format. Printed copies of the DCCP/EA were available at local public libraries, and upon request. All changes made as a result of public and agency comments were documented. A summary of public involvement is included in Appendix J; public comments on the DCCP/EA and the Service's responses to comments are included in Appendix K.

1.9.2 Key Issues Addressed in the CCP

The core planning team evaluated the issues and concerns raised during public scoping. The Service defines an issue as "Any unsettled matter that requires a management decision, e.g., an initiative, opportunity, resource management problem, threat to the resources of the unit, conflict in uses, public concern, or the presence of an undesirable resource condition (602 FW 1 1.6 K)." Issues are important to the planning process because they identify topics to be addressed in the CCP, pinpoint the types of information to gather, and help define alternatives for the CCP. It is the Service's responsibility to focus planning and the analysis on the major issues. Major issues typically suggest different actions or alternative solutions, are within the Refuge's jurisdiction, and have a positive or negative effect on the resource. The following issues are within the scope of the CCP and were considered by the Service to be the major issues to address in this planning process:

Wildlife and Habitat Management: What actions should the Service take to sustain and restore priority species and habitats over a period of 15 years? Given the importance of lowland pasture habitats to sensitive goose populations within the Nestucca Bay estuary, what priority should the Service place on restoring hydrologic function, historic water flows, tidal flows and floodplain functions on the refuge? How can the Service accomplish pasture maintenance and habitat restoration and still maintain a balance between diverse habitat types including some rare habitats that are least well-represented? Are there opportunities to restore upland forest, forested wetlands, and riparian areas? How much emphasis should the Service place on restoring coastal prairie to the standards required to support reintroduction of the threatened Oregon silverspot butterfly? How will the Service prioritize inventory, control, and monitoring of invasive species?

Climate Change: What actions should the Service take to address anticipated impacts to refuge resources from climate change/sea level rise, including species range shifts, phenological changes, decoupling of species assemblages, hydrological changes, ocean acidification, and changes in disturbance regimes? Are there focal species that will be adversely affected (directly or indirectly) by climate change, and what might be done to mitigate for that? How can cumulative stresses be reduced (e.g., among climate stress and other anthropogenic stresses, which do we have most control over)? Many of these threats are much larger in scope than just Nestucca Bay NWR. They will be addressed at various scales depending on available information and what is most appropriate and relevant to the Refuge.

Public Uses: What public use opportunities best support refuge purposes and increase visitor awareness of the Service's and Refuge System mission and goals? Should the Service consider opening new areas of the Refuge to public access, and what activities should be allowed in these areas? Where would new trails and other wildlife observation facilities be compatible and desirable on Nestucca Bay NWR, and if constructed, how can these be designed to enhance public enjoyment, understanding, appreciation, and stewardship of refuge resources? Should the Service consider opening portions of the Refuge to waterfowl hunting and fishing, and if so, where?

Facilities: Is there a need for a Service-owned visitor and education center at Nestucca Bay NWR? Should the Service place high priority on constructing a visitor center at Nestucca Bay NWR, or would it better serve the resources and the public to replace the existing volunteer residence with a combination bunkhouse and small office? Does the potential exist for redesigning and expanding the parking capabilities to accommodate an increase in public use?

1.10 Refuge Vision and Goals

1.10.1 Vision Statement

Coastal prairie, wooded uplands, managed pastures, and salt marsh provide a mosaic of habitats for fish and wildlife at Nestucca Bay National Wildlife Refuge. The verdant pastures lining Nestucca Bay are a winter haven for thousands of Canada geese while the restored tidal marshes are nursery habitat for salmonids.

Through refuge trails and overlooks and hands-on environmental education programs we will strive to inspire visitors to act wisely to preserve the wide diversity of healthy habitats and the abundance of wildlife that characterize the Refuge.

Deep in Neskowin Marsh rare sedge fen, shrub carr, and sphagnum bogs are surrounded by a forested lagg and shelter endemic plants. The rich soils of the marsh, with their alternating layers of peat and sand, harbor a well preserved history of tsunami activity. With minimal human influence, the rare habitats of the marsh will continue to recover and evolve.

Working together with our partners, friends, and volunteers, the future of this Refuge will reflect a commitment to adapt to the realities of climate change and a dedication to wildlife conservation.

1.10.2 Refuge Goals

Refuge management goals are descriptive, open-ended, and often broad statements of desired future conditions that convey a purpose, but do not define measurable units. Goals must support the refuge vision and describe the desired end result.

Wildlife and Habitat Goals:

1. Protect and maintain agricultural lands supporting wintering migratory birds.
2. Restore, protect, and maintain upland prairie and grasslands characteristic of the North Pacific Coastal Ecosystem.
3. Protect and maintain upland forests characteristic of the North Pacific Coastal Ecosystem.
4. Enhance, protect, and maintain estuarine habitats characteristic of the Pacific Coastal Ecosystem.
5. Protect and maintain freshwater habitats characteristic of the North Pacific Coastal Ecosystem.
6. Protect and maintain forested wetlands and stream-riparian habitat characteristic of the North Pacific Coastal Ecosystem.
7. Promote the recovery of the federally threatened Oregon silverspot butterfly.
8. Enhance, protect, and maintain instream aquatic habitat for all dependent species including anadromous and estuary-dependent fish.
9. Research and monitoring. Gather scientific information (surveys, research, and assessments) to support adaptive management decisions.

Public Use Goals:

10. Provide and manage quality opportunities for visitors of all abilities to observe and/or photograph a variety of subspecies of Canada geese and other wildlife using lowland pastures along with coastal wetlands, grasslands and mixed hardwood forest thus promoting the protection and preservation of coastal ecosystems.
11. Offer hands-on environmental education programs to communities that promote life-long learning about coastal wildlife and their habitats.
12. In cooperation with partners and volunteers offer year-round interpretive opportunities to visitors of all ages and abilities to learn about and experience a range of coastal habitats including coastal prairie, estuary, and tidal marsh thus instilling an ethic of conservation and resource protection for coastal wildlife adapted to these habitats.
13. Provide and manage safe, enjoyable, and quality hunting and fishing opportunities for people of varying ages and resources that furthers the tradition of wildlife conservation and stewardship.
14. Provide facilities and materials that welcome and orient children and adults to Nestucca Bay National Wildlife Refuge so they can easily and safely learn about its fish and wildlife resources.

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Chapter 2
Management Direction

Roy W. Lowe/USFWS

Chapter 2. Management Direction

2.1 Overview

During development of this CCP, the Service reviewed and considered a variety of local and regional physical and biological resource conditions, as well as social, economic, and organizational aspects important for managing the Refuge. This background information is described more fully in Chapters 3, 4, and 5. As is appropriate for a national wildlife refuge, natural resource considerations were fundamental in designing alternatives. House Report 105-106 accompanying the National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57) states "…the fundamental mission of our System is wildlife conservation: wildlife and wildlife conservation must come first." Toward this end, the refuge planning team reviewed scientific reports and studies to better understand ecosystem trends and the latest scientific recommendations for species and habitats.

Public involvement was an important part of the planning process. Local, State, and Federal agencies, Tribes, and elected officials were contacted by the Refuge Complex planning team to ascertain priorities and problems as perceived by others. In addition to holding a public scoping meeting to explain the process and accept comments and suggestions, the team contacted refuge users, nonprofit groups, and community organizations to ensure their comments and ideas were considered during the development of alternatives. The planning team then developed preliminary management concepts and strategies, which they presented to the public in a planning update and at a public meeting in fall 2011. Based on all of the information gathered and feedback from others through the public involvement process, the Service developed three draft alternatives for the Draft Comprehensive Conservation Plan and Environmental Assessment (Draft CCP/EA) for Nestucca Bay National Wildlife Refuge (USFWS 2012a), which was released in September 2012. Alternative C was selected as the preferred alternative.

The CCP planning team reviewed and evaluated all of the comments received during the 30-day Draft CCP/EA comment period. Alternative C within the Draft CCP/EA was selected for implementation. In some cases, the management direction has been either clarified or modified based upon public feedback. The details of public participation can be found in Appendix J, Public Involvement, and Table L-2 within Appendix K, Comments Received during Public/Agency Review Period and Service Responses, shows the major changes between the draft and the final CCP.

2.2 Management Directions Considered but Not Developed

Early in the alternatives development process, the planning team considered including the following actions in one or more CCP alternatives. These actions were ultimately eliminated from further consideration in this CCP for the reasons provided.

New Trails, Observation Decks, and a Road in Sensitive Areas. Several trails, observation decks and a road that were requested by the public during scoping could not be considered for development due to the high likelihood of impacts to sensitive fish, wildlife, and plant species and negative effects to marsh hydrology. The Service was initially asked to consider the development of an elevated boardwalk trail to replace the existing tsunami evacuation trail through Neskowin Marsh since this trail often floods in the winter months. The primary use of the trail is as a tsunami evacuation trail, although it is also used daily by local residents to travel between Neskowin Crest and other parts of the community including the beach. Development of this trail into an elevated boardwalk to serve the public for wildlife-oriented recreation purposes has physical limitations within the community of Neskowin including very narrow streets, a lack of parking, and the community preference against inviting public use through town. These limitations led to the decision to eliminate from further consideration the replacement of the tsunami evacuation trail with an elevated boardwalk for use by the general public.

A request was made to the Service by local residents and the Tillamook County Board of Commissioners to convert the tsunami evacuation trail into a one-lane road for vehicles to use during an evacuation. Allowing a road to be constructed on the Refuge for this purpose would not be an appropriate use. Constructing a road would necessitate removal of riparian vegetation and construction of a bridge would be necessary to meet ODFW and NOAA Fisheries fish passage requirements for threatened coho salmon. The placement of additional fill material or rock on the existing trail would further impound high flows resulting in more extensive flooding affecting Hawk Street, adjacent low-lying homes and negatively impacting marsh hydrology. For these reasons, converting the tsunami evacuation trail to a road was eliminated from further consideration. Other trails through Neskowin Marsh, including a trail north of the existing tsunami evacuation trail, would traverse rare bog habitat and would necessitate major construction and disruption of the hydrology of the marsh and would impact rare plants; therefore, new trails through Neskowin Marsh were not developed as alternatives.

Restoration of all Pastures to Tidal Marsh. The National Wildlife Refuge System Administration Act of 1966, as amended, requires management of units of the Refuge System to be consistent with individual refuge purposes and the mission of the System. The System mission is “to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.” We believe that over the long term, restoration of some lowland pastures on refuge lands within Nestucca Bay NWR to a naturally functioning tidal marsh may be desirable; however, for the life of this plan (15 years) we believe that restoration would not best serve current conservation objectives.

The Nestucca Bay NWR was established in 1991 to conserve fish, wildlife, and plants which are listed as endangered or threatened species; for migratory birds; and for conservation of wetlands. The Refuge protects and provides high quality forage and sanctuary for wintering geese and other migratory birds. The diked marshes and lowland pastures are managed intensively for six subspecies of white-cheeked geese, with particular emphasis placed on dusky Canada and Aleutian Canada geese. When the Refuge was established in 1991, the Aleutian Canada goose had been listed as endangered since 1967. It was downgraded to threatened in 1990 and was removed from the Federal Endangered Species List in 2001. Establishing legislation for the Refuge included the Endangered Species Act, and the Service’s intent in acquiring the lowland pastures was to manage them to continue providing quality wintering forage and sanctuary for these geese. The Nestucca Bay area is also the only known wintering area for the declining dusky Canada geese on the Oregon coast. The Refuge is cited in the Pacific Flyway Dusky Management Plan as providing important wintering habitat for duskys (PFC 2008). Up to 18% of the entire dusky Canada goose population is supported by refuge pastures on an annual basis during the winter period (Stephensen and Horton 2011). In addition, refuge pastures support up to 100% of the unique Semidi Islands Aleutian Canada goose population.

The Refuge was established with the objective of managing to protect wintering goose habitat in the Nestucca Bay area while recognizing the importance of the dairy industry in meeting that objective. Since establishment, refuge managers have worked with local dairy farmers to maintain short grass habitats (pastures) around Nestucca Bay to benefit geese and other wildlife. Dikes and tide gates have been maintained to protect the lowland pastures from flooding. Of the Refuge's 1,010 acres, 346 acres are actively managed as pasture habitat for geese and other waterfowl. Because they are historic tidal marsh, the lowland pasture soils are poorly drained, fine-textured, and very strongly acidic, which limits the plant species that can successfully grow in the pastures. The pastures are level or lower than the estuary water table and the soils are waterlogged during the wet season of October through April. The low elevation of the fields causes the water levels to rise following periods of heavy rain, sometimes quite rapidly. The pastures currently function as wet meadow/seasonal wetlands.

The Aleutian Canada goose was removed from protection under the Endangered Species Act in 2001 and the population had expanded to approximately 112,000 birds by the winter of 2011 (USFWS 2011c), resulting in crop damage complaints from farmers in wintering and migration areas including Nestucca Bay. In recent years, a large increase in the number of Aleutian Canada, lesser Canada and Taverner's Canada geese wintering in the Nestucca Bay area has greatly intensified goose damage concerns to area dairy operations. Area dairy farmers often haze geese from their pastures particularly in late-winter and spring, in order to protect the grass forage for their dairy cows. The spring growth of new grass is particularly important to local dairy operations. In order to reduce the incidence of disturbance to dusky Canada geese through hazing and other methods, and to minimize goose depredation on neighboring privately owned pastures, the Refuge's intent has continued to be the attraction and maintenance of wintering geese, especially dusky Canada geese, on refuge pastures. Restoration of all refuge pastures to tidal marsh at this time would eliminate this habitat and place the full burden of providing goose forage on private dairy farmers.

Tidal marsh habitat at Nestucca Bay has declined by 91 percent (Brophy 2011), and other Oregon estuaries have experienced similar losses. Tidal marsh habitat is unequivocally acknowledged as extremely important for many species of fish and wildlife as well as overall health of an estuary. In 2007, an 82-acre parcel of Nestucca Bay NWR was restored to tidal marsh. This area formerly consisted of five private parcels that previously served as diked pasture, but had been allowed to revert to muted tidal conditions for 15-20 years before refuge acquisition. The restoration project involved removing a 0.7-mile dike, placing 23 complexes of large woody debris (LWD), re-establishing or restoring 2 miles of tidal channel, and removing two tide gates to provide fish passage to 1.5 miles of tidal channel. The project benefited juvenile salmonids, including spring and fall Chinook, chum, and coho salmon and steelhead and cutthroat trout, by providing rearing habitat.

The Service acknowledges that the decision not to consider full restoration of pastures to tidal marsh at this time is based on planning for the next 15 years and not the foreseeable future. Climate change and sea level rise will be of increasing importance in setting management direction for all low-lying lands and waters within the Refuge. According to sea level rise modeling under a scenario of no further raising of dikes, the majority of the lowland pasture units of the Refuge would likely be at least partially inundated by sea level rise at some time during this century (So et al. 2011). As this happens, maintenance of dikes and water control structures to keep tidal action out of the pastures would become increasingly expensive and unsustainable, and the pastures would gradually return to tidal marsh whether or not the Service undertakes an active restoration program. However, because of our previous agreement with landowners, our continuing desire to manage for a variety of habitats, and the ongoing need for this protected wintering habitat in the Nestucca Bay area, particularly for dusky Canada geese, for the life of this 15-year management plan the Service did not develop the alternative of restoring all lowland pastures to tidal marsh.

2.3 Description of Management Direction

A brief description of the management direction follows. Table 2-1 contains additional details regarding actions associated with the CCP. A map displaying management direction for the Refuge is located at the end of this chapter (Figure 2-1).

Wildlife and Habitat Management. Refuge management will continue to emphasize protecting and maintaining lowland pasture, estuarine, coastal bog, stream-riparian, and forested habitats. All lowland pastures will continue to be managed for wintering goose habitat through cooperative farming agreements with local farmers. Additional active habitat management, monitoring, and restoration will also be implemented. The 25-acre restoration of former coastal prairie on Cannery Hill will be focused on specific life-history parameters needed by the threatened Oregon silverspot butterfly, with the goal of introducing a nonessential experimental population once habitat parameters specified in the Oregon Silverspot Butterfly Recovery Plan are achieved. An additional 14 acres of upland grassland will also be restored to coastal prairie. In addition to allowing natural processes to drive vegetative changes, techniques such as thinning, girdling, and falling will be used to promote the development of late-successional characteristics within 214 acres of existing forest. A hydrological study will be conducted and used to guide the modification of the tsunami evacuation route through Neskowin Marsh to improve hydrology and accessibility. The Neskowin Marsh Unit will be proposed for designation as a Research Natural Area (RNA).

Public Use Management. Wildlife observation and photography will be enhanced by the development of new trails at Cannery Hill and the Little Nestucca Restoration area. An accessible path will provide a safe route around the lower parking lot to the new goose observation deck on Cannery Hill, and a gravel parking lot will be created on the west end of the Little Nestucca Restoration area. Wildlife observation and photography will be allowed year-round on Brooten Marsh.

A waterfowl hunting program will be established on Brooten Marsh (108 acres) and the mouth of the Little Nestucca River (33 acres) and clamming access will be allowed through Brooten Marsh. Bank fishing will be allowed on the east end of the Little Nestucca Restoration Area following the development of an access trail and gravel parking lot.

Environmental education efforts will be expanded through use of the Nature Discovery Backpack program, other partner-driven programs, and hiring of additional staff and volunteers. Interpretive signs and materials will be developed and installed in conjunction with new trails at Cannery Hill and the Little Nestucca Restoration Area.

To accommodate increasing visitation to the Refuge, the current refuge volunteer residence will be replaced with a bunkhouse and small administrative office. The Service will also remodel the north bay of the maintenance shop to accommodate two offices: one for maintenance staff and a second for the refuge Friends Group.

Adaptive Management. Adaptive management is a management philosophy and decision process that incorporates flexibility and continual learning. It involves monitoring and evaluation of refuge accomplishments, comparing accomplishments to objectives, and changing management strategies or objectives as necessary to achieve desired results. In the presence of accelerated climate change, adaptive management is an increasingly important management-decision process. The Refuge will employ adaptive management as a standard operating procedure.

Appropriateness and Compatibility. Consistent with relevant laws, regulations, and policies, prior to allowing any public use of the Refuge (including commercial use), each use will first need to be found appropriate and determined compatible (16 U.S.C. 668dd-668ee, 50 CFR 25, 26, and 29; and 603 FW 1 and 2). In the Draft CCP/EA, the Service made preliminary findings and determinations regarding the appropriateness and compatibility of each use included in each alternative. Appropriateness findings and compatibility determinations have been finalized for each use included in the Service's management direction. Appropriateness and compatibility are further discussed in Appendices A and B.

Climate Change. As stated in the Department of the Interior's Secretarial Order 3226 and the Service's Climate Change Strategic Plan (USFWS 2010a), the Service considers and analyzes climate change in its decisions, long-range plans and other activities. Habitat conditions and wildlife populations are directly and indirectly sensitive to climatic conditions, namely precipitation and temperature and changes to hydrologic conditions, sea level rise, and ocean acidification. As described in greater detail in Chapter 3, the Refuge is potentially affected by sea level rise in spite of upward vertical land movement and estimated sediment and vegetative accretion rates. The Refuge may be also be affected by storm surges, increases in extreme precipitation events, higher water temperatures, and ocean acidification.

The combined changes can affect the Refuge's habitats and species directly, such as the timing of arrival of migratory birds and many other phenologic responses, changes in species' ranges and physiology, and indirectly such as added vulnerability to other stressors including increasing invasive species and pathogens. Predicting biological response at the population level, however, requires complex research and information and sophisticated models that can be validated with field studies over time. This highlights the importance of monitoring habitat and species to establish potential correlations and adaptation options.

Knowledge and monitoring of regional and local climate trends on refuge resources will be used to assess potential changes or enhancements to the Refuge's management actions and techniques and/or their timing, using the adaptive management approach described above.

The Refuge Complex staff will participate in and contribute to climate change and sea level rise assessment efforts, including those underway at a landscape scale. Participation in the North Pacific Coast Landscape Conservation Cooperative (LCC) will provide refuge staff with a means to tie in with a larger scale assessment of the impacts of climate change (USFWS 2010a). LCCs are formal science-management partnerships between the Service, Federal agencies, states, tribes, non-government organizations (NGOs), universities, and other entities to address climate change and other biological stressors in an integrated fashion. LCCs provide science support, biological planning, conservation design, research, and design of inventory and monitoring programs.

As needed, objectives and strategies will be adjusted to assist in enhancing the resiliency of refuge resources to climate change. Specific management goals, objectives and strategies, based on climate change impact projections, will be identified for refuge habitats most vulnerable to climate change and sea level rise.

The Service has developed a Strategic Plan for Responding to Accelerating Climate Change in the 21st Century (USFWS 2010a), and an Action Plan outlining specific actions needed to implement the Strategic Plan. The Action Plan calls for the Service to make its operations carbon-neutral by 2020. The Refuge will work toward this goal by continuing to pursue and engage in mechanisms to conserve energy in refuge operations, including the use of fuel-efficient vehicles and building appropriately sized, energy-efficient facilities, as funding becomes available. The Refuge will also reduce the carbon footprint of land management activities by using energy-efficient techniques, where feasible and in line with management goals. The Refuge will also continue to explore ways of offsetting any remaining carbon balance through carbon sequestration such as reforesting a portion of Cannery Hill, which began a decade ago.

Cultural Resources Protection. The Service will continue to uphold Federal laws protecting cultural resources, including the National Historic Preservation Act (NHPA), Archaeological Resources Protection Act (ARPA), and Native American Graves Protection and Repatriation Act (NAGPRA). These laws also mandate consultation with Native American tribes, the State Historic Preservation Office (SHPO), and other preservation partners. The NHPA mandates that all projects that use Federal funding, permitting, or licensing be reviewed by a cultural resource professional to determine if there is the potential to affect cultural resources. An inventory will be conducted as necessary, and appropriate actions to mitigate effects will be identified prior to implementation of the project. A project-specific determination will be conducted for all undertakings as defined by NHPA, including habitat maintenance and restoration projects as well as new or expanded trails, roads, facilities, and public use areas.

Fire Management. The overall objective for fire management on the Complex is to promote a program that provides for firefighter and public safety, reduces the occurrence of human-caused wildfires, and ensures appropriate suppression response capability to meet expected wildland fire complexity. Fire Management Plans (FMPs) were completed for the entire Complex, including Nestucca Bay Refuge, in 2004. The FMP details response to the threat of wildfire and under what circumstances the refuges will use wildland fire as a tool on refuge lands.

Implementation Subject to Funding Availability. Actions described in this CCP will be implemented over the life of the plan as funding becomes available. Project priorities and projected staffing/funding needs are included in Appendix C.

Integrated Pest Management (IPM). In accordance with 517 Departmental Manual (DM) 1 and 569 Fish and Wildlife Service Manual (FW) 1, an integrated pest management (IPM) approach will be utilized, where practicable, to eradicate, control, or contain pest and invasive species (herein collectively referred to as pests) on refuge lands. IPM will involve using methods based upon effectiveness, cost, and minimal ecological disruption, which considers minimum potential effects to non-target species and the refuge environment. Pesticides may be used where physical, cultural, and biological methods or combinations thereof, are impractical or incapable of providing adequate control, eradication, or containment. If a pesticide is needed on refuge lands, the most specific (selective) chemical available for the target species will be used unless considerations of persistence or other environmental and/or biotic hazards would preclude it. In accordance with 517 DM 1, pesticide usage will be further restricted because only pesticides registered with the U.S. Environmental Protection Agency (USEPA) in full compliance with the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and as provided in regulations, orders, or permits issued by USEPA may be applied on lands and waters under refuge jurisdiction.

Appendix G contains the Refuge's IPM program documentation to manage pests for this CCP. Along with a more detailed discussion of IPM techniques, this documentation describes the selective use of pesticides for pest management on refuge lands, where necessary. Throughout the life of the CCP, most proposed pesticide uses on refuge lands will be evaluated for potential effects to refuge biological resources and environmental quality. These potential effects will be documented in "Chemical Profiles" (see Appendix G). Pesticide uses with appropriate and practical best management practices (BMPs) for habitat management as well as facilities maintenance will be approved for use on refuge lands where there likely would be only minor, temporary, and localized effects to species and environmental quality based upon non-exceedance of threshold values in Chemical Profiles. However, pesticides may be used on refuge lands where substantial effects to species and the environment are possible (exceed threshold values) in order to protect human health and safety (e.g., mosquito-borne disease).

Because invasive plants and animals currently represent the greatest threat to the Refuge's wildlife and habitat, control of invasive species will be a high priority management activity. Invasive species such as Scotch broom, Himalayan blackberry and reed canarygrass will continue to be a primary management concern and will be controlled to the degree that funding permits. Invasive species control will be initiated prior to or concurrently with all habitat restoration efforts.

The magnitude of pest problems on the Refuge is beyond the available capital resources to expect control or eradication during any single field season; therefore it is essential to prioritize treatment of infestations. Some non-native species which are pervasive on refuge lands are the subject of long-term control efforts and will continue to be a high priority. Also, the Service will find and verify the identity of new invasive species as early after entry as possible, when eradication and control are still feasible and less costly. Regardless of whether the invasive species is well established or newly introduced, the Refuge will prioritize pre- and post-treatment monitoring, assessment of the successes and failures of treatments and development of new approaches when proposed methods do not achieve desired outcomes.

Land Protection. The Service has the authority to acquire land or negotiate agreements on behalf of the National Wildlife Refuge System only within an approved refuge boundary. The Service can make offers to purchase land, purchase conservation easements, or enter into management agreements with willing landowners within the approved boundary. Lands or interests therein do not become part of the National Wildlife Refuge System unless they are purchased from or are placed under a management agreement with the individual landowner. Service authority over any use of lands within an approved refuge boundary is limited to lands the Service has acquired in fee title, conservation easement, or entered into a management agreement. Private landowners within an approved refuge boundary retain all of the rights, privileges, and responsibilities of private land ownership and are under no obligation to sell their property to the Service. Service policy for land acquisition is to work on a one-on-one basis with a willing seller/interested landowner. Based on the availability of funds, the Service will continue to negotiate with willing sellers to acquire lands within the existing approved refuge boundary.

Maintenance of Existing Facilities. Periodic maintenance of refuge buildings and facilities will be necessary. Periodic maintenance and upgrading of facilities is necessary for safety and accessibility and to support management and visitor needs, and is incorporated in the Service Asset Management System.

Regulatory Compliance. Prior to implementation, all planned activities will undergo appropriate reviews and consultations, and permits and clearances will be secured, as necessary, to comply with legal and policy requirements. This includes water quality permits required under Section 401, and dredge and fill permits required under Section 404 of the Federal Water Pollution Control Act of 1982, as amended (33 U.S.C. 1251-1382); appropriate evaluations and documentation under the National Environmental Policy Act; and, as noted above, evaluation and consultation required by Section 7 of the Endangered Species Act, and review and consultation required by Section 106 of the National Historic Preservation Act.

Response to Mosquito-borne Diseases. Under draft refuge policy (72 Federal Register 71939), mosquito populations on refuge lands are allowed to fluctuate and function unimpeded unless they pose a threat to wildlife and/or human health. While the Service recognizes that mosquitoes are a natural component of most wetland ecosystems which provide food for some fish and wildlife including migratory birds, we also recognize they can be a nuisance and may represent a threat to human and/or wildlife health. To protect human and wildlife health and safety, the state or a local vector control agency would be allowed to control mosquito populations on refuge lands using pesticide treatments (larvicides, pupacides, or adulticides) only if local, current population monitoring and/or disease surveillance data indicate refuge-based mosquitoes pose a health threat to humans and/or wildlife. As previously described, mosquito treatments would be allowed on refuge lands in accordance with IPM principles applicable to all pests (see Appendix G). Proposed pesticide uses for mosquito control will utilize appropriate and practical BMPs, where possible, given potential effects documented in Chemical Profiles. If mosquitoes are determined to be posing a threat to wildlife and/or human health, a refuge compatibility determination (CD) will be written, which will provide details regarding mosquito population monitoring, disease surveillance, and treatments.

A disease contingency plan (DCP) will be prepared addressing response to mosquito-borne disease outbreaks on and/or adjacent to refuge lands. Much of the information will be evaluated and described in the previously mentioned CD (e.g., IPM treatment options) and will be incorporated with additional specificity, where necessary, into this plan. The DCP also will include other information such as the history of mosquito-borne diseases on and/or adjacent to the Refuge as well as measures to protect refuge visitors, Service-authorized agents, and Service employees when a health threat or emergency is identified by health officials.

Participation in Regional Planning and Conservation Efforts. The Refuge Complex staff will actively participate in and contribute to planning and conservation efforts for ongoing and future monitoring and research associated with tidal marsh restoration, invasive species detection and rapid response, and other activities that may affect refuge wildlife resources and habitats. Refuge Complex staff will cultivate working relationships with pertinent local, county, State, and Federal agencies to stay abreast of current and potential developments; and will utilize outreach, education, and information as needed to raise awareness of refuge resources and their dependence on a healthy local environment.

Partnerships. Partnerships on the Refuge are critical components in maintaining and continuing efforts to enhance recreation opportunities or implement resource management improvements, such as restoring habitat for threatened and endangered species. These partnerships typically involve joining forces with Federal, state, and local agencies and organizations. The Service will continue to devote time and effort towards maintaining existing and developing new partnerships to enhance collaboration on support of fish and wildlife resources, wildlife-dependent recreational opportunities, and educational programs, and to explore ways to share funding and seek grants on projects of mutual interest. Specifically, the Service will work with local and state agencies to promote mutual understanding, encourage environmentally friendly development, and promote eco-tourism opportunities.

Refuge Revenue Sharing. Annual payments to Tillamook County under the Refuge Revenue Sharing Act (16 U.S.C. 715s) will continue according to the established formula and subject to congressional appropriations.

State Coordination. The Refuge Complex will continue to coordinate with Oregon State agencies regarding areas of mutual interest. This includes communications with ODFW regarding public recreation, fish passage, and habitat restoration and management priorities identified through the Oregon Conservation Strategy.

Tribal Coordination. The Service will coordinate and consult with Native American Tribes on a regular basis regarding issues of shared interest. Currently the Service seeks assistance from Tribes in Native American Graves Protection and Repatriation Act and National Historic Preservation Act and related issues. The Service is also interested in partnering with Tribes to provide cultural resources education and interpretation opportunities.

Volunteer Opportunities and Partnerships. Volunteer opportunities and partnerships are recognized as key components of the successful management of public lands and vital to implementation of refuge programs, plans, and projects.

Wilderness Review. The Service's CCP policy requires that a wilderness review be completed for all CCPs. If it is determined that the potential for wilderness designation is found, the process moves on to the wilderness study phase. As part of the process for this CCP, the planning team completed a wilderness review which can be found in Appendix D. This review concluded that the Refuge is not suitable for wilderness designation

Table 2-1. Summary of Management Direction

Key Theme/issue	Future Management
Grasslands	
Pasture management	346 acres managed as pasture. Continue to manage and maintain pastures through Cooperative Land Management Agreements (CLMAs), including grazing and silaging fields, fertilizing, weed control, and maintaining fences and ditches. Evaluate and monitor water quality, control nuisance mammals where necessary to protect dikes and ditches.
Upland coastal prairie restoration	Restore up to 25 acres of native prairie by 2028 through a phased restoration project. Methods include control of non-native plants, removal of encroaching woody plants, seeding and planting of native prairie grasses and forbs, and periodic disturbance to maintain restored habitat. Focus is on habitat parameters necessary to support introduction of nonessential, experimental population of threatened Oregon silverspot butterfly.
Mixed upland grasslands	14 acres maintained and managed until restoration to upland coastal prairie is funded. Techniques will include targeted control of reed canarygrass, mowing and silage, and mechanical removal of encroaching woody species.
Forest	
Sitka spruce-western hemlock forest	214 acres actively managed. Continue control of invasive species. Use appropriate forest management techniques to thin trees where needed.

Table 2-1. Summary of Management Direction

Key Theme/issue	Future Management
Wetland Habitats	
Salt marsh	208 acres protected and maintained. Monitor and control invasive species using appropriate IPM techniques. Monitor salmonid use. Outplanting of rare, native species (e.g., Henderson's checkermallow) to increase native vegetation presence.
Intertidal mudflat	19 acres protected. Monitor for invasive and nuisance species and utilize appropriate IPM techniques to control. Work with Oregon Department of State Lands to cooperatively manage resources and treat/monitor invasive species.
Forested lagg – Neskowin Marsh	61 acres protected. Monitor for invasive and nuisance species and utilize appropriate IPM techniques to control. Designate as RNA.
Coastal bog – Neskowin Marsh	70 acres protected with additional site-specific monitoring. Monitor and control invasive species using IPM techniques. Conduct additional monitoring of water quality for off-site contaminants. Conduct plot-based sampling for swamp loosestrife. Designate as RNA.
Freshwater emergent wetland – Neskowin Marsh	33 acres protected and maintained. Monitor for invasive and nuisance species and utilize IPM techniques to control. Monitor water quality. Conduct hydrological study to assess management options. Designate as RNA.
Neskowin Marsh tsunami evacuation trail	Keep tsunami evacuation trail open. Conduct a hydrologic study. Modify footbridge to enhance safety and accessibility. Modify trail and footbridge to enhance hydrologic connectivity based on results of hydrologic study. Mark trail with tsunami evacuation signs. Vegetation management will be conducted. The Service acknowledges that the trail floods annually following heavy rainfall, as does the adjacent Hawk Road that leads to the trail. The Service will install reflective markers on both sides of the trail to outline the trail route during flooding or at night.
Forested wetlands and stream-riparian habitat (wet-mesic Sitka spruce-western hemlock forest)	6 acres of forested wetlands and stream-riparian habitat protected and maintained. Continue invasive species control.
Wildlife – Listed Species	
Oregon silverspot butterfly	1 experimental population introduced. Continue establishment and maintenance of life cycle habitat parameters (larval host plants and adult nectar plants) for listed Oregon silverspot butterfly (OSB). Following coastal prairie restoration and successful establishment of high-quality OSB habitat, introduce a nonessential experimental population of OSB onto restored prairie.
Monitoring and Research	
Status monitoring	Continue current status monitoring and collect additional data on fish, amphibians, small mammals, plants, migratory songbirds, soil accretion, water levels, forest diseases, and pests.
Effectiveness monitoring	Monitor CCP and other step-down plan objectives. Conduct long-term monitoring associated with the effectiveness of salt marsh restoration projects including salmonid use, vegetation response, and water quality parameters.
Research and scientific assessments	Identify priority research needs and cooperate with partners to accomplish. Conduct hydrological assessment at Neskowin Marsh. Nominate Neskowin Marsh as an RNA.

Table 2-1. Summary of Management Direction

Key Theme/issue	Future Management
Wildlife Observation and Photography	
Cannery Hill Unit	Trail and parking lots at Cannery Hill remain open. Develop Powerline Trail, a new loop trail, “Discovery Trail,” and goose observation deck in the lower parking lot.
Little Nestucca Restoration Area	Develop north end of old roadbed into spur road trail to an observation point and allow year-round public access on this trail. Create gravel parking lot on west end of restoration site.
Brooten Marsh	Allow wildlife observation and photography throughout unit.
Neskowin Marsh Unit	Area remains closed to observation and photography.
Environmental Education	
Environmental education (EE)	Develop a fully functioning, year-round EE program with full-time EE specialist, Nature Discovery Backpack program, and other partner-driven EE programs. Utilize volunteers to deliver on-site EE programs.
Interpretation	
Interpretation	Continue existing programming on Cannery Hill and develop additional interpretive facilities and programs in conjunction with new trails at Cannery Hill and Little Nestucca Restoration Area.
Hunting	
Waterfowl hunting	Allow waterfowl hunting 7 days per week on Brooten Marsh (108 acres) and mouth of Little Nestucca River (33 acres).
Fishing	
Fishing	Allow bank fishing on the east end of the Little Nestucca Restoration Area following development of access trail and gravel parking lot.
Clamming	Adjacent to Brooten Marsh, allow clamming per ODFW regulations and subject to Oregon Department of Agriculture (ODA) and ODFW shellfish safety closures.
Facilities	
Facilities	Keep some existing structures and facilities. Replace residence with a bunkhouse and small administrative office. Add 10 additional parking spaces. Remodel the north bay of the maintenance shop to accommodate two offices. Utilize habitat-appropriate native plants for landscaping around buildings, kiosks, and other public use facilities.
Climate Change Adaptation	
Reduce carbon footprint	Replace current vehicles with more fuel-efficient vehicles. Any new or replaced facilities will be appropriately sized and energy-efficient. Use energy-efficient land management techniques where feasible and in line with management goals. Explore ways of offsetting carbon balance, such as carbon sequestration.

2.4 Goals, Objectives, and Strategies

Goals and objectives are the unifying elements of successful refuge management. They focus and describe management priorities and actions that resolve issues and help bring a refuge closer to its vision. A vision broadly reflects the refuge purposes, the Refuge System mission and goals, other statutory requirements, and larger-scale plans as appropriate. Public use and wildlife/habitat management goals then define general targets in support of the vision, followed by objectives that direct effort into incremental and measurable steps toward achieving those goals. Finally, strategies identify specific tools and actions to accomplish objectives.

The goals for Nestucca Bay NWR over the next 15 years under the CCP are presented on the following pages. The goal order does not imply any priority. Each goal is followed by the objectives that pertain to that goal. Some objectives pertain to multiple goals and have simply been placed in the most appropriate location. Similarly, some strategies pertain to multiple objectives. The timeframe for accomplishing CCP objectives is the 15-year life of the CCP, unless otherwise specified in the objective.

Readers, please note the following:

Below each objective statement are the strategies that could be employed in order to accomplish the objectives. Symbols used in the following tables include:

% percent sign
> greater than
< less than

2.4.1 Goal 1: Protect and maintain agricultural lands supporting wintering migratory birds.

Objective 1.1 Protect and maintain lowland pastures
Protect and maintain 346 acres of lowland pastures on Nestucca Bay NWR for the benefit of wintering Canada geese (e.g., dusky, Aleutian Canada geese), other waterfowl (e.g., American wigeon, northern pintail, mallard), and other migratory birds (e.g., bald eagle, peregrine falcon, American kestrel) throughout the life of the CCP. Lowland pastures are characterized by the following: • Pasture mix (e.g., orchard grass, annual rye, white clover) that is a maximum of 2" to 4" in height by end of October • Saturated to shallowly flooded from October to May • <10% cover of invasive/undesirable plants (e.g., reed canarygrass, Himalayan blackberry, *Juncus* spp.) • Minimal human disturbance while geese are present (October to April)
Strategies Applied to Achieve Objective
Management Strategies:
a. Maintain drainage ditches, dikes, and water control structures using heavy equipment to provide adequate drainage and flood protection
b. Mow, green chop (silage), and graze livestock to provide desirable vegetation height
c. Use commercial fertilizers and manure to enhance vegetation productivity and apply with buffers to protect water quality
d. Rehabilitate pastures as needed using standard agricultural practices (e.g., seeding with appropriate pasture mix, fertilizing, liming) to maintain optimum productivity and plant species mix
e. Utilize appropriate IPM techniques including mechanical/physical, chemical, biological, and cultural means (see IPM Appendix)

f. Control nuisance mammals (e.g., nutria, beaver), where necessary, to protect dikes and ditches using appropriate lethal and non-lethal methods
g. Maintain fencing to support cattle grazing and containment
Monitoring Strategies (see also Objective 9.1 Survey):
h. Monitor water quality on the Refuge to ensure contaminant levels are not exceeded and aquatic resources are protected
i. Conduct periodic soil testing to maintain optimal pH levels and soil condition
j. Monitor lowland pasture vegetation height and species composition to achieve desired parameters
k. Monitor populations six subspecies of Canada geese (western, dusky, lesser, Taverner's, Aleutian, cackling) to determine distribution and abundance
l. Monitor waterfowl populations to determine distribution and abundance
m. Monitor nuisance mammals (e.g., nutria, beaver) populations to determine distribution and abundance
n. Monitor invasive plant species (e.g., reed canarygrass, Himalayan blackberry, *Juncus* spp.) to determine infestation percent and location
Rationale: The U.S. Fish and Wildlife Service established the Nestucca Bay National Wildlife Refuge in 1991, in part, to protect and enhance habitat on agricultural lands for wintering geese and other migratory birds. The Refuge currently consists of 1,010 acres, of which 346 acres are actively managed as pasture habitat for geese and other waterfowl. These pasturelands experience sustained waterfowl use from fall through spring and provide quality forage, which improves waterfowl health and survival. Approximately 6,000 to 10,700 Canada geese of six subspecies winter within refuge boundaries, including the delisted Aleutian Canada goose and up to 18% of the world's population of the dusky Canada goose (a Federal species of special concern). Recently, an increase in the number of wintering geese in the Nestucca Bay area has caused serious depredation concerns among dairy farmers. Our goal is to minimize depredation on private pasturelands by maximizing waterfowl use on refuge lands. Refuge pasture management is based on recognition of the importance of short grass habitats to geese and a commitment to habitat protection for the mutual benefit of wildlife and the dairy industry. Current management practices will continue to be followed under the CCP's management direction. A desirable grass mixture of orchard grass, annual rye, and white clover is maintained at a maximum of 2" to 4" in height by end of October through mowing, green chopping (silage), and grazing livestock. Refuge pastures are tested annually to determine soil condition and fertilizer needs to ensure proper growth and health of desired plant species. In addition, invasive plant species are controlled using appropriate IPM techniques including mechanical/physical, chemical, biological, and cultural means so as not to compete with desired plant species. Nuisance mammals (e.g., nutria, beaver) are controlled to protect dikes and ditches using appropriate lethal and non-lethal methods.

2.4.2 Goal 2: Restore, protect, and maintain upland prairie and grasslands characteristic of the North Pacific Coastal Ecosystem.

Objective 2.1 Restore upland coastal prairie

Within the next 15 years, restore and then protect and maintain up to 25 acres of upland coastal prairie on Nestucca Bay NWR through a phased restoration project for the benefit of the federally listed Oregon silverspot butterfly, native plants, and other coastal prairie-dependent species. Upland coastal prairie is characterized by the following attributes:

- >50% relative cover of native prairie species such as California oatgrass, red fescue, pearly everlasting, yarrow, and California aster maintained at a density of no fewer than five flowering stems/square meter
- Early blue violet in patches, with densities of >20 plants/patch and at least 100 patches/acre
- Little to no thatch buildup
- <50% cover of introduced plant species (e.g., orchard grass, annual rye, white clover)
- <5% cover of other invasive plants or noxious weeds (i.e., bull thistle, tansy ragwort)
- No encroaching woody species
- No reed canarygrass
- 1-3% bare ground component

Strategies Applied to Achieve Objective

Management Strategies:

a. Mechanical removal of encroaching woody species to promote desired plant species growth

b. Utilize appropriate IPM techniques including mechanical/physical, chemical, biological, and cultural means (see IPM Appendix)

c. Seeding and planting of native prairie grasses and forbs with local genotypes to achieve desired plant species for the Oregon silverspot butterfly

d. Prescribed fire or other periodic disturbance to prevent thatch buildup and maintain prairie habitat

Monitoring Strategies (see also Objective 9.1 Survey):

e. Monitor native coastal prairie plant species (e.g., early blue violet, California oatgrass, red fescue, pearly everlasting, yarrow, and California aster) to obtain desired composition, percent cover, and density

f. Monitor early blue violet patch and plant density to achieve >20 plants/patch and at least 100 patches/acre

g. Monitor amount of thatch buildup

h. Monitor invasive plant species (e.g., bull thistle, tansy ragwort, reed canarygrass) to determine percent, cover, and location

i. Monitor woody vegetation species to determine percent present

j. Monitor newly planted native grasses and forbs to determine success rate and growth

k. Monitor Oregon silverspot butterfly experimental population (after introduction) to determine distribution and abundance

l. Monitor fire effects on vegetation

m. Monitor bare ground to achieve 1-3%

Rationale: The Cannery Hill Unit of the Nestucca Bay National Wildlife Refuge contains 25 acres of former upland coastal prairie habitat that currently consists of primarily non-native pasture grasses. The site also includes some native grasses and other remnant coastal prairie species, including red fescue and early blue violet.

Our goal is to restore up to 100 percent of this habitat through a phased restoration project by completing portions gradually over the next 15 years. This area of highly degraded former upland coastal prairie has the potential to provide life-supporting habitat for the federally listed Oregon silverspot butterfly and other coastal prairie-dependent species. The Nature Conservancy's Cascade Head Preserve is located 8 miles south of the Refuge and supports one of only four populations of the threatened Oregon silverspot butterfly. Three of these populations are currently experiencing marked declines. The life history of the Oregon silverspot revolves around its obligatory host plant, the early blue violet. Female butterflies oviposit their eggs among the meadow vegetation near the violet host plant, and after the eggs hatch, the butterfly larvae feed on the violet's leaves.

It is the intention of the Service to have the restored area support an experimental release of the butterflies, which are not currently using the area because of its degraded status. See also Goal 7: Promote the recovery of the federally threatened Oregon silverspot butterfly. The Service will partner with the Institute for Applied Ecology (IAE) to convert a refuge grassland from non-native pasture grasses and other invasive plants to native coastal grasses and forbs with an emphasis on the species and structure required by the Oregon silverspot butterfly. The IAE will partner with the USFWS throughout the restoration process to control invasive species, produce genetically appropriate native plants, and seed and transplant the native plants. In addition, IAE will provide on-site training in invasive species identification and removal as well as appropriate, scientifically sound monitoring techniques.

Native prairie grasses and forbs, including the early blue violet, will be planted and existing native prairie vegetation will be cultivated to stimulate growth. Habitat manipulation such as removal of woody species and thatch buildup will enhance growth and production of native prairie plant species and entice Oregon silverspot butterflies to the area. Also, 1-3% bare ground is needed for the butterfly to warm-up and for access to mud (puddling) for mineral uptake. Edible (or dune) thistle was identified on-site; this native species looks much like the non-native bull thistle. Care will be taken to preserve this native species since bees and butterflies are attracted to it. The cleared area will be planted with species necessary for all life stages of the butterfly, and the planted species will be representative of native coastal headland prairie. Invasive plant species will be controlled using appropriate IPM techniques including mechanical/physical, chemical, biological, and cultural means so as not to compete with desired native prairie plant species.

Objective 2.2 Protect and maintain mixed upland grasslands until restored to native upland coastal prairie

Protect and maintain 14 acres of mixed, upland grasslands on Nestucca Bay NWR for the benefit of migratory birds (e.g., song sparrow, white-crowned sparrow, western meadowlark) and other wildlife (e.g., black-tailed deer) until restored to native upland coastal prairie. See Objective 2.1 for the desired habitat parameters. Restoration of the area will occur as funds and personnel become available. The mixed upland grasslands are characterized by the following attributes:

- Dominated by introduced pasture grasses (e.g., orchard grass, annual rye, white clover)
- <5% cover of reed canarygrass and other invasive plants (e.g., thistle spp., tansy ragwort)
- <5% cover of rank, residual plant cover
- No woody encroachment

Strategies Applied to Achieve Objective
Management Strategies:
a. Utilize appropriate IPM techniques including mechanical/physical, chemical, biological, and cultural means (see IPM Appendix)
b. Greenchopping (silage) – two cuttings with first cutting in July to reduce vegetation height with first cutting in July to protect ground-nesting birds
c. Prescribed fire or other periodic disturbance to rejuvenate stand and reduce residual cover
d. Mechanical removal of encroaching woody species
Monitoring Strategies (see also Objective 9.1 Survey):
e. Monitor woody vegetation species to determine percent present
f. Monitor invasive plant species (e.g., thistle, tansy ragwort, reed canarygrass) to determine percent, cover, and location
g. Monitor native coastal prairie plant species (e.g., early blue violet, California oatgrass, red fescue, pearly everlasting, yarrow, and California aster) to obtain desired composition, percent cover, and density
h. Monitor fire effects on vegetation
i. Monitor migratory birds (e.g., song sparrow, white-crowned sparrow, western meadowlark, killdeer) and other wildlife (e.g., black-tailed deer) populations to determine distribution and abundance
Rationale: Under the CCP's management direction, 14 acres of mixed upland grasslands will be protected and maintained until restored to upland prairie habitat. Currently these grasslands provide nesting habitat, forage, and shelter for migratory birds (e.g., song sparrow, white-crowned sparrow, savannah sparrow) and other wildlife (e.g., black-tailed deer). The ultimate goal is to restore the grasslands within 15 years to upland coastal prairie to provide life-supporting habitat for the federally listed Oregon silverspot butterfly and other coastal prairie-dependent species. We will assess success of restoration efforts on adjacent lands as a basis for the extent of prairie restoration in this area. See Objective 2.1 Restore Upland Coastal Prairie for the restoration plan and desired wildlife and habitat parameters. Restoration of the area will occur as funds and personnel become available. Reed canarygrass has encroached upon the land and will be controlled as a precursor to full-scale prairie restoration. In addition, other invasive plant species will be controlled using appropriate IPM techniques including mechanical/physical, chemical, biological, and cultural means so as not to compete with desired upland grassland or coastal prairie plant species.

2.4.3 Goal 3: Protect and maintain upland forests characteristic of the North Pacific Coastal Ecosystem.

Objective 3.1 Protect and maintain Sitka spruce-western hemlock forest
Protect and maintain 214 acres of Sitka spruce-western hemlock forest on Nestucca Bay NWR for the benefit of migratory landbirds (e.g., chestnut-backed chickadee, pileated woodpecker) and a diverse assemblage of other forest-dependent species (e.g., black-tailed deer, bald eagle, bobcat, Pacific giant salamander) throughout the life of the CCP. The desired attributes of this forested habitat are the following:

• 30-95% (73% average) canopy cover of Sitka spruce and western hemlock with DBH 24-36" • 25-95% (83% average) cover of a mosaic of native shrubs (e.g., salmonberry, huckleberry, salal, wax myrtle), ferns, and herbaceous species (e.g., sedges) in understory. Shrub height averages 3 meters (9.8 feet) • 600 square feet/acre density of nurse logs • 6/acre density of snags • <5% cover of invasive plants (e.g., Himalayan blackberry, Scotch broom) • <1% cover English ivy
Strategies Applied to Achieve Objective
Management Strategies:
a. Use appropriate forest management techniques (e.g., girdling, falling) to thin trees using multiple entry approach, where needed
b. Utilize appropriate IPM techniques including mechanical/physical, chemical, biological, and cultural means (see IPM Appendix)
Monitoring Strategies (see also Objective 9.1 Survey):
c. Monitor migratory landbirds (e.g., chestnut-backed chickadee, pileated woodpecker) and other forest-dependent species (e.g., black-tailed deer, bald eagle, bobcat, Pacific giant salamander) populations to determine distribution and abundance
d. Estimate canopy cover and DBH of Sitka spruce and western hemlock to determine percent cover by species
e. Estimate understory cover of a mosaic of native shrubs (e.g., salmonberry, huckleberry, salal, wax myrtle), ferns, and herbaceous species (e.g., sedges) to determine percent cover by species
f. Monitor snags to determine density and location
g. Monitor invasive plant species (e.g., Himalayan blackberry, Scotch broom, English ivy) to determine percent cover, and location
h. Monitor tree density and thinning efforts to determine areas that need attention
i. Monitor bald eagles to determine distribution, population, and reproductive success
Rationale: The long-term target is production of late-successional Sitka spruce and western hemlock forest characteristics and restoration of up to 100% of the historic extent of this forest type within the Refuge. Numerous definitions of late-successional or old growth forest exist and vary by location and dominant tree species. However, most definitions indicate four important structural components: number and minimum size of large live trees; canopy conditions; number and minimum size of snags; and number and size of downed LWD. Late-successional Sitka spruce-western hemlock forests provide nesting habitat, forage, and shelter to a variety of wildlife species. Migratory landbirds use the conifer forests because of the presence of other birds and rodents, bark and wood-boring insects, and conifer seeds. Amphibian species prefer steep cold mountain streams in old growth forests as breeding habitat and require damp litter on the forest floor to survive as metamorphosed adults. Much of this habitat type has been removed from the Oregon coast due to extensive logging and development. The Refuge currently contains 214 acres of Sitka spruce-western hemlock forest. Currently, the forested stands exist within the southern part of the Semidi Tract, Cannery Hill area, and Neskowin Marsh Unit. This on-refuge habitat benefits migratory landbirds (e.g., chestnut-backed chickadee, pileated woodpecker) and a diverse assemblage of other forest-dependent species (e.g., black-

tailed deer, bald eagle, bobcat, Pacific giant salamander).

While this objective emphasizes allowing natural processes (e.g., windfall and natural regeneration in openings) to drive vegetative changes, additional techniques such as thinning, girdling, and falling will also be used to promote the development of late-successional characteristics. Thinning (girdling, falling) trees reduces competition for the resources needed for growth thus promoting larger DBH of late-successional Sitka spruce and western hemlock. Snags are also an important component of a late-successional forest and tree girdling (strip of bark removed from circumference of trunk) can be used to kill trees and create snags.

Maintenance measures, primarily invasive plant control, will be regularly implemented using appropriate IPM techniques including mechanical/physical, chemical, biological, and cultural means. Invasive plants compete with desired tree and shrub species, limit native vegetation production, and cause impacts to food, nesting, and cover for wildlife. Controlling and treating invasive species on a consistent basis will allow the Refuge to continue to provide quality habitat to improve fish and wildlife health and survival.

2.4.4 Goal 4: Enhance, protect, and maintain estuarine habitats characteristic of the North Pacific Coastal Ecosystem.

Objective 4.1 Enhance, protect, and maintain salt marsh
Enhance, protect, and maintain 208 acres of salt marsh on Nestucca Bay NWR for the benefit of migratory birds (e.g., American wigeon, northern pintail, mallard, savannah sparrow, great blue heron, northern harrier), salmonids (e.g., Chinook, cutthroat, coho), and diverse assemblage of other species (e.g., river otter, black-tailed deer) throughout the life of the CCP. Salt marsh is characterized by the following attributes: • Diverse elevations ranging from about 3 feet below mean lower low water (MLLW) to 9 feet above MLLW for tidal flats and tidal marshes. Hydrological flows are affected by high flows in the rivers and tidal cycles • Low elevation areas are a mosaic of native species including salt grass and pickleweed • Upper elevation includes Lyngby’s sedge, slough sedge, tufted hairgrass, Pacific silverweed and occasional Henderson’s checkermallow • Interspersed tidal channels of different orders with LWD component • Lands completely submerged during high seasonal tidal cycles • No cordgrass species
Strategies Applied to Achieve Objective
Management Strategies:
a. Utilize appropriate IPM techniques including mechanical/physical, chemical, biological, and cultural means (see IPM Appendix)
b. Outplanting of rare, native species (e.g., Henderson’s checkermallow) to increase native vegetation presence
c. Clean and disinfect clothing and boating equipment before and after entering salt marsh
d. Apply public outreach to inform public about invasive or exotic animal species introductions, transport, and control methods

Monitoring Strategies (see also Objective 9.1 Survey):
e. Monitor migratory birds (e.g., savannah sparrow, great blue heron, northern harrier), and other mammal species (e.g., river otter, black-tailed deer) populations to determine distribution and abundance
f. Monitor waterfowl to determine populations and habitat use
g. Monitor salt marsh to determine stopover (feeding and loafing) and breeding habitat parameters for waterfowl
h. Monitor hydrological flows and tidal elevations/cycles to understand hydrological influence and parameters
i. Survey native plant species (salt grass, pickleweed, Lyngby's sedge, slough sedge, tufted hairgrass, Pacific silverweed and Henderson's checkermallow) to determine distribution and density
j. Monitor LWD to determine location and composition and vegetation response
k. Monitor salmonid species and other estuary-dependent fish to determine distribution, biological characteristics, and use of LWD installations
l. Monitor water quality to describe water quality parameters
m. Monitor composition and relative abundance of macro invertebrates to determine abundance and distribution
n. Monitor invasive plant (e.g., cordgrass, reed canarygrass, Himalayan blackberry) and animal species to determine distribution and abundance
o. Monitor sedimentation rates and vegetation response within the bay or salt marsh
p. Monitor public use programs (i.e., waterfowl hunting, fishing) to determine fish and wildlife impact and response
q. Work with partners to monitor environmental factors that are climate change related stressors (e.g., changes to hydrology, acidification, storm intensity, floods)
Rationale: The 208 acres of salt marsh at Nestucca Bay NWR are functionally connected with mudflat habitat and riverine habitats and act as a transition zone between aquatic and terrestrial sites. These marshes provide shoreline stability against wave and wind erosion, reduce flood peaks, trap nutrients, sediment, and pollutants. Salt marshes are also good for sequestering carbon and, unlike freshwater wetlands, do not produce methane. Tidal wetlands are considered essential habitat for many marine and anadromous fish (including threatened coho salmon) and migratory birds. Salt marshes also provide food and nursery areas for numerous young fish, crabs, shrimp, clams, and other invertebrates. Migratory waterfowl, such as mallard, American wigeon, northern pintail, bufflehead and green-winged teal, use this habitat at Nestucca Bay. Migratory waterfowl and shorebirds in turn provide an important prey base for the recently delisted bald eagle and the peregrine falcon. Slough sedge, tufted hairgrass, Pacific silverweed, and Henderson's checkermallow are native salt marsh species and are often associated with unaltered estuarine habitat in Oregon. The Refuge's salt marsh provides critical ecosystem services, especially considering the status of this habitat type in the state. In Oregon's seventeen largest estuaries, tidal wetland acreage has declined considerably based on pre-settlement estimates. Fourteen of these estuaries have experienced tidal wetland decreases of 40 percent or more (Good 2000). Based on Scranton (2004) and Hawes et al. (2008), Brophy (2011) estimated 16,173 acres of tidal marsh within the state in the 1850s and by 2005 80% of those acres were no longer tidal marsh. As much as 90 percent of

these losses have been for agricultural development and consist of diking and draining of salt marshes to convert them to pastures and crop-growing fields. Within the Nestucca Bay estuary, the comparison of 1850s historic vegetation with recent vegetation mapping indicates a 91% loss of tidal marsh (ibid.).

If unaltered or restored to a more natural hydrologic state (i.e., characterized by sinuous, deeply-incised, and complex tidal channel networks; and the absence of alterations such as ditching, diking, tidegates, restrictive culverts, and roads), salt marsh habitat such as that located at Brooten Marsh and the Little Nestucca Restoration Area will maintain itself with very little or no input from land managers. Outplanting of rare, native species, such as Henderson's checkermallow, is needed to reestablish a healthy population since this species is nearly absent at Nestucca Bay.

Invasive species degrade habitats that support a diverse community of estuarine organisms including aquatic migratory birds and anadromous fish, and the invertebrate and plant communities that support them. For example, the widespread colonization by cordgrass, which is not currently present on the Refuge, would induce major modifications of physical, hydrological, chemical, and biological estuarine functions. Cordgrass displaces eelgrass on mudflats and native vegetation in salt marshes. This invasive plant must be controlled using IPM techniques including mechanical/physical, chemical, biological, and cultural means.

Introduced native and non-native animal species in salt marshes (New Zealand mudsnail, nutria) are usually in direct competition with native wildlife species for food, shelter, and breeding areas and often cause existing native species populations to decline or become extirpated. Ultimately, invasive animal species can result in considerable impact to native wildlife and the habitat they are dependent upon. Limiting invasive and exotic animal species will provide improved quality habitat and wildlife health and survival. Actions will be taken to reduce competition between native and non-native animal species.

Monitoring sedimentation rates and vegetation response within the bay and salt marsh is important to the understanding of the potential resilience of these habitats to sea level rise, storm surges, and flood events.

Objective 4.2 Protect and maintain intertidal mudflats

Protect and maintain 19 acres of intertidal mudflats on Nestucca Bay NWR for the benefit of migratory birds (e.g., American wigeon, mallard, great blue heron, peregrine falcon, western sandpiper, short-billed dowitcher), salmonids (e.g., Chinook, cutthroat, coho), shellfish (e.g., sand shrimp, benthic worms, native clams), and diverse assemblage of intertidal mudflat species (e.g., river otter) throughout the life of the CCP. Intertidal mudflats are characterized by the following attributes:

- Diverse elevations ranging from about 3 feet below MLLW to about 4 feet MLLW that is completely inundated during two daily tidal cycles
- Sandy/muddy substrate that is sparsely vegetated by widgeon grass and seasonal algae blooms
- Presence of LWD
- Presence of biofilm on muddy substrate
- No Japanese eelgrass

• No cordgrass species
Strategies Applied to Achieve Objective
Management Strategies:
a. Utilize appropriate IPM techniques including mechanical/physical, chemical, biological, and cultural means (see IPM Appendix)
b. Work with Oregon Department of State Lands to cooperatively manage resources, treat/monitor invasive species
Monitoring Strategies (see also Objective 9.1 Survey):
c. Monitor migratory birds (e.g., American wigeon, mallard, great blue heron, peregrine falcon, western sandpiper, short-billed dowitcher), salmonids (e.g., Chinook, cutthroat, coho), shellfish (e.g., sand shrimp, benthic worms, native clams), and mammal species (e.g., river otter) to determine populations, biological characteristics, and use of intertidal mudflats
d. Monitor invasive plant species (e.g., Japanese eelgrass, cordgrass) to determine percent cover and location
e. Monitor shorebirds to determine distribution, populations, and habitat use
f. Monitor habitat parameters to determine stopover feeding and loafing habitat quality for shorebirds
g. Monitor composition and relative abundance of macro invertebrates to determine abundance and distribution
h. Monitor/survey biofilm/algae to determine abundance and composition
i. Monitor sedimentation rates and vegetation response within the bay or intertidal mudflats
j. Monitor water quality on the Refuge to ensure contaminant levels are not exceeded and aquatic resources are protected
k. Monitor LWD to determine rate of deposition
l. Work with partners to monitor environmental factors that are climate change related stressors (e.g., changes to hydrology and salinity)
Rationale: The 19 acres of intertidal mudflats are functionally connected with salt marsh and riverine habitats which contain a rich invertebrate community that supports a diversity of native fishes, shorebirds, and waterfowl. Algae and diatoms are the principal plant types; vascular plants are rare or absent. Invertebrates such as snails, shrimp, clams, worms, and crabs are locally common or abundant. The most common and important non-fish species occupying the mudflats include Dungeness crab, softshell clams, and sand shrimp. Waders such as great blue heron and great egret, and shorebirds such as least and western sandpiper, dunlin, dowitchers, greater yellowlegs, black-bellied plover, and whimbrel, make extensive use of the mudflats for foraging on macro-invertebrates and in some cases biofilm. Dabbling ducks, diving ducks, gulls, peregrine falcons, and bald eagles also forage there. Harbor seals forage on the mudflats when they are inundated at high tide and in the lower bay or they haul out on the flats and spit to rest. LWD provides perch sites for migratory birds including raptors and waders. Intertidal mudflats tend to maintain their integrity naturally and managers need to conduct very little active management. As a result, to accomplish this objective, the Refuge primarily needs to pursue invasive species control. Invasive species such as Japanese eelgrass and cordgrass degrades habitats that support a diverse community of estuarine organisms including aquatic migratory birds and anadromous fish, and the invertebrate and plant communities that support them. Widespread colonization by these invasive plants induces major modifications of physical, hydrological,

chemical, and biological estuarine functions. Japanese eelgrass and cordgrass displaces native eelgrass on mudflats and other native vegetation in salt marshes. Actions would be taken to reduce competition between native and non-native vegetation species. These invasive plants must be controlled using IPM techniques including mechanical/physical, chemical, biological, and cultural means. Since land owned by the state is adjacent to refuge lands, we would work cooperatively with the State of Oregon to control invasives. At minimum, eradication efforts would be attempted on an annual basis on properties within Nestucca Bay to remove and prevent further spread of invasive species. Water quality must also be closely monitored since lowland pastures are nearby and the spread of manure or commercial fertilizer and herbicide is a common practice. If fertilizers or other chemicals enter the water system, they can be deposited within the environment and bio-accumulate in associated organisms.

Sedimentation is a natural event which occurs in bays and estuaries and can alter plant communities and hydrology. The rate of sedimentation should be monitored and the habitat changes due to sedimentation documented. Monitoring sedimentation rates and vegetation response for intertidal mudflats is important to the understanding of the potential resilience of this habitat type to sea level rise, storm surges, and flood events.

2.4.5 Goal 5: Protect and maintain freshwater habitats characteristic of the North Pacific Coastal Ecosystem.

Objective 5.1 Protect and maintain mesic Sitka spruce-skunk cabbage-slough sedge association (forested lagg) in the Neskowin Marsh Unit
Protect and maintain 61 acres of mesic Sitka spruce-skunk cabbage-slough sedge association within the Neskowin Marsh Unit at Nestucca Bay NWR for the benefit of migratory landbirds (e.g., chestnut-backed chickadee, pileated woodpecker) and a diverse assemblage of other forest-dependent species (e.g., black-tailed deer, bobcat, northwestern salamander) throughout the life of the CCP. The attributes of this forested lagg are the following: • 60-100% canopy cover dominated by Sitka spruce and western hemlock, where 75% is Sitka spruce • DBH of overstory trees is 50-118" • >25% cover of a mosaic of native shrubs (e.g., salal), ferns, and herbaceous species (e.g., slough sedge, skunk cabbage) in understory • 6/acre density of snags • <5% cover of invasive plants (e.g., Himalayan blackberry) • No English ivy
Strategies Applied to Achieve Objective
Management Strategies:
a. Utilize appropriate IPM techniques including mechanical/physical, chemical, biological, and cultural means (see IPM Appendix G)
Monitoring Strategies (see also Objective 9.1 Survey):
b. Monitor migratory landbirds (e.g., chestnut-backed chickadee, pileated woodpecker) and other forest-dependent species (e.g., black-tailed deer, bobcat, northwestern salamander) to determine populations and use of forested lagg
c. Monitor/survey Sitka spruce and western hemlock to determine canopy cover and DBH

d. Monitor/survey native shrubs (e.g., salal), ferns, and herbaceous species (e.g., slough sedge, skunk cabbage) to determine understory percent cover

e. Survey snags to determine density

f. Monitor/survey invasive plant species (e.g., Himalayan blackberry, English ivy) to determine percent cover and location

Rationale: The mesic Sitka spruce-skunk cabbage-slough sedge association is found within forested laggs (or wetlands) that form a swamp-like moat around the outer edges of some bogs. At the Neskowin Marsh Unit, this unique, exceedingly rare habitat type is >200 years old and in a late-successional stage. This forested wetland is part of a habitat complex with exceptional biological value important to a diverse and abundant group of plant and animal species. Migratory landbirds (e.g., chestnut-backed chickadee, pileated woodpecker) and a diverse assemblage of other forest-dependent species are abundant and use the surrounding upland habitat for hunting, foraging, and resting. In addition, snags offer nesting cavities for many migratory landbird species.

This habitat type tends to maintain itself naturally, and managers typically need to conduct very little active management. As a result, to accomplish this objective, the Refuge primarily needs to pursue control of invasive plants. Invasive plant species such as Himalayan blackberry and English ivy present challenges. Himalayan blackberry readily invades riparian areas, forest edges, oak woodlands, meadows, roadsides, clear-cuts, and any other relatively open area, including all open forest types. Once it becomes well established, it out competes low stature native vegetation and can prevent establishment of shade intolerant trees, leading to the formation of apparently permanent blackberry thickets with little other vegetation present. English ivy is a vigorous growing vine that impacts all levels of disturbed and undisturbed forested areas, growing both as a ground cover and a climbing vine. As the ivy climbs in search of increased light, it engulfs and kills branches by blocking light from reaching the host tree’s leaves. English ivy is present on the Refuge in this habitat, and control efforts need to be continued.

Objective 5.2 Protect and maintain coastal bog in the Neskowin Marsh Unit

Protect and maintain 70 acres of coastal bog habitats (i.e., shrub-carr, sphagnum, sedge fen) on the Neskowin Marsh Unit of Nestucca Bay NWR for the benefit of migratory landbird (e.g., common yellowthroat) and a diverse assemblage of other wildlife species (e.g., black-tailed deer, bobcat, northwestern salamander) and rare plants species and assemblages throughout the life of the CCP. The attributes of this coastal bog habitat are the following:

- Permanently flooded with 1-48" depths with mosaic of scattered open water areas
- Water quality is tannic (pH ranges from 4.8 to 6.2)
- Deep peat soils
- Presence of native shrubs (e.g., smooth Labrador tea) typically occurring in high acidic sites
- Presence of rare plants including russet cotton grass, native cranberry, and *Pohlia sphagnicola* (moss)
- Presence of insectivorous round leaf sundew plant
- No swamp loosestrife, water lily, or English ivy
- <5% cover of other invasive plants (e.g., Himalayan blackberry)

Strategies Applied to Achieve Objective

Management Strategies:

a. Utilize appropriate IPM techniques including mechanical/physical, chemical, biological, and

cultural means (see IPM Appendix)
Monitoring Strategies (see also Objective 9.1 Survey):
b. Monitor water quality to detect presence of off-site contaminants (point and non-point sources)
c. Monitor presence of invasive species (e.g., Himalayan blackberry, swamp loosestrife, water lily, and English ivy) including plot-based sampling to determine location and infestation percent
d. Monitor migratory landbird (e.g., common yellowthroat) and other wildlife species (e.g., black-tailed deer, bobcat, northwestern salamander) to determine populations and use
e. Monitor native shrubs (e.g., smooth Labrador tea), rare plants (russet cotton grass, native cranberry, and *Pohlia sphagnicola*), and insectivorous round leaf sundew plant to determine distribution and abundance
Rationale: The coastal bog of Neskowin Marsh is a rare habitat type. Rare plants such as russet cotton grass, native cranberry, and *Pohlia sphagnicola* (moss) are present. Migratory landbirds (e.g., common yellowthroat) and a diverse assemblage of other wildlife species are abundant and use the surrounding upland habitat for hunting, foraging, and resting. There are three types of coastal bog within Neskowin Marsh, including sedge fen, shrub-carr, and sphagnum bog. The sedge fen is distinguished from other bog habitats because of the neutral pH of the water; this type of coastal bog is dominated by slough sedge and Sitka sedge. The shrub-carr bog is dominated by western crabapple, Trapper's tea, and Hooker willow. The rare and diverse sphagnum bog has been developing over a period of at least several thousand years. The sphagnum bog within Neskowin Marsh is the southernmost sphagnum bog on the West Coast. It contains the largest known occurrence of acid-forming mire on the Oregon coast and supports the rare pohlia moss, which occurs on the tops of sphagnum hummocks. This habitat type tends to maintain itself naturally, and managers need to actively complete very little work unless invasive plant species are present. Invasive plant species (Himalayan blackberry, swamp loosestrife, water lily, and English ivy) displace native vegetation, altering the composition and structure of vegetation communities, affecting food webs, and modifying ecosystem processes. Very little invasive plant species control efforts have been conducted at Neskowin Marsh, and these species continue to invade and spread through the marsh. As a result, to accomplish this objective, the Refuge primarily needs to pursue control of invasive plants.

Objective 5.3 Protect and maintain freshwater, emergent wetland in the Neskowin Marsh Unit
Protect and maintain 33 acres of freshwater, emergent wetland on the Neskowin Marsh Unit at Nestucca Bay NWR throughout the life of the CCP for the benefit of waterfowl (e.g., wood ducks, northern pintail, mallard), rails (e.g., Virginia rail, American coot), other migratory landbirds (e.g., red-winged blackbird, common yellowthroat), native amphibians (e.g., northwestern salamander, red-legged frog), salmonids (e.g., coho salmon, coastal cutthroat), and a diverse assemblage of other species (e.g., river otter, beaver). The attributes of this freshwater, emergent wetland are the following: • Permanently flooded with water depths ranging from saturated soils to 36" deep • Scattered stands of native trees including Hooker willow • Mosaic of native emergents (e.g., giant burreed, hard-stem bulrushes) with pockets of open water with submergent plants (e.g., pondweeds, coontail) • No swamp loosestrife or water lily • <5% cover of reed canarygrass

Strategies Applied to Achieve Objective
Management Strategies:
a. Utilize appropriate IPM techniques including mechanical/physical, chemical, biological, and cultural means (see IPM Appendix)
b. Maintain current tsunami evacuation trail and footbridge to allow residents safe passage in the event of a tsunami
c. Modify footbridge to enhance safety, accessibility, and hydrologic connectivity based on results of hydrologic study
Monitoring Strategies (see also Objective 9.1 Survey):
d. Conduct hydrologic study to determine effects of tsunami evacuation trail (old roadbed) has on water flow and assess management opportunities
e. Monitor water quality to detect presence of off-site contaminants (point and non-point sources)
f. Monitor invasive species (e.g., swamp loosestrife, water lily, reed canarygrass) to determine presence and infestation percent
g. Monitor waterfowl (e.g., wood ducks, northern pintail, mallard), rails (e.g., Virginia rail, American coot) other migratory landbirds (e.g., red-winged blackbird, common yellowthroat), native amphibians (e.g., northwestern salamander, red-legged frog), and mammals (e.g., river otter, beaver) to determine population and distribution
h. Monitor salmonids (e.g., coho salmon, coastal cutthroat) and other fish to determine abundance and use
Rationale: The freshwater emergent wetland at the Neskowin Marsh Unit consists of freshwater pools and ponds interspersed with emergent vegetation such as bulrush, giant bur-reed, Douglas spirea, and water parsley. The largest bulrush stand along the Oregon coast occurs at this location. Waterfowl (e.g., wood ducks, northern pintail, mallard), rails (e.g., Virginia rail, American coot), other migratory landbirds (e.g., red-winged blackbird, common yellowthroat), native amphibians (e.g., northwestern salamander, red-legged frog), and a diverse assemblage of other species (e.g., river otter, beaver) are abundant and use the surrounding habitat for hunting, foraging, and resting. Refuge biologists have documented substantial use of Neskowin Marsh by juvenile coho salmon and cutthroat trout. Juvenile coho salmon may use the marsh as off-channel overwintering habitat. In the spring, thousands of egg masses laid by amphibians appear in the marsh, indicating its importance as a breeding area for red-legged frogs and northwestern salamanders. The recently delisted peregrine falcon and bald eagle nest in the general vicinity. This habitat type tends to maintain itself naturally, and managers typically need to conduct very little active management. As a result, to accomplish this objective, the Refuge primarily needs to pursue control of invasive plants. Invasive species such as swamp loosestrife, water lily, and reed canarygrass have been noted on the Refuge; however, very little control efforts have been conducted, and these species continue to invade and spread throughout the wetland. A small footbridge spans the Meadow Creek outlet channel of the marsh and serves as one of only a few tsunami escape routes for Neskowin, a low-lying community. The tsunami evacuation trail traverses the south end of the marsh near the north end of the Neskowin Beach Golf Course. The trail was in existence before establishment of the Neskowin Marsh Unit of the Refuge and acquisition of this parcel in 2002. This trail allows local residents in the nearby dunes to escape on foot to high ground in the Neskowin Crest area as well as passage to U.S. Highway 101 during a locally generated tsunami event. The Service acknowledges that the trail floods annually following

heavy rainfall, as does the adjacent Hawk Road that leads to the trail. The Service will install reflective markers on both sides of the trail to outline the trail route during flooding or at night. Individuals using the trail do so at their own risk, which will require wading if the trail is flooded. Residents should be aware that during a subduction zone earthquake the trail may receive damage prior to the arrival of a tsunami. This trail is located on a former roadbed that extended across the marsh linking Hawk Street with Cove Crest Drive. It is unknown at this time how the presence of the old roadbed may be affecting the hydrology of the marsh by impounding water and impacting the health of the marsh. Therefore, a detailed hydrologic study is needed.

2.4.6 Goal 6: Protect and maintain forested wetlands and stream-riparian habitats characteristic of the North Pacific Coastal Ecosystem.

Objective 6.1 Protect and maintain wet-mesic Sitka spruce-western hemlock forest
Protect and maintain 6 acres of wet-mesic Sitka spruce-western hemlock forest and adjacent riparian habitat on Nestucca Bay NWR throughout the life of the CCP for the benefit of migratory landbirds (e.g., chestnut-backed chickadee, Wilson's warbler, pileated woodpecker) and a diverse assemblage of other forest-dependent species (e.g., black-tailed deer, bobcat, northwestern salamander). The desired attributes of wet-mesic Sitka spruce-western hemlock forest are the following (based on Brophy 2009, Brophy et al. 2011, Brophy and van de Wetering 2012, NatureServe 2012): • Periodic freshwater tidal and/or seasonal riparian flooding • Flat topography with local microrelief caused by logs, stumps, and buttressed roots of spruce trees • High organic content of soils (>20% organic matter) • Woody vegetation dominated by native trees and shrubs (e.g., Sitka spruce, red alder, Hooker willow, Sitka willow, twinberry, Pacific crabapple). Dominant herbaceous species include slough sedge and skunk cabbage with non-wetland species (e.g., salal, huckleberry) growing on fallen logs or spruce root platforms. • <5% cover of invasive plants (e.g., blackberry, gorse, Scotch broom) • No English ivy
Strategies Applied to Achieve Objective
Management Strategies:
a. Utilize appropriate IPM techniques including mechanical/physical, chemical, biological, and cultural means (see IPM Appendix)
Monitoring Strategies (see also Objective 9.1 Survey):
b. Monitor migratory landbird (e.g., chestnut-backed chickadee, Wilson's warbler pileated woodpecker) and other forest-dependent species (e.g., black-tailed deer, bobcat, northwestern salamander) population and use
c. Monitor plant community composition (i.e., percent cover of trees, shrubs, ferns, and herbaceous species)
d. Determine woody species stem density and basal area
e. Monitor salmonids and other fish to determine use and distribution
f. Monitor invasive plant species (e.g., Himalayan blackberry, Scotch broom, reed canarygrass,

English ivy) to determine abundance and distribution
Rationale: For the purposes of this CCP, wet-mesic Sitka spruce-western hemlock forests are defined as woody habitats that consist of valley forested wetlands and riparian forest along rivers, salt marsh, or mudflats (e.g., National Vegetation Classification Standard *Tsuga heterophylla* - *Picea sitchensis*/*Lysichiton americanus* Hardwood-Conifer Rich Swamp Group, NatureServe 2012). Riparian and wetland forests are highly variable in their composition, size, and structure. Periodic freshwater tidal and/or seasonal riparian flooding are the major natural processes that drive this system. Soils are perennially wet, usually with high organic content. Historically, many of the areas located in the lower brackish (mesohaline to oligohaline) and freshwater tidal zones of Oregon's estuaries were likely Sitka spruce and/or shrub tidal swamp. Tidal swamps were also found on the margins of the marine salinity zone where freshwater dilutes ocean water, such as along tributary streams, on high natural levees, and in hillslope seepage zones. The 6 acres of wet-mesic Sitka spruce-western hemlock (lowland riparian) forest are found on the Refuge fringing the Brooten Marsh. Migratory landbirds (e.g., chestnut-backed chickadee, Wilson's warbler, pileated woodpecker) and a diverse assemblage of other forest-dependent species are found here and use the surrounding habitat for hunting, foraging, and resting. This area also provides off-river habitat for salmonids during high waters, including the threatened coho salmon. Invasive plant species such as Himalayan blackberry, English ivy, and Scotch broom present the same challenges for this habitat type as described in Objective 5.1. Due to lack of funding and staff, control efforts to date have been sporadic and not sufficient to halt spread of these species on the Refuge.

2.4.7 Goal 7: Promote the recovery of the federally threatened Oregon silverspot butterfly.

Objective 7.1 Establish Oregon silverspot butterfly – nonessential, experimental population
Initiate introduction of a healthy, sustainable population of the Oregon silverspot butterfly within the life of the CCP on upland prairie habitat on Nestucca Bay NWR. The long-term objective, which will follow a timeline that will extend beyond the life of the CCP, is a sustainable population that is characterized by the following attributes: • Minimum viable population of 200 to 500 butterflies for at least 10 years • Located in permanently protected habitat within an identified habitat conservation area • Located in habitat that is managed to maintain at approximately 3 percent early blue violet cover, multiple nectar sources flowering throughout the butterfly's flight period, and minimal presence of invasive and competitive plants
Strategies Applied to Achieve Objective
Management Strategies:
a. See strategies listed under restoration of upland prairie habitat (Objective 2.1)
b. Partner with various entities as appropriate (Oregon Zoo, ODFW, Xerces Society, TNC, USFWS Ecological Services) to establish larval host plant/adult nectar plant populations and introduce butterfly populations
c. Develop butterfly release plan to outline certain number of butterflies released, timeframe, and monitoring strategies

d. Release pupae and/or larvae of a nonessential experimental population according to the plan when an appropriate amount of high quality habitat has been established
Monitoring Strategies (see also Objective 9.1 Survey):
e. Survey native Oregon silverspot butterfly to determine presence or absence
f. Monitor nonessential experimental Oregon silverspot butterfly (larvae and/or adult) to determine population and introduction success
g. Monitor early blue violet to determine cover and percent composition
h. Monitor invasive plant species to determine abundance and distribution
i. Monitor upland prairie habitat native plant species to determine composition and abundance
Rationale: The Oregon silverspot butterfly, a unique and rare species, is listed as a federally threatened species. The life history of the Oregon silverspot revolves around its obligatory host plant, the early blue violet. Female butterflies oviposit their eggs among the meadow vegetation near the violet host plant, and after the eggs hatch, the butterfly larvae feed on the violet leaves. The Nature Conservancy's Cascade Head Preserve is located 8 miles south of the Refuge and supports one of only five populations of the Oregon silverspot butterfly, four in Oregon and one in California near the border with Oregon. Three of these populations are currently experiencing marked declines. The Service will introduce and sustain a nonessential, experimental population of the Oregon silverspot butterfly within restored high quality upland coastal prairie habitat on Nestucca Bay NWR. Under the Endangered Species Act, Secretary of Interior may designate restored populations established outside the species' current range, but within its historical range, as "experimental." Based on the best scientific and commercial data available, experimental populations are deemed either "essential" or "nonessential" to the continued existence of the species. Regulatory restrictions are considerably reduced under a nonessential, experimental population designation. An Oregon silverspot butterfly captive-rearing program began in 1999 to raise caterpillars for release into declining populations. These population augmentations or reintroductions are a last resort to prevent further population extinctions and support implementation of the recovery plan. Multiple years of releases are needed to successfully stabilize the declining populations, but the augmentation appears to be a promising species recovery tool. Prior to any experimental introduction of the butterfly, the Service will restore 25 acres of rare and unique upland coastal prairie habitat at Cannery Hill to the standard delineated in the species' recovery plan (see Objective 2.1 Restore Upland Coastal Prairie for the restoration plan and desired wildlife and habitat parameters). Cannery Hill contains a remnant of upland coastal prairie that provides life-supporting habitat for the federally listed butterfly and other coastal prairie-dependent species. Our goal is to restore up to 100 percent of this habitat through a phased restoration project gradually over the next 15 years. The Service will partner with the Institute for Applied Ecology (IAE) to convert a refuge grassland from non-native pasture grasses and other invasive plants to native coastal grasses and forbs with an emphasis on the species and structure required by the Oregon silverspot butterfly. Native prairie grasses and forbs, including the early blue violet, will be planted and existing native prairie vegetation will be cultivated to stimulate growth. Habitat manipulation such as removal of woody species and thatch buildup will enhance growth and production of native prairie plant species. Also, a 1-3% bare ground standard is needed

for the butterfly to warm-up and for access to mud (puddling) for mineral uptake.

The establishment or introduction of the experimental population will occur toward the end of the CCP (15 years), due to the time needed for the native prairie restoration. The minimum viable population of 200 to 500 butterflies for at least 10 years is a long-term objective that will not occur within the life of this CCP (15 years). The restoration of upland prairie habitat and release of the experimental population will entice native Oregon silverspot butterflies to the area.

2.4.8 Goal 8: Enhance, protect, and maintain instream aquatic habitat for all dependent species including anadromous and estuary-dependent fish.

Objective 8.1 Enhance, protect, and maintain instream aquatic habitat

Enhance, protect, and maintain instream aquatic habitat within the Refuge throughout the life of the CCP for anadromous fish and other estuary-dependent fish common in the Nestucca estuary and refuge tributaries, including fall Chinook salmon, chum salmon, coho salmon, winter steelhead, and cutthroat trout. Instream aquatic habitat is characterized by the following attributes:

- Instream and estuary channel presence of woody and organic debris
- Meandering estuary channels and freshwater creeks (e.g., complex and braided) with unimpeded fish access
- Water quality that will meet life-history needs for salmonids (e.g., water temperature 12.8°-17.8°C, dissolved oxygen levels >7.0 mg/L)
- Instream substrate (spawning gravel),<5% cover, pool/riffle ratio suitable for cutthroat trout
- <1% non-native or invasive fish (e.g., largemouth bass, bluegill) and plants

Strategies Applied to Achieve Objective
Management Strategies:
a. Installation and maintenance of LWD (i.e., logs and root wads) in stream channels to promote diverse hydrological and physical structure
b. Provide spawning (cutthroat trout) and rearing habitat (salmon)
c. Plant and maintain streamside vegetative cover to reduce water temperatures
d. Work cooperatively with ODFW and adjacent landowners to address fish passage and water quality issues
e. Coordinate with ODFW, USFS, and other partners to support physical habitat restoration actions listed in the Oregon Coast Coho Conservation Plan for the Nestucca watershed (http://www.dfw.state.or.us/fish/CRP/docs/coastal_coho/final/Coho_Plan.pdf)
f. Work cooperatively with ODFW and USFWS Fisheries Program to understand, monitor, and control non-native invasive fish (e.g., largemouth bass, bluegill) that are competitive with native fishes
g. Work cooperatively with researchers to inventory, monitor, determine species composition and richness of estuary and instream invertebrate community
Monitoring Strategies (see also Objective 9.1 Survey):
h. Monitor salmonids to determine distribution, biological characteristics, and use of LWD installations
i. Monitor water quality (e.g., temperature, turbidity, dissolve oxygen, pH, toxins, nutrients, organic loading, dissolved and suspended solids) to detect presence of off-site contaminants (point

and non-point sources)
j. Monitor estuary and instream benthic invertebrates to determine species composition, diversity, and abundance
k. Monitor riparian and estuary invasive plant and animal species to determine infestation, abundance, and distribution
Rationale: Protection and enhancement of aquatic habitat is important to anadromous and estuary-dependent fish species. The Nestucca River watershed is a productive fishery resource for the State of Oregon. Salmonids common in the Nestucca system include spring and fall Chinook salmon, coho salmon (threatened species), summer and winter steelhead, and coastal cutthroat trout. Threats currently facing salmonids and other estuary-dependent fish include the present or threatened destruction, modification, or curtailment of habitat or range. In many Oregon coastal streams, past human activities (e.g., logging, agriculture, gravel mining, urbanization) have resulted in impediments to fish passage, degradation of stream complexity, increased sedimentation, reduced water quality and quantity, loss and degradation of riparian habitats, and loss and degradation of lowland, estuarine, and wetland salmonid rearing habitats. Most anadromous fish species in the Pacific Northwest have been in decline for decades. Spring Chinook salmon, coho salmon, chum salmon and coastal cutthroat trout all have depressed populations. Coho salmon on the Oregon Coast are listed as “Threatened” on the Federal Threatened and Endangered Species List. Conserving and restoring salmonid populations is an important goal, not only for their own sake, but also because of their cultural, historical, and ecological value. Salmonids are an important food source for numerous other wildlife species. Sixty-seven wildlife species of the Pacific Northwest, including many known to inhabit the Refuge, have been known to have a “strong” or “recurrent” relationship with salmon (Cederholm et al. 2000). For a full list of benefitting species, see Appendix E, Biological Resources of Concern. For successful production, juvenile salmonids that live at the edges of streams or in backwater areas depend on the presence of streambank vegetation and abundant instream structure created by logs and root wads, as well as adequate water quality. LWD has been placed at the Little Nestucca Restoration Area to provide cover and to increase channel diversity quality, which improves health and survival of estuary-dependent and juvenile salmonids. To control invasive non-native fish such as largemouth bass and bluegill, the Refuge will work cooperatively with ODFW and other fisheries biologists to detect the presence of and remove and control these species to reduce competition between native and non-native fish species. Invasive plant species have been noted on the Refuge; however, very limited control efforts have been conducted and these species may be continuing to invade and spread through refuge aquatic habitat. Limiting invasive species will provide quality forage to improve fish health and survival. Invasive species will be controlled using appropriate IPM techniques including mechanical/physical, chemical, biological, and cultural means to prevent them from competing with desired native species. Tidal saltwater inundation of the 82-acre tidal marsh restoration project along the Little Nestucca River is resulting in the natural elimination of invasive red canarygrass and Himalayan blackberry.

2.4.9 Goal 9: Research and monitoring. Gather scientific information (surveys, research, and assessments) to support adaptive management decisions.

Objective 9.1 Conduct inventory and monitoring surveys
Throughout the life of the CCP, conduct high-priority inventory and monitoring (survey) activities that evaluate resource management and public-use activities to facilitate adaptive management. These surveys contribute to the enhancement, protection, use, preservation, and management of wildlife populations and their habitats on- and off-refuge lands. Specifically, they can be used to evaluate achievement of resource management objectives identified under Goals 1 through 8 in CCP. These surveys have the following attributes: • Data collection techniques will likely have minimal animal mortality or disturbance and minimal habitat destruction • Minimum number of samples (e.g., water, soils, vegetative litter, plants, macroinvertebrates, vertebrates) to meet statistical analysis requirements will be collected for identification and/or experimentation in order to minimize long-term or cumulative impacts • Proper cleaning of investigator equipment and clothing as well as quarantine methods, where necessary, will minimize the potential spread or introduction of invasive species • Projects will adhere to scientifically defensible protocols for data collection, where available and applicable
Strategies Applied to Achieve Objective
a. Prepare inventory and monitoring plan
b. Early detection and rapid response monitoring to identify new or spreading invasive plant and animal problems
c. Collect data and samples of fish, wildlife, and habitat parameters to determine overall health of the Refuge
d. Utilize scientific survey protocols for data collection to ensure quality results
e. Utilize most recent and up-to-date survey equipment to ensure reliable data are collected
f. Implement management strategies as needed as identified by survey data to maintain biological integrity, diversity, and environmental health
g. Monitor invasive/nuisance plant and animal species in mudflats, salt marsh, freshwater wetlands, uplands, and forested habitats to determine distribution and infestation
h. Monitor forest diseases and pests to determine presence and extent
i. Monitor salmonids to determine distribution, biological characteristics, and use of LWD
j. Monitor mammals, migratory landbirds, shorebirds, waterfowl (including white-cheeked geese), insects, and amphibians to determine populations, distributions, and habitat use
k. Conduct long-term hydrological, biological, and physical monitoring to determine effectiveness of salt marsh and coastal prairie restoration projects
l. Monitor water quality returning to river and bay to determine pollution levels
m. Conduct periodic soil testing to maintain optimal pH levels and soil condition
n. Monitor habitat parameters including vegetation associated with respective habitat types to determine health of ecosystem
o. Monitor sedimentation rates and vegetation response within the bay or salt marsh

p. Monitor public use programs (i.e., waterfowl hunting) to determine waterfowl impact and response
q. Monitor Sitka spruce and western hemlock to determine growth rate, density, canopy cover and DBH
r. Monitor a mosaic of native shrubs (e.g., salmonberry, huckleberry, salal), ferns, and herbaceous species (e.g., sedges) to determine understory cover
s. Monitor snags to determine density
t. Monitor existing and planted trees and shrubs to determine survival rate
u. Monitor tree density and thinning efforts to determine areas that need attention
v. Monitor/survey biofilm/algae to determine abundance and composition
w. Monitor hydrological parameters (e.g., flow regime—timing and magnitude) and associated physical attributes (e.g., water temperature, dissolved oxygen levels) to determine if parameters are within water quality standards
x. Monitor hydrological flows and tidal elevations/cycles to understand hydrological influence and parameters
y. Monitor wetland native vegetation to determine species composition
z. Monitor vegetation and wildlife to determine response to IPM techniques
aa. Hire an additional permanent full-time (PFT) Wildlife Biologist to identify survey needs, collect scientific data, and meet the needs of the Refuge's biological program
Rationale: National Wildlife Refuge System Administration Act of 1966, as amended (16 U.S.C. 668dd-ee) set a requirement to "… monitor the status and trends of fish, wildlife, and plants in each refuge." Surveys will be used primarily to evaluate resource response to assess progress toward achieving refuge management objectives (under Goals 1 through 8 in this CCP) derived from the NWRS Mission, refuge purpose(s), and maintenance of biological integrity, diversity, and environmental health (601 FW 3). Determining resource status and evaluating progress toward achieving objectives is essential to implementing adaptive management on Department of Interior lands as required by policy (522 DM 1). Specifically, results of surveys will be used to refine management strategies, where necessary, over time in order to achieve resource objectives. Surveys will provide the best available scientific information to promote transparent decision-making processes for resource management over time on refuge lands. The Service will provide staff to adequately address biological complexity of the Refuge with the goal of hiring an additional Permanent Full Time (PFT) Wildlife Biologist. Currently, the Complex has only one PFT Wildlife Biologist for six national wildlife refuges. The Wildlife Biologist will design and implement scientific studies.

Objective 9.2 Conduct research
Throughout the life of the CCP, conduct high-priority research projects that provide the best science for habitat and wildlife management on and off the refuge. Scientific findings gained through these projects will expand knowledge regarding life-history needs of species and species groups as well as identify or refine habitat and wildlife management actions. Wildlife and habitat responses to refuge management actions will be monitored through research projects, and as a result, resource management objectives and adaptive management will be facilitated to achieve

desired outcomes. These research projects have the following attributes:

- Adhere to scientifically defensible protocols for data collection, where available and applicable, in order to develop the best science for resource management
- Data collection techniques will have minimal animal mortality or disturbance and minimal habitat destruction
- Collect the minimum number of samples (e.g., water, soils, vegetative litter, plants, macroinvertebrates, vertebrates) to meet statistical analysis requirements for identification and/or experimentation in order to minimize long-term or cumulative impacts
- Utilize proper cleaning of investigator equipment and clothing as well as quarantine methods, where necessary, to minimize the potential spread or introduction of invasive species
- Often result in peer reviewed articles in scientific journals and publications and/or symposiums

Strategies Applied to Achieve Objective
a. Identify and articulate priority management-oriented research needs to a wide scientific audience
b. Collect data and samples of fish, wildlife, and habitat parameters to meet statistical analysis requirements
c. Utilize scientific survey protocols for data collection to ensure quality results
d. Utilize most recent and up-to-date survey equipment to ensure reliable data are collected
e. Quarantine or clean investigator equipment and clothing to prevent spread of invasive plant and animals
f. Conduct research on salt marshes to determine accretion and subsidence rates
g. Conduct research on the potential effects of climate change and sea level rise on salt marshes

Rationale: Like monitoring, results of research projects will expand the best available scientific information and potentially reduce uncertainties to promote transparent decision-making processes for resource management over time on refuge lands. In combination with results of surveys, research will promote adaptive management on refuge lands. Scientific publications resulting from research on refuge lands will help increase the visibility of the NWRS as leader in the development of the best science for resource conservation and management.

Research projects on refuge lands will address a wide range of natural and cultural resource as well as public-use management issues. Examples of management-oriented research projects include habitat use and life-history requirements for specific species/species groups, practical methods for habitat management and restoration, extent and severity of environmental contaminants, techniques to control or eradicate pest species, effects of climate change on environmental conditions and associated habitat/wildlife response, identification and analyses of paleontological specimens, modeling of wildlife populations, and assessing response of habitat/wildlife to disturbance from public uses. Projects may be species-specific, refuge-specific, or may evaluate the relative contribution of refuges to larger landscape (e.g., ecoregion, region, flyway, national, international) issues and trends.

The findings from two ongoing projects may elicit new fields of inquiry and research, and influence priorities for inventory and monitoring on the Refuge. The Refuge will monitor the results of coastal and marine species climate sensitivity analyses (in progress, Dr. Deborah Reusser, USGS, lead researcher, funded by the North Pacific Landscape Conservation Cooperative) and a North Pacific birds sensitivity analysis (in progress, PRBO-Conservation

Science, funded by the North Pacific Landscape Conservation Cooperative).

Objective 9.3 Conduct scientific assessments
Throughout the life of the CCP, conduct scientific assessments to provide baseline information that will expand our knowledge regarding the status of refuge resources and better inform resource management decisions. The scientific assessments will contribute to the development of refuge resource objectives and they will also be used to facilitate habitat restoration through selection of appropriate habitat management strategies based upon site-specific conditions. • Utilize accepted standards, where available, for completion of assessments • Scale and accuracy of assessments will be appropriate for development and implementation of refuge habitat and wildlife management actions
Strategies Applied to Achieve Objective
a. Utilize scientific assessment results to implement management strategies to benefit ecosystems
b. Complete water resource assessment for the Refuge – Division of Engineering, Water Resources Branch
c. Develop a National Vegetation Classification Standard vegetation data layer for use in GIS
d. Conduct hydrological assessment at Neskowin Marsh
e. Conduct baseline assessment of water chemistry and monitor changes over time to determine acidification rate
Rationale: In accordance with the Service policy for implementing adaptive management on refuge lands (522 DM 1), appropriate and applicable environmental assessments are necessary to determine resource status, promote learning, and evaluate progress toward achieving objectives whenever using adaptive management. These assessments will provide fundamental information about biotic (e.g., vegetation data layer) as well as abiotic processes and conditions (e.g., soils, topography, hydrology) that are necessary to ensure that implementation of on-the-ground resource management actions achieve resource management objectives identified under Goals 1 through 8. For example, a baseline estuary water chemistry analysis is lacking and needed to monitor the long-term potential effects of ocean acidification, a high risk to refuge resources.

2.4.10 Goal 10: Provide and manage quality opportunities for visitors of all abilities to observe and/or photograph six subspecies of Canada geese and other wildlife using lowland pastures along with coastal wetlands, grasslands, and mixed hardwood forest thus promoting the protection and preservation of coastal ecosystems.

Objective 10.1 Provide high-quality wildlife observation and wildlife/nature photography opportunities at Cannery Hill
Throughout the life of the CCP, provide visitors of all ages and different abilities with a variety of safe and accessible opportunities at Cannery Hill to successfully observe or photograph wildlife and the surrounding landscape while limiting the impacts of wildlife and habitat disturbance. Quality wildlife observation and wildlife/nature photography programs at Cannery Hill are defined by several elements including: • Focusing on major wildlife species and groups of wildlife species, including wintering waterfowl, raptors, and neotropical songbirds • Incorporating a diversity of habitats

• Using various types of facilities (e.g., trails, observation decks) in order to view/photograph wildlife and their habitats • Emphasizing activities on a year-round basis • Satisfying a range of skill sets, from casual and beginning observers/photographers to more advanced observers/photographers
Strategies Applied to Achieve Objective
a. Maintain the Pacific View Trail, observation deck, and associated parking lot
b. Build a Discovery Trail and observation deck in the lower parking lot
c. Develop a seasonal trail that follows the current power line right of way
d. Develop a trail to direct visitors from the lower parking lot safely to the Pacific View Trail (i.e., loop trail)
e. Provide signs and brochures that promote appropriate use of trails and observation decks to minimize wildlife and habitat disturbance
f. Develop a bird checklist
g. Partner with the local Chamber of Commerce and other organizations to support nature-based tourism including the Birding and Blues Festival
h. Work with refuge volunteers and other partners to develop, improve and maintain public use trails
Rationale: Wildlife and nature photography promotes public understanding and appreciation for the Refuge's natural resources. At Cannery Hill, public use infrastructure is in place for wildlife observation, photography, interpretation, and environmental education. The Refuge maintains two parking lots for the public at Cannery Hill. The paved lower parking lot has 10 standard parking spaces, two school bus spaces, and a single vault restroom. The paved upper parking lot contains five standard parking spaces. The lower parking area of Cannery Hill contains a welcoming kiosk that orients visitors to the Refuge. It contains information on the hiking trails, things for visitors to do, and the rules and regulations of the Refuge. This area will benefit from the addition of a few visitor amenities. The Refuge is completing the development of a new observation deck in the lower parking lot to provide visitors with an opportunity to view and photograph wildlife using woodlands, lowland pastures, and grasslands. The Refuge will also build a "discovery trail" that will link the existing orientation kiosk to the new observation deck. The discovery trail will serve two main purposes: to provide a safe and accessible route for pedestrians to move between the existing kiosk and new observation deck without having to walk through the parking lot, and to provide a needed programmatic element that converts the lower parking area into a destination worth visiting. The Refuge will add another trail that will increase the opportunity for visitors to observe and photograph wildlife. There is a grassy, undeveloped trail that follows the power line corridor from Christensen Road to a refuge-owned tide gate and dike (i.e., the Powerline Trail). The trail is maintained by staff, volunteers, and the local power company, but it is currently closed to public use. The trail goes through a variety of habitats and provides visitors with the best opportunity to view small songbirds on the Refuge. The Service will improve this trail and open it for seasonal use. Specifically, wildlife observation and photography will be allowed from April 1 through September 30. Because the trail passes alongside pastures used by wintering white-cheeked geese and the Refuge strives to provide undisturbed feeding areas for geese, the trail will be closed to the public from October 1 through March 31.

From the lower parking lot of Cannery Hill, visitors can either drive or walk to the upper parking lot. Both routes take visitors through a matrix of forest including restored forest, mature coniferous forest, and a small patch of native hardwoods. If visitors walk they must share the roadway with cars, which presents a safety hazard, even though traffic volume is low. Consequently, the Refuge will design and develop a loop trail with the express purpose of getting visitors off the road and onto a safer route. The trail will begin in the lower parking lot, traverse through refuge woodlands, and end at the Pacific View Trail. Except for the Powerline Trail, all of the trails and observation decks will be open year-round for the purpose of wildlife observation, photography, environmental education, and interpretation, and visitors will be restricted to staying on the trail. From the upper parking lot, visitors can access the Pacific View Trail, which is 0.3 mile in length, paved, and wheelchair-accessible. It leads visitors to an elevated viewing deck perched atop Cannery Hill. There are four interpretive panels that share the story of the diversity of wildlife habitats and wildlife found on the Refuge. This trail is used by visitors for wildlife observation, photography, interpretation, and environmental education. All environmental education programs on the Refuge are informal and are led by refuge volunteers, interns, or staff. The Service will continue to allow these uses on Cannery Hill and will require advance reservations for all groups participating in environmental education. The Service will also require that, prior to engaging in activities, all groups be educated on refuge etiquette and ways to reduce disturbance to wildlife and habitat. The Birding and Blues Festival is an annual springtime event hosted by the community of Pacific City. The Service is one of the festival sponsors, offering presentations, workshops, and guided bird walks. The festival events educate birders of all interest levels and ages, promote tourism in the area, and inform visitors of the many outdoor activities available in the area, including the Refuge.

Objective 10.2 Provide high-quality wildlife observation and wildlife/nature photography opportunities at the Little Nestucca Restoration Area, Brooten Marsh, and Neskowin Marsh Unit
Throughout the life of the CCP, provide visitors of all ages and different abilities with a variety of safe and accessible opportunities at the Little Nestucca Restoration Area, Brooten Marsh, and the Neskowin Marsh Unit to successfully observe or photograph wildlife and the surrounding landscape while limiting the impacts of wildlife and habitat disturbance. Quality wildlife observation and wildlife/nature photography programs in these designated areas are defined by the same elements as in Objective 10.1.
Strategies Applied to Achieve Objective
a. Develop a short and accessible trail along the old roadbed in the Little Nestucca Restoration Area and allow wildlife observation and photography year-round
b. Improve the parking lot on the west end of the restoration site
c. Keep the tsunami evacuation trail at Neskowin Marsh open as an escape route and make the bridge on the tsunami evacuation trail Architectural Barriers Act (ABA) accessible
d. Keep tsunami evacuation trail open and conduct a hydrologic study and modify roadbed and bridge to improve hydrology and accessibility
e. Allow unrestricted walking, year-round, for the purpose of wildlife observation and photography

on Brooten Marsh
Rationale: The former U.S. Highway 101 roadbed is on the west end of the restoration site on the Little Nestucca River. The restoration site is a great place to view wintering waterfowl. The Refuge will improve the roadbed by grading a small parking area, building a short trail that leads visitors of all abilities into a portion of the restoration site, screening the trail with vegetation to reduce wildlife disturbance, and developing a welcoming and orientation kiosk. A small wooden footbridge spans Neskowin Marsh's outlet channel serves as one of only a few tsunami escape routes for the low-lying community of Neskowin. The tsunami evacuation trail traverses the south end of Neskowin Marsh and is located on a former roadbed that crossed the marsh. The trail was in existence before establishment of the Neskowin Marsh Unit of the Refuge and is kept open for the safety of the community. The trail allows local residents in the nearby dunes to escape on foot to high ground in the Neskowin Crest area as well as passage to U.S. Highway 101. The Refuge will conduct a hydrologic study to determine if the roadbed is negatively affecting marsh hydrology and ecology and is therefore in need of modification. The hydrologic study will be designed to guide the modification of the former roadbed to improve hydrology and accessibility. See also Objective 5.3.

2.4.11 Goal 11: Offer hands-on environmental education programs to communities that promote life-long learning about coastal wildlife and their habitats.

Objective 11.1 Provide high-quality environmental education opportunities for children and adults
Throughout the life of the CCP, provide quality hands-on environmental education programs to community groups and schools with an emphasis on the themes of habitat restoration, climate change, invasive species management, and the natural history of white-cheeked geese. In addition, a high quality environmental education program at Nestucca Bay NWR should also include the following attributes: • Emphasize enjoyable, hands-on, outdoor learning • Appeal to a broad range of learning styles and provide interdisciplinary opportunities that link natural resources through multiple academic subject areas • Minimize impacts to fish, wildlife, plants, and their habitats; other compatible public uses; and refuge management programs and facilities • Link directly to wildlife observation and interpretation programs
Strategies Applied to Achieve Objective
a. Hire a full-time permanent Environmental Education Specialist
b. Seek grant opportunities to develop curriculum and programming
c. Develop a nature discovery backpack check-out program
d. Recruit, train and utilize volunteers to deliver on-site environmental education programs
e. Collaborate with partners to enhance environmental education opportunities and to ensure refuge programming is unique and does not conflict with other programming in the county
f. Develop and implement evaluation techniques to maintain program quality

g. Partner with schools to engage students in hands-on learning and stewardship
h. Foster long-term support for the environmental education program with the assistance of the refuge friends group once established
i. Engage adults through citizen science programs
j. Evaluate effectiveness of environmental education efforts through pre- and post-program evaluations for students and surveys for teachers
Rationale: Environmental education plays a key role in encouraging current and future generations to engage in environmentally responsible behavior like supporting the protection of habitat for wildlife through the National Wildlife Refuge System. Currently the Refuge offers very few and no formal environmental education (EE) programs on-site at Nestucca Bay NWR. All EE programs are informal and led by refuge volunteers, interns, or staff. The number of students and community groups served is limited by the availability of staff and volunteers needed to manage a program. The Service will continue to allow EE programs on Cannery Hill and will require advance reservations for all groups participating in EE. Prior to engaging in activities, students and groups will be educated on refuge etiquette and ways to reduce disturbance to wildlife and habitat. The Refuge engages adults in EE at Nestucca Bay NWR through a citizen science program called Project NestWatch. NestWatch is a continent wide citizen-science project and nest monitoring database of the Cornell Lab of Ornithology. The Refuge will continue with this program indefinitely and will seek opportunities to engage volunteers and visitors in other Citizen Science programs. In 2001, the Oregon Coast National Wildlife Refuge Complex entered into a long-term partnership with the Jane Goodall Environmental Middle School (JGEMS) in an effort to enable students to learn biological research methods in an outdoor classroom alongside dedicated professionals who are passionate about environmental education and the land. In this partnership the Refuge and JGEMS have tackled a variety of research projects that not only benefit the students but have added to the baseline knowledge of biological resources. The Refuge will continue to foster this partnership throughout the life of the CCP and will seek out new partnerships with local schools. Friends groups often play a critical role in supporting a refuge EE program. Friends groups have the ability to raise funds, write curriculum, implement programs, and expand community involvement. Establishment of a refuge friends group at Nestucca Bay is a high priority for the Refuge. Once the friends group is established, group members' involvement in EE will be encouraged.

2.4.12 Goal 12: In cooperation with partners and volunteers offer year-round interpretive opportunities to visitors of all ages and abilities to learn about and experience a range of coastal habitats including coastal prairie, estuary, and tidal marsh, thus instilling an ethic of conservation and resource protection for coastal wildlife adapted to these habitats.

Objective 12.1 Provide high-quality interpretive opportunities at Cannery Hill
Throughout the life of the CCP, provide visitors with opportunities for self-guided and refuge-led interpretation at Cannery Hill. A high-quality interpretive program will consist of the following

features: • Emphasize learning about white-cheeked goose management, coastal prairie restoration, and invasive species management • Emphasize non-guided activities but offers periodic guided programs • Link directly to the wildlife observation and environmental education programs
Strategies Applied to Achieve Objective
a. Hire a permanent, full-time north coast refuge manager
b. Establish a refuge friends group
c. Hire a permanent, full-time refuge volunteer coordinator
d. Expand current programming for guided natural history and birding hikes conducted by refuge staff, volunteers, and partners
e. Maintain interpretive facilities at Cannery Hill
f. Develop an interpretive trail guide
Rationale: Interpretation is identified as one of the priority public uses of the National Wildlife Refuge System. Interpretation will be used at Nestucca Bay NWR as a way to provide information to visitors, either through a self-guided experience or one that is led by refuge staff, about Canada goose management, coastal prairie restoration, and invasive species management with the ultimate goal of enhancing their appreciation, understanding and enjoyment of the Refuge's natural resources. Interpretation will also be used to help in visitor management by sharing refuge rules and regulations in a manner that encourages visitors to care for the Refuge and its wildlife. The Service will also have staff and volunteers expand current programming to offer guided natural history and birding hikes. A successful interpretive program depends on the help of volunteers and partnerships. They are key components of the successful management of refuge lands and are vital to refuge biological and public use programs and projects. This is especially true in times of static or declining budgets. Currently the Refuge makes extensive use of volunteers in public use programs and to a lesser degree in habitat management and biological inventory and monitoring. In the future, successful implementation of environmental education and interpretation programs will require the use of partnerships, including a refuge friends group, and volunteers. Thus it is important that the Refuge have a refuge manager and volunteer coordinator on staff to manage these critical partnerships.

Objective 12.2 Provide high-quality interpretive opportunities at the Little Nestucca Restoration Area
Throughout the life of the CCP, provide visitors with opportunities for self-guided and refuge-led interpretation at the Little Nestucca Restoration Area. A high-quality interpretive program at these units consists of the same features as in Objective 12.1 except that the focal topics are wintering waterfowl, salmonid use of estuaries, sphagnum bogs, and other rare habitats, and the function of tidal marshes.
Strategies Applied to Achieve Objective
a. Develop interpretive panels for the Little Nestucca Restoration Area public use trail
b. Partner with the Tillamook Estuaries Partnership to develop an interpretive water trail guide
c. Offer a minimum of two interpreter-led paddle trips annually
Rationale: The Service will expand interpretation on the Refuge by offering interpreter-led paddle trips each summer. It will partner with the Tillamook Estuaries Partnership to market the water

trail guide developed for the Nestucca and Little Nestucca Rivers. Water trails are defined paths on a waterway connected through signs, maps, and access points providing a scenic and educational experience for recreational users. These forms of interpretive material will help educate the public on minimizing wildlife and habitat disturbance.

2.4.13 Goal 13: Provide and manage safe, enjoyable, and quality hunting and fishing opportunities for people of varying ages and resources that further the tradition of wildlife conservation and stewardship.

Objective 13.1 Provide opportunities for quality waterfowl hunting
Throughout the life of the CCP, provide an opportunity for waterfowl hunters of all ages and abilities to hunt a variety of dabbling and diving ducks on 141 acres, while minimizing impacts to wintering dusky Canada geese, other wildlife, and other recreational users. Provide a quality, safe waterfowl hunt program that: • Place a priority on safety • Include clear and concise regulations and makes them readily available • Pose minimal conflict with wildlife and habitat objectives • Pose minimal conflict with other priority public use activities • Pose minimal conflict with neighboring lands
Strategies Applied to Achieve Objective
a. Prepare waterfowl hunting plan and opening package
b. Allow hunting on Brooten Marsh
c. Allow hunting on at the mouth of the Little Nestucca River
d. Develop an informational tear sheet on the rules and regulations of waterfowl hunting at Nestucca Bay NWR
e. Allow hunters to access refuge lands open to hunting via boat or foot
f. Conduct law enforcement patrols on a regular basis to ensure compliance with state and Federal waterfowl hunting regulations
Rationale: Hunting is identified as a priority public use by the NWRS Improvement Act, when it is compatible with national wildlife refuge purposes. There is currently no official hunting program on Nestucca Bay NWR because of the establishment purpose of the Refuge as undisturbed quality wintering habitat for Canada geese. Consequently all lowland pastures will remain closed to waterfowl hunting to maximize goose use and minimize goose depredation on adjacent private lands. Public duck hunting opportunities in the area surrounding Nestucca Bay NWR are limited, with the next nearest opportunities occurring on Tillamook Bay. Private lands offer waterfowl hunting opportunities but only to those who are granted permission and/or the ones willing and able to purchase hunting rights or leases. There is a demand for public hunting in the Nestucca Valley, especially those lands that have walk-in access and do not require the use of a boat. During the public scoping process the Service received requests to allow hunting on refuge lands at Nestucca Bay. There was specific interest by ODFW to provide walk-in opportunities for hunters on the Refuge. Allowing waterfowl hunting on Brooten Marsh and the mouth of the Little Nestucca River will increase hunting opportunities in the area for hunters with or without a boat.

During the public scoping process it was requested that hunting be allowed on the Little Nestucca Restoration Area. The 82-acre restoration is a narrow band of habitat bordering Highway 130/Little Nestucca River Road. Allowing hunting at this site would result in 100% of the tidal marsh habitats within Nestucca Bay NWR being open to waterfowl hunting with no refuge sanctuary provided within this habitat type. Consequently the Service will keep the area closed to all waterfowl hunting.

With this CCP, and in accordance with ODFW hunting regulations, the Refuge will open refuge lands at Brooten Marsh (108 acres) and the mouth of the Little Nestucca River (33 acres) to waterfowl hunting. Through participation in a waterfowl hunt program, hunters will have an opportunity to learn about and understand the Refuge's purpose and resource management activities.

For Brooten Marsh, hunters will access the area either via boat or by walking in from a pull-out along Brooten Road near the southeast corner of the marsh (Figure 2-1). The Service will improve a trail that leads from this pull-out to Brooten Marsh to support this and other wildlife-dependent uses planned for the area. Access to the mouth of the Little Nestucca River is only possible via boat. There are three public boat launches nearby that hunters occasionally use to launch their watercraft. For both areas, access to refuge lands will be allowed for hunting from one hour before sunrise to one hour after sunset. Establishment of permanent blinds will not be allowed; however, hunters will be allowed to use portable blinds or blinds constructed of on-site dead vegetation or driftwood under the condition that they either be removed or disassembled at the end of each day.

Objective 13.2 Provide opportunities for quality fishing
Throughout the life of the CCP, provide opportunities for visitors to clam and fish from refuge lands in accordance with state fishing regulations, while minimizing impacts to other resources. Provide a quality fishing program that: • Includes clear and concise regulations that are readily available • Poses minimal conflict with wildlife and habitat objectives • Poses minimal conflict with other priority public use activities
Strategies Applied to Achieve Objective
a. Prepare fishing plan and opening package
b. Allow bank fishing on the east end of the Little Nestucca Restoration Area
c. Adjacent to Brooten Marsh, allow clamming per ODFW regulations and subject to ODA and ODFW shellfish safety closures
d. Develop a pedestrian trail on the east side of the restoration site
e. Develop a gravel parking lot on east end of the restoration site
f. Conduct law enforcement patrols on a regular basis to ensure compliance with state and Federal fishing regulations
Rationale: Fishing is identified as a priority public use, and this popular activity occurs at many locations along the Oregon coast. Recreational fishing is a popular sport off-refuge on the navigable waters of both the Little Nestucca River and the Nestucca River from boats, and also on the riverbanks on private lands. The Refuge will increase opportunities for bank fishing by allowing it to occur on lands restored by the Service along Little Nestucca River. Allowing bank fishing along the southeastern bank of the Little Nestucca Restoration Area will increase opportunities for fishing in this area, provide an opportunity for people who do not own or have

access to a boat, and help create a greater awareness among anglers about the importance of estuaries to salmonids.
To improve access for fishing, the Service will develop a small gravel parking lot on the northeast side of the Unit along Highway 130/Little Nestucca River Road. The Service will develop and improve a short pedestrian trail along the dike on the east end of the restoration area to lead safely to the bank of the Little Nestucca River. The trail will be open for anglers to access during daylight hours only. Camping, overnight use, and fires will be prohibited. Anglers will be permitted to use pole and line or rod and reel while bank fishing and will be required to follow ODFW regulations for fishing in bays and tidelands. Anglers will be allowed to use either bait or artificial lures. The designated sites along the trail will concentrate anglers and potentially generate trash including monofilament line, which can entangle wildlife and is therefore a hazard. The Service will provide containers for anglers to discard their used monofilament line. Clamming is currently allowed on state-owned tidelands at Nestucca Bay. Clamming takes place on state tidelands adjacent to refuge lands and may spill over onto the Refuge due to lack of boundary posting on the Brooten Marsh Unit. Because fishing (i.e., clamming) is one of the Service's priority wildlife-dependent public uses, the Refuge supports clamming on and adjacent to Brooten Marsh and the development of improved safe access working cooperatively with the ODFW's sport fishing program. In addition to the harvest of clams, the harvest of sand shrimp other marine invertebrates for bait is included within the term clamming. If the Service is notified by the ODA and ODFW of a shellfish safety closure or contaminant issue that threatens human health, the Refuge will take corrective action (e.g., closure of fishing/hunting). To provide for additional clamming opportunities in Nestucca Bay, the Refuge will allow clamming on the 100-acre Brooten Marsh and the adjacent 19 acres of refuge mudflats located where the Nestucca River joins the Little Nestucca River. The entire mudflat habitat within the marsh will be open to clamming. Clammers will access the marsh by walking in from a pull-out along county maintained Brooten Road. The Service will improve a trail that leads from this pull-out to Brooten Marsh to support this and other planned wildlife-dependent uses for the area. Visitors will be allowed to harvest softshell clams by digging with a hand shovel or using a clam gun (i.e., aluminum or PVC-piped suction device).

2.4.14 Goal 14: Provide facilities and materials that welcome and orient children and adults to Nestucca Bay National Wildlife Refuge so they can easily and safely learn about its fish and wildlife resources.

Objective 14.1 Provide facilities that welcome and orient visitors to the Refuge
Throughout the life of the CCP, provide an integrated set of welcome and orientation facilities for visitors to: • Feel welcomed • Easily find accurate, timely, and appropriate orientation materials and information • Be aware of their options (available activities and experiences, where and when to go, how to get there, etc.) • Safely pursue self-guided activities
Strategies Applied to Achieve Objective
a. Maintain restroom in lower parking lot of Cannery Hill

b. Replace refuge volunteer residence with a small administrative office/visitor contact station/two room bunkhouse
c. Add five additional parking spaces for staff by the Maintenance Shop
d. Add five additional parking spaces for staff and visitors by the administrative office
e. Remodel the north bay of the maintenance shop to accommodate two offices: one for maintenance staff and another for the refuge friends group
f. Determine if lower parking lot needs to be redesigned to accommodate extra parking spaces on south side
g. Mark Neskowin Marsh tsunami evacuation trail with signs
h. Utilize habitat-appropriate native plants for landscaping around buildings, kiosks, and other public use facilities
Rationale: As described in the Oregon State Parks Regional Interpretive Framework (Oregon Parks and Recreation Department [OPRD] 2005), the Oregon Coast is considered one of the world's most stunning landscapes. It features dramatic rocky shoreline, historic lighthouses, endless beaches, quaint seaside towns, and scenic bridges. The U.S. Highway 101 National Scenic Byway follows the shoreline and is the main route used by visitors who come to the coast from Portland and other inland population centers including Corvallis, Eugene, Roseburg, Medford, and Grants Pass. According to OPRD, bird watching, walking, and day hiking will be the most popular recreation activities over the next 10 years (OPRD 2008). Visitors to the Oregon Coast NWR Complex will likely stop for a couple of reasons: a short 20-minute stop made to look at a view and take a picture, or a longer, one- to three-hour, stop allowing visitors to leave the car and stretch their legs. Interpretive signs may enhance observation, interpretation, and education during short stops. Visitors making longer stops may be more interested in learning about the site, taking in a short program, or taking a short walk, and the Refuge will be adding trails and interpretive signs to meet these needs. Cannery Hill was identified in a Facilities Review plan as the best location on the north coast to provide a range of opportunities that allow visitors to experience refuge natural resources. Opportunities include stunning views, interpretive signage, and a variety of walking trails that provide wildlife viewing opportunities. In addition, this site already has infrastructure such as parking and a vault toilet. To accommodate increasing visitation to the Refuge, the Service will replace the current refuge volunteer residence with a small administrative office/two room bunkhouse combination. To support these facilities the Service will also add 10 additional parking spaces. The Service will remodel the north bay of the maintenance shop to accommodate two offices: one for maintenance staff and a second for the refuge friends group. This will increase Refuge staff capability to maintain visitor facilities and interact directly with visitors.

Objective 14.2 Conduct public outreach
Throughout the life of the CCP, conduct outreach to the public in an effort to: • Describe the Refuge and its place as part of the National Wildlife Refuge System • Provide current information about refuge management, biology, volunteer opportunities, public use events, and rules and regulations

Strategies Applied to Achieve Objective
a. Maintain an up-to-date brochure on the Refuge Complex
b. Partner with media outlets in Oregon to market public use opportunities on the Refuge
c. Participate in social media outreach
d. Maintain a refuge website
e. Maintain online photo sharing database
f. Partner with non-profit conservation organizations and appropriate media outlets in Oregon to disseminate information about refuge wildlife and habitats
g. Maintain a refuge presence at community events that have high potential to deliver refuge messages to key audiences
h. Evaluate the potential to develop digital trail guides for use on MP3 players and/or smartphones
Rationale: Outreach is critical in educating the public, volunteers, and partners about how refuges protect and conserve natural resources and what we are doing to provide economic benefits to communities. When people know and understand about the mission of the Service and the NWRS they are more likely to support the Refuge. Outreach can also improve visitors' awareness of regulations and policies and the reasons behind them. Our outreach efforts will focus on providing specific information about Nestucca Bay NWR including important news and events and will be used as a means of building an online community of support for the Oregon coast refuges. Specific examples of outreach will involve maintaining a refuge website and utilizing social media to advertise volunteer opportunities, announce interpretative and environmental education events, relate news releases, distribute the refuge newsletter, share photos and videos, and provide an engaging view of what employees and volunteers do for the Oregon Coast NWR Complex.

Objective 14.3 Establish partnerships with friends groups and volunteers
Throughout the life of the CCP, develop and support a friends group and increase volunteer program to assist with public use programming, monitoring, research, and maintenance on the Refuge.
Strategies Applied to Achieve Objective
a. Establish a friends group and solicit individuals or groups to become involved
b. In conjunction with friends group, develop habitat-related projects that support refuge monitoring, research, and maintenance needs
c. Dedicate a refuge staff member to serve as the liaison between the friends group and the Refuge, including attendance at friends group board meetings
d. Work with friends group and volunteers to assist with maintenance of public use facilities and trails
e. Work with friends group to recruit volunteers to conduct monitoring projects on the Refuge
f. Hire a full-time volunteer coordinator GS-9
Rationale: In the past 15 years a network of groups, called friends, have adopted individual refuges or complexes and have begun to advocate for the needs of refuges by providing both financial and volunteer support. Friends groups and volunteers are recognized as key components of the successful management of public lands and are vital to implementation of refuge wildlife and habitat programs. During these times of declining budgets the National Wildlife Refuge System faces a growing shortage of staff, and in many cases funding for key conservation

programs has been reduced.

Through establishment of a friends group at Nestucca Bay NWR, the Refuge will benefit by increasing the support it gives and receives from the community. The friends group will in turn play a critical role in providing volunteer support for the Refuge and serve as an advocate for protecting refuge wildlife and habitat.

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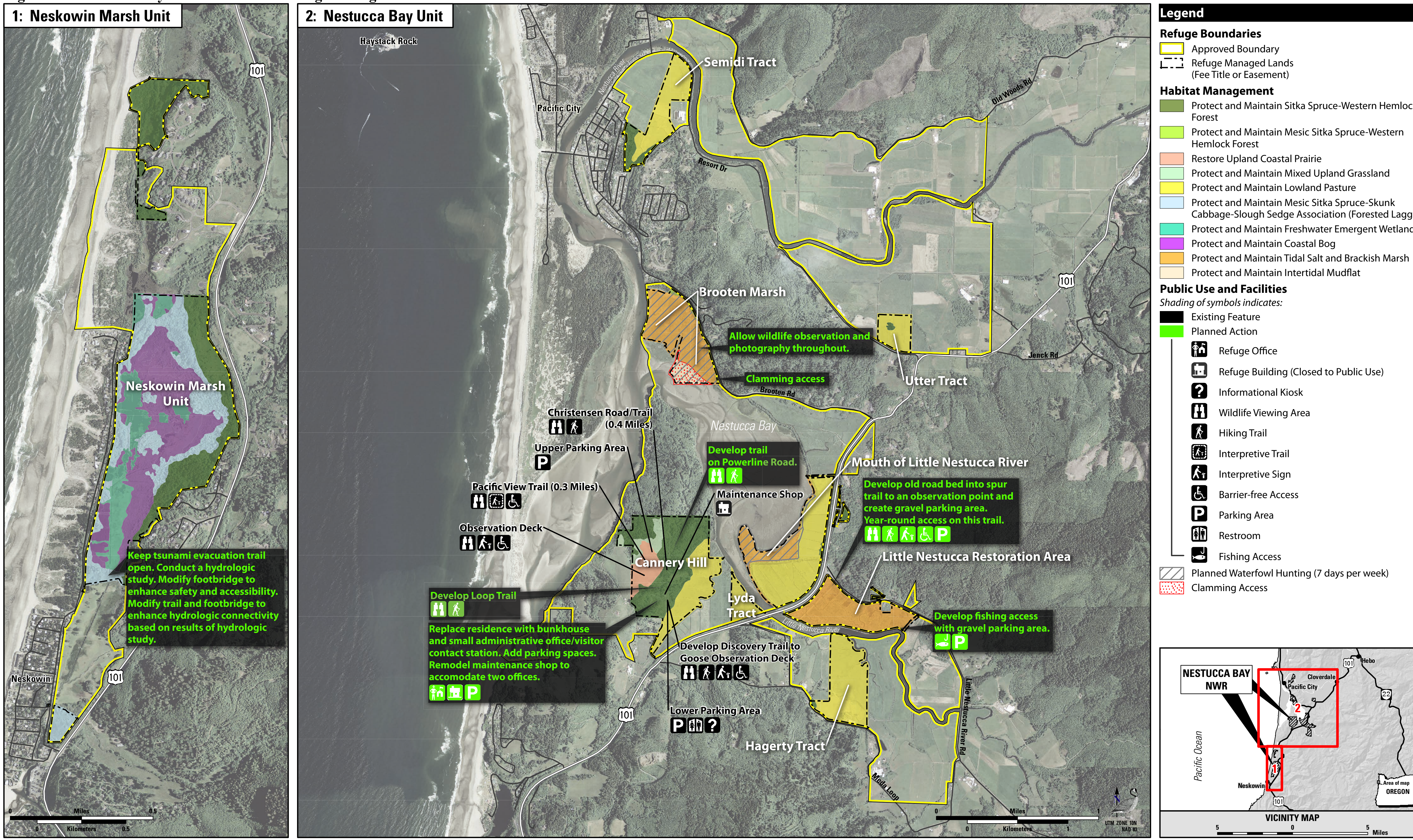
Figure 2-1. Nestucca Bay National Wildlife Refuge management direction.



Data Sources: Refuge Boundaries from USFWS/R1; Roads from ESRI; Imagery from 2009 NAIP

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Shawn Stephensen/USFWS

Chapter 3
Physical Environment

Chapter 3. Physical Environment

3.1 Climate and Climate Change

3.1.1 General Climate Conditions

The climate at Nestucca Bay National Wildlife Refuge (NWR or Refuge) is greatly influenced by the Pacific Ocean on the west and the Coast Range to the east. The Coast Range rises between 2,000 and 3,000 feet (610-914 meters) above sea level in the north and between 3,000 and 4,000 feet (914-1,219 meters) in the southwestern portion of the state with occasional mountain peaks rising an additional 1,000 to 1,500 feet (305-457 meters). The coastal zone is characterized by wet winters, relatively dry summers, and mild temperatures throughout the year. Because of the moderating influence of the Pacific Ocean, extremely high or low temperatures are rare and the annual temperature range is lower here than in any other Oregon climate zone. Precipitation is heavier and more persistent during the winter but regular moisture occurs from rain and fog throughout the year (Western Regional Climate Center [WRCC] 2011a). The area's heavy precipitation during winter results from moist air masses moving from the Pacific Ocean onto land. The lower elevations along the coast receive annual precipitation of 65 to 90 inches (165-229 centimeters), which can cause flood events if abundant rainfall is consistent for several days. Occasional strong winds (50-70 miles/hour) occur along the coast, usually in advance of winter storms. Wind speeds have been recorded to exceed hurricane force and have caused substantial damage to structures and vegetation in exposed coastal locations (Taylor and Hannan 1999, Taylor 2008). Skies are usually cloudy in the winter during the frequent storms and clear to partly cloudy during summer, with localized fog along the coastline. As a result of persistent cloudiness, total solar radiation is lower along the coast than in any other region of the state.

Climate Change Trends

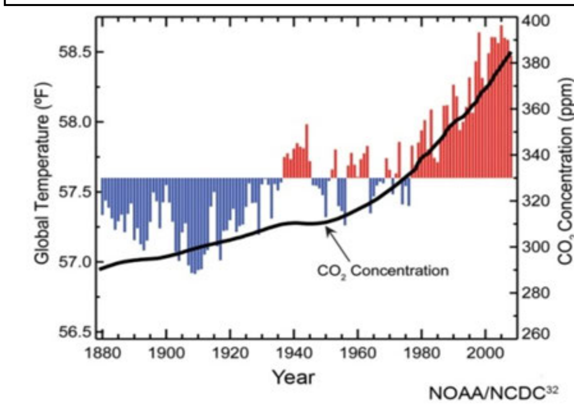
The greenhouse effect is a natural phenomenon that assists in regulating and warming the temperature of our planet. Just as a glass ceiling traps heat inside a greenhouse, certain gases in the atmosphere, called greenhouse gases (GHG), absorb and emit infrared radiation from sunlight. The primary greenhouse gases occurring in the atmosphere include carbon dioxide (CO_2), water vapor, methane, and nitrous oxide. CO_2 is produced in the largest quantities, accounting for more than half of the current impact on the Earth's climate.

A growing body of scientific evidence has emerged to support the fact that the Earth's climate has been rapidly changing during the 20th century and the magnitude of these alterations is largely due to human activities (Intergovernmental Panel on Climate Change [IPCC] 2007a; National Academy of Sciences [NAS] 2008; U.S. Global Change Research Program [USGCRP] 2009). Increasingly, the role of human activities in the concentrations of heat-trapping greenhouse gases have increased significantly over the last several hundred years due to human activities such as deforestation and the burning of fossil fuels (Ibid).

Although climate variations are well documented in the Earth's history, even in relatively recent geologic time (e.g., the Ice Age of 10,000 years ago), the current warming trend differs from shifts earlier in geologic time in two ways. First, this climate change appears to be driven primarily by human activity which results in a higher concentration of atmospheric GHG. Second, atmospheric CO_2 and other greenhouse gases, levels of which are strongly correlated with Earth temperature, are now higher than at any time during the last 800,000 years (USGCRP 2009). Prior to the start of the Industrial Revolution in 1750, the amount of CO_2 in the atmosphere was about 280 parts per million (ppm). Current levels are about 390 ppm and are increasing at a rate of about 2 ppm/year (U.S. Department of Energy [DOE] 2012). The current concentration of CO_2 and other greenhouse gases as well as the rapid rate of increase in recent decades are unprecedented in the prehistoric record (Ibid).

The terms "climate" and "climate change" are defined by the IPCC. The term "climate" refers to the mean and variability of different types of weather conditions over time, with 30 years being a typical period for such measurements, although shorter or longer periods also may be used (IPCC 2007b). The term "climate change" thus refers to a change in the mean or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (Ibid).

Figure 3-1. Global annual average temperature and CO_2 from 1880-2008 (NOAA 2012).



Global annual average temperature (as measured over both land and oceans). Red bars indicate temperatures above and blue bars indicate temperatures below the average temperature for the period 1901-2000. The black line shows atmospheric carbon dioxide (CO_2) concentration in parts per million (ppm). While there is a clear long-term global warming trend, each individual year does not show a temperature increase relative to the previous year, and some years show greater changes than others.[33] These year-to-year fluctuations in temperature are due to natural processes, such as the effects of El Niños, La Niñas, and the eruption of large volcanoes.

Scientific measurements spanning several decades demonstrate that changes in climate are occurring, and that the rate of change has been faster since the 1950s (Figure 3-1). Examples include warming of the global climate system, and substantial increases in precipitation in some regions of the world and decreases in other regions (e.g., IPCC 2007b, Solomon et al. 2007). In the Pacific Northwest, increased greenhouse gases and warmer temperatures have resulted in a number of physical and chemical impacts. These include changes in snowpack, stream flow timing and volume, flooding and landslides, sea levels, ocean temperatures and acidity, and disturbance regimes such as wildfires, insect, and disease outbreaks (USGCRP 2009). All of these changes will cause major perturbations to ecosystem conditions, possibly imperiling species that evolved in response to local conditions.

Results of scientific analyses presented by the IPCC show that most of the observed increase in global average temperature since the mid-20th century cannot be explained by natural variability in climate, and is "very likely" (defined by the IPCC as 90 percent or higher probability) due to the observed increase in greenhouse gas (GHG) concentrations in the atmosphere as a result of human activities, particularly carbon dioxide emissions from use of fossil fuels (IPCC 2007b, Solomon et al. 2007). Further confirmation of the role of GHGs comes from analyses by Huber and Knutti (2011), who concluded that it is extremely likely that approximately 75 percent of global warming since 1950 has been caused by human activities.

In the Northern Hemisphere, recent decades appear to be the warmest since at least about A.D. 1000, and the warming since the late 19th century is unprecedented over the last 1,000 years. Globally, including 2011, all 11 years in the 21st century so far (2001 to 2011) rank among the 13 warmest years in the 130-year instrumental record (1880 to present) according to independent analyses by National Oceanic and Atmospheric Administration (NOAA) and National Aeronautics and Space

Administration (NASA). 2010 and 2005 are tied as the warmest years in the instrumental record and the new 2010 record is particularly noteworthy because it occurred in the presence of a La Niña and a period of low solar activity, two factors that have a cooling influence on the planet. However, in general, decadal trends are far more important than any particular year's ranking.

Trends in global precipitation are more difficult to detect than changes in temperature because precipitation is generally more variable and subject to local topography. However, while there is not an overall trend in precipitation for the globe, significant changes at regional scales can be found. Over the last century, there have been increases in annual precipitation in the higher latitudes of both hemispheres and decreases in the tropical regions of Africa and southern Asia (USGCRP 2009). Most of the increases have occurred in the first half of the 20th century and it is not clear that this trend is due to increasing greenhouse gas concentrations.

Just as important as precipitation totals are changes in the intensity, frequency, and type of precipitation. Warmer climates, owing to increased water vapor, lead to more intense precipitation events, including more snowstorms and possibly more flooding, even with no change in total precipitation (Dominguez et al. 2012). The frequency of extreme single-day precipitation events has increased, especially in the last two decades. Paradoxically more droughts and heat waves have occurred because of hotter, longer-lasting high pressure systems.

3.1.2 Air Temperatures

As a result of the ocean's proximity, winter minimum and summer maximum temperatures along the coast are moderated. It is rare for Nestucca Bay NWR to experience temperatures below freezing. No days are on record with temperatures at or below 0°F. Also, it is only in the extreme occurrences that temperatures have been recorded to exceed 90°F (WRCC 2011b, WRCC 2011c, WRCC 2011d).

There is no climate/weather station established on Nestucca Bay NWR; however, temperature data have been consistently collected since July 1948 at the Tillamook station (number 358494) located approximately 19 miles north of the Refuge, since December 1940 at the Cloverdale station (number 351682) located approximately 3 miles north of the Refuge, and since July 1948 at the Otis station (number 356366) located approximately 6 miles south of the Refuge. The proximity of these stations to the Refuge provides valuable regional data. Table 3-1 provides a summary of the periods of record.

Table 3-1. Air Temperature Summaries Near Nestucca Bay NWR (WRCC 2011b, WRCC 2011c, WRCC 2011d)

Temperatures (°F)	Tillamook July 1948 – Oct. 2010	Cloverdale Dec. 1940 – Sept. 2010	Otis July 1948 – Sept. 2010
Average Monthly Temperature – High	59.3	60.3	59
Average Monthly Temperature – Low	41.9	43.2	42.6
Monthly Mean Winter Temperature – High	50.9	51.4	48.6
Monthly Mean Winter Temperature – Low	36.5	38	36.7
Monthly Mean Summer Temperature – High	66.8	68.9	68.8

Table 3-1. Air Temperature Summaries Near Nestucca Bay NWR (WRCC 2011b, WRCC 2011c, WRCC 2011d)

Temperatures (°F)	Tillamook July 1948 – Oct. 2010	Cloverdale Dec. 1940 – Sept. 2010	Otis July 1948 – Sept. 2010
Monthly Mean Summer Temperature – Low	48.8	49.3	49.3
Daily Maximum Extreme – High	102	106	99
Daily Maximum Extreme – Low	69	68	64
Daily Minimum Extreme – High	34	36	39
Daily Minimum Extreme – Low	1	8	4

Mote (2003) observed that the Pacific Northwest region experienced warming of approximately 1.5°F during the 20th century. For trends local to the Refuge we turn to the United States Historical Climatology Network (USHCN), which provides a high-quality data set of daily and monthly records of basic meteorological variables from 1,218 observing stations throughout the continental U.S. The data have been corrected to remove biases or heterogeneities from non-climatic effects such as urbanization or other landscape changes, station moves, and instrument and time of observation changes. The closest station is Tillamook and trends are provided in Table 3-2 and Figures 3-2 through 3-4 below. The average yearly temperature change has increased 0.02°F over the past 30 years, and more striking are the seasonal trends which show warmer winters and cooler springs (Table 3-2).

Table 3-2. Seasonal Temperature Trends, 1981-2010 (USHCN 2012)

Tillamook, Oregon United States Historical Climatology Network Observation Station			
Monthly Absolute Change	**Maximum Temp.**	**Average Temp.**	**Minimum Temp.**
Winter (Dec-Feb)	+0.22°F	+0.43°F	+0.64°F
Spring (March-May)	-1.23°F	-0.65°F	-0.07°F
Summer (Jun-Aug)	-0.55°F	+0.31°F	+1.17°F
Fall (Sept-Nov)	-0.70°F	+0.05°F	+0.78°F

The graphs below illustrate a sample of these temperature trends using monthly data. The most recent 30-year period is calculated using the slope of the linear trendline, and temperature change is shown as an absolute change over the 30-year period. A water year is defined as the 12-month period from October 1, for any given year, through September 30 of the following year. The water year is designated by the calendar year in which it ends and which includes 9 of the 12 months.

Figure 3-2. Water year temperature 1925-2010 at Tillamook, Oregon (USHCN 2012).

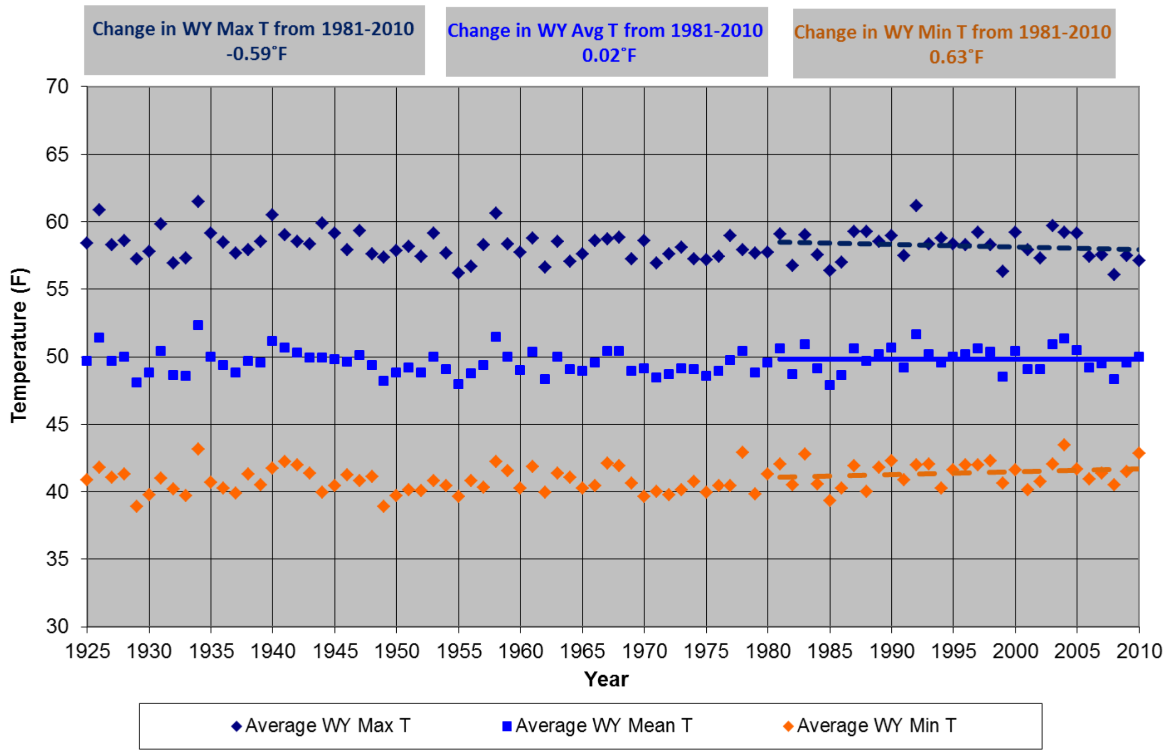


Figure 3-3. Winter (Dec-Feb) temperature 1925-2010 at Tillamook, Oregon (USHCN 2012).

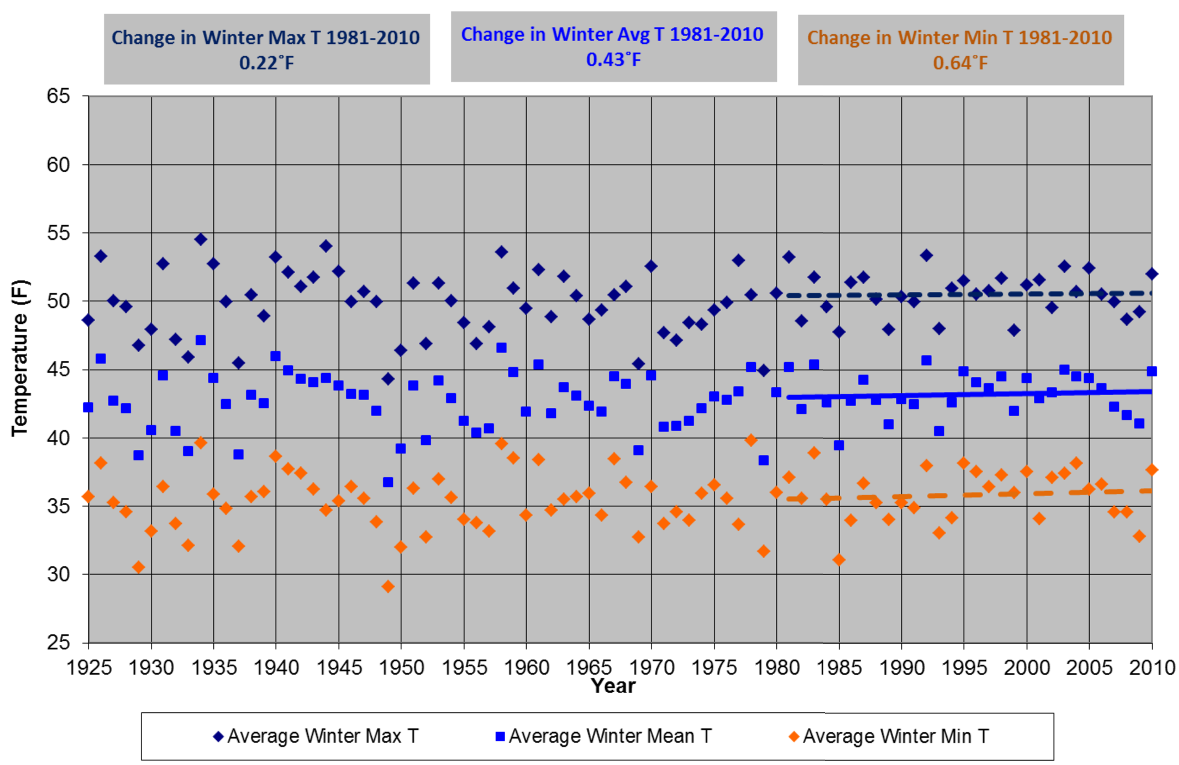
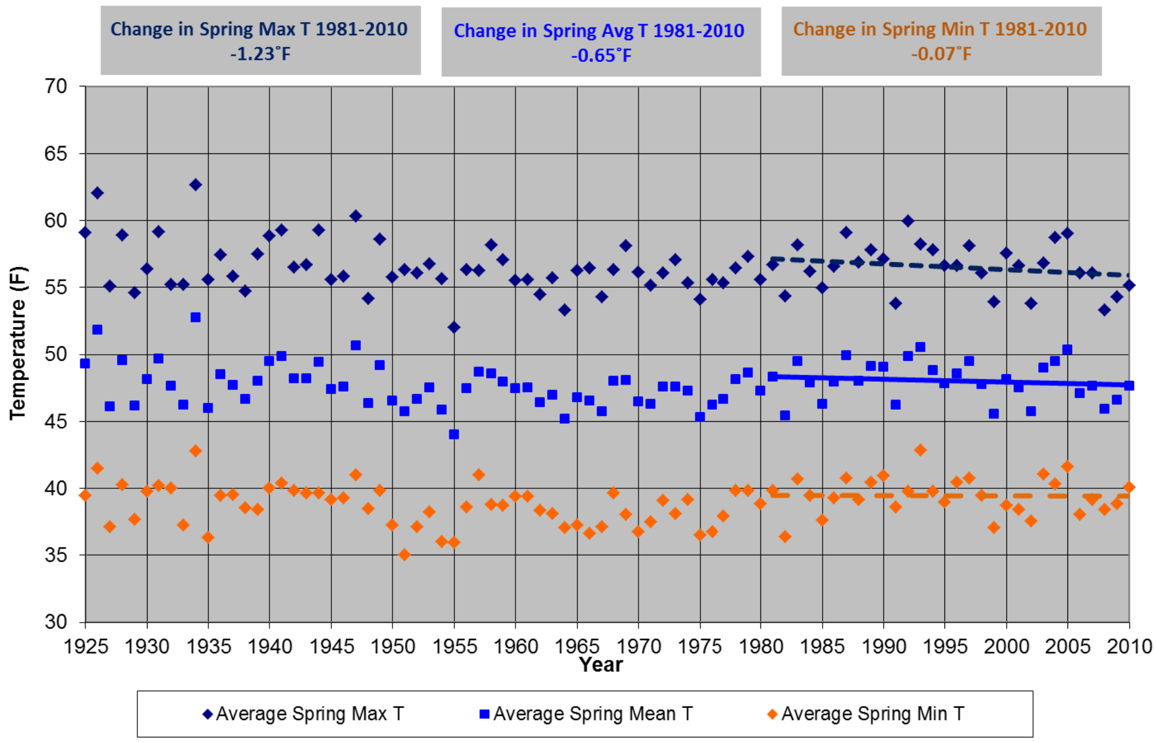


Figure 3-4. Spring (Mar-May) Temperature 1925-2010 at Tillamook, Oregon (USHCN 2012).



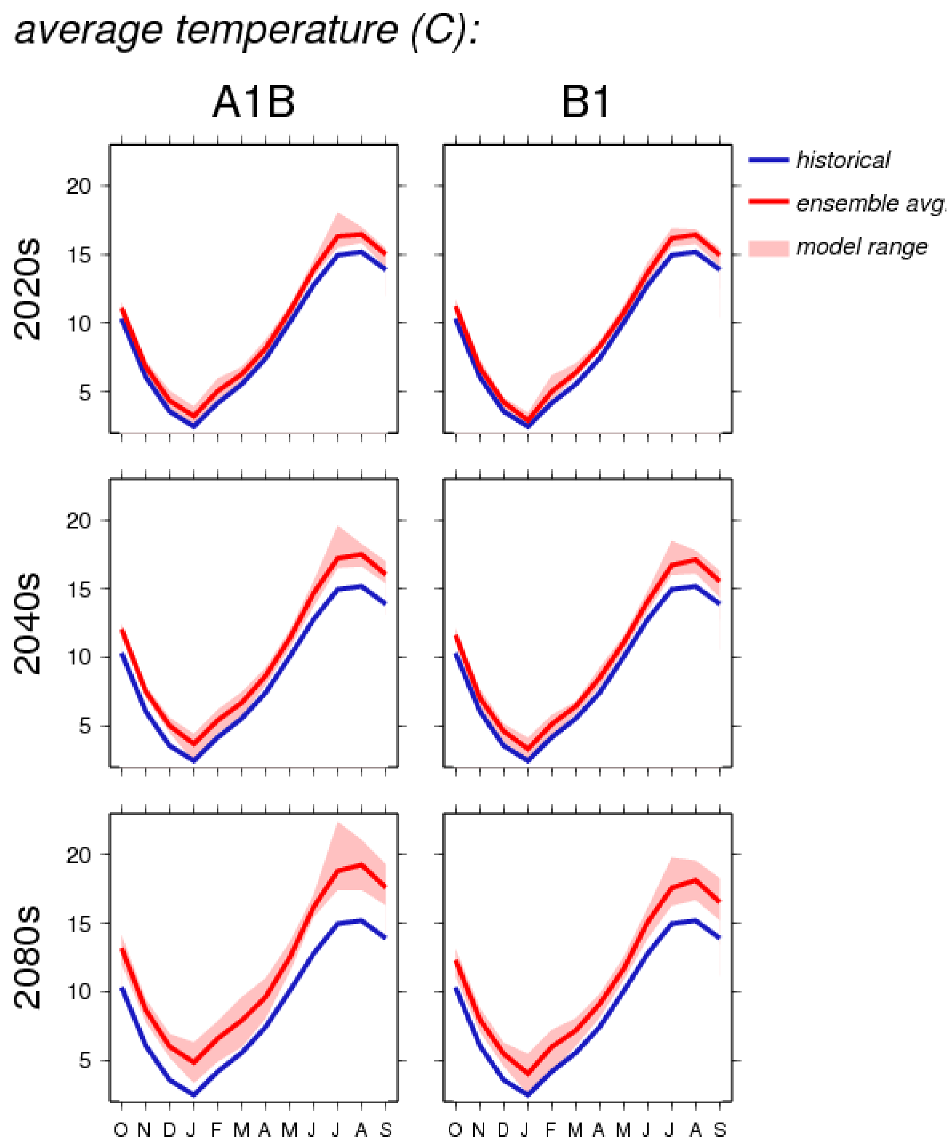
Future Trends

Scientists use a variety of climate models, which include consideration of natural processes and variability, as well as various scenarios of potential levels and timing of GHG emissions, to evaluate the causes of changes already observed and to project future changes in temperature and other climate conditions (e.g., Meehl et al. 2007, Ganguly et al. 2009, Prinn et al. 2011). All combinations of models and emissions scenarios yield very similar projections of increases in the most common measure of climate change, average global surface temperature (commonly known as global warming), until about 2030. Although projections of the magnitude and rate of warming differ after about 2030, the overall trajectory of all the projections is one of increased global warming through the end of this century, even for the projections based on scenarios that assume that GHG emissions will stabilize or decline. Thus, there is strong scientific support for projections that warming will continue through the 21st century, and that the magnitude and rate of change will be influenced substantially by the extent of GHG emissions (IPCC 2007c, Meehl et al. 2007, Ganguly et al. 2009, Prinn et al. 2011).

Statistical downscaling methods first derive empirically-based relationships between coarse-scale (e.g., the altitude of the 700 hPa pressure level) and observed local (e.g., precipitation or temperature) climate variables. Predicted values of the coarse-scale variables obtained from global climate models are then used to drive the statistical relationships in order to estimate the regional and/or local scale details of future climate (see Mote and Salathé 2010 for more on downscaling methods). The statistical downscaling of 20 global climate models (Mote and Salathé 2009, 2010) projects average annual temperature to increase 2.0°F by the decade of the 2020s for the Pacific Northwest, 3.2°F by the decade of the 2040s, and 5.3°F by the decade of the 2080s, relative to the 1970-1999 average temperature. The projected changes in average annual temperature are substantially greater than the

1.5°F increase in average annual temperature observed in the Pacific Northwest during the 20th century. Seasonally, summer temperatures are projected to increase the most. Actual global emissions of greenhouse gases in the past decade have so far exceeded the emissions scenarios used in projections of Mote and Salathé. Consequently, if these emissions trends continue, the climate projections referenced herein likely represent a conservative estimate of future climatic changes. Figure 3-5 shows these modeled, downscaled temperature projections for the Wilson-Trask-Nestucca watershed (Hydrologic Unit Code 17100203) (Hamlet et al. 2010).

Figure 3-5. Projected temperature changes for the Wilson-Trask-Nestucca Watershed under two emission scenarios. A1B is a higher emission scenario than B1. Current rates are higher than both A1B and B1 (Hamlet et al. 2010).



3.1.3 Precipitation

The discussion below includes data from the three climate stations closest to Nestucca Bay NWR, located in Tillamook, Cloverdale, and Otis. Roughly 57 percent of the annual precipitation at these stations occurs during late fall and winter, in the months of November, December, January, and February. By comparison, the summer months of June, July, and August receive a scant 7 percent of the annual precipitation. On average, 62-68 days per year experience more than 0.50 inch of precipitation and 21-29 days greater than 1.00 inch (WRCC 2011e, WRCC 2011f, WRCC 2011g). Snow events are infrequent. Fog (water vapor condensing into tiny liquid water droplets in the air) is a common phenomenon along the Oregon coast because of contrasting differences between air, land, and ocean temperatures and humidity. The average number of days per year with dense fog (visibility of 0.25 mile or less) in Astoria is 41. June averaged the fewest days (1) with dense fog and October with the most days (7) (WRCC 2011h). Fog records for other northern coastal locations were unavailable. Precipitation data for Tillamook, Cloverdale, and Otis are summarized in Table 3-3.

Table 3-3. Precipitation summaries near Nestucca Bay NWR (WRCC 2011e, WRCC 2011f, WRCC 2011g)

Precipitation (inches)	Tillamook July 1948 – Oct. 2010	Cloverdale Dec. 1940 – Sept. 2010	Otis July 1948 – Sept. 2010
Average Annual Precipitation	89.07	82.39	97.35
Average Annual Snowfall	2.2	2.6	2.9
Average Monthly Snowfall Range (winter)	0.1 to 0.7	0.2 to 1.3	0.2 to 1.4
Highest Annual Snowfall	24.5 (1951)	21.7 (1969)	24.0 (1969)
Highest Monthly Snowfall	19.0 (March 1951)	19.8 (January 1969)	20.0 (January 1950)
Wettest Year on Record	122.71 (1996)	113.53 (1971)	135.18 (1996)
Driest Year on Record	61.21 (1985)	55.53 (1944)	71.21 (1976)
Wettest Season on Record	62.0 (winter 1999)	53.45 (winter 1999)	67.47 (winter 1999)
Driest Season on Record	0.76 (summer 1967)	1.15 (summer 1967)	1.37 (summer 1967)

Longer-term precipitation trends in the Pacific Northwest are more variable than temperature and vary with the period of record analyzed (Mote et al. 2005). The Pacific Northwest experiences wide precipitation variability based on geography and seasonal and year-to-year variability (Salathé et al. 2010). Looking at the period 1920 to 2000, total annual precipitation has increased almost everywhere in the region, though not in a uniform fashion. Most of that increase occurred during the first part of the record with decreases more recently (Mote et al. 2005).

Precipitation trends from the Tillamook USHCN observation station shows the average yearly precipitation change has decreased more than 2% over the past 30 years, with more striking decreases in the summer and fall (Table 3-4 and Figures 3-6 to 3-8).

Future Trends

On a global scale, warmer temperatures are predicted to lead to a more vigorous hydrologic cycle, translating to more severe droughts and/or floods (IPCC 1996). Using data derived from the statistical downscaling of 20 global climate models, projected changes in annual precipitation within the Pacific Northwest throughout the twenty-first century, averaged over all models, are small (+1% to +2%) though individual models produce changes of as much as -10% or +20% by the 2080s. Some models project an enhanced seasonal cycle with changes toward wetter autumns and winters and drier summers (Mote and Salathé 2010). However, even small changes in seasonal precipitation could have impacts on streamflow flooding, summer water demand, drought stress, and forest fire frequency. Additionally, researchers have consistently found that regional climate model simulations yield an increase in the measures of extreme precipitation. This finding suggests that extreme precipitation changes are more related to increased moisture availability in a warmer climate than to increases in climate-mean precipitation (Leung et al. 2004, Salathé et al. 2010). It is important to note that the one conclusion shared by researchers is that there is greater uncertainty in precipitation projections than that of temperature predictions and models (Leung and Qian 2003, Climate Impacts Group [CIG] 2004, Salathé et al. 2010). Figure 3-9 shows these modeled, downscaled precipitation projections for the Wilson-Trask-Nestucca watershed (Hydrologic Unit Code 17100203) (Hamlet et al. 2010).

Table 3-4. Seasonal Precipitation Trends, 1981-2010 (USHCN 2012)

Tillamook, Oregon, United States Historical Climatology Network Observation Station	
Monthly Precipitation	**30-year Change % from 1981 Value**
Winter (Dec-Feb)	4.8%
Spring (March-May)	1.0%
Summer (Jun-Aug)	-30.7%
Fall (Sept-Nov)	-7.3%

Figure 3-6. Water year total precipitation 1925-2010 at Tillamook, Oregon (USHCN 2012).

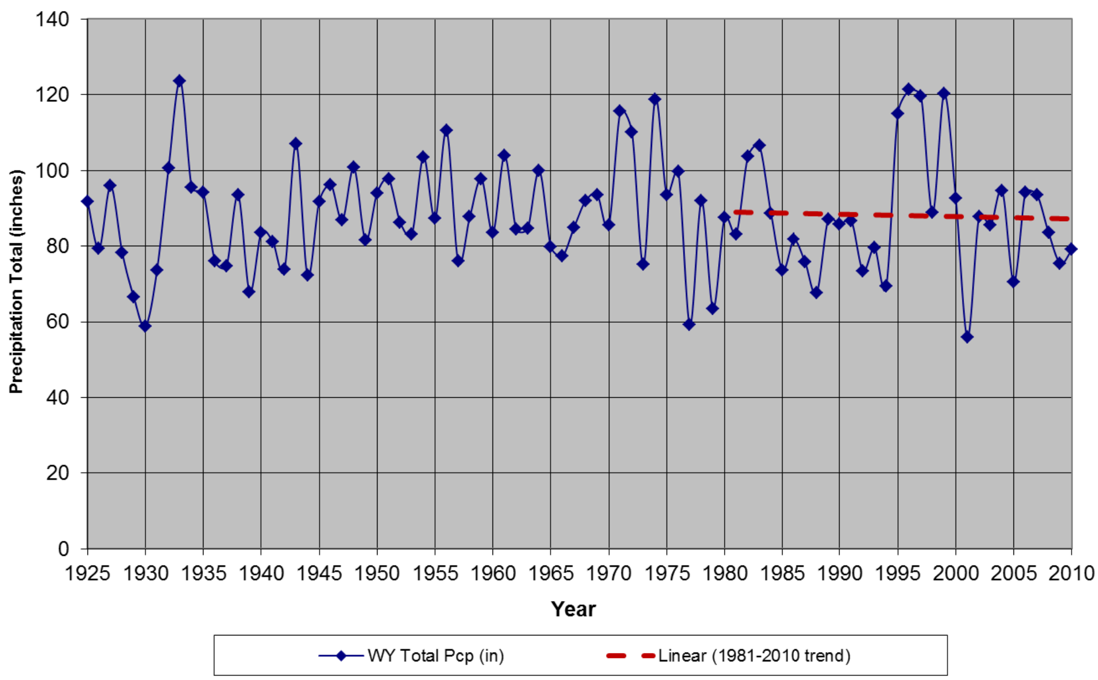


Figure 3-7. Summer (Jun-Aug) total precipitation 1925-2010 at Tillamook, Oregon (USHCN 2012).

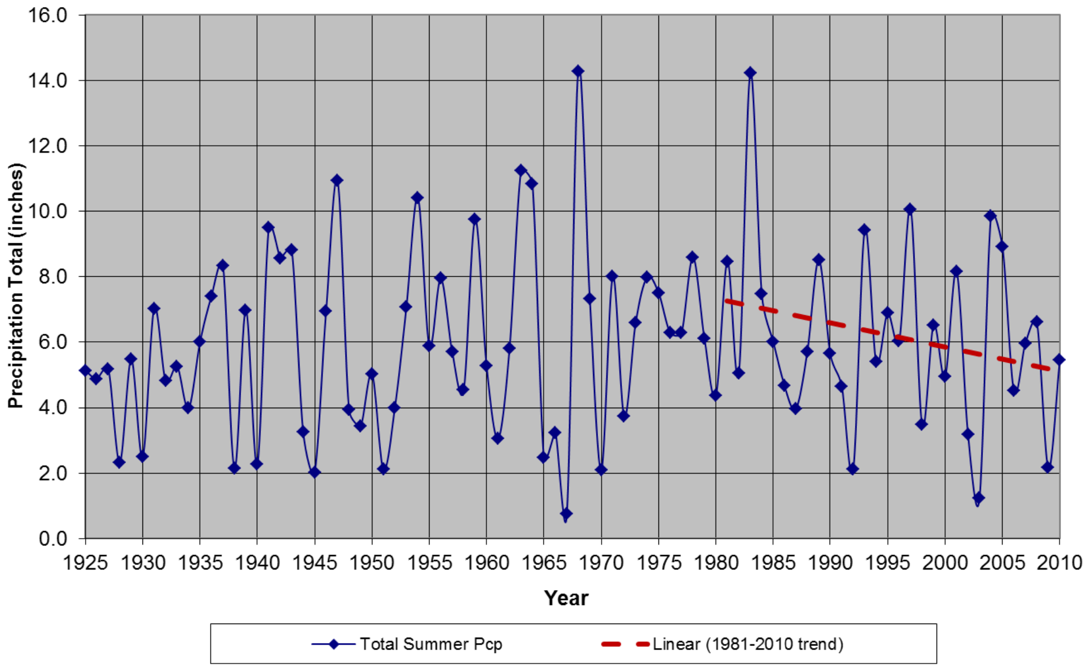


Figure 3-8. Fall (Sept-Nov) total precipitation 1925-2010 at Tillamook, Oregon (USHCN 2012).

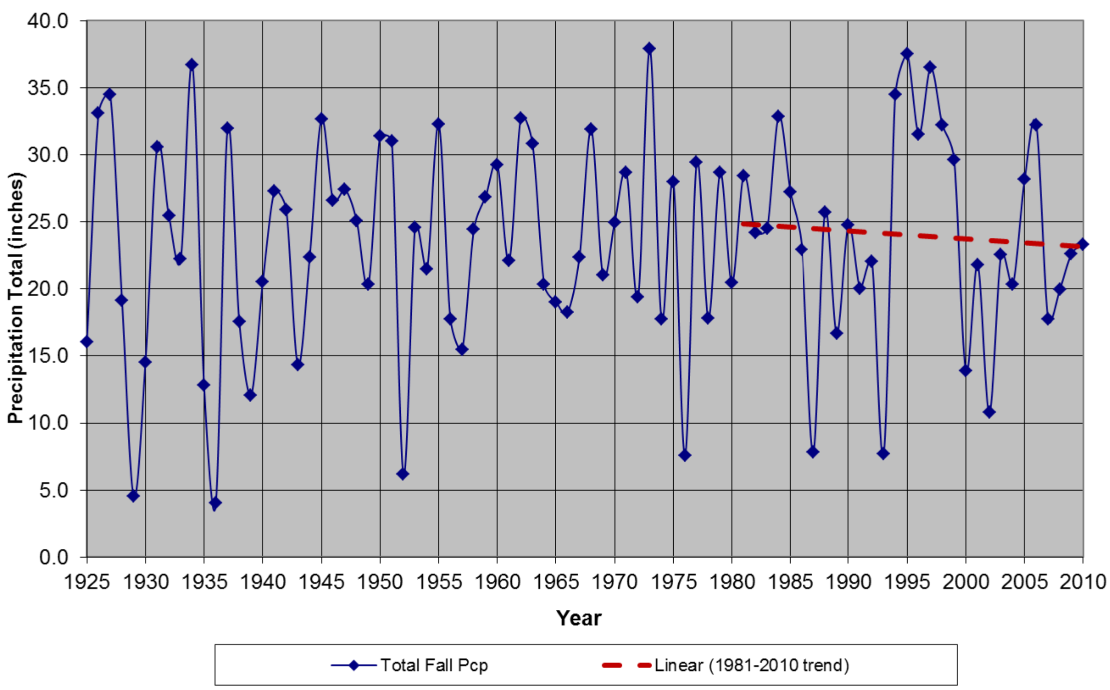
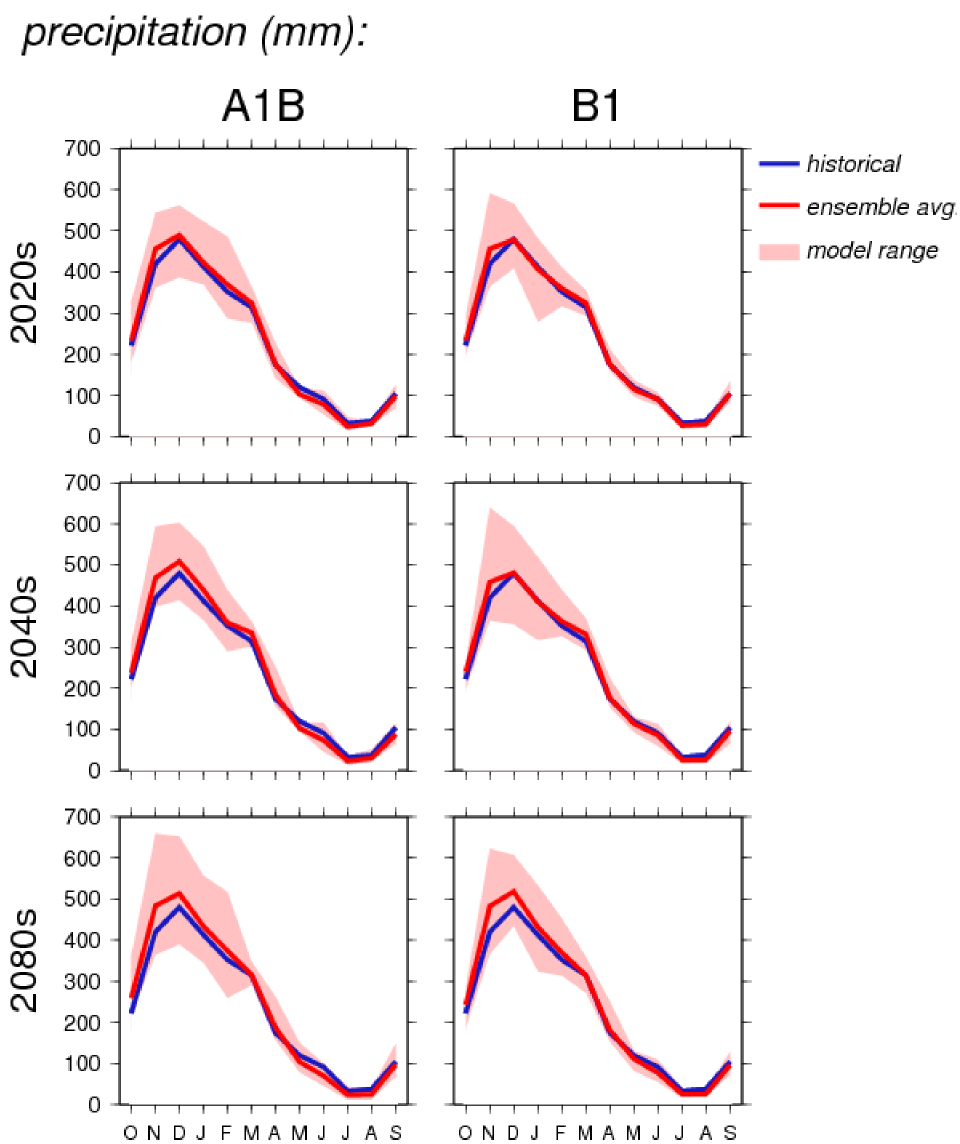


Figure 3-9. Projected precipitation changes for the Wilson-Trask-Nestucca Watershed under two emission scenarios. A1B is a higher emission scenario than B1. Current rates are higher than both A1B and B1 (Hamlet et al. 2010).



3.1.4 Wind

During the spring and summer, the semi-permanent low-pressure cell over the North Pacific Ocean becomes weak and moves north beyond the Aleutian Islands. Meanwhile, a high-pressure area spreads over the North Pacific Ocean. Air circulates in a clockwise direction around the high-pressure cell bringing prevailing westerly and northwesterly winds. This seasonal flow is comparatively dry, cool, and stable (WRCC 2011i).

In the fall and winter, the high-pressure cell weakens and moves southward while the Aleutian low-pressure cell intensifies and migrates southward as well (WRCC 2011i). It reaches its maximum intensity in midwinter. Wind direction switches to primarily southeasterly or easterly prevailing winds. The air mass over the ocean is moist and near the temperature of the water. As it moves inland, it cools and condenses, bringing the beginning of the wet season by the end of October (Taylor and Hannan 1999).

Wind data collected hourly from automated stations at reporting airports on the Oregon coast have been used to draw generalizations about wind activity in/on Nestucca Bay NWR (Table 3-5). Average wind speeds have been calculated on hourly data collected from 1996 to 2006. The highest average wind speeds at Astoria and Newport occurred during the winter months of December, January, and February. At North Bend, the highest average wind speeds occurred during the summer months of June, July, and August. The calmest months at Astoria and Newport were during the late-summer/early-fall months of August, September, and October. At North Bend, the calmest months were October, November, and February.

Prevailing wind direction, defined as the direction with the highest percent of frequency, was calculated from hourly data during 1992 to 2002. In Astoria, easterly winds occur from October through March, switching to southerly winds in April, and then to west and northwest winds from May through September. In Newport, winds from the east occur in December through February, from the south during fall and spring, and north-northwest during the summer months. In North Bend, winds blow from the south-southeast from November to April before becoming northerly for the remainder of the year.

Table 3-5. Wind Data Summaries for Three Locations Along the Oregon Coast (WRCC 2011j, WRCC 2011k)

	Astoria	Newport	North Bend
Prevailing Wind Direction	E	S	N
Average Annual Wind Speed	7.7 miles/hour	8.8 miles/hour	8.9 miles/hour
Average Monthly Wind Speed Range	6.7 (Sept.) – 8.7 (Dec.) miles/hour	6.5 (Sept.) – 11.2 (Dec.) miles/hour	7.3 (Oct.) – 11.2 (Jul.) miles/hour

Several times each year, very strong winds hit the Oregon coast (Taylor and Hannan 1999). Wantz and Sinclair (1981) published estimates of extreme winds in the Northwest. They estimate that speeds along the coast sustained for an average of one minute and recurring on average every two years are as high as 56 miles per hour, while 50-year events would produce winds of approximately 74 miles per hour. Peak gusts would be about 40% higher.

As a rule, Oregon does not experience hurricanes, and tornadoes are infrequent and generally small in the northwestern part of the United States. However, the National Weather Service issued a hurricane warning for the first time for the Oregon coast during an extremely powerful storm that slammed into the Pacific Northwest during December 2–4, 2007, during which winds topped out at 130 miles per hour (209 kilometers/hour) along coastal Oregon (Read 2008). The National Climatic Data Center (NCDC) maintains a database that provides information on the incidence of tornadoes reported in each county in the United States. This database reports that 100 tornadoes were reported in Oregon from 1950 to 2010. In Tillamook County, only four tornadoes have been recorded. Of these, three tornadoes had maximum wind speeds estimated in the range of 40 to 72 miles per hour (64-116 kilometers/hour, or F0), and one had maximum wind speeds in the range of 73 to 112 miles per hour (117-180 kilometers/hour, or F1) (NCDC 2011).

3.1.5 Climate Cycles in the Pacific Northwest

Two climate cycles have major influences on the climate and hydrologic cycles in the Pacific Northwest: the El Niño/Southern Oscillation (ENSO) and the Pacific Decadal Oscillation (PDO). In El Niño years, average sea surface temperatures in the central and eastern equatorial Pacific Ocean are warmer than average and easterly trade winds in the tropical Pacific are weakened. A La Niña is characterized by the opposite – cooler than average sea surface temperatures and stronger than normal easterly trade winds. These changes in the wind and ocean circulation can have global impacts to weather events. The ENSO influence on Pacific Northwest climate is strongest from October to March. During an El Niño event, the winters tend to be warmer and drier than average. La Niña winters tend to be cooler and wetter than average. Each ENSO phase typically lasts 6 to 18 months and the shift between the two conditions takes about four years (CIG 2011; Conlan and Service 2000).

Like ENSO, the PDO is characterized by changes in sea surface temperature, sea level pressure, and wind patterns. The PDO is described as being in one of two phases: warm and cool. During a warm phase, sea surface temperatures near the equator and along the coast of North America are warmer while in the central north Pacific they are cooler. During a cool phase, the patterns are opposite. Within the Pacific Northwest, warm phase PDO winters tend to be warmer and drier than average while cool phase PDO winters tend to be cooler and wetter than average. A single warm or cool PDO phase lasts 20-30 years. The triggering cause of the PDO phase shift is not understood.

The potential for temperature and precipitation extremes increases when ENSO and PDO are in the same phases and thereby reinforce each other. When ENSO and PDO are in opposite phases, their opposite effects on temperature and precipitation can cancel each other out, but not in all cases and not always in the same direction (CIG 2011).

Future Trends

Based on the evidence of the history of ENSO and PDO events, it is likely that these cycles will continue to occur far into the future. However, the potential influence of anthropogenic climate change on ENSO and PDO is unknown because more information is needed by the experts.

3.2 Hydrology

3.2.1 Refuge Hydrology

Nestucca Bay Unit

The majority of the Nestucca Bay Unit is located within the Nestucca Bay estuary, which covers approximately 3,336 acres, including diked and filled lands, and has a watershed of about 322 square miles (Good 2000, Adamus et al. 2005). Two major streams flow into the Nestucca Bay estuary. The Nestucca River enters from the north while the Little Nestucca River enters from the south. Heads of tide along the Nestucca River and Little Nestucca River are approximately 8.5 and 3.2 miles from the mouth (Oregon Department of State Lands [DSL] 1989). The estuary has been significantly altered, mostly through the diking and draining of tidal wetlands for pasture, resulting in a 91% loss in tidal marshes and swamps from 1870 to 1970 (Good 2000). Revised estimates by Brophy (2011) using

Scranton (2004) and Hawes et al. (2008) indicate a 91% loss of tidal marsh and 98% loss of tidal swamp within the estuary.

Approximately two-thirds of the Nestucca Bay Unit is composed of either intertidal wetlands or diked pastures draining into the Nestucca River, Little Nestucca River, or directly into Nestucca Bay. Three areas within the Refuge currently receive full tidal action: Brooten Marsh, the Little Nestucca Restoration Area, and the areas outside of the dikes protecting the North and Middle Pastures. Brooten Marsh, located where the Little Nestucca River meets Nestucca River to form Nestucca Bay, has not been historically diked; however, several ditches with associated sidecast berms are obvious on the site. Tidal circulation enters primarily from the south and pools in a central low area. Flood waters from the mainstem Nestucca River also wash over the western natural levee (Brophy 2002).

The Little Nestucca Restoration Area, located on the north side of the Little Nestucca River at approximately river mile 1, was historically altered by diking, ditching, the installation of culverts and tide gates, and the removal of trees on the formerly forested northern part of the site. Straight ditches were dug throughout the site and lower sections of the site's major tidal channels were deepened through dredging (Brophy 2010). The construction of the Old Highway 101 further reduced hydrologic connectivity within the site. However, in 2007, the Refuge and partners completed an 82-acre tidal marsh restoration project which removed dikes and tidegates, filled some ditches, reconnected historic tidal channels, and lowered and breached the former highway roadway to allow tidal exchange. Additionally, culverts on the site's north edge at the Little Nestucca Highway were upgraded to improve drainage between the adjacent hillslope and the tidal wetland.

Diked lowland pastures within the Nestucca Bay Unit are grouped into seven different areas: the North Pastures, Middle Pastures, Main Pastures, Semidi Tract, Utter Tract, and Hagerty Tract. During fall, winter, and spring, these lowland pastures receive seasonal flooding from small streams, creeks and drainages that run through them and discharge their flow via open ditches to the Nestucca or Little Nestucca Rivers through tidegates in dikes. In the case of the Utter Tract, the pastures drain into privately owned ditches that eventually spill into the Nestucca River. The tidegates allow freshwater out but block brackish water from entering the ditches and subsequently the pastures. At two locations, a fish-friendly tidegates have been installed that allows some muted tidal action in the larger pasture ditches. A detailed description of the pastures and their associated hydrological connections to Nestucca Bay can be found in Chapter 4.

Neskowin Marsh Unit

The Neskowin Marsh Unit is located within the Neskowin Creek watershed, which includes all the tributaries that flow into Neskowin Creek and Daley Lake and has a basin area of approximately 12 square miles. The mouths of Neskowin and Hawk Creeks are classified as estuaries but are small compared to the Nestucca Bay estuary. Three streams are found within Neskowin Marsh Unit: Meadow Creek, Butte Creek, and Hawk Creek. Meadow Creek originates in Neskowin Marsh and flows south from the marsh through the Neskowin Beach Golf Course to where it empties into Butte Creek near the south end of the golf course. Much of Meadow Creek was ditched and drained during 1912 and 1913 in an effort to grow cranberries commercially. However, this effort proved unsuccessful as a result of brackish water reaching the marsh during high tide events, which killed the cranberries (Tillamook County 1981 as cited in USFWS 2000a).

Hawk Creek flows west through the former Hawk Creek Golf Course and under Highway 101 where it empties into Butte Creek through the freshwater marsh just south of the Neskowin Beach Golf

Course. Tidal influence extends up Butte Creek to the semi-functional tide gates located just south of the Neskowin Beach Golf Course clubhouse. Consequently, none of the refuge lands within this unit are tidally influenced.

Future Trends

While the refuge lands themselves currently receive the vast majority of their annual precipitation as rainfall, the watershed feeding the Nestucca and Little Nestucca Rivers currently receives substantial quantities of its annual precipitation as snow. One of the most important responses to warmer winter temperatures in the Pacific Northwest has been the loss of spring snowpack (Mote et al. 2005). Climate impacts on snow hydrology in the Pacific Northwest are particularly sensitive because total annual precipitation is highly concentrated in the winter months and the region includes a large amount of snow cover that accumulates at temperatures near 0°C; areas at greater risk to climate warming than cold climate snowpacks because temperature affects both precipitation phase (snow versus rain) and the rate of snowpack ablation (Nolin and Daly 2006). As temperatures rise, the likelihood of winter precipitation falling as rain rather than snow increases. Small increases in average winter temperatures can lead to increased rains, reduced snowpack, and earlier snowmelt.

Also, the changes in precipitation described in Section 3.1.3, above, foretell lower freshwater flows to the Refuge especially in the summer and fall months.

3.2.2 Tides and Salinity

The nearest National Ocean Survey tidal benchmarks to Nestucca Bay NWR are located in Netarts, Depoe Bay, and Garibaldi, approximately 19 miles north, 25 miles south, and 27 miles north of the Refuge. However, a subordinate tidal station with available predictions closer to the Refuge is available at the Nestucca Bay entrance. Tidal benchmark information for Netarts, Depoe Bay, and Garibaldi for the 1983-2001 period is summarized in Table 3-6. Historic records of tides and water levels from the Nestucca Bay entrance, Netarts, Depoe Bay, and Garibaldi tide stations are summarized in Table 3-7. Data for each station include mean ranges, diurnal ranges, and the minimum and maximum water levels on record where available. The mean range is the difference in height between the mean high water and the mean low water. The diurnal range is the difference between the mean higher high water (MHHW) and the mean lower low water (MLLW) of each tidal day.

Table 3-6. Tidal Benchmark Summary for Netarts, Depoe Bay, and Garibaldi, Oregon (NOAA 2011a, NOAA 2011b, NOAA 2011c)

Station Information	Netarts Sta. ID 9437262	Depoe Bay Sta. ID 9435827	Garibaldi Sta. ID 9437540
Mean Higher High Water (MHHW) (feet)	6.85	8.24	8.32
Mean High Water (MHW) (feet)	6.09	7.53	7.61
Mean Tide Level (MTL) (feet)	3.58	4.45	4.48
Mean Sea Level (MSL) (feet)	3.64	4.42	4.49
Mean Low Water (MLW) (feet)	1.06	1.37	1.35
North American Vertical Datum 1988 (NAVD88)	N/A	0.63	N/A
Mean Lower Low Water (MLLW)	0.00	0.00	0.00

Table 3-7. Historic Tidal Data Summary for the Nestucca Bay Entrance, Netarts, Depoe Bay, and Garibaldi, Oregon (NOAA 2011d, NOAA 2011e, NOAA 2011f, NOAA 2011g)

Station Information	Nestucca Bay Entrance Sta. ID TWC0857	Netarts Sta. ID 9437262	Depoe Bay Sta. ID 9435827	Garibaldi Sta. ID 9437540
Mean Range (feet)	5.8	5.02	6.16	6.26
Diurnal Range (feet)	7.6	6.86	8.24	8.32
Mean Tide Level (MTL) (feet)	4.0	3.58	4.45	4.48
Minimum Water Level (feet below MLLW)	N/A	N/A	-3.33 (05/24/1982)	-3.44 (11/26/2007)
Maximum Water Level (feet above MLLW)	N/A	N/A	12.22 (01/26/1983)	11.96 (12/31/2005)

Tide water is brackish: more salty during the growing season, and more fresh during high winter river flows. Freshwater flow, measured at the Nestucca River gauge in Beaver at river mile 15.5, is usually lowest in August and September and highest during December and January (U.S. Geological Survey [USGS] 2011a). Mean salinities recorded for the Nestucca Bay estuary at a location just south of Brooten Marsh for April-June and July-September are 19 and 32 parts per thousand (ppt) (Hamilton 1984). The limit of salt water intrusion in the Nestucca River occurs between river miles 4 and 5 in the summer and between river miles 1.5 and 2.5 during the winter (Giger 1972 as cited in Starr 1979).

Future Trends

It is anticipated that the warming of Oregon's temperate climate will contribute to fundamental changes along the coast, including but not limited to shifts in the timing and intensity of coastal storms, changes in precipitation and the delivery of freshwater inputs, sea level rise, and increased inundation of the shallow tidal basins. Regional coastal climate change may also result in changes in the intensity and timing of coastal upwelling, shifts in temperatures and dissolved oxygen concentrations, and alteration of the carbonate chemistry of nearshore waters. The combination of these changes will alter chemical concentrations in estuaries (Ruggiero et al. 2010). The Nestucca Bay estuary, a highly river-dominated drowned river mouth estuary, and the Neskowin Creek estuary, a tidally restricted coastal creek (Lee and Brown 2009), may experience changes in their salinity regimes in response to changes in precipitation and snow melt in their watersheds (resulting in changes in freshwater inflows) and increased intrusion of seawater associated with rising sea levels. However, the effect of climate change on estuarine salinity will vary with location inside the estuary and the magnitude of the relative sea level rise rate in the vicinity of the estuary.

3.2.3 Sea Level Rise

Sea level rise on the Oregon coast is the result of three major forces: global mean sea level rise driven by the melting of land-based ice, local dynamical sea level rise driven by changes in wind which pushes coastal waters toward or away from shore, and localized vertical land movements driven primarily by tectonic forces (Mote et al. 2008, McKay et al. 2011). Mean sea level is defined as the average sea level over a 19-year period, above which other fluctuations (e.g., tides, storm surges, etc.) occur (Smerling et al. 2005). Global mean sea level rise has been in the range of 1.3 (0.05 inch) to 2.3 millimeters (0.09 inch) per year between 1961 and 2003 (IPCC 2007a). But since

1993 the rate has increased about 50% above the 20th century rise rate to 3 millimeters/year (0.1 inch/year) (Bromirski et al. 2011), and the latest global satellite sea level observations measure a rate of 3.19 millimeters/year (0.12 inch/year) (NASA 2012). This acceleration is primarily the result of ice field and glacier melt-off (McKay et al. 2011). For example, the total global ice mass lost from Greenland, Antarctica, and Earth's glaciers and ice caps between 2003 and 2010 was about 4.3 trillion tons (1,000 cubic miles), adding about 0.5 inch (12 millimeters) to global sea level in a seven-year period (Jacob et al. 2012).

Based on monthly mean sea level data from 1970 to 2006, the mean sea level trend at Garibaldi, Oregon, located approximately 27 miles north of the Refuge, is 1.98 millimeters/year (0.08 inch/year) with a 95% confidence interval of ±1.82 millimeters/year (0.07 inch/year). This is equivalent to a change of approximately +0.65 feet (0.2 meter) per century (NOAA 2011h).

Future Trends

The IPCC Special Report on Emissions Scenarios (SRES) forecasted that global sea level will increase by approximately 12 inches (30 centimeters) to 39 inches (100 centimeters) by 2100 (IPCC 2001). However, more recent analyses (Chen et al. 2006, Monaghan et al. 2006) indicate that the eustatic rise in sea levels is progressing more rapidly than was previously assumed, perhaps due to the dynamic changes in ice flow omitted within the IPCC report's calculations. Vermeer and Rahmstorf (2009) suggest that, taking into account possible model error, a feasible range by 2100 might be 30 inches (75 centimeters) to 75 inches (190 centimeters) (Vermeer and Rahmstorf 2009).

Tebaldi et al. (2012) show that even seemingly low increases in sea level will have significant impacts in the short term when storm surges are taken into account. An analysis of historic data combined with future projections of sea level rise is used to estimate future return periods for what today are considered 50-year and 100-year events. This magnifies sea level rise by a factor of five, on average, and dramatically increases the occurrence, or return periods, of storm surge events. The closest area to the Refuge that was analyzed is the South Beach tide gauge in Newport. The return period for storm surges currently qualifying as 100-year events is projected to change to every 5 years at this site by 2050. The analysis shows that 50-year storm surges events are projected to increase by approximately 52 inches at the tide gauge, and 100-year storm surges events are projected to increase approximately 54 inches.

Rising sea levels and storm surges may result in tidal marsh submergence (Moorhead and Brinson 1995) and habitat migration as salt marshes transgress landward and replace tidal freshwater and brackish marsh (Park et al. 1991). Changes in tidal marsh area and habitat type in response to sea level rise were modeled using the Sea Level Affecting Marshes Model (SLAMM 6), which accounts for the dominant processes involved in wetland conversion and shoreline modifications during long-term sea level rise (Park et al. 1989, Clough et al. 2010, Clough and Larson 2010). Within SLAMM, there are five primary processes that affect wetland fate under different scenarios of sea level rise: inundation, erosion, overwash, saturation, and accretion. There are currently several active projects involving the use of SLAMM 6 to estimate the impacts of sea level rise on the coasts of the Pacific Northwest (e.g., Glick et al. 2007).

For Nestucca Bay NWR, SLAMM 6 was run using mean and maximum estimates from scenario A1B from the SRES. Under the A1B scenario, the IPCC AR4 (IPCC 2007a) suggests a likely range of 0.21 to 0.48 meter (0.7 to 1.6 feet) of sea level rise by 2090-2099 "excluding future rapid dynamical changes in ice flow." The A1B-mean scenario that was run as a part of this project falls near the middle of this estimated range, predicting 0.40 meter (1.3 feet) of global sea level rise by 2100. The A1B-maximum scenario predicts 0.69 meter (2.26 feet) of sea level rise by 2100. To allow for flexibility when interpreting the results, SLAMM was also run assuming 1 meter (3.3 feet), 1.5 meters (4.9 feet), and 2 meters (6.6 feet) of eustatic sea level rise by the year 2100. Pfeffer et al. (2008) suggests that 2 meters (6.6 feet) by 2100 is at the upper end of plausible scenarios due to physical limitations on glaciological conditions. Model results through 2025 for Nestucca Bay NWR under several sea level rise scenarios where the dikes would not continue to be maintained or raised and thus subjected to inundation, are presented in Table 3-8 (Clough and Larson 2010, So et al. 2011). Sites that are diked or hydrologically impaired due to tide gates or restrictive culverts were initially classified as “Inland Fresh Marsh.” All model results are subject to uncertainty due to limitations in input data, incomplete knowledge about factors that control the behavior of the system being modeled, and simplifications of the system.

For example, mineral sedimentation rates and organic matter (vegetative) accretion rates need to be taken into account for inland marine influenced ecosystems such as the Refuge’s marshes. Nyman et al. (2006) find that the vegetative component is the more significant of the two factors (i.e., accretion varied with organic accumulation rather than mineral sedimentation). Salt-marsh accretion rate was investigated by Thom (1992) at six sites that spanned a gradient in relative rate of sea level rise in Washington and Oregon. Mean accretion rate over all sites was found to be 3.6 millimeters/year (0.14 inch/year) (95% confidence interval = 2.4 to 4.8 millimeters/year [0.09 to 0.18 inch/year]). However, accretion rates specific to Nestucca Bay have not yet been measured.

Table 3-8. Predicted Change in Acreage of Land Categories at Nestucca Bay NWR by 2025 Given SLAMM Modeled Scenarios of Sea Level Rise (Clough and Larson 2010, So et al. 2011)

		Sea Level Rise Scenarios				
	Initial Condition	A1B Mean (.39 meter [1.3 feet] by 2100)	A1B Maximum (.69 meter [2.3 feet] by 2100)	1 meter (3.3 feet) by 2100	1.5 meters (4.9 feet) by 2100	2 meters (6.6 feet) by 2100
Inland Fresh Marsh	1670.0	668.4	653.0	633.8	598.4	564.1
Undeveloped Dry Land	1375.0	1304.8	1302.5	1300.0	1297.8	1293.6
Tidal Flat	327.9	331.2	331.6	332.1	332.9	333.8
Regularly Flooded Marsh	110.1	854.6	880.3	908.1	953.2	997.7
Swamp	103.5	86.6	85.5	84.2	81.8	79.4
Estuarine Open Water	57.2	69.8	70.1	70.2	70.3	70.6
Irreg. Flooded Marsh	35.9	34.2	34.2	34.3	34.3	34.6
Developed Dry Land	26.1	25.8	25.8	25.8	25.7	25.7
Ocean Beach	20.8	21.8	21.6	21.5	13.5	4.9
Inland Open Water	15.2	6.8	6.6	6.6	6.6	6.4
Riverine Tidal	10.2	6.0	5.8	5.8	5.7	5.6
Tidal Swamp	4.3	4.0	4.0	3.9	3.8	3.7
Tidal Fresh Marsh	3.6	2.5	2.5	2.5	2.4	2.2
Inland Shore	0.9	0.9	0.9	0.9	0.9	0.9
Estuarine Beach	0.2	0.2	0.2	0.2	0.2	0.2
Trans. Salt Marsh	0.0	343.0	335.8	330.6	324.7	320.2
Open Ocean	0.0	0.3	0.5	0.7	8.7	17.4

3.3 Ocean Chemistry

The ocean will eventually absorb most carbon dioxide released into the atmosphere as a result of the burning of fossil fuels and other sources. Current rates of carbon dioxide emissions are causing and an increase in the acidity of ocean surface waters and a decrease the saturation of calcium carbonate ($CaCO_3$), a compound necessary for most marine organisms' development of shells and skeletons (Hönisch et al. 2012). Oceanic absorption of CO_2 from fossil fuels may result in larger acidification changes over the next several centuries than any inferred from the geological record of the past 300 million years (with the possible exception of those resulting from rare, extreme events such as meteor impacts). In the past 300 million years, three analogous ocean acidification events have been identified and these events coincided with mass extinctions of marine organisms; however, it should be noted that warming and corresponding oxygen depletion co-occurred during these events and contributed to the extinctions (Hönisch et al. 2012).

Virtually every major biological function of marine organisms has been shown to respond to acidification changes in seawater, including photosynthesis, respiration rate, growth rates, calcification rates, reproduction, and recruitment. Much of the attention has focused on carbonate-based animals and plants which form the foundation of our marine ecosystems. An increase in ocean acidity has been shown to impact shell-forming marine organisms from plankton to benthic mollusks, echinoderms, and corals (Doney et al. 2009). Many calcifying species exhibit reduced calcification and growth rates in laboratory experiments under high-CO_2 conditions. Ocean acidification also causes an increase in carbon fixation rates in some photosynthetic organisms (both calcifying and noncalcifying) (Doney et al. 2009, Smith and Baker 2008, Ocean Carbon and Biogeochemistry Program 2008). These potential impacts to the marine food web may obviously negatively affect refuge resources such as seabirds, shorebirds, and salmonids. Localized acidification rates within Nestucca Bay have not been evaluated.

3.4 Topography and Bathymetry

With the exceptions of the Cannery Hill, and parts of the Neskowin Marsh Unit, the topography of the Nestucca Bay NWR does not vary significantly and is largely flat, with most areas below 10.0 feet North American Vertical Datum 1988 (NAVD88) in elevation (Oregon LiDAR Consortium [OLC] 2010). Approximately two-thirds of the Refuge is situated within the coastal plain and drains into Nestucca Bay, or the Nestucca or Little Nestucca Rivers. The highest elevations within the Refuge occur within the vicinity of Cannery Hill at around 364.23 feet NAVD88. Cannery Hill is part of a northeast-southwest ridge running between Nestucca Bay on the north to Daley Lake on the south.

The Neskowin Marsh Unit occupies a 1.25 × 0.5 mile linear trough between the sand dunes of Kiwanda Beach to the west and uplands to the east, including some large basalt bluffs at the northern end (Christy and Brophy 2002). The northern section of the Neskowin Marsh Unit reaches 237.93 feet NAVD88. The average elevation of the southern portion of the Neskowin Marsh Unit is approximately 16 feet NAVD88.

3.5 Geology and Geomorphology

3.5.1 Tectonic Context

The Oregon coast is located on the western margin of the North American continental plate near its junction with the Juan de Fuca plate, a section of denser oceanic crust. Where the latter plate moves eastward and collides with the North American plate, it slides underneath and descends into the earth's mantle in an area known as the Cascadia Subduction Zone (Orr et al. 1992, Nelson et al. 1995). Although the subduction process is very gradual, proceeding at a relative velocity of 4 centimeters/year (1.5 inches/year), the massive forces that drive the converging plates cause strain to accumulate at the edge of the North American plate (Douglas 1991). Over time, the accumulation of strain causes the edge of the continental plate to bend and rise in elevation in a process known as uplift. Periodically, this strain is released during an earthquake and the edge of the North American plate rapidly drops downward, suddenly lowering the coastline, and correspondingly raising the relative sea level. The elevation drop that occurs during an earthquake is termed subsidence. These processes of regional plate tectonics along with the effects of eustatic sea level changes, wave and wind action, and fluvial and tidal processes in estuaries have had substantial influence in shaping the physical features and geographic characteristics of the Oregon coast (McDowell 1987).

3.5.2 Geologic and Geomorphologic Overview

Nestucca Bay NWR is within the Coastal Range physiographic province described by Orr et al. (1992). The Coast Range, a long narrow belt of moderately high mountains and coastal headlands, extends southward from the Columbia River to approximately the middle fork of the Coquille River, and inland from the continental shelf and slope to the western edge of the Willamette Valley. Over 200 miles long, and 30 to 60 miles wide, the province averages 1,500 feet in altitude with a maximum elevation of 4,097 feet at Mary's Peak.

The Coast Range has its origins in accreted oceanic sediments born from volcanic activity approximately 64 million years ago. These Roseburg volcanics in the southern portions of the range were followed by the Siletz River and Tillamook volcanics in the northern portions of the range, formed mostly during the Paleocene to middle Eocene (about 60 to 45 million years ago). Deposited with these volcanics but also overlying them and intruded by them is a regionally extensive marine sandstone and siltstone commonly referred to as the Tyee Formation. Successively younger deposits of sediments and volcanics are found to the east of the Coast Range and along the coast. During the Oligocene (-25 million years ago), uplift of sedimentary basins in Oregon resulted in the westward migration of the coastline from as far east as Idaho toward the present position. As the western edge of the North American plate was uplifted by pressure from the subducting Juan de Fuca plate, a series of basalt flows from fissures in eastern Oregon began to reach the coast. During the Miocene, Columbia River lavas invaded the northern coastal area. By the Pliocene, the current coastline was approximately in place and rivers continued to cut deep valleys through igneous and sedimentary rocks.

Subduction of the Juan de Fuca plate under North America is continuing to push the Coast Range upward, albeit at varying rates along the coast. For example, Cape Blanco is being uplifted at a rate of 1 inch every 3 years while Astoria is only being uplifted at a rate of 1 inch every 36 years (Orr et al. 1992). The last great (moment magnitude >8) Cascadia Subduction Zone earthquake occurred on January 26, 1700 (Atwater et al. 2005). Hazard estimates, based on the magnitude-9 earthquakes, had set the recurrence interval at about 500 years, with a 10-15% chance of another in the next 50 years. However, Goldfinger et al. (2010) determined an average recurrence interval of about 240 years, leading to a 37% probability of a great earthquake occurring somewhere along the Cascadia fault in the next 50 years.

3.5.3 Geology of Refuge Uplands

Cannery Hill is primarily composed of Eocene basalt and marine sedimentary rocks, including conglomerate, sandstone, mudstone, and siltstone. Middle Miocene rocks of the Depoe Bay basalt intrude the older rocks in some locations. Quaternary age landslide deposits constitute the lower slopes of Cannery Hill adjacent to the refuge pastures. The Alsea Formation, a marine siltstone and very fine-grained sandstone stratum uplifted during the Oligocene, underlies the northern portion of the Neskowin Marsh Unit (Snavely et al. 1996).

3.5.4 Geology of the Refuge Lowlands

Excluding the upland areas of the Refuge, the remainder was formed during the Holocene (12,000 years ago to present) following a series of sea level rise, subsidence, uplift, accretion, and erosion events. Considered a “drowned river” estuary, the Nestucca Bay estuary formed when melting glaciers at the end of the most recent ice age caused global and regional sea level rise. The remnant river mouth was then submerged and over time infilled with sediment. Infilling of the estuary and marsh development occurs as runoff from precipitation washes sediments from slopes into streams or their flood plains. These sediments are then transported downstream to the estuary where they settle and become influenced by tides (Simenstad 1983). Most of the present-day Refuge, excluding Neskowin Marsh, is located on this alluvium, which is predominantly composed of mixtures of gravel, sandy silt, silt, silty clay, clay, sand, and peat (Schlicker et al. 1972). Much of the coarser sediment settles out near the banks of the river, forming natural levees. The finer materials such as fine sands and clayey silts remain suspended longer and settle throughout the intertidal zone and flooded lowlands. Additionally, sediments are moved into the lower estuary from the ocean shore by tsunamis, storm surges, and dune building. Geologists studying stratigraphic sequences beneath the margins of Nestucca Bay have documented a history of relative sea level change in response to the earthquake deformation cycle as well as the effects of the 1.2 ka (i.e., 1,200 years ago) and 1700 tsunamis (Witter et al. 2010).

The Neskowin Marsh Unit is located inland from a beach foredune composed of Quaternary age unconsolidated sand. The marsh likely originated as a deflation plain wetland, which formed where wind scoured the sand down to the level of the water table. Streams flowing into Neskowin Marsh from upslope deposited sediment and organic materials and increased the permanent water supply into the wetland (Bickford 2010). Over time, the slow steady rise of the water level induced a continued growth of sphagnum moss and other wetland vegetation which then formed thick deposits of peat and organic soils. Interstratified alluvial and beach sediments may also be present (Schlicker et al. 1972).

3.6 Soils

All soil types and descriptions are mapped and described in the Soil Survey of Tillamook County, Oregon (U.S. Department of Agriculture [USDA] 2011). The principal soil type on Nestucca Bay NWR’s diked lowland pastures and also at the restored tidal marsh on the Little Nestucca River is

Coquille silt loam (0 to 1 percent slope). Coquille silt loam is a deep, very poorly drained soil with slow permeability that formed in mixed alluvium along the tidally influenced flood plain. When not diked and drained, this soil type has a permanent high water table at or near the surface and fluctuates with the tides. Extreme high tides and high tides along with peak freshwater flows inundate the soil unless protected by dikes or levees.

At the Semidi Tract, the natural river levee formed on the north end along the Nestucca River is underlain with Nehalem silt loam (0 to 3 percent slopes). In contrast to the Coquille silt loam, the Nehalem silt loam is very deep and formed in mixed alluvium on flood plains but well drained and typically found at slightly higher elevations. The upland forest fringing the southern end of the Martella Tract has Waldport fine sand (3 to 12 and 15 to 60 percent slopes) and Neskowin-Salander medial loams (30 to 60 percent slopes).

The Quillamook complex (3 to 15 percent slopes) is found on the southern part of the Hagerty Tract. Formed on stream terraces in silty alluvium overlying sandy and gravelly alluvium derived from igneous rock, the Quillamook complex consists of very deep, well-drained soils with moderate permeability. Although used for pasture and forage production, native vegetation on this soil type includes Sitka spruce, western hemlock, Douglas fir, red alder, cascara buckthorn, western brackenfern, western swordfern, salmonberry, and trailing blackberry.

In Brooten Marsh and outside of the dikes on Nestucca Bay North and Middle Pastures, Fluvaquents-Histosols are found. This soil complex is saturated with water that is high in content of soluble salts. Fluvaquents are in areas normally covered by average high tides and in surge channels whereas histosols are on higher elevations that are covered by extreme high tides. The surface layer of fluvaquents generally is mineral and is sandy, silty, or clayey, depending on the velocity of the tides in a given area. Histosols are made up of a layer of organic material that overlies alternating layers of mineral and organic material.

The Utter Tract is made up of several soil types: Brenner silt loam (0 to 1 percent slopes), Chitwood-Knappa medial silt loams (45 percent Chitwood, 40 percent Knappa, 0 to 7 percent slopes), and Knappa medial silt loam (3 to 15 percent slopes). Brenner silt loam, a very deep, poorly drained soil, is found in swales on flood plains adjacent to stream terraces. The soils formed in silty mixed recent alluvium derived from basic igneous and sedimentary rocks. Unless drained, this soil type is saturated with water for several months each year. Water ponds in winter after heavy rains or when streams overflow leaving thin layers of fresh alluvium on the surface.

The Chitwood soil type is very deep, somewhat poorly drained, and with slow permeability. Formed in mixed old fine textured alluvium derived from sedimentary rocks, this soil type is found on coastal marine and valley terraces. The soil is usually moist and is saturated with water extended periods during the winter. The water table is at its uppermost limit from November through May. While Chitwood soil occurs in slightly concave areas, Knappa soil occurs on nearly level to convex areas of terraces. The Knappa soil type is very deep but well drained soils, with moderate permeability formed in moderately fine-textured alluvium derived predominantly from sedimentary rock.

Cannery Hill contains a diverse group of soils including: Neotsu-Salander medial loams (60 percent Neotsu, 30 percent Salander, 5 to 30 percent slopes), Salander-Necanicum complex (60 percent Salander, 25 percent Necanicum, 30 to 60 percent slopes), Tolovana-Templeton medial silt loams (45 percent Tolovana, 40 percent Templeton, 5 to 30 and 30 to 60 percent slopes), and Winema-Fendall medial silt loams (55 percent Winema, 30 percent Fendall, 5 to 30 percent slopes). All are well drained soils with moderate permeability found on coastal hills and mountains. Both the Neotsu and Salander soil types are formed in colluvium or residuum primarily from igneous rock and in some areas basaltic sandstone. However, Neotsu soil has with 20 to 40 inches to contact with basalt while Salander soil has greater than 60 inches to basalt bedrock. The Necanicum soil type formed in mixed colluvium from volcanic basalt.

Templeton, Tolovana, and Winema soils are more than 40 inches deep to bedrock. Tolovana soils formed in colluvium overlying residuum from sandstone, siltstone or igneous rock and have a surface mantle dominated by amorphous material. Tolovana soils also have a medial over loamy particle-size family class. Templeton, Winema, and Fendall soils formed in colluvium and residuum weathered from sedimentary rocks. Templeton soils average less than 35 percent clay in the particle-size control section and have a fine-silty particle-size family class though while Winema soils are medial over clayey. Fendall soils have a fine particle-size family class. Winema-Fendall medial silt loams occur at the bottom of the slope, immediately above the refuge pastures.

The majority of Neskowin Marsh is composed of histosols, including significant amounts of peat. The western edge of the marsh, where the vegetation is more dominated by shrubs is underlain with Heceta fine sand (0 to 3 percent slopes) and Waldport fine sand (3 to 12 percent slopes) The Heceta soil is on nearly level deflation plains and the Waldport soil is on small, stabilized sand dunes. These soil types are deep, poorly drained, and have rapid permeability and low moisture capacity. The uplands to the east of the marsh are primarily Salander-Necanicum complex, Neotsu-Salander medial loams, and Munsoncreek-Flowerpot complex (65 percent Munsoncreek, 20 percent Flowerpot, 5 to 30 percent slopes) soil types. The northern part of the Neskowin Marsh Unit consists of Waldport fine sand and Neskowin-Salander medial loams (60 percent Neskowin, 25 percent Salander, 30 to 60 percent slopes).

3.7 Fire

3.7.1 Pre-settlement Fire History

There is little published information available describing the specific historic role of fire on lands that are now within Nestucca Bay NWR. Wildland fires on the Oregon coast have always been infrequent and do not exhibit any predictable cycle. The forested refuge areas are dominated by Sitka spruce and located in the “near coastal zone” where climatic conditions limit the frequency and intensity of naturally occurring fires. The limited data available indicate that fires in this zone were very infrequent and tended to burn wide areas but only under very rare, extremely dry and windy conditions in late summer and fall. In the tidal and freshwater marsh ecosystems that comprise much of the Refuge, fire was likely very infrequent. However, in the Nestucca Bay area, Native Americans settled small communities around the bay, and occasionally burned portions of the forest to create open spaces and habitat for game animals and to promote the growth of weaving materials and food. The Native Americans in the Oretown/Meda area burned each year to clear brush for hunting. Unpublished information also suggests that the Cannery Hill grasslands were kept open by Native Americans’ intentional fires.

3.7.2 Post-settlement Fire History

The normal fire season recognized by the U.S. Forest Service and the Oregon Department of Forestry (ODF) Tillamook District is June 1 to September 30. From 1993-2003 there have been 5 recorded fire incidents on or adjacent to refuge lands, totaling 0.47 acre. All were human caused (escaped debris burn, discarded cigarette).

Under the current refuge fire management plan, guidelines for appropriate wildland fire suppression, hazard fuel reduction, and pile burning are detailed. Mechanical treatment may be used as a fire management strategy for hazard fuels reduction. Pile burning as a limited prescribed fire technique may be used to reduce hazard fuels; however, no prescribed burning has been conducted on the Refuge. Typical “prescribed fire season” is fall and spring and is weather-dependent. Pile burning can occur year-round depending on weather conditions and restrictions placed by the Oregon Smoke Management Plan. There is no formally established “prescribed burning season” as any domestic pile or barrel burning is allowed all year contingent on weather conditions. Larger scale burning such as forestry slash burning requires a permit and a pre-burn inspection by ODF.

3.8 Environmental Contaminants

3.8.1 Air Quality

The Oregon Department of Environmental Quality (ODEQ) does not have any ambient air quality monitoring stations located on the Oregon Coast. The majority of ODEQ’s air quality monitoring stations are located within the interior valleys between the Coast and Cascade Mountain Ranges where the majority of Oregon’s population resides. The lack of ambient air quality monitoring on the Oregon Coast makes it difficult to assess baseline air quality conditions.

Nestucca Bay NWR is located within the Oregon Coast Airshed, which is generally well mixed year around due to the influence of the Pacific Ocean. Low pressure systems move through the airshed throughout the year and usually bring wind, clouds, and rain. The intensity and frequency of these low pressure systems increases during the fall through winter resulting in sometimes very rainy and windy conditions. In between these low pressure systems high pressure systems move in resulting in drying trends. High pressure systems generally dominant the airshed during late spring, summer, and early fall. Coastal fog due to inland heating is common during the summer months. In general, the Oregon Coast Airshed remains relatively unstable resulting in a well-mixed airshed with suspected good air quality.

Locally, air quality may be affected by various activities on and adjacent to the Refuge including: marine vessels, automobiles, and other human-caused activities such as outdoor burning, wood stoves, and operation of various vehicles and machines (e.g., gasoline/diesel powered equipment, motorboats). The refuge staff uses various types of equipment and transportation methods to achieve the refuge habitat conservation projects, monitoring, and research. Habitat improvement projects and daily monitoring activities may include the use of tractors, heavy equipment and/or the operation of trucks, boats, or other vehicles. Refuge visitors generally drive their automobiles to visit Cannery Hill and others operate motor boats on the Nestucca and Little Nestucca Rivers to participate in fish and wildlife-dependent recreation opportunities in the estuary (hunting, fishing, wildlife observation).

3.8.2 Water Quality and Contaminants

A state is required to identify waters that do not meet that state’s water quality standards under Section 303(d) of the Clean Water Act (CWA). These waters are considered “water quality limited” and placed on the state’s 303(d) impaired waters list. Section 303(d) requires the state to develop

Total Maximum Daily Loads (TMDLs) for impaired waterbodies. TMDLs are the amount of each pollutant a waterbody can receive and not exceed water quality standards. Water quality standards for Oregon include beneficial uses, narrative and numeric criteria, and antidegradation policies. ODEQ lists impaired water segments by designated fish uses; therefore, entire tributaries can be listed after one assessment event. Parameters included in the assessment are aquatic weeds or algae, bacteria (E. coli), bacteria (fecal coliform), biological criteria, chlorophyll a, dissolved oxygen, pH, sedimentation, temperature, total dissolved gas, toxic substances, and turbidity.

None of the smaller streams within or adjacent to the Nestucca Bay NWR boundary (i.e., Upton Slough, Hawk, Meadow, Butte, Kiwanda, or Upton Creeks) were listed as impaired because these waters have not been assessed under the CWA. However, Nestucca Bay, the Nestucca River, and the Little Nestucca River were listed as impaired in the 2002 and 2004/2006 303(d) reporting cycles. All three were also listed as impaired in Oregon’s 2010 Section 303(d) List of Category 5 Water Quality Limited Waters Needing a TMDL submitted by ODEQ to EPA for review and approval in January 2011. Nestucca Bay and the Little Nestucca River are listed as water quality limited for fecal coliform, which affects the beneficial use of shellfish harvesting. Sources of bacteria in the watershed include rural and urban residential development (failing septic systems), urban stormwater runoff, livestock management and other agricultural activities, and several wastewater treatment plants that discharge either to the rivers or the bay. Significant impairments on the Nestucca River include dissolved oxygen, temperature, E. coli, and fecal coliform. These impairments affect the beneficial uses of salmonid fish spawning, salmonid fish rearing, resident fish and aquatic life, anadromous fish passage, water contact recreation, and shellfish growing (ODEQ 2011). While not State-listed, the local creeks and drainage ditches adjacent to the Refuge likely collect waste products from the cattle that graze the pastures. These nutrient loads would be added to the existing loads within Nestucca Bay, potentially further degrading water quality. Nestucca Bay NWR integrates best management practices within the Cooperative Land Management Agreements for all grazing activities on the refuge lands in order to minimize waste and wastewater from reaching water courses (drainages, streams, rivers, and estuary). TMDLs for temperature, bacteria, and sedimentation for the Nestucca Bay watershed were approved by EPA in 2002.

The Nestucca Bay watershed contains large areas of pasture where chemical fertilizers are used and commercial forest land where chemical herbicides are used. These chemicals could be transported to the Refuge via runoff and surface water. Chemical fertilizers and herbicides are also occasionally applied on the Refuge. Any chemicals used on the Refuge must go through the Pesticide Use Proposal (PUP) process which reviews each chemical for potential adverse impacts to trust resources. In addition, if a large coastal oil spill occurred in the vicinity of the Refuge, the estuary could be contaminated with material carried in with the tide. Also, U.S. Highway 101 runs through the Refuge and could be a source for a spill or pollution resulting from an auto accident.

The Neskowin Marsh Unit is surrounded by rapidly developing coastal homesites to the west and north. Potential contaminant sources related to the residential development include malfunctioning or inadequate on-site septic systems and urban/community stormwater runoff. At least one failed septic systems has been found discharging raw sewage on the surface of the ground which flowed toward the marsh. Stormwater runoff from these areas can potentially carry a substantial load of various point and nonpoint source pollutants including toxic chemicals, bacteria, and pathogens.

Climate change has the potential to cause water quality impairments including possible effects on estuarine water temperature, salinity, dissolved oxygen, nutrients, chlorophyll a, bacterial contamination, and carbonate chemistry (Ruggiero et al. 2010).

3.9 Surrounding Land Use

Nestucca Bay NWR is located in the southwest corner of Tillamook County along the northern Oregon Coast. The Nestucca Bay area is essentially rural. The unincorporated communities of Woods and Pacific City are small. In 2010, Tillamook County had a population of 25,250. On the whole, the county averages 22 people per square mile. The main industries within the county, in order of economic importance, are dairy farming, tourism, government, and lumber and wood products. Consequently, primary land uses near the Refuge are agriculture and forestry. The dairy products and livestock industries, in particular, are economic cornerstones for the Nestucca Bay area. Nearly all of the lands suitable for these industries are currently being used for this purpose.

The Neskowin Marsh Unit is bounded on the east by Highway 101 and on the south by Neskowin Beach State Wayside. The western edge of the unit is generally bounded by Hawk Street within the unincorporated community of Neskowin and the northern boundary is the Sahhali Shores subdivision. The core area of Neskowin is primarily single family residences with little commercial development. Today, Neskowin is a cottage community with a large amount of vacation beach homes that have been passed down through generations. New housing developments adjacent to or overlooking Neskowin Marsh continue to be planned and constructed. The Neskowin Beach Golf Course is located within the approved refuge boundary. The golf course experiences localized flooding during the fall, winter, and spring periods, limiting the golfing season to 6 months or less a year.

Chapter 4 Biological Environment

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Chapter 4. Biological Environment

This chapter addresses the biological resources and habitats on the Nestucca Bay National Wildlife Refuge (NWR or Refuge); however, it is not an exhaustive overview of all species and habitats. The chapter begins with a discussion of biological integrity (historic conditions and ecosystem function), as required by the Refuge Administration Act. The bulk of the chapter is then focused on the presentation of pertinent background information for the priority habitats and species that the Refuge Complex personnel will actively manage to accomplish biological conservation and/or restoration. The priority habitats and species are collectively known as the Priority Resources of Concern (ROCs) designated under this CCP. Background information includes description, location, condition, trends, key ecological attributes, and threats (stresses and sources of stress) associated with each ROC. The information presented herein was used to develop goals and objectives for the CCP (see Chapter 2).

4.1 Biological Integrity, Diversity, and Environmental Health

The National Wildlife Refuge System Administration Act, as amended, directs the Service to ensure that the biological integrity, diversity, and environmental health (BIDEH) of the Refuge System are maintained for the benefit of present and future generations of Americans. The BIDEH policy (601 FW 3) defines *biological integrity* as “the biotic composition, structure, and functioning at genetic, organism, and community levels comparable with historic conditions, including the natural biological processes that shape genomes, organisms, and communities.” *Biological diversity* is defined as “the variety of life and its processes, including the variety of living organisms, the genetic differences among them, and communities and ecosystems in which they occur.” *Environmental health* is defined as the “composition, structure, and functioning of soil, water, air, and other abiotic features comparable with historic conditions, including the natural abiotic processes that shape the environment.” In simplistic terms, elements of BIDEH are represented by native fish, wildlife, plants, and their habitats, as well as those ecological processes that support them.

The Refuge System policy on BIDEH (601 FW 3) also provides guidance on consideration and protection of the broad spectrum of fish, wildlife, and habitat resources found on the refuge and in associated ecosystems that represents BIDEH.

4.1.1 Historic Conditions

The historic conditions of the Nestucca Bay area during pre-settlement times are described as a marine-affected environment with a large expanse of tidal salt marsh in the lowlands bordered by riparian Sitka spruce forest and forested tidal swamp. The upland areas consisted of old growth forests and native prairie. Historic vegetation of the Oregon coast, based on General Land Office survey records of the 1850s, has been mapped by the Oregon Natural Heritage Information Center (ORNHIC) (Hawes et al. 2008, Christy et al. 2001). An ORNHIC map shows that most of the Nestucca Bay area was tidal marsh and riparian Sitka spruce forest. Based on studies of least-disturbed tidal wetlands in Oregon (Brophy 2009, 2007a, Brophy et al. 2007-2009) and the elevation and landscape setting of this “riparian forest,” it is believed that some of the area was actually a forested tidal wetland (“tidal swamp”) dominated by Sitka spruce. The ORHNIC historic vegetation classification does not specifically include shrub or forested wetlands, so presence of these habitats must be inferred from landscape setting and other data sources.

Sitka spruce tidal swamp is now very rare in Oregon, but it was once common on the Oregon coast (Brophy 2007b). Studies have been conducted at some of the remaining remnant tidal swamps, and data suggest Sitka spruce tidal swamps can be found where summer surface water salinities are in the oligohaline and low mesohaline range, 0.5 to 10 parts per thousand (ppt) (Brophy 2009, Brophy 2007a, Brophy et al. 2007-2009, Christy and Brophy 2007). Judging from the prevalence of salinity stress in some of the pastures around Nestucca Bay, salinities could have been in the low mesohaline range prior to diking (Brophy 2010). This suggests that Sitka spruce tidal swamps existed in some areas of present day lowland pastures of the Nestucca Valley.

Evidence of human occupation of the Oregon Coast dates back at least 8,000 years. Most coastal Native Americans lived very close to the ocean or at the edge of an estuary. The Nestucca-dialect speaking people of the Tillamooks or Killmooks lived in the Nestucca watershed. This larger tribe consisted of Salish-speaking people generally located west of the Coast Range and along the coast from Tillamook Head to 10 or 20 miles south of Siletz Bay. They depended on large game, shellfish, anadromous fish, and berries as food sources. They often set small fires, perhaps one half to one acre in size, to maintain quality hunting and gathering areas. Contact with European people in the early to mid-1800s resulted in pandemic diseases, causing an estimated 70-80% loss in the native population during the years from 1829 to 1845 (Barczak 1998).

4.1.2 Habitat Alterations

The biological integrity, diversity, and environmental health (BIDEH) of the ecosystems including and surrounding Nestucca Bay NWR have undergone dramatic alterations since pre-settlement times. The most discernible changes include: (1) the conversion and development of large portions of coastal areas into agriculture, housing, and commercial lands; (2) logging; (3) the alteration of fire regimes; (4) introduction of contaminants into the aquatic environment; (5) the loss of native species accompanied by a large influx of non-native and invasive plants and animals into the system; and (6) climate change. This section discusses the connection between some of these main landscape level changes with the current vegetation and wildlife on the lands and waters occupied by the Refuge. This summary is not a complete analysis of all factors related to changes in native vegetation, fish, and wildlife.

The Nestucca Bay area has been substantially modified by human activities. Lands adjacent to the Nestucca River were first homesteaded in the mid to late 1800s and continued into the early 1900s. A salmon cannery was established on the east side of Nestucca Bay in 1886; however, after a few good years the salmon became scarce and the cannery ceased operations and was dismantled (Aaby 2003). Trees were cleared and dairies were started in the lower valleys. Most of the bay tidal salt marshes were diked off from tidal action and converted to pastures for the area dairy operations resulting in a 91% loss of this habitat type within the Nestucca Bay estuary (Brophy 2011). In addition, the once common forest wetlands or swampland found around the bay have been reduced by 98% (Brophy 2011).

Demand for lumber began to increase in the late 1800s, and timber companies acquired land in the watershed. Around the turn of the century, much land in the area was burned repeatedly, leaving extensive “brushfields.” Expansion of the logging industry and associated road building increased sedimentation rates in the bay. As the logging industry expanded, the combined effects of logging debris, erosion, sedimentation, and several decades of intense fishing, caused the small commercial fishing industry to disappear. Also, increased sedimentation rates severely reduced the navigability of the bay and rivers.

When the first white settlers arrived in the Nestucca area, the physical landscape they observed was quite different from the one observed today (Aaby 2003). In describing the physical landscape, settlers, surveyors, and local newspapers stated that the area was open and rugged (Rock 1926). Other descriptions stated that a fire had raged through the area sometime 40 to 50 years prior, burning all the "magnificent forests" (U.S. Congress 1893) that once covered the mountains. The accuracy of this observation is validated by a similar account printed in *The Oregonian*, on August 25, 1894, which described a great fire around the Nestucca Bay in 1845 (Morris 1934). This might help to explain the description of open areas, as well as the abundance of "the finest spruce and alder, some cedar and fir" (Yamhill Reporter 1883) along the coast. This fire had also left scars upon the landscape that were observed as late as 1934:

> The vast deforested area today covered with ferns, brush, and scattered young trees in the hills along the highway between Willamina and Hebo marks the course of a fire known from the tree ages to have occurred about 1845. The exact extent of the fire is unknown, as later fires have destroyed part of the evidence of the original fire (Morris 1934).

Based on various accounts, it is likely that this fire covered about 380,000 acres and was started when a slash burn grew out of control. Also, the statement above suggests this was not the only fire to burn in the Nestucca area.

Today, large expanses of agricultural fields exist in the bottomlands of the Nestucca Valley. The agricultural fields are typical diked wetlands that were converted to use as pasture. Alterations consisted of diking, installation of culverts and tide gates, removal of trees, and extensive ditching for drainage. Many straight ditches were dug throughout the area; however, major tidal channels were left in place but deepened through dredging. The construction of the Little Nestucca Highway and other roads in the area reduced the hydrologic connectivity between adjacent hillslopes and tidal wetlands. Currently, drainage from the hillslopes is channeled through culverts and carries substantial freshwater to various streams.

Neskowin Marsh, a few miles to the south of Nestucca Valley, is also part of Nestucca Bay NWR. Neskowin Marsh occupies a 1.25 × 0.5 mile linear trough between the sand dunes of Kiwanda Beach to the west, and uplands to the east, including some large basalt bluffs at the northern end. Much of the surrounding sand dunes and uplands have been developed for housing. The wetland downstream from Neskowin Marsh was converted from a swamp to a golf course (Neskowin Beach) by draining the area, leveling it with heavy equipment, burning the vegetation, and dynamiting hundreds to tree stumps (Rissel and Noegel 2009). The golf course opened for business in 1931. The marsh, originally a lake, formed when shifting sand blocked stream drainages. The area is underlain by peat, and a number of lakes, ponds, and pools scattered throughout the wetland are vestiges of a larger lake system in-filled by peat formation. The western and southern portions of the marsh, constituting about two-thirds of the Neskowin Marsh Unit of the Refuge, were cleared and ditched in the early 1900s, reportedly for cultivation of cranberries by the Tillamook Cranberry Company, and were later used for pasture. This area is currently characterized by open water, hardstem bulrush, and lesser amounts of reed canarygrass and other early-seral emergent marsh. The remaining third in the northern and northeastern portions of the marsh were ditched less extensively, but were used for pasture. This area now supports extensive shrub swamps (hooker willow, Pacific crabapple, and spirea), Sitka spruce swamp, Sitka sedge, ferns, and peatland with high-quality sphagnum fens interspersed with lakes, pools, and ponds. The marsh is one of the largest and highest-quality freshwater wetlands remaining on the coast of Oregon; the sphagnum fen is the second-largest known site on the coast, and it contains the largest known occurrence of acid-forming *Sphagnum fuscum* mire known on the coast (Christy and Brophy 2002).

4.1.3 Early Refuge Management

The Nestucca Bay NWR was established in 1991 to protect and enhance habitat for dusky Canada and Aleutian Canada geese and estuarine-dependent fish and wildlife resources. Refuge managers and the Nestucca Bay Landowners Association have been cooperating under a Memorandum of Understanding (MOU) since 1992 to maintain short grass habitats (pastures) around Nestucca Bay to also benefit geese and other wildlife. This cooperative effort aims to protect this habitat for the mutual benefit of the dairy industry and wildlife. The active pasture management program provides habitat for geese during the wintering period and feed for dairy cows during spring through fall. Dikes and tide gates have been maintained to protect the lowland pastures from flooding.

A portion of the Nestucca Bay NWR was restored to tidal wetlands in 2007. The Little Nestucca River Restoration Project was a partnership between the U.S. Fish and Wildlife Service, Ducks Unlimited, Stanard Foundation, The Nature Conservancy, and the Confederated Tribes of the Siletz Indians. The project involved removing a 0.7-mile dike to restore an 82-acre tidal wetland, placing 23 complexes of large woody debris, re-establishing or restoring 2 miles of tidal channels, and removing two tide gates to provide fish passage to 1.5 miles of tidal channels. The area restored to tidal marsh was formerly comprised of degraded diked muted wetlands within five private ownerships that were acquired by the Service with the intention of restoring tidal action. The project benefits juvenile salmonids, including spring and fall Chinook, chum, and coho salmon and steelhead and coastal cutthroat trout, by providing rearing habitat. The restoration area also supports numerous migratory birds including ducks and shorebirds.

Restoration of the historic coniferous forest on the slopes of Cannery Hill is currently underway. Invasive Himalayan blackberry was removed by hand and by mowing followed by the planting of native Sitka spruce, western hemlock, western red cedar, bigleaf maple, and red alder. Blackberry removal and control continues with the application of herbicides as well as mechanical removal. Approximately 15 acres of upland grasslands on Cannery Hill are mowed to maintain short grass for black-tailed deer; the remainder is dominated by tall, rank reed canarygrass. Mowing of the area is a temporary measure to reduce seed production of invasive reed canarygrass until the area is restored to native prairie. The mowed area does benefit deer, raptors, and some songbirds.

The management direction of the Neskowin Marsh Unit includes: (1) protecting key habitats for threatened and endangered species such as the coho salmon, (2) protecting freshwater wetlands, including the rare and unique coastal bog ecosystem, (3) providing a diversity of habitats for mammals, amphibians, reptiles, and migratory waterfowl, shorebirds, wading birds, and songbirds, and (4) developing compatible wildlife-dependent recreational activities in partnership with the local community (USFWS 2000a). Since acquisition in 2000, managers have implemented strategies to accomplish these goals for the Neskowin Marsh Unit and have utilized the “hands-off” management approach. The unit has been closed to the public to protect the fragile ecosystem. However, limited reconnaissance biological studies have been conducted to gather baseline data and assess current environmental status.

4.2 Selection of Priority Resources of Concern

4.2.1 Analysis of Priority Resources of Concern

Refuge management priorities are derived from the National Wildlife Refuge System (NWRS) Mission, individual refuge purpose(s), NWRS policy that identifies NWRS Resources of Concern, and the mandate to maintain the BIDEH of the refuge. These mandates are consistent with the National Wildlife Refuge System Administration Act of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997. The management direction of Nestucca Bay NWR is driven by refuge purposes and statutory mandates, coupled with species and habitat priorities. The latter are identified in various USFWS conservation plans, as well as those developed by our state, Federal, and private partners (USFWS 2008b). The step-by-step process to prioritize Resources of Concern and management priorities for a refuge is displayed in Figure 4-1.

Wildlife and habitat goals and objectives were designed directly around the habitat requirements of species designated as Priority Resources of Concern (ROCs). Resources of concern are called conservation targets in conservation planning methodologies used by other agencies and non-governmental organizations. In developing objectives, the team followed the process outlined in the Service's draft Identifying Resources of Concern and Management Priorities for a Refuge: A Handbook (USFWS 2008b). As defined in the Service's Policy on Habitat Management Plans (620 FW 1), resources of concern are:

> all plant and/or animal species, species groups, or communities specifically identified in refuge purpose(s), System mission, or international, national, regional, state, or ecosystem conservation plans or acts. For example, waterfowl and shorebirds are a resource of concern on a refuge whose purpose is to protect 'migrating waterfowl and shorebirds.' Federal or State threatened and endangered species on that same refuge are also a resource of concern under terms of the respective endangered species acts (620 FW 1.4G)…
>
> Habitats or plant communities are resources of concern when they are specifically identified in refuge purposes, when they support species or species groups identified in refuge purposes, when they support NWRS resources of concern, and/or when they are important in the maintenance or restoration of biological integrity, diversity, and environmental health.

Therefore, resources of concern for a refuge may be a species or species group, or the habitat/plant community that supports a priority species/species group.

In developing its listing of Priority ROCs, the planning team selected not only species mentioned in establishing documents for the Refuge, but also species that captured the ecological attributes of habitats required by larger suites of species. The ecological attributes of habitats should be analyzed to meet the life history requirements of ROCs, and are therefore critical to sustain the long-term viability of the ROC and other benefitting species. Ecological attributes of habitats include vegetation structure, species composition, age class, patch size and/or contiguity with other habitats; hydrologic regime; and disturbance events (e.g., flooding, fire). These provide measurable indicators that strongly correlate with the ability of a habitat to support a given species. Tables listing the desired conditions for habitat types found on the Refuge incorporate "Desired" conditions that were based on scientific literature review and team members' professional judgment. These desired conditions for specific ecological attributes were then used to help design habitat objectives, as presented in Chapter 2. However, not all ecological attributes or indicators were deemed ultimately feasible or necessary to design an objective around. Other factors, such as feasibility and the Refuge's ability to reasonably influence or measure certain indicators, played a role in determining the ultimate parameters chosen for each habitat objective. Thus, ecological attributes should be viewed as a step in the planning process. The ultimate design of objectives was subject to further discussion and consideration.

Limiting factors were also considered in developing objectives. A limiting factor is a threat to, or an impairment or degradation of, the natural processes responsible for creating and maintaining plant and animal communities. In developing objectives and strategies, the team gave priority to mitigating or abating limiting factors that presented high risk to ROCs. In many cases, limiting factors occur on a regional or landscape scale and are beyond the control of individual refuges. Therefore, objectives and strategies may seek to mimic, rather than restore, natural processes. The structure of plant communities utilized by ROCs can be created, rather than restoring the original native species composition. For example, mowing and/or grazing may be used to maintain a desirable vegetation structure, when restoring native grassland communities may be impractical. Through the consideration of BIDEH, the Refuge will provide for or maintain all appropriate native habitats and species. Refuge management priorities may change over time, and because the CCP is designed to be a living, flexible document, changes will be made at appropriate times.

Early in the planning process, the planning team cooperatively identified priority species for the Refuge, as recommended under the Service's Habitat Management Planning policy (620 FW1). These ROCs frame the development of goals and objectives for wildlife and habitat. ROCs may be species, species groups, or features that the Refuge will actively manage to conserve and restore over the life of the CCP, or species that are indicators of habitat quality for a larger suite of species. Negative features of the landscape, such as invasive plants, may demand a large part of the refuge management effort, but are not designated as ROCs.

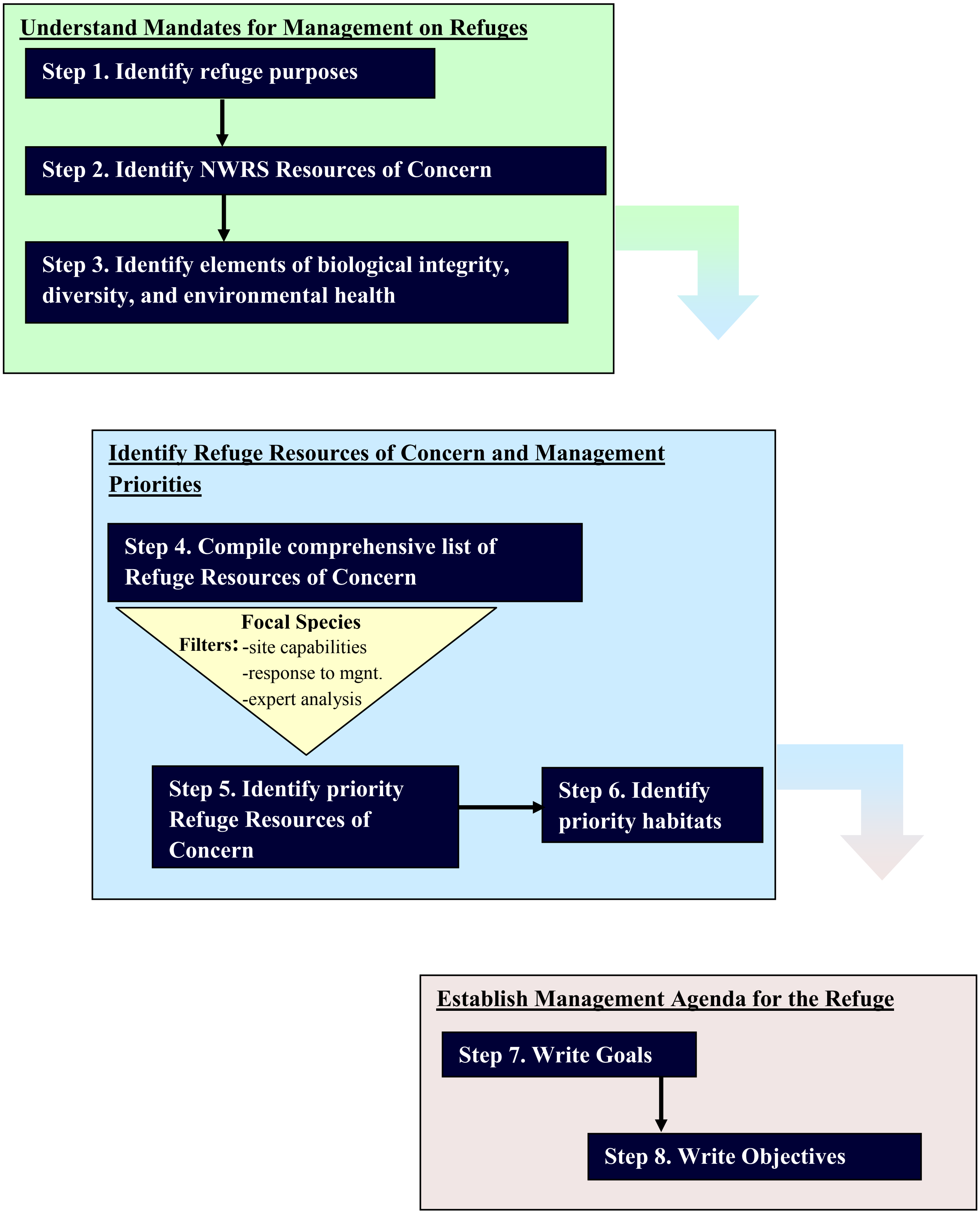
The main criteria for selecting priority ROCs included the following requirements:

- The resource must be reflective of the refuge's establishing purposes and the Refuge System mission;
- The resource must include the main natural habitat types found at the refuge;
- The resource must be recommended as a conservation priority in the Wildlife and Habitat Management Review; or
- The resource must be federally or state listed as a candidate for listing, or a species of concern.

Other criteria that were considered in the selection of the resources of concern included the following:

- Species groups and/or refuge features of special management concern;
- Species contributing to the biological diversity, integrity, and environmental health of the ecosystem;
- Species where it is feasible to estimate abundance (needed for future monitoring and adaptive management).

Figure 4-1. Overview of the process to prioritize resources of concern and management priorities for a refuge (USFWS 2008b).



4.2.2 Priority Resources of Concern Selection

In preparing this plan, the Service reviewed other local, regional, and national plans that pertain to the wildlife and habitats of Nestucca Bay NWR (see Chapter 1). The Service also sought input from Oregon State conservation agencies, non-governmental organizations, and the general public. The refuge purposes, as stated in the enabling legislation for each refuge (see Chapter 1), were carefully reviewed as was the Refuge's contribution to maintenance of BIDEH (Appendix E) within the ecoregion. As a result of this information gathering and review process, a comprehensive list of potential ROCs was developed. From this list, those species and habitats that are most representative of refuge purposes and habitats, BIDEH, as well as other FWS and ecosystem priorities, were chosen as ROCs (habitat types) and focal resources (plant and animal species). Habitats selected as ROCs include: (1) Lowland Pastures, (2) Upland Prairie and Mixed Upland Grasslands (North Pacific Hypermaritime Shrub and Herbaceous Headland), (3) Upland Forests (North Pacific Hypermaritime Sitka Spruce Forest), (4) Estuarine Habitats (Temperate Pacific Tidal Salt and Brackish Marsh, Temperate Pacific Intertidal Mudflat, and North Pacific Intertidal Freshwater Wetland), (5) Freshwater Habitats (Temperate Pacific Freshwater Emergent Marsh and North Pacific Bog and Fen), (6) Forested Wetland and Stream-Riparian Habitat (North Pacific Hardwood-Conifer Swamp, North Pacific Intertidal Freshwater Wetland, North Pacific Lowland Riparian Forest and Shrubland). Vegetation type descriptions according to the International Terrestrial Ecological System Classification under development by NatureServe and its natural heritage program members (Comer et al. 2003, NatureServe 2012) are listed in parentheses.

Priority resources of concern and focal resources consist of habitats and species whose conservation and enhancement will guide refuge management into the future. Potential management actions will be evaluated on their effectiveness in achieving refuge goals and objectives for the priority resources of concern. However, many native species that are present on the refuges will also benefit. They are referred to here as other benefiting species. See Appendix E for a completed list of priority resources of concern, focal resources and other benefiting species.

4.3 Lowland Pastures

Canada geese and dabbling ducks winter on lowland refuge and privately owned dairy pastures at Nestucca Bay from fall through spring. The lowland pastures within the Nestucca Bay Unit are managed intensively to provide forage for Canada geese, using the management practices of grazing and silage production. Grass species including water foxtail, perennial ryegrass, annual ryegrass, New Zealand white clover, lotus, orchardgrass, and *Ranunculus* spp., are kept short (2-4 inches) and actively growing throughout the year under these management practices.

Nestucca Bay NWR provides important winter habitat for the formerly endangered Aleutian Canada goose and serves as an important overwintering site for 8-16% of the declining population of the dusky Canada goose. Other subspecies of Canada geese, including Taverner's, cackling, lesser, and western Canada geese also use refuge pastures. Peak weekly counts of Canada geese range from 6,000 to 10,700 birds within the approved refuge boundary at Nestucca Bay during the winter (Stephensen 2010, Stephensen and Horton 2011, USFWS unpublished data). Hundreds of dabbling ducks (e.g., mallard, northern pintail, green-winged teal, American wigeon) also use the pastures as foraging habitat when the fields have standing water or are flooded during the winter months (Stephensen, personal observation).

4.3.1 Description of Lowland Pastures

The lowland pastures within Nestucca Bay primarily occur on the Hebo Series soil type, a Natural Resources Conservation Service classification (NRCS 2011). These soils are poorly drained, fine-textured, and very strongly acidic, which severely limits the plant species that can successfully grow in these pastures. The pastures are level or lower than the estuary water table and the soils are waterlogged during the wet season (October–April). Forage yields are generally lower than the average for southern Tillamook County pastures because drainage is poor. Most areas within Tillamook County with this soil series have been cleared and some have been drained by the use of ditching and drainage tiles.

The pastures mostly contain non-native forage species including perennial and annual ryegrasses and New Zealand white clover, as well as natives including water foxtail, lotus, and *Ranunculus* spp. When these pastures are rehabilitated, they are generally disced and seeded with a short annual ryegrass and New Zealand white clover. The low elevation and winter flooding regime permit re-growth of the other wet pasture vegetation species from the existing seed bank.

Lowland pastures are characterized by the following:

- Pasture mix (e.g., orchardgrass, annual rye, white clover) that is a maximum of 2" to 4" in height by end of October
- Saturated to shallowly flooded from October to May
- <10% cover of invasive/undesirable plants (e.g., reed canarygrass, Himalayan blackberry, tussock, Baltic rush)

4.3.2 Historic and Current Distribution

The Nestucca Bay area has been substantially modified by human activities. Historically, native peoples settled small communities around Nestucca Bay and subsisted by shellfishing, fishing, hunting, gathering, and trading. Natives burned portions of forest to create open areas, but essentially the lands changed little. By the late 1820s, the Oregon coast was well known to fur trappers. In the mid-nineteenth century, permanent non-native settlements became established on the Nestucca as well as most other Oregon estuaries. Native populations declined precipitously due to lack of immunity to European diseases as well as forced removal to reservations that continuously shrank to accommodate settlers' desire for these lands. The California and Oregon gold rushes created demand for Oregon lumber and agriculture products. Trees were cleared as the floodplains of the Nestucca and Little Nestucca Rivers were converted to agriculture. As the Euro-American population steadily grew adjacent to the bay, most of the lowlands were homesteaded for farms. The key economic activities in the late 1880s were salmon and timber harvest and the establishment of the dairy industry. By the early 1900s, the dairy products industry was firmly established and remains a staple of the area economy today. Most of the bay tidal marshes were diked off from tidal action and converted to pastures for the area dairy operations (USFWS 1990). Approximately 33% of the current Nestucca Bay Unit is lowland pasture behind dikes and tide gates.

4.3.3 Refuge-specific Sites

The lowland pasture habitat of the Nestucca Bay National Wildlife Refuge totals 346 acres. The lowland pastures are scattered throughout the Nestucca Bay Unit of the Nestucca Bay National

Wildlife Refuge (Figures 2-1 and 4-2). The North Pastures (pastures #1-6) and Middle Pastures (pastures #7-12) are located between U.S. Highway 101 and Nestucca Bay proper. The Little Nestucca River parallels pasture #12 and flows into Nestucca Bay. The Main Pastures (pastures #13-20 and 24-25) is west of the Mouth of Little Nestucca River and adjacent to Cannery Hill. The Semidi Tract (pastures #21-22) is north of Pacific City and adjacent to the horseshoe bend in the Nestucca River. Pastures 26-32 (Hagerty Tract) are along the Meda Loop Rd. and adjacent to the Little Nestucca River. The Utter Tract (pasture #23) is located along Resort Drive.

4.3.4 Condition, Trends, and Threats

The lowland pastures within the Nestucca Bay Unit were purchased to provide quality undisturbed wintering habitat for dusky and Aleutian Canada geese. The pastures continue to be managed intensively for this purpose. In recent years, the continuing increase in numbers of wintering and migrating geese have intensified the pressure to reduce depredation on neighboring privately owned pastures by attracting and holding geese on refuge pastures. A total of 346 acres of refuge pastures are managed by five local dairy farmers under Cooperative Land Management Agreements. The vegetation in the pastures is kept short and actively growing throughout the year using various management practices including grazing (mid-March through early November); mowing and “greenchopping” (baling or bulk removal of mowed grass for silage production; similar in effect to intensive grazing except that a machine is used to harvest the crop); application of manure and commercial fertilizer with a 20-foot setback from ditches; herbicide application to control invasive rush species (*Juncus* spp.) on approximately 50 acres; and periodic cleaning of ditches to maintain drainage and water flow. If not intensively managed, these lowland pastures are steadily invaded by rush and other wetland species and become significantly less attractive as forage and resting sites for the geese. Sixty-three acres of lowland pasture fields are certified organic. In addition, no commercial fertilizers or herbicides have been used for the past 30 years on the recently acquired 76-acre Semidi Tract.

During fall, winter, and spring, refuge lowland pastures receive water from small streams, creeks, and drainages that run through them and discharge their flow to the Little Nestucca and Nestucca Rivers through water control structures in the dikes. On occasion, high water flows in the Nestucca River results in flooded roads and topped dikes and direct field flooding in the Semidi and Utter Tracts. Drainage and therefore field flooding depends on the condition of the pasture ditches, topography of the particular pasture, amount of short-term rainfall, and height of tides within the adjacent bay and tidally influenced rivers. Small pools of standing water persist throughout the rainy period creating habitat for several species of waterfowl and shorebirds. The diked pastures are regulated with drainage ditches which drain to tidegates. The tidegates allow freshwater out but block brackish water from entering the ditches and subsequently the pastures. At two locations (the Middle Pastures and Upton Slough outlet within the Main Pastures), there are fish-friendly tidegates which permit some muted tidal action in the larger pasture ditches of the unit, allowing fish passage over a longer period of the tide cycle. On a very rare occasion a tidegate may fail either partially or completely, or debris can prevent the flap from closing properly, and the pastures become inundated with brackish water. Repairs to damaged tidegates are completed as quickly as possible to prevent further flooding and pasture damage.

There are 32 diked lowland pasture fields on the Refuge, which are grouped into six different pasture units. The three pasture units surrounding Nestucca Bay include the North (pastures #1-6), Middle (#7-12), and Main (#13-20 and #24-25) (Figure 4-2). The Main Pastures is slightly above the estuary water level and was tiled for drainage. The North and Middle Pastures are at or lower than the estuary level and are susceptible to frequent flooding. All three pasture units are drained by open ditches, which flow out into Nestucca Bay through tidegates. Specific field topography determines the management options for each field, and has potential effects both direct and indirect on the waterways and the bay with regard to salmonids and water quality. A description of the fields and their associated hydrological connections to Nestucca Bay follows.

North Pastures—pastures #1-6: Field 2 has a direct connection to Nestucca Bay through a tidegate on its northwestern edge. The tidegate and culvert under the dike was replaced in 1992 shortly after the land was acquired. Runoff from the field can enter the bay through the tidegate, if winter storm events cause the water level in the ditch along the west side of the fields to rise and flood the field. An indirect connection exists between Nestucca Bay and pastures 1 and 3-6 through the ditch bordering the western edge of the unit. In addition, a highway borrow ditch along the eastern edge of all north unit fields is connected by a culvert to the fenced-off drainage ditch between each field (except for the ditch between fields 5 and 6), which connects to the borrow ditch along the west side of the unit. Cross pasture ditch banks are high enough that field runoff will not go over the bank except in an extreme winter flooding situation. Field 6 drains to the south, into a small wetland area that has no direct connection to the bay. The outer dike separating the pastures from the bay and the cross dike separate the North and Middle Pastures were rehabilitated in 2007.

Middle Pastures—pastures #7-12: The northern portions of pastures 9-12 hold water throughout the winter. The main ditch along the north edge of these fields backs up during high tides and heavy rainfall. This unit has a direct connection to Nestucca Bay through a tidegate on northwestern edge of field #12. There is an indirect connection to the bay from winter runoff out of these fields into the ditch along the north edge of fields. A fenced-off drainage ditch exists between each field, and the ditches connect to the borrow ditch along the north side of the unit. The tidegate in this unit completely failed in December 2001 and was replaced with a fish-friendly tidegate.

Main Pastures—pastures #13-20 and 24-25: This unit has a direct connection to the bay through two tidegates located at the north end of Upton Slough, which runs parallel to the east edge of fields 13-20. The pastures on the east side of Upton Slough are privately owned, with the exception of the newly acquired (2011) pastures #24-25, a triangular parcel which also borders the river and U.S. Highway 101. There is an indirect connection to the bay from field runoff into Upton Slough. The drainage ditch that runs north along the western edge of fields 17-20 backs up in the winter and floods field 20. This ditch intersects fields 16 and 17 to connect with Upton Slough. There is a fenced-off drainage ditch between each field in this unit. The dike and water control structures are maintained by the diking district, which the Refuge is a member of. The district maintains a water pump and when field flooding reaches extreme levels, the water is pumped and removed from the area.

The other three refuge pasture units are connected to Nestucca Bay and estuary through the Nestucca or the Little Nestucca River. These pasture units are also drained by open ditches that flow out to the river or, in the case of the Utter Tract, into other privately owned ditches that eventually spill into the river. In these pasture units, specific field topography determines the management options for each field.

The Semidi Tract (pastures #21-22) includes two lowland pastures and totals approximately 70 acres. These pastures are adjacent to the Nestucca River on the northern edge of the community of Pacific City. Semidi Islands Aleutian Canada geese frequent these pastures during the winter and show high site fidelity to these specific pastures—thus the name Semidi Tract. This area is flooded several times during the winter when the Nestucca River overflows its banks, and drains through a tidegate on the south end of the property. The soil has not been cultivated in over thirty years (S. Martella, personal communication).

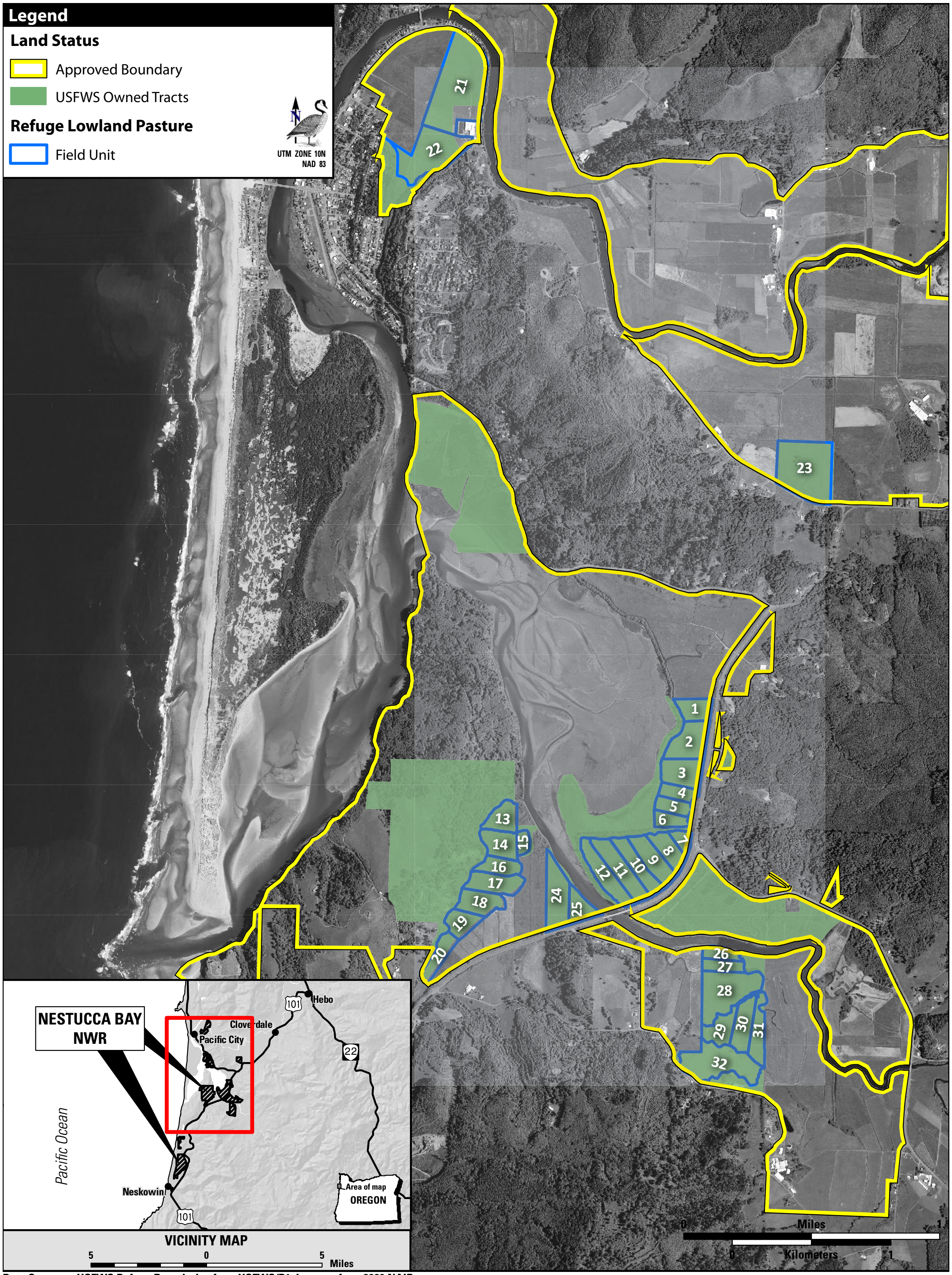
The Hagerty Tract was acquired in 2011 and has six lowland pastures (# 26-32) totaling approximately 79 acres. The northernmost pasture in this unit (#26) is diked and parallels the Little Nestucca River. This property is bordered on the east and west sides by private lands. Drainage of this tract is through a tide gate shared with the landowner to the east. This tract is now being rehabilitated and managed by two local dairy farmers through Cooperative Land Management Agreements.

The Utter Tract (#23) is a small lowland pasture of approximately 31 acres and is surrounded by private land on three sides and Resort Drive on the south. The northern portion of the pasture is very low and is often flooded during winter from the waters of the Nestucca River. A group of Sitka spruce is in the middle of the pasture, and the land rises to higher elevation on the south. Hundreds of ducks are observed in the winter in the flooded area of the pasture and use of the upland pastures by Canada geese is increasing.

Manure application 2-3 times annually during the dry season is a common management practice on all refuge fields, as is application of commercial fertilizer on the non-organic fields. The required setback of fertilizer application from ditches is 20 feet. Because of the low elevation of the fields, water levels rise following periods of heavy rain, sometimes quite rapidly, and manure or fertilizer could be drawn into the ditches. The flooding period is generally during the winter months and the fertilizer/manure application is during the summer months; however, there may be potential negative impacts resulting from the use of manure and commercial fertilizer, both to the application area and by extension to the ditches and the bay. Steps to reduce possible contamination are utilized by fertilizing only during dry periods when the flood waters are not present. Also, fertilizer is spread during the summer months which provide time for the soil to soak up the fertilizer before the winter flooding period.

Climate change and sea level rise will be of increasing importance in setting management direction for all low-lying lands and waters within the Refuge. Pasture units of this Refuge, currently managed for wintering geese and other trust species, may be eventually inundated by increasing storm surge and sea level rise in the future.

Figure 4-2. Nestucca Bay National Wildlife Refuge lowland pasture units.



Data Sources: USFWS Refuge Boundaries from USFWS/R1, Imagery from 2009 NAIP

The back sides of maps are blank to improve readability.

4.3.5 Key Species Supported

The lowland pasture habitat is managed for the benefit of wintering Canada geese (e.g., western, Taverner's, lesser, cackling, dusky, Aleutian), dabbling ducks (e.g., American wigeon, northern pintail, mallard, green-winged teal), and other migratory birds (e.g., bald eagle, peregrine falcon, American kestrel). The lowland pastures are particularly important for six sub-species of Canada geese, specifically dusky and Aleutian Canada geese.

This is the only known wintering area for dusky Canada geese on the Oregon coast. Approximately 8-16% of the entire dusky Canada geese population is supported on an annual basis during the winter period (Stephensen and Horton 2011). See Section 4.9 for more detailed information.

The Aleutian Canada geese winter on lowland pastures at Nestucca Bay and their numbers have dramatically increased over the years as the population has recovered from its once endangered status (listed in 1967, delisted in 2001). Nestucca Bay is also extremely important to a genetically distinct group of geese known as the Semidi Islands Aleutian Canada geese. The most recent population estimate is approximately 150 individuals (USFWS unpublished data). These birds nest in an entirely separate area from the rest of the Aleutian Canada goose population. The Semidi Islands birds wintering at Nestucca Bay breed on Kiliktagik Island and Anowik Island within the group of Semidi Islands located approximately 100 miles southwest of Kodiak Island, Alaska while the rest of the Aleutian Canada geese nest in the western Aleutian Islands. The Semidi Islands birds use the pastures of the Semidi Tract and two adjacent privately owned dairy pastures during the day and roost offshore on Haystack Rock or on the ocean at night. Haystack Rock is part of the Oregon Islands National Wildlife Refuge.

Aquatic mammals such as marsh shrew, Oregon vole, nutria, beaver, mink, river otter, and raccoon are common in the marshes and wetter pastures. Black-tailed deer and occasionally Roosevelt elk graze the marsh and pasture grasses.

4.4 Upland Prairie and Mixed Upland Grasslands

Land survey records from the 1850s provide information only about the extent and general appearance of native upland prairies. Details about the structure and composition of native upland prairies, however, can be inferred by combining early accounts with observations of the few remaining native prairies (Wilson 1998).

Native upland prairies now cover much less than 1% of their former area, making them among the rarest of North American ecosystems (Wilson 1998). The only upland prairie habitat found on Nestucca Bay NWR is located on Cannery Hill which overlooks the Pacific Ocean and Nestucca River estuary at ~200 feet elevation. Historically, coastal prairie habitat was maintained by Native Americans, who utilized intermittent fires to prevent trees and shrubs from encroaching and shading low-growing food sources.

4.4.1 Description of Upland Coastal Prairie and Mixed Upland Grasslands

Upland coastal prairie includes sporadic pockets of forbs and grasslands that are usually absent of trees and shrubs. Seasonal seeps often hydrate the soil to saturation in winter and gradually dry out in summer. These areas are commonly impacted by wind and/or salt spray. Historically, most of the native plants of the upland coastal prairie were classified into one of two types of perennial grasses: bunch and sod-forming. Bunch grasses are extremely long lived and increase in size each year. They have an extensive root system that burrows deep into the soil and naturally prevents erosion. The parent plant produces and spreads an abundance of seeds. In contrast, the sod-forming grasses tend to propagate vegetatively and reproduce by sprouting from a root-like structure. The conversion of upland coastal prairie to agricultural land has created a suitable habitat for invasive annual grasses, and has become the single greatest threat to native perennial grasses (North Coast Explorer 2011).

Coastal prairies with a high native plant component are characterized by low growing bunch grasses such as gray red fescue, California oatgrass, California brome, and blue wildrye (IAE 2011). Other plants that are found in coastal prairie habitat include species that are important to the threatened Oregon silverspot butterfly such as early blue violet, Canada goldenrod, dune goldenrod, California aster, pearly everlasting, dune thistle, yarrow, tansy ragwort, and hairy cat's ear (USFWS 2001a). The desired condition of upland coastal prairie is characterized by the following attributes:

- 50% cover of native prairie species such as California oatgrass, red fescue, pearly everlasting, yarrow, and California aster maintained at a density of no fewer than five flowering stems/square meter
- Early blue violet in patches with densities of >20 plants/acre and at least 100 patches per acre
- Little to no thatch buildup
- <50% cover of introduced plant species
- <5% cover of other invasive plants (e.g., thistle, tansy ragwort)
- No encroaching woody species present
- No reed canarygrass
- 1-3% bare ground component

Mixed upland grasslands are also present on Cannery Hill. Cannery Hill grasslands were historically coastal prairie; however, early settlers of the area "improved" the forage for their grazing animals by planting a variety of non-native grasses which persist today. This habitat type is characterized by introduced pasture grasses such as creeping bentgrass, orchard grass, sweet vernal grass, and perennial ryegrass, with other species such as clover, lotus, and *Ranunculus* spp. Invasive species such as reed canarygrass, thistle, and tansy ragwort are also present. The mixed upland grasslands are characterized by the following attributes:

- Dominated by introduced pasture grasses
- <5% cover of reed canarygrass and other invasive plants (e.g., thistle, tansy ragwort)
- <5% cover of rank, residual plant cover
- No woody encroachment

4.4.2 Historic and Current Distribution

Approximately 44 acres of grasslands on the Cannery Hill area of Nestucca Bay NWR were historically coastal prairie, based upon historic maps (General Land Office maps and Coast Survey maps) dating from the mid- to late-1800s. At that time, coastal prairie in the southern Nestucca Bay area extended from the north end of Cannery Hill south to the current vicinity of Neskowin, but is now limited to the very small area on Cannery Hill that lies within the Refuge. Coastal prairie is an exceedingly rare, highly imperiled, and little-studied habitat type. Nearly the entire historic coastal prairie has been lost to residential and commercial development, forest encroachment or succession, or conversion for agricultural use. Early settlers planted a variety of non-native grasses to be used as forage for their grazing animals. Application of manure as fertilizer is also suspected of spreading non-native grasses.

4.4.3 Refuge-specific Sites

The Cannery Hill area of the Nestucca Bay National Wildlife Refuge contains 25 acres of unrestored or remnant upland coastal prairie and 14 acres of mixed upland grasslands (Figure 2-1). The Cannery Hill area currently supports primarily non-native pasture grasses, but also includes some native grasses and other remnant coastal prairie species, including red fescue and early blue violet.

The north end of Cannery Hill to the northwest of the Pacific View Trail and overlook contains meadow habitat with the highest native plant component. This 0.5-acre site is referred to in the Institute for Applied Ecology (IAE) management plan as “remnant prairie” although it is in need of enhancement. This south facing meadow contains early blue violet plants and also other natives in a matrix of non-native grasses. Dune thistle is present, as well as California oatgrass. There are small patches of invasive plants such as reed canarygrass and hairy cat’s ear in this area, and trees are encroaching from the north and east. This 0.5-acre remnant prairie area has the highest potential for federally threatened Oregon silverspot butterfly (see Section 4.10) establishment and highest potential management outcomes. Areas surrounding the 0.5-acre site have limited opportunities for enhancement due to encroaching trees and shrubs and the nearly complete dominance by invasive grasses. However, these adjacent areas are conducive to more intensive restoration practices and are the subject of a separate more comprehensive restoration effort with the remnant prairie area used as a reference site (IAE 2011).

4.4.4 Condition, Trends, and Threats

The few remaining upland prairies along the Oregon coast are being threatened by development, natural succession to shrub lands and forests, and invasion by non-native pest plants. Threats from development include urbanization and conversion of prairie to agriculture. Most native prairie plant species are unable to survive these changes.

The climate and soils of most coastal upland prairies can support forests (Franklin and Dyrness 1988). Natural succession to forest is occurring because the fires that keep the growth of trees and shrubs in check have stopped. Shrub and tree invasion is slow or episodic; however, non-native herbaceous weeds have invaded all native prairies, and except in a few cases, are more abundant that native plant species (Wilson 1996). An abundance of woody plants or herbaceous pest plants is harmful to upland prairies for several reasons. First, many of the non-native plants now in remnant prairies are taller than the natives. For example, the foliage of the pest plant tall-oatgrass tends to be 1½-3 times as tall as that of the native low growing bunchgrasses and other native plants (Wilson 1998). Most native plant species cannot tolerate the shade cast by these invading plants. Shading can be particularly severe from invasive shrubs, like Scotch broom and Himalayan blackberry, which can effectively eliminate native prairie structure and composition (Wilson 1994). Also, shading by pest plants makes it harder for insects to find food and ovipositioning plants. Competition of non-native plants for water and nutrients also depresses the growth of native plants. Lastly, non-native plants alter the horizontal structure of native prairie (Wilson 1998). Some aggressive invaders, like reed canarygrass, can spread vegetatively forming dense patches that exclude most native plants. Non-native annual grasses can establish in open spaces between bunchgrasses, eliminating microsites for native perennial plants. The elimination of fire has additional impacts on prairie physiognomy, besides allowing the invasion of shrubs and trees. Without fire, plant litter accumulates on the soil surface, which alters nutrient and water availability, disease and herbivory incidence, and patterns of seedling establishment (Facelli and Pickett 1991).

All upland prairies now also contain many non-native plants. Native species seem to coexist with invaders, such as orchard grass and Queen Anne’s lace, that are relatively slender and do not spread vegetatively. More of a problem is aggressive non-native pest plants, like tall rank reed canarygrass and tall-oatgrass, which form dense patches essentially devoid of native plant species. Nonnative annual grasses (e.g., soft brome, hedgehog dogtail grass, and medusahead) may also pose a threat to the native flora by usurping water and nutrients, although these species might be a symptom of degraded upland prairie rather than a cause (Wilson 1998).

Lack of disturbance and establishment of invasive grasses have altered the ecology of the Cannery Hill Unit. Specific threats include:

- Native plant succession: Native trees, such as Sitka spruce and Douglas-fir, have encroached into open habitat.
- Invasive plant establishment: Non-native shrubs, such as Himalayan blackberry, are encroaching along the margins of the prairie/grasslands. Reed canarygrass occupies large areas of the site and poses a threat to areas with native species.
- Non-native grass in meadows: Non-native grasses such as creeping bentgrass, orchardgrass, and sweet vernal grass have shaded violets and butterfly nectar species.
- Lack of active management to address invasive species and woody species encroachment is a long-term threat to the integrity of the site (IAE 2011).

4.4.5 Key Species Supported

Cannery Hill is located midway between two of the three known Oregon coastal sites (Mount Hebo and Cascade Head) occupied by the federally threatened Oregon silverspot butterfly (see Section 4.10). The Oregon silverspot butterfly declined as a species due to the degradation and loss of its coastal prairie habitat. The Oregon silverspot butterfly Recovery Plan (USFWS 2001a) states that delisting can be considered when certain conditions have been met, including establishment of viable populations in protected habitats; management of habitat to maintain native, early successional grassland communities with early blue violet abundance; a minimum of five native nectar species dispersed abundantly throughout the habitat and flowering throughout the entire flight period; and reduced abundances of invasive non-native plant species. Because of the similarity and proximity to the sites currently occupied by the butterfly, some portions of the Cannery Hill grasslands have potential for restoration or creation of both primary larval host plant and adult dispersal/nectaring habitats for the Oregon silverspot butterfly. The Oregon silverspot butterfly currently has not been observed or recorded on refuge lands, in part because the early blue violet, which is the obligatory plant host for the Oregon silverspot butterfly caterpillar, is present only on an extremely small area (several acres) to the northwest of the Pacific View Trail and Overlook.

Two Cross Program Recovery (an internal Service funding program) projects (2009 and 2010) created a limited amount of dispersal and nectaring habitat along the length of the Pacific View Trail by seeding and maintaining the four primary species of nectar plants along both sides of the trail. The Service has entered into a five year (2011-2015) agreement with the Institute for Applied Ecology (IAE) to utilize their technical expertise in the development and implementation of a restoration and adaptive management plan to restore currently degraded grassland to coastal prairie at Nestucca Bay

NWR. The goal is to accomplish a scientifically sound restoration of meadow dominated by non-native pasture grasses to native coastal grasses and forbs with an emphasis on the species and structure required for the Oregon silverspot butterfly. This project is expected to result in the establishment of suitable habitat for a potential experimental release of a threatened species which could contribute to its recovery.

The Oregon silverspot butterfly occupies four types of grassland habitats: marine terrace, coastal headland “salt spray” meadows, stabilized dunes, and montane grasslands. To support Oregon silverspot butterfly, each habitat area must provide both the caterpillar host plant and adult butterfly nectar sources. Early blue violets are the caterpillars’ primary host plant. Violet density influences the number and location of Oregon silverspot butterfly eggs laid, with areas of higher violet densities used most frequently for egg laying. Native nectar plants most frequently used by adult Oregon silverspot butterfly are Canada goldenrod, dune goldenrod California aster, pearly everlasting, dune thistle, and yarrow (IAE 2011).

4.5 Upland Forests

4.5.1 Description of Sitka Spruce–Western Hemlock Forest

Sitka spruce and western hemlock are the principal components of the Pacific Northwest coastal fog belt type or the Sitka spruce zone found along the Oregon and Washington coasts. The tremendous potential for rapid growth and high yield of the Sitka spruce-western hemlock type ranks it among the most productive coniferous types in the world (Smith et al. 1984).

This large-patch coniferous forest community is present on rich, fresh sites overlaying nutrient-rich bedrock types from coastal British Columbia, south to the Oregon central coast. These forests occur at elevations from 0 to 650 meters (0 to 2,132 feet). Soils are usually loamy to sandy and are most commonly classified as Ferro-Humic Podzols but are quite variable and range from Dystric Brunisols to Gleysols. Soils are usually derived from fluvial or colluvial materials but may also be morainal or organic materials. Soil nutrient regimes are usually mesic or subhygric (but range from submesic to hydric), and soil nutrient regimes are usually rich to very rich (NatureServe 2010).

The forest community has a moderately closed canopy, poorly developed shrub layer dominated by regenerating western hemlock, well-developed forb layer, and moderately well-developed moss layer with variable species composition. The moderately closed canopy is dominated by high cover of Sitka spruce and western hemlock, often with low to moderate cover of western red cedar, the latter more common in the north. The poorly developed shrub layer is dominated by moderate cover of regenerating western hemlock and low cover of red huckleberry and salmon berry. Low to moderate cover of false huckleberry, blueberry, or salal sometimes occurs in the shrub layer. The well-developed forb layer is typically dominated by western sword fern. The composition of the moderately developed moss layer varies with the moisture regimes with more feathermosses on drier sites and more leafy mosses on wetter sites (NatureServe 2010). The desired attributes of this forested habitat include:

- 30-95% (73% average) canopy cover of Sitka spruce and western hemlock with DBH >24-36"
- 25-95% (83% average) cover of a mosaic of native shrubs (e.g., salmonberry, huckleberry, salal), ferns, and herbaceous species in understory. Shrub height averages 3 meters (9.8 feet).

- 6/acre density of snags
- <5% cover of invasive plants (e.g., blackberry, Scotch broom)
- <1% cover English ivy

4.5.2 Historic and Current Distribution

Sitka spruce-western hemlock forests occur in the mountains of the Queen Charlotte Islands, the mountains and lowlands of western and northern Vancouver Island and along the outer coast and windward slopes of the Coast Mountains and Kitimat Ranges of British Columbia, at low elevations on the western Olympic Peninsula and western Willapa Hills of Washington, along a narrow outer coastal strip in northern and central Oregon, and just barely into the northwestern Cascade Range of Washington. It occurs on all slope positions on gentle to steep slopes on all aspects. At the south end of its range, it tends to occur more commonly on middle slopes (NatureServe 2010). Forests dominated by western hemlock and Sitka spruce hug the fog belt along the Oregon coast, seldom reaching more than a few miles inland or a few hundred feet above sea level. Both species are shade tolerant, but Sitka spruce is more resistant to salt spray. Sitka spruce sometimes grows in pure stands but is more commonly mixed with western hemlock, western red cedar, Douglas-fir, red alder, and lodgepole pine (commonly called shore pine along the coast).

4.5.3 Refuge-specific Sites

A forested buffer of Sitka spruce, western hemlock, red alder, and salal occurs along the eastern edge and to the north of Neskowin Marsh Unit. This forest type also occurs on Cannery Hill and in upland areas adjacent to the lowland pastures. A total of 214 acres of Sitka spruce-western hemlock forest are within the Nestucca Bay NWR (Figure 2-1).

4.5.4 Condition, Trends, and Threats

Sitka spruce-western hemlock forests are among the most productive in the world and have been extensively managed for timber production. Harvest of old-growth and mature forests for commercial timber and paper production has resulted in loss of species diversity and forest complexity on most of the landscape due to planting of even-aged, monotypic stands, and short harvest rotations.

Threats facing this habitat type include climate change, invasive species, and insect or disease infestation. Response to climate change will vary according to regional and local topography, forest type, soil moisture, productivity rates, species distribution and competition, and disturbance regimes.

Both Sitka spruce and western hemlock are species with shallow roots highly susceptible to windthrow. Natural disturbance is primarily windthrow resulting in small gaps and an all-aged stand structure. Forest regeneration is usually rapid and forest openings can quickly develop a dense canopy of young trees with sparse understory vegetation. Other small gaps may result from insect-caused mortality or root-rot.

Historically fire was a very rare occurrence, occurring approximately every 4,000 years on average (Lertzman et al. 2002). Human-induced wildfire is a potential catastrophic threat to forested habitats as well as fire suppression. Conversion of habitat to residential and non-forest uses has accelerated forest fragmentation. Introduced invasive plants (e.g., English ivy and holly) pose a significant threat to forested habitats on the Refuge. Potential insects or diseases that could affect the Refuge's forests include aphids, scale and bark beetles, root rot, leaf cast, and other fungi.

4.5.5 Key Species Supported

In late-successional or old-growth state, Sitka spruce-western hemlock forests provide both food and nesting habitat for a large variety of bird species. Many species of birds, such as great horned owl, northern saw-whet owl, northern flicker, pileated woodpecker, hairy woodpecker, Hammond's flycatcher, Steller's jay, common raven, chestnut-backed chickadee, red-breasted nuthatch, Pacific wren, and varied thrush, use the conifer forests because of the presence of other birds and rodents, bark and wood-boring insects, and conifer seeds. In addition, the litterfall of arboreal lichens and needles provides winter forage for black-tailed deer. Many species of amphibians occur because of the damp litter on the floor of mature forests. These include northwestern salamander, western red-backed salamander, ensatina salamander, clouded salamander, and western toad. The Pacific giant salamander and tailed frog both prefer steep cold mountain streams in old growth forests as breeding habitat, and damp litter on the forest floor to survive as metamorphosed adults; however, at least one Pacific giant salamander has been found on Cannery Hill (R. Lowe, personal communication).

4.6 Estuarine Habitats

One goal of the Refuge System is to conserve and restore, where appropriate, critical ecosystems and ecological processes characteristic of those ecosystems. One such critical ecosystem in the Pacific Northwest and elsewhere includes estuaries and the associated tidal wetlands. Tidal wetlands are of high ecological importance and are considered essential habitat for many marine and anadromous fish and migratory birds (Seliskar and Gallagher 1983). In Oregon's seventeen largest estuaries, tidal wetland acreage has declined considerably based on pre-European-settlement (pre-1850s) estimates. Fourteen of these estuaries have experienced tidal wetland decreases of 40 percent or more and Nestucca Bay has lost 91% of the historic tidal marsh and swamp that was present (Good 2000). Consequently, Federal, state, and local jurisdictions consider tidal wetlands a high priority for protection, enhancement and restoration, and many have established programs to conserve or restore this critical resource (e.g., ODFW 2006).

4.6.1 Description of Salt Marsh and Intertidal Mudflats

Salt marshes are vegetated lands flooded and exposed by estuary waters. Acting as a transition zone between aquatic and terrestrial sites, salt marshes are extremely valuable habitats. These marshes provide shoreline stability against wave and wind erosion, reduce flood peaks, trap nutrients, sediment, and pollutants. As one of the most productive ecosystems on earth, salt marshes are highly important to fish, wildlife, and society. Salt marshes provide food and nursery areas for numerous young fish, crabs, shrimp, clams, and other invertebrates when flooded (USFWS 1990). Plant communities indicative of a salt marsh or tidal wetland include Lyngby's sedge, seashore saltgrass, pickleweed, Pacific silverweed, and tufted hairgrass. These plant communities are often associated with unaltered estuarine tidal wetlands in Oregon (USFWS 2006). Desired conditions of salt marsh are characterized by the following attributes:

- Diverse elevations ranging from about 3 feet below MLLW to 9 feet above MLLW for tidal flats and tidal marshes. Hydrological flows are affected by high flows in the rivers and tidal cycles

- Low elevation is a mosaic of species including salt grass and pickleweed
- Upper elevation includes Lyngby's and slough sedge, tufted hairgrass, and Pacific silverweed
- Interspersed tidal channels of different orders with large woody debris component
- Completely submerged during high seasonal tidal cycles
- No Spartina

Intertidal mudflats are substrates flooded and exposed by tidal action and comprise the most extensive intertidal habitat within Nestucca Bay. Desired conditions of intertidal mudflats are characterized by the following attributes:

- Diverse elevations ranging from about 3 feet below MLLW to about 4 feet MLLW that is completely inundated during two daily tidal cycles
- Sandy/muddy substrate that is sparsely vegetated by wigeon grass and seasonal algae blooms
- Presence of large woody debris
- Presence of bio-film on muddy substrate
- No Japanese eelgrass
- No Spartina

4.6.2 Historic and Current Distribution

All coastal states contain salt marshes, which flourish near river mouths, in estuaries, and around lagoons in areas protected from battering ocean waves and storms. Along the Atlantic and Gulf coasts, salt marshes are widely dispersed and often sprawl over large areas. On the Pacific coast however, they are relatively small and sparsely distributed, accounting for only three percent of the nation's total acreage, and making them all the more valuable for their scarcity. In Oregon's seventeen largest estuaries, tidal wetland acreage has declined considerably based on pre-settlement estimates. Fourteen of these estuaries have experienced tidal wetland decreases of 40 percent or more (Good 2000). Brophy (2011) using Scranton (2004) and Hawes et al. (2008) estimated 16,173 acres of tidal marsh within the state in the 1850s and by 2005 80% of those acres were no longer tidal marsh.

Tidal marshes are not extensive in Nestucca Bay due to past diking activity and conversion to agriculture. Many of the diked pastures around Nestucca Bay are former salt marshes which have been cut off from tidal action by the construction of levees and drainage systems but then continue to function as freshwater seasonal wetlands. The former diked marshes at Nestucca Bay are intensively managed and maintained as pasture for dairy farms and provide important habitat for wildlife including Canada geese, ducks, shorebirds, and raptors.

4.6.3 Refuge-specific Sites

Brooten Marsh and the Little Nestucca Restoration Area contain a total of 208 acres of salt marsh (Figure 2-1). Brooten Marsh is located where the Nestucca and Little Nestucca Rivers join Nestucca Bay proper. The 82-acre Little Nestucca Restoration Area is located east of Highway 101 and south of Little Nestucca River Road along the north bank of the Little Nestucca River. The area restored to tidal marsh was formerly comprised of five private ownerships that were acquired by the Refuge. Historically the restoration area was tidal marsh which was diked and drained for agricultural use in the early 20th century. In the 1980s and 1990s farming of this area was discontinued by the owners and the area reverted to diked wetlands. A 10-foot-wide breach formed in the 3,450-foot-dike in 1996 while in private ownership, resulting in muted tidal influence and nascent natural restoration of the site. The restoration project re-established full tidal wetland values and functions on the 82 acres by removing the dikes, filling borrow and drainage ditches, and re-establishing former tidal channels (USFWS 2006).

Most of the mudflats within Nestucca Bay are not currently included within the Refuge and are owned by the State of Oregon. Brooten Marsh and the area near the Mouth of the Little Nestucca River contain 15 and 4 acres respectively of intertidal mudflats (Figure 2-1). A total of 19 acres of intertidal mudflats are protected for the benefit of migratory birds, salmonids, shellfish, and diverse assemblage of intertidal mudflat species.

4.6.4 Condition, Trends, and Threats

Diking, channeling, and filling of salt marshes have damaged and displaced many thousands of acres throughout coastal America. Wetlands were once extensive throughout much of the nation and were viewed as impediments to settlement, development, and progress. Even Federal lawmakers saw them as wastelands of no apparent value. The Swamplands Acts of 1849, 1859, and 1860 promoted the diking and draining of wetlands by offering free land to those willing to transform them into valuable dry land for agriculture and other purposes. All salt marshes in the Pacific Northwest have been altered to some extent, and most have been degraded or eliminated altogether. As much as 90 percent of these losses have been for agricultural development and consist of diking and draining of salt marshes to convert them to pastures and crop-growing fields. Since the l9th century, the natural functions of Oregon’s salt marshes have been overshadowed by their obvious value as dry land. Compared to other coastal states, Oregon had relatively small salt marshes to begin with, but even those have been drastically reduced or obliterated, not only for agricultural purposes, but also for urban, industrial, and port development. In Coos Bay and Tillamook Bay, for example, only about 15 percent of the original marshlands remain and at Nestucca Bay 9% remains. Early logging and lumber operations also directly and indirectly took their toll on Oregon’s coastal wetlands. With marshes fringing the shallow estuary shoreline areas, earliest port and industrial facilities included long piers extending over the marshes, well into the estuaries where water was deep enough to moor ships. Eventually, those marshes were filled with dry ballast from the ships, sawdust from the mills, and spoils from the dredges used to keep navigation channels open. Coastal wetlands were also turned into fields for raising hay and oats to feed the livestock used in nearby logging camps (Oberrecht 1997).

Brooten Marsh shows some unusual topographic and associated plant community patterns. This marsh is not totally undisturbed, as it has several human-made ditches on site. Their profiles show a deep central channel, carved by tidal flow, which meanders within a broader ditched area. Although the marsh has never been diked there is a straight-line fill area bordering an excavated ditch in the southern 1/3 of the marsh. This fill area corresponds with the location of a boardwalk that was built from the mainland to the edge of the marsh where a dock was located. The boardwalk and dock was used to delivery supplies to the adjacent Brooten Baths and Guest Facilities that operated in the 1920s and 1930s. The bay was much deeper at this time as ocean going vessels delivered supplies to this dock (Rissel and Noegell 2009). The majority of the Brooten Marsh is occupied by low marsh communities with pickleweed, seaside arrowgrass, and Lyngby’s sedge communities. The western third of the site has both low and high marsh communities with species such as fleshy jaumea and tufted hairgrass (Brophy 2002)

Tidal circulation at the Brooten Marsh is also unusual. Most undisturbed marsh sites rise in elevation from the tidal inlet to the upper, most dendritic tidal channels. The smallest upper channels are usually located amidst high marsh communities. At the Brooten Marsh, tidal circulation enters from the south and pools in a central low area, which is occupied by mudflat, Lyngby's sedge, and seaside arrowgrass communities. Just west of the low area, the elevation rises sharply to a natural levee. A large accumulation of drift logs against the natural levee shows that flood flows often back up here. These flood flows may come from the Little Nestucca River, which may flow into the site's center in a turbulent backwash as the Little Nestucca joins the Nestucca River. Flood flows probably also enter the site from the Nestucca mainstem, which may wash across the natural levee on the site's northwest corner and contribute to the topography of the site (Brophy 2002).

The Little Nestucca River Restoration Project restored approximately 82 acres of former wetland, created 3.6 acres of new wetland (levee and old Highway 101 removal), converted 1.7 acres of wetland to upland, and is contributing to ecosystem restoration in several ways. Wetland types which have declined significantly in Oregon and which were historically found at the site became reestablished. Wetland functional attributes, such as fish and wildlife habitat and floodplain function, were restored or enhanced through the project. These restoration benefits and purposes are consistent with the management goals of the Nestucca Bay NWR and the Oregon Department of State Lands General Authorization for Wetland Restoration and Enhancement (USFWS 2006).

The Little Nestucca Restoration Area was monitored before and after restoration activities. Juvenile salmonids responded positively to the removal of the dike, since juvenile salmonid use increased both in the context of marsh residence as well as during daily tidal migrations from the mainstem river into the marsh. There was less of a direct response by juvenile salmonids to engineered complex-large-wood-floating structures placed at the salt marsh mouths than to those single-large-wood-stationary structures placed more internally within the marsh. This may be a result of the immediate depth and velocity refugia created by the internally placed structures in comparison to the mouth structures. Anecdotal information suggests the mouth structures are increasing channel complexity and refugia but at a different scale and trajectory. Historic ditching that was not filled during restoration will likely remain an unnatural feature of the site's channel morphology for years to come. In addition, it is unclear how long those channels that were over-dug during restoration will take to reach elevation equilibrium. It is also not clear that this abnormally deep channel morphology will negatively impact juvenile salmonids, but it is likely to shift species composition toward age 0+ coho salmon at interior portions of this site. Anecdotal habitat observations also suggested seasonal water quality improved within the marsh.

An emerging field in estuarine restoration is the use of invertebrates to describe salt marsh condition or status. The Little Nestucca Restoration Area is in a dynamic state of change at this time. Sediments that built up during several decades of diking are now being scoured out by daily tidal flushing action. More recent historic anaerobic sediments are becoming more aerobic (van de Wetering, personal observation). Relative to benthic invertebrates, an attempt to examine those habitats that were restored with large wood added versus those that were not. Significant differences were found among sites for each metric explored; however, those differences did not appear to be related to restoration status. Species composition, including densities for amphipods (e.g., *Corophium* spp.) were comparable with samples from other marshes examined across the Pacific Northwest. Because the restoration actions are very new, we anticipate continued shifts in the next several years as channel morphology and plant communities work their way more toward a static condition (van de Wetering et al. 2009).

The presence of non-native nutria has been documented at Nestucca Bay NWR (USFWS unpublished observations). Native to South America, this semi-aquatic mammal is tolerant of mild coastal winters. This rodent is capable of extensive damage as a result of its foraging and burrowing behaviors, which adversely impact the root mass of wetland plants that holds the wetland together. In addition to direct habitat damage to salt marshes and competition with native species (e.g., muskrat, beaver), this large rodent is capable of transporting parasites and pathogens communicable to wildlife, domestic animals and humans (Sheffels and Sytsma 2007). The high reproductive rate of the animal is a concern, as one breeding pair can result in a population of more than 16,000 after only 3 years and if left unchecked the numbers are capable of increasing to tens of thousands within a 30 year period (Sheffels and Sytsma 2007, Chesapeake Bay Nutria Working Group 2003). See invasive species section for further descriptions.

4.6.5 Key Species Supported

The estuarine marshland supports migratory waterfowl and shorebirds, which in turn provide an important prey base for the recently delisted bald eagle and peregrine falcon. Both birds breed locally and are found year-round in the area. The Nestucca Bay watershed and riverine system provides important habitat for anadromous fish, including Chinook, chum, and threatened coho salmon (Oregon Coast ESU), Pacific lamprey, steelhead, and coastal cutthroat trout. Common marine fish species include Pacific staghorn, buffalo sculpin, shiner perch, and English sole (USFWS 2006).

Each type of mudflat (sand, mud, or gravel) has a slightly different plant and animal composition. Algae and diatoms are the principal plant types; vascular plants are rare or absent. Invertebrates such as snails, shrimp, clams, worms, and crabs are locally common or abundant. The most common and important non-fish species occupying the mudflats include Dungeness crab, softshell clams, Baltic clams, ghost shrimp, and mud shrimp. Great blue and herons, and shorebirds such as black-bellied plovers, killdeer, western and least sandpipers, dunlin, and short-billed and long-billed dowitchers make extensive use of the mudflats for foraging. Dabbling ducks, diving ducks, gulls, peregrine falcons and bald eagles also forage there. Harbor seals forage on the mudflats when they are inundated at high tide and in the lower bay they haul out on the flats and spit to rest (USFWS 1990).

4.7 Freshwater Habitats

On Nestucca Bay NWR, freshwater habitats are found exclusively on the Neskowin Marsh Unit. Prior to acquisition and inclusion in the Refuge, Neskowin Marsh was the largest unprotected freshwater marsh remaining on the Oregon Coast (USFWS 2000a). It is a rare and outstanding example of a coastal bog ecosystem with exceptional biological values. Habitats within the Neskowin Marsh Unit include freshwater marsh, bogs, forested wetlands, forested lagg, upland shrub and meadows, and adjacent forested uplands. In addition to the rare native plant communities, Neskowin Marsh supports a diversity of fish and wildlife species, including the federally listed coho salmon.

4.7.1 Description of Mesic Sitka Spruce-Skunk Cabbage Sedge Association (Forested Lagg), Coastal Bog, and Freshwater Emergent Wetland

Mesic Sitka Spruce-Skunk Cabbage Sedge Association is a forested lagg (or wetland) that forms a swamp-like moat around the outer edges of some bogs. The lagg's forest canopy is dominated by Sitka spruce, western hemlock, and red alder. Most of the shrub vegetation occurs on undrained peatland along with conspicuously stunted Sitka spruce and western hemlock. Shrub species include salal, thimbleberry, bracken fern, Nootka rose, sword fern, and black hawthorne (USFWS 2000a). The desired attributes of this forested lagg are the following:

- 60-100% canopy cover dominated by Sitka spruce and western hemlock, where 75% is Sitka spruce
- DBH of overstory trees is 50-118"
- >25% cover of a mosaic of native shrubs (e.g., salal), ferns, and herbaceous species (e.g., slough sedge, skunk cabbage) in understory
- 6/acre density of snags
- <5% cover of invasive plants (e.g., blackberry)
- No English ivy

Coastal bog or peat bog is a type of wetland where sphagnum moss grows on top of water. Peat is formed from dead sphagnum moss. Over time, layers of peat covered by sphagnum moss are formed several feet above the surface of the water. A high quality sphagnum bog interspersed with pools and ponds occurs within the undrained peatland. There are three types of bog within Neskowin Marsh, including sedge fen, shrub carr, and sphagnum bog. The sedge fen is distinguished from other bog habitats because of the neutral pH of the water, and is dominated by slough sedge and Sitka sedge. The shrub carr bog is dominated by western crabapple, Trapper's tea, and Hooker willow. The rare and diverse sphagnum bog has been developing over a period of at least several thousand years. It contains the largest known occurrence of acid-forming mire on the Oregon coast and supports the rare pohlia moss, which occurs on the tops of sphagnum hummocks (The Nature Conservancy 1998). The sphagnum bog is dominated by sphagnum moss, bog cranberry, round-leaved sundew, and various small ground cover plants (USFWS 2000a). The desired attributes of this coastal bog habitat are the following:

- Permanently flooded with 1-48" depths with mosaic of scattered open water areas
- Water quality is tannic (pH ranges from 4.8 to 6.2)
- Deep peat soils
- Presence of native shrubs (e.g., smooth Labrador tea or Trapper's tea) typically occurring in high acidic sites
- Presence of rare plants including russet cotton grass, native cranberry, and pohlia moss
- Presence of insectivorous sundew plant
- No swamp loosestrife, water lily, or English ivy
- <5% cover of other invasive plants (e.g., blackberry)

The freshwater marsh is a type of wetland that is associated with open standing water. Freshwater emergent wetlands consist of freshwater pools and ponds interspersed with emergent vegetation such as bulrush, giant bur-reed, Douglas spirea, and water parsley (USFWS 2000a). The desired attributes of freshwater, emergent wetland are the following:

- Permanently flooded with water depths ranging from saturated soils to 36" deep
- Scattered stands of native trees including Hooker willow,
- Mosaic of native emergents (e.g., giant burreed, hard-stem bulrush) with pockets of open water with submergent plants (e.g., pondweeds, coontail)
- No purple loosestrife or water lily
- <5% cover of reed canarygrass

4.7.2 Historic and Current Distribution

Based on hand core samples taken at several locations within the freshwater wetlands, Neskowin Marsh appears to have formed at least several thousand years ago when water began to pool behind a stable foredune developed along the beach, leading eventually to the well-developed marsh, peat bog, and forested wetland habitats present today (USFWS 2000a). The areas of open water within Neskowin Marsh are remnants of what was once a much larger lake system that has slowly filled by peat formation.

Three streams can be found within Neskowin Marsh: Meadow Creek, Butte Creek, and Hawk Creek. Meadow Creek originates in Neskowin Marsh and flows south of the marsh through the Neskowin Beach Golf Course, from where it flows into Butte Creek near the south end of the golf course. Hawk Creek flows west through the former Hawk Creek Golf Course, under Highway 101 where it empties into Butte Creek through the freshwater marsh, just south of the Neskowin Beach Golf Course. Much of Meadow Creek has been ditched in an attempt to drain the area. During 1912 and 1913, the southern end of the freshwater marsh was ditched, drained, and cleared in an attempt to grow cranberries commercially. This effort proved unsuccessful as a result of brackish water reaching the marsh during high tide events, killing the cranberries (Tillamook County 1981). The ditching can still be seen today on aerial photographs, although it is less obvious in the northern portion of the marsh.

4.7.3 Refuge-specific Sites

The Neskowin Marsh Unit of the Nestucca Bay National Wildlife Refuge contains 61 acres of mesic Sitka spruce-Skunk cabbage-slough sedge association, 70 acres of coastal bog habitats (shrub-carr, sphagnum, sedge fen), and 33 acres of freshwater, emergent wetlands (Figure 2-1).

A structurally diverse wetland known as a forested lagg occurs adjacent to the eastern edge of the bog habitats, between the bogs and the upland meadows and upland forest. The upland meadow habitat is located east of the forested lagg and continues to the north end of the marsh, and is dominated by a variety of grasses, slough sedge, and trailing blackberry. The marsh is bordered on the west by a small strip of woodland dominated by red alder and Sitka spruce, on the east by a larger area of alder/spruce forest, and on the north by rolling headlands covered with grass (USFWS 2004).

4.7.4 Condition, Trends, and Threats

Neskowin Marsh is a rare and outstanding example of a coastal bog ecosystem with exceptional biological value. Marsh, bog, forested wetlands, and upland meadows form a habitat complex important to a diverse and abundant group of plant and animal species. The marsh is a dynamic system that exhibits a natural pattern of habitat succession. Areas of open water are slowly being replaced by sphagnum bogs and forested wetlands, but the pace of habitat succession is highly variable, and is influenced by factors like flooding or draining, water quality, and sedimentation rates from adjacent uplands (USFWS 2000a). Tannins leaching from the thick peat layers below the marsh acidify the water and cause it to appear tea-colored.

The Oregon Coast continues to experience rapid growth in residential, resort, and recreational development. These developments can threaten the integrity of coastal ecosystems that support existing fish and wildlife populations. Some of this type of growth is occurring in and adjacent to the community of Neskowin, particularly on the north and east side of Neskowin Marsh. Without appropriate safeguards, further development around Neskowin Marsh could severely impact the unique habitat the area currently provides. The close proximity of houses to the marsh creates potential threats of contamination from sewage spills, septic system failures, fertilizer and pesticide runoff from yards. At least one failed septic system has been found discharging raw sewage on the surface of the ground which flowed toward the marsh.

A tsunami evacuation trail traverses the south end of the marsh near the north end of the Neskowin Beach Golf Course. The trail is located on a former roadbed that extended across the marsh linking Hawk Street with Cove Crest Drive. A small footbridge spans the Meadow Creek outlet channel of the marsh and serves as one of only a few tsunami escape routes for this low-lying community. The trail was in existence before establishment of the Neskowin Marsh Unit of the Refuge and acquisition of this parcel in 2002. This trail allows local residents in the nearby dunes to escape on foot to high ground in the Neskowin Crest area as well as passage to U.S. Highway 101 during a tsunami event. Because of this safety concern, the Refuge has kept this trail open for the community although it is not advertised to the general public. The old roadbed that the trail is located on may be restricting water flows and affecting the hydrology of the marsh and cause obstruction to fish passage. A hydrologic study is needed to determine the effects the old roadbed has on the marsh.

4.7.5 Key Species Supported

The complexity of marsh, forested wetlands, and adjacent upland woodlands found within the Neskowin Marsh Unit provide important habitat for neotropical migrant birds such as warblers, flycatchers, and thrushes. Waterfowl use the marsh throughout the winter and in the fall and spring migration periods. Species commonly observed include mallard, wood duck, American wigeon, northern pintail, green-winged teal, ring-necked duck, lesser scaup, and bufflehead. Both the mallard and wood duck are thought to breed there. A variety of other waterbirds using the marsh include great blue heron, green heron, Virginia rail, and sora. Mammals observed include black-tailed deer, Roosevelt elk, black bear, beaver and river otter. Anadromous fish, including Chinook salmon, threatened coho salmon, chum salmon, steelhead and coastal cutthroat trout use Neskowin Creek for spawning and rearing. Refuge biologists have documented substantial use of Neskowin Marsh by juvenile coho salmon and coastal cutthroat trout. Juvenile coho salmon may also use the marsh as off-channel overwintering habitat. In the spring, thousands of egg masses laid by amphibians appear in the marsh, indicating its importance as a breeding area for red-legged frogs and northwestern salamanders. The recently delisted peregrine falcon and bald eagle have nested in the vicinity and use the wetlands and surrounding upland habitat for foraging, and resting (USFWS 2004).

4.8 Forested Wetland and Stream-Riparian Habitat

4.8.1 Description of Wet-Mesic Sitka Spruce-Western Hemlock

For the purposes of this CCP, wet-mesic Sitka spruce-western hemlock forests are defined as woody habitats that consist of valley forested wetlands and riparian forest along rivers, salt marsh, or mudflats (e.g., National Vegetation Classification Standard *Tsuga heterophylla* - *Picea sitchensis*/*Lysichiton americanus* Hardwood-Conifer Rich Swamp Group, NatureServe 2012). Periodic freshwater tidal and/or seasonal riparian flooding are the major natural processes that drive this system. The disturbance regime is mostly small-scale windthrow or other gap mortality processes (though there are occasional widespread intense windstorms) and very few fires. Soils are perennially wet, usually with high organic content.

Historically, many of the areas located in the lower brackish (mesohaline to oligohaline) and freshwater tidal zones of Oregon's estuaries were likely Sitka spruce and/or shrub tidal swamp. Tidal swamps were also found on the margins of the marine salinity zone where freshwater dilutes ocean water, such as along tributary streams, on high natural levees, and in hillslope seepage zones. On higher quality, least-disturbed remnant tidal Sitka spruce swamp sites, this community has scattered to abundant Sitka spruce, often growing on islands such as downed timber and natural levees along deep well-defined tidal channels, and a mixed herbaceous-woody understory. The vegetation between forested islands or along waters' edges consists of typical high marsh or tidal freshwater wetland species like tufted hairgrass, creeping bentgrass, Pacific silverweed, Baltic rush, slough sedge, and western skunk cabbage as well as brackish-tolerant wetland shrubs such as red-osier dogwood, Nootka rose, dewberry, salmonberry, black twinberry, Pacific crabapple, and Hooker willow (Brophy 2002, NatureServe 2012). Non-wetland species such as salal and huckleberry can also be fairly abundant, growing on fallen logs or spruce root platforms elevated well over the hydric soil surface. Riparian red alder is also present and is important for its role in improvement of soil nutrient cycling and soil microbiology. Tree roots stabilize river banks and help prevent erosion. Alder also adds organic matter and nutrients to the river and keeps waters cool through shading. Cool water temperatures and cover are essential for fish spawning and survival (USFWS 1990).

The desired attributes of wet-mesic Sitka spruce-western hemlock forest (i.e., forested wetland and stream-riparian habitats) are the following (based on Brophy 2009, Brophy et al. 2011, Brophy and van de Wetering 2012, NatureServe 2012):

- Periodic freshwater tidal and/or seasonal riparian flooding
- Flat topography with local microrelief caused by logs, stumps, and buttressed roots of spruce trees.
- High organic content of soils (>20% organic matter)
- Woody vegetation dominated by native trees and shrubs (e.g., Sitka spruce, red alder, Hooker willow, Sitka willow, twinberry, Pacific crabapple). Dominant herbaceous species include slough sedge and skunk cabbage with non-wetland species (e.g., salal, huckleberry) growing on fallen logs or spruce root platforms.
- <5% cover of invasive plants (e.g., blackberry, gorse, Scotch broom)
- No English ivy

4.8.2 Historic and Current Distribution

Sitka spruce is commonly referred to as "tideland spruce" in historical documents due to its prominence in tideland areas of Oregon and Washington (Franklin and Dyrness 1988). Sitka spruce forms the canopy of the only major type of tidal forest in Oregon, the spruce tidal swamp. Tidal swamps were historically located in a narrow elevation band at the upslope margin of emergent tidal marsh. The spruce tidal swamp is now rare in Oregon, but it was once extensive in the Columbia and Tillamook estuaries, and probably other estuaries as well (Jefferson 1975). Estimates by Brophy (2011) using Scranton (2004) and Hawes et al. (2008) indicate a 90% loss of tidal swamp within Oregon's estuaries. It is likely that large portions of the Nestucca Bay area were once spruce tidal swamp, but like most of Oregon's tidal forest lands, these areas have probably been filled, diked, or cleared of trees (Brophy 2002).

4.8.3 Refuge-specific Sites

Nestucca Bay NWR contains 6 acres of wet-mesic Sitka spruce-western hemlock forest (Figure 2-1). Currently, these woody riparian habitats are located along Brooten Marsh and consist of a small narrow band of tree stands. Sitka spruce and western hemlock trees stands have invaded the diked area or levee next to the Middle Pastures. Although they are present within the low-elevation, alluvial floodplain, these stands are not remnants of historic tidal Sitka spruce swamp and function more like upland forests. Consequently, these small, linear stands are not considered wet-mesic Sitka spruce-western hemlock forest.

4.8.4 Condition, Trends, and Threats

In Oregon, the tidal wetland type that has been the most severely impacted by human alterations is tidal spruce swamp or "spruce tideland forest." This plant community is now very rare on the Oregon coast; in the Columbia estuary, over 90% of the former spruce tidal swamp is gone (Brophy 2002) and Nestucca Bay has experienced a 98% loss (Brophy 2010, USFWS unpublished data).

Sitka spruce and western hemlocks have shallow root systems and poor anchorage of trees results from this characteristic. This may be due to shallow soil underlain by bedrock, an impermeable layer near the soil surface, or a high water table, the latter being most common in spruce-hemlock forests. It is not known what amount of excess soil moisture damages the roots, or the duration of the damage, but it is clear that prolonged saturation will restrict rooting to the soil above the saturated layer. Under severe conditions, rooting will be restricted to the familiar flat plates seen on uprooted trees (Fraser and Gardiner 1967).

4.8.5 Key Species Supported

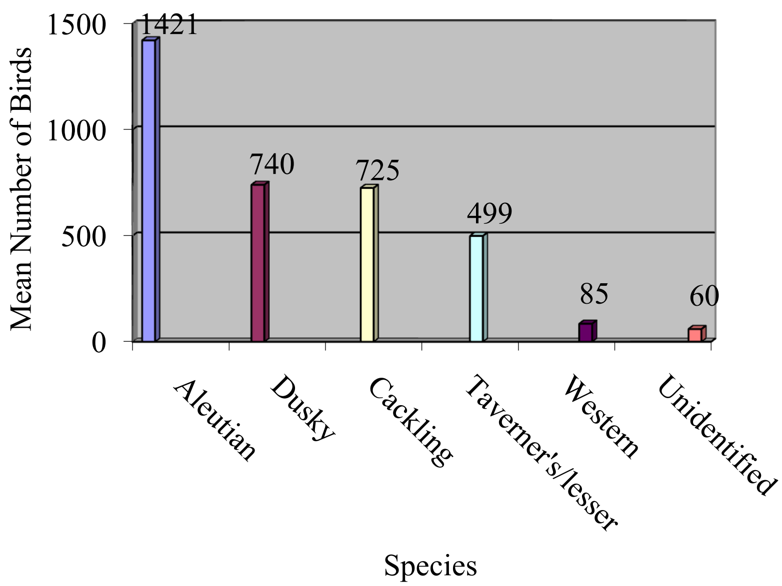
The riparian forest patches and the forested wetlands support Roosevelt elk and black-tailed deer and small mammals such as beaver, mink, river otter, muskrat, raccoon, deer mouse, and vagrant shrew. Many amphibians and reptiles such as long-toed salamander, rough-skinned newt, Pacific tree frog, and garter snake are also dependent upon these habitats. The forest areas are also home to typical forest passerine species in addition to those birds dependent on water edges such as green and great blue heron, belted kingfisher, wood duck, Pacific wren, and varied thrush (USFWS 2004).

4.9 Wintering Canada Geese

The majority of pasturelands at Nestucca Bay and in the Nestucca Valley is in private ownership and used to support local dairy farms. These pastures are also important habitat and highly desired by wintering and migrating geese as a food resource. The Service established the Nestucca Bay NWR specifically to provide a safe haven for Canada geese. The Refuge was established in 1991 to (1) protect wintering habitat for Aleutian Canada geese, federally listed as threatened at the time but now delisted, (2) protect wintering habitat for dusky Canada geese, a Federal species of concern, and (3) protect diverse coastal wetland and upland habitat buffers for a variety of waterfowl, shorebirds, marine mammals, raptors, songbirds, anadromous and resident fishes, and other wildlife, including endangered species (USFWS 2000a). In recognition of the importance of short grass habitats to geese and the mutual benefit of managing these pastures by local dairy farmers using standard dairy farming practices, 346 acres of refuge pastures are actively managed as pasture habitat for wintering geese (see Section 4.3). However, an increase in the number of wintering geese in Nestucca Bay over the years has caused serious depredation concerns among dairy farmers. Some farmers have since hazed geese from their lands to protect their forage crops. Local landowners have reported damage to newly planted pastures and loss of forage for dairy cows due to large flocks of geese foraging on the private pastures. Refuge pastures are managed to provide forage and sanctuary to geese and try to minimize depredation impacts on private land (Stephensen and Horton 2011).

Refuge personnel conduct Canada goose surveys and observations at Nestucca Bay throughout the wintering period to document distribution, abundance, and behavior. These surveys enable wildlife managers to assist in the management of Canada geese through monitoring of abundance and distribution, and determination of high use areas (Stephensen 2009, Stephensen 2010, Stephensen and Horton 2011). Refuge personnel conducted goose counts on 31 different days throughout the winter of 2010-11. The daily mean number of Aleutian, dusky, cackling, Taverner's/lesser, and western was 1,421, 740, 725, 499, and 85 birds respectively (Figure 4-3). Unidentified species had a daily mean of 60 individual birds. The largest concentrations of geese were found on Nestucca Bay National Wildlife Refuge properties and one other local farmer's property with a daily mean of 573 and 688 individual birds respectively (Stephensen and Horton 2011). The number of birds counted appears to be directly related to the total number of acres owned by each landowner and influenced by hazing intensity. Nestucca Bay National Wildlife Refuge and other high use local farm property have the most acreage in the survey area and birds are not hazed while foraging on these properties.

Figure 4-3. Daily mean number of individual Canada geese by subspecies at Nestucca Bay during winter 2010-11 (Stephensen and Horton 2011).



4.9.1 Description of Canada Geese

White-cheeked geese are classified as Canada geese and consist of eleven subspecies. Six of the eleven different Canada geese subspecies winter at Nestucca Bay. These subspecies include: western, dusky, lesser, Taverner's, Aleutian, and cackling.

Currently, there is debate to split Canada geese into two species groups, Canada and cackling. In July 2004, the American Ornithologists' Union's Committee (AOU) on Classification and Nomenclature split Canada geese into two species, making cackling geese into a full species with the scientific name *Branta hutchinsii*. However, USFWS continues to consider all previously recognized subspecies of the Canada goose (*Branta canadensis*) as one species. The USFWS choose to include the four subspecies AOU now considers cackling goose in the listing of Canada goose, rather than include them in a separate species (Federal Register Feb 05, 2010, Page 8).

The Canada geese vary in size and body plumage from light grey to dark brown. These geese have the typical black head and neck, white cheek patches, grayish brown back and wings, white rump, black tail feathers, legs, and feet. The black head and neck with white "chinstrap" distinguish Canada geese from all other geese species, with the exception of Barnacle Geese. This species is 76 to 110 centimeters (30 to 43 inch) long with a 127 to 180 centimeters (50 to 71 inch) wingspan. The male usually weighs 3.2 to 6.5 kilograms (7.1 to 14 lb.), and can be very aggressive in defending territory. The female looks virtually identical but is slightly lighter at 2.5 to 5.5 kilograms (5.5 to 12 lb.), generally 10% smaller than its male counterpart, and has a different honk. The life span in the wild of geese that survive to adulthood ranges from 10 to 24 years (Mowbray et al. 2002). The longest lived banded Canada goose recorded was 33 years 3 months according to the Bird Banding Laboratory longevity records of North American birds. This female goose was banded in 1969 in Ohio as an "after hatching year" bird and shot in Ontario, Canada, in 2001 (U.S. Geological Survey [USGS] 2011b). In July 1991, refuge personnel color banded (K63) a female Semidi Islands gosling and this individual was still being seen on Nestucca Bay Refuge as recently as January 2011, making it nearly 20 years old.

The Aleutian Canada goose is small subspecies of Canada geese averaging 1,700 to 2,100 grams (60 to 74 ounces). It is distinguished by a conspicuous white neck ring at the base of the neck that, in adult plumage, is usually greater than 10 millimeters (0.39 inch) wide and is subtended by a ring of darker feathers. The cheek patches are usually separated by a black line under the throat and the breast is a pale grayish-brown color, although a small number of lighter and darker breasted birds occur. The westernmost population did not appreciably differ in color, except that the neck ring was always very wide and white in the few attested specimens (Mowbray et al. 2002). Similar in appearance are the cackling Canada geese which are smaller in size and have a dark breast color with a purplish or brownish cast whereas Taverner's Canada geese are larger and have a lighter breast color. Both cackling and Taverner's sometimes have white neck rings but these are usually narrow or indistinct.

The dusky Canada goose is a medium-sized subspecies with a body mass of 2.7 to 3.9 kilograms (5.9 to 8.6 lb) during winter (Bromley 1981, Chapman 1970). The subspecies is characterized by dark plumage overall, with dark ventral feathers varying from rich brown (chestnut to near chocolate) to medium charcoal gray (Bellrose 1986, Chapman 1970). Although color of the wings and body varies considerably among individuals of a single subspecies, there are differences that further assist identification. For example, common traits such as size and color can be used to determine different geese subspecies. Listed are geese from largest to smallest: western, dusky, lesser, Taverner's, Aleutian, and cackling; and from dark to light (generally): dusky, cackling, Aleutian, lesser, Taverner's, and western.

4.9.2 Historic and Current Status

Nestucca Bay NWR, in part, was established to protect wintering habitat for dusky and Aleutian Canada geese (USFWS 1990). In this section, the focus is on only those two geese subspecies since they are a priority and specifically mentioned in the original Environmental Assessment and Land Protection Plan (USFWS 1993a).

Dusky Canada geese have experienced a drastic population decline since the 1964 Good Friday Earthquake in Alaska and are listed as a species of concern by the USFWS (PFC 2008). The 1964 earthquake caused vast expanses of land to rise 6 to 8 feet above sea level, uplifting the entire breeding range of this species. This change altered the hydrology and habitat depended upon by the dusky for breeding purposes. The annual aerial survey of dusky Canada geese at Copper River Delta and Middleton Island, Alaska, conducted in May 2011, estimated the total population at 11,800 birds and a 3-year running average of 9,346 birds (USFWS 2011a). Analysis of multi-year aerial survey indices and the derived population estimate strongly support a continued long-term decline in population size. This species breeds on the Copper River Delta, Alaska during the spring and summer, and winters in Oregon and Washington. The primary wintering area is the Willamette Valley and lower Columbia River; however, dusky Canada geese have been observed wintering at Nestucca Bay for more than three decades and the percentage of the population using Nestucca Bay has increased over time. Currently, Nestucca Bay NWR supports the largest coastal wintering concentration of dusky Canada geese totaling approximately 7.9 to 16.1% of the population in 2011 (Stephensen and Horton 2011). Some of these geese have been marked with plastic neck collars and leg bands to assist with conservation assessments and monitor movements.

Populations of Aleutian Canada geese declined early in the 20th century following the introduction of Arctic foxes to most of their nesting islands in Alaska (Bailey 1993). As a result, the USFWS listed the species as federally endangered in 1967. A formal recovery plan was initiated in the mid-1970s and efforts to re-establish the birds on their nesting islands were implemented, along with a ban on hunting and increased emphasis on identification and protection of important wintering habitat. The Aleutian Canada goose had recovered sufficiently to be reclassified as “Threatened” in 1990, and the subspecies was officially “delisted” in 2001 (USFWS 2001b) when recovery was considered complete. However, prior to delisting, the Pacific Flyway subcommittee for the Aleutian Canada goose developed a management plan (PFC 1999) that included specific conservation measures for the Semidi Islands sub-population. This remnant population of Aleutian Canada goose breeds on Kiliktagik and Anowik islands within the Semidi Islands Archipelago, Alaska, and spends the winter near Pacific City, Oregon (Hatch and Hatch 1983). Currently, the total breeding population of Semidi Islands geese is approximately 150 individuals (V. Byrd, personal communication). During July 2008, USFWS and Alaska Department of Fish and Game (ADF&G) biologists captured and marked 83 Semidi Islands Aleutian Canada geese on the breeding islands. Seventy-nine adults and four goslings were captured. Of the adults captured, 78 were marked with a green plastic neck collars with white numeric code, a red plastic leg band with white numeric code on one tarsus, and a numbered metal USGS band on the other tarsus. One adult received only the red plastic tarsal band and metal USGS band. Two goslings received both red plastic tarsal bands and metal USGS bands, and two goslings received metal USGS bands only. Prior to 2008, Semidi Islands Aleutian Canada geese were marked with red plastic neck collars and/or tarsal bands with a white numeric code, along with metal USGS tarsal bands (Byrd 2008). As a result, local movement and population monitoring of marked birds on the wintering grounds can be evaluated.

In 2007, after a suspension of two decades, goose hunting resumed in Tillamook County with the exception of a closed zone at Nestucca Bay to specifically protect dusky and Semidi Islands birds and to retain as many geese on refuge pastures as possible. On May 26, 2009, the Refuge acquired the 75.9-acre Semidi Tract near Pacific City, which is one of three sites that together support nearly 100% of the wintering Semidi Islands Aleutian Canada geese (Stephensen 2009, Stephensen 2010, Stephensen and Horton 2011). Monitoring of these geese would aid in evaluating the size and configuration of future hunting closure zones to determine if sufficient protection has been achieved.

Semidi Islands Aleutian Canada Geese Monitoring

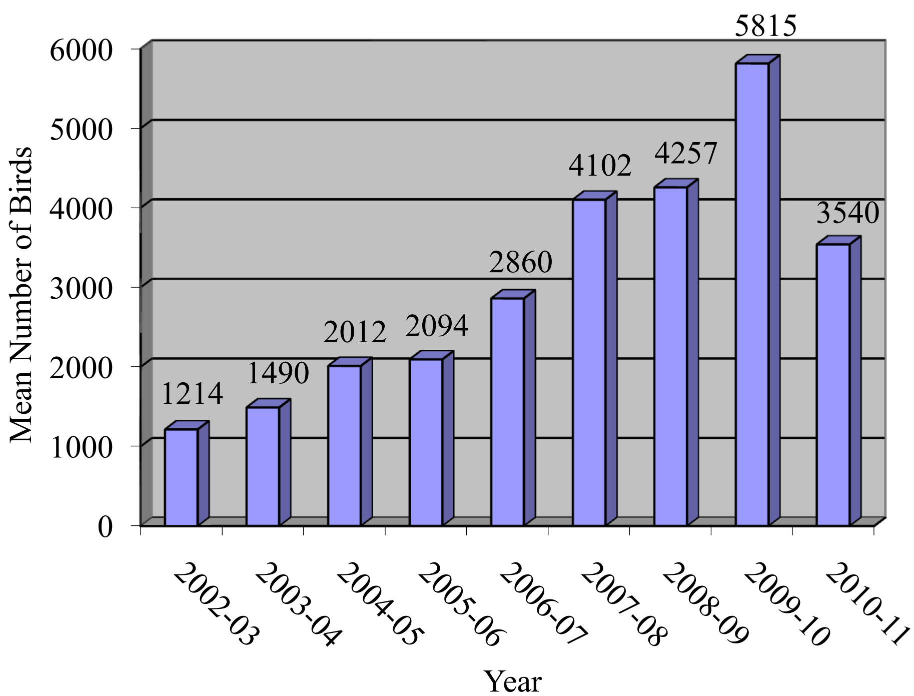
Semidi Islands Aleutian Canada geese marked with plastic neck collars and leg bands were the focus of a special monitoring effort conducted by refuge personnel. The birds were first discovered by biologists in Pacific City/Woods in 1980 (Hatch and Hatch 1983) and their population has been monitored annually since. Semidi Islands birds were marked with red plastic leg bands and metal legs bands in 1980, 1981, 1987, 1989, 1990, 1991, and 1995 (USFWS unpublished data). In 2001 Semidi birds were marked with red plastic neck collars for the first time along with plastic and metal leg bands. In 2001, 32 birds were marked with neck collars in the Semidi Islands and 31 survived migration and were observed at Nestucca Bay that fall and four of the birds were still observed at Nestucca Bay in 2012. During summer 2008, seventy-eight additional birds were marked with green plastic neck collar and plastic and metal leg bands. Semidi Islands Aleutian Canada geese monitoring efforts were concentrated on specific fields within the Nestucca Bay National Wildlife Refuge and adjacent private property near Pacific City and Woods, Oregon. Binoculars and spotting scope was used to aid in identification of alpha numeric collar and or leg band codes of the marked birds. Neck collar data were recorded. Fifty-one of the seventy-eight green-collared Semidi Islands Aleutian Canada geese marked during summer 2008 were resighted during the winter of 2010-2011. In addition, two of three birds marked with only red tarsal bands were also observed during the monitoring period. Together, these observations constitute a 65% resighting rate of the 2008 marked birds. Eleven fewer marked birds were observed in 2010-2011 compared to 2009-2010. An additional 12 Semidi Islands Aleutian Canada geese marked prior to 2008 with red collars or leg bands were also resighted. During 2008-2009, we observed 78 of the 81 marked birds (96% resighting rate) and during 2009-2010 we observed 64 marked birds (79% resighting rate) (Stephensen 2009, Stephensen 2010, Stephensen and Horton 2011). These monitoring efforts confirm that the Semidi Islands Aleutian Canada geese spend most of their time during the winter primarily on the Nestucca Bay NWR and adjacent private pastures along the Nestucca River in Pacific City and Woods.

The Pacific Flyway Council proposed to continue to provide special management consideration to that segment of the Aleutian goose population that breeds in the Semidi Islands and winters along the Oregon coast (PFC 1999, PFC 2006). Specific recommended management actions include: (1) Protect and manage breeding, migration, and wintering habitats; (2) Depredation management; (3) Conduct annual winter population inventories; (4) Marking and banding efforts; (5) Harvest management; and (6) Conduct research to determine factors that limit population increase (PFC 1999).

Geese Population Trends

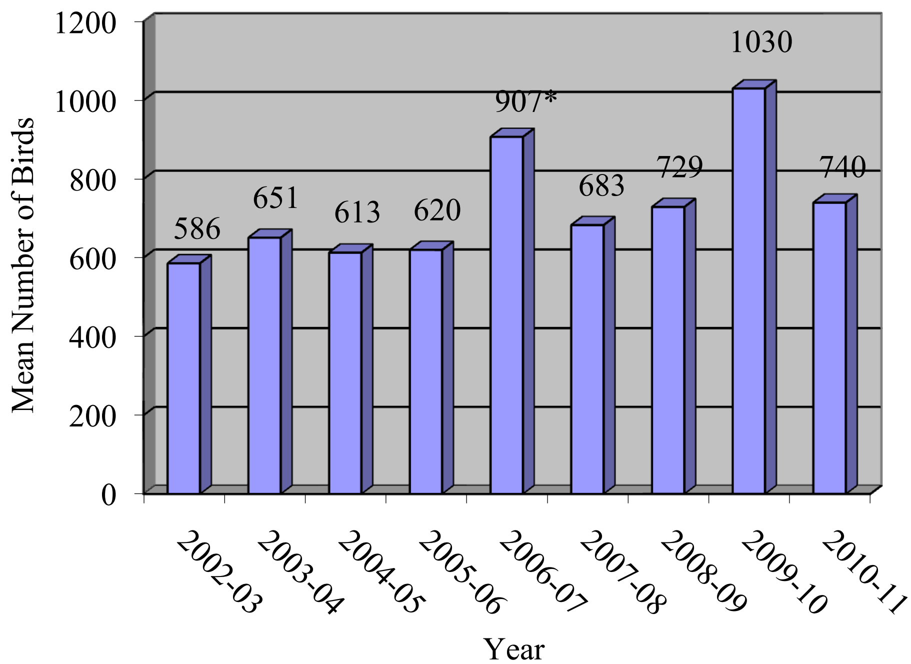
The number of geese observed in the Nestucca Bay area has steadily increased since 2002 with a slight decline in 2010-2011 (Figure 4-4). A comparison of the daily mean number of individual Canada geese counted each year show an overall increase of 1,214 birds in 2002-2003 to 3,540 birds in 2010-2011. Nearly three times as many birds were present during winter 2010-2011 compared to 2002-2003. During the 2009-2010 wintering period, pastures within the Nestucca Bay NWR consistently had large flocks of geese grazing on pasture grasses and other vegetation. This was the first year that the largest concentration of geese was found on refuge property (Stephensen 2010). This may be in part due to the recent addition of newly acquired properties into the Refuge System. In addition, since the early 1990s refuge personnel have worked with local dairy farmers to implement short grass management strategies and plant forage grass species on refuge lands. Management of pastures on the Refuge for the benefit of wintering geese is conducted by local dairy farmers under Cooperative Land Management Agreements. The management objective is to attract and hold more geese on refuge pastures and lessen depredation impacts to private dairy farms around Nestucca Bay. Hazing of geese on private lands may also be driving more geese to the Refuge.

Figure 4-4. Yearly comparison of daily mean number of individual Canada geese (all species combined) at Nestucca Bay.



The mean daily count (740 individuals) of dusky Canada geese at Nestucca Bay during the 2010-2011 winter period constitutes 7.9% of the entire population, and the peak count of 1,505 birds on January 12, 2011, constitutes 16.1% of the entire population (Stephensen and Horton 2011, USFWS 2011a). During winter 2008-2009 we documented a peak count of 1,290 birds, which resulted in 18.3% of the entire population (Stephensen 2009). This indicates that Nestucca Bay NWR is a very important wintering area for this species. In addition, the number of dusky Canada geese using the area has an overall increasing trend since geese monitoring efforts were initiated in 1985 (Figure 4-5) (Stephensen 2009, Stephensen 2010, Stephensen and Horton 2011, USFWS unpublished data).

Figure 4-5. Yearly comparison of daily mean number of individual dusky Canada geese at Nestucca Bay. *Incomplete data set (two observations).



Canada goose census and monitoring efforts conducted during each winter confirm the importance of the Nestucca Bay as a wintering area for six geese subspecies. Over 9,000 geese were observed on several occasions on Nestucca Bay pastureland during a one-day sample period in 2010 and over 6,000 in 2011. The winter population of geese at Nestucca Bay increased each year until 2010-2011 where a slight decline, in comparison to 2009-2010, was reported (Stephensen and Horton 2011). Cooperative efforts between USFWS, ODFW, and private landowners to protect these wintering areas, while preventing excessive depredation of privately owned pastureland, are critical to sustaining viable geese populations and healthy relationships between private landowners and managing agencies.

4.9.3 Key Habitats Used

The lowland pastures within the Nestucca Bay Unit are managed intensively for and used by all six sub-species of Canada geese during October to April. Geese utilize both private and refuge pasturelands. Occasionally flocks are observed on the ocean, ocean islands or beaches, Little Nestucca Restoration Area, and Nestucca Bay proper; however, the highest use areas are the lowland pastures. Geese, particularly Semidi Islands birds and duskys, have utilized Haystack Rock as an overnight roosting site in the past. Haystack Rock is an offshore island near Pacific City and is part of the Oregon Islands National Wildlife Refuge. Biologists have observed geese on the island and flying to and from the mainland at dawn and dusk. Birds have also been observed roosting on the ocean near Haystack Rock (Lowe, personal observation).

4.10 Oregon Silverspot Butterfly

4.10.1 Description of Oregon Silverspot Butterfly

The Oregon silverspot butterfly is a small, darkly marked coastal subspecies of the species *Zerene fritillary*, a widespread butterfly species in montane western North America. Coloration is orange and brown with black veins and spots on the dorsal (upper) wing surface, and a yellowish submarginal band and bright metallic silver spots on the ventral (under-side) wing surface. The Oregon silverspot butterfly, a true fritillary of the family *Nymphalidae*, is one of eight species and 36 subspecies of the genus *Speyeria* found in the Pacific Northwest (USFWS 2001a). The Oregon silverspot butterfly is one of five subspecies in the *bremnerii* group, which differs from other subspecies in its coloration, dark reddish brown disc color and clear yellow submarginal band, and small size. These are morphological adaptions for survival in a persistently windy and foggy environment. The forewing length averages about 27 millimeters (1 inch) for males and 29 millimeters (1.1 inch) for females. *Hydaspe fritillary*, a related species found in adjacent habitats can be distinguished by the cream, rather than silver, colored spots of the ventral wing surface (USFWS 2011b). Caterpillar development rate is very slow in comparison to the other subspecies. The species is named for the metallic silver spots located on the ventral hindwing.

The life history of the Oregon silverspot revolves around its obligatory host plant, the early blue violet. Females oviposit up to 200+ eggs singly amongst the salt-spray meadow vegetation near the violet host plant, usually in late August and early September. Sites with good sun exposure are favored. The eggs hatch in approximately 16 days and the newly hatched larvae wander short distances to find a suitable site for diapause (suspended growth for overwintering). The larvae end diapause sometime in early spring and begin to feed on the violet leaves. As the larvae grow, they pass through five molts (shed outer covering) before they enter the intermediate stage between larval and adult forms (pupate). Approximately two or more weeks later, the butterflies emerge from their pupal case (eclose). Adult emergence starts in July and extends into September. Shortly thereafter, their wings and other body parts harden and they escape the windy, cool meadows for nearby forests or brush lands (USFWS 2011b).

Mating occurs through August and September. Those individuals (male and female) that are most efficient at basking and maintaining proper body temperature would be able to operate longer and deeper in the windy meadow zone, thus improving their opportunities for successful reproduction (USFWS 2011b).

An Oregon silverspot butterfly captive-rearing program began in 1999 to raise caterpillars for release into declining populations. The Oregon Zoo in Portland, Oregon and the Woodland Park Zoo in Seattle, Washington receive a small number of wild female Oregon silverspot butterflies each year. Each of these females may lay hundreds of eggs which quickly hatch into tiny first instar caterpillars. The zoos care for the caterpillars throughout their development, overwintering them in their diapause state in cool refrigerators, and feeding them violets during the spring and summer until they become pupae. The pupae are then released into areas with declining populations. These population augmentations or reintroductions are a last resort to prevent further population extinctions. Multiple years of releases are needed to successfully stabilize the declining populations but the augmentation appears to be a promising species recovery tool.

An objective of the USFWS is to establish one or more healthy, sustainable populations of the Oregon silverspot butterfly within upland prairie habitat on Cannery Hill at Nestucca Bay NWR. A sustainable population is characterized by the following attributes:

- Minimum viable population of 200 to 500 butterflies for at least 10 years
- Located in permanently protected habitat within an identified habitat conservation area.
- Located in habitat that is managed to maintain at least 3 percent early blue violet cover, multiple nectar sources flowering throughout the butterfly's flight period, and minimal presence of invasive and competitive plants.

4.10.2 Historic and Current Distribution

The historical range of the Oregon silverspot butterfly extends from the Long Beach Peninsula, Pacific County, Washington, south to Del Norte County, California. At least 20 separate locations were known to support Oregon silverspot butterflies in the past. All of these populations were restricted to the immediate coast, centered around salt-spray meadows, or within a few miles of the coastline in similar meadow-type habitat (USFWS 2001a). Within its historical range, the butterfly is known to have been extirpated from at least 11 colonies (2 in Washington, 8 in Oregon, and 1 in California). Oregon silverspot butterflies are likely now extirpated from Long Beach Peninsula in Washington.

The USFWS listed the Oregon silverspot butterfly as threatened species with critical habitat in 1980 (U.S. Department of the Interior [USDI] 1980). At the time of listing, the only viable population known was at Rock Creek-Big Creek (near Yachats, OR) on the Siuslaw National Forest in Lane County, Oregon. Additional populations were since discovered at Mount Hebo, Cascade Head, Bray Point, and Clatsop Plains in Oregon, on the Long Beach Peninsula in Washington, and in Del Norte County in California (USFWS 2001a).

Oregon silverspot butterfly populations are currently thought to occur at only six sites. Two populations are in Lane County, Oregon (Rock Creek and Bray Point), two are in Tillamook County, Oregon (Cascade Head and Mount Hebo), and one is in Del Norte County, California (Lake Earl). The population status at a sixth site in Clatsop County, Oregon (Clatsop Plains) is not known with the last confirmed Oregon silverspot butterfly sighting documented in 1998 (Van Buskirk 1998).

Oregon silverspot butterflies are not currently present within the Nestucca Bay NWR; however, efforts have been ongoing to enhance and manage the upland meadows that the butterflies utilize along the coast. A project has been initiated at the Cannery Hill Unit to enhance habitat suitable for eventual Oregon silverspot butterfly reintroduction. Cannery Hill is located midway between two of the three known Oregon coastal sites (Mount Hebo and Cascade Head) occupied by the species. Since Oregon silverspot butterfly adults may travel relatively long distances for nectar, it is highly probable that the adults currently using Mount Hebo and Cascade Head locations would find the planted nectar sources on Cannery Hill. Also, a captive rearing program has been initiated to produce an experimental population of Oregon silverspot butterfly. An experimental population could be released at Cannery Hill after the habitat has been adequately enhanced.

4.10.3 Condition, Trends, and Threats

Coastal Tillamook County is home to one of four remaining populations of Oregon silverspot butterfly. This species is now in danger of extinction due to habitat loss. This butterfly is specifically adapted to the relatively harsh, coastal habitat characterized by salt spray, fog, persistent and cool winds, and poor soils. Three of the four remaining Oregon populations are currently experiencing marked declines and current efforts to enhance these populations are meeting with limited success. This species has been designated as recovery priority 3 by the USFWS, indicating both a high degree of threat to the persistence of extant populations but also a high recovery potential.

From 1990-2007, The Nature Conservancy used standardized butterfly survey methods (Pollard 1977) at four of the Oregon silverspot butterfly sites on the Oregon central coast to monitor the populations. The survey results produced an Index of Abundance value which provides a relative population measure year by year. In 1993, all four central Oregon coast populations declined dramatically, likely due to unfavorable weather conditions that year. In 2004, another detrimental weather year, all central coast sites had index values significantly below their 15-year mean (Pickering 2008, Patterson 2010). Augmentation efforts 2000-2009 were conducted at Cascade Head, and/or Bray Point and Rock Creek to stabilize the population levels and prevent the extirpation of these vulnerable populations. Year-to-year population fluctuations make it difficult to determine the effectiveness of the augmentation efforts. The Cascade Head Oregon silverspot butterfly population may be increasing in response to the release of captive-reared pupae through multiple years of augmentations. Monitoring is needed to confirm a positive population response.

The status of the Clatsop Plains Oregon silverspot butterfly population is not known. The last confirmed sighting of an Oregon silverspot butterfly on the Clatsop Plains was in 1998, with one confirmed and two potential observations (Van Buskirk 1998). Despite subsequent surveys, no Oregon silverspot butterflies have been confirmed on the Clatsop Plains since that time (Patterson 2005). The area is highly fragmented, degraded from invasive non-native species, and is difficult for surveyors to access due to landownership issues. These factors have limited the scope and methodology of Oregon silverspot butterfly surveys at this site.

The Lake Earl, Del Norte County, California Oregon silverspot butterfly population appears to be increasing or stabilizing in recent years without augmentations or habitat management. In 1998, California Department of Fish and Game estimated that there were 62 individuals on California state-owned land. In 2003, 81 butterflies were observed (Wright 2003). Since 2005, standardized surveys have provided an index of abundance value for year-to-year comparisons (Table 4-1, Figure 4-6). Between 2005 and 2008 the index values nearly doubled in 3 consecutive years, from 104 in 2005 to 883 in 2008. The 2009 value was 728, making it the second largest wild Oregon silverspot butterfly population (G. Falxa, personal communication).

Table 4-1. Oregon Silverspot Butterfly Index of Abundance Counts 2000-2010 (Pickering 2010, Patterson 2010, USFWS 2010c)

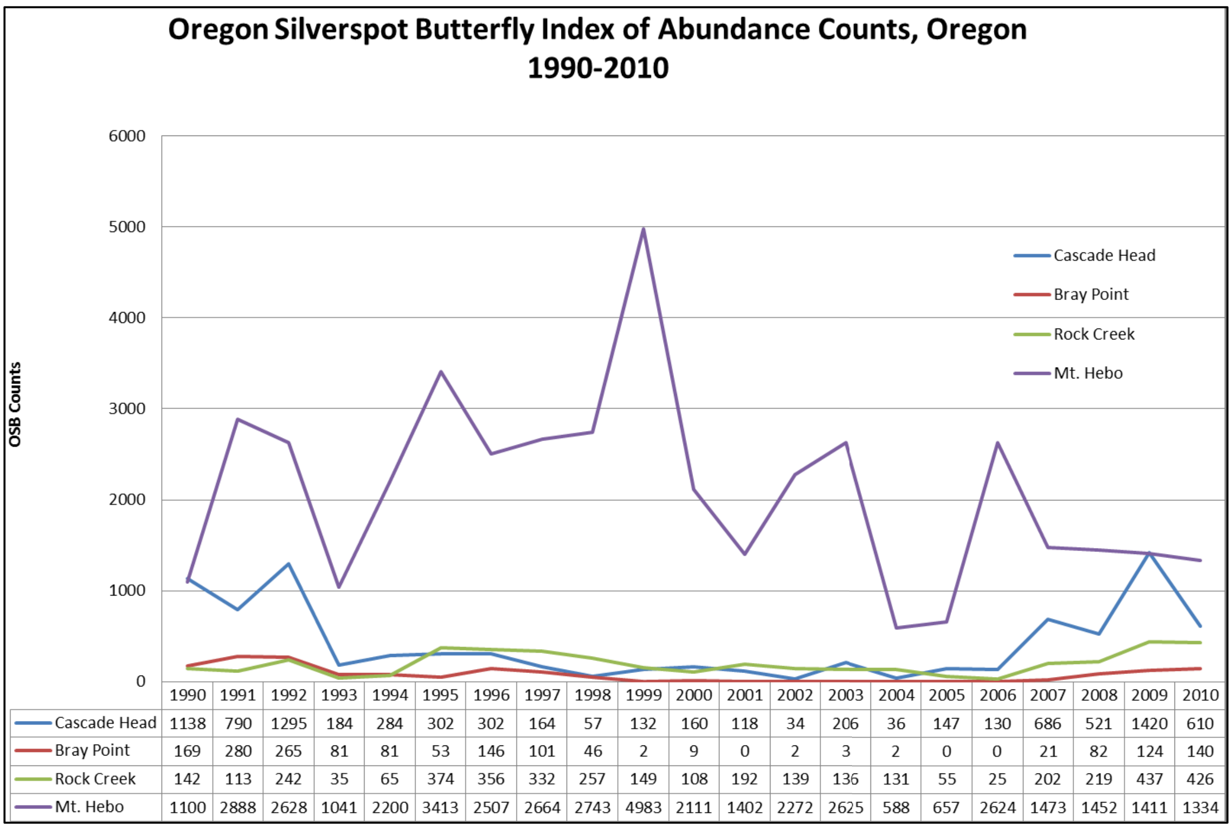
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Mount Hebo	2,111	1,402	2,272	2,625	588	657	2,624	1,473	1,452	1,411	1,334
Cascade Head	160 (107)	118	34	206 (161)	36	147 (132)	130 (26)	686 (560)	521 (537)	1,420 (1,209 + 10 A)	610 (1,017 P + 6 A)

Table 4-1. Oregon Silverspot Butterfly Index of Abundance Counts 2000-2010 (Pickering 2010, Patterson 2010, USFWS 2010c)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Bray Point	9	0	2	3	2 (5)	0	0	21 (123)	82 (300)	124 (1,182 + 31 A +7 L)	140 (1,350 P + 11 L + 6 A)
Rock Creek	108	192	139	136	131 (47)	55	25	202 (153)	219 (199)	437 (813 L+ 21 A)	426 (665 L)
Del Norte						104	196	481	883	728	355
Totals	**2,388**	**1,712**	**2,447**	**2,971**	**757**	**859**	**2,975**	**3,284**	**3,157**	**4,120**	**2,865**

Numbers in parenthesis are the number of augmented pupae that survived and were released as butterflies (P), plus released larvae (L) or adults (A). These butterflies would have been included in the index counts if observed.

Figure 4-6. Oregon silverspot butterfly index of abundance counts, Oregon 1990-2010 (Pickering 2010, Patterson 2010, USFWS 2010c).



Range wide, the greatest threat to the Oregon silverspot butterfly populations include factors that contribute to the loss of quality and quantity of suitable habitat. The quality of habitat has been degraded from native grasslands to non-native dominated grasslands or thickets of woody shrubs and trees. The introduction and spread of exotic vegetation, such as Scotch broom, and a variety of tall exotic grasses, many introduced for and maintained as lawns, have stabilized the dynamic processes of the coastal environment necessary to maintain the native plant community composition and structure (Lesh et al. 2003). The quantity of Oregon silverspot butterfly habitat is threatened by habitat degradation and urban and commercial development. Urban development in native grasslands results in ground-disturbing activities, which destroy or alter the native vegetation community and fragment remaining habitat patches (USFWS 2001a). Habitat fragmentation continues to threaten Oregon silverspot butterfly by isolating populations, inhibiting recruitment, and increasing the likelihood of genetic problems such as inbreeding depression (Pickering 2005). U.S. Highway 101, which cuts through Oregon silverspot butterfly habitat in some areas, has contributed to habitat fragmentation and may directly impact butterflies from road kills.

The major limiting factors affecting this species are related primarily to the dearth of suitable habitat. The highly specialized salt-spray meadow habitat within the geographical range for the Oregon silverspot was never common. This early seral community has always had a patchy distribution, occurring only where fire, salt-laden winds, or other natural or human-related occurrences (e.g., grazing, controlled burning) have maintained an open meadow. Evidence suggests that such habitat was more extensive in the past than it is today. Historical accounts show the butterfly and its habitat as locally common within its range. However, good habitat has steadily been used for residential and business establishments, public parkland development, and parking areas or lawns. Excessive use of the salt-spray meadows by grazing animals or off-road vehicles has directly eliminated habitat. Secondary impacts of people's activities, introduction of exotic plants, and fire suppression with subsequent succession of meadows to brush and stunted woodland have also contributed to a reduction in suitable habitat (USFWS 2011b).

The coastal prairie habitat on which the Oregon silverspot butterfly is dependent would quickly become scrub, brush, or forest land if left unmanaged. Natural processes such as wildfires and wildlife grazing likely functioned to maintain open grasslands in the past. Today the habitat must be actively managed to maintain a grassland structure. Mowing, burning, and the planting of native plants are current habitat management strategies. Habitat destruction is unquestionably the reason for the threatened status of this butterfly today. It should be noted, however, that as colony size is reduced by habitat loss, restricted genetic variability and/or catastrophic events can ultimately cause the extinction of these small populations.

Climatic fluctuations are another threat to Oregon silverspot butterfly populations, especially cold wet springs and summers. Heavy mortality of eggs and larvae can occur as a result. While viable populations would generally rebound provided good conditions, a small population size is particularly vulnerable to loss and extinction from otherwise natural mortality factors (Hellmann 2002). Dry summers may also affect population levels (Patterson 2005). These effects may become more problematic as a result of long-term climate change. However, long-term climate change cannot be adequately predicted at the scale necessary to determine the effects on the Oregon silverspot butterfly.

4.10.4 Key Habitats Used

The Oregon silverspot occupies three types of grassland habitat. One type consists of marine terrace and coastal headland salt-spray meadows (e.g., Cascade Head, Bray Point Rock Creek-Big Creek and portions of Del Norte sites). The second consists of stabilized dunes as found at the Long Beach Peninsula, Clatsop Plains, and the remainder of Del Norte. Both of these habitats are strongly influenced by proximity to the ocean, mild temperatures, high rainfall, and persistent fog. The third habitat type consists of montane grasslands found on Mount Hebo and Fairview Mountains.

Conditions at these sites include colder temperatures, significant snow accumulations, less coastal fog, and no salt spray (USFWS 2011b).

The butterflies prefer south facing slopes that provide solar exposure and protection from coastal winds. Oregon silverspot butterflies lay their eggs in sites with early blue violet a food source for the butterfly’s caterpillars. Adult butterflies primarily nectar on native aster species such as Canada goldenrod, dune goldenrod, California aster, pearly everlasting, dune thistle, and yarrow. The butterflies also utilize non-native asters such as tansy ragwort and hairy cat’s ear (USFWS 2001a).

The most important feature of the habitat of the Oregon silverspot is the presence of the early blue violet. This plant is normally the only species on which the Oregon silverspot can successfully feed and develop as larva. However, in the laboratory setting the butterflies accept other species of violets, and there is evidence that some individuals on Mount Hebo are using another species of violet. This plant is part of the salt-spray meadow vegetation and is an obligatory component of the butterfly’s habitat. Other features of optimum habitat include moderate grass cover, including red fescue used as a shelter for larvae, and a mixture of herbaceous plants such as California aster used for nectaring by adults. Apparently the more inland meadow sites occupied by related subspecies of silverspots are not accessible to Oregon silverspots. The habitat is similar on Mount Hebo with early blue violet as the key component. The distribution and composition of the flora may differ slightly, but the habitat functions similarly to the salt-spray meadow. The shallow soil apparently helps to keep this area in the meadow stage (USFWS 2011b).

Although the salt-spray meadow is the nursery area for the butterfly and a key element of this species' habitat, it is a rather harsh environment for the adults. Upon eclosion (metamorphosis of the pupa into the adult butterfly), the adults generally move out of the meadows into the fringe of conifers or brush where there is shelter for more efficient heat conservation and nectaring flights. The forest shelter may also be used for courtship and mating. Where such sheltered conditions exist, the adults use various nectar sources, including native and exotic plants, particularly composites such as the native California aster, yarrow, and Indian thistle and some exotics such as hairy cat’s ear and tansy ragwort (USFWS 2011b).

4.10.5 Refuge-specific Sites

The Oregon silverspot butterfly is not currently found on refuge lands, in part because the early blue violet, which is the obligatory plant host for the caterpillar, is present only on an extremely small area on Cannery Hill to the northwest of the Pacific View Trail and Overlook. The existing violet plants on refuge lands were thought to be too widely dispersed to be successfully used by larva. Since Oregon silverspot butterfly adults may travel relatively long distances for nectar, it is possible that the adults currently using Mount Hebo and Cascade locations would find the planted nectar sources on Cannery Hill.

Some portions of the Cannery Hill grasslands have potential for restoration or creation of both primary larval host plant and adult dispersal/nectaring habitats. Efforts have been initiated on Cannery Hill to enhance coastal prairie habitat suitable for eventual Oregon silverspot butterfly experimental reintroduction. A project in 2009 and 2010 created dispersal/nectaring habitat along both sides of the Pacific View Trail by seeding and maintaining the four primary species of nectar plants (mid-coast harvested yarrow, Douglas’ aster, Canada goldenrod, and pearly everlasting).

As part of the project agreement with IAE, the Service plans to embark on a formal inventory and assessment of the suitability of existing violet populations for reintroduction of the Oregon silverspot butterfly, and will determine the most suitable locations and density for establishing additional violet populations.

4.11 Salmonids

The Nestucca watershed is a productive fishery resource for the State of Oregon (Good et al. 2005) and the open water environments are critical to the important fisheries of Nestucca Bay. The mixing of fresh and salt waters within the estuary permits anadromous fish to adjust to the change in salinity and temperatures as they pass to and from the ocean environment. Anadromous fish common in the Nestucca system include spring and fall Chinook salmon, coho salmon, winter steelhead, coastal cutthroat trout, and Pacific lamprey. Once abundant chum salmon may only occur in small numbers now. Seasonal migrations of anadromous fish result in year-round use of the Nestucca watershed by adult salmon. In addition, resident coastal cutthroat trout are found throughout the watershed.

Conserving and restoring salmonid populations is an important goal, not only for their own sake, but also because of their cultural, historical, and ecological value. Salmonids are an important food source for numerous other wildlife species. Sixty-seven wildlife species of the Pacific Northwest, including many known to inhabit the Refuge, have been known to have a “strong” or “recurrent” relationship with salmon (Cederholm et al. 2000). Salmon play an important ecological role in the transport of energy and nutrients between the ocean, estuary, and freshwater streams, supporting overall ecosystem health. All life stages provide nutrients and energy needed for healthy stream ecosystems. Today, only three percent of the marine-derived biomass once delivered by anadromous fish is currently reaching those watersheds. Research on the consumption of salmon by vertebrate wildlife has documented 137 species of birds, mammals, amphibians, and reptiles are predators or scavengers of salmon. In coastal streams, marine derived nutrients from salmon carcasses increase the overall productivity of the system (Cederholm et al. 2000).

4.11.1 Description of Coho Salmon and Coastal Cutthroat Trout

The Oregon Coast coho salmon evolutionarily significant unit (ESU) found in the Nestucca River system is listed as a threatened species under the Endangered Species Act (National Oceanic and Atmospheric Administration [NOAA] 2008). The size of an adult coho may measure more than 2 feet (61 centimeters) in length and can weigh up to 36 pounds (16 kilograms). However, the average weight of adult coho is 8 pounds (3.6 kilograms). Coho salmon have dark metallic blue or greenish backs with silver sides and a light belly and there are small black spots on the back and upper lobe of the tail while in the ocean. The gumline in the lower jaw is white while in Chinook salmon it is black. Spawning fish in inland rivers are dark with reddish-maroon coloration on the sides. Coho salmon adults migrate from a marine environment into freshwater streams and rivers of their birth in order to mate (called anadromy; i.e., anadromous). They spawn only once and then die. Adults return to their stream of origin to spawn and die, usually at around three years old. Some precocious males known as “jacks” return as two-year-old spawners. Spawning males develop a strongly hooked snout and large teeth. Females prepare several redds (nests) where the eggs remain for six to seven weeks until they hatch. As the time for migration to the sea approaches after spending a year in freshwater, juvenile coho salmon lose their parr marks, a pattern of vertical bars and spots useful for camouflage, and gain the dark back and light belly coloration used by fish living in open water. Their gills and kidneys also begin to change at this time so that they can process salt water. In their freshwater stages, coho feed on plankton and insects, and switch to a diet of small fishes as adults in the ocean (NOAA 2010). Parr have 8-12 narrow parr marks centered along the lateral line. The marks are narrow and widely spaced. The adipose fin is finely speckled, imparting to it a gray color, but the other fins lack spots and are tinted orange. They have 9-12 dorsal fin rays, 12-17 anal fin rays, and 9-11 pelvic fin rays. Lateral line scales number from 121-148 and the scales are pored. There are 11-15 branchiostegal rays on either side of the jaw. Gill rakers are rough and widely spaced, with 12-16 in the lower half of the first arch (Moyle 1976).

Throughout their native and introduced range, coastal cutthroat trout vary widely in size, coloration, and habitat selection. Though their coloration can range from golden to gray to green on the back, depending on strain and habitat, all populations universally feature distinctive red, pink, or orange marks on the underside of the lower jaw or below the gill plates; usually the easiest diagnostic of the species for the casual observer. These markings are responsible for the formation of the typical name "cutthroat." At maturity, different populations of cutthroat can range from 6–40 inches in length, depending on habitat and food availability, making size an ineffective indicator as to species identity. Anadromous cutthroat may reach weights of 20 pounds but those fish that remain permanently in fresh water may only reach a weight of 2 pounds (Eddy and Underhill 1978). Cutthroat readily interbreed with the closely related rainbow trout, producing fertile hybrids commonly called "cutbow." As this species generally bears similar coloration and overall appearance to the cutthroat, retaining the characteristic orange-red slash, these hybrids often pose a taxonomical difficulty (Connolly et al. 2008).

Coastal cutthroat trout exhibit anadromous, stream-dwelling, lake-dwelling, and headwater stream-resident life history forms. Anadromous fish spawn in small tributaries from late winter through spring, depending on the locality. Juveniles remain in streams for two or more years and congregate during their early months in habitats along stream edges. Later, they move to pools unless coho salmon are present, in which case they are driven to riffles. Most anadromous coastal cutthroat trout juveniles smolt are typically age 3 or 4 when they migrate to sheltered saltwater areas. Seaward migration peaks in May, and the fish remain close inshore while in salt water. The fish seldom overwinter at sea but return to rivers in the fall or winter of the year they go to sea. In some instances, these are overwintering migrations only, because anadromous female coastal cutthroat trout seldom spawn before age four. Stream-dwelling forms migrate to main-stem rivers or to lakes; otherwise, their life history characteristics are much like those of the anadromous form. Headwater stream-resident coastal cutthroat trout become sexually mature as early as age two, but seldom live beyond age four or five. These fish exhibit only limited instream movements and generally live out their lives within 200 meters (656 feet) of their birthplace (Trotter 1989).

4.11.2 Historic and Current Distribution

Coho salmon are a widespread species of Pacific salmon, occurring in most major river basins around the Pacific Rim from central California to Korea and northern Hokkaido, Japan. In the United States distribution is from Point Hope, Alaska to the San Lorenzo River in Santa Cruz County. The historic range of the coho in the lower 48 states included coastal streams of California, Oregon and Washington, plus the much larger Sacramento and Columbia river systems, reaching as far inland as Idaho. It also occurs in rivers throughout coastal British Columbia and western Alaska. Published investigations have reported that a number of local populations of coho salmon in Washington, Oregon, Idaho, and California have become extinct and that abundance and productivity of many others is depressed (Brown and Moyle 1991, Frissell 1993, Nehlsen et al. 1991, Good et al. 2005, NOAA 2008).

We have very limited direct information about the spatial structure of the Oregon Coast coho salmon populations. The estimated potential historical abundance of coho salmon in the Nestucca River ranged from 104,000 to 115,000 individuals using methods based on peak historical catch and estimated habitat capacity. Potential historical smolt and adult abundance at Neskowin Marsh is 49,000 and 5,000 respectively (Lawson et al. 2007). The term “historical” represents the time frame of historical biological conditions before current threats became substantial. Previous analyses (Nickelson and Lawson 1998, Nickelson 2001) assumed that spawners from major river basins are largely isolated, and that each basin comprises at least one population. The Umpqua River is large and diverse enough to hold several populations, but for analysis purposes it was considered as one. Three coastal lakes, Siltcoos, Tahkenitch, and Tenmile, are considered to be a single population, but may actually be separate. Genetic analyses are being conducted to resolve these questions, but results were not available at the time of this review (Good et al. 2005). This is a change from the status review update in 1997 (Schiewe 1997), when the Oregon coast was considered to consist of four populations, called gene conservation groups. Three of these groups (north/mid coast, mid/south coast, and Umpqua) were in the Oregon Coast coho salmon ESU and the fourth (south coast) was in the Southern Oregon/Northern California Coast coho salmon ESU (Good et al. 2005).

The following ESUs are “likely to become endangered in the foreseeable future:” Snake River fall-run Chinook, Snake River spring/summer-run Chinook, Puget Sound Chinook, Lower Columbia River Chinook, Upper Willamette River Chinook, California Coastal Chinook, Central Valley spring-run Chinook, Snake River steelhead, Lower Columbia River steelhead, Upper Willamette River steelhead, Northern California steelhead, Central California Coast steelhead, South-Central California Coast steelhead, Oregon Coast coho, Southern Oregon/Northern California Coast coho, Ozette Lake sockeye, Hood Canal summer-run chum, and Lower Columbia River chum (Good et al. 2005).

Cutthroat trout are native to western North America. The species has evolved through geographic isolation into many subspecies, each native to a different major region or specific drainage basin. Native cutthroat species are found along the Pacific Northwest coast, in the Cascade Range, the Great Basin, and throughout the Rocky Mountains. For the coastal cutthroat trout subspecies, some populations have anadromous individuals, living for periods in the Pacific Ocean as adults and returning to freshwater from fall through early spring to feed on insects and spawn (Trotter 1989). Most populations, however, stay in fresh water throughout their lives and are known as non-migratory, stream-resident or riverine populations.

The coastal cutthroat trout occurs over the broadest geographical range of any of the recognized cutthroat trout subspecies (Behnke 1979, Johnston 1981). The subspecies is distributed along the Pacific coast from the Humboldt Bay area of California to Prince William Sound, Alaska, a distance of about 3,025 kilometers (1,880 miles). It occurs inland to the crest of the Cascade Mountain Range in Oregon and Washington and to the Coast Range crest in British Columbia and southeast Alaska, an average distance of 160 kilometers (99 miles) (Trotter 1989). Its native range coincides quite closely with the coastal rain forest belt defined by Waring and Franklin (1979).

4.11.3 Condition, Trends, and Threats

The status of most anadromous fish within the Oregon Coast ESU has been in decline for decades. Currently, coho salmon on the Oregon Coast (Oregon Coast ESU) are listed as “Threatened” on the Federal Threatened and Endangered Species List. Oregon Coast Coho ESU was originally listed threatened in 1998, set aside due to Alsea case and commitment to conduct status review; proposed threatened in 2004, found not warranted in 2006, contested and listed in 2008 (73 FR 7816); contested and new status review conducted; threatened finding published in Federal Register in 2011 (superseded 2008 finding) and kept critical habitat and protective regulations from 2008 in place. The State of Oregon lists coho salmon as a Threatened species for the entire state. Oregon Coast steelhead was found not warranted for listing in 1998 and considered a "species of concern" by NOAA in 2004 due to specific risk factors. Oregon Coast Chinook ESU found not warranted for listing in 1998 because populations appear healthy and stable in some areas of the coast and declining in others. There are very little data available for sea run and native coastal cutthroat trout, and their population status is unclear.

In 2003 the Oregon Workgroup of the Oregon Northern California Coast Technical Recovery Team convened to review and analyze information that could shed light on historical populations of Oregon Coast coho salmon. Documentation of life history traits, distribution, or abundance of Oregon Coast coho salmon prior to 1940 is limited. Considerable biological information has been gathered during the past 30 years, and particularly the past 12 years; however, it is difficult to relate the biological characteristics of modern populations to those that existed historically in the same basin. Human activities over the past 200 years have altered every aspect of salmon habitat on the coast, harvest has changed abundance patterns, and hatcheries may have blurred the distinctions among stocks. Coho salmon have adapted their behavior to many of these changes and, as a result, present-day Oregon Coast coho salmon populations function differently than they did historically (Lawson et al. 2007).

The abundance and productivity of Oregon Coast coho since the status review completed in 1997 (National Marine Fisheries Service [NMFS] 1997b) represented some of the best and worst years on record (NOAA 2008). Yearly adult returns for the Oregon Coast coho ESU were in excess of 160,000 natural spawners in 2001 and 2002, far exceeding the abundance observed for the past several decades. These encouraging increases in spawner abundance in 2000–2002 were preceded, however, by three consecutive brood years (the 1994–1996 brood years returning in 1997–1999, respectively) exhibiting recruitment failure (recruitment failure is when a given year class of natural spawners fails to replace itself when its offspring return to the spawning grounds 3 years later). These 3 years of recruitment failure were the only such instances observed thus far in the entire 55+ year abundance time series for Oregon Coast coho salmon (although comprehensive population-level survey data have only been available since 1980). The encouraging 2000–2002 increases in natural spawner abundance occurred in many populations in the northern portion of the ESU, populations that were the most depressed at the time of the 1997 review (NMFS 1997b). Although encouraged by the increase in spawner abundance in 2000–2002, the long-term trends in ESU productivity were still negative due to the low abundances observed during the 1990s (NOAA 2008).

The Oregon Coast coho salmon ESU total natural spawner abundance was estimated based on stratified random survey (SRS) techniques, broken down by ODFW's monitoring areas (MAs), for 11 major river basins and for the coastal lakes system. These data are for the return years 1990–2002 and are expressed in terms of naturally produced fish, rather than the standard of naturally spawning fish used in other status review updates. Total recent average (3-year geometric mean) spawner abundance for this ESU is estimated at about 140,600, up from the 5-year geometric mean of 52,000 in the 1997 update and higher than the estimate at the time of the most recent status review (Good et al. 2005). In 2001, the ocean run size was estimated to be about 178,000; this corresponds to one-tenth of ocean run sizes estimated in the late 1800s and early 1900s, and only about one-third of those in the 1950s (ODFW 1995). In 2002, the ocean run size increased to 304,500, fourth highest since 1970 and perhaps 25% of historical abundance. Present abundance is more evenly distributed within the ESU than it was in 1997. Escapement in the relatively small mid/south coast monitoring area was the strongest in the ESU until 2001. In 2002, escapements in the mid/south were down about 25%, while the north and mid-coast monitoring areas showed strong gains. The Umpqua monitoring area is up by a factor of 4 since 1996 (Good et al. 2005).

Threats currently facing the Oregon Coast coho ESU include the present or threatened destruction, modification, or curtailment of its habitat or range. In many Oregon coastal streams, past human activities (e.g., logging, agriculture, gravel mining, urbanization) have resulted in impediments to fish passage, degradation of stream complexity, increased sedimentation, reduced water quality and quantity, loss and degradation of riparian habitats, and loss and degradation of lowland, estuarine, and wetland coho rearing habitats. The relevant issues are whether current habitat conditions are adequate to support the ESU's persistence and whether habitat conditions are likely to worsen in the future. There is uncertainty about the adequacy of current habitat conditions, and this uncertainty contributed to the finding that the ESU was likely to become an endangered species within the foreseeable future. Also, if the long-term decline in productivity of the Oregon Coast coho ESU reflects deteriorating conditions in freshwater habitat, this ESU could face very serious risks of local extinction during the next cycle of poor ocean conditions. With respect to population growth and urbanization, approximately 3.4 percent of "high intrinsic potential" habitat areas for coho (e.g., lowland stream reaches particularly important to juvenile coho rearing and overwintering survival) are within currently designated urban growth areas, suggesting that future human population growth may not represent a significant threat to the ESU (NOAA 2008). With respect to lowland and upland habitat areas under various types of land use and ownership, NOAA found that some areas are likely to improve, some are likely to decline, and others are likely to remain in their current condition. Overall, there is a high level of uncertainty associated with projections of future habitat conditions due to underlying economic and sociopolitical factors influencing forest harvest and restoration rates, urban conversion of agricultural and forest lands, and the enforcement and implementation of land-use plans and regulations. Based on their analysis, NMFS found that there is insufficient evidence to conclude that the Oregon Coast coho ESU was more likely than not to become an endangered species because of the "threatened destruction, modification, or curtailment of its habitat or range." It remains uncertain whether future freshwater habitat conditions would be adequate to support a viable coho ESU, particularly during periods of unfavorable ocean conditions and poor marine survival.

Another identified threat is overutilization for commercial, recreational, scientific, or educational purposes. Harvest rates on Oregon Coast coho populations ranged between 60 and 90 percent between the 1960s and 1980s (Good et al. 2005). Modest harvest restrictions were imposed in the late 1980s, but harvest rates remained high until most directed coho salmon harvest was prohibited in 1994. These restrictive harvest regulations, developed concurrently with the Oregon Plan and subsequently revised, have imposed conservative restrictions on directed and incidental fishery mortality, and appropriately consider marine survival conditions and the biological status of naturally produced coho populations. Under these revised regulations, harvest rates are stipulated to be between 0 and 8 percent during critically low spawner abundance, and may increase to a maximum exploitation rate of 45 percent under high survival and abundance conditions. Empirical data over the last 10 years show that harvest mortality for Oregon Coast coho has been maintained below 15 percent since the adoption of the revised regulations (NOAA 2008).

Disease, predation, past species introductions, and habitat modifications have resulted in increased non-native predator populations, notably in coastal lake habitats. Predation by increased populations of marine mammals (principally sea lions) may influence salmon abundance in some local populations when other prey species are absent and where physical conditions lead to the concentration of adults and juveniles (Cooper and Johnson 1992). However, the extent to which marine mammal predation threatens the persistence of Oregon coast coho populations is unknown. Infectious disease is one of many factors that can influence adult and juvenile salmon survival. Salmonids are exposed to numerous bacterial, protozoan, viral, and parasitic organisms in spawning and rearing areas, hatcheries, migratory routes, and the marine environment. Specific diseases such as bacterial kidney disease, ceratomyxosis, columnaris, furunculosis, infectious hematopoietic necrosis virus, redmouth and black spot disease, erythrocytic inclusion body syndrome, and whirling disease, among others, are present and known to affect West Coast salmonids (Rucker and Ordall 1953, Wood 1979, Leek 1987, Foott et al., 1994, Gould and Wedemeyer undated). In general, very little current or historical information exists to quantify trends over time in infection levels and disease mortality rates. However, studies have shown that naturally spawned fish tend to be less susceptible to pathogens than hatchery-reared fish (Buchanan et al. 1983, Sanders et al. 1992). Native salmon populations have co-evolved with specific communities of these organisms, but the widespread use of artificial propagation has introduced exotic organisms not historically present in a particular watershed. Habitat conditions such as low water flows and high temperatures can exacerbate susceptibility to infectious diseases. Aggressive hatchery reform efforts implemented by the State of Oregon have reduced the magnitude and distribution of hatchery fish releases in the ESU, and, consequently, the interactions between hatchery- and natural-origin fish and the potential transmission of infectious diseases. Additionally, regulations controlling hatchery effluent discharges into streams have reduced the potential of pathogens being released into coho habitats.

Natural or human-caused factors may affect the coho’s continued existence. Natural variability in ocean and freshwater conditions has at different times exacerbated or mitigated the effects on Oregon Coast coho populations of habitat limiting factors. There is considerable uncertainty in predicting ocean-climate conditions into the foreseeable future, as well as, their biological impacts on the Oregon Coast coho ESU. Variability in ocean-climate conditions is expected, and coho productivity and abundance are similarly expected to fluctuate in response to this natural environmental variability. It is unknown whether unfavorable ocean conditions would predominate in the foreseeable future.

During the twentieth century, the coho decreased to as little as 1% of its former abundance in its southern range (in California and Oregon). It is extirpated in more than half of its native rivers in that region. The decline of the coho stocks of California and Oregon has been caused by several interacting factors. Much of their freshwater habitat has been degraded by siltation and temperature increases caused by logging and other disturbances in the watersheds of their breeding and rearing habitats in headwater streams. Clear-cut logging in the riparian (or stream-side) zone results in large increases in the summertime water temperature, which can be lethal for these cool-water fish. In addition, the erosion of soil from destabilized stream-banks and at road crossings results in the deposition of silt into the gravel spawning and larval-rearing habitat of salmon, which smothers the eggs and larvae. Moreover, many rivers have had hydroelectric dams constructed on them, and this prevents or impedes the migration of coho to and from the sea. Other threats to coho include erosion associated with overgrazing of livestock, in-river mining of gravel or gold, urban and industrial pollution, agricultural diversions, and urbanization. These factors have affected coho salmon throughout their range on the Pacific coast, but the damages have been most intense for stocks breeding on coastal rivers in California and Oregon. Overall, the coho has become extirpated over about 56% percent of its historic range in the lower 48 states, endangered in about 13%, threatened in about 20%, and of special concern in 5%. The coastal rivers of Oregon produced about 1.4-million coho in 1900, but fewer than 20,000 in the 1990s. In Washington, the 1.2 million coho that once lived in the Columbia basin are virtually extinct (NOAA 2000).

NOAA Fisheries' 1999 review of West Coast coastal cutthroat trout populations identified six ESUs, including the Oregon Coast Coastal Cutthroat Trout ESU that includes the Nestucca River watershed. The 1999 analysis by NOAA was evenly divided on whether the Oregon Coast cutthroat trout ESU is likely to become endangered in the foreseeable future. Currently, coastal cutthroat trout of the Oregon Coast ESU is not listed on the state or Federal Threatened and Endangered Species List. Current or historical abundance information, especially for adult coastal cutthroat trout, is available for only a very small proportion of the known populations within any ESU. Biologists familiar with coastal cutthroat trout generally believe that, in some areas (e.g., Lower Columbia River Basin, Puget Sound, Northern California), anadromous coastal cutthroat trout populations have experienced significant recent declines relative to historical levels of abundance (NOAA 1999). Coastal cutthroat trout have a very plastic life history and are wide-spread in coastal areas; however, very little specific data have been collected to assess trends. Coastal cutthroat trout is subject to many of the same factors as coho and other salmon species, in addition to factors affecting isolated resident populations upstream of salmon distribution in watersheds.

The Oregon Coast coastal cutthroat trout Species Management Unit (SMU) includes 24 historical populations of coastal cutthroat trout inhabiting ocean tributary streams from the Necanicum River south to the Sixes River. All four life history types are present with the SMU, and several populations exhibit all four life history types. A status assessment of coastal cutthroat trout within the SMU determined all historical populations were found to be in existence and not at risk of extinction in the near future. An assessment for the Oregon Coast coastal cutthroat trout SMU found all populations passed all of the interim criteria and therefore, the conservation of the SMU was not at risk (Connolly et al. 2008).

4.11.4 Key Habitats Used

Coho salmon spawn in the headwaters of tributaries, rivers, or streams in beds with clean gravel. The freshwater habitat of the headwater is characterized by cool clean water with water quantity and quality conditions and substrate supporting spawning, incubation, and larval development. These features are essential in the environment because without them the species cannot successfully spawn and produce offspring (NOAA 2008). After hatching from eggs, coho salmon fry spend one year in freshwater habitat, specifically in backwater pools and stream edges. As juveniles, coho salmon depend on deep water pools, off-channel alcoves, ponds, beaver dam pools, and complex cover for rearing and refuge during high winter runoff events (Barczak 1998, Pollock et al. 2004). Estuarine areas are also important to coho and in some cases smolts spend months in this transition zone, where the salt and fresh water meet. The estuaries need to be free of obstruction with water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh and saltwater. Submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels provide natural cover. Juveniles and adults forage on aquatic invertebrates and fishes which supports growth and maturation. These features are essential in the estuary because without them juveniles cannot reach the ocean in a timely manner and use the variety of habitats that allow them to avoid predators, compete successfully, and complete the behavioral and physiological changes needed for life in the ocean. Similarly, these features are essential to adult salmonids because they provide a final source of abundant forage that provides the energy stores needed to make the physiological transition to fresh water, migrate upstream, avoid predators, and develop to maturity upon reaching spawning areas (NOAA 2008).

Coho migrate from the freshwater to the ocean, where they feed and grow for several years. During the marine phase of their life history, coho live in open-water (or pelagic), cool-temperate regions of the northeastern Pacific Ocean. When they reach sexual maturity, they return to the headwaters of their natal stream, where they breed, and die. Coho salmon migrate from the ocean to freshwater in September-January, and they spawn in October-January.

Resident coastal cutthroat trout grow, mature, and spawn often very close to the location from which they hatched. Fluvial and adfluvial cutthroats migrate to spawning streams in the spring, usually to the streams in which they hatched (natal streams), and spawn in spring or summer in small streams. For successful production, juvenile coastal cutthroat trout that live at the edges of streams or in backwater areas depend on the presence of streambank vegetation and abundant instream structure created by logs and root wads.

Anadromous coastal cutthroat trout migrate into freshwater in late summer to late fall, usually to their natal streams, and spawn from late winter to spring. The adults migrate back to the ocean shortly after spawning. Sea-run cutthroat fry migrate to lower reaches of streams after emerging from the gravel in spring or summer. As early as the following spring, but more often two to four springs later, juvenile coastal cutthroat trout migrate to estuaries and the ocean as seawater-adapted "smolts." In the marine environment, coastal cutthroat trout tend to grow about an inch every month, feeding on a variety of small crustaceans and fish. Their residency in seawater is brief—usually only a few months—and they tend to stay close to the freshwater streams and rivers from which they came. The fish return to freshwater later the same year in autumn to spawn or to spend another year growing and developing before undertaking another seaward migration (Fitzpatrick 1999).

4.11.5 Refuge-specific Sites

One study indicated salmonids utilize the Little Nestucca Restoration Area as a nursery or rearing site (van de Wetering et al. 2009). The Little Nestucca Restoration Area was restored to tidal action in 2007. Juvenile salmonids responded positively to the removal of the dike at the site. Juvenile salmonid use increased both in the context of marsh residence as well as during daily tidal migrations from the mainstem river into the marsh. There was less of a direct response by juvenile salmonids to engineered complex-large-wood-floating structures placed at the salt marsh mouths than to those single-large-wood-stationary structures placed more internally within the marsh. This may be a result of the immediate depth and velocity refugia created by the internally placed structures in comparison to the mouth structures. Anecdotal information suggests the mouth structures are increasing channel complexity and refugia but at a different scale and trajectory. It is not clear that abnormally deep channel morphology would negatively impact juvenile salmonids, but it is likely to shift species composition toward age 0+ coho at interior portions of the restoration site (van de Wetering et al. 2009).

Preliminary surveys in the southern portion of Neskowin Marsh have revealed substantial use of the area by fry and smolt-sized coho salmon and cutthroat trout. The coho salmon and cutthroat trout use the marsh as off-channel overwintering habitat prior to their migration from fresh water to salt water. These fish must navigate through the Neskowin Beach golf course to reach the marsh. Chinook salmon and steelhead spawn in nearby Neskowin Creek, and may use Neskowin Marsh as well (USFWS 2000a).

4.12 Waterfowl (Ducks)

Waterfowl include ducks, geese, and swans and are part of the worldwide family *Anatidae*. These are aquatic, web-footed, gregarious birds that mostly feed on water but some also graze on land. Ducks are classified in the tribe Anatini which contains three genera and 40 species throughout the world. In North America there is but one genus, *Anas*, embracing 10 species of “dabbling or puddle ducks” (Bellrose 1986). Dabbling ducks or puddle ducks are surface-feeders that occur in freshwater shallows or salt marshes. Some of the more commonly found dabbling ducks in the Nestucca estuary include mallard, northern pintail, American wigeon, and green-winged teal, Although a dabbling duck in general appearance, the wood duck belongs to the tribe Cairinini. This species belongs to a group called “perching ducks” which are surface feeding woodland ducks that nest in tree cavities or nest boxes. There are nine genera representing 13 species worldwide. Only one species, the wood duck, inhabits North America north of Mexico (Bellrose 1986).

The remaining ducks are placed in three tribes embracing 12 extant genera around the world and are generally referred to as “diving ducks.” The tribe Aythyini is represented by the “pochards or bay ducks” (Bellrose 1986). In North America all belong to one genus, *Aythya*, composed of the canvasback, redhead, ring-necked duck, and the scaups (greater and lesser). Members of the tribe Mergini are termed “sea ducks” and although most of them frequent the ocean during the winter, many also inhabit freshwater areas. This species breeds in the far north and migrate in large compact flocks to and from their coastal wintering grounds. Common sea ducks include the scoters (surf, white-winged, and black), harlequin duck, long-tailed duck, goldeneyes (common and Barrows), bufflehead, and mergansers (common, red-breasted, and hooded). Lastly, the tribe Oxyurini make up the “stiff-tailed duck” group which consists of one genus and two species that frequent North America (Bellrose 1986). The most common species of this group is the ruddy duck. Both dabbling and diving ducks are known to hybridize, and seemingly rare birds sighted outside their normal range may be hybrids.

4.12.1 Description of Waterfowl

Surface-feeding members of the genus *Anas* are termed “dabbling or puddle ducks.” Dabblers feed by tipping tail-up to reach aquatic plants, seeds, and snails. They require no running start to take off but spring directly into flight. Members of this group have their feet set forward underneath their body and their hind toes are smooth without a lobe of skin. Most species show a distinguishing swatch of bright color, or speculum, on the secondary feathers. Many are known to hybridize. “Perching ducks” (wood duck) are equipped with sharp claws for perching in trees, well-developed hind toes, and broad wings.

The “diving ducks” consist of “pochards or bay ducks, sea ducks, and stiff-tailed ducks.” These diving ducks have legs set far back and far apart (a location that facilitates diving), which makes walking awkward. These heavy-bodied birds require a running start on water for takeoff. This group also has a lobe of skin on their hind toes. Sea ducks are stocky and have short necks. Mergansers have long, thin, serrated bills which help to catch fish, crustaceans, and aquatic insects. The ruddy duck is the most distinct species among all ducks and is termed “stiff-tailed duck.” Their feathers are long, stiff, and pointed and their legs are farther back on their bodies than other ducks. Their necks are short and thick. They lay the largest eggs among waterfowl, considering their size. They perform a bizarre courtship display, unique among waterfowl.

4.12.2 Historic and Current Distribution

Migratory waterfowl use four major migratory routes (Pacific, Central, Mississippi, and Atlantic flyways) in North America. The Pacific Flyway includes Alaska, Arizona, California, Idaho, Nevada, Oregon, Utah, Washington, and those portions of Colorado, Montana, New Mexico, and Wyoming west of the Continental Divide. Because of the unique biological characteristics and relative number of hunters in these regions, state and Federal wildlife agencies adopted the flyway structure for administering migratory bird resources within the United States. Each flyway has its own council that is an administrative body that forges cooperation among public wildlife agencies for the purpose of protecting and conserving migratory birds in western North America. Flyway councils have responsibilities in the annual process of setting migratory bird policy and regulations within the United States, and they conduct and contribute to migratory bird research and management throughout the United States, Canada, and Mexico.

4.12.3 Conditions, Trends, and Threats

Ducks are plentiful in late fall through the winter months, utilizing refuge wetlands and flooded lowland pastures. Waterfowl numbers vary greatly depending on habitat conditions and yearly variables such as weather and breeding production. Using mid-winter waterfowl survey numbers as an index, the number of wintering ducks in the Nestucca Bay is highly variable and no trends can be inferred. However, tidal salt marsh restoration at Little Nestucca has provided additional good quality wetland habitat within the Refuge and can support large numbers of waterfowl. The most abundant duck species identified at Nestucca Bay during the 2009 mid-winter waterfowl survey are the mallard, northern pintail, American wigeon, green-wing teal, and bufflehead (USFWS unpublished data). Some of the duck species that can be found wintering in the Nestucca area have been documented as breeders on refuge lands including mallards and wood ducks.

Waterfowl hunting will be allowed on the Refuge (see Chapter 2) and occurs on adjacent lands which may influence bird distribution and behavior. Hunting, by its nature, results in the intentional take of individual animals, as well as wounding and disturbance (DeLong 2002). Indirect impacts such as displacement of animals by hunters or disturbance from gunfire also occurs in and adjacent to, areas opened for hunting. It can also alter behavior (e.g., foraging time), population structure (young birds are generally more susceptible), and distribution patterns of wildlife (Owens 1977, Raveling 1979, White-Robinson 1982, Thomas 1983, Bartlett 1987, Madsen 1985, and Cole and Knight 1990). Prolonged and extensive disturbances may cause large numbers of waterfowl to leave disturbed areas and migrate elsewhere (Madsen 1985).

Every year, the U.S. Fish and Wildlife Service conducts surveys that are used to estimate waterfowl hunting activity, success and harvest by species. Results are used by the Service and State wildlife agencies, in part, to establish season lengths and bag limits designed to maintain healthy, sustainable waterfowl populations. During 2010-2011 season, waterfowl hunters in Oregon harvested an estimated 419,100±18% (Raftovich et al. 2011) ducks. On state-owned tidelands of Nestucca Bay during 2010-2011, hunters harvested very few ducks and the numbers are considered to be below reportable levels (B. Reishus, ODFW, personal observation). Waterfowl harvest data are unavailable because only a small number of hunters pursue waterfowl in the Nestucca Bay area and no hunters were surveyed in 2010-2011. At any given time there are only one to two hunting parties in the Bay because of space, and hunting quality is best at only a few spots (e.g., the mouth of the sloughs). Waterfowl hunters tend to self-limit their numbers. Most hunting occurs in October and November and tides influence hunting times. After November the birds disperse further inland and there is almost no hunting occurring in the Bay.

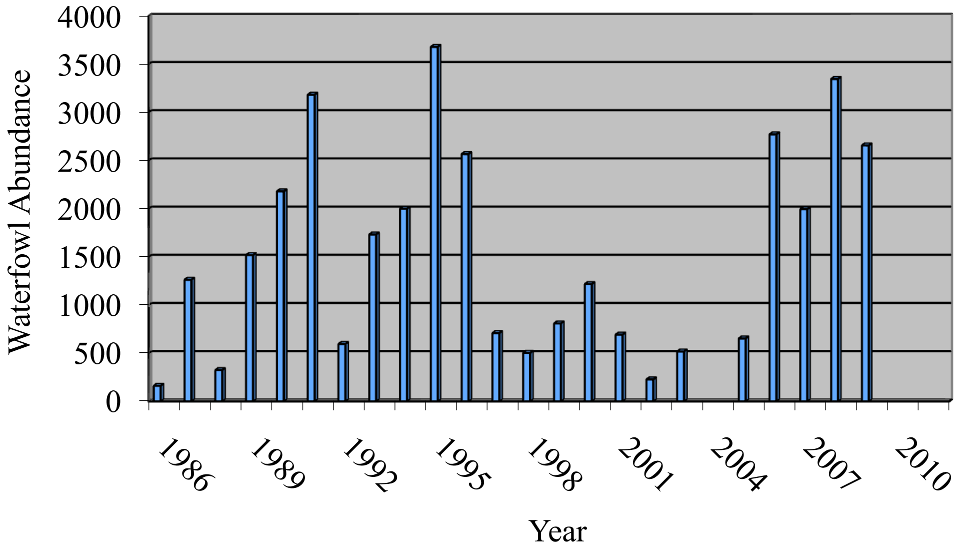
The most heavily harvested duck species in Oregon are mallard, American wigeon, northern pintail, green-winged teal, and northern shoveler (Raftovich et al. 2011). In 2011, continental populations of northern shoveler, green-wing teal, and mallard were all above their long-term averages (USFWS 2011c). American wigeon were 20% below their long-term average and northern pintails were similar to the long-term average. Hunters are permitted to harvest coots, but this species is uncommon on the Refuge and coots are not popular with Oregon hunters. Given the low harvest rates of these species relative to the State harvest, the refuge hunt program will not significantly contribute to the population changes of these species and the Refuge will continue to conform to State bag limits for ducks.

4.12.4 Waterfowl Population Trends

The Waterfowl Breeding Population and Habitat Survey is the most extensive and most important of North America's waterfowl population surveys. This survey is a cooperative effort of the United States Fish and Wildlife Service, the Canadian Wildlife Service, and state, provincial, and tribal agencies. It currently covers more than 2.1 million square miles of the northern United States and Canada, and includes most of the primary duck nesting areas in North America. Each year, air crews (a pilot biologist and an observer) fly fixed-wing aircraft at low altitude (150 feet) over transect lines through waterfowl habitat areas. Over 55,000 miles of transects are flown every year. Estimates of breeding populations for all waterfowl species observed are derived by taking the aerial counts, adjusting them based on the visibility correction factors, and expanding them over the survey area. Final results from the 2011 Waterfowl Breeding Population and Habitat Survey indicate a total duck population estimate of 45.6 million birds in the traditional survey area, which is an 11% increase over last year's tally of 40.9 million and 35 percent above the long-term average. Continental populations of northern shoveler, green-wing teal, and mallard were all above their long-term averages. American wigeon were 20% below their long-term average and northern pintails were similar to the long-term average (USFWS 2011c).

Biologists from state and Federal agencies annually conduct the Midwinter Waterfowl Survey to provide a measure of the relative numbers or trends of duck populations. The survey identifies winter waterfowl distribution and habitat use throughout the United States. The survey also provides estimates of the size of goose and swan populations and tracks population trends of duck species that nest outside of breeding survey areas. Midwinter Waterfowl Surveys are conducted during the first two weeks in January along the Oregon coast. Observers count divers, dabblers, geese, swans, and American coots from a fixed-wing aircraft and an overall abundance is estimated (USFWS unpublished data). Data were compiled for all waterfowl observed at Nestucca Bay during the midwinter waterfowl surveys from 1986 to 2009 and are displayed in Figure 4-7. The overall mean count was 1,534 individuals and the lowest count was 161 individual birds recorded in 1986 and the largest was 3,678 in 1995. These data are collected from a fixed-wing aircraft at 200-300 feet altitude and traveling 80-120 miles per hour, which limits ability to survey all areas and all habitats and count every individual present. However, general abundance and population trends can be inferred and obviously Nestucca Bay is an important use area for waterfowl. Waterfowl abundance is usually lower during the January mid-winter survey compared to fall months, when birds are concentrated on the bay prior to dispersing throughout the area due to field and seasonal wetland flooding (R. Lowe, personal observation). It should be noted that the mid-winter waterfowl survey serves as an index for comparative purposes and is not necessarily representative of the number of ducks that may be present within the entire geographic area. Refuge counts for ducks have generally ranged between 2,000 to 3,400 over the past several winters.

Figure 4-7. Waterfowl abundance at Nestucca Bay, Oregon from 1986 to 2009 (USFWS unpublished data).



4.12.5 Key Habitats Used and Refuge-specific Sites

Surveys have indicated waterfowl make significant use of the open bay, mud flats, and tidal marsh with heaviest use occurring from September through January and again during spring migration. Dabbling ducks use freshwater shallows and chiefly in the winter, salt marshes. The lowland pastures within the Nestucca Bay Unit are managed intensively for six sub-species of Canada geese that use the pastures during October to April. Waterfowl also use the lowland pastures during the winter months since the lowlands are often flooded due to heavy rainfall. Waterfowl utilize both private and refuge pasturelands. Waterfowl are also observed on the Little Nestucca Restoration Area, Nestucca Bay proper, and Neskowin Marsh; however, the highest use areas are the lowland pastures when standing water is present.

4.13 Threatened, Endangered, and Candidate Species

4.13.1 State or Federally Listed Species Known to Occur on the Refuge

One goal of the Refuge System is “To conserve, restore where appropriate, and enhance all species of fish, wildlife, and plants that are endangered or threatened with becoming endangered.” In the policy clarifying the mission of the Refuge System, it is stated, “We protect and manage candidate and proposed species to enhance their status and help preclude the need for listing.” In accordance with this policy, the CCP planning team considered all species with Federal or State status. Tables 4-2 and 4-3 lists state or Federal endangered and threatened species that are known to occur on the Refuge. Other listed species may occur but have not been documented. Discussion follows the tables in Section 4.13.2.

Table 4-2. Federal or State Listed Bird Species Known to Occur on the Refuge

Common Name	Federal Status	State Status	Current Occurrence on Refuge
Marbled murrelet	Threatened	Threatened	Potential Fly over

Table 4-3. Federal or State Listed Fish Species Occurring on the Refuge or in Surrounding Waters

Common Name	Federal Status	State Status	Current Occurrence on Refuge
Coho salmon	Threatened		Nestucca Bay NWR Units/Nestucca and Little Nestucca Rivers/coastal streams
Pacific smelt (eulachon)	Threatened		Nestucca and Little Nestucca Rivers
Green sturgeon	Threatened		Nestucca and Little Nestucca Rivers

4.13.2 Description and Status of Listed Species Known to Occur on the Refuge

Marbled Murrelet

The marbled murrelet is a small, robin-sized, diving seabird that feeds primarily on fish and invertebrates in near-shore marine waters. It spends the majority of its time on the ocean, roosting and feeding, but comes inland up to 80 kilometers (50 miles) to nest in forest stands with old growth forest characteristics. These dense shady forests are generally characterized by large trees with large branches or deformities for use as nest platforms. Murrelets nest in stands varying in size from several acres to thousands of acres. However, larger, unfragmented stands of old growth appear to be the highest quality habitat for marbled murrelet nesting. Nesting stands are dominated by Douglas-fir in Oregon and Washington and by old-growth redwoods in California (USFWS 2012d).

Salmonids

See Salmonid Section 4.11.

Pacific Smelt (eulachon)

Eulachon (commonly called smelt, candlefish, or hooligan) are a small, anadromous fish from the eastern Pacific Ocean. They are distinguished by the large canine teeth on the “vomer” and 18 to 23 rays in the anal fin. Like Pacific salmon they have an "adipose fin"; it is sickle-shaped. The paired fins are longer in males than in females. All fins have well-developed breeding tubercles (raised tissue “bumps”) in ripe males, but these are poorly developed or absent in females. Adult coloration is brown to blue on the back and top of the head, lighter to silvery white on the sides, and white on the ventral surface; speckling is fine, sparse, and restricted to the back. They feed on plankton but only while at sea.

Eulachon typically spend 3 to 5 years in saltwater before returning to freshwater to spawn from late winter through mid-spring. During spawning, males have a distinctly raised ridge along the middle of their bodies. Eggs are fertilized in the water column. After fertilization, the eggs sink and adhere to the river bottom, typically in areas of gravel and coarse sand. Most eulachon adults die after spawning. Eulachon eggs hatch in 20 to 40 days. The larvae are then carried downstream and are dispersed by estuarine and ocean currents shortly after hatching. Juvenile eulachon move from shallow nearshore areas to mid-depth areas. Within the Columbia River Basin, the major and most consistent spawning runs occur in the mainstem of the Columbia River as far upstream as the Bonneville Dam, and in the Cowlitz River.

Eulachon occur in nearshore ocean waters and to 1,000 feet (300 meters) in depth, except for the brief spawning runs into their natal (birth) streams. Spawning grounds are typically in the lower reaches of larger snowmelt-fed rivers with water temperatures ranging from 39 to 50° F (4-10° C). Spawning occurs over sand or coarse gravel substrates (NOAA 2012a).

Green Sturgeon

Green sturgeon are long-lived, slow-growing fish and the most marine-oriented of the sturgeon species. Mature males range from 4.5-6.5 feet (1.4-2 meters) in “fork length” and do not mature until they are at least 15 years old, while mature females range from 5-7 feet (1.6-2.2 meters) fork length and do not mature until they are at least 17 years old. Maximum ages of adult green sturgeon are likely to range from 60-70 years. This species is found along the west coast of Mexico, the United States, and Canada.

Green sturgeon are believed to spend the majority of their lives in nearshore oceanic waters, bays, and estuaries. Early life-history stages reside in fresh water, with adults returning to freshwater to spawn when they are more than 15 years of age and more than 4 feet (1.3 meters) in size. Spawning is believed to occur every 2-5 years. Adults typically migrate into fresh water beginning in late February; spawning occurs from March-July, with peak activity from April-June (Moyle et al. 1995). Females produce 60,000-140,000 eggs. Juvenile green sturgeon spend 1-4 years in fresh and estuarine waters before dispersal to saltwater. They disperse widely in the ocean after their out-migration from freshwater (NOAA 2012b).

4.14 Invasive and Exotic Plant Species

One of the largest threats to wildlife and habitat of the Refuge is exotic or invasive plants. Invasive plant species displace native vegetation, altering the composition and structure of vegetation communities, affecting food webs, and modifying ecosystem processes (Olson 1999). Ultimately, invasive plant species can result in considerable impact to native wildlife and the habitat they are dependent upon.

Several non-native invasive plants found on Nestucca Bay NWR include reed canarygrass, Himalayan blackberry, English ivy, and Scotch broom. Gorse and *Spartina* spp. are not currently found on the Refuge; however, monitoring for those species is conducted to detect outbreaks or infestation and control efforts would be implemented immediately if any of these species were found. Many exotic and invasive plants have been introduced to the Refuge; therefore, this list is not all inclusive and includes only the most problematic species.

4.14.1 Description and Status of Reed Canarygrass

A highly variable species, reed canarygrass is a rhizomatous perennial grass that can reach three to six feet in height. The sturdy, often hollow stems can be up to 1/2 inch in diameter, with some reddish coloration near the top. The leaf blades are flat and hairless, 1/4 to 3/4 of an inch wide. The flowers are borne in panicles on culms high above the leaves. The panicles are generally three to six inches in length. The species flowers in June and July (Weinmann et al. 1984, Hitchcock et al. 1969).

Reed canarygrass is extremely aggressive and often forms dense, highly productive single species stands that pose a major threat to many wetland ecosystems. The species grows so vigorously that it is able to inhibit and eliminate competing native species. In addition, areas that have existed as reed canarygrass monocultures for extended periods may have seed banks that are devoid of native species (Apfelbaum and Sams 1987). Unlike native wetland vegetation, dense stands of reed canarygrass have little value for wildlife. Few species eat the grass, and the stems grow too densely to provide adequate cover for small mammals and waterfowl (Maia 1994). The species is considered a serious weed along irrigation banks and ditches because infestations can increase siltation (Marten and Heath 1973). When in flower, the species produces abundant pollen and chaff, which aggravate hay fever and allergies (Weinmann et al. 1984). Once established, reed canarygrass is difficult to control because it spreads rapidly by rhizomes.

4.14.2 Description and Status of Himalayan Blackberry

Himalayan blackberry is a robust, perennial, sprawling, more or less evergreen, shrub of the Rose family. Leaves are large, round to oblong and toothed, and typically come in sets of three (side shoots) or five (main stems). The most characteristic feature is probably the robust stems supporting large stiff prickles. The shrubs first appear as individual canes, then groups of canes, gradually increasing to become great mounds or banks with individual canes reaching up to 3 meters (9.8 feet). Trailing canes spread up to 20 to 40 feet, frequently taking root at the tips. The white flowers and then the roundish black and shiny 2 centimeter (less than 1 inch) fruit forms on second year (secondary) canes that grow off of first year canes. The fruit ripens from midsummer to autumn; late when compared with native blackberries.

Himalayan blackberry readily invades riparian areas, forest edges, oak woodlands, meadows, roadsides, clear-cuts, and any other relatively open area, including all open forest types. Once it becomes well established, it out competes low stature native vegetation and can prevent establishment of shade intolerant trees (e.g., Douglas-fir), leading to the formation of blackberry thickets with little other vegetation present. The resulting dense thickets can limit movement of large animals from meadow to forest and vice versa, reducing the utility of small openings and meadows as foraging areas. Although the fruit is widely consumed by native animals, it is a poor functional replacement for a diverse native forest understory, meadow, or riparian floodplain. Seeds from the fruit are spread widely by birds via their feces.

4.14.3 Description and Status of English Ivy

English ivy is an evergreen climbing vine that attaches to the bark of trees, buildings, and other surfaces by way of small root-like structures which exude a sticky substance that helps the vines adhere to various surfaces. Older vines have been reported to reach 1 foot in diameter. Leaves are dark green with white veins, waxy to somewhat leathery, and arranged alternately along the stem. Leaf forms include a 3 to 5-lobed leaf (the most common) and an unlobed rounded leaf often found on mature plants in full sun that are ready to flower. Vines may grow for up to ten years before producing flowers. Under sufficient light conditions, terminal clusters of small, pale yellow-green flowers are produced in the fall. The flowers are attractive to flies and bees in search of late season nectar sources. The black-purple fruits have a thin fleshy outer covering, contain one to three hard stone-like seeds, and may persist through the winter if not eaten first. This feature also helps ensure effective seed dispersal by birds (National Park Service [NPS] 2011).

English ivy is a vigorous growing vine that impacts all levels of disturbed and undisturbed forested areas, growing both as a ground cover and a climbing vine. As the ivy climbs in search of increased light, it engulfs and kills branches by blocking light from reaching the host tree's leaves. Branch dieback proceeds from the lower to upper branches, often leaving the tree with just a small green "broccoli head." The host tree eventually succumbs entirely from this insidious and steady weakening. In addition, the added weight of the vines makes infested trees much more susceptible to blow-over during high rain and wind events and heavy snowfalls. Trees heavily draped with ivy can be hazardous if near roads, walkways, homes, and other peopled areas. On the ground, English ivy forms dense and extensive monocultures that exclude native plants (NPS 2011). Ivy only flowers and sets fruit on climbing vines; therefore, as a first defense it is advisable to prevent the plants from climbing or removing climbing vines first to prevent fruit production.

4.14.4 Description and Status of Scotch Broom

Scotch broom is a perennial evergreen shrub in the legume family. It reaches heights up to 10 feet and has stiff, angled, more or less erect, dark green, broom-like branches. Many branches are leafless or have few leaves. Upper leaves are simple, but lower leaves are trifoliate (three-parted). The bright yellow flowers are about 3/4 inch long, shaped like pea flowers, and bloom from April to June. The brown or black pods are flat with hairs on the margins only. Each contains several seeds. Seeds are oval, about 1/8 inch long, dark greenish-brown, and have a shiny surface. Seeds can last for 60 years in the soil (Hulting et al. 2008).

Scotch broom was introduced as a garden ornamental by early settlers of the Pacific Coast. It has spread far beyond the bounds of cultivation and now covers many acres west of the Cascades from British Columbia to California. Scotch broom is moving rapidly into forest lands of western Oregon and Washington, where it is interfering increasingly with re-establishment of conifer seedlings on harvested lands. Scotch broom also is being found more frequently in areas east of the Cascades. Wherever it grows, this aggressive plant spreads to form pure stands at the expense of desirable forbs, grasses, and young trees. Because it is a threat to native plant species and indirectly to animals that feed on the displaced plants, Scotch broom is a Class B noxious weed in Washington and Oregon (Hulting et al. 2008).

4.14.5 Description and Status of Gorse

Gorse is not currently found on the Refuge. However, there are infestations in coastal Lincoln and Lane counties; therefore, monitoring for this species is warranted. If gorse is detected in the area, control efforts should be implemented immediately to eliminate the infestation on and adjacent to refuge lands. Gorse is native to western and central Europe where it was cultivated as hedgerows and as a reserve for livestock forage. In southern coastal Oregon, gorse was introduced by early European emigrants and planted as an ornamental shrub. This invasive non-native plant grew in monotypic stands and became an established exotic shrub in most coastal habitats. This species is extremely competitive, displaces native plants, and impoverishes the soil. In addition, it creates an extreme fire hazard due to oily, highly flammable foliage and seeds, and abundant woody material in the plant's center. The city of Bandon in southwestern Oregon was almost completely destroyed by a fire fueled in part by gorse in 1936. All but 16 buildings out of 500 were completely burned to the ground.

4.14.6 Description and Status of *Spartina*

Smooth cordgrass or saltmarsh cordgrass is a perennial deciduous grass, which is found naturally in intertidal wetlands, especially salt marshes on the East Coast. However on the West Coast, smooth cordgrass is viewed as an aggressive exotic that alters estuarine structure and function, excludes native salt marsh and mudflat vegetation, and eliminates native habitat for shorebirds, waterfowl, and certain shellfish and finfish (USFWS 1997b).

This long-lived, warm season perennial typically grows from 1-2.3 meters (3.2-7.5 feet) tall, and has smooth, hollow stems that bear leaves up to 20-60 centimeters (7.8-23.6 inches) long and 1.5 centimeters (0.6 inch) wide at their base, which are sharply tapered and bend down at their tips. The flowers are a yellowish-green, turning brown in the winter, and are wind pollinated. Like its relative saltmeadow cordgrass, it produces flowers and seeds on only one side of the stalk and spreads extensively by long hollow rhizomes. Soft, spongy stems up to ½ inch in diameter emerge from the rhizomes. The rhizoidal roots, when broken off, can result in vegetative asexual growth. In September and October seedheads which are 10 to 12 inches long emerge at the end of the stem. Each spike holds from twelve to fifteen 2 or 3 inch long spikelets (U.S. Department of Agriculture [USDA] 2008). Smooth cordgrass can become an invasive species either by itself or by hybridizing with native species and preventing propagation of the pure native strain.

Smooth cordgrass dynamically alters West Coast physical, hydrological, chemical, and biological estuarine functions and is noted for its capacity to act as an environmental engineer. It grows out into the water at the seaward edge of a salt marsh and can appear on mudflats far from nearby marshes. Sediment accumulates in the cordgrass infested area and enables other habitat-engineering species to settle. This accumulation of sediment and other substrate-building species gradually builds up the level of the mudflats and tidal channels are deepened. This in turn eliminates the gently sloping bare intertidal zone that lies between the salt marsh and the tidal channels (USFWS 1997b). As the marsh accretes, smooth cordgrass moves still further out to form a new edge. Smooth cordgrass grows in tallest forms at the outermost edge of a given marsh, displaying shorter morphologies up onto the landward side of the cordgrass belt.

Cordgrass may affect habitat structure for native wetland animals, benthic invertebrate populations, and shorebird and wading bird foraging areas. As a result of smooth cordgrass growth, benthic invertebrate species composition and abundance in the intertidal zone changes substantially as their habitat is overgrown. In turn, food sources shrink for birds who feed on those invertebrates. smooth cordgrass also displaces eelgrass on mudflats and native vegetation in salt marshes (USFWS 1997b).

Smooth cordgrass was introduced into Willapa Bay, Washington, in 1894 as packing material for oyster shipments from the East Coast. From 1945 to 1988, the plant spread rapidly throughout Willapa Bay. In 1999 it covered 6,000-10,000 ha (15 to 25 thousand acres) of land. Due to extensive control efforts only approximately 10 acres are considered to be infested at Willapa Bay according to a 2012 estimate. It is also now making inroads into Puget Sound and Grays Harbor in Washington.

4.14.7 Refuge-specific Sites

Reed canarygrass, Himalayan blackberry, English ivy, and Scotch broom occur sporadically on Nestucca Bay NWR whereas gorse and Cordgrass are not currently found on the Refuge. Mechanical, physical, biological, and chemical means have been utilized to combat invasive plants throughout the Refuge in accordance with 7 RM 14 (Pest Control Policy). Plans to remove, control, and prevent establishment of non-native plant species and treat infestations with IPM techniques are implemented on an as needed basis.

Reed canarygrass is found throughout the Refuge, with major infestations at Cannery Hill, in the lowland pastures, and within the Little Nestucca Restoration Area. However, a significant decrease in extent and a decline in condition of the reed canarygrass communities at the Little Nestucca Restoration Area was documented in 2008-2009 (Brophy 2010). Reed canarygrass is being replaced by a mix of transitional species and typical native tidal marsh species due to the presence of salt water.

Invasive species treatment has been concentrated on the Himalayan blackberry that infests much of the refuge uplands, roadsides, and trail edges. The blackberry was primarily hand-cut on hillsides by Oregon Youth Authority crews although some mowing with equipment was also done and the hillsides were revegetated with native trees planted by volunteers, refuge staff, and school groups through Service Learning projects. Several thousand small Sitka spruce, western hemlock, red alder, Pacific dogwood, cascara, and western red cedar trees have been planted on Cannery Hill since 2003, to revegetate where the blackberry was removed. In recent years the unavailability of the Oregon Youth Authority led to a rapid re-growth of blackberry in some portions of the Refuge, and in order to avoid reversing all gains, the Refuge began treatment in selected areas with herbicides. Since October 2008, Cannery Hill roadsides have been treated with herbicide once per year and mowed using a Bobcat or tractor throughout the growing season to maintain visibility and a walking path for visitors. Treatment of invasive plants along the Pacific View Trail and on Cannery Hill itself (tansy ragwort and thistle) has so far been limited to hand pulling, digging, and a relatively new steam treatment that did not perform as well as expected. Plans are underway for a site-specific application of herbicide in areas planted for Oregon silverspot butterfly nectar plants, to prohibit invasive grasses from taking over and smothering the nectar plantings.

Intensive efforts to remove English ivy have also been completed. Volunteers and school groups spent many hours each year since 2007 cutting, chopping, and removing ivy that had infested wooded areas on the Nestucca Bay and Neskowin Marsh Units of the Refuge.

Scotch broom has formed dense thickets along Highway 101 near the refuge lowland pastures, ditch banks and fences, and forested borders. Efforts to control Scotch broom have been erratic and only partially successful. Plants re-sprout if roots systems are not removed or killed and quickly reoccupy the sites.

4.15 Invasive and Exotic Animal Species

One of the largest threats to wildlife and habitat of the Refuge is pest animals. Introduced native and non-native animal species are usually in direct competition with native wildlife species for food, shelter, and breeding areas and often cause existing native species populations to decline or become extirpated. Ultimately, animal invasive species can result in considerable impact to native wildlife and the habitat they are dependent upon. For example, introductions of Arctic and red foxes for fur farming purposes resulted in widespread extirpation of breeding Aleutian Canada geese in the Aleutian Islands, Alaska due to predation (USFWS 1993c, Bailey and Trapp 1984). The fox decimated goose populations by preying upon vulnerable nesting adults, chicks, and eggs. The Aleutian Canada goose inhabits refuge lands in Alaska during the summer and Oregon during the fall through spring. Because of cooperative recovery efforts, that included removing invasive foxes from the breeding islands, the USFWS officially delisted this species from threatened status in 2001 (USFWS 2001b). The following list is not all inclusive and includes only the most problematic species. Many other exotic animals have been introduced.

4.15.1 Description and Status of the New Zealand Mudsnail

New Zealand mudsnails are relatively small (average length of 4-5 millimeters [0.15-0.19 inch] in western United States), with a maximum of 11 millimeters (0.43 inch) in native habitats. They reach maturity at 3 millimeters (0.1 inch) in length in rivers in western Montana and Idaho. Their shell usually consists of a right-handed coiling of five to six whorls. The shell varies in color (gray, light to dark brown). An operculum (i.e., plate) covers the opening of the shell. New Zealand mudsnails have triploid, parthenogenetic female populations: asexual females are born with developing embryos in their reproductive system. Diploid, sexual male and female populations are extremely rare in western USA. Asexual females generally produce twice the number of daughters as sexual females. The adult New Zealand mudsnail may easily be confused with various native and exotic species which can be similar in appearance, and all newly discovered populations should be verified by experts. The shell of the New Zealand mudsnail is narrower, longer, and has more whorls than most hydrobiid snails native to the United States. New Zealand mudsnails are live bearers (they release embryos and not eggs), and therefore, the presence of newly released young may indicate a possible population. New Zealand mudsnails can inhabit lakes, ponds, streams, rivers, lagoons, estuaries, canals, ditches, water tanks, and reservoirs and occupy a wide variety of substrates including silt, sand, mud, concrete, vegetation, cobble, and gravel. They are capable of tolerating a wide range of temperatures with upper thermal limits of 28°C and lower thermal limits near freezing. They also have a wide salinity tolerance range from saline and brackish to freshwater. Populations in saline conditions produce fewer offspring, grow more slowly, and undergo longer gestation periods. Individuals of this species are able to tolerate turbidity, clear water, and degraded conditions (including sewage) and may pass through the digestive tracts of many fish species (Aquatic Nuisance Species [ANS] 2011).

The New Zealand mudsnail has a history of becoming a pest species in many parts of the world, and its recent introduction into North American waters is cause for concern. Since the mid-1980s, North American population densities in some infested streams have reached up to 3/4 million individuals per square meter. New Zealand mudsnails could displace native invertebrates. Five species of mollusks (all native to the Snake River) have recently been listed as “endangered” in part due to the establishment of the New Zealand mudsnail and its potential impacts. Establishment is expected to have negative impacts on native fauna (e.g., decrease in densities of herbivorous invertebrates, decrease in attached filter-feeding organisms). There is evidence for a negative correlation between populations of mayflies, stoneflies, caddisflies, and chironomids and New Zealand mudsnail densities of <28,000 per square meter in a spring creek in southwestern Montana. This species may have the potential to impact the food chain of native trout and other fish species and to disrupt the physical characteristics of invaded ecosystems (e.g., reduction in the biomass of periphyton), and the resulting interactions can have wide-ranging effects on stream ecosystem processes. They also have the potential to become a pest species of freshwater supplies: in Australia, New Zealand mudsnails actually emerged from domestic water taps (ANS 2011).

There is great concern about this hitchhiker’s ability to spread because of its asexual reproduction and its ability to survive in harsh conditions. Because the mudsnails reproduce asexually, it only takes one individual to become introduced into new water to make an impact. Also, the mudsnails can readily attach themselves to boats, boots, and waders. Preventative measures for anglers must include checking fishing gear and ensuring that it is free of mud and any noticeable snails. People entering areas infested with New Zealand mudsnails must also disinfect boats, boots and other equipment before leaving the area.

This snail has the ability to reproduce quickly and mass in high densities. In some western streams, snails have become as dense as one-half million per meter square, which has raised concern that the mudsnails will impact the food chain of native trout and alter the physical characteristics of the streams themselves. Research is needed to determine the impacts of large populations of mudsnails on the native fauna, such as aquatic insects and native snails, and on any changes in the physical environment.

4.15.2 Description and Status of Nutria

The nutria is a large, dark-colored, semiaquatic rodent that is native to southern South America. At first glance, a casual observer may misidentify nutria as either beaver or muskrat, especially when it is swimming. This superficial resemblance ends when a more detailed study of the animal is made. Other names used for the nutria include coypu, nutria-rat, South American beaver, Argentine beaver, and swamp beaver.

Nutria are members of the family *Myocastoridae*. They have short legs and a robust, highly arched body that is approximately 24 inches (61 centimeters) long. Their round tail is from 13 to 16 inches (33 to 41 centimeters) long and scantily haired. Males are slightly larger than females; the average weight for each is about 12 pounds (5.4 kilograms). Males and females may grow to 20 pounds (9.1 kilograms) and 18 pounds (8.2 kilograms), respectively. The dense grayish underfur is overlaid by long, glossy guard hairs that vary in color from dark brown to yellowish brown. The forepaws have four well-developed and clawed toes and one vestigial toe. Four of the five clawed toes on the hind foot are interconnected by webbing; the fifth outer toe is free. The hind legs are much larger than the forelegs. When moving on land, nutria may drag its chest and appear to hunch its back. Like beavers, nutria have large incisors that are yellow-orange to orange-red on their outer surfaces. In addition to having webbed hind feet, nutria have several other adaptations to a semiaquatic life. The eyes, ears, and nostrils of nutria are set high on their heads. Additionally, the nostrils and mouth have valves that seal out water while swimming, diving, or feeding underwater. The mammae or teats of the female are located high on the sides, which allows the young to suckle while in the water. When pursued, nutria can swim long distances under water and see well enough to evade capture (Internet Center for Wildlife Damage Management [ICWDM] 2011).

Nutria construct burrows in banks of rivers, sloughs, and ponds, sometimes causing considerable erosion. Burrowing is a commonly reported damage caused by nutria. Burrows can weaken roadbeds, stream banks, dams, and dikes, which may collapse when the soil is saturated by rain or high water. Rain action can wash out and enlarge collapsed burrows and compounds the damage. Nutria depredation on crops is also well documented. Crops that have been damaged include corn, sugar and table beets, alfalfa, wheat, barley, oats, various melons, and a variety of vegetables from home gardens and truck farms. Nutria girdle fruit, nut, deciduous and coniferous forest trees, and ornamental shrubs. They dig up lawns when feeding on the tender roots and shoots of sod grasses. At high densities and under certain adverse environmental conditions, foraging nutria can also significantly impact natural plant communities. Overutilization of emergent marsh plants can damage stands of desirable vegetation used by other wildlife. Nutria are aggressive competitors with the native muskrat, which is smaller. Muskrats have been largely eliminated or greatly reduced where nutria have become established (ODFW 2011a).

4.15.3 Description and Status of Feral Cats

A feral cat is a domestic cat that is free roaming, untamed, and un-owned. These cats live and breed entirely in the wild and depend on native wildlife as prey items. Feral cats are often apex predators in local ecosystems feeding on local birds and small mammals.

4.15.4 Refuge-specific Sites

Nutria have been observed on the lowland pastures and wetlands throughout the Refuge. These animals like the ditch banks between the pastures and use the high vegetation as cover. They also burrow into dikes threatening the integrity of these structures. Feral cats have also been observed on Cannery Hill and in some lowland pastures. There have not been reports of the New Zealand mudsnail within the estuarine areas of the Refuge and the extent of infestation is unknown.

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Chapter 5
Human Environment

William Medlen/USFWS

Chapter 1 Introduction and Background

Chapter 2 Management Direction

Chapter 3 Physical Environment

Chapter 4 Biological Environment

Chapter 5 Human Environment

Appendices

Chapter 5. Human Environment

5.1 Cultural Resources

5.1.1 Native American Cultural Landscape

For thousands of years, people living on the Oregon coast relied upon resources obtained from estuaries (Minor and Toepel 1983, Draper 1988, Ross 1990, Lyman 1991 as cited in Byram 2002). Fish, shellfish, terrestrial and marine mammals, avian species, and edible plants all provided the means for sustenance. With its dense food value and predictable runs, salmon in particular were of high value. This is reflected in the ethnographic accounts and archaeological evidence. Major river drainages are known to have been well populated and have many major archaeological sites. However, smaller estuaries without a major stream to support a strong salmon run had smaller populations and fewer major archaeological sites.

The concentration of preferred resources in the productive interface of ocean and land led to numerous stable and distinct groups of Native people on the Oregon coast. These are recorded in early written records and later ethnographic studies. Each estuary and bay was associated with a unique group which broadly shared the same cultural habits, beliefs, and sometimes language with other coastal groups.

Nestucca Bay National Wildlife Refuge

Nestucca Bay National Wildlife Refuge (NWR or Refuge) is located within the traditional territory of the Nestucca-dialect speaking people of the Tillamooks or Killmooks. This larger tribe consisted of the Salish-speaking people generally located west of the Coast Range and along the coast from Tillamook Head to 10 or 20 miles south of Siletz Bay. The Tillamooks can be considered the southernmost full expression of the classic Northwest Coast Culture that extended north to British Columbia, Canada. For example, permanent homes, which varied slightly in shape and size through time, were commonly built of cedar logs and split planks. These cedar plank houses could be built totally above ground or partially buried into the terrain. The roof pattern, style of entry, and internal layout were of the Northwest Coast pattern.

The year was divided by procurement and religious ritual recognition of various resources. Along the estuary and on the outer coast, many food resources such as marine fish and shellfish were probably harvested throughout the year, but some of the most valued foods had to be harvested in quantities, processed, and stored when they were available. These included salmon, drift whales other sea mammals, starchy plants such as camas and fern roots, and elk. Weirs, nets, and other traps were common fish catching techniques; spearing and clubbing also occurred. Many products would be steam cooked in an earth oven or could be brought to a boil with hot stones dipped into a water-filled basket. Some food would be preserved though air drying or smoking on a rack.

In spring, various plants and marine fish became abundant, and the tides were low on the shore for shellfish harvests. Salmonberry sprouts were gathered beginning in April and harvested when ripe during May and June. In late spring and summer, anadromous fish would become available above tidewater, and groups would move to upriver camps to begin their harvests, and to gather and process plant foods such as camas. Salalberry, huckleberry and strawberry were harvested in July and August. When adequate stores were acquired, people had time to travel to inland valleys or north and south along the coast for trade, gaming, and socializing. The Chinook salmon were caught in the runs of August and September, coho in October. During the fall, elk would be taken, and in November, chum salmon could be caught. Winter was a period of less outdoor work activity, when most village residents remained at home and relied largely on stored foods. Stories were told, dances were held, and tools, clothing, basketry, and other crafts and art were produced and maintained. Winter steelhead obtained between December and April brought the cycle back to spring.

Evidence of the above activities and items has been found along the coast. Shell middens or layers of shell, bone, charcoal and fire-cracked rocks that accumulate at occupation sites are common on the coast. Large quantities of fire-cracked rock with charcoal indicate a roasting pit location. Subtle ground depressions may indicate where a plank house stood. Although Nestucca Bay and the estuarine reaches of the Nestucca and Little Nestucca Rivers were prime locations for prehistoric Native American villages, to date no archaeological sites that may represent such villages have been recorded.

5.1.2 Post-settlement Overview

Nestucca Bay Unit

The first recorded European to enter the area was Arthur Black in 1828, who sheltered with the Tillamooks. The Donation Land Claims Act of 1850 and the Homestead Act of 1862 provided incentives that encouraged the settlement of the coastal lowlands and river valleys. Lands adjacent to the Nestucca River were first homesteaded in the mid to late 1800s. Fishing, logging, and eventually dairy farming, became the primary occupations in the Nestucca Valley. A commercial salmon cannery was established on the east side of Nestucca Bay in 1886; however, after a few good years the salmon became scarce and the cannery ceased operations and was dismantled. Demand for lumber began to increase in the late 1800s, and timber companies acquired land in the watershed. Through diking, installation of culverts and tide gates, removal of trees, and extensive ditching for drainage, dairies were established in the lower valleys.

Neskowin Marsh Unit

A Nestucca Indian encampment at the mouth of Neskowin Creek was reportedly abandoned before the time of the white settlers (Tillamook County 1999). Euro-American settlers first moved into the area along Neskowin Creek in the late 1870s. Early on, Neskowin became a campground and picnic area where families came for fun, relaxation and relief from the stresses of city life. A plat of the town of Neskowin was filed in 1910 and in the 1930s, beachgrass was planted in dune areas to make more land available for the development of building sites. Deed restrictions shaped the growing community into one of primarily single family residences and discouraged commercial development. The rich bottomlands along the major Neskowin drainage (i.e., Neskowin Creek, Hawk Creek, Butte Creek, and Meadow Creek) were all farmed. Old drainage ditches are still evident in the Butte and Meadow Creek wetlands areas. At one time, areas now within the Neskowin Marsh Unit along Meadow Creek were dry enough to pasture horses and cattle. Additionally, cranberry bogs were planted in this area during 1912-13; however, the plants failed to grow and the project was abandoned. It is believed that salt water from high tides killed the plants.

5.1.3 Archaeological Sites and Surveys

Within the approved boundary of the Nestucca Bay NWR, there are three recorded archaeological sites. There are three known archaeological sites within the vicinity of the Refuge but outside of the approved boundary (Tables 5-1 and 5-2).

Table 5-1. Known Archaeological Sites within or in the Vicinity of Nestucca Bay National Wildlife Refuge

Trinomial	Common Name	Type	Attributes	Within Approved Refuge Boundary
TI00028	Dodge's Cabin	Prehistoric	Midden	Yes
TI00087	Burnt Ledge	Prehistoric	Roasting pit	Yes
Unrecorded	Village	Prehistoric	Ethnographic report	Yes
TI00024		Prehistoric	Midden	No
TI00025		Prehistoric	Midden	No
Unrecorded	Village	Prehistoric	Ethnographic report	No

Table 5-2. Archaeological Surveys within or in the Vicinity of Nestucca Bay National Wildlife Refuge

SHPO Number	Survey Title	Author	Within Approved Refuge Boundary
323	US 101-Green Timber Road	D.L. Cole	Yes
326	Waste Water Facilities	C.R. Swanson	Yes
631	Water Facilities Improvement	J.A. Follansbee	Yes
20382	Cannery Hill Overlook	A. Bourdeau	Yes
17568	Private House		Yes
18772	Straub Park OSMA 2003-7	G. Tassa	No
22230	Waste Water Line		No
16604	US 101		No

5.1.4 Threats to Cultural Resources

A variety of natural and human-caused activities can threaten cultural resources, including:

- Fire, both naturally occurring and prescribed for habitat restoration, can cause significant damage to historic structures and archaeological sites as can the activities to suppress and manage fire (such as creating fuel breaks, etc.)
- Erosion, whether the byproduct of fire, wind, waves or another natural or manmade agent
- Habitat restoration and other land management activities.
- Vandalism or "pot hunting"

Any activity identified in the CCP's management direction (see Chapter 2), including wetland restoration, construction of new facilities, or changes in public use could have a potential impact to cultural resources. The greatest threats may be posed by earthmoving, removal of structures, or alteration of the current erosion patterns occurring during habitat restoration, construction, or other land management activities.

The Service is committed to protecting valuable evidence of plant, animal, and human interactions with each other and the landscape over time. These may include previously recorded or yet undocumented historic, cultural, archaeological, and paleontological resources as well as traditional cultural properties and the historic built environment. Protection of cultural resources is legally mandated under numerous Federal laws and regulations. Foremost among these are the National Historic Preservation Act (NHPA) as amended, the Antiquities Act, the Historic Sites Act, the Archaeological Resources Protection Act (ARPA) as amended, and the Native American Graves Protection and Repatriation Act (NAGPRA). The Service's Native American Policy (USFWS 1994) articulates the general principles guiding the Service's relationships with Tribal governments in the conservation of fish and wildlife resources. Additionally, the Refuge seeks to maintain a working relationship and consult on a regular basis with the Tribes that are or were traditionally tied to lands and waters within the Refuge.

5.2 Refuge Facilities

The infrastructure and facilities discussed in this section include boundary signs, public entrances, roads, trails, and administrative buildings. Facilities associated with specific public use programs are discussed in Section 5.5. All public and administrative facilities, with the exception of boundary signs, are depicted on the map located in Chapter 2.

5.2.1 Boundary Signs

To date, approximately 70% of the Refuge is posted with official refuge boundary signs. Boundary signs are located primarily where refuge lands are adjacent to roads, dikes, and privately owned agricultural fields. The perimeter areas that need to be posted include the north end of the Upton Slough Tract, the eastern portion of the Mecklem Tract, the Utter Tract, and the Lyda Tract. The western boundary of Brooten Marsh adjacent to state tidelands is also not posted due to lack of survey for exact placement as well as inhospitable terrain for posts. Approximately 60% of the Neskowin Marsh Unit has been posted with boundary signs or markers. The perimeter areas that need to be posted include the south end, the southeast and northwest corners, and the northeast line of the Neskowin Marsh Tract; and the west and north portion of the Sahhali Shores Tract.

5.2.2 Public Entrances, Roads, Launches, Access Points, and Parking

There is one official public entrance to Nestucca Bay NWR and it is located on the west side of U.S. Highway 101 on Christensen Road. The area accessed through this road is referred to as Cannery Hill and it is the only area where public use is currently allowed on the Refuge. There are two standard refuge entrance signs on Nestucca Bay NWR. Both signs are located on the west side of Highway 101 in refuge-managed pastures. One is at the entrance road (Christensen Road) to Cannery Hill and the other is approximately 2 miles north of Christensen Road in refuge pasture #1.

The 1-mile entrance road to Cannery Hill, Christensen Road, is paved for the first 0.4 mile while the remainder is graveled. There are two vehicle parking areas for the public on Cannery Hill and both have parking stalls that are accessible for people with disabilities. The paved lower parking lot has 10 parking spaces and a single vault restroom, which is maintained by refuge volunteers and staff. There are two solar-powered electronic gates on Christensen Road. The gate by the lower parking area opens at sunrise and closes at sunset to coincide with the open public use hours for this part of the Refuge. The second gate is adjacent to the upper parking lot and remains closed at all times to prevent visitors from trespassing onto closed areas of the Refuge and onto neighboring private property. The paved upper parking lot contains five parking spaces.

The public can access the Little Nestucca River and Nestucca Bay by motorized or non-motorized boat during high tide via three public boat launches. One launch is located within Bob Straub State Park. The other two additional launches are managed by Tillamook County. One is located on Brooten Road just south of the entrance to Pacific City while the other one is sited on the south bank of the Little Nestucca River on Meda Loop Road and just east of Highway 101.

The Neskowin Marsh Unit is closed to public use thus there are no public entrances to the unit and the USFWS does not have a standard refuge entrance sign installed at Neskowin Marsh. The Refuge does maintain the Neskowin tsunami evacuation trail, though it is not accessible to wheelchairs. This is a trail located on an old roadbed that crosses the southern portion of the marsh and is maintained by the USFWS for use by local residents in order for them to escape during a tsunami.

5.2.3 Trails

Cannery Hill

There are two official wildlife observation and interpretation trails at Cannery Hill. Christensen Road/Trail is a 0.4-mile graveled trail that is not accessible to visitors with disabilities. It leads visitors from the lower parking lot to the upper parking lot through a matrix of forest including restored forest, mature coniferous forest, and a small patch of native hardwoods. The Pacific View Trail is paved, accessible to people with disabilities, 0.3 mile in length, and starts at the upper parking lot and leads to an elevated viewing deck perched atop Cannery Hill. The viewing deck affords visitors a sweeping view of the Pacific Ocean, Haystack Rock, Cape Kiwanda, Nestucca Bay, and the Coast Range.

Neskowin Marsh Unit

The "Neskowin Tsunami Evacuation Trail", which traverses the south end of the marsh near the north end of the Neskowin Beach Golf Course, serves as one of only a few tsunami escape routes for residents living along Hawk Street in the low-lying community of Neskowin. The trail is located on a former roadbed that crossed the marsh and there is a small wooden footbridge that spans the marsh outlet channel. This trail would theoretically allow local residents in the nearby dunes to escape on foot to high ground in the Neskowin Crest area as well as foot passage to U.S. Highway 101. The tsunami evacuation trail is not open to the general public.

5.2.4 Administrative Buildings and Other Infrastructure

The Oregon Coastal Field Office is located on the campus of the Oregon State University, Hatfield Marine Science Center in Newport, OR and houses the Refuge Complex and the Newport Ecological Services Field Office. Management of Nestucca Bay NWR, as well as the other north coast refuges, is carried out from this office. The administrative facilities consist of a small interpretive display, a laboratory, an attached shop/garage, a conference room and office space for 8 permanent, two term, and four temporary employees.

The Refuge owns facilities at Cannery Hill. These facilities consist of a residence dating from 1951 and a maintenance shop built in 2000 and expanded in 2004. The residence has two bedrooms and one bath and is set up for refuge staff or volunteer family living quarters. The house is in poor condition and is scheduled for replacement in 2014. The house is intermittently occupied by refuge volunteer(s). The Refuge also owns two dairy barns in fair condition on the Hagerty Tract.

The Refuge manages pastures for wintering goose forage. To manage these pastures, the Refuge maintains a system of levees, ditches, culverts, and tidegates. Part of the Nestucca Bay Unit pastures is slightly above the estuary water level and was tiled before becoming refuge; the remainder of the units is at estuary level or below, and could not be tiled since the water constantly percolates onto the Refuge. All the pastures are drained by open cross ditches that flow out into the bay through tidegates. Two refuge tidegates drain the northerly pastures.

5.3 Wildlife-dependent Public Uses

The National Wildlife Refuge System Improvement Act of 1997 defined six wildlife-dependent recreational uses (hunting, fishing, wildlife observation and photography, environmental education, and interpretation) and required that they receive priority consideration in refuge planning when they are compatible with the refuge mission.

Nestucca Bay NWR currently offers four of the six wildlife-dependent activities including wildlife observation and photography, environmental education, and interpretation. The Refuge was closed to all public use until October of 2008 when Cannery Hill was opened. Since then visitation has increased to approximately 77,000 visitors annually as people learn about public use opportunities through communication with refuge staff and volunteers, news articles, directional highway signage, a refuge website, Facebook, and general word-of-mouth within the local community. The Neskowin Marsh Unit of the Refuge is not open to the general public.

5.3.1 Hunting

There is currently no official hunting program on the Nestucca Bay NWR. The tidelands adjacent to the Refuge are owned and managed by the Oregon Department of State Lands and are legally open to hunting where some waterfowl hunting, managed by the Oregon Department of Fish and Wildlife, occurs.

5.3.2 Fishing and Clamming

There is currently no fishing program on Nestucca Bay NWR. Clamming takes place, under Oregon Department of Fish and Wildlife regulations, on state tidelands adjacent to refuge lands at two locations. The first location is the Little Nestucca River tideflats 0.5 mile west (downstream) from the Highway 101 Bridge. Some clammers have been reported trespassing through closed wildlife refuge pastures to access this area. The second area where clams and sand shrimp are harvested is the tide flat adjacent to Brooten Marsh. Access to this area is provided by a developed access point 0.3 mile east of Tract 12 and an undeveloped access point on the eastern edge of Tract 12. Some harvesting at this location may occur on the Refuge, but the south end of Tract 12 has not yet been surveyed and this refuge boundary is not posted.

5.3.3 Wildlife Observation and Photography

These two wildlife-dependent activities are popular on Cannery Hill. The Pacific View Trail, the Viewing Deck, and the lower parking lot at Cannery Hill are the some of the best locations for these two activities. The best season for viewing geese and other species of waterfowl on the Refuge is from November to March. This public use does not coincide with the peak of visitation primarily due to seasonal migration of waterfowl and geese, inclement weather, and a dearth of tourists in winter months. Another good time for wildlife viewing is during songbird migration in the spring. Lincoln City Audubon Society regularly offers guided bird walks that follow the existing Christensen Road/Trail and Pacific View Trail and coincide with the migration and nesting season for songbirds.

5.3.4 Environmental Education

The Refuge offers very few environmental education (EE) programs onsite at Nestucca Bay NWR. All EE programs are informal and led by refuge volunteers, interns, or staff. The Refuge conducts a citizen science program called Project NestWatch. NestWatch is a continent wide citizen science project and nest monitoring database of the Cornell Lab of Ornithology.

5.3.5 Interpretation

Nestucca Bay NWR is represented in a Refuge Complex general brochure that is stocked at the headquarters office and in the welcoming kiosk in the lower parking lot at Nestucca Bay NWR. The Refuge Complex also maintains a website (www.fws.gov/oregoncoast) where current information regarding the Refuge can be obtained at any time. The Refuge further involves the public through social media and maintains a Facebook account and a Flickr site.

Cannery Hill

The lower parking lot contains a welcoming kiosk that orients visitors to Nestucca Bay NWR. It contains information on the hiking trails, things for visitors to do, and the rules and regulations of the Refuge. Along the Pacific View Trail there are four interpretive panels that share the story of the diversity of wildlife habitats and wildlife found on the Refuge.

Also at Cannery Hill, there is a trail that follows the power line right-of-way corridor from Christensen Road to a refuge-maintained tide gate and dike. The trail is maintained by staff, volunteers, and the local power company. The trail is closed to public use due to the potential for disturbance of geese during fall and winter, as well as safety concerns resulting from frequently flooded conditions. Staff lead visitors down the trail during special wildlife observation events such as the Birding and Blues Festival in April. The trail goes through a variety of habitats and thus provides visitors with some of the best birdwatching opportunity on the Refuge.

During the summer, refuge staff and volunteers lead a series of events that provide opportunities for the public to learn more about the wildlife and habitats of Nestucca Bay. These events include nature photography, nature sculpture, guided bird walks, historical talks on the early settlers of the area and more. The Refuge is partnering with the Tillamook Estuaries Partnership to develop a water trail for the Nestucca and Little Nestucca Rivers. Water trails are defined boating routes on a waterway connected through signs, maps and access points providing a scenic and educational experience for recreational users.

The Birding and Blues Festival is an annual springtime event hosted by the community of Pacific City. The festival attracts from 150 to 300 visitors to the local area. The Service is one of the festival sponsors offering wildlife oriented presentations, workshops, and guided bird walks. The various festival events educate birders of all interest levels and ages. This festival promotes tourism in the area and informs visitors of the many outdoor activities available in the Pacific City area, including the Refuge.

5.4 Other Refuge Uses

5.4.1 Non-recreational Public Uses

Four private inholdings have easements to use Christensen Road to access their property. The Tillamook People's Utility District has an easement to access and maintain a power line that runs north through the Cannery Hill area. The Refuge is also part of the Little Nestucca Drainage District. On the Neskowin Marsh Unit, right-of-ways on record relate to the county maintained road and utilities (phone/electric) to serve public facilities. In addition, the Neskowin Regional Water District holds several easements for domestic water supply lines that cross the Neskowin Marsh Unit. Finally, the homeowners association for Sahhali Shores holds an easement on a trail that provides the homeowners with access to the beach from the development.

5.4.2 Economic Use

A total of 346 acres of refuge pastures are managed for wildlife habitat by five local dairy farmers through Cooperative Land Management Agreements. The vegetation in the pastures is kept short and actively growing for geese and waterfowl habitat throughout most of the year using various management practices including grazing, mowing and "greenchopping" (cutting silage for dairy cattle). Through this arrangement, wildlife receive 100% of the crop in the form of short, green browse available to foraging white-cheeked geese from November through April; and the cooperator also gets a share of the crop in the form of cattle forage and/or silage during the summer months when the geese are not present.

5.4.3 Illegal/Unauthorized Uses

Currently the Oregon Coast NWR Complex has one full-time Wildlife Law Enforcement (LE) Officer. LE assistance is also provided to the Refuge Complex by the Zone LE Officer (who is responsible for western Oregon and Washington) as well as Oregon State Police, the Tillamook County Sheriff's Office, Bureau of Land Management, and the U.S. Forest Service.

The Refuge deals with law enforcement (LE) issues that include wildlife disturbance, geocaching (when conducted in closed areas), illegal hunting, trespass, destruction of government property, illegal tree cutting and girdling, litter and pet related infractions.

5.5 Surrounding Area Outdoor Recreational Opportunities and Trends

5.5.1 Nearby Recreational Opportunities

Nestucca Bay NWR is nestled in between two small urban areas on the coast. Lincoln City is approximately 20 miles to the south and the city of Tillamook is 30 miles to the north. Local, state, and Federal governments have all developed recreational opportunities for both residents and visitors. The Lincoln City Department of Parks and Open Space collectively manages 11 parks with amenities that include picnic tables, boat ramps, walking trails, interpretive signs, beach access, and crabbing docks. They also manage nine open space properties that provide habitat for wildlife and a place for people to walk and enjoy nature. The City of Tillamook manages three city parks with facilities for the public to enjoy day use activities and they manage one interpretive trail.

Oregon Parks and Recreation Department (OPRD) manages nine state parks within a 40-mile radius of Nestucca Bay NWR. The U.S. Forest Service manages the Siuslaw National Forest, which has a total of seven hiking trails, three campgrounds and multiple day use areas for off-road vehicles in the vicinity of Nestucca Bay NWR. Other nearby popular recreation locations includes Cape Kiwanda State Natural Area, Clay Meyers State Natural Area at Whalen Island, and Cascade Head Nature Preserve.

There are waterfowl hunting opportunities in Tillamook County in Tillamook Bay, Nestucca Bay and Netarts Bay and on privately owned pasturelands (ODFW 2011b).

5.5.2 Outdoor Recreation Trends

OPRD is responsible for providing guidance, information and recommendations to Federal, state, and local units of government, as well as the private sector, in making policy and planning decisions regarding outdoor recreation in Oregon. They do this in the Statewide Comprehensive Outdoor Recreation Plan or SCORP (OPRD 2008). The latest SCORP is a five-year plan covering outdoor recreation in Oregon from 2008 through 2012.

The OPRD began the SCORP planning process in September 2005. The agency took a more proactive approach in addressing a limited number of previously identified and defined issues. Key findings from the 2003-2007 SCORP and the 2005-2014 statewide trails planning efforts identified a number of important demographic and social changes facing outdoor recreation providers in the coming years including: (1) a rapidly aging Oregon population, (2) fewer Oregon youth learning outdoor skills, and (3) an increasingly diverse Oregon population. Key findings for each of these issues are:

Aging Oregon Population

- On average across all activities, respondents expect to spend 28% more days recreating 10 years from now than they currently do.
- The most popular outdoor recreation activities for Oregonians between the ages of 42 and 80 included walking, picnicking, sightseeing, visiting historic sites, and ocean beach activities. A comparison across age categories for top five activities by participation intensity leads to the following conclusions: Walking is the top activity across all age categories (40-79);

jogging is a top activity between the ages of 40-59, but is also popular for those in their 70s; bicycling is a top activity between the ages of 40-64; sightseeing is a top activity between the ages of 45-74; bird watching is a top activity between the ages of 55-79; and RV/trailer camping is a top activity between the ages of 55-74.
- The top five activities in terms of future participation intensity 10 years from now included walking, bicycling, jogging, bird watching, and day hiking.
- Over one-third of Oregon Boomers and Pre-Boomers volunteered in their community, with an average time commitment of 5.3 hours per week. Of those who volunteered, 43% expect future changes in their volunteer activities, with most of the changes involving greater volunteerism: more time, more projects at current volunteer opportunities, and new volunteer opportunities.

Youth Learning Outdoor Skills

- The most popular outdoor activities for parents were walking, viewing natural features, and relaxing/hanging out. For children, the most popular were walking, followed by outdoor sports/games, relaxing/hanging out, and general play at neighborhood parks/playgrounds.
- The more a parent engages in an outdoor recreation activity, the more their child does. Participation varies across child age, with both the number of activities and the number of activity-days peaking amongst 12-14 year olds and decreasing for 15-17 year olds.
- Rural children spend more days, on average, in outdoor activities relative to urban and suburban children.
- Outdoor sports programs and day camps were the most popular types of outdoor recreation programs with respect to past participation. Many parents indicated that it would be very likely for their children to participate in outdoor sports programs (62%), multi-day camps (49%), outdoor adventure trips (45%), and day camps (45%) in the future.

An Increasingly Diverse Oregon Population

- Walking for pleasure was the most common favorite activity for both Hispanics and Asians, with fishing and soccer being the next most common for Hispanics and hiking and fishing the next most common for Asians.
- Both Hispanic and Asian respondents most commonly did their favorite activity with members of their immediate family. Asians were more likely than Hispanics to do activities alone, as were older respondents relative to younger respondents.
- The most common location for Hispanic and Asian respondents to do their favorite activity was in a park or other area outside one’s town or city. Males were more likely than females to engage in their favorite activity further from home.
- Walking for pleasure was also the activity respondents spent the most days engaged in during the past year. Hispanics engage more intensely than Asians in jogging/running, day hiking, picnicking, fishing, viewing natural features, visiting nature centers, and visiting historic sites.
- The most common activities respondents would like to do more often, or start doing were walking for Asians and walking and camping for Hispanics. The factor that would most help make this happen is availability of partners, followed by more time.
- For the Hispanic population, being in the outdoors, relaxing and having fun were the most important motivators or reasons for participating in outdoor activities. For the Asian population, relaxing, fitness, and having fun were the top motivators.

A summary of management recommendations, that are relevant to the types of outdoor recreation that the Service is engaged in, resulting from the SCORP are as follows:

- Develop a statewide youth outdoor programming framework and funding source to focus youth programming efforts across Oregon to address a specific set of key measurable objectives.
- Create a new Outdoor Recreation Section within OPRD addressing the areas of outdoor recreation and environmental education.
- Develop a strategy to strengthen the role of park and recreation agencies in the state's Safe Routes to Schools grant program.
- Plan and develop regional trail systems in areas having highest relocation intensity in the 40 to 79 age range (Coastal, Southern and Central Oregon communities).
- Provide design assistance for innovative park designs connecting kids with nature.
- Encourage organizational cultural change within public recreation agencies/organizations to effectively address the diversity issue.
- Develop recommendations for addressing language barriers to encourage underrepresented population use of outdoor recreation facilities and programs
- Create a customer service training module related to serving the outdoor recreation needs of an increasingly diverse population.

5.6 Socioeconomics

5.6.1 Population and Area Economy

Oregon’s population of approximately 3,825,700 ranks 27th in the nation. State land area covers 95,997 square miles compared to 3,537,438 square miles in the United States with a population density of 40 persons per square mile compared to 87 nationwide.

Table 5-3 shows the local population and area economy. The county population increased 2 percent from 1999 to 2009, compared with an 11 percent increase for the State of Oregon and a 10 percent increase for the U.S. as a whole. Tillamook County employment increased by 9 percent from 1999 to 2009, slightly outpacing Oregon and the United States. Per capita income in Tillamook County increased by 9 percent over the 1999-2009 period, while the State of Oregon and the U.S. increased by 4 and 9 percent respectively.

The largest industry sectors for Tillamook County are ranked below by employment (Table 5-4). The largest employer is the State and local government. Natural resource-based industries (logging and sawmills) totaled 758 jobs while the dairy and cheese industries supported 1,184 jobs. Food services and retail stores, which are impacted by refuge visitation, are also important contributors to the economy (1,476 jobs).

Table 5-3. Nestucca Bay NWR: Summary of Area Economy, 2009 (population and employment in thousands; per capita income in 2010 dollars)

	Population		Employment		Per Capita Income	
	2009	Percent Change 1999-2009	2009	Percent Change 1999-2009	2009	Percent Change 1999-2009
Tillamook County, OR	24.9	2%	13.4	9%	$33,311	9%
Oregon	3,825.7	11%	2,202.7	8%	$36,785	4%
United States	307,006.6	10%	173,809.2	8%	$40,285	9%

Source: U.S. Department of Commerce 2011.

Table 5-4. Industry Summary for Tillamook County (dollars in thousands)

Industry	Employment	Output	Employment Income
State and Local Government	1,473	78,724	69,505
Food Services	962	49,780	14,711
Dairy Cattle and Milk Production	821	92,409	6,595
Retail Stores	514	31,293	12,289
Commercial Logging	386	93,309	14,103
Sawmills and Wood Preservation	372	97,621	22,854
Cheese Manufacturing	363	322,988	20,326
Real Estate	358	39,339	2,136
Private Hospitals	271	31,963	16,511
Animal (except poultry) slaughtering, rendering, and processing	259	119,474	10,357

Source: Minnesota IMPLAN Group, Inc. 2008.

5.6.2 Economic Benefits of Refuge Visitation to Local Communities

From an economic perspective, Nestucca Bay National Wildlife Refuge provides a variety of environmental and natural resource goods and services used by people either directly or indirectly. The use of these goods and services may result in economic impacts to both local and state economies. The various services the Refuge provides can be grouped into five broad categories: (1) maintenance and conservation of environmental resources, services and ecological processes; (2) production and protection of natural resources such as fish and wildlife; (3) protection of cultural and historical sites and objects; (4) provision of educational and research opportunities; and (5) outdoor and wildlife-related recreation. People who use these services benefit in the sense that their individual welfare or satisfaction level increases with the use of a particular good or service. One measure of the magnitude of the change in welfare or satisfaction associated with using a particular good or service is economic value. Aside from the effect on the individual, use of the good or service usually entails spending money in some fashion. These expenditures, in turn, create a variety of economic effects collectively known as economic impacts.

A comprehensive economic profile (baseline) of the Refuge would address all applicable economic effects associated with the use of Refuge-produced goods and services. However, for those goods and services having nebulous or non-existent links to the market place, economic effects are more difficult or perhaps even impossible to estimate. Some of the major contributions of the Refuge to the natural environment, such as watershed protection, maintenance and stabilization of ecological processes, and the enhancement of biodiversity would require extensive on-site knowledge of biological, ecological, and physical processes and interrelationships even to begin to formulate economic benefit estimates. This is beyond the scope of this section. Consequently, this section focuses on economic effects, which can be estimated using currently available information. As a result, benefits represent conservative estimates of total social impacts.

The following section focuses on a limited subset of refuge goods and services, primarily those directly linked in some fashion to the marketplace, such as recreation use and refuge budget expenditures. It should be kept in mind that the emphasis on these particular market-oriented goods and services should not be interpreted to imply that these types of goods and services are somehow more important or of greater value (economic or otherwise) than the non-market goods and services previously discussed.

Regional Economic Impacts of Recreational Activities

Two types of information are needed to estimate the economic impacts of recreational visits to the Refuge: (1) the amount of recreational use on the Refuge by activity; and (2) expenditures associated with recreational visits to the Refuge. Recreational use is estimated by refuge staff. Expenditure patterns used were obtained from the 2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (USFWS 2007b). With this information, total expenditures for each activity can be estimated. These expenditures, in turn, can be used in conjunction with regional economic models to estimate industrial output, employment, employment income and tax impacts associated with these expenditures.

Nestucca Bay NWR currently offers four of the “Big Six” wildlife-dependent activities including wildlife observation and photography, environmental education, and interpretation. The Refuge was closed to all public use until October 2008 when Cannery Hill was opened. Since then visitation has increased as people learn about public use opportunities through communication with refuge staff and volunteers, news articles, directional highway signage, a refuge website, and general word-of-mouth within the local community. In 2009, over 40 wildlife-dependent special events were hosted onsite, and 235 people participated in these events. Refuge visitors are a blend of local residents, owners of second homes in Pacific City or Neskowin, and tourists. Refuge visitation peaks in the summer starting in late May and use tapers off in late September. If the weekend weather is sunny in fall, winter, or spring the public use facilities at the Refuge get a spike in visitation ranging from 5 to 20 vehicles per day.

Table 5-5 shows the recreation visits for Nestucca Bay NWR. The Refuge had 77,154 recreation visits in 2010. In addition to recreation visits, the Refuge also had 446 environmental education and interpretation visits for programs such as Project NestWatch and Through the Looking Glass. However, education and interpretation opportunities do not contribute to the local economic impacts because the events do not generally bring visitors who are spending money toward travel-related goods and services. Therefore, only visits associated with recreational activities are used to estimate economic effects.

Table 5-5. Nestucca Bay NWR: FY 2010 Recreation Visits

Activity	Residents	Non-residents	Total
Non-consumptive:			
Pedestrian	35,074	35,074	70,147
Photography	3,437	3,437	6,873
Total Recreation Visitation	**38,644**	**38,510**	**77,154**

Regional Economic Analysis

Visitor recreation expenditures for 2010 are shown in Table 5-6. Total expenditures were $787,500 with non-residents accounting for $618,000 or 78 percent of total expenditures. Pedestrian visits represented 84 percent of expenditures.

Table 5-6. Nestucca Bay NWR: Visitor Recreation Expenditures (2010 dollars in thousands)

Activity	Residents	Non-residents	Total
Non-consumptive:			
Pedestrian	$141.7	$516.7	$658.5
Photography	$27.8	$101.3	$129.0
Total Expenditures	**$169.5**	**$618.0**	**$787.5**

Input-output models (Minnesota IMPLAN Group, Inc. 2004, Miller and Blair 1985) were used to determine the economic impact of expenditures on the Refuge's local economy. The estimated economic impacts are expected to occur in the local area of Tillamook County, Oregon. It is assumed that visitor expenditures occur primarily within this county. Table 5-7 summarizes the local economic effects associated with recreation visits. Final demand totaled $927,600 with associated employment of 11 jobs, $288,600 in employment income and $140,200 in total tax revenue.

Table 5-7. Nestucca Bay NWR: Local Economic Effects Associated with Recreation Visits (2010 dollars in thousands)

	Residents	Non-Residents	Total
Final Demand	204.9	722.7	$927.6
Jobs	3	8	11
Job Income	65.3	223.3	$288.6
Total Tax Revenue	$31.1	$109.1	$140.2

The economic impacts from recreation expenditures estimated in this report are gross area-wide impacts. Information on where expenditures may occur locally and the magnitude and location of resident and non-resident expenditures (resident and non-resident relative to the geographical area of interest) is not currently available. Generally speaking, non-resident expenditures bring outside money into the area and thus generate increases in real income or wealth. Spending by residents is simply a transfer of expenditures on one set of goods and services to a different set within the same area. In order to calculate net economic impacts within a given area derived from resident expenditures, much more detailed information would be necessary on expenditure patterns and visitor characteristics. Since this information is not currently available, the gross area-wide estimates are used as an upper-bound for the net economic impacts of total resident and non-resident spending in the two and six county areas. The economic impacts of non-resident spending in Table 5-7 represent a real increase in wealth and income for the area (for additional information, see Loomis 1993:191).

Regional Economic Impacts of the Refuge Budget

In addition to impacts from recreational visitors, there are also economic effects related to the refuge expenditures that contribute to local and regional economies. In 2010, the refuge budget totaled about $31,500. Approximately $21,000 (67 percent) is allocated to salaries while the remaining $10,500 is allocated to goods and services supporting the Refuge. Table 5-8 summarizes the Refuge's expenditures in fiscal year 2010.

Table 5-8. Nestucca Bay National Wildlife Refuge Annual Expenditures, 2010 (2010 dollars in thousands)

Expenditure	Annual Expenditures
Salary – Permanent Employees	$21.0
Non-Salary	$10.5
Total	**$31.5**

Table 5-9 shows the jobs, job income, and tax revenues generated by refuge expenditures. The Refuge's annual budget generates less than one job and $16,600 in job income. Overall, refuge expenditures result in about $40,100 in final demand.

Table 5-9. Local Annual Economic Effects Associated with 2010 Refuge Budget (2010 dollars in thousands)

	Salary	Non-salary	Total
Final Demand	$23.7	$16.4	$40.1
Jobs	0.2	0.2	0.4
Job Income	$7.0	$9.6	$16.6
Total Tax Revenue	$3.2	$2.6	$5.8

5.6.3 Refuge Revenue Sharing

National wildlife refuges, like other Federal, State, and County-owned lands are not subject to property taxes. However, under provisions of the Refuge Revenue Sharing Act, the Service annually reimburses counties for revenue lost as a result of acquisition of fee title. Payments to the county are based on the highest value as determined by one of the following three equations: three-fourths of 1 percent of the fair market value of the land; 25 percent of net receipts; or $.75 per acre, whichever is greater. Refuge lands are re-appraised every 5 years to ensure that payments are based on current land values. The revenue sharing fund consists of net income from the sale of products or privileges such as timber sales, grazing fees, permit fees, mineral royalties, etc. If this fund has insufficient funds to cover payments to local counties, Congress is authorized to appropriate money to make up the deficit. Should Congress fail to appropriate such funds, payments to counties will be reduced accordingly.

Table 5-10 summarizes refuge revenue sharing payments made to Tillamook County from 2006 to 2010.

Table 5-10. Refuge Revenue Sharing Payments to Tillamook County for Nestucca Bay National Wildlife Refuge

Year	Fee Acres	Total Payment
2006	812	$6,855
2007	812	$6,628
2008	812	$6,787
2009	888	$8,257
2010	888	$5,818

5.7 Special Designation Areas

Nestucca Bay has been designated as an Important Bird Area (IBA) by the National Audubon Society. Oregon's IBA program recognizes sites of outstanding importance to birds in the state (Audubon Society of Portland 2011). Sites with IBA designation are extremely important to Oregon's birds, though the IBA program by itself does not ensure the continued productivity of selected sites and certainly cannot guarantee continued avian diversity throughout the state. Most species of birds within IBAs are at least partially migratory, and most of the waterfowl, shorebirds, and seabirds of Oregon's IBAs are highly migratory or at least make extensive flights between the recognized IBAs and other areas. In Oregon, this non-regulatory global program is coordinated by The Audubon Society of Portland (2011) with a mission to identify places in Oregon that are important for birds and to promote the restoration and conservation of important bird values at these sites through partnerships, education, observation, and hands-on efforts.

Appendices A-J

Roy W. Lowe/USFWS

Appendix A. Appropriate Use Findings

A.1 Introduction

The Appropriate Refuge Uses Policy (603 FW 1 (2006)) outlines the process that the U.S. Fish and Wildlife Service (Service or USFWS) uses to determine when general public uses on refuges may be considered. Priority public uses previously defined as wildlife-dependent uses (hunting, fishing, wildlife observation and photography and environmental education and interpretation) under the National Wildlife Refuge System Improvement Act of 1997 are generally exempt from appropriate use review. Other exempt uses include situations where the Service does not have adequate jurisdiction to control the activity and refuge management activities. In essence, the appropriate use policy provides refuge managers with a consistent procedure to first screen and then document decisions concerning a non-priority public use. When a use is determined to be appropriate, a refuge manager must then decide if the use is compatible before allowing it on a refuge. For purposes of this CCP an "appropriate use" must meet at least one of the following three conditions.

- The use is a wildlife-dependent recreational use as identified in the Refuge Improvement Act.
- The use involves the take of fish and wildlife under state regulations.
- The use has been found to be appropriate as specified in Section 1.11 of the policy and documented on FWS Form 3-2319.

The policy also requires review of existing non-priority public uses. During the CCP process, the refuge manager evaluated all existing and proposed non-priority refuge uses at Nestucca Bay National Wildlife Refuge (NWR or Refuge) using the following guidelines and criteria as outlined in the appropriate use policy:

- Do we have jurisdiction over the use?
- Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?
- Is the use consistent with applicable Executive orders and Department and Service policies?
- Is the use consistent with public safety?
- Is the use consistent with goals and objectives in an approved management plan or other document?
- Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?
- Is the use manageable within available budget and staff?
- Will this be manageable in the future within existing resources?
- Does the use contribute to the public's understanding and appreciation of the Refuge's natural or cultural resources, or is the use beneficial to the Refuge's natural or cultural resources?
- Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality, compatible, wildlife-dependent recreation into the future?

Using this process and these criteria, and as documented on the following pages, the refuge manager determined the following refuge uses were appropriate, and directed that compatibility determinations be completed for each use: Research, Livestock Grazing, and Ensilage.

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Finding of Appropriateness of a Refuge Use

Refuge Name: Nestucca Bay National Wildlife Refuge

Use: Research, Scientific Collecting, and Survey Activities

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision criteria:	YES	NO
(a) Do we have jurisdiction over the use?	X	
(b) Does the use comply with applicable laws and regulations (federal, state, tribal, and local)?	X	
(c) Is the use consistent with applicable executive orders and Department and Service policies?	X	
(d) Is the use consistent with public safety?	X	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	X	
(f) Has an earlier documented analysis not denied the use, or is this the first time the use has been proposed?	X	
(g) Is the use manageable within available budget and staff?	X	
(h) Will this be manageable in the future within existing resources?	X	
(i) Does the use contribute to the public's understanding and appreciation of the Refuge's natural or cultural resources, or is the use beneficial to the Refuge's natural or cultural resources?	X	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D. for description), compatible, wildlife-dependent recreation into the future?	X	

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will generally not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ___ No _X_

When the refuge manager finds the use **appropriate** based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate_____ Appropriate__X___

Refuge Manager: Rebecca G. Chuck Acting Date: 12/18/12

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.
If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.
If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor: ______________________ Date: 12/18/12

A compatibility determination is required before the use may be allowed.

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Finding of Appropriateness of a Refuge Use

Supplement to FWS Form 3-2319

Research, Scientific Collecting, and Surveys

Further Explanation of Answers Provided for the Decision Criteria:

Project: Conducting research on refuge lands and waters

Summary: The Refuge receives requests to conduct scientific research on Refuge lands and waters.

Research applicants must submit a proposal that outlines: (1) objectives of the study; (2) justification for the study; (3) detailed methodology and schedule; (4) potential impacts on Refuge wildlife and/or habitat, including disturbance (short and long term), injury, or mortality; (5) personnel required; (6) costs to Refuge, if any; and (7) end products expected (i.e., reports, publications). Research proposals will be reviewed by refuge staff, the Regional Office Branch of Refuge Biology, and others as appropriate prior to the Refuge issuing a special use permit (SUP). Projects will not be open-ended, and at a minimum, will be reviewed annually.

For each of the findings listed on FWS Form 3-2319, a justification has been provided below:

(a) Do we have jurisdiction over the use?

Some or all of the proposed activities will take place within refuge boundaries. The Refuge has jurisdiction over those research projects that are sited within refuge boundaries.

(b) Does the use comply with applicable laws and regulations (federal, state, tribal, and local)?

Any proposed research activities will comply with all applicable laws and regulations and any restrictions or qualifications that are required to comply with laws and regulations will be specified in the SUP.

(c) Is the use consistent with applicable executive orders and Department and Service policies?

Through the review of individual projects, the Refuge will ensure that they are consistent with applicable policies, especially the Research on Service Lands Policy (803 FW 1).

(d) Is the use consistent with public safety?

Through individual project review, the Refuge will ensure that each project is consistent with public safety. If necessary, stipulations to ensure public safety will be included in the project's SUP.

(e) Is the use consistent with goals and objectives in an approved management plan or other document?

The Refuge Administration Act directs the Service to "ensure that the biological integrity, diversity, and environmental health of the National Wildlife Refuge System are maintained for the benefit of present and future generations of Americans…" The Service's Biological Integrity, Diversity, and Environmental Health Policy (601 FW 3) provides for the consideration and protection of a broad spectrum of native fish, wildlife, and habitat resources found on refuges and associated ecosystems. When evaluating the appropriate management direction for refuges (e.g., in compatibility determinations), refuge managers are to use sound professional judgment to determine their refuge's contribution to biological integrity, diversity, and environmental health at multiple landscape scales. Sound professional judgment incorporates field experience, knowledge of refuge resources, an understanding of the refuge's role within an ecosystem, applicable laws, and best available science, including consultation with others both inside and outside the Service. Therefore, research is consistent with Service policy.

In addition, one of the refuge goals listed in the 1993 Refuge Management Plan is "to cooperate with other agencies, institutions of higher education, private organizations, and individuals in providing technical assistance and research opportunities." The Complex believes that appropriate, compatible research activities will contribute to, and are essential to accomplishing, the enhancement, protection, conservation, and adaptive management of native wildlife populations and their habitats on the Refuge.

(f) Is the use manageable within available budget and staff?

The Refuge receives few requests per year for this activity, and it is manageable with available budget and staff.

(g) Will this be manageable in the future within existing resources?

The use at current levels will be manageable in the future with the existing resources.

(h) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?

The use is beneficial to the Refuge's natural and cultural resources because the types of research projects approved are those that have the distinct likelihood of helping achieve refuge purposes by providing information useful for the management of trust resources and contributing to the public's understanding and appreciation of natural and/or cultural resources.

(i) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see Section 1.6D, 603 FW 1, for description) compatible, wildlife-dependent recreation into the future?

The Service believes that wildlife and habitat conservation and management on the Refuge should be based upon statistically viable scientific research combined with long-term monitoring. The information gained through appropriate, compatible research on refuge lands will be beneficial to the Refuge's natural resources through application of this information into adaptive management strategies. The Refuge Complex will also distribute any information gained to the public, which will allow them to better understand and appreciate the refuge resources and the need for protecting them.

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Finding of Appropriateness of a Refuge Use

Refuge Name: Nestucca Bay National Wildlife Refuge

Use: Livestock Grazing and Ensilage

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision criteria:	YES	NO
(a) Do we have jurisdiction over the use?	X	
(b) Does the use comply with applicable laws and regulations (federal, state, tribal, and local)?	X	
(c) Is the use consistent with applicable executive orders and Department and Service policies?	X	
(d) Is the use consistent with public safety?	X	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	X	
(f) Has an earlier documented analysis not denied the use, or is this the first time the use has been proposed?	X	
(g) Is the use manageable within available budget and staff?	X	
(h) Will this be manageable in the future within existing resources?	X	
(i) Does the use contribute to the public's understanding and appreciation of the Refuge's natural or cultural resources, or is the use beneficial to the Refuge's natural or cultural resources?	X	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D. for description), compatible, wildlife-dependent recreation into the future?	X	

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will generally not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ___ No _X_

When the refuge manager finds the use **appropriate** based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate_____ Appropriate__X___

Refuge Manager: Rebecca G. Chuck Acting Date: 12/18/12

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.
If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.
If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor: ______________ Date: 12/18/12

A compatibility determination is required before the use may be allowed.

FWS Form 3-2319
02/06

Finding of Appropriateness of a Refuge Use

Supplement to FWS Form 3-2319

Livestock Grazing and Ensilage

Further Explanation of Answers Provided for the Decision Criteria:

Project: Conducting livestock grazing and ensilage on refuge lands and waters

(e) Is the use consistent with goals and objectives in an approved management plan or other document?

The initial justification and planning for the grazing and ensilage program is documented in the Revised Final Environmental Assessment and Land Protection Plan for Nestucca Bay National Wildlife Refuge and Cooperative Resource Management Area (USFWS 1993a) and in the subsequent Nestucca Bay Refuge Management Plan (USFWS 1993b). Management of lowland pastures through continuation of established dairy farming practices, including grazing and ensilage, is identified as the preferred method of habitat management to support wintering geese on the Refuge.

(i) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see Section 1.6D, 603 FW 1, for description) compatible, wildlife-dependent recreation into the future?

This use is beneficial to the Refuge's natural resources. Nestucca Bay Refuge was established, in part, to protect wintering habitat for the dusky Canada goose (sensitive species) and the (then) endangered Aleutian Canada goose. In 1990, when the proposal to establish the Refuge was under evaluation, the dairy pastures adjacent to Nestucca Bay provided the wintering habitat used by these geese. In the Revised Final EA for Nestucca Bay NWR (USFWS 1993a), the Service emphasized that acquisition was considered a mechanism for ensuring that the dairying practices which had supplied the migratory geese with high quality wintering habitat would be continued for the long term. The Service and dairy landowner representatives worked toward developing an understanding that would protect wintering goose habitat in the Nestucca Bay area while recognizing the importance of the dairy industry in meeting that objective. The intention was that refuge lands would continue to be grazed as appropriate, since it was, and still is, vital that the refuge pastures be maintained in a shortgrass condition in order to support wintering geese.

References:

USFWS. 1993a. Revised final environmental assessment and land protection plan. Nestucca Bay National Wildlife Refuge and Cooperative Resource Management Area, Tillamook County, Oregon. U.S. Fish and Wildlife Service. Portland, OR. 56 pp.

USFWS. 1993b. Refuge management plan, Nestucca Bay National Wildlife Refuge, Pacific City, Oregon. U.S. Fish and Wildlife Service, Region 1. Portland, OR.

Appendix B. Compatibility Determinations

B.1 Introduction

The compatibility determinations (CDs) developed during the comprehensive conservation plan (CCP) planning process evaluate uses projected to occur under Alternative C, the preferred alternative, in the draft CCP/environmental assessment (EA) for the Nestucca Bay National Wildlife Refuge (NWR or Refuge) (USFWS 2012a), which has carried forward as the management direction for the Refuge in this CCP. The evaluation of funds needed for management and implementation of each use is described in Appendix C, Implementation. Chapter 6 of the draft CCP/EA also contained an analysis of the impacts of refuge uses to wildlife and habitats. That document is incorporated through reference into this set of CDs.

B.1.1 Uses Evaluated At This Time

The following section includes full CDs for all refuge uses that are required to be evaluated at this time. According to Service policy, compatibility determinations are to be completed for all uses proposed under a CCP that have been determined to be appropriate. Existing wildlife-dependent recreational uses must also be reevaluated and new CDs prepared during development of a CCP. According to the Service's compatibility policy, uses other than wildlife-dependent recreational uses are not explicitly required to be reevaluated in concert with preparation of a CCP, unless conditions of the use have changed or unless significant new information relative to the use and its effects have become available or the existing CDs are more than 10 years old. However, the Service planning policy recommends preparing CDs for all individual uses, specific use programs, or groups of related uses associated with the proposed action. Accordingly, the following CDs are included in this document for public review.

Table B-1. Summary of Compatibility Determinations

Refuge Use	Compatible	Page
Wildlife Observation, Photography, Interpretation, and Environmental Education	Yes	B-5
Waterfowl Hunting	Yes	B-23
Fishing and Clamming	Yes	B-33
Research, Scientific Collecting, and Surveys	Yes	B-47
Grazing and Ensilage	Yes	B-65

B.1.2 Compatibility–Legal and Historical Context

Compatibility is a tool refuge managers use to ensure that recreational and other uses do not interfere with wildlife conservation, the primary focus of national wildlife refuges. Compatibility is not new to the Refuge System and dates back to 1918, as a concept. As policy, it has been used since 1962. The Refuge Recreation Act of 1962 directed the Secretary of the Interior to allow only those public uses on refuge lands that were "compatible with the primary purposes for which the area was established."

Legally, national wildlife refuges are closed to all public uses until officially opened through a compatibility determination. Regulations require that adequate funds be available for administration and protection of refuges before opening them to any public uses. However, wildlife-dependent recreational uses (hunting, fishing, wildlife observation and photography, environmental education, and interpretation) are to receive enhanced consideration and cannot be rejected simply for lack of funding resources unless the refuge has made a concerted effort to seek out funds from all potential partners. Once found compatible, wildlife-dependent recreational uses are deemed the priority public uses at the refuge. If a proposed use is found not compatible, the refuge manager is legally precluded from approving it. Economic uses that are conducted by or authorized by the refuge also require compatibility determinations.

Under compatibility policy, uses are defined as recreational, economic/commercial, or management use of a refuge by the public or a non-Refuge System entity. Uses generally providing an economic return (even if conducted for the purposes of habitat management) are also subject to compatibility determinations. The Service does not prepare compatibility determinations for uses when the Service does not have jurisdiction. For example, the Service may have limited jurisdiction over refuge areas where property rights are vested by others; where legally binding agreements exist; or where there are treaty rights held by tribes. In addition, aircraft overflights, emergency actions, some activities on navigable waters, and activities by other Federal agencies on "overlay refuges" are exempt from the compatibility review process.

New compatibility regulations, required by the National Wildlife Refuge System Improvement Act of 1997 (Improvement Act), were adopted by the Service in October 2000 (USFWS 2000b). The regulations require that a use must be compatible with both the mission of the System and the purposes of the individual refuge. This standard helps to ensure consistency in application across the Refuge System. The Act also requires that compatibility determinations be in writing and that the public have an opportunity to comment on most use evaluations.

The Refuge System mission emphasizes that the needs of fish, wildlife, and plants must be of primary consideration. The Improvement Act defined a compatible use as one that "… in the sound professional judgment of the Director, will not materially interfere with or detract from the fulfillment of the mission of the System or the purposes of the Refuge." Sound professional judgment is defined under the Improvement Act as "… a finding, determination, or decision, that is consistent with principles of sound fish and wildlife management and administration, available science and resources …." Compatibility for priority wildlife-dependent uses may depend on the level or extent of a use.

Court interpretations of the compatibility standard have found that compatibility is a biological standard and cannot be used to balance or weigh economic, political, or recreational interests against the primary purpose of the refuge (Defenders of Wildlife v. Andrus [Ruby Lake Refuge]).

The Service recognizes that compatibility determinations are complex. For this reason, refuge managers are required to consider "principles of sound fish and wildlife management" and "best available science" in making these determinations (House of Representatives Report 105-106). Evaluations of the existing uses on the Nestucca Bay NWR are based on the professional judgment of refuge and planning personnel including observations of refuge uses and reviews of appropriate scientific literature.

In July 2006, the Service published its Appropriate Refuge Uses Policy (603 FW 1). Under this policy, most proposed uses must also undergo a review prior to compatibility. Uses excepted from the policy include priority wildlife-dependent recreational uses, and uses under reserved rights – see policy for more detail. Appropriate use findings for Nestucca Bay NWR are included in Appendix A.

B.1.3 References

Defenders of Wildlife v. Andrus (Ruby Lake Refuge I). Case 2098 (D.D.C. 1978). Environmental Reporter 11:873.

House of Representatives. 1997. Report 105-106 on NWRSIA. Available at: http://refuges.fws.gov/policyMakers/mandates/HR1420/part1.html.

USFWS. 2000b. Compatibility regulations. Available at: http://Refuges.fws.gov/policymakers/nwrpolicies.html.

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B.2 Compatibility Determination

Use: Wildlife Observation, Photography, Interpretation, and Environmental Education

Refuge Name: Nestucca Bay National Wildlife Refuge

County and State: Tillamook County, Oregon

Establishing and Acquisition Authorities:

Nestucca Bay NWR was established in 1991 under the authority of the Endangered Species Act of 1973, as amended (16 U.S.C. 1532-1544, 87 Stat. 884); the Fish and Wildlife Act of 1956, as amended (16 U.S.C. 742(a)-754); the Migratory Bird Conservation Act of 1929 (16 U.S.C. 715-715d); the Consolidated Farm and Rural Development Act [7 U.S.C. 2002]; and the Emergency Wetlands Resources Act of 1986 [16 U.S.C. 3901(b), 100 Stat. 3583].

Refuge Purpose(s):

- "to conserve (a) fish or wildlife which are listed as endangered species or threatened species…or (b) plants" [16 U.S.C. 1534 (Endangered Species Act of 1973)].
- "for the development, advancement, management, conservation, and protection of fish and wildlife resources" [U.S.C. 742f(a)(4)]…"for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude" [16 U.S.C. 742f (b)(1) (Fish and Wildlife Act of 1956)].
- "for use as an inviolate sanctuary, or for any other management purpose, for migratory birds" [16 U.S.C. 715d (Migratory Bird Conservation Act)].
- "for conservation purposes" [7 U.S.C. 2002 (Consolidated Farm and Rural Development Act)].
- for "the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to fulfill international obligations contained in various migratory bird treaties and conventions" [16 U.S.C. 3901(b), 100 Stat. 3583 (Emergency Wetlands Resources Act of 1986)].

National Wildlife Refuge System Mission:

"The mission of the System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." (National Wildlife Refuge System Administration Act of 1966 as amended, 16 U.S.C. 668dd-668ee).

Description of Use:

Wildlife observation, photography, interpretation, and environmental education are defined as priority public uses under the Refuge Improvement Act of 1997 and can enhance the users' appreciation of the Refuge, the National Wildlife Refuge System, wildlife, their habitats, and the human environment. Under the management direction described in the CCP for Nestucca Bay NWR, the U.S. Fish and Wildlife Service (Service) will continue to allow wildlife observation, photography, interpretation, and environmental education to occur at Cannery Hill. In addition, the Service will open the Little Nestucca Restoration Area to wildlife observation, photography, and interpretation and Brooten Marsh to wildlife observation and photography.

At Cannery Hill, public use infrastructure is in place for wildlife observation, photography, interpretation, and environmental education. The Refuge maintains two parking lots for the public at Cannery Hill. The paved lower parking lot has 10 standard parking spaces of which two are accessible, two school bus spaces, and a single vault restroom. The paved upper parking lot contains five standard parking spaces, one of which is accessible. The lower parking area of Cannery Hill contains a welcoming kiosk that orients visitors to the Refuge. It contains information on the hiking trails, things for visitors to do, and the rules and regulations of the Refuge. The visitor experience will be enhanced by the addition of a few visitor amenities. Under the management direction described in the CCP, the Refuge will develop a new observation deck in the lower parking lot to provide visitors with an opportunity to view and photograph wildlife using refuge woodlands, lowland pastures, and grasslands. Along with the deck, the Refuge will also build a “discovery trail” that will link the existing orientation kiosk to the observation deck. The “discovery trail” will serve two main purposes: (1) to provide a safe and accessible route for pedestrians to move between the existing kiosk and observation deck without having to walk through the parking lot and; (2) to provide a needed programmatic element to activate the lower parking area as a destination worth visiting.

From the lower parking lot of Cannery Hill visitors can either drive or walk 0.4 mile up a graveled, non-wheelchair-accessible road to the upper parking lot. This road, which doubles as a trail, takes visitors through a matrix of forest including restored forest, mature coniferous forest, and a small patch of native hardwoods. If visitors walk, they must share the roadway with cars, which, though traffic volume is low, presents a safety hazard. Consequently, the Refuge will design and develop a loop trail with the express purpose of getting visitors off the road and onto a safer route. This trail will not be accessible for people with disabilities due to steep grades. The planned trail will begin in the lower parking lot, traverse through refuge woodlands, and end at the existing paved Pacific View Trail. All of the trails and observation decks will be open year-round for the purpose of wildlife observation, photography, environmental education, and interpretation, and visitors will be restricted to the trail.

The Refuge will add an additional trail that will increase the opportunity for visitors to observe and photograph wildlife in a more wooded setting. There is a grassy, undeveloped trail that follows the power line corridor from Christensen Road to a Refuge-owned tide gate and dike. The trail is maintained by staff, volunteers, and the local power company but it is currently closed to public use. The trail goes through a variety of habitats and provides visitors with the best opportunity for viewing small songbirds on the Refuge. The Service will improve this trail and open it for seasonal use, allowing wildlife observation and photography on this trail from April 1 through September 30. The trail will be closed to the public from October 1 through March 31 because the trail passes alongside pastures used by wintering white-cheeked geese and the Refuge strives to provide undisturbed sanctuary for geese.

From the upper parking lot, visitors can access the paved Pacific View Trail, which is 0.3 mile in length and wheelchair-accessible. It leads visitors to an elevated viewing deck perched atop Cannery Hill. There are four interpretive panels that share the story of the diversity of wildlife habitats and wildlife found on the Refuge. This trail is used by visitors for wildlife observation, photography, interpretation, and environmental education. All environmental education programs on the Refuge are informal and are led by refuge volunteers, interns, or staff. The Service will continue to allow these uses on Cannery Hill and will require advance reservations for all groups participating in environmental education. Organized environmental education groups, prior to engaging in activities, will be educated on refuge regulations, etiquette, and ways to reduce disturbance to wildlife and habitat.

The Service will expand interpretation on the Refuge by offering interpreter-led paddle trips each summer and will partner with the Tillamook Estuaries Partnership to market the water trail they developed for the Nestucca and Little Nestucca Rivers. Water trails are defined paths on a waterway connected through signs, maps, and access points providing a scenic and educational experience for recreational users. Although the rivers are not Service-owned, they pass through and are adjacent to refuge lands. With the Service's participation in creating the materials to guide the experience, these forms of interpretive material will help educate the public on minimizing wildlife and habitat disturbance. The Service will also have staff and volunteers lead a series of interpretive events on both Cannery Hill that include nature photography, nature sculpture, bird watching, and local history on the early settlers.

Brooten Marsh is an approximately 108-acre tidal salt marsh located at the confluence of the Nestucca River and the Little Nestucca River. Brooten Marsh will be open to wildlife observation and photography year-round. Trails will not be developed within the marsh and visitors will not be restricted to where they can go. The Service does not expect much participation in wildlife observation and photography at Brooten Marsh due to the difficulty of accessing the lands, the presence of uneven terrain, and copious amounts of large woody debris. The Service will be improving a trail that leads from a pull-out along Brooten Road to the edge of the marsh to support clamming and other wildlife-dependent uses.

At the Little Nestucca Restoration Area, the Service will build infrastructure to support wildlife observation, photography, and interpretation. The former Highway 101 roadbed is within the restoration site and offers reliably productive views of wintering waterfowl and migratory shorebirds. The Refuge will improve the area by grading a small parking area outside of the dike adjacent to the road and developing a welcoming and orientation kiosk. A short trail will be designated on the old roadbed inside the dike that leads visitors into a portion of the restoration site, screening the trail with vegetation to reduce wildlife disturbance. The trail will be open year-round for the purpose of wildlife observation, photography, and interpretation, and visitors will be restricted to the trail. This location has been selected to be enhanced for wildlife observation, photography, and interpretation based on a variety of factors. The area provides safe and quick access from Highway 101; there is an existing degraded roadbed that will serve as a base support for a short nature trail, and visitors will have a clear view of the restoration area that is used by a variety of resident and migratory birds and provides a reliable opportunity to observe and photograph wildlife.

All refuge trails and observation decks will be open to wildlife-dependent recreational activities during daylight hours. Camping, overnight use, and fires will be prohibited. All pets including dogs will be required to remain in their vehicles at all times and will not be allowed on refuge trails, observation decks, or in parking areas. Wildlife observation, photography, and interpretation will largely be self-guided and will be restricted to designated trails and observation decks. On occasion, off-trail activities may occur but will be led by refuge staff and/or trained volunteers (i.e., tours conducted during special events or environmental education programs). Interpretive materials will be available to visitors through interpretive panels and an informational kiosk on site, refuge brochures, and through the internet via a refuge website and/or social media site. These forms of interpretive materials will help educate the public on minimizing wildlife and habitat disturbance.

All refuge lands within the Neskowin Marsh Unit will remain closed to all public use with the exception of the "Neskowin Tsunami Evacuation Trail." This foot-travel route traverses the southern end of Neskowin Marsh and serves as one of only a few tsunami escape routes for residents living in the low-lying community of Neskowin. The route was in existence before the establishment of the Neskowin Marsh Unit of the Refuge and is kept open for the safety of the community. The trail is located on a narrow and degraded former roadbed that crosses the marsh. There is a small wooden footbridge, not accessible to people with disabilities, which spans the marsh outlet channel. In the event of a tsunami, this trail would theoretically allow local residents in the nearby dunes to escape by foot to high ground in the Neskowin Crest area as well as foot passage to the higher elevations at U.S. Highway 101. The Service acknowledges that the trail floods annually following heavy rainfall, as does the adjacent Hawk Road that leads to the trail. The Service will install reflective markers on both sides of the trail so that when flooded or at night the markers will outline the trail route. Individuals using the trail do so at their own risk which will require wading if the trail is flooded. Residents should be aware that during a subduction zone earthquake the trail may receive damage prior to the arrival of a tsunami; however for some nearby residents, this may be their only timely escape route. The tsunami evacuation trail is not open to the general public as a nature trail due to the lack of parking and restricted access routes to the trail; it is open only to homeowners and guests of the community of Neskowin. The Service will conduct a hydrologic study to determine the impact that the presence of the old roadbed has on the hydrology of the marsh. The Service will replace the existing footbridge with an accessible bridge.

Availability of Resources:

Under the CCP's management direction, Nestucca Bay NWR will be open for wildlife observation, photography, interpretation, and environmental education. The Service has one full-time employee dedicated to the Visitor Service program for the Refuge Complex. Additional refuge staff assist in trail and parking area maintenance, facility and road maintenance, sign posting, construction projects, interacting with the public, and developing and implementing refuge management programs.

Costs to Administer and Manage Public Use Programs at Nestucca Bay NWR under the CCP's Management Direction

Activity or Project	One-time Expense	Recurring Expense
Build a short discovery trail and observation deck in the lower parking lot of Cannery Hill	$45,000	$2,000
Develop a seasonal trail that follows the current power line right-of-way at Cannery Hill	$87,200	$2,000
Develop a trail to direct visitors from the lower parking lot safely to the Pacific View Trail	$63,400	$2,000
Develop a short trail along the old roadbed in the Little Nestucca Restoration Area	$56,300	$2,500
Upgrade the bridge on the Tsunami trail at Neskowin Marsh to make it accessible	$46,600	$ 500
Develop a welcoming kiosk and interpretive panel for the Little Nestucca Restoration Area public use trail	$5,000	

Costs to Administer and Manage Public Use Programs at Nestucca Bay NWR under the CCP's Management Direction

Activity or Project	One-time Expense	Recurring Expense
Brochures		$500
Environmental Education Specialist		$50,000
Law enforcement patrols		$10,000
Recruit and train volunteers to help manage the public use program		$16,500 (Vol. coordin. Salary, volunteer expenses, intern cost)
Maintain existing viewing deck and trail		$2,500
Staff		$3,000

Anticipated Impacts of the Use(s):

The Service is committed to providing quality opportunities for wildlife oriented recreation at Nestucca Bay NWR. The six Refuge System priority wildlife-dependent uses, which are hunting, fishing, wildlife observation, photography, environmental education, and interpretation, will be offered at Nestucca Bay NWR to help meet the Service mission and refuge goals for Nestucca Bay NWR. Offering wildlife observation, photography, interpretation, and environmental education will help fulfill refuge purposes and goals and does not conflict with the mission of the Refuge System.

<u>General Impacts:</u>
A general assessment of impacts resulting from wildlife observation, photography, and interpretation has been compiled from the literature and is briefly summarized below.

Effect of disturbance intensity: Some researchers have attempted to correlate disturbance events in wildlife to the intensity, proximity, or loudness of human disturbance. While studying shorebirds on an eastern coastal refuge, Burger (1986) found that the level of disturbance in the shorebirds increased (fewer remained, more flew) as the total number of disturbances and the number of children, joggers, people walking, dogs, aircraft, and boats increased, and the duration of the disturbance and distance from the disturbance decreased.

Effect of human proximity: Other researchers have looked at the question of proximity. At what distance do humans on foot elicit a disturbance response? From an examination of the available studies, it appears that the distance varies dramatically from species to species. Burger and Gochfeld (1991) found that sanderlings foraged less during the day and more during the night as the number of people within 100 meters (328 feet) increased. Elk in Yellowstone National Park were disturbed when people were at average distances of 573 meters (1,880 feet) (Cassirer 1990). The elk temporarily left the drainage and their home range core areas and moved to higher elevations, steeper slopes, and closer to forested areas. Average return time to the drainage was two days. Erwin (1989) studied colonial wading and seabirds in Virginia and North Carolina. Mixed colonies of common terns and black skimmers responded at the greatest distances, with respective means of 142 meters (466 feet) and 130 meters (427 feet); mixed wading bird species were more reluctant to flush (30-50 meters [98-164 feet] average). There were few statistically significant relationships between flushing distance and colony size. Similarly, there were few differences between responses during incubation compared to post-hatching periods.

Miller et al. (2001) defined an “area of influence” as the area that parallels a trail or line of human movement within which wildlife would flush from a particular activity with a certain probability. In a study analyzing response distance from hiking and mountain biking in sagebrush-grassland habitat in Utah, Taylor and Knight (2003) found that at 100 meters (328 feet) from the line of movement of an off-trail trial, mule deer showed a 96 percent probability of flushing. That probability did not drop to 70 percent until the perpendicular distance increased to 390 meters (1,280 feet).

Taylor and Knight (2003) also found that the area of influence around a recreationist on a trail did not differ between mountain biking and hiking. This may suggest that wildlife do not differentiate between hikers and bikers, but are instead reacting to the presence of a moving human on a trail, regardless of the person's activity. However, the area of influence differed considerably between on-trail and off-trail trials.

An analysis of over 4,000 human activity events near bald eagle nests in Central Arizona (Grubb and King 1991) found distance to disturbance to be the most important classifier of bald eagle response, followed in decreasing order of discriminatory value by duration of disturbance, visibility, number of units per event, position relative to affected eagle, and sound.

Breeding bald eagles in north-central Minnesota (Fraser et al. 1985) flushed at an average distance of 476 meters (1,561 feet) at the approach of a pedestrian. A multiple regression model including number of previous disturbances, date, and time of day, explained 82 percent of the variability in flush distance and predicted a maximum flush distance at the first disturbance of 503 meters (1,650 feet). Skagen (1980), studying bald eagles in northwest Washington, found a statistically significant decrease in the proportion of eagles feeding when human activity was present within 200 meters (656 feet) of the feeding area in the previous 30 minutes. A statistically significant between-season variation occurred in the use of feeding areas relative to human presence, which correlated with food availability. Eagles appeared more tolerant of human activity in the season of low food availability. In a review of several studies of the reaction of waterfowl and other wetland birds to people on foot, distances greater than 100 meters (328 feet) in general did not result in a behavioral response (DeLong 2002).

Effects from pedestrian access: Wildlife is frequently more sensitive to disturbance from people on foot than in vehicles (Skagen 1980, Grubb and King 1991, MacArthur et al. 1982). Numerous studies have confirmed that people on foot can cause a variety of disturbance reactions in wildlife, including flushing or displacement (Erwin 1989, Fraser et al. 1985, Freddy 1986), heart rate increases (MacArthur et al. 1982), altered foraging patterns (Burger and Gochfeld 1991), and in some cases, diminished reproductive success (Boyle and Samson 1985). These studies and others have shown that the severity of the effects depends upon the distance to the disturbance and its duration, frequency, predictability, and visibility to wildlife (Knight and Cole 1995). Taylor and Knight (2003), in a logistic regression analyzing mule deer, pronghorn antelope, and bison response to mountain biking and hiking on- and off-trail found that the variables best explaining wildlife response included wildlife species, perpendicular distance of animals to trail (closest distance of animal to trail, regardless of recreationist position), trail position (on-trail or off-trail), and degree of vegetation cover.

Effects on migrant birds versus resident birds: Klein (1989) studied the effect of visitation on migrant and resident waterbirds at Ding Darling National Wildlife Refuge, finding that resident birds were less sensitive to human disturbance than migrants. Migrant ducks were particularly sensitive when they first arrived on-site in the fall. They usually remained more than 80 meters (262 feet) from a visitor footpath on a dike, even at very low visitor levels. Herons, egrets, brown pelicans, and anhingas were most likely to habituate to humans, thus exposing them to direct disturbance as they fed on or near the dike. Shorebirds showed intermediate sensitivity. Strauss (1990) observed piping plover chicks spent less time feeding (50 percent vs. 91 percent) and spent more time running (33 percent vs. 2 percent), fighting with other chicks (4 percent vs. 0.1 percent), and standing alert (9 percent vs. 0.1 percent) when pedestrians or moving vehicles were closer than 100 meters (328 feet) than when they were undisturbed. In addition, plover chicks spent less time out on the feeding flats (8 percent vs. 97 percent) and more time up in the grass (66 percent vs. 0.1 percent) during periods of human disturbance.

Wildlife photography: Wildlife photography is likely more disturbing, per instance, than wildlife observation. Klein (1993) observed at Ding Darling NWR that of all the wildlife-dependent public uses, photographers were the most likely to attempt close contact with birds. He also concluded that even slow approach by photographers was disruptive to waterbirds. Wildlife photographers tend to have larger disturbance impacts than those viewing wildlife since they tend to approach animals more closely (Morton 1995, Dobb 1998).

Predictability of disturbance (habituation): Dwyer and Tanner (1992) noted that wildlife habituate best to disturbance that is somewhat predictable or “background.” Investigating 111 nests of sandhill cranes in Florida, Dwyer and Tanner found that nesting cranes seemed to habituate to certain forms of human disturbance and nested within 400 meters (1,312 feet) of highways, railroads, and mines; cranes also were tolerant of helicopter flyovers. Visits to nests and development-induced alterations of surface water drainage were implicated in 24 percent of the nest failures. Taylor and Knight (2003) found that for mule deer, the area of influence around off-trail trials was much greater than that for on-trail trials, suggesting habituation to trails. However, the time it takes for wildlife to habituate, and what wildlife use is like compared to pre-disturbance uses, remains a fertile question. A study by Fairbanks and Tullous (2002) measured the distance of pronghorn from recreational trails on Antelope Island State Park in Utah. The study gathered data the year before the trails were opened for public use, and compared these to data gathered in three consecutive years after recreational use began. Groups of pronghorn were observed significantly farther from trails in years with recreational use than in the year before recreational areas were opened.

Effects from boat proximity: Boating, both motorized and non-motorized, can alter the distribution, reduce use of particular habitats or entire areas by waterfowl and other birds, alter feeding behavior and nutritional status, and cause premature departure from areas (Knight and Cole 1995). More sensitive species may find it difficult to secure adequate food or loafing sites as their preferred habitat becomes fragmented and recreation related disturbance increase (Skagen et al. 1991, Pfister et al. 1992). However, disturbance to birds in general was reduced when boats traveled at or below 5 miles per hour speed limit. Motorized boats can generally have more impact on wildlife than non-motorized boats because motorboats produce a combination of movement and noise (Tuite et al. 1983, Knight and Cole 1995). Motorized boats can also cover a larger area in a relatively short time, in comparison to non-motorized boats.

Motorized boats introduce noise and pollution, in the form of gas and oil, and particulates in the air, in estuarine and riverine habitats. Hydrocarbon pollution has been found to bio accumulate with the complex food web, posing a serious threat to the marine environment (Tjarnlund et al. 1993). Hydrocarbons can also be transferred to eggs from the plumage of incubation birds. Extremely small amounts of petroleum hydrocarbons can be toxic to eggs and birds that ingest these contaminants (Hoffman 1989).

Canoes and kayaks can cause significant disturbance effects based on their ability to penetrate into shallower marsh areas (Speight 1973, Knight and Cole 1995). In the Ozark National Scenic Riverway, green heron activity declined on survey routes when canoes and boat use increased on the main river channel (Kaiser and Fritzell 1984). Canoes or slow moving boats have also been observed to disturb nesting great blue herons (Vos et al. 1985). Huffman (1999) found that non-motorized boats within 30 meters (98 feet) of the shoreline in south San Diego Bay caused all wintering waterfowl to flush between the craft and shore. However, compared to motorboats, canoes and kayaks appear to have less disturbance effects on most wildlife species (Jahn and Hunt 1964, Huffman 1999, DeLong 2002).

The total number of boats and people can be an inappropriate measure of recreational intensity because the presence of a single boat might be just as disturbing as that of many (Tuite et al. 1983, Knight and Knight 1984). Even a low level of boating activity affects the duration and pattern of use by wildlife (Bratton 1990).

<u>Refuge-specific Impacts:</u>
People engaging in wildlife observation, photography, environmental education, or interpretation generally access the Refuge by motorized vehicles travelling on public roads, and using pull-outs and parking lots. Pull-outs, parking lots, and public roads have minimal direct impacts because they occupy a relatively small acreage. The additional graveled parking lots will be designed to minimize potential runoff from vehicles.

Designated trails will be added to support wildlife observation, photography, interpretation, and environmental education at Cannery Hill and Little Nestucca Restoration Area. Under the management direction described in the CCP, the Refuge will add a new loop trail and goose observation deck at the lower parking lot. In forested habitat where the loop trail and Powerline Trail will be developed or enhanced, additional trail construction may require the removal of some trees, snags, logs, or other vegetation. In addition, a minor amount of habitat degradation (vegetation removal or modification and soil compaction) from trail use and trail maintenance (mowing, trail clearing) may be expected in this habitat type, but negative effects from this habitat degradation will be negligible in the long term since vegetation regrowth is very rapid in this climate. Some temporary disturbance impacts from trail users may occur to songbirds utilizing this habitat; however, sound and visibility dissipate rapidly away from the trail in this habitat type, so the additional disturbance is considered negligible.

Enhanced public use facilities and visitor service programs (e.g., environmental education) are expected to draw additional visitors over the course of 15 years. As visitation increases, there will be the potential for a degree of additional trampling of Sitka spruce-western hemlock forest habitats from off-trail usage as well as some minor additional disturbance to species inhabiting this habitat. However, these negative effects are considered negligible because the trails are paved or otherwise kept clear and the trail edges are either dense underbrush or tall rank grasses, and very few people venture away from the established trails or decks/viewing sites.

Bicycle access: A few people access the Refuge areas along its boundaries (U.S. Highway 101) by bicycle. Although bicycles on roads may create additional disturbance, state-managed highways are not under refuge jurisdiction; therefore, effects from activities occurring on these roads are not considered in this compatibility determination. The Service will not allow bicycles on the Pacific View Trail, the Powerline Trail, or the short trail at the Little Nestucca Restoration Area due to the short distance of each trail, the multiple uses that will be allowed, and the resulting potential for user conflicts on this trail. Trails will be limited to pedestrian and disabled-access users engaged in wildlife observation, photography, interpretation, and environmental education.

Pedestrian access: Pedestrian access to the Refuge creates the highest potential for disturbance or damage to natural resources. Foot travel associated with wildlife observation or photography could potentially result in temporary and minor vegetation trampling; however, the effects on vegetation on Cannery Hill should be minor to negligible as public use will continue to be restricted to trails. All pedestrian access at Cannery Hill is currently limited to designated year-round trails, and the new loop trail will be year-round as well. The Service will enhance and open the existing Powerline Trail to the public; however, this trail will be closed from October 1 through March 31 to eliminate potential disturbance to white-cheeked geese and other migratory waterfowl using refuge pastures, which border the lower part of the trail. The year-round closure of off-trail refuge lands to pedestrian access serves to further limit pedestrian human disturbance during the season of highest goose use in refuge pastures, which helps fulfill the refuge purposes. The only areas on Cannery Hill that people will be permitted to access by foot for wildlife observation, photography, and interpretation are on designated trails. Since wildlife observers and photographers tend to remain on the observation decks or on designated trails when they are clearly delineated and present the easiest route of travel, direct effects from trampling will likely be minor.

Brooten Marsh is a wide-open expanse of mudflat, low tidal marsh vegetation, and copious amounts of large woody debris. Use of the marsh for wildlife observation and photography is expected to be minimal due to the dispersed nature of bird usage. Since birds can easily move to a point further out in the tide flats and away from people to continue their loafing and feeding activities, disturbance should be localized and temporary, and is expected to cause no lasting impacts to birds on Brooten Marsh.

Under the management direction described in the CCP, the development of public use infrastructure at the Little Nestucca Restoration Area will provide year-round pedestrian access on a designated trail. The new trail will be developed on the old roadbed that has a few native trees and a mix of invasive species. There are some expected disturbance impacts to waterfowl and shorebirds using the restoration site, as the total area of the restoration is only 82 acres and the trail is immediately adjacent to the west end of the restoration site. The trail will be constructed to remove the invasive species and replace with native trees and shrubs in a manner that will cause this vegetation to function as a visual screen to reduce disturbance to wildlife, so effects from visitor use should be minor and temporary. In addition, at the access point for the trail a welcoming and orientation kiosk will be developed to educate visitors on photography and wildlife observation ethics that will reduce or limit wildlife disturbance.

Boat access: Boat access to the Refuge creates a potential for disturbance to migratory and resident waterfowl and wading birds. Motorized and non-motorized boat use associated with wildlife observation or photography could potentially create disturbance in or near any habitat adjacent to navigable waters. Boat access to the Refuge creates a potential for disturbance to migratory and resident waterfowl and wading birds. Boat use associated with wildlife observation, photography, or interpretation could potentially create disturbance in or near any habitat adjacent to navigable waters. This may cause birds that use the waters of the bay and the tidal channels of the Little Nestucca Restoration Area to flush. The disturbance to wildlife is anticipated to be localized and of short duration. Nearby resting and feeding areas will be available for use by any displaced wildlife.

Under the management direction described in the CCP, the Refuge will partner with non-governmental organizations to develop a water trail for non-motorized boats (e.g., canoes, kayaks) on waters of the Little Nestucca River adjacent to the Little Nestucca Restoration Area. Information included in the water trail guide will discuss use of non-motorized boats for photography and wildlife observation and how to apply techniques or ethics that will reduce or limit wildlife disturbance.

Although refuge lands accessible by boat are not currently open to the public, boats can travel in waters that traverse the Refuge and thus visitors can observe wildlife from the waters of the Little Nestucca River and the Nestucca River. This access to the Refuge is challenging for boaters during the fall, winter, and spring due to inclement weather; however, it is fairly regular during the summer. Since the boats are not traveling on refuge waters, the Service cannot directly regulate boating practices but it is possible to reduce impacts through education. To reduce disturbance of migratory and resident wildlife from boaters, the Refuge will include information on how visitors can observe ethics and boating practices such as no-wake and slower speeds that will reduce or limit wildlife disturbance on its website, in refuge-specific publications (e.g., hunting and fishing tearsheets) and in the Nestucca-Neskowin water trail guide.

Some interpretive and environmental education programs are moderately large, organized events (<35 visitors) that differ in character from the more informal day-to-day observation and interpretive activities. These types of programs create more disturbances and can potentially impact habitat through trampling or vegetation damage. To reduce these effects to wildlife and habitat all organized events will be guided by staff or trained volunteers that educate visitors to minimizing wildlife and habitat disturbance.

Both refuge visitation and the number of facilities and emphasis devoted to wildlife observation, photography, interpretation, and environmental education are projected to increase under the management direction described in the CCP. Most studies cited above have demonstrated immediate, rather than long-term responses to disturbance. Long-term responses are inherently more difficult and expensive to determine. Given that wildlife observation, photography, interpretation, and environmental education efforts are not typically loud or intense kinds of activities, the area of habitat within a known distance of human activity centers (trails, decks, interpretation panels, etc.) is considered a reasonable indicator to evaluate the disturbance effects of public uses on refuge wildlife. In a review of several studies of the reaction of waterfowl and other wetland birds to people on foot, distances greater than 328 feet (100 meters) generally did not result in a behavioral response (DeLong 2002).

Both refuge visitation and the number of facilities and emphasis devoted to wildlife observation, photography, interpretation, and environmental education will increase under the management direction described in the CCP. Although disturbance to wildlife from these activities will be higher than at present, the overall effect to refuge wildlife is expected to be minor.

Impacts to listed species: The listed species utilizing Nestucca Bay NWR are the threatened coho salmon, Pacific smelt (eulachon), and green sturgeon. Because wildlife observation, photography, and interpretation are planned only from designated trails and from boats on waters outside refuge lands, impacts on coho, green sturgeon, and eulachon are expected to be a negligible negative effect.

Under the management direction described in the CCP, the threatened Oregon silverspot butterfly will be reintroduced following reestablishment of suitable habitat that meets all the parameters in the Recovery Plan (USFWS 2001a). Although the public will not be allowed to free roam on the restored prairie, the existing Pacific View Trail is located within the future prairie restoration area. The nectar plants are located on mostly steep banks adjacent to the paved trail and where switchbacks exist, fences are in place to keep visitors on the trail and discourage them from cutting across prairie habitat. Following reintroduction of the butterfly, trail use will be monitored to ensure visitors are not going off-trail and causing destruction of butterfly habitat. Specific public education and use of designated trails with educational panels can assist in raising awareness and preventing undue impacts to this species. If off-trail use from designated trails results in unacceptable adverse effects to listed species or habitats, the Refuge will increase patrols to raise the level of compliance. Because of the trail design and the location of the majority of the future butterfly habitat away from public use facilities, impacts to this species, following reintroduction, are expected to be minor to negligible.

Impacts to other priority public uses: At Brooten Marsh, refuge lands will be open to wildlife observation and photography year-round. Thus the area will be open to wildlife observation and photography during the same time of year as waterfowl hunting. It is possible that wildlife observers or photographers could flush waterfowl being pursued by hunters. However, the Service does not expect there to be much participation in wildlife observation and photography at Brooten Marsh in the fall and winter due to inclement weather, the difficulty of accessing the lands, the presence of uneven terrain, and copious amounts of large woody debris which make walking throughout the unit very challenging. The Service believes that offering these public uses at the same time is not expected to cause negative impacts to either user.

The Service will offer interpreter-led paddle trips along the Little Nestucca River, which passes by Brooten Marsh, but the trips will only be offered during the summer and thus will not overlap with the hunt period so no impacts to hunters are anticipated by interpretation activities. There is some recreational non-motorized boating occurring alongside Brooten Marsh for the purpose of wildlife observation and photography but most of this activity occurs during the summer when weather is more predictable thus reducing the likelihood of conflicts between hunters and people observing or photographing wildlife from boats.

Bank fishing will be allowed on the Refuge along the southern bank of the Little Nestucca River within the southeast portion of the Little Nestucca Restoration Area, and clamming will be allowed at the Mouth of the Little Nestucca River and Brooten Marsh. No impacts are expected to occur on anglers from wildlife observers and photographers in any of these areas. It is possible that recreational boaters (observing or photographing wildlife) floating up tidal channels in the Little Nestucca Restoration Area could disturb anglers fishing in the area. The Service will provide information to all visitors using the Refuge to respect the rights of anglers by keeping back from fishing lines to avoid entanglement and disturbing anglers. Overall the Service expects no impacts to anglers from visitors engaged in wildlife observation or photography.

The Service will establish a waterfowl hunting program at Brooten Marsh and the Mouth of the Little Nestucca River; however, visitors accessing the Refuge to observe wildlife are not expected to come in contact with or directly impact refuge visitors using other areas of Nestucca Bay NWR to hunt waterfowl due to the distance of hunters from Cannery Hill and the Little Nestucca Restoration Area. These distances are as follows: Mouth of Little Nestucca River hunt area to the Little Nestucca Restoration Area is 370 yards (340 meters); Brooten Marsh to the Little Nestucca Restoration Area is 2,400 yards (2,200 meters); Mouth of Little Nestucca River hunt area to Cannery Hill is 1,100 yards (1,000 meters); Brooten Marsh to Cannery Hill is 2,000 yards (1,800 meters). The access points for the various refuge public use areas are at separate locations along Highway 101 so the visitors engaged in wildlife observation and photography at Cannery Hill will not be entering the Refuge at the same location as those coming to hunt waterfowl, or to fish or clam. Consequently, no impacts are anticipated to waterfowl hunters from people engaged in wildlife observation, photography, interpretation, or environmental education from Cannery Hill.

The Service will provide information about hunting boundaries and seasons to the general public and those utilizing other refuge programs to ensure safety and minimize conflict between people engaged in wildlife observation, photography, and interpretation and those hunting at Brooten Marsh and the Mouth of the Little Nestucca River. Information will be provided at the interpretive kiosks, on the refuge website, and in refuge offices. In addition, law enforcement patrols will be conducted on a regular basis to ensure compliance with State, Federal, and refuge regulations. The refuge law enforcement officer will also monitor and collect data on all public use activities while in the field to ensure they do not interfere with one another. If necessary, programs will be modified accordingly.

Public Review and Comment:

Wildlife observation, photography, interpretation, and environmental education were all discussed at two public meetings held in conjunction with the Comprehensive Conservation Plan process. To initiate the CCP process, a Notice of Intent was published in the Federal Register on November 29, 2010 (Volume 75, Number 228). Written comments were solicited from the public about proposed wildlife-dependent recreational uses. Two CCP planning updates were prepared to summarize the progress of the CCP and to discuss issues related the planning process. This compatibility determination was submitted for public review and comment as an appendix to the Draft Comprehensive Conservation Plan and Environmental Assessment for Nestucca Bay NWR. Appendix K of the CCP contains a summary of the comments and Service responses.

Determination:

__________ Use is Not Compatible

____X____ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility:

- Motorized vehicles and bicycles will be limited to designated public roads and parking lots.
- Advanced reservations will be required for all groups participating in environmental education. Limits will be established for the total number of environmental education groups permitted per day.
- All groups participating in environmental education programs will be instructed on refuge regulations and etiquette and ways to reduce wildlife and habitat disturbance.
- Dogs and any other pets will be required to remain inside vehicles and will not be allowed on refuge trails.
- Refuge lands associated with these planned uses are available during daylight hours.
- Camping, overnight use, and fires are prohibited.
- To provide undisturbed sanctuary for white-cheeked geese during the winter, the trail developed along the power line right-of-way at Cannery Hill will be closed to the public from October 1 through March 31 annually.
- All trails and observation decks will be open year-round for the purpose of wildlife observation, photography, and interpretation and visitors will be restricted to remaining on trails and decks to reduce the impacts of wildlife disturbance.

- The Service will screen the Little Nestucca River restoration trail with vegetation to reduce wildlife disturbance.
- The Refuge will provide signs and brochures to promote appropriate use of the trails, observation decks and refuge lands to minimize wildlife and habitat disturbance, including boating practices such as no-wake and slower speeds. These materials will clearly state pertinent Refuge-specific regulations.
- The Service will periodically monitor and evaluate the area and programs to determine if objectives are being met and to ensure the resource is not being degraded.
- All refuge lands at Neskowin Marsh will remain closed to all public use with the exception of the "Neskowin Tsunami Evacuation Trail."
- Law enforcement patrols will be conducted on a regular basis to ensure compliance with refuge regulations.

Justification:

As wildlife-dependent recreational uses, wildlife observation, photography, interpretation, and environmental education receive enhanced consideration in the Comprehensive Conservation Planning process. Given the location of seasonal sanctuary, closed areas, and the locations of wildlife viewing, photography, and interpretation facilities, these uses are expected to have a minor direct impact on refuge resources. The associated disturbance to wildlife from these activities, though larger than at present, is also expected to be minor. It is anticipated that wildlife populations will find sufficient food resources and resting places such that their abundance and use of the Refuge will not be measurably lessened from allowing these activities to occur. The relatively limited number of individual animals and plants expected to be adversely affected will not cause wildlife populations to materially decline, the physiological condition and production of refuge species will not be impaired, their behavior and normal activity patterns will not be altered dramatically, and their overall welfare will not be negatively impacted. Thus, allowing wildlife photography, observation, interpretation, and environmental education programs under the stipulations described above will not materially detract or interfere with the purposes for which the Refuge was established or the refuge mission. Wildlife observation, photography, interpretation, and environmental education provide visitors with the joy of experiencing wildlife on their public lands, and as such, help fulfill the mission of the National Wildlife Refuge System.

Mandatory Re-Evaluation Date:

____X____ Mandatory 15-year reevaluation date (for wildlife-dependent public uses)

__________ Mandatory 10-year reevaluation date (for all uses other than wildlife-dependent public uses)

NEPA Compliance for Refuge Use Decision: (check one below)

__________ Categorical Exclusion without Environmental Action Statement

__________ Categorical Exclusion and Environmental Action Statement

____X____ Environmental Assessment and Finding of No Significant Impact

__________ Environmental Impact Statement and Record of Decision

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Refuge Determination:

Prepared by:	Rebecca G. Chuck (Signature)	12/18/12 (Date)
Refuge Manager/ Project Leader Approval:	Rebecca G. Chuck Acting (Signature)	12/18/12 (Date)

Concurrence:

Refuge Supervisor:	(Signature)	12/18/12 (Date)
Regional Chief, National Wildlife Refuge System:	Robt. West (Signature)	12-14-12 (Date)

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B.3 Compatibility Determination

Use: Waterfowl Hunting (Ducks and American Coots only)

Refuge Name: Nestucca Bay National Wildlife Refuge

County and State: Tillamook County, Oregon

Establishing and Acquisition Authorities:

Nestucca Bay NWR was established in 1991 under the authority of the Endangered Species Act of 1973, as amended (16 U.S.C. 1532-1544, 87 Stat. 884); the Fish and Wildlife Act of 1956, as amended (16 U.S.C. 742(a)-754); the Migratory Bird Conservation Act of 1929 (16 U.S.C. 715-715d); the Consolidated Farm and Rural Development Act [7 U.S.C. 2002]; and the Emergency Wetlands Resources Act of 1986 [16 U.S.C. 3901(b), 100 Stat. 3583].

Refuge Purpose(s):

- "to conserve (a) fish or wildlife which are listed as endangered species or threatened species…or (b) plants" [16 U.S.C. 1534 (Endangered Species Act of 1973)].
- "for the development, advancement, management, conservation, and protection of fish and wildlife resources" [U.S.C. 742f(a)(4)]…"for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude" [16 U.S.C. 742f (b)(1) (Fish and Wildlife Act of 1956)].
- "for use as an inviolate sanctuary, or for any other management purpose, for migratory birds" [16 U.S.C. 715d (Migratory Bird Conservation Act)].
- "for conservation purposes" [7 U.S.C. 2002 (Consolidated Farm and Rural Development Act)].
- for "the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to fulfill international obligations contained in various migratory bird treaties and conventions" [16 U.S.C. 3901(b), 100 Stat. 3583 (Emergency Wetlands Resources Act of 1986)].

Description of Use(s):

Under the management direction described in the CCP for Nestucca Bay NWR, the U.S. Fish and Wildlife Service (Service) will allow the hunting of ducks and coots, hereafter referred to as waterfowl hunting, on Brooten Marsh and the Mouth of Little Nestucca River. The Service will allow waterfowl hunting on these refuge lands from October through January seven days per week in accordance with State and Federal regulations and seasons. Brooten Marsh is an approximately 108-acre tidal wetland located where the Nestucca River joins the Little Nestucca River. The Mouth of the Little Nestucca River is located just upstream of Brooten Marsh and consists of 33 acres of tidal marsh. In addition to waterfowl hunting, Brooten Marsh will be open to other wildlife-dependent public uses including wildlife observation and photography and clamming during the waterfowl hunting season. The Mouth of the Little Nestucca River will only be open to waterfowl hunting and will remain closed to all other public uses year-round.

Goose hunting will remain closed on all lands within Nestucca Bay NWR. Specifically, Oregon Department of Fish and Wildlife (ODFW) allows goose hunting in certain areas of the Nestucca Valley and some refuge lands are within the state's designated goose hunt area. Although some refuge lands are within the State's hunt area, all refuge lands will remain closed to goose hunting to provide sanctuary for wintering geese.

Public duck hunting opportunities in the area surrounding Nestucca Bay NWR are limited with the next nearest opportunities occurring on Tillamook and Siletz Bays. Private lands offer waterfowl hunting opportunities but only to those who are granted permission and/or the ones willing and able to purchase hunting rights or leases. There is a demand for public hunting in the Nestucca Valley, especially those lands that have walk-in access and do not require the use of a boat. Allowing waterfowl hunting on Brooten Marsh and the Mouth of the Little Nestucca River will increase hunting opportunities in the area for hunters with or without a boat.

For Brooten Marsh, hunters will access the area either via boat or by walking in from a pull-out along Brooten Road near the southeast corner of the marsh. The Service will be improving a trail that leads from this pull-out to Brooten Marsh to support this and other wildlife-dependent uses planned for the area. Access to the Mouth of the Little Nestucca River is only possible via boat. There are three public boat launches nearby that hunters occasionally use to launch their watercraft. One launch is located within Bob Straub State Park. The other two launches are managed by Tillamook County. One is located on Brooten Road just south of the entrance to Pacific City while the other one is on the south bank of the Little Nestucca River along Meda Loop Road and 200 yards east of Highway 101.

For both areas, access to refuge lands will be allowed from one hour before sunrise to one hour after sunset. Permanent blinds will not be allowed; however, hunters will be allowed to use portable blinds or blinds constructed of onsite dead vegetation or driftwood under the condition that they either be removed or disassembled at the end of each day.

Although dogs are prohibited on the Refuge, they are a vital part of the waterfowl hunting tradition and can reduce the loss of waterfowl to the hunter's bag and hence prevent waste and reduce the overall impact to the resource. Because of their role, both as part of the waterfowl hunting tradition and their contribution to increasing the likelihood of retrieval of birds that have been shot, properly trained dogs used in the act of hunting will be allowed on Nestucca Bay NWR per Service Policy in 50 CFR 32.26.21.

Hunters must comply with all State and Federal regulations regarding waterfowl hunting including provisions outlined in the Code of Federal Regulation 50 CFR 32.2, which states:

- Each person shall secure and possess the required State license and waterfowl validation.
- Each person 16 years of age and older shall secure and possess a Federal Migratory Bird Hunting Stamp while hunting migratory waterfowl.
- Each person shall comply with the terms and conditions authorizing access or use of wildlife refuges.
- The distribution of bait and the hunting over bait is prohibited on wildlife refuges.
- The use or possession of alcoholic beverages while hunting is prohibited.
- Hunters may possess only approved nontoxic shot while in the field or on certain other areas of the National Wildlife Refuge System.

Availability of Resources

The following funding/annual costs will be required to administer and manage waterfowl hunting activities as described above:

Costs to Administer Waterfowl Hunting at Nestucca Bay NWR under the CCP's Management Direction

Activity or Project	One-time Expense	Recurring Expense
Develop hunt opening package	$10,000	
Improve parking area along Brooten road for walk-in access	$2,000	$500
Law Enforcement patrols		$2,000
Brochures, signs, posters		$500
Maintenance		$2,000
Staff		$2,000

Anticipated Impacts of the Use(s):

The Service is committed to providing quality opportunities for wildlife-oriented recreation at Nestucca Bay NWR. As part of the Service mission and refuge goals for Nestucca Bay NWR all six of the Refuge System's priority wildlife-dependent uses will be offered including hunting, fishing, wildlife observation and photography, environmental education and interpretation. Offering hunting will help fulfill refuge purposes and goals and does not conflict with the mission of the Refuge System.

<u>Harvest of Ducks and Coots:</u>
Hunting, by its nature, results in the intentional take of individual animals, as well as wounding and disturbance (DeLong 2002). Indirect impacts such as displacement of animals by hunters or disturbance from gunfire also occurs in and adjacent to, areas opened for hunting. It can also alter behavior (e.g., foraging time), population structure (young birds are generally more susceptible), and distribution patterns of wildlife (Owens 1977, Raveling 1979, White-Robinson 1982, Thomas 1983, Bartlett 1987, Madsen 1985, Cole and Knight 1990). Prolonged and extensive disturbances may cause large numbers of waterfowl to leave disturbed areas and migrate elsewhere (Madsen 1985).

The harvest of ducks and coots will be allowed at Brooten Marsh and the Mouth of the Little Nestucca River seven days per week during the waterfowl hunting season as established by the Oregon Department of Fish and Wildlife. The Refuge will maintain a sanctuary area at the Little Nestucca Restoration Area where hunting does not occur and birds can feed and rest relatively undisturbed. In addition, all refuge lowland pastures will remain closed to all hunting, providing the birds with additional sanctuary.

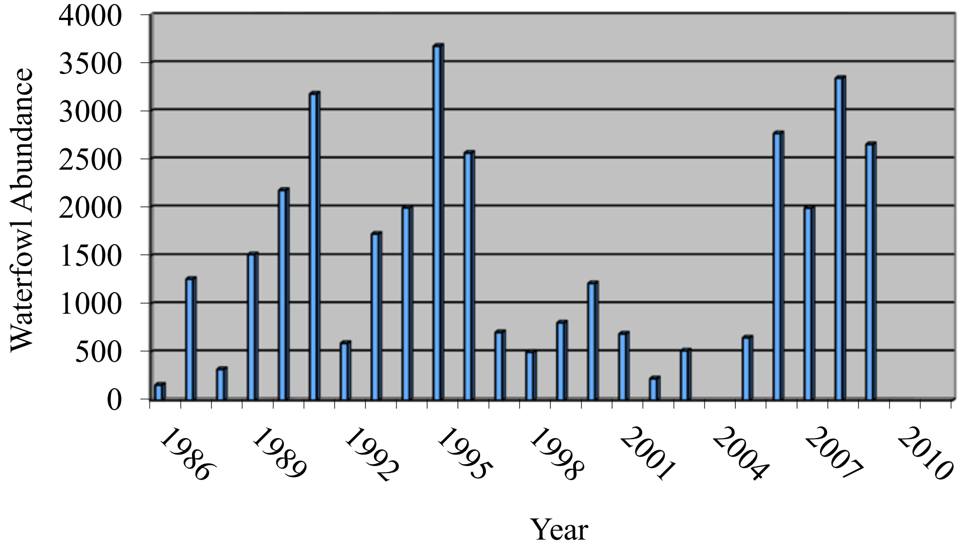
The Service conducts annual surveys that are used to estimate waterfowl hunting activity, success, and harvest by species. Results are used by the Service and State wildlife agencies, in part, to establish season lengths and bag limits designed to maintain healthy, sustainable waterfowl populations. During the 2010-2011 hunting season, waterfowl hunters in Oregon harvested an estimated 419,100 ±18% ducks (Raftovich et al. 2011). On state-owned tidelands of Nestucca Bay during 2010-2011, hunters harvested very few ducks and the numbers are considered to be below reportable levels (B. Reishus, ODFW, personal observation). Waterfowl harvest data are unavailable because only a small number of hunters pursue waterfowl in the Nestucca Bay area, and no hunters were surveyed in 2010-2011. At any given time there are only one to two hunting parties in the bay because of space, and hunting quality is best at only a few spots (e.g., the mouth of the sloughs). Waterfowl hunters tend to self-limit their numbers. Most hunting occurs in October and November and tides influence hunting times. After sufficient rainfall in November the birds disperse further inland to freshwater seasonal wetlands or to adjacent flooded pastures and there is almost no hunting occurring in the bay.

The most heavily harvested duck species in Oregon are mallard, American wigeon, northern pintail, green-winged teal, and northern shoveler (Raftovich et al. 2011). In 2011, continental populations of northern shoveler, green-wing teal, and mallard were all above their long-term averages (USFWS 2011c). American wigeon were 20% below their long-term average and northern pintails were similar to their long-term average. Hunters are permitted to harvest coots, but while this species is common on the Refuge, coots are not popular with hunters. Given the low harvest rates of these species relative to the State harvest, the refuge hunt program will not significantly contribute to the population changes of these species, and the Refuge will continue to conform to State bag limits for ducks and coots.

Biologists from state and Federal agencies annually conduct the Midwinter Waterfowl Survey to provide a measure of the relative numbers or trends of duck populations. The survey identifies winter waterfowl distribution and habitat use throughout the United States. The survey also provides estimates of the size of goose and swan populations and tracks population trends of duck species that nest outside of breeding survey areas. Surveys have indicated waterfowl make significant use of the open bay, mud flats, and tidal marsh with heaviest use occurring from September through January and again during spring migration. Some of the more commonly found birds in the Nestucca estuary include common loon, double-crested cormorant, great blue heron, gulls, and western Canada geese. Common dabbling ducks include mallard, northern pintail, American wigeon, and green-winged teal and diving ducks include bufflehead, greater and lesser scaup, common goldeneye, red-breasted merganser, and surf scoter.

Midwinter Waterfowl Surveys are conducted during the first two weeks in January along the Oregon coast. Observers count divers, dabblers, sea ducks, geese, swans, and American coots from a fixed-wing aircraft and an overall abundance is estimated (USFWS unpublished data). Data were compiled for all waterfowl observed at Nestucca Bay during the midwinter waterfowl surveys from 1986 to 2009 and are displayed in Figure B-1. The overall mean count was 1,534 individuals and the lowest count was 161 individual birds recorded in 1986 and the largest was 3,678 in 1995. These data are collected from a fixed-wing aircraft at 60-100 meters (197-328 feet) altitude and traveling 130-200 kilometers per hour (80-124 miles/hour), which limits ability to survey all areas and all habitats and count every individual present. However, general abundance and population trends can be inferred and obviously Nestucca Bay is an important use area for waterfowl. Waterfowl abundance is usually lower during the January mid-winter survey compared to fall months, when birds are concentrated on the bay prior to dispersing throughout the area due to field and seasonal wetland flooding (R. Lowe, personal observation). Given the low waterfowl harvest rates relative to the large wintering duck population, the refuge hunt program will not significantly contribute to waterfowl population changes and the area should support a sustainable harvest. A program will be implemented to monitor waterfowl population numbers and habitat use.

Figure B-1. Waterfowl abundance at Nestucca Bay, Oregon from 1986 to 2009 (USFWS unpublished data).



Impacts to Non-Target Species:
The refuge hunt program indirectly impacts species other than those targeted by hunters. The presence of hunters and dogs, sounds of gunfire, and the sight of hunters traveling to and from hunt areas can disturb other wildlife species such as Canada geese, pied-billed grebe, great blue heron, bald eagle, great egrets, northern harrier, which forage in refuge wetlands and waterbodies. This disturbance, especially when repeated over a period of time, may result in some wildlife species altering food habits or moving to other areas. Hunting will occur outside of the breeding season for these species and hunt areas are located away from known eagle nests and heron roosts to limit disturbance to these sensitive areas. Accidental shootings of non-game birds are believed to be negligible. Hunters' foot trails and temporary blinds in the tidal marsh could slightly alter wetland vegetation; however, impacts to refuge fish populations and other wildlife are expected to be negligible.

Impacts to Other Priority Public Uses:
While hunting and wildlife observation and photography will be available to the public on Brooten Marsh during the same time of year, the direct impacts to refuge visitors engaged in the other priority public uses either via foot or boat during the hunting season (October through January) are expected to be minor. The hunt period occurs during the time of year when the activities of wildlife observation and photography receive the lowest amount of use by visitors due to rainy and windy weather. Another factor limiting participation in wildlife observation and photography is the difficulty involved in walking through Brooten Marsh due to the abundance of large woody debris and a lack of trails. The Service does not expect any impacts to occur to other priority public uses at the Mouth of the Little Nestucca River as this area will only be open to waterfowl hunting and will remain closed to all other public uses year-round.

Offering hunting at Brooten Marsh and the Mouth of the Little Nestucca River is not expected to directly impact refuge visitors using other areas of Nestucca Bay NWR during the hunt season due to the distance of hunters from Cannery Hill and the Little Nestucca Restoration Area. These distances are as follows: Mouth of Little Nestucca River hunt area to the Little Nestucca Restoration Area is 370 yards (340 meters); Brooten Marsh to the Little Nestucca Restoration Area is 2,400 yards (2,200 meters); Mouth of Little Nestucca River hunt area to Cannery Hill is 1,100 yards (1,000 meters); Brooten Marsh to Cannery Hill is 2,000 yards (1,800 meters). The Refuge will offer interpreter-led paddle trips along the Little Nestucca River but they will only be offered during the summer and thus will not overlap with the hunt period. Recreational non-motorized boating occurs alongside Brooten Marsh for the purpose of wildlife observation and photography but most of this activity occurs during the summer when weather is more predictable, thus reducing the likelihood of conflicts between hunters and people observing/photographing wildlife from boats.

To ensure safety and minimize conflict between hunters and people engaged in wildlife observation and photography, the Service will provide information about hunting boundaries and seasons to the general public and those utilizing other refuge programs. Information will be provided at the interpretive kiosks, on the refuge website, and in refuge offices. In addition, law enforcement patrols will be conducted on a regular basis to ensure compliance with State, Federal, and refuge regulations. The refuge law enforcement officer will also monitor and collect data on hunting activities in the field to ensure limited conflicts with other wildlife-dependent uses. If necessary, the program will be modified accordingly.

<u>Other Impacts:</u>
No significant effects to roads, trails, or other refuge infrastructure from the hunting program are foreseen. Normal road, trail, and facility maintenance will continue. There will be a minor impact to some members of the refuge staff because of increased workload as they oversee the improvement of the parking area along Brooten Road, develop informational materials related to hunting and maintain the integrity of site for wildlife and people in perpetuity. Law enforcement patrols will also increase as will enforcement coordination with other enforcement entities. To facilitate hunting, hunters may set up temporary blinds; however, to ensure the structures do not interfere with habitat, they must be removed at the end of the hunt day.

Public Review and Comment:

Waterfowl hunting was discussed at two public meetings held in conjunction with the Comprehensive Conservation Plan (CCP) process. To initiate the CCP process, a Notice of Intent was published in the Federal Register on November 29, 2010 (Volume 75, Number 228). Written comments were solicited from the public about proposed wildlife-dependent recreational uses including waterfowl hunting. Two CCP planning updates were prepared to summarize the progress of the CCP and to discuss issues related the planning process. This compatibility determination was submitted for public review and comment as an appendix to the Draft Comprehensive Conservation Plan and Environmental Assessment for Nestucca Bay NWR. Appendix K of the CCP contains a summary of the comments and Service responses.

Determination:

__________ Use is Not Compatible

____X____ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility:

The refuge hunting programs is designed to provide a safe, quality experience with reasonable harvest opportunities, while avoiding significant impacts to other users and non-target wildlife resources. The Refuge has developed the following stipulations to reduce impacts and promote safety:

- Only ducks and coots may be taken in accordance with Oregon Department of Fish and Wildlife bag and possession limits.
- Hunting is allowed on Brooten Marsh and at the Mouth of the Little Nestucca River seven days per week.
- Access to the Refuge is allowed from one hour before sunrise to one hour after sunset.
- Law enforcement patrols will be conducted on a regular basis to assure compliance with State, Federal, and refuge regulations. The refuge law enforcement officer will also monitor and collect data on hunting activities in the field to ensure limited conflicts with other wildlife-dependent public uses. If necessary, the program will be modified accordingly.
- The Refuge will ensure safety and minimize conflict with other priority public uses by providing information about hunting boundaries and seasons to the general public and those utilizing other refuge programs. Information will be provided at interpretive kiosks, on the refuge website, and in refuge offices.
- The Refuge will provide signs and brochures to promote appropriate use of refuge lands to minimize wildlife and habitat disturbance, including boating practices such as no-wake and slower speeds. These materials will clearly state pertinent refuge-specific regulations.
- Hunters accessing Brooten Marsh via walk-in will be allowed to use the gravel pull-out along Brooten Road. Hunters accessing refuge lands via boat must secure/anchor boat and use established boat launch areas.
- Camping, overnight use, and fires are prohibited.
- Permanent blinds are not allowed; however, hunters will be allowed to use portable blinds or blinds constructed of onsite dead vegetation or driftwood under the condition that they either be removed or disassembled at the end of each day.
- Dogs used for hunting will be allowed but they must be engaged in hunting activity and under the immediate control of a licensed hunter (see 50 CFR 26.21(b)).
- The Service will implement a program to monitor waterfowl population numbers and habitat use and reserves the right to modify existing programs to accommodate existing or changing conditions.
- Hunters must comply with all State and Federal regulations regarding waterfowl hunting including provisions outlined in 50 CFR 32.2 which states:
    - Each person shall secure and possess the required State license and waterfowl validation.
    - Each person 16 years of age and older shall secure and possess a Federal Migratory Bird Hunting Stamp while hunting migratory waterfowl.
    - Each person shall comply with the terms and conditions authorizing access or use of wildlife refuges.
    - The distribution of bait and the hunting over bait is prohibited on wildlife refuges.
    - The use or possession of alcoholic beverages while hunting is prohibited.
    - Only approved nontoxic shot is allowed on refuge lands to hunt waterfowl.

Justification:

Hunting is a wildlife-dependent recreational use as defined in the National Wildlife Refuge System Improvement Act of 1997. More specifically, it is one of the six priority public uses of the National Wildlife Refuge System and is by definition an appropriate use on a national wildlife refuge, and if it is officially determined to be compatible, should be allowed. Refuge hunting programs are designed to provide high-quality, safe experiences, with a reasonable opportunity to harvest game species. By allowing this use on Nestucca Bay NWR, we will increase the visitors' knowledge and appreciation of fish and wildlife, which may lead to increased public stewardship of wildlife and their habitats on the Refuge. Increased public stewardship will support and complement the Service's actions in achieving the refuge's purposes and the mission of the National Wildlife Refuge System.

Mandatory Re-Evaluation Date:

____X____ Mandatory 15-year reevaluation date (for wildlife-dependent public uses)

_________ Mandatory 10-year reevaluation date (for all uses other than wildlife-dependent public uses)

NEPA Compliance for Refuge Use Decision: (check one below)

__________Categorical Exclusion without Environmental Action Statement

__________Categorical Exclusion and Environmental Action Statement

____X_____Environmental Assessment and Finding of No Significant Impact

__________Environmental Impact Statement and Record of Decision

References:

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Refuge Determination:

Prepared by:	Rebecca G. Chuck (Signature)	12/18/12 (Date)
Refuge Manager/ Project Leader Approval:	Rebecca G. Chuck Acting (Signature)	12/18/12 (Date)

Concurrence:

Refuge Supervisor:	(Signature)	12/18/12 (Date)
Regional Chief, National Wildlife Refuge System:	(Signature)	12-19-12 (Date)

B.4 Compatibility Determination

Use: Fishing and Clamming

Refuge Name: Nestucca Bay National Wildlife Refuge

County and State: Tillamook County, Oregon

Establishing and Acquisition Authorities:

Nestucca Bay NWR was established in 1991 under the authority of the Endangered Species Act of 1973, as amended (16 U.S.C. 1532-1544, 87 Stat. 884); the Fish and Wildlife Act of 1956, as amended (16 U.S.C. 742(a)-754); the Migratory Bird Conservation Act of 1929 (16 U.S.C. 715-715d); the Consolidated Farm and Rural Development Act [7 U.S.C. 2002]; and the Emergency Wetlands Resources Act of 1986 [16 U.S.C. 3901(b), 100 Stat. 3583].

Refuge Purpose(s):

- "to conserve (a) fish or wildlife which are listed as endangered species or threatened species…or (b) plants" [16 U.S.C. 1534 (Endangered Species Act of 1973)].
- "for the development, advancement, management, conservation, and protection of fish and wildlife resources" [U.S.C. 742f(a)(4)]…"for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude" [16 U.S.C. 742f (b)(1) (Fish and Wildlife Act of 1956)].
- "for use as an inviolate sanctuary, or for any other management purpose, for migratory birds" [16 U.S.C. 715d (Migratory Bird Conservation Act)].
- "for conservation purposes" [7 U.S.C. 2002 (Consolidated Farm and Rural Development Act)].
- for "the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to fulfill international obligations contained in various migratory bird treaties and conventions" [16 U.S.C. 3901(b), 100 Stat. 3583 (Emergency Wetlands Resources Act of 1986)].

Description of Use:

The National Wildlife Refuge System Improvement Act of 1997 defined six wildlife-dependent recreational uses and required that they receive priority consideration in refuge planning when they are appropriate and compatible with the refuge mission. Fishing is one of the six wildlife-dependent recreational uses. Because there is often substantial overlap between activities associated with bank fishing and clamming these uses are evaluated together in this compatibility determination.

Under the management direction described in the CCP for Nestucca Bay NWR, the U.S. Fish and Wildlife Service will allow year-round access to recreational bank fishing on the Little Nestucca River and clamming at Brooten Marsh. All recreational fishing and clamming on refuge lands will be conducted in accordance with State, Federal, and refuge-specific regulations and seasons to ensure that it will not interfere with the conservation of fish and wildlife and their habitats, or conflict with other public use programs.

Currently there is no fishing program on Nestucca Bay NWR. Recreational fishing is a popular sport off-refuge on the navigable waters of both the Little Nestucca River and the Nestucca River from boats, and also on the rivers' banks from private lands. Under the management direction described in the CCP, the Service will allow access to recreational bank fishing in the Little Nestucca River and clamming along the southern end of Brooten Marsh.

At the east end of the Little Nestucca Restoration Area, the Service will improve access for anglers by developing a small gravel parking lot on the unit along Highway 130/Little Nestucca River Road. The Service will also develop and improve a short (0.1 mile) pedestrian trail along the existing dike to allow safe travel to the bank of the Little Nestucca River. The trail will be open for anglers to access during daylight hours only. Camping, overnight use, and fires will be prohibited. The designated sites along the trail will concentrate anglers and potentially generate trash including monofilament line, which can entangle wildlife and is therefore a hazard. The Service will provide containers for anglers to discard their used monofilament line. Anglers will be permitted to use pole and line or rod and reel while bank fishing, and under ODFW regulations for fishing in bays and tidelands, anglers will be allowed to use either bait or artificial lures. Pets and dogs must remain inside of vehicles and will not be allowed on any refuge lands including trails and parking lots. Allowing access to bank fishing along the north bank of the Little Nestucca Restoration Area will increase opportunities for fishing in this area, providing a fishing opportunity for people who do not own or have access to a boat. Educational efforts promoting this opportunity will help create a greater awareness among anglers about the importance of estuaries to salmonids.

Clamming is currently allowed on state-owned tidelands adjacent to the Refuge on the west side of U.S. Highway 101 at Brooten Marsh. The Refuge will allow year-round access to clamming beds adjacent to Brooten Marsh which is an approximately 108-acre salt marsh located where the Nestucca River joins the Little Nestucca River. Clammers will access the marsh by walking in from a pull-out along county-maintained Brooten Road. The Service will be improving a trail that leads from this pull-out into Brooten Marsh to support this and the other wildlife-dependent uses for the area. Clamming will be allowed within the mudflats of Brooten Marsh Unit and is intended to provide an opportunity for visitors to harvest softshell clams by digging with a hand shovel or using a clam gun (i.e., aluminum or PVC piped suction device). In addition to the harvest of clams, the harvest of shrimp and other marine invertebrates for bait is included within the term clamming. The entire mudflat habitat within and adjacent to the marsh is open to clamming. Because fishing (including clamming) is one of the Service's priority wildlife-dependent public uses, providing an opportunity for clamming on Brooten Marsh and access to the Little Nestucca River, and the concurrent development of improved safe access for these activities, works cooperatively with the ODFW sport fishing program.

Anglers must comply with all State and Federal regulations regarding fishing and clamming including provisions outlined in the Code of Federal Regulation (50 CFR 32.5).

Availability of Resources:

There will be costs associated with the development of infrastructure to support bank fishing and clamming at Nestucca Bay NWR. Following the development and approval of a Fishing Opening Package, initial facilities costs will include the development of a gravel parking lot and improvement of a pedestrian trail along the dike at the Little Nestucca Restoration Area and improvement of the access along Brooten Road. An informational kiosk will also be developed and place at the parking lot to share information on fishing access and refuge rules and regulations.

Once infrastructure is in place the annual cost related to management of a fishing program at Nestucca Bay NWR will be minimal. Expenses will consist primarily of posting and maintaining "Public Fishing Area" signs, maintenance of the trail and parking lot, law enforcement patrols, retrieval of monofilament line deposited in waste containers, and production and dissemination of materials regarding fishing access and regulations.

Costs to Administer a Fishing Program at Nestucca Bay NWR under the CCP's Management Direction

Activity or Project	One-time Expense	Recurring Expense
Develop fishing opening package	$5,000	
Build a small gravel parking lot on the Little Nestucca Restoration Area	$600,000	$2,000
Improve the pedestrian trail along the dike at the Little Nestucca Restoration Area	$130,600	$2,000
Improve parking access along Brooten Road	$2,000	
Informational Kiosk	$2,800	
Law Enforcement patrols		$3,500
Brochures, signs, posters	$1,000	$500
Maintenance		$2,000
Staff		$2,500

Anticipated Impacts of the Use(s):

The Service is committed to providing quality opportunities for fish and wildlife-oriented recreation at Nestucca Bay NWR. As part of the Service mission and refuge goals for Nestucca Bay, all six of the Refuge System's priority wildlife-dependent uses will be offered at Nestucca Bay including fishing, hunting, wildlife observation, photography, environmental education, and interpretation. Offering these public uses will help fulfill refuge purposes and goals and does not conflict with the mission of the Refuge System.

<u>Impacts to Wildlife and Habitat:</u>
Effect of disturbance intensity: Some researchers have attempted to correlate disturbance events in wildlife to the intensity, proximity, or loudness of human disturbance. While studying shorebirds on an eastern coastal refuge, Burger (1986) found that the level of disturbance in the shorebirds increased (fewer remained, more flew) as the total number of disturbances and the number of children, joggers, people walking, dogs, aircraft, and boats increased, and the duration of the disturbance and distance from the disturbance decreased.

Effect of human proximity: Other researchers have studied the effect of human proximity on wildlife. At what distance do humans on foot elicit a disturbance response? From an examination of the available studies, it appears that the distance varies dramatically from species to species. Burger and Gochfeld (1991) found that sanderlings foraged less during the day and more during the night as the number of people within 100 meters (328 feet) increased. Elk in Yellowstone National Park were disturbed when people were at average distances of 573 meters (1,880 feet) (Cassirer 1990). These elk temporarily left the drainage and their home range core areas and moved to higher elevations, steeper slopes, and closer to forested areas. Average return time to the drainage was two days. Erwin

(1989) studied colonial wading and seabirds in Virginia and North Carolina. Mixed colonies of common terns and black skimmers responded at the greatest distances, with respective means of 142 meters (466 feet) and 130 meters (427 feet); mixed wading bird species were more reluctant to flush (30-50 meters [98-164 feet] average). There were few statistically significant relationships between flushing distance and colony size. Similarly, there were few differences between responses during incubation compared to post-hatching periods.

Miller et al. (2001) defined an “area of influence” as the area that parallels a trail or line of human movement within which wildlife would flush from a particular activity with a certain probability. In a study analyzing response distance from hiking and mountain biking in sagebrush-grassland habitat in Utah, Taylor and Knight (2003) found that at 100 meters (328 feet) from the line of movement of an off-trail trial, mule deer showed a 96 percent probability of flushing. That probability did not drop to 70 percent until the perpendicular distance increased to 390 meters (1,278 feet).

Taylor and Knight (2003) also found that the area of influence around a recreationist on a trail did not differ between mountain biking and hiking. This may indicate that wildlife do not differentiate between hikers and bikers, but are instead reacting to the presence of a moving human on a trail, regardless of the person's activity. However, the area of influence differed considerably between on-trail and off-trail trials.

An analysis of over 4,000 human activity events near bald eagle nests in Central Arizona (Grubb and King 1991) found distance to disturbance to be the most important classifier of bald eagle response, followed in decreasing order of discriminatory value by duration of disturbance, visibility, number of units per event, position relative to affected eagle, and sound.

Breeding bald eagles in north-central Minnesota (Fraser et al. 1985) flushed at an average distance of 476 meters (1,562 feet) at the approach of a pedestrian. A multiple regression model including number of previous disturbances, date, and time of day, explained 82 percent of the variability in flush distance and predicted a maximum flush distance at the first disturbance of 503 meters (1,650 feet). Skagen (1980), studying bald eagles in northwest Washington, found a statistically significant decrease in the proportion of eagles feeding when human activity was present within 200 meters (656 feet) of the feeding area in the previous 30 minutes. A statistically significant between-season variation occurred in the use of feeding areas relative to human presence, which correlated with food availability. Eagles appeared more tolerant of human activity in the season of low food availability. In a review of several studies of the reaction of waterfowl and other wetland birds to people on foot, distances greater than 100 meters (328 feet) in general did not result in a behavioral response (DeLong 2002).

Effects from pedestrian access: Wildlife is frequently more sensitive to disturbance from people on foot than in vehicles (Skagen 1980, Grubb and King 1991, MacArthur et al. 1982). Numerous studies have confirmed that people on foot can cause a variety of disturbance reactions in wildlife, including flushing or displacement (Erwin 1989, Fraser et al. 1985, Freddy 1986), heart rate increases (MacArthur et al. 1982), altered foraging patterns (Burger and Gochfeld 1991), and even, in some cases, diminished reproductive success (Boyle and Samson 1985). These studies and others have shown that the severity of the effects depends upon the distance to the disturbance and its duration, frequency, predictability, and visibility to wildlife (Knight and Cole 1995).

Effects on migrant birds versus resident birds: Klein (1989) studied the effect of visitation on migrant and resident waterbirds at Ding Darling National Wildlife Refuge and found that resident birds were less sensitive to human disturbance than migrants. Migrant ducks were particularly sensitive when they first arrived on-site in the fall. They usually remained more than 80 meters (262 feet) from a visitor footpath on a dike, even at very low visitor levels. Herons, egrets, brown pelicans, and anhingas were most likely to habituate to humans, thus exposing them to direct disturbance as they fed on or near the dike. Shorebirds showed intermediate sensitivity. Strauss (1990) observed piping plover chicks spent less time feeding (50 percent versus 91 percent) and spent more time running (33 percent versus 2 percent), fighting with other chicks (4 percent versus 0.1 percent), and standing alert (9 percent versus 0.1 percent) when pedestrians or moving vehicles were closer than 100 meters (328 feet) than when they were undisturbed. In addition, plover chicks spent less time out on the feeding flats (8 percent versus 97 percent) and more time up in the grass (66 percent versus 0.1 percent) during periods of human disturbance.

Predictability of disturbance (habituation): Dwyer and Tanner (1992) noted that wildlife habituate best to disturbance that is somewhat predictable or "background." Investigating 111 nests of sandhill cranes in Florida, Dwyer and Tanner found that nesting cranes seemed to habituate to certain forms of human disturbance and nested within 400 meters (1,312 feet) of highways, railroads, and mines; cranes also were tolerant of helicopter flyovers. Visits to nests and development-induced alterations of surface water drainage were implicated in 24 percent of the nest failures. Taylor and Knight (2003) found that for mule deer, the area of influence around off-trail trials was much greater than that for on-trail trials, suggesting habituation to trails. However, the time it takes for wildlife to habituate, and what wildlife use is like compared to pre-disturbance uses, remains a fertile question. A study by Fairbanks and Tullous (2002) measured the distance of pronghorn from recreational trails on Antelope Island State Park in Utah. The study gathered data the year before the trails were opened for public use, and compared these to data gathered in three consecutive years after recreational use began. Groups of pronghorn were observed significantly farther from trails in years with recreational use than in the year before recreational areas were opened.

Fishing-specific impacts: Fishing, when practiced as a solitary and stationary activity, tends to be less disturbing to wildlife than hunting or motorized boating (Tuite et al. 1983). Direct habitat impacts include a certain amount of litter and general garbage left at fishing sites. Installation and use of parking areas and access trails can decrease impacts to vegetation and soil adjacent to fishing areas, by concentrating visitors on hardened surfaces.

Fishing will cause minor and localized disturbance to birds and other wildlife using refuge mudflats and tidal marsh. Fishing activities may influence the composition of bird communities, as well as distribution, abundance, and productivity of waterbirds (Tydeman 1977, Bouffard 1982, Bell and Austin 1985, Edwards and Bell 1985, and Cooke 1987). Anglers often fish in shallow, sheltered bays and creeks that birds prefer, negatively impacting distribution and abundance of waterfowl, grebes, and coots (Cooke 1987). Increases in anglers and associated shoreline activity discouraged waterfowl from using otherwise suitable habitat (Jahn and Hunt 1964). In Britain, anglers displaced waterfowl from their preferred feeding and roosting areas and caused wigeon, green-winged teal, pochard, and mallard to depart from a reservoir prematurely (Jahn and Hunt 1964). On fishing days, anglers influenced the numbers, behavior, and diurnal distribution of avian scavengers present at sites in Washington when compared to nonfishing days (Knight et al. 1991). Shoreline activities, such as human noise, could cause some birds to flush and go elsewhere. In addition, vegetation trampling and deposition of human waste are expected to occur (Liddle and Scorgie 1980). Disturbance and destruction of riparian vegetation, and impacts to bank stability and water quality, may result from high levels of bank fishing activities.

Effects from boat proximity: Boating, both motorized and non-motorized, can alter the distribution, reduce use of particular habitats or entire areas by waterfowl and other birds, alter feeding behavior and nutritional status, and cause premature departure from areas (Knight and Cole 1995). More sensitive species may find it difficult to secure adequate food or loafing sites as their preferred habitat becomes fragmented and recreation related disturbance increase (Skagen et al. 1991, Pfister et al. 1992). However, disturbance to birds in general was reduced when boats traveled at or below 5 miles per hour speed limit.

Motorized boats can generally have more impact on wildlife than non-motorized boats because motorboats produce a combination of movement and noise (Tuite et al. 1983, Knight and Cole 1995). Motorized boats can also cover a larger area in a relatively short time, in comparison to non-motorized boats. Motorized boats introduce noise and pollution, in the form of gas and oil, and particulates in the air, in estuarine and riverine habitats of the Refuge. Hydrocarbon pollution has been found to bio accumulate with the complex food web, posing a serious threat to the marine environment (Tjarnlund et al. 1993). Hydrocarbons can also be transferred to eggs from the plumage of incubating birds. Extremely small amounts of petroleum hydrocarbons can be toxic to eggs and birds that ingest these contaminants (Hoffman 1989).

Canoes and kayaks can cause significant disturbance effects based on their ability to penetrate into shallower marsh areas (Speight 1973, Knight and Cole 1995). In the Ozark National Scenic Riverway, green heron activity declined on survey routes when canoes and boat use increased on the main river channel (Kaiser and Fritzell 1984). Canoes or slow moving boats have also been observed to disturb nesting great blue herons (Vos et al. 1985). Huffman (1999) found that non-motorized boats within 30 meters (98 feet) of the shoreline in south San Diego Bay caused all wintering waterfowl to flush between the craft and shore. However, compared to motorboats, canoes and kayaks appear to have less disturbance effects on most wildlife species (Jahn and Hunt 1964, Huffman 1999, DeLong 2002).

The total number of boats and people can be an inappropriate measure of recreational intensity because the presence of a single boat might be just as disturbing as that of many (Tuite et al. 1983, Knight and Knight 1984). Even a low level of boating activity affects the duration and pattern of use by wildlife (Bratton 1990).

<u>Refuge-specific Impacts:</u>
People engaging in fishing and clamming are expected to access the Refuge by motorized vehicles travelling public roads, and then using pull-outs and parking lots. Pull-outs, parking lots, and public roads have minimal direct impacts because they occupy a relatively small acreage.

Currently the Nestucca Bay NWR does not provide fishing and clamming opportunities. Under the management direction described in the CCP, the Refuge will add river bank fishing on the east end of the Little Nestucca Restoration Area following the development of an access trail and gravel parking lot and clamming on the mudflat habitat in and adjacent to Brooten Marsh. Along river banks and within mudflats foot travel will result in a minor amount of habitat degradation (vegetation modification and soil compaction) from fishing activities.

Pedestrian access: Pedestrian access for fishing to the Little Nestucca River creates the highest potential for wildlife disturbance or damage to natural resources. Foot travel associated with bank fishing and clamming could potentially result in temporary and minor vegetation trampling. Pedestrian access for fishing will be allowed only east of the Little Nestucca River bridge, as the lowland pastures west of the bridge are extremely important, high quality wintering habitat for the geese that the Refuge was established to provide for. Allowing access for fishing from this river dike west of the bridge during the time the migrant geese are present, from October through the end of April, will cause unacceptable levels of disturbance to these geese and could in effect remove these pastures from the wintering area acceptable to the geese. Fishing from the bank at the east end of the restoration area, which is east of the bridge, is expected to cause negligible to minor disturbance to geese and other waterfowl using refuge pastures although it could cause very minor disturbance to geese using privately owned pastures immediately upstream.

Angler access to fish or clam is limited to designated trails or dike tops. Nearby resting and feeding areas will be available for use by any displaced wildlife by anglers.

Both fishing and clamming visitation and emphasis devoted to fishing are projected to increase under the management direction described in the CCP. Given this, future disturbance effects are likely to be somewhat higher than present. Most studies cited above have demonstrated immediate, rather than long-term responses to disturbance. Long-term responses are inherently more difficult and expensive to determine. If disturbance to wildlife or damage to habitat reaches unacceptable levels, the Service will reevaluate the program and make revisions as necessary to reduce impacts.

Impacts to listed species: The listed species found on Nestucca Bay NWR is the threatened coho salmon, Pacific smelt (eulachon), and green sturgeon. Effects from bank fishing and clamming access on coho and green sturgeon are expected to be negligible. The highest potential for impacts to this species is from accidental capture during fishing for other species. Impacts to this fish species are minimized through adopting state regulations for fishing in Nestucca Bay and by the small scope and limited capacity of this new fishing opportunity. It is expected no impact or a neutral effect on eulachon will occur because of fishing activities. In addition, specific public education (e.g., handouts) can assist in raising awareness and preventing undue impacts to these species.

Sport fishing in waters containing coho salmon is an approved recreational activity by the National Marine Fisheries Service under a Section 7 consultation of the Endangered Species Act within a Biological Opinion (PFMC 1999) and under ODFW’s “Oregon Coastal Coho, coastal Rivers Coho Sports Fishery” Fisheries and Management Plan (National Marine Fisheries Service concurred with under limit 4 of the Endangered Species Act 4(d) rule; ODFW 2009, NMFS 2009).

Impacts to other priority public uses: Nestucca Bay NWR is committed to providing quality opportunities for wildlife-dependent recreation. The Refuge will support all six of the Refuge System’s priority wildlife-dependent uses: hunting, fishing, wildlife observation and photography, environmental education, and interpretation. The direct impacts to refuge visitors engaged in the other priority public uses either via foot or boat from fishing are expected to be negligible.

Bank fishing and clamming generally result in little disturbance to other visitors. However, some clammers may inadvertently flush waterfowl being pursued by hunters on Brooten Marsh. This impact is expected to be minimal because waterfowl hunting will occur only during late fall and winter, a time of year when visitors engaged in clamming are fewer in number and clamming occurs during low tide when hunters are usually absent

Access to bank fishing will be allowed for fish along the north bank of the Little Nestucca River at the east end of the Little Nestucca Restoration Area. This activity will be separated from the other trail that will be built at the western end of the restoration area for the purpose of wildlife observation and photography. Since the uses will be physically separated, no impacts are expected to occur on wildlife observers and photographers in this area. The Service does not expect there to be much participation in wildlife observation and photography at Brooten Marsh due to the difficulty of accessing the lands, the presence of uneven terrain, and copious amounts of large woody debris. Therefore, no impacts by clammers are expected to occur on people engaged wildlife observation or photography due to the limited numbers of individuals engaged in fishing and clamming, and the limited areas where the use will be allowed.

No significant effects to roads, trails, or other refuge infrastructure from the fishing program are foreseen. Normal road, trail, and facility maintenance will continue to be necessary. There will be a minor impact to some members of the refuge staff as it will be necessary for them to increase their workload as they oversee the improvement of a trail into the marsh from Brooten Road, a parking lot and trail in the Little Nestucca Restoration Area and develop informational materials related to fishing and maintain the integrity of all sites for wildlife and people in perpetuity.

Law enforcement patrols will be conducted on a regular basis to ensure compliance with State, Federal, and refuge regulations. The refuge law enforcement officer will also monitor and collect data on fishing activities in the field to ensure it does not interfere with other wildlife-dependent uses. If necessary, the program will be modified accordingly.

Public Review and Comment:

Fishing and clamming were discussed at two public meetings held in conjunction with the Comprehensive Conservation Plan process. To initiate the CCP process, a Notice of Intent was published in the Federal Register on November 29, 2010 (Volume 75, Number 228). Written comments were solicited from the public about proposed wildlife-dependent recreational uses including fishing and clamming. Three CCP planning updates were prepared to summarize the progress of the CCP and to discuss issues related the planning process. This compatibility determination was submitted for public review and comment as an appendix to the Draft Comprehensive Conservation Plan and Environmental Assessment for Nestucca Bay NWR. Appendix K of the CCP contains a summary of the comments and Service responses.

Determination:

__________ Use is Not Compatible

____X____Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility:

- Fishing and clamming are allowed only during daylight hours.
- Anglers will be permitted to use pole and line or rod and reel. Anglers must attend their line.
- The Service will provide containers for anglers at the bank fishing location to discard their used monofilament line.
- The Refuge will ensure safety and minimize conflict with other priority public uses by providing information about fishing and clamming to the general public and those utilizing other refuge programs. These materials will clearly state pertinent State Federal, and Refuge-specific regulations. Information will be provided at interpretive kiosks, on the refuge website and in refuge offices.

- Anglers are required to comply with ODFW fishing regulations.
- The Refuge will provide signs and brochures to promote appropriate use of refuge lands to minimize wildlife and habitat disturbance, including boating practices such as no-wake and slower speeds. These materials will clearly state pertinent refuge-specific regulations.
- For the Little Nestucca Restoration Area anglers will access the area by a gravel parking lot on the northeast side of the unit along Highway 130/Little Nestucca River Road and a short pedestrian trail along the dike of the Little Nestucca River.
- For Brooten Marsh clammers will access the area via a pull-out along Brooten Road and an improved trail.
- Pets and dogs must remain inside of their vehicles. No pets are allowed on refuge trail or in parking lots.
- Camping, overnight use, and fires are prohibited.
- The Service will implement a program to monitor fish population numbers and habitat use and reserves the right to modify existing programs to accommodate existing or changing conditions.

Justification:

Wildlife-dependent recreational uses including fishing receive enhanced consideration in the Comprehensive Conservation Planning process. Given the limited locations of bank fishing and clamming, these uses are expected to have a minor direct impact on refuge resources. The associated disturbance to wildlife from these activities, though larger than at present, is also expected to be minor. It is anticipated that wildlife populations will find sufficient food resources and resting places such that their abundance and use of the Refuge will not be measurably lessened from allowing these activities to occur. The relatively limited number of individual animals and plants expected to be adversely affected will not cause wildlife populations to materially decline, the physiological condition and production of refuge species will not be impaired, their behavior and normal activity patterns will not be altered dramatically, and their overall welfare will not be negatively impacted. Thus, allowing access to fishing and clamming under the stipulations described above will not materially detract or interfere with the purposes for which the Refuge was established or the refuge mission. Furthermore, educational efforts promoting access to bank fishing and clamming on the Nestucca Bay NWR will create a greater awareness among anglers about the importance of estuaries and unimpeded coastal creeks for salmonids. Fishing provides visitors with the joy of experiencing wildlife on their public lands, and as such, helps fulfill the mission of the National Wildlife Refuge System.

Mandatory Re-Evaluation Date:

____X____ Mandatory 15-year reevaluation date (for wildlife-dependent public uses)

__________ Mandatory 10-year reevaluation date (for all uses other than wildlife-dependent public uses)

NEPA Compliance for Refuge Use Decision: (check one below)

__________ Categorical Exclusion without Environmental Action Statement

__________ Categorical Exclusion and Environmental Action Statement

____X____ Environmental Assessment and Finding of No Significant Impact

_________ Environmental Impact Statement and Record of Decision

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Refuge Determination:

Prepared by:	Rebecca G Chuck (Signature)	12/18/12 (Date)
Refuge Manager/ Project Leader Approval:	Rebecca G. Chuck Acting (Signature)	12/18/12 (Date)

Concurrence:

Refuge Supervisor:	(Signature)	12/18/12 (Date)
Regional Chief, National Wildlife Refuge System:	(Signature)	12-19-12 (Date)

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B.5 Compatibility Determination

Use: Research, Scientific Collecting, and Surveys

Research: Planned, organized, and systematic investigation of a scientific nature.

Scientific collecting: Gathering of refuge natural resources or cultural artifacts for scientific purposes.

Surveys: Scientific inventory or monitoring.

Refuge Name: Nestucca Bay National Wildlife Refuge

County and State: Tillamook County, Oregon

Establishing and Acquisition Authorities:

Nestucca Bay NWR was established in 1991 under the authority of the Endangered Species Act of 1973, as amended (16 U.S.C. 1532-1544, 87 Stat. 884); the Fish and Wildlife Act of 1956, as amended (16 U.S.C. 742(a)-754); the Migratory Bird Conservation Act of 1929 (16 U.S.C. 715-715d); the Consolidated Farm and Rural Development Act [7 U.S.C. 2002]; and the Emergency Wetlands Resources Act of 1986 [16 U.S.C. 3901(b), 100 Stat. 3583].

Refuge Purpose(s):

- "to conserve (a) fish or wildlife which are listed as endangered species or threatened species…or (b) plants" [16 U.S.C. 1534 (Endangered Species Act of 1973)].
- "for the development, advancement, management, conservation, and protection of fish and wildlife resources" [U.S.C. 742f(a)(4)]…"for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude" [16 U.S.C. 742f (b)(1) (Fish and Wildlife Act of 1956)].
- "for use as an inviolate sanctuary, or for any other management purpose, for migratory birds" [16 U.S.C. 715d (Migratory Bird Conservation Act)].
- "for conservation purposes" [7 U.S.C. 2002 (Consolidated Farm and Rural Development Act)].
- for "the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to fulfill international obligations contained in various migratory bird treaties and conventions" [16 U.S.C. 3901(b), 100 Stat. 3583 (Emergency Wetlands Resources Act of 1986)].

Description of Use(s):

The refuge staff receives periodic requests from non-Service entities (e.g., universities, state or territorial agencies, other Federal agencies, nongovernmental organizations) to conduct research, scientific collecting, and surveys on refuge lands. These project requests can involve a wide range of natural and cultural resources as well as public-use management issues including basic absence/presence surveys, collection of new species for identification, habitat use and life-history requirements for specific species/species groups, practical methods for habitat restoration, extent and severity of environmental contaminants, techniques to control or eradicate pest species, effects of climate change on environmental conditions and associated habitat/wildlife response, identification and analyses of paleontological specimens, wilderness character, modeling of wildlife populations, bioprospecting, and assessing response of habitat/wildlife to disturbance from public uses. Projects may be species-specific, refuge-specific, or evaluate the relative contribution of the refuge lands to larger landscapes (e.g., ecoregion, region, flyway, national, international) issues and trends.

The Service's Research and Management Studies (4 RM 6) and Appropriate Refuge Uses (603 FW1.10D(4)) policies indicate priority for scientific investigatory studies that contribute to the enhancement, protection, use, preservation, and management of native wildlife populations and their habitat as well as their natural diversity. Projects that contribute to refuge-specific needs for resource and/or wilderness management goals and objectives, where applicable, will be given a higher priority over other requests.

Availability of Resources:

Refuge staff responsibilities for projects by non-Service entities will be primarily be limited to the following: review of proposals, prepare SUP(s) and other compliance documents (e.g., Section 7 of the Endangered Species Act of 1973, Section 106 of the National Historic Preservation Act), and monitor project implementation to ensure that impacts and conflicts remain within acceptable levels (compatibility) over time. Additional administrative support, logistical and operational support may also be provided depending on each specific request. Estimated costs for one-time (e.g., prepare SUP) and annually re-occurring tasks by refuge staff and other Service employees will be determined for each project. Sufficient funding in the general operating budget of the refuge(s) must be available to cover expenses for these projects. The terms and conditions for funding and staff support necessary to administer each project on the refuge(s) will be clearly stated in the SUP(s).

The Nestucca Bay Refuge has the following staffing and funding to administratively support and monitor research that is currently taking place on refuge lands (see table below). Any substantial increase in the number of projects will create a need for additional resources to oversee the administration and monitoring of the investigators and their projects. Any substantial additional costs above those itemized below may result in finding a project not compatible unless expenses are offset by the investigator(s), sponsoring agency, or organization.

Category and Itemization	One-time ($)	Annual ($/year)
Administration and management		$1,000
Maintenance		$500
Monitoring		$1,750
Special equipment, facilities, or improvement		
Totals		**$3,250**

Itemized costs in the previous table are current estimates calculated using 30% of the base cost for a GS-11 refuge biologist and a 3% of the cost of a GS-11 refuge manager.

Anticipated Impacts of the Use(s):

Use of the Refuge to conduct research, scientific collecting, and surveys will generally provide information that will benefit fish, wildlife, plants, and their habitats. Scientific findings gained through these projects provide important information regarding life-history needs of species and species groups as well as identify or refine management actions to achieve resource management objectives in refuge management plans (especially CCPs). Reducing uncertainty regarding wildlife and habitat responses to refuge management actions in order to achieve desired outcomes reflected in resource management objectives is essential for adaptive management in accordance with 522 DM 1.

If project methods impact or conflict with refuge-specific resources, priority wildlife-dependent public uses, other high-priority research, wilderness, and refuge habitat and wildlife management programs, then it must be clearly demonstrated that its scientific findings will contribute to resource management and that the project cannot be conducted off-refuge for the project to be compatible. The investigator(s) must identify methods/strategies in advance required to minimize or eliminate the potential impact(s) and conflict(s). If unacceptable impacts cannot be avoided, then the project will not be compatible. Projects that represent public or private economic use of the natural resources of any national wildlife refuge (e.g., bioprospecting), in accordance with 16 U.S.C. 715s, must contribute to the achievement of the national wildlife refuge purposes or the National Wildlife Refuge System mission to be compatible (50 CFR 29.1).

Impacts will be project- and site-specific, and they will vary depending upon nature and scope of the field work. Data collection techniques will generally have minimal animal mortality or disturbance, habitat destruction, no introduction of contaminants, or no introduction of non-indigenous species. In contrast, projects involving the collection of biotic samples (plants or animals) or requiring intensive ground-based data or sample collection will have short-term impacts. To reduce impacts, the minimum number of samples (e.g., water, soils, vegetative litter, plants, macroinvertebrates, vertebrates) will be collected for identification and/or experimentation and statistical analysis. Where possible, researchers will coordinate and share collections to reduce sampling needed for multiple projects. For example, if one investigator collects fish for a diet study and another research examines otoliths, then it may be possible to accomplish sampling for both projects with one collection effort.

Investigator(s) obtaining required State or Territorial, and Federal collecting permits will also ensure minimal impacts to fish, wildlife, plants, and their habitats. After incorporating the above strategies, projects will not be compatible if they will result in long-term or cumulative effects. A Section 7 consultation under the Endangered Species Act (16 U.S.C. 1531-1544, 87 Stat. 884, as amended Public Law 93-205) will be required for activities that may affect a federally listed species and/or critical habitat. Only projects that have no effect or will result in not likely to adversely affect determinations will be considered compatible.

Spread of invasive plants and/or pathogens is possible from ground disturbance and/or transportation of project equipment and personnel, but it will be minimized or eliminated by requiring proper cleaning of investigator equipment and clothing as well as quarantine methods, where necessary (see Attachment 4). If after all practical measures are taken and unacceptable spread of invasive species is anticipated to occur, then the project will be found not compatible without a restoration or mitigation plan.

There also could be localized and temporary effects from vegetation trampling, collecting of soil and plant samples, or trapping and handling of wildlife. Impacts may also occur from infrastructure necessary to support a projects (e.g., permanent transects or plot markers, exclosure devices, monitoring equipment, solar panels to power unattended monitoring equipment). Some level of disturbance is expected with these projects, especially if investigator(s) enter areas closed to the public and collect samples or handle wildlife. However, wildlife disturbance (including altered behavior) will usually be localized and temporary in nature. Where long-term or cumulative unacceptable effects cannot be avoidable, the project will not be found compatible. Project proposals will be reviewed by refuge staff and others, as needed, to assess the potential impacts (short-term, long-term, and cumulative) relative to benefits of the investigation to refuge management issues and understanding of natural systems.

At least 6 months before initiation of field work (unless an exception is made by prior approval of the refuge manager), project investigator(s) must submit a detailed proposal using the format provided in Attachment 1. Project proposals will be reviewed by refuge staff and others, as needed, to assess the potential impacts (short-term, long-term, and cumulative) relative to benefits of the investigation to refuge management issues and understanding of natural systems. This assessment will form the primary basis for allowing or denying a specific project. Projects that result in unacceptable refuge impacts will not be found compatible. If allowed and found compatible after approval, all projects also will be assessed during implementation to ensure impacts and conflicts remain within acceptable levels.

If the proposal is approved, then the refuge manager will issue a SUP(s) with required stipulations (terms and conditions) of the project to avoid and/or minimize potential impacts to refuge resources as well as conflicts with other public-use activities and refuge field management operations. After approval, projects also are monitored during implementation to ensure impacts and conflicts remain within acceptable levels based upon documented stipulations.

The combination of stipulations identified above and conditions included in any SUP(s) will ensure that proposed projects contribute to the enhancement, protection, conservation, and management of native wildlife populations and their habitats on the refuge(s). As a result, these projects will help fulfill refuge purpose(s); contribute to the mission of the NWRS; and maintain the biological integrity, diversity, and environmental health of the refuge(s).

Projects that are not covered by the CCP (objectives under Goal 9 [Gather scientific information (surveys, research, and assessments) to support adaptive management decisions under objectives for Goals 1-8.]) will require additional NEPA documentation.

Public Review and Comment:

This CD was prepared concurrently with the Nestucca Bay NWR CCP/EA. Public notice was provided and open houses were held and written comments were solicited from the public during the scoping period for the CCP/EA. Public review and comment were solicited during the draft CCP/EA comment period. Appendix K of the CCP contains a summary of the comments and Service responses.

Determination: (check one below)

__________ Use is Not Compatible

____X____ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility:

Each project will require a SUP. Annual or other short-term SUPs are preferred; however, some permits will be a longer period, if needed, to allow completion of the project. All SUPs will have a definite termination date in accordance with 5 RM 17.11. Renewals will be subject to refuge manager review and approval based timely submission of and content in progress reports, compliance with SUP stipulations, and required permits.

- Projects will adhere to scientifically defensible protocols for data collection, where available and applicable.
- Investigators must possess appropriate and comply with conditions of State or Territorial and Federal permits for their projects.
- If unacceptable impacts to natural resources or conflicts arise or are documented by the refuge staff, then the refuge manager can suspend, modify conditions of, or terminate an on-going project already permitted by SUP(s) on a refuge(s).
- Progress reports are required at least annually for multiple-year projects. The minimum required elements for a progress report will be provided to investigator(s) (see Attachment 2).
- Final reports are due one year after completion of the project unless negotiated otherwise with the refuge manager.
- Continuation of existing projects will require approval by the refuge manager.
- The refuge staff will be given the opportunity to review draft manuscript(s) from the project before being submitted to a scientific journal(s) for consideration of publication.
- The refuge staff will be provided with copies (reprints) of all publications resulting from a refuge project.
- The refuge staff will be provided with copies of raw data (preferably electronic database format) at the conclusion of the project.
- Upon completion of the project or annually, all equipment and markers (unless required for long-term projects), must be removed and sites must restored to the refuge manager's satisfaction. Conditions for clean-up and removal of equipment and physical markers will be stipulated in the SUP(s).
- All samples collected on refuge lands are the property of the Service even while in the possession of the investigator(s). Any future work with previously collected samples not clearly identified in the project proposal will require submission of a subsequent proposal for review and approval. In addition, a new SUP will be required for additional project work. For samples or specimens to be stored at other facilities (e.g., museums), a memorandum of understand will be necessary (see Attachment 3).
- Sampling equipment as well as investigator(s) clothing and vehicles (e.g., ATV, boats) will be thoroughly cleaned (free of dirt and plant material) before being allowed for use refuge lands to prevent the introduction and/or spread of pests. Where necessary, utilize quarantine methods (see Attachment 4)
- The NWRS, specific refuge, names of refuge staff and other Service personnel that supported or contributed to the project will be appropriately cited and acknowledged in all written and oral presentations resulting from projects on refuge lands.
- At any time, refuge staff may accompany investigator(s) in the field.
- Investigator(s) and support staff will follow all refuge-specific regulations that specify access and travel on the refuge(s).

Justification:

Research, scientific collecting, and surveys on refuge lands are inherently valuable to the Service because they will expand scientific information available for resource management decisions. In addition, only projects that directly or indirectly contribute to the enhancement, protection, use, preservation, and management of refuge wildlife populations and their habitats generally will be authorized on refuge lands. In many cases, if it were not for the refuge staff providing access to refuge lands and waters along with some support, the project would never occur and less scientific information would be available to the Service to aid in managing and conserving the refuge resources. By allowing the use to occur under the stipulations described above, it is anticipated that wildlife species which could be disturbed during the use will find sufficient food resources and resting places so their abundance and use will not be measurably lessened on the refuge(s). Additionally, it is anticipated that monitoring, as needed, will prevent unacceptable or irreversible impacts to fish, wildlife, plants, and their habitats. As a result, these projects will not materially interfere with or detract from fulfilling refuge purposes; contributing to the mission of the NWRS; and maintaining the biological integrity, diversity, and environmental health of the refuge.

Mandatory Re-Evaluation Date:

__________ Mandatory 15-year reevaluation date (for wildlife-dependent public uses)

____X____Mandatory 10-year reevaluation date (for all uses other than wildlife-dependent public uses)

NEPA Compliance for Refuge Use Decision: (check one below)

__________ Categorical Exclusion without Environmental Action Statement

__________ Categorical Exclusion and Environmental Action Statement

____X____ Environmental Assessment and Finding of No Significant Impact

__________Environmental Impact Statement and Record of Decision

Refuge Determination:

Prepared by:	Rebecca G. Chuck (Signature)	12/18/12 (Date)
Refuge Manager/ Project Leader Approval:	Rebecca G. Chuck Acting (Signature)	12/18/12 (Date)

Concurrence:

Refuge Supervisor:	(Signature)	12/18/12 (Date)
Regional Chief, National Wildlife Refuge System:	(Signature)	12-19-12 (Date)

Attachment 1

FORMAT FOR PROPOSALS TO CONDUCT RESEARCH OR LONG-TERM MONITORING ON NATIONAL WILDLIFE REFUGES

A Special Use Permit (SUP) is required to conduct research and/or long-term monitoring on refuge lands. To receive a SUP, a detailed project proposal using the following format must be submitted to the Refuge Manager approximately 6 months prior to the start of the project.

Title:

Principal Investigator(s):
Provide the name(s) and affiliation(s) of all principal investigator(s) that will be responsible for implementation of the research and/or long-term monitoring described in the proposal. In addition, provide a brief description or attach vitae of expertise for principal investigator(s) germane to work described in the proposal.

Background and Justification:
In a narrative format, describe the following as applicable:

- *The resource management issue (e.g., decline in Pisonia rainforest) and/or knowledge gap regarding ecological function that currently exists with any available background information.*
- *Benefit of project findings (e.g., management implications) to resources associated with refuge.*
- *Potential consequences if the conservation issue and/or knowledge gap regarding ecological function is not addressed.*

Objectives:
Provide detailed objective(s) for the proposed project.

Methods and Materials:
Provide a detailed description of the methods and materials associated with field and laboratory work (if applicable) to be conducted for the project. Methods should include the following:

- *study area(s)*
- *number of samples;*
- *sampling dates and locations*
- *sampling techniques*
- *data analyses including* ***statistical methods*** *and* ***significance levels****.*

Previously published methods should be cited without explanation; whereas, new or modified techniques should be described in detail. Include number of personnel as well as all facilities and equipment (e.g., vehicles, boats, structures, markers) required to collect samples/data. Provide a clear description of the relationships among study objectives, field methods, and statistical analyses.

Permits:
Identify all State or Territorial and Federal permits required if applicable.

Potential Impacts to Refuge Resources:
Describe potential impacts to threatened or endangered species as well as other refuge plants, wildlife, and fish species that could result from the implementation of project activities on the refuge. Consider the cumulative impacts associated with this project.

Animal Welfare Plan:
If appropriate, attach a copy of the Institutional Animal Care and Use review and/or animal welfare plans that are required by the principle investigator's affiliation.

Partnerships and Funding Sources:
List other participating institutions, agencies, organizations, or individuals as well as the nature and magnitude of their cooperative involvement (e.g., funding, equipment, personnel).

Project Schedule:
Provide estimated initiation and completion dates for field sampling, laboratory work, data analyses, and report/manuscript preparation. If the project is divided into phases to be accomplished separately provide separate initiation and completion dates for each phase.

Reports and Raw Data:
Establish a schedule for annual progress and final reports; include adequate time for peer review of the final report/manuscript. Draft reports/manuscripts should be submitted to the Refuge Manager for review prior to submission for consideration of publication. At the conclusion of a research study (manuscripts accepted for publication), an electronic copy of the data (e.g., GIS vegetation layers, animal species composition and numbers, genetics) should be provided to the Refuge Manager. For long-term monitoring projects, the Service also requires raw data for management and planning purposes for the refuge(s).

Publications:
Describe the ultimate disposition of study results as publications in scientific journals, presentation at professional symposiums, or final reports.

Disposition of Samples:
If the project entails the collection of biotic and/or abiotic (e.g., sediment) samples, then describe their storage. Although the samples may be in the possession of scientists for the purposes of conducting the project in accordance with the SUP, the Service retains ownership of all samples collected on refuge lands. If the samples will be used for subsequent research activities that are not described within the original proposal, a new proposal must be submitted to the Refuge Manager to obtain a SUP before initiation of the follow-up project. After conclusion of the research activities, consult with the Refuge Manager regarding the final disposition of the samples. If specimens will be curated at a museum, then prepare a MOU using the format provided in Attachment 3.

Attachment 2

ANNUAL PROGRESS REPORTS FOR REFUGE RESEARCH AND LONG-TERM MONITORING PROJECTS

Study title:

Fiscal year:

Progress:
In a narrative format, summarize the work that was completed on the study including the number and types of samples collected and/or data analyses.

Important findings:
In narrative format, generally describe any conclusions and/or management recommendations that may be drawn from the work completed to date.

Describe problems encountered:
In narrative format, describe any problems that were encountered during the year and their effects upon the study.

Proposed resolution to problems:
For each problem encountered, describe the actions that have been taken to remediate it.

Preparer:

Date prepared:

Attachment 3

MEMORANDUM OF UNDERSTANDING
FOR CURATORIAL SERVICES
BETWEEN THE

(Name of the Federal agency)
AND THE
(Name of the Repository)

This Memorandum of Understanding is entered into this (**day**) day of (**month and year**), between the United States of America, acting by and through the (**name of the Federal agency**), hereinafter called the Depositor, and the (**name of the Repository**), hereinafter called the Repository, in the State/Territory of (**name of the State/Territory**).

The Parties do witnesseth that

WHEREAS, the Depositor has the responsibility under Federal law to preserve for future use certain collections of paleontological specimens and/or biological samples as well as associated records, herein called the Collection, listed in Attachment A which is attached hereto and made a part hereof, and is desirous of obtaining curatorial services; and

WHEREAS, the Repository is desirous of obtaining, housing and maintaining the Collection, and recognizes the benefits which will accrue to it, the public and scientific interests by housing and maintaining the Collection for study and other educational purposes; and

WHEREAS, the Parties hereto recognize the Federal Government's continued ownership and control over the Collection and any other U.S. Government-owned personal property, listed in Attachment B which is attached hereto and made a part hereof, provided to the Repository, and the Federal Government's responsibility to ensure that the Collection is suitably managed and preserved for the public good; and

WHEREAS, the Parties hereto recognize the mutual benefits to be derived by having the Collection suitably housed and maintained by the Repository;

NOW THEREFORE, the Parties do mutually agree as follows:

1. The Repository shall:

    a. Provide for the professional care and management of the Collection from the (**names of the resources**) sites, assigned (**list site numbers**) site numbers. The collections were recovered in connection with the (**name of the Federal or federally-authorized project**) project, located in (**name of the nearest city or town**), (**name of the county, if applicable**) county, in the State/Territory of (**name of the State/Territory**)-

    b. Assign as the Curator, the Collections Manager and the Conservator having responsibility for the work under this Memorandum, persons who are qualified museum professionals and whose expertise is appropriate to the nature and content of the Collection.

c. Begin all work on or about (**month, date and year**) and continue for a period of (**number of years**) years or until sooner terminated or revoked in accordance with the terms set forth herein.

d. Provide and maintain a repository facility having requisite equipment, space and adequate safeguards for the physical security and controlled environment for the Collection and any other U.S. Government-owned personal property in the possession of the Repository.

e. Not in any way adversely alter or deface any of the Collection except as may be absolutely necessary in the course of stabilization, conservation, scientific study, analysis and research. Any activity that will involve the intentional destruction of any of the Collection must be approved in advance and in writing by the Depositor.

f. Annually inspect the facilities, the Collection and any other U.S. Government-owned personal property. Every (**number of years**) years inventory the Collection and any other U.S. Government-owned personal property. Perform only those conservation treatments as are absolutely necessary to ensure the physical stability and integrity of the Collection, and report the results of all inventories, inspections and treatments to the Depositor.

g. Within five (5) days of discovery, report all instances of and circumstances surrounding loss of, deterioration and damage to, or destruction of the Collection and any other U.S. Government-owned personal property to the Depositor, and those actions taken to stabilize the Collection and to correct any deficiencies in the physical plant or operating procedures that may have contributed to the loss, deterioration, damage or destruction. Any actions that will involve the repair and restoration of any of the Collection and any other U.S. Government-owned personal property must be approved in advance and in writing by the Depositor.

h. Review and approve or deny requests for access to or short-term loan of the Collection (or a part thereof) for scientific and educational uses. In addition, refer requests for consumptive uses of the Collection (or a part thereof) to the Depositor for approval or denial.

i. Not mortgage, pledge, assign, repatriate, transfer, exchange, give, sublet, discard or part with possession of any of the Collection or any other U.S. Government-owned personal property in any manner to any third party either directly or indirectly without the prior written permission of the Depositor, and redirect any such request to the Depositor for response. In addition, not take any action whereby any of the Collection or any other U.S. Government-owned personal property shall or may be encumbered, seized, taken in execution, sold, attached, lost, stolen, destroyed or damaged.

2. The Depositor shall:

a. On or about (month, date and year), deliver or cause to be delivered to the Repository the Collection, as described in Attachment A, and any other U.S. Government-owned personal property, as described in Attachment B.

b. Assign as the Depositor's Representative having full authority with regard to this Memorandum, a person who meets pertinent professional qualifications.

c. Every (number of years) years, jointly with the Repository's designated representative, have the Depositor's Representative inspect and inventory the Collection and any other U.S. Government-owned personal property, and inspect the repository facility.

d. Review and approve or deny requests for consumptively using the Collection (or a part thereof).

3. Removal of all or any portion of the Collection from the premises of the Repository for scientific or educational purposes; any conditions for handling, packaging and transporting the Collection; and other conditions that may be specified by the Repository to prevent breakage, deterioration and contamination.

4. The Collection or portions thereof may be exhibited, photographed or otherwise reproduced and studied in accordance with the terms and conditions stipulated in Attachment C to this Memorandum. All exhibits, reproductions and studies shall credit the Depositor, and read as follows: "Courtesy of the (**name of the Federal agency**)." The Repository agrees to provide the Depositor with copies of any resulting publications.

5. The Repository shall maintain complete and accurate records of the Collection and any other U.S. Government-owned personal property, including information on the study, use, loan and location of said Collection which has been removed from the premises of the Repository.

6. Upon execution by both parties, this Memorandum of Understanding shall be effective on this (**day**) day of (**month and year**), and shall remain in effect for **(number of years**) years, at which time it will be reviewed, revised, as necessary, and reaffirmed or terminated. This Memorandum may be revised or extended by mutual consent of both parties, or by issuance of a written amendment signed and dated by both parties. Either party may terminate this Memorandum by providing 90 days written notice. Upon termination, the Repository shall return such Collection and any other U.S. Government-owned personal property to the destination directed by the Depositor and in such manner to preclude breakage, loss, deterioration and contamination during handling, packaging and shipping, and in accordance with other conditions specified in writing by the Depositor. If the Repository terminates, or is in default of, this Memorandum, the Repository shall fund the packaging and transportation costs. If the Depositor terminates this Memorandum, the Depositor shall fund the packaging and transportation costs.

7. Title to the Collection being cared for and maintained under this Memorandum lies with the Federal Government.

IN WITNESS WHEREOF, the Parties hereto have executed this Memorandum.

Signed: (signature of the Federal Agency Official) Date: (date)

Signed: (signature of the Repository Official) Date: (date)

Attachment 3A: Inventory of the Collection

Attachment 3B: Inventory of any other U.S. Government-owned Personal Property

Attachment 3C: Terms and Conditions Required by the Depositor

Attachment 4

ALIEN SPECIES QUARANTINE RESTRICTIONS FOR NATIONAL WILDLIFE REFUGES

A. Introduction

Thank you for your interest in conducting research/monitoring on the refuge(s). To protect wildlife and habitat communities found on the refuge, visitation is carefully regulated and requires that each individual, or group, secure a Special Use Permit (SUP) to gain access to the refuge. Each SUP clearly outlines the responsibilities of each permittee, including specific quarantine policies, which may be more detailed than the policies listed within this document. Details for securing a SUP can be found by contacting the Refuge Manager. Prospective scientific researchers must apply for the SUP at least 6 months prior to their proposed study period.

One of the gravest threats to the refuge(s) is the introduction of alien plant and animal species. The practices described below are complex, but the Service has found them to be effective at greatly reducing additional introductions of invasive species on refuge(s).

B. Definitions

1. **Clothing** - all apparel, including shoes, socks, over and under garments.
2. **Soft gear** - all gear such as books, office supplies, daypacks, fannypacks, packing foam or similar material, camera bags, camera/binocular straps, microphone covers, nets, holding or weighing bags, bedding, tents, luggage, or any fabric or material capable of harboring seeds or insects.
3. **New Clothing/Soft Gear** - new retail items, recently purchased and never used.
4. **Refuge Dedicated Clothing/Soft Gear** - items that have ONLY been used at the refuge(s), and which have been stored in a quarantined environment between trips to the refuge(s).
5. **Sensitive Gear** - computers, optical equipment, and other sensitive equipment.
6. **Non-Sensitive Equipment and Construction Materials** - building materials, power and hand tools, generators, misc. machinery etc.
7. **Suitable Plastic Packing Containe**r - packing containers must be constructed of smooth, durable plastic which can be easily cleaned and will not harbor seeds or insects. Packing containers may be re-used for multiple trips to the refuge(s), but must be thoroughly cleaned before each trip and strictly dedicated to refuge-related projects.
    - Examples of APPROPRIATE plastic packing containers are 5 gallon plastic buckets and plastic totes constructed with a single layer and having a smooth surface. All appropriate packing containers must have tight fitting plastic lids.
    - An example of an INAPPROPRIATE plastic packing container is US mail totes. Mail totes are typically constructed of cardboard-like plastic that provides a porous multi-layered surface, allowing seeds and insects to easily hitch-hike.

C. Special Use Permit (SUP)

All persons requesting use of the refuge(s) must secure a SUP, as described in Section A above, and agree to comply with all refuge requirements to minimize the risk of alien species introductions.

D. Quarantine Inspections

All personal gear, supplies, equipment, machinery, vehicles (e.g., ATVs, trucks, trailers), and vessels (e.g., planes, boats, ships, barges) will be inspected for quarantine compliance by Service staff prior to entering the refuge(s) and again before departing the refuge(s). A concerted effort will be made to ensure that alien pests are not transported. Service staff on the refuge(s) will inspect outbound cargo prior to transport.

E. Prohibited Items (Transport of the following items are strictly prohibited)

1. Rooted plants, cuttings, flowers, and seeds (raw or propagative).
2. Soil, sand, gravel, or any other material that may harbor unwanted plant and animal species.
3. Animals (no exceptions).
4. Cardboard (paper and plastic cardboard harbors seeds and insects).

F. Regulated Items (Transport of the following items are strictly regulated)

1. Food items have the potential to carry alien pests and are therefore selected, packed and shipped with great care for consumption on the refuge(s). Foods will not be allowed on the refuge(s) without prior authorization.
2. Because wood products often harbor seeds and insect, only treated wood that has been painted or varnished may be allowed on the refuge(s). Approved wood products must also be frozen for 48 hours or fumigated as described in Section K below.

G. Packing Procedures

Ensure that the environment selected for packing has been well cleaned and free of seeds and insects. Keep packing containers closed as much as possible throughout the packing process so insects cannot crawl in before the containers have been securely closed. Quarantine procedures should be performed as close to the transportation date as possible to ensure that pests do not return as hitch-hikers on the packing containers.

H. Packing Containers

1. All supplies and gear must be packed and shipped in SUITABLE PLASTIC PACKING CONTAINERS (see Section A for definitions of packing containers). Packing containers must be constructed of smooth, durable plastic that has been thoroughly cleaned prior to use.
2. Packing containers may be re-used for multiple trips to the refuge(s), but must be thoroughly cleaned before each trip and strictly dedicated to refuge-related projects. Cardboard containers are strictly prohibited because they can harbor seeds and insects.

I. Clothing and Soft Gear

1. All persons entering the refuge(s) must have NEW or REFUGE DEDICATED clothing and soft gear (including all footwear).
   a. Freeze all clothing and soft gear for 48 hours (including both new and refuge dedicated).
   b. Fumigation under a tarp or in a large container is also an option.

J. Sensitive Equipment

All sensitive gear (e.g., optical equipment, computers, satellite phones, other electronic equipment) must be thoroughly inspected and cleaned.

K. Non-Sensitive Equipment and Construction Materials

1. All non-sensitive equipment, machinery, and construction materials that are water resistant must be steam cleaned or pressure washed to ensure the removal of all dirt, insects, and seeds from external surfaces.
2. All non-water resistant items must be tented and fumigated to kill unwanted pests or frozen for 48 hours.
3. Quarantine procedures should be performed as close to the transportation date as possible to ensure that pests do not return to the equipment or packing containers.

L. Aircraft Quarantine

Aircraft personnel will ensure that the plane has been thoroughly cleaned and free of any alien species prior to flying to refuge(s). The aircraft captain will notify the Service at least 10 full working days prior to all flights departing for the refuge(s) in order to arrange a quarantine inspection of all cargo bound for the refuge(s). Inspections will take place the scheduled day of departure.

M. Commercial Ships and Barges, and Private Sailing and Motor Vessel Quarantine

1. Ship owners or captains will notify the Service at least 10 full working days prior to all vessels departing for the refuge(s) in order to arrange a quarantine inspection of all vessels and cargo bound for the refuge(s). The inspection will be scheduled as close to the departure date as possible.
2. Ship owners or captains will ensure that all ships and barges entering the refuge(s) have had their hulls cleaned of fouling marine/freshwater organisms. The ships and barges must depart for the refuge(s) within 14 days of having had the hulls cleaned. All ship and barge hulls must be re-cleaned should the vessel return to a port for greater than 14 days before returning to the refuge(s). Results of all hull cleanings must be submitted to the Service 2 full working days prior to the vessel departure. Contact the refuge office for additional details.
3. No discharge of ballast water, grey water, sewage, or waste of any kind will be allowed by any vessel within the refuge boundary (e.g., 12-mile territorial sea).

(Date)

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B.6 Compatibility Determination

Use: Livestock Grazing and Ensilage

Refuge Name: Nestucca Bay National Wildlife Refuge

County and State: Tillamook County, Oregon

Establishing and Acquisition Authorities:

Nestucca Bay NWR was established in 1991 under the authority of the Endangered Species Act of 1973, as amended (16 U.S.C. 1532-1544, 87 Stat. 884); the Fish and Wildlife Act of 1956, as amended (16 U.S.C. 742(a)-754); the Migratory Bird Conservation Act of 1929 (16 U.S.C. 715-715d); the Consolidated Farm and Rural Development Act [7 U.S.C. 2002]; and the Emergency Wetlands Resources Act of 1986 [16 U.S.C. 3901(b), 100 Stat. 3583].

Refuge Purpose(s):

- "to conserve (a) fish or wildlife which are listed as endangered species or threatened species…or (b) plants" [16 U.S.C. 1534 (Endangered Species Act of 1973)].
- "for the development, advancement, management, conservation, and protection of fish and wildlife resources" [U.S.C. 742f(a)(4)]…"for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude" [16 U.S.C. 742f (b)(1) (Fish and Wildlife Act of 1956)].
- "…for use as an inviolate sanctuary, or for any other management purpose, for migratory birds" [16 U.S.C. 715d (Migratory Bird Conservation Act)].
- "…for conservation purposes" [7 U.S.C. 2002 (Consolidated Farm and Rural Development Act)].
- for "the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to fulfill international obligations contained in various migratory bird treaties and conventions" [16 U.S.C. 3901(b), 100 Stat. 3583 (Emergency Wetlands Resources Act of 1986)].

National Wildlife Refuge System Mission:

> "The mission of the System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." (National Wildlife Refuge System Administration Act of 1966 as amended, 16 U.S.C. 668dd-668ee).

Description of Use:

The Oregon Coast National Wildlife Refuge (NWR) Complex will continue the existing uses of grazing and ensilage, accomplished through Cooperative Land Management Agreements, as the primary tools for providing high quality wintering habitat for dusky Canada and Aleutian Canada geese on 346 acres of lowland pasture within the Nestucca Bay Unit of Nestucca Bay National Wildlife Refuge. Ensilage is the process of preserving green food or vegetation for livestock in an un-dried condition in airtight conditions, either in a storage silo (an airtight pit), or in plastic wrapping. The fodder which is the result of the process is called silage. Ensilage only, without the option of cattle grazing, will continue to be used as a management tool on a portion of those acres within the same refuge unit. Cattle grazing and ensilage are refuge management economic activities; therefore an Appropriate Use Finding has been completed for this use.

Nestucca Bay NWR is located near the communities of Pacific City, Cloverdale, and Neskowin, in Tillamook County, Oregon. Nestucca Bay Refuge was established to protect wintering habitat for the Aleutian Canada goose, which was originally federally listed as endangered in 1967 and delisted in 2001, and for the declining dusky Canada goose; and to protect diverse coastal wetland habitats and upland habitat buffers for a variety of migratory waterfowl, shorebirds, raptors, songbirds, anadromous fish, and other wildlife. In 2002, the Refuge was expanded to include the Neskowin Marsh Unit (currently at 228.34 acres) located about 2.5 miles south of the Nestucca Bay Refuge Unit. Neskowin Marsh incorporates unique freshwater wetland and bog habitats and wildlife resources not found within the original refuge boundary.

The Refuge is composed of two distinct areas: the Nestucca Bay Unit and the Neskowin Marsh Unit. The Nestucca Bay Unit includes all the refuge lands north of the Neskowin Marsh Unit, including the lowland pastures, Cannery Hill, Brooten Marsh, the Little Nestucca Restoration Area, the Semidi Tract, the Utter Tract, and the Hagerty Tract. Grazing and ensilage will take place on the lowland pastures and Semidi and Hagerty Tracts, and ensilage will take place on the Utter Tract. No grazing or ensilage will be allowed on the Brooten Marsh, Little Nestucca Restoration Area, Cannery Hill, or the Neskowin Marsh Unit.

Lowland pastures on Nestucca Bay NWR are intensively managed to provide foraging habitat for migratory and wintering waterfowl, primarily Aleutian and dusky Canada geese. The primary diurnal use and feeding areas of these geese are centered on a few locations in the Nestucca Bay area and these areas now provide a significant portion of their nutritional needs. Carefully managed grasslands will continue to provide a substantial source of the forage requirements of Aleutian and dusky Canada geese and other species of white-cheeked geese on Nestucca Bay NWR.

Managing pastures by grazing, mowing, and greenchopping (ensilage or cutting silage for dairy cattle) is an effective way of providing the short grass habitat needed by the geese. Optimal pasture growth and condition occurs when pasture is consistently grazed before it is 6 inches tall. Grass species including water foxtail, perennial ryegrass, clover, lotus, and *Ranunculus* spp., are kept short and actively growing throughout the year under these management practices. On 316 acres of primarily lowland pastures, which are fenced into 32 separate units, both grazing and ensilage will continue. Pastures in which only ensilage will continue are located on the partially unfenced, 29-acre Utter Tract (field 23) along Resort Drive.

Under the current program, the lowland pastures are expected to be in short grass condition (2-4 inches) by October 31 of each year. The timing for grazing and ensilage on the Nestucca Bay Unit is based primarily on winter flooding conditions, normally taking place approximately April through October. Dates are determined seasonally each year after an on-site review of pasture conditions and the onset of flooding. Pastures which are predominantly grazed are also mowed several times per year to hinder noxious weed growth and prevent seed dispersal. Chemical fertilizers and/or manure are applied as needed to improve forage conditions. Water flow through drainage ditches and tidegates is maintained to permit drainage of excess water in pastures, stimulating grass and clover growth. An AUM level (one AUM or Animal Unit Month is the amount of forage required by one mature, 1,000 pound cow and one calf or its equivalent for one month) is not set for pastures; instead, the farming cooperators are required to provide sufficient cattle and or ensilage capabilities throughout the dry season and to ensure the pastures are at the required height by October 31.

Boundary and internal fencing and associated access points are required to produce site specific grazing management, allow access to infrastructure, and provide wildlife census routes. Additional management strategies, including mowing without removing mowed vegetation, pasture rehabilitation, and herbicide spraying, are used in conjunction with grazing and ensilage in order to meet the habitat objectives for the Nestucca Bay Unit pastures. These management strategies are not stand-alone refuge management economic activities, and details pertaining to these activities are included in this Compatibility Determination in the “Stipulations to Ensure Compatibility” section. In addition, the herbicide spraying aspect of the pasture management program is and will continue to be managed through separate Pesticide Use Proposals as part of an Integrated Pest Management Program.

Refuge pastures are managed through Cooperative Land Management Agreements (CLMA) with local dairy farmers who have the expertise, equipment, and animals to execute the required management strategies. Part 29.2 of Title 50, Code of Federal Regulations, entitled “Cooperative Land Management” states that “Cooperative agreements with persons for crop cultivation, haying, grazing, or the harvest of vegetative products, including plant life, growing with or without cultivation on wildlife refuge areas may be executed on a share-in-kind basis when such agreements are in aid or benefit to the wildlife management of the area.” Managing pastures on Nestucca Bay NWR with farming cooperators is consistent with the intent of a CLMA. Wildlife receive 100% of the crop in the form of short, green vegetation available to foraging geese from November through April. Every acre of managed pasture is available to wildlife because it is grazed, mowed, or greenchopped. Unmanaged lowlands tend to produce tall, rank stands of grasses and forbs that ultimately convert to meadows of rush (*Juncus* spp.) and are not as heavily utilized by geese. The cooperator gets a share of the crop in the form of cattle forage and/or silage during the summer months when the geese are not present. The farming cooperators also provide resources to the Refuge to assist in other management activities associated with these lands. The farming cooperators combined with refuge personnel and resources working together provide enhanced overall management of Nestucca Bay NWR.

Under the management direction described in the CCP, CLMAs will continue to be maintained by and between the Refuge and the farming cooperators. The CLMAs establish and document a share-in-kind program for the benefit of Aleutian and dusky Canada geese. They also provide flexibility in management options for meeting the habitat needs of other wildlife to the extent possible while maintaining emphasis on the needs of the geese.

On expiration of a CLMA, future cooperator(s) will be selected from a list of persons who indicate a desire to exercise grazing and ensilage privileges on the Refuge and meet eligibility criteria. The cooperator(s) must demonstrate a willingness to comply with the Refuge’s strict guidelines and must have access to other locations for their cattle during the winter. Selections will be prioritized according to 5 RM 17, Exhibit 6, with priority given in the following order: (1) previous cooperators with a favorable record of working with the Service, (2) former landowners, (3) former tenants, (4) resident neighbors, (5) non-resident neighbors (applicants who operate land in local vicinity), and (6) applicants outside the local vicinity. The chosen cooperator(s) will maintain facilities associated with grazing and ensilage use (e.g., fences, water lines, ditches) and perform habitat improvements associated with the use (e.g., herbicide spraying, pasture renovation, mowing of isolated areas where cattle consumption is not sufficient to meet habitat objectives) in exchange for grazing and ensilage rights to the land. CLMAs will be established for a 3-year period, with provisions for terminating the contract for non-performance. The cooperator will be required to meet with refuge staff in late winter to discuss the previous year's performance, document expenditures and work performed, and establish plans for the upcoming season.

The infrastructure to support a cooperative grazing and ensilage program, such as pasture fencing and water troughs, is already in place and maintained by cooperators. Under the management direction in the CCP, the cooperators will continue to maintain grazing facilities and perform habitat improvements associated with grazing and ensilage. The rental value of the land will be determined through a review of average pasture rental rates for Tillamook County and will be updated every five years.

The initial justification and planning for the grazing and ensilage program is documented in the Establishing Environmental Assessment (EA) (USFWS 1990) and in the subsequent Nestucca Bay Refuge Management Plan (USFWS 1993b). The Refuge protects and provides high-quality forage and sanctuary for wintering geese and other migratory birds. The pastures are managed intensively for six sub-species of white-cheeked geese, with particular emphasis placed on dusky Canada and Aleutian Canada geese. When the Refuge was established in 1991, the Service's intent in acquiring the lowland pastures was to manage them to continue providing quality wintering forage and sanctuary for these geese. The Nestucca Bay area is also the only known wintering area for the declining dusky Canada geese on the Oregon coast. The Refuge is cited in the Pacific Flyway Dusky Management Plan as providing important wintering habitat for duskies (PFC 2008) and up to 18% of the entire dusky Canada goose population is supported by the refuge pastures on an annual basis during the winter period (Stephensen 2010). In addition, refuge pastures (the Semidi Tract, fields 21-22), along with two adjacent privately owned tracts, support nearly 100% of the genetically distinct Semidi Islands Aleutian Canada goose population.

The primary objective for pasture management on the Nestucca Bay Unit is to provide and sustain high quality wintering habitat for the Aleutian and dusky Canada geese and other species of white-cheeked geese. Providing short grass pastures at the appropriate time of year is an integral part of fulfilling that objective. Grazing and ensilage are being allowed because these uses have been demonstrated to benefit the wildlife species for which Nestucca Bay NWR was established. Grazing and ensilage, as refuge management economic activities accomplished through farming cooperators, are also the most economically efficient tools for managing refuge pastures to meet the needs of the geese and fulfill the purposes of the Refuge. If unmanaged, the lowland pastures are steadily invaded by rush (*Juncus* spp.) and become significantly less attractive to the geese.

Managing the pastures by force account (refuge staff) mowing only, as a refuge management activity not subject to compatibility requirements, was not proposed as an option for several reasons. This activity would not be economically feasible as it would require the Refuge to expend financial and staff resources that are not available in the foreseeable future for management of refuge pastures. In addition, mowing without removal of excess vegetation would not produce the desired pasture conditions. One-half of the annual growth in non-irrigated Oregon coastal pastures occurs between late April and early June. The Middle and North Pastures on Nestucca Bay NWR are frequently too flooded to permit mowing or cutting ensilage, or even grazing during those months, resulting in excessive grass growth. Ideally pastures should be mowed or grazed before grasses are 6 inches tall; with additional growth the forage becomes increasingly less nutritious and palatable. Regular removal of surplus grass growth and storage as silage (ensilage) maintains pastures in optimal growing condition. If pastures are allowed to grow tall and rank and are not subsequently mowed and removed for silage, this condition leads to a greater percentage of weed species and substantially lower quality forage available for the geese in late fall and winter.

Both grazing and ensilage will be continued as components of the lowland pasture management program, as opposed to grazing only or ensilage only. Silage harvesting removes all plant species, while livestock grazing is selective, leaving behind the undesirable plants. However, exclusive silage harvesting on a yearly basis would cause a gradual decline in clover, a highly desirable goose browse, as a percentage of the total plant population, and nutrients are not as readily recycled back into the soil except with heavy applications of manure or other fertilizer. Grazing will be allowed in fenced pastures only.

This use is also being continued to provide depredation relief for area dairy farms by encouraging waterfowl use on Service property so that private lands do not bear an unreasonable burden for providing forage. Currently, nearly all of the Semidi Islands Aleutian Canada geese (SIACG) use only three sites near Pacific City, only one of which is refuge lands (Semidi Tract). However, western Aleutian Canada geese, dusky Canada geese and four other subspecies of Canada geese utilize refuge pastures as well as adjacent private lands, and management of these pastures to attract and support the geese is in accordance with the goals of the Refuge.

The Aleutian Canada goose was removed from protection under the Endangered Species Act in 2001 and the population had expanded to approximately 112,000 birds by the winter of 2011 (USFWS 2011c), resulting in crop damage complaints from farmers in wintering and migration areas including Nestucca Bay. In recent years, a large increase in the number of Aleutian, lesser and Taverner’s Canada geese wintering in the Nestucca Bay area has greatly intensified goose damage concerns to area dairy operations. Area dairy farmers often haze geese from their pastures fall-spring, but particularly in late-winter and spring, in order to protect the new growth grass forage for their dairy cows. The spring growth of new grass is particularly important to local dairy operations. In order to reduce the incidence of disturbance to dusky Canada geese (through hazing and other methods) and to minimize goose depredation on neighboring privately owned pastures, the refuge intent has been to implement pasture management techniques to attract geese to refuge pastures.

Availability of Resources:

Costs to implement the livestock grazing and ensilage program include staff salaries for monitoring pasture conditions and goose use of pastures, and CLMA administration; tractor maintenance for occasional force account mowing or participation in field rehabilitation; and fuel for refuge staff and cooperators’ equipment use on refuge pastures. Additional costs for contractor services may be incurred on an infrequent basis. Continuation of the existing livestock grazing and ensilage program is not expected to increase refuge-incurred costs for administering the program. An estimated $7,000 of refuge staff time is needed annually for planning, oversight, and coordination of this use. Before each field season, the refuge manager meets with each individual farming cooperator to review the previous season and discuss the annual work plan for the coming season. Periodically, assistance may be required of refuge maintenance staff to maintain the ditches or to mow fields that are not short enough just prior to the arrival of the geese. Refuge staff monitor the grazing and ensilage operations and periodically evaluate habitat conditions before, during, and after the field season. At the end of the season, refuge staff review the worksheet provided by the farming cooperator and update the balance sheet attached to the CLMA. The overall cost to the Refuge in terms of labor is considered to be low, especially taking into the consideration the benefits provided to the Refuge in meeting the previously described goal and objectives. Current refuge financial and staff resources are adequate to administer the use.

- Manager 1 day/month for 12 months est. $4,000
- Maintenance – ditch cleaning 1 week est. $1,500
- Refuge equipment and vehicle use est. $1,500

As previously stated, the CLMA establishes a share-in-kind program in which the cooperator maintains grazing facilities and performs habitat improvements associated with grazing, in exchange for grazing and ensilage rights to the land. The infrastructure to support the cooperative grazing and ensilage program is already in place and maintained by cooperators. Additional costs which may be incurred by cooperators include contracted services for ditch maintenance, fertilizer purchases, and fencing supplies as necessary. Work performed or services contracted by the cooperator will be documented and valued according to rates set forth in the CLMA, and the annual total should be equivalent to the total cost to rent the land.

Anticipated Impacts of the Use(s):

The potential impacts of the existing and planned grazing and ensilage program on the Service's ability to achieve refuge purposes and on the Refuge System mission are summarized below. Activities and considerations necessary to mitigate potentially negative effects are detailed in the section "Stipulations to Ensure Compatibility."

The use will benefit the geese and other waterfowl in the winter by providing optimum short grass pastures, which satisfy their requirement for high-quality wintering habitat. This benefit fulfills refuge purposes and by extension, does not conflict with the mission of the Refuge System. Grazing and ensilage will reduce the presence of standing and accumulation of dead plant material, providing an optimum foraging environment for the geese. Canada geese do not generally use fields with tall standing material, alive or dead, as they require areas where they have a clear view of the area around them, giving them security from predation. The short grass is also thought to be more desirable as it is actively growing and consists of tender new growth instead of tough, rank stems.

Conversely, a negative impact of this emphasis on maintaining pastures in short growing condition is a reduction in potential habitat for a diversity of other wildlife, as maintaining water flow through ditches and keeping the grass short will reduce or eliminate potential habitat for amphibians, shorebirds, ground-nesting waterfowl, and songbirds. Shorebirds may be negatively affected by the absence of suitable mudflat habitat in refuge pastures caused by activities associated with this use. Maintaining ditches results in drainage of low wetland areas in pastures and prevents establishment of suitable shorebird foraging areas. Birds nesting in pastures that have been allowed to grow tall and rank could be negatively affected by summer ensilage activities. Damage and/or nest loss could occur from trampling and loss of standing vegetation if it were allowed to grow tall enough to be attractive to ground nesting birds; however, the CLMAs require the pastures to be grazed and greenchopped frequently enough that the vegetation will not be allowed to become tall and rank.

Amphibians could be negatively affected by maintenance of water flow in cross ditches and in Upton Slough. Mortality of eggs and tadpoles could occur if ditches are allowed to silt in and then cleared in late spring while egg masses are still intact, or immediately following hatch. Careful consideration with regard to timing of ditch maintenance should reduce or eliminate this potential impact. If pasture conditions allow equipment travel, ditches requiring cleaning to maintain flows should be cleared in the fall, while fields are dry enough to traverse with an excavator or other ditch-cleaning equipment, or in late winter before amphibian egg-laying commences if field conditions permit.

Under the management direction described in the CCP, no additional native habitat loss will occur with this use, as no areas will be brought under cultivation or grazing that are not already being grazed or cut for silage.

The physical and structural impacts of livestock grazing on the pasture itself include removing healthy standing vegetation, trampling of other vegetation, and reducing populations of pioneering woody plants. These impacts are primarily desirable for accomplishing the stated purpose and can be managed by manipulating timing and cattle numbers. However, if pastures are grazed too early in spring when they are saturated or flooded, cattle can break through the sod. This damages the underlying structure and creates an extremely uneven surface that is difficult and undesirable for goose use. This potential negative impact is reduced by restricting grazing to the less rainy seasons (generally April through October). If a particular field surface has become too uneven for geese, the potential exists for surface leveling during field rehabilitation and re-seeding.

A potential negative impact from grazing activity on the Refuge is a decline in water quality, as measured by fecal coliforms and turbidity in Upton Slough, pasture drainage ditches, and Nestucca Bay from manure (cattle-deposited as well as manure applied as fertilizer) being transported from fields through the drainage system. Amphibians and fish, including threatened coho salmon, are found in the ditches bordering pastures. The lowland pastures are classified as the Hebo Series soil type (USDA/NRCS), which is poorly drained, fine-textured, and very strongly acid. The pastures are level with or lower than the estuary water table, and soils are waterlogged during the wet season. Most of the Hebo soils in the area of Nestucca Bay NWR are used for pasture and silage during the wet season but forage yields are low because drainage is poor. The Main Pastures (fields 13-20, 24, 25) are slightly above the estuary water level and thus was tiled for drainage. The North and Middle Pastures (fields 1-12) are at or lower than estuary level and cannot be tiled for drainage. The lower fields within the Hagerty Tract (fields 26-32) also border the river and are regularly flooded in the winter. Most of the refuge pastures are drained by open ditches that flow out to Nestucca Bay through tidegates. The potential decline in water quality can be partially mitigated by reducing pathways for manure to enter waterways, accomplished through maintenance of electric and wire fences preventing cattle access to ditches, and by managing timing and location of grazing to avoid cattle presence while pastures are heavily flooded. Cross-fences are set back from ditches far enough that cattle cannot access the waterways, and water is provided in troughs in most fields. In addition, CLMAs include the requirement of a 20-foot setback from any water channel when applying manure or commercial fertilizer.

The grazed pastures require maintenance of fences to control grazing access. Fences may impede the movement of some wildlife, especially when overgrown with Himalayan blackberry, but they are also frequently used as perch sites for raptors such as harriers and red-tailed hawks and as singing posts for songbirds.

Farming may also result in the use and introduction into the environment of chemical agents from pesticide usage and the potential exacerbation of weed issues through ground disturbance and field to field movement of cultivating and harvesting equipment. In addition, small mammals, reptiles, and amphibians may be occasionally subject to mortality from farm machinery, and nesting birds may be occasionally disrupted and nests destroyed.

For weed species that are or become established, mechanical, cultural, and biological control methods will be evaluated in that order. If these methods are not effective, then the Refuge may decide to use an herbicide. Chemical usage will be subject to provisions of the Refuge IPM plan (Appendix G). Among other provisions, this plan provides direction that "the most efficacious pesticide available with the least potential to degrade environmental quality (soils, surface water, and groundwater) as well as least potential effect to native species … would be acceptable for use on the refuge." Each approved pesticide will undergo a chemical profile analysis; active ingredients will be analyzed for their risk quotient and this value compared to a Level of Concern for surrogate species, as established by the Environmental Protection Agency. All applications of herbicides will conform to the specific pesticide label requirements. Employment of this approach will provide for a moderate to minor risk from chemical exposure. However, unquantified risks may still occur via factors not assessed under current protocols, such as: intermingling of unlike chemicals in the field; species-specific sensitivity that differs from surrogate species sensitivity; exposure through inhalation, exposure through ingestion of pesticide-contaminated soil, and other factors (see Appendix G).

<u>Impacts to Listed Species:</u>
Currently, there are no listed species inhabiting farm fields or pastures; however, some use of the cross ditches and the adjacent slough and river by threatened coho salmon is documented. Based on past history, there is a potential for infrequent inadvertent impacts to these populations from spray drift and overspray. The CLMA requirements for setback from waterways during weed control and fertilizer/manure application are expected to reduce or eliminate this potential.

<u>Impacts to Priority Public Uses:</u>
The Service's management direction includes plans for the construction of several additional trails in the vicinity of Cannery Hill. Although the refuge pastures are closed to public access, the potential exists for visitors to the Cannery Hill Overlook as well as those observing refuge lands and wildlife from Highway 101 to object to the idea of cattle on a national wildlife refuge. However, because grazing and ensilage will attract and hold geese and other waterfowl in the fall and winter, this use will contribute to enhanced wildlife viewing opportunities for the visiting public. Additionally, using grazing and ensilage to manage refuge pastures will present an opportunity to interpret this aspect of wildlife management as it relates to the local dairy industry, providing a tangible connection between the Refuge and the local community. Currently the public occasionally encounters farming equipment and operations while traveling the access road up to Cannery Hill, and may view on-going grazing or ensilage from the viewing deck or trail. Although some aspects of farming operations, including noise, spraying, sight of grazing animals, and temporary traffic congestion, may be occasional annoyances to members of the public, conflicts and impacts are expected to remain minor over the life of the plan.

Public Review and Comment:

Public review and comment are required before issuing a final compatibility determination. Public review and comment on compatibility determinations occurred concurrently with the 30-day public comment period for the draft CCP/EA. Comments received were addressed in the final CCP and compatibility determinations.

Grazing and ensilage at Nestucca Bay NWR were discussed by Comprehensive Conservation Plan (CCP) extended team members as well as Oregon Department of Fish and Wildlife biologists at a Wildlife and Habitat Review, which was held on the Refuge on March 17, 2010. Public scoping for the CCP began in November 2010 with a notice in the Federal Register [November 29, 2010, Volume 75, Number 228] and a public meeting November 30, 2010 in Pacific City. Public input was also solicited through distribution of planning updates to our mailing list and meetings with key stakeholder groups. The comments and suggestions made through this process helped further develop and refine the management alternatives for the CCP, including the preferred alternative. A second planning update containing draft alternatives was distributed in November 2011 and another public open house meeting was held on November 16, 2011 in Pacific City to explain the alternatives and take comments. Thus, grazing and ensilage were discussed at a total of two public meetings held in conjunction with the CCP process. The draft CCP and compatibility determination resulted in additional comments, which were evaluated by the planning team. A complete summary of public involvement can be found in Appendix J. Appendix K of the CCP contains a summary of the comments and Service responses.

Determination:

__________ Use is Not Compatible

____X____ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility:

- Grazing and ensilage will be conducted on Nestucca Bay NWR by cooperator(s) and managed through CLMAs.
- Wildlife, especially goose use, is acknowledged as the primary purpose for all pasture management on refuge lands. Harassment (hazing) of any wildlife under any circumstances on any refuge land is strictly prohibited. Lowland pastures are closed to all public entry except for cooperators.
- Cooperators will be responsible for providing the number of cattle and other equipment necessary to ensure that the lowland pastures are in short grass condition (2-4 inches) by October 31 of each year. Methods may include any of the following: grazing, ensilage, spraying weed species, mowing, fertilizing, liming, reseeding, and restoration.
- Based on an approved work plan, cooperators will accomplish certain facility management projects within a predetermined time frame. These projects may include maintenance or improvements of existing facilities or installation of new facilities. Specific projects may include: fence installation, repair, or removal; dike repair or removal; ditch maintenance; water control structure installation, maintenance or removal; sign repair or installation; gate installation; road maintenance; building and well maintenance; and vegetation planting, control, or enhancement. All improvements made to the Refuge as a result of this CLMA become property of the United States.
- Any changes or additions to fencing or irrigation systems must be approved in advance by the refuge manager. Ditch maintenance may be completed only with the written approval of the refuge manager, after an on-site examination to verify current amphibian and/or fish use of the specific ditch and establishment of an appropriate time frame for maintenance based on wildlife needs. Ditches will be inspected by the Service annually or as requested by the cooperator to determine maintenance needs. Any significant deepening or widening of field ditches is under the jurisdiction of the Army Corps of Engineers and may only be permitted after consultation with National Marine Fisheries Service and application for and receipt of Section 10 and 404 permits.

- All management projects conducted in accordance with the CLMA will have direct benefits to fish and wildlife on Nestucca Bay NWR. Said benefits will be documented and monitored by the Service.
- Any cooperator-arranged work to be done on refuge facilities by contractors, or materials purchased by a cooperator for repairs or projects, must be approved in advance by the refuge manager. All work performed shall be documented with proper invoices, time sheets, billing statements, etc. Work performed by the cooperator will be valued in accordance with rates specified in the CLMA.
- CLMA's established to manage grazing and ensilage on Nestucca Bay NWR do not establish a use precedent. Future use of refuge lands will be based on the most satisfactory use of the land for wildlife benefits and habitat management needs.
- Any application of herbicides, pesticides, or biocontrols on the Refuge by a cooperator must be approved in advance by the Service. The Service's approval process begins with a request submitted by the cooperator which must include documentation of the problem, proposed application dates, amounts, methods, and chemicals requested for use. The request should be submitted concurrent with the annual work plan and will include a completed pesticide use record sheet for the previous season. The Service will notify the cooperator when and if approval is received. No restricted use chemicals will be permitted for use on the Refuge. All chemical application must be done in accordance with the Oregon Department of Agriculture and Service regulations, and label instructions.
- Cooperators shall comply with all county and state laws applicable to their farming operations under this agreement as well as all Federal laws and regulations governing national wildlife refuges and the area described in this agreement.
- The Service will not guarantee the quality of the forage for livestock; however, if pastures are dominated by non-forage plants (rushes, sedges, blackberry, etc.) the grazing fee will be adjusted annually based on percent of total pasture acreage affected. Those pastures inaccessible due to standing water or pasture restoration will be subtracted from the total available acres for forage removal.
- Cooperators shall comply with the livestock regulations of the State of Oregon relating to health and sanitation requirements, and shall not run any diseased livestock on refuge lands.
- Application of manure and fertilizer to refuge lowland pastures will be in accordance with State of Oregon regulations governing agricultural operations and nonpoint source pollution. Cooperators will adhere to refuge requirements regarding buffer zones and approved time frame for manure application.
- Only the cooperator and his/her immediate workforce will be allowed onto the Refuge. Only those persons directly associated with pasture management operations shall be allowed access to the Refuge.

Justification:

The use supports the goals and objectives for Nestucca Bay NWR. One of the primary purposes for establishing the Refuge was to provide and sustain high-quality wintering habitat for dusky Canada geese and Aleutian Canada geese. Grazing and ensilage provide the optimum short grass pastures which satisfy that habitat requirement. In the Establishment EA for Nestucca Bay NWR, the "Environmental Consequences" section for the preferred alternative states that "Present farming practices are largely compatible with habitat management goals for dusky and Aleutian Canada geese. It is the intent of the Service to ensure that compatible practices continue through the Refuge easement program." The Revised Final EA and Land Protection Plan (USFWS 1993a) does not specifically obligate the Service to allow grazing or ensilage. However, it acknowledges that "…diked… pastures provide excellent winter habitat for Aleutian and dusky Canada geese… this important habitat needs to be maintained through intensive management such as grazing, haying, and/or green chop (ensilage) practices… the existing habitat and associated goose populations also indicate that current dairy farming practices used in Tillamook County are compatible and supportive of the goal of ensuring continued suitable habitat for the geese." Detailed descriptions of the grazing and ensilage program are given in the Refuge Management Plan (RMP), completed in 1993 following Refuge establishment (USFWS 1993b).

One of the main legal responsibilities of the Service and the National Wildlife Refuge System is the protection and enhancement of migratory birds and their habitats. In consideration of the increasing Service emphasis on protecting coastal waterfowl habitats and the importance of Nestucca Bay habitats to then-endangered Aleutian Canada geese and declining dusky Canada geese, the Service established Nestucca Bay NWR in 1991 as a mechanism for ensuring that the dairying practices of grazing and ensilage, which had been supplying the migratory geese with high quality wintering habitat, will be continued for the long term. The Service acknowledges that the maintenance of fences, drainage ditches, and other associated facilities to support grazing and ensilage has a negative effect on the Refuge's ability to provide optimum habitat for a full diversity of wildlife. However, continuation of grazing and ensilage on refuge pastures, when managed according to the Stipulations Necessary to Ensure Compatibility, directly benefits the goose species for which the Refuge was established and supports the NWRS mission with regard to migratory birds, while still providing some flexibility for managing habitats for other wildlife needs.

The use does not conflict with any existing or proposed/potential wildlife-dependent, priority public use. Based on the biological importance of the use, implementation of stipulations in the Compatibility Determination, and management of the use through the individual Cooperative Land Management Agreements, it is anticipated that wildlife populations will find sufficient food resources and resting places such that their abundance and use of the Refuge will not be measurably lessened due to continuation of grazing and ensilage on refuge pastures. The continuation of management of 346 acres of refuge lands managed through this use will not cause wildlife populations to materially decline, the physiological condition and production of species present will not be impaired, their behavior and normal activity patterns will not be altered dramatically, and their overall welfare will not be negatively impacted. Thus, allowing this use to occur will not materially detract or interfere with the purposes for which the Refuge was established or the refuge mission. Additionally, allowing the use will contribute to achieving refuge purposes in that the use provides migratory geese with high quality wintering habitat.

Mandatory Re-Evaluation Date:

__________ Mandatory 15-year reevaluation date (for wildlife-dependent public uses)

____X_____ Mandatory 10-year reevaluation date (for all uses other than wildlife-dependent public uses)

NEPA Compliance for Refuge Use Decision: (check one below)

__________Categorical Exclusion without Environmental Action Statement

__________Categorical Exclusion and Environmental Action Statement

____X____ Environmental Assessment and Finding of No Significant Impact

__________ Environmental Impact Statement and Record of Decision

References:

PFC (Pacific Flyway Council). 2008. Pacific Flyway management plan for the dusky Canada goose. Unpublished report. Dusky Canada Goose Subcommittee, Pacific Flyway Study Committee. Portland, OR. 38 pp. + appendices.

Stephensen, S.W. 2010. White-cheeked geese surveys at Nestucca, Nehalem, and Tillamook Bays, Oregon 2009-10. Unpublished report, on file at Oregon Coast National Wildlife Refuge Complex. U.S. Fish and Wildlife Service. Newport, OR. 29 pp.

U.S. Fish and Wildlife Service (USFWS). 1990. Environmental assessment Nestucca Bay National Wildlife Refuge. U.S. Fish and Wildlife Service. Portland, OR. 34 pp. + appendices.

USFWS. 1993a. Revised final environmental assessment and land protection plan. Nestucca Bay National Wildlife Refuge and Cooperative Resource Management Area, Tillamook County, OR. U.S. Fish and Wildlife Service. Portland, OR. 56 pp.

USFWS. 1993b. Refuge management plan, Nestucca Bay National Wildlife Refuge, Pacific City, Oregon. U.S. Fish and Wildlife Service, Region 1. Portland, OR.

USFWS. 2011c. Waterfowl population status, 2011. U.S. Department of the Interior. Washington, D.C. 80 pp.

Refuge Determination:

Prepared by:	Rebecca G. Chuck (Signature)	12/18/12 (Date)
Refuge Manager/ Project Leader Approval:	Rebecca G. Chuck Acting (Signature)	12/18/12 (Date)

Concurrence:

Refuge Supervisor:	(Signature)	12/18/12 (Date)
Regional Chief, National Wildlife Refuge System:	(Signature)	12-19-12 (Date)

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Appendix C. Implementation

C.1 Introduction

Implementation of the comprehensive conservation plan (CCP) will require increased funding, which will be sought from a variety of sources including Congressional allocations and public and private partnerships and grants. There are no guarantees that additional Federal funds will be made available to implement any of these projects. Activities and projects identified will be implemented as funds become available.

The CCP identifies several projects to be implemented over the next fifteen years. Some of the projects are included in the Refuge Operational Needs System (RONS - new staff), or Service Asset Maintenance and Management System (SAMMS - deferred maintenance projects) which are used to request funding from Congress. Visitor Facility and Enhancement (VFE) projects considered for funding must be requested through the Division of Visitor Services. Currently, a large backlog of maintenance needs exists for Nestucca Bay National Wildlife Refuge (NWR or Refuge). Prioritized staffing needs identified in the RONS will be necessary to implement the CCP to meet refuge goals and objectives and legal mandates. The SAMMS database documents and tracks repairs, replacements, and maintenance of facilities and equipment. Smaller projects will be implemented as funding allows, and funding will be sought for these projects through a variety of sources.

Annual refuge revenue sharing payments, associated with Nestucca Bay NWR in Tillamook County, will continue. USFWS paid Tillamook County $5,818 in 2010 for 888 acres of refuge lands within Tillamook County.

Monitoring activities will be conducted on a percentage of all new and existing projects and activities to document wildlife populations and changes across time, habitat conditions, and responses to management practices. Actual monitoring and evaluation procedures will be detailed in step-down management plans. General monitoring activities are discussed in Chapter 2 under Goal 9, which addresses the collection of scientific information (inventories, monitoring, feasibility studies, assessments, and research) to support adaptive management decisions on Nestucca Bay NWR.

C.2 Step-down Plans

The Comprehensive Conservation Plan is one of several necessary plans used by managers, biologists, and staff for refuge management. The CCP provides guidance in the form of goals, objectives, and strategies for several refuge program areas but may lack some of the specifics needed for implementation. Step-down management plans will be developed for individual program areas within approximately 5 years after CCP completion. All step-down plans require appropriate NEPA compliance and implementation may require additional county, state and Federal permits. Project-specific plans, with appropriate NEPA compliance, may be prepared outside of these step-down plans. Step-down plans for the Refuge follow in Table C-1.

Table C-1. Nestucca Bay NWR Step-down Management Plans

Step-down Management Plan	Status (date completed and/or date to be prepared/updated)
Habitat Management Plan (HMP)	CCP meets requirement for HMP
Waterfowl Hunt Plan	Initiate planning after completion of CCP
Fishing Plan	Initiate planning after completion of CCP
Integrated Pest Management Plan	Prepared concurrently with CCP, Appendix G
Fire Management Plan	Updated 2012
Visitor Services Plan	Initiate planning after completion of CCP
Inventory and Monitoring Plan	Initiate planning after completion of CCP

C.3 Costs to Implement CCP

The following sections detail both one-time and recurring costs for various projects, as described within the CCP. One-time costs reflect the initial costs associated with a project, whether it is purchase of equipment, contracting services, construction, a research project, or other activity. Recurring costs reflect the future operational and maintenance costs associated with the project. The following tables primarily document projects with a physically visible, trackable "on-the-ground" component, such as visitor and administrative facilities, habitat restoration, research, and monitoring and surveys. The scope and costs for "administrative" activities such as the development and implementation of cooperative documents (e.g., memorandum of understanding, agreements), reporting, and establishment of partnerships are difficult to estimate in advance and thus are not accounted for in the tables below.

C.3.1 One-time Costs

One-time costs are project costs that have a start-up cost associated with them, such as purchasing equipment necessary for wildlife and habitat monitoring, or designing, constructing and installing an interpretive sign. Some cost estimates are for projects that can be completed in three years or less. One-time costs can include the cost of temporary or term salary associated with a short-term project. Salary for existing and new positions, and operational costs, are reflected in operational (or recurring) costs.

Funds for one-time costs will be sought through increases in refuge base funding, special project funds, and grants. Projects listed below in Table C-2 show one-time start-up and implementation costs, such as those associated with building and facility needs including replacement of buildings, public use facilities, road/trail improvements, and new signs. One-time costs in Table C-2 are also associated with projects such as habitat restoration, invasive plant and animal control, and research. In many cases, new research projects, because of their relatively high initial establishment cost, are considered one-time projects and include costs of contracting services or hiring a temporary staff position for the short-term project. Some project costs are estimated from past projects; 2011 RONS or SAMMS proposals; others are not yet in any project database and their costs have been estimated, particularly if the scope of the project is unknown at this time due to lack of baseline data. Estimates of costs for Visitor Facility projects not yet in a database but have been calculated by the Portland Regional Office's Engineering Division.

Table C-2. One Time Costs (in thousands) for Research and Assessments; Inventories, Surveys, and Monitoring, Habitat Management and Restoration, Facilities and Public Use-Related Actions

Project Description	Type	Current Management	Future Management	Potential Fund Source
Research				
Conduct research on salt marshes to determine accretion and subsidence rates	Study	7	10	1260 funds, grants
Conduct research on the potential effects of climate change and sea level rise on salt marshes	Study	8	11	1260 funds, grants, partnerships
Conduct hydrological study at Neskowin to determine effects tsunami escape route has on water flow and assess management opportunities	Study	0	50	1260 funds, other funding to contract
Subtotal (thousands)		**15**	**71**	
Surveys and Assessments				
Monitor invasive plant species (e.g., Himalayan blackberry, Scotch broom, English ivy) to determine infestation percent and distribution	Project	3	10	1260 funds
Conduct forest assessments to determine condition and needs for active management	Project	0	3	1260 funds
Monitor water quality returning to river and bay to determine pollution levels	Project	0	3	1260 funds
Monitor migratory birds and other mammal species populations to determine distribution and abundance	Project	0	10	
Conduct baseline vegetation surveys and monitoring	Survey	3	10	1260 funds, Partnerships
Monitor habitat parameters including vegetation associated with respective habitat types to determine health of ecosystem	Survey	3	5	1260 funds, Partnerships
Conduct long-term monitoring to determine effectiveness of coastal prairie restoration	Project	0	8	1260 funds, Partnerships, Partners/Coastal Program funds
Monitor hydrological parameters to determine if they are within water quality standards	Project	0	3	1260, RO WRD
Subtotal (thousands)		**9**	**52**	
Habitat Management and Restoration				
Restore native coastal prairie, including seeding and planting of native prairie grasses and forbs and prescribed fire or other periodic disturbance to rejuvenate stand and reduce residual cover	Project	18	32	1260 funds, Coastal Program/partner funds, Fire program funds
Use appropriate forest management techniques where needed to thin trees in Sitka spruce-western hemlock forest	Project	0	6	

Table C-2. One Time Costs (in thousands) for Research and Assessments; Inventories, Surveys, and Monitoring, Habitat Management and Restoration, Facilities and Public Use-Related Actions

Project Description	Type	Current Management	Future Management	Potential Fund Source
Install and maintain woody debris in stream channels to enhance salmonid habitat	Project	0	3	1260 funds
Subtotal (thousands)		**18**	**41**	
Facilities				
Replace current residence with small bunkhouse		330	0	
Replace current residence with small bunkhouse and office for refuge manager	Project	0	464	1260 funds (DM)
Subtotal (thousands)		**330**	**464**	
Public Use				
Build a short “Discovery Trail” and observation deck in the lower parking lot of Cannery Hill	Project	45	45	VFE funds
Develop a seasonal trail that follows the current power line right-of-way at Cannery Hill	Project	0	87	
Develop a trail to direct visitors from the lower parking lot safely to the Pacific View Trail	Project	0	63	1260 funds, grants
Develop a short trail along the old roadbed in the Little Nestucca Restoration Area	Project	0	56	
Improve parking area along Brooten Road for walk-in access	Project	0	2	
Develop informational tear sheet on waterfowl hunting regulations	Project	0	4	
Upgrade the bridge on the tsunami evacuation trail at Neskowin Marsh to make it accessible	Project	0	47	1260 funds
Develop a welcoming kiosk and interpretive panel for the Little Nestucca Restoration Area public use trail	Project	0	5	1260 funds, Refuge Roads funding
Build a small gravel parking lot and improve the pedestrian trail along the dike on the Little Nestucca Restoration Area. Includes road widening and marking for safety.	Project	0	730	1260 funds, Refuge Roads funding, grants
Subtotal (thousands)		**45**	**1,039**	
Total of all one time project costs		**417**	**1,667**	

C.3.2 Annual Operational (recurring) Costs

Operational costs reflect refuge spending of base funds allocated each year. These are also known as recurring costs and are usually associated with day-to-day operations and projects that last longer than three years. Operational costs use base funding in Service fund code 1260.

Table C-3 displays projected annual operating costs to implement strategies under the CCP. The CCP will require increased funding for new or expanded public uses and facilities, habitat management and restoration activities, and new monitoring needs. This table includes such things as salary and operational expenditures such as travel, training, supplies, utilities and maintenance costs. Project costs listed in Table C-3 include administrative support for all programs and projects as well as permanent and seasonal staff needed year after year to accomplish each project; these staffing costs are not isolated in this table but are included as part of the entire project cost.

Table C-3. Annual Operational (recurring) Costs

Activity Description	Current Management Cost Est. (K)	Future Management Cost Est. (K)	Potential Fund Source
Research: Facilitate and cooperate in specific research projects to benefit refuge resources	3	5	1260, Special Projects, Grants
Surveys and assessments: Aerial and land surveys and assessments; GIS-based inventory and monitoring programs for plants and wildlife; invasive species monitoring; monitor biodiversity trends; provide administrative and material support for all biological activities.	50	82	1260 and special project funds
Habitat management and restoration: inventory, remove, control and prevent new establishment of invasive plants and treat infestations with IPM. Rehabilitate pastures as needed using standard agricultural practices to maintain optimum productivity and plant species mix. Continue long-term coastal prairie restoration.	48	80	1260 and special project funds
Facilities maintenance: Maintain and make minor repairs on refuge infrastructure and facilities, equipment, and interpretive and regulatory signs.	40	66	1260,SAMMS (DM)
Public use opportunities and education: Provide funding for and manage a variety of both on-refuge and off-refuge interpretive and education programs; maintain interpretive panels located on and off refuge to offer interpretation through self-guided experience; conduct and manage volunteer program; patrol, enforce regulations and educate visitors to the sensitivity of wildlife resources, replace boundary and regulatory signage as needed.	73	126	1260 VFE funds
Total Recurring Costs	**214**	**359**	

C.3.3 Maintenance Costs

The maintenance need over the next 15 years is defined as funds needed to repair or replace buildings, equipment, and facilities. Maintenance includes preventative maintenance; cyclic maintenance; repairs; replacement of parts, components, or items of equipment; adjustments, lubrication, and cleaning (non-janitorial) of equipment; painting; resurfacing; rehabilitation; special safety inspections; and other actions to assure continuing service and to prevent breakdown. Maintenance costs include the maintenance "backlog" needs that have come due but are as yet unfunded, as well as the increased maintenance need associated with new facilities.

The facilities associated with Nestucca Bay NWR that require maintenance include trails, kiosks, interpretive panels, regulatory signs, roads, parking lots, fencing, and administrative office, shop and garage buildings. Major equipment includes boats, vehicles, heavy equipment, and ATVs. Operational (non-project) maintenance funding for the Oregon Coast NWR Complex is expended on all six Complex refuges including Nestucca Bay NWR and varies significantly by year.

C.3.4 Staffing

Current (2012) staffing and future staffing to implement the programs detailed within the CCP are shown in Table C-4. Current positions described below serve all six refuges within the Oregon Coast NWR Complex. There is no separate budget for the individual refuges; thus, the staffing costs presented include the entire Complex staff in Table C-4. There is currently no staff stationed at Nestucca Bay NWR. Under future management, a North Coast Manager will be stationed at this Refuge and will manage Nestucca Bay, Siletz Bay, Cape Meares, and Three Arch Rocks NWRs and the north half of Oregon Islands NWR. Other Complex staff positions will expend varying amounts of time at Nestucca Bay with the remainder of Complex staff time expended on the other five refuges in the Complex.

Table C-4. Current and Future Staffing

Current Position	Status	GS & Grade	Annual Salary Cost (K)* (FY12 $$)	% Expended on Nestucca Bay NWR	Annual Salary (K)* Expended on Nestucca Bay NWR
Project Leader	PFT	GS-0485-13	126.1	20	25.2
Deputy Project Leader	PFT	GS-0485-12	113.0	20	22.6
Wildlife Biologist	PFT	GS-0486-11	93.1	30	27.9
Administrative Officer	PFT	GS-0341-09	82.9	10	8.3
Visitor Services Manager	PFT	GS-0025-11	88.9	20	17.8
Wildlife Refuge Law Enforcement Officer	PFT	GL-1801-09	79.2	25	19.8
Facilities Operations Specialist	PFT	GS-1640-09	76.9	40	30.8
Office Automation Clerk	TPT	GS-0326-04	8.8	10	1
South Coast Refuge Manager	PFT	GS-0485-12	117.3	0	0
Restoration Biologist	TFT	GS-0401-11	84.3	0	0
Maintenance Worker	PFT	WG-4749-08	65.0	0	0

Table C-4. Current and Future Staffing

Total salary currently expended on Nestucca Bay NWR					**153.4**
Future Position	**Status**	**GS & Grade**	**Annual Salary Cost (K) (FY12 $$)**	**% Planned for Nestucca Bay NWR**	**Annual Salary* (K) Planned for Nestucca Bay NWR**
Environmental Education Specialist	PFT	GS-1001-07	49.3	20	9.9
South Coast Wildlife Refuge LE Officer	PFT	GL-1801-09	79.2	10	7.9
Volunteer Coordinator/ Interpreter	PFT	GS-0025-07	49.3	30	14.8
South Coast Wildlife Biologist	PFT	GS-0486-09	60.3	0	0
North Coast Refuge Manager	PFT	GS-0485-11	80	25	20
Complex Wildlife Biologist	PFT	GS-0486-09	60.3	20	12.1
Total current and future staffing costs					**218.1**

* = salary and benefits
PFT: Permanent Full Time, TFT = Term Full Time, TPT = Temporary Part Time
GS: General Schedule Federal Employee, WG: Wage Grade Federal Employee, GL: Law Enforcement Officers (LEOs)

C.3.5 Budget Summary

Table C-5 summarizes the data from Tables C-2 and C-3 and displays the overall funding needed for the Oregon Coast National Wildlife Refuge Complex to implement the CCP for Nestucca Bay NWR.

Table C-5. Budget Summary (one-time projects and annual funding needs for Nestucca Bay NWR as identified in the CCP)

Budget Category	**Current Management**		**Future Management**	
	One-time Cost (K)	**Annual Recurring Cost (K)**	**One-time Cost (K)**	**Annual Recurring Cost (K)**
Research	15	3	71	5
Surveys and assessments	9	50	52	82
Habitat management and restoration	18	48	41	80
Facilities and maintenance	330	40	464	66
Public use, education and law enforcement	45	73	1,039	126
Totals	**417**	**214**	**1,667**	**359**

C.4 Partnership Opportunities

Partnerships are an important component of the implementation of this CCP and are reflected in the goals, objectives, and strategies identified in Chapter 2. Nestucca Bay NWR's location along the Pacific Coast Scenic Byway facilitates many opportunities for partnerships; however, the absence of staff stationed at the Refuge has resulted in fewer partnerships than the Refuge's location and resources could sustain. Current and past partners include Federal and state agencies, nonprofit and non-governmental organizations, school volunteers, and individuals.

The Oregon Coast NWR Complex already enjoys positive relationships with partners including state and Federal agencies, Tribes, volunteers, schools, conservation organizations, and individuals. Refuge Complex staff will work to strengthen existing partnerships and will actively look for new partnerships to assist in achieving the goals, objectives, and strategies set forth in this CCP.

Oregon Department of Fish and Wildlife (ODFW)

The ODFW's management responsibilities along the coast, including lands and waters, fish and wildlife, threatened and endangered species, and other programs, frequently overlap with Service resources and responsibilities. ODFW and the Refuge Complex share mutual interests in wildlife surveys, developing joint research projects, education and outreach programs, species management and dissemination of data, results, and information to a wider audience. ODFW has been closely involved with Refuge Complex staff in fisheries habitat surveys and restoration, waterfowl surveys, predator management, and restoration project permits. Increased cooperation between ODFW and the Refuge Complex will assist both agencies in meeting their missions and mandates, and provide a more systematic and accessible process for sharing information, expertise and funding.

Oregon Parks and Recreation Department (OPRD)

The OPRD manages Oregon beaches, numerous coastal State Parks, and State Scenic Viewpoints along the Oregon coast. The OPRD's management responsibilities, including lands, facilities, and interpretive and educational programs, frequently overlap with Refuge Complex goals and responsibilities for public outreach and education. The Refuge Complex works closely with OPRD to maintain visitor use facilities, develop new facilities, collaborate on interpretive panel messages, develop joint educational and interpretive programs and utilize shared volunteers.

Law Enforcement Entities

The Refuge Complex has only one full-time Law Enforcement Officer, and enforcement coverage on Nestucca Bay NWR as well as all the other refuges will continue to rely on coordination with city police, county sheriff departments, Oregon State Police, and Federal officers from USCG, NMFS, USFS and BLM. Specific LE tasks include: (1) Clarifying jurisdictions of Service and all other enforcement agencies regarding refuge regulations, determine the extent of proprietary state law authority on Federal lands, and enable joint enforcement of wildlife protection and refuge trespass laws and regulations; and (2) Developing LE assistance agreements with OSP; county sheriffs and associated Marine Patrol officers; city police departments in cities where refuge lands are located; USCG; and NOAA for enforcement of wildlife and refuge regulations including joint enforcement of Marine Mammal Protection Act regulations.

Volunteers

Volunteers are extremely important in helping reduce wildlife disturbance, educating the public, and disseminating information on the mission of the National Wildlife Refuge System. A resident volunteer is usually stationed at Nestucca Bay NWR and assists with greeting the visiting public, leading special tours and environmental education programs, and maintaining the grounds.

Appendix D. Wilderness Review

D.1 Introduction

D.1.1 Refuge Overview

Nestucca Bay National Wildlife Refuge (Refuge or NWR) is located near Pacific City and Neskowin, in Tillamook County, Oregon. The Refuge was established in 1991 with the acquisition of a 370-acre dairy farm, and has since expanded to 1,010 acres, with an additional 2,500+ acres of private and state inholdings within the approved refuge boundary. Nestucca Bay Refuge was established to protect wintering habitat for the Aleutian Canada goose, which was originally federally listed as endangered in 1967 and delisted in 2001, and for the declining dusky Canada goose; and to protect diverse coastal wetland habitats and upland habitat buffers for a variety of migratory waterfowl, shorebirds, raptors, songbirds, anadromous fish, and other wildlife. In 2002, the Refuge was expanded to include the Neskowin Marsh Unit (currently at 228 acres) located about 2.5 miles south of the Nestucca Bay Unit. The Neskowin Marsh Unit incorporates unique freshwater wetland and bog habitats and wildlife resources not found within the original refuge boundary.

D.1.2 Policy and Direction for Wilderness Reviews

U.S. Fish and Wildlife Service (USFWS or Service) policy (Part 602 FW 3.4 C. (1) (c)) requires that wilderness reviews be completed as part of the CCP process. This review includes the re-evaluation of refuge lands existing during the initial 10-year review period of The Wilderness Act of 1964, as amended (16 U.S.C. 1131-1136), as well as new lands and waters added to the Refuge System since 1974. A preliminary inventory of the wilderness resources is to be conducted during pre-acquisition planning for new or expanded refuges (341 FW 2.4 B, “Land Acquisition Planning”). Refuge System policy on Wilderness Stewardship (610 FW 1-5) includes guidance for conducting wilderness reviews (610 FW 4 – Wilderness Review and Evaluation).

A wilderness review is the process of determining whether the Service should recommend Refuge System lands and waters to Congress for wilderness designation. The wilderness review process consists of three phases: wilderness inventory, wilderness study, and wilderness recommendation.

Wilderness Inventory

The inventory is a broad look at a refuge to identify lands and waters that meet the minimum criteria for wilderness—size, naturalness, and outstanding opportunities for solitude or primitive and unconfined type of recreation. All areas meeting the criteria are preliminarily classified as Wilderness Study Areas (WSAs). If WSAs are identified, the review proceeds to the study phase.

Wilderness Study

During the study phase, WSAs are further analyzed:

1. for all values of ecological, recreational, cultural, economic, symbolic
2. for all resources, including wildlife, vegetation, water, minerals, soils
3. for existing and proposed public uses
4. for existing and proposed refuge management activities within the area,

5. to assess the refuge's ability to manage and maintain the wilderness character in perpetuity, given the current and proposed management activities. Factors for evaluation may include, but are not limited to, staffing and funding capabilities, increasing development and urbanization, public uses, and safety.

We evaluate at least an "All Wilderness Alternative" and a "No Wilderness Alternative" for each WSA to compare the benefits and impacts of managing the area as wilderness as opposed to managing the area under an alternate set of goals, objectives, and strategies that do not involve wilderness designation. We may also develop "Partial Wilderness Alternatives" that evaluate the benefits and impacts of managing portions of a WSA as wilderness.

In the alternatives, we evaluate:

1. the benefits and impacts to wilderness values and other resources
2. how each alternative would achieve the purposes of the Wilderness Act and the National Wilderness Preservation System
3. how each alternative would affect achievement of refuge purpose(s) and the refuge's contribution toward achieving the Refuge System mission
4. how each alternative would affect maintaining and, where appropriate, restoring biological integrity, diversity, and environmental health at various landscape scales
5. other legal and policy mandates
6. whether a WSA can be effectively managed as wilderness by considering the effects of existing private rights, land status and service jurisdiction, refuge management activities and refuge uses, and the need for or possibility of eliminating Section 4(c) prohibited uses

Wilderness Recommendation

If the wilderness study demonstrates that a WSA meets the requirements for inclusion in the National Wilderness Preservation System, a wilderness study report should be written that presents the results of the wilderness review, accompanied by a Legislative Environmental Impact Statement (LEIS). The wilderness study report and LEIS that support wilderness designation are then transmitted through the Secretary of the Interior to the President of United States, and ultimately to the United States Congress for action. Refuge lands recommended for wilderness consideration by the wilderness study report will retain their WSA status and be managed as "… wilderness according to the management direction in the final CCP until Congress makes a decision on the area or we amended the CCP to modify or remove the wilderness recommendation" (610 FW 4.22B). When a WSA is revised or eliminated, or when there is a revision in "wilderness stewardship direction, we include appropriate interagency and tribal coordination, public involvement, and documentation of compliance with NEPA" (610 FW 3.13).

D.1.3 Criteria for Evaluating Lands for Possible Inclusion in the National Wilderness Preservation System

The Wilderness Act of 1964, as amended (16 U.S.C. 1131-1136), provides the following description of wilderness:

> "A wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain. An area of

> wilderness is further defined to mean in this Act as an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions…"

The following criteria for identifying areas as wilderness are outlined in Section 2(c) of the Act and are further expanded upon in Refuge System policy (610 FW 4). The first three criteria are evaluated during the inventory phase; the fourth criterion is evaluated during the study phase.

1. Generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable;
2. Has outstanding opportunities for solitude or a primitive and unconfined type of recreation;
3. Has at least five thousand acres of land or is of a sufficient size as to make practicable its preservation and use in an unimpaired condition; and
4. May also contain ecological, geological, or other features of scientific, educational, scenic, or historic value.

Criterion 3 is further defined in Section 3(c) of the Act as 1) a roadless area of 5,000 contiguous acres or more, or 2) a roadless island. Roadless is defined as the absence of improved roads suitable and maintained for public travel by means of 4-wheeled, motorized vehicles that are intended for highway use.

D.1.3 Relationship to Previous Wilderness Reviews

No previous wilderness reviews have been prepared for Nestucca Bay NWR.

D.2 Wilderness Inventory

The following constitutes the inventory phase of the wilderness review for Nestucca Bay NWR.

D.2.1 Lands Considered under This Wilderness Review

All FWS-owned lands and waters (in fee title) within the Nestucca Bay NWR boundary were considered during this wilderness review.

D.2.2 Inventory Units

The first step of a wilderness assessment is to divide the refuge or other management entity into preliminary wilderness evaluation units. The boundaries of these artificial units can follow the refuge boundary, but may not cross permanent roadways, private or other non-Federal lands, or non-Service owned waterways. These roads, non-Federal lands, or waterways can form the boundary for an individual evaluation unit. Other obvious incompatible wilderness uses or structures (such as refuge headquarters, residential areas, rights-of-way, and non-jurisdictional waters) may also be eliminated from any evaluation units at this time. Once boundaries have been established for each individual evaluation unit, the criteria in Sections D.2.3 are applied to determine each unit's suitability as potential wilderness and the need for further evaluation under the Wilderness Study.

In determining units to be evaluated for wilderness character per this inventory, the Refuge was mapped using geographic information system (GIS) software. Using the major constraints set by the

Wilderness Act, specifically land ownership/refuge boundary and permanent road systems, initial large evaluation units were developed by including all contiguous lands within those intractable confines. GIS acreages, which may differ from acreages contained in Realty records, were calculated and are reported below. Through this process, several units/tracts (listed from north to south) were defined for evaluation:

The **Semidi Tract** includes a total of 75.9 acres of lowland pastures and totals 75.9 acres. These pastures are adjacent to the Nestucca River in the small town of Woods, near Pacific City. Brooten Road borders the tract on the north and private residences and/or agricultural lands surround the tract on east, west, and south. Semidi Islands Aleutian Canada geese frequent these pastures during the winter and show high site fidelity to this specific site, thus the name Semidi Tract. This area is flooded several times during the winter when the Nestucca River overflows its banks, and drains through a tidegate on the south end of the property. The soil has not been cultivated in over thirty years (Martella, personal communication).

The approximately 105-acre **Brooten Marsh** is located where the Nestucca and Little Nestucca Rivers join. The marsh is not undisturbed, as it has several human-made ditches on site. Their profiles show a deep central channel, carved by tidal flow that meanders within a broader ditched area. The site has never been diked and the existing ditching appears to have been ineffective in allowing agricultural use of the site. The site's elevation is so low that pasture grasses would have been unsuccessful, except perhaps on the highest marsh at the northwest corner of the site. The majority of the Brooten Marsh is occupied by low marsh communities with pickleweed, seaside arrowgrass, and Lyngby's sedge communities. The western third of the site has both low and high marsh communities with species such as fleshy jaumea and tufted hairgrass (Brophy 2002).

The 30-acre **Utter Tract** is located north of Resort Drive and is surrounded on three sides by private agricultural lands and a county road on the south side. The tract is composed of upland and low pastures and a small stand of Sitka spruce trees. During fall and winter the lower half is almost constantly flooded and does not dry out enough for mowing until almost June.

The diked lowland pastures of the Nestucca Bay Unit are divided into several subunits. The **North and Middle Pastures** are located on the west side of Highway 101 on the eastern side of Nestucca Bay. The areas outside of the dikes protecting the North and Middle Pastures are marshes subject to full tidal action. In aggregate, these areas total 148 acres.

The 214-acre **Cannery Hill area** includes the Main Pastures, upland forest, and approximately 45 acres of grasslands that were historically coastal prairie, based upon historic maps (General Land Office maps and Coast Survey maps) dating from the mid- to late-1800s. The USFWS-owned lands in this area are bordered by private forestland to the north, private residences to the west, and private agricultural lands to the south. Currently, the Refuge's only public uses are concentrated at Cannery Hill.

The 22-acre **Lyda Tract**, a triangular parcel that also borders the Little Nestucca River and Highway 101, is currently a diked lowland pasture.

The approximately 82-acre **Little Nestucca Restoration Area** is located east of Highway 101 and south of Little Nestucca River Road along the Little Nestucca River. The area restored to tidal marsh was formerly comprised of five private ownerships that were acquired by the Refuge. Historically the restoration area was tidal marsh, which was diked and drained for agricultural use in the early 20th century. In the 1980s farming of this area was discontinued by the owners and the area reverted to diked wetlands. A 10-foot-wide breach formed in the 3,450-foot dike in 1996 while in private ownership, resulting in muted tidal influence and nascent natural restoration of the site. The restoration project re-established full tidal wetland values and functions on the 82 acres by removing the dikes, filling borrow and drainage ditches, and re-establishing former tidal channels (USFWS 2006).

The **Hagerty Tract** is located on Meda Loop Road and is border on the south by the road, the east and west by private agricultural lands, and the north by the Little Nestucca River. This tract was acquired in 2011 and has six lowland pastures totaling 87.4 acres. The northernmost pasture in this unit is diked and parallels the Little Nestucca River. The upland pastures on this tract were heavily overgrazed year-round for the past 5-10 years and in 2011 were in poor condition. This tract drains through a tide gate shared with the landowner to the east.

The Neskowin Marsh Unit is composed of three discontinuous sections. **Neskowin Marsh North** consists of 27.5 acres of seasonally flooded marsh and adjacent coastal dune and riparian woodland. This area is bordered by the Sahhali Shores housing development with planned homes situated on a steep slope above and to the southeast of the area. **Neskowin Marsh Main** consists of 201 acres of freshwater marsh, bogs, forested wetlands, forested lagg, upland shrub and meadows, and adjacent forested uplands. Private residences within the town of Neskowin are to the west of the marsh complex while additional housing developments and Highway 101 forms the eastern boundary. A golf course is situated between Neskowin Marsh Main and the 6-acre **Neskowin Marsh South**.

D.2.3 Process of Analysis

The following evaluation process was used in identifying the suitability of refuge units for wilderness designation:

- Determination of refuge unit sizes.
- Assessment of the units' capacity to provide opportunities for solitude or primitive and unconfined recreation.
- Assessment of "naturalness" of refuge units.

General guidelines used for evaluating areas for wilderness potential during this wilderness inventory process include:

1. The area should provide a variety of habitat types and associated abiotic features, as well as a nearly complete complement of native plants and wildlife indicative of those habitat types. Non-native and invasive species should comprise a negligible portion of the landscape.
2. The area should be spatially complex (vertically and/or horizontally) and exhibit all levels of vegetation structure typical of the habitat type, have an interspersion of these habitats, and provide avenues for plant and wildlife dispersal.
3. The area should retain the basic natural functions that define and shape the associated habitats, including but not limited to, flooding regimes, fire cycles, unaltered hydrology and flowage regimes, basic predator-prey relationships including herbivory patterns.
4. Due to their size, islands may not meet the habitat guidelines in 1 and 2 above. Islands should, however, exhibit the natural cover type with which they evolved and they should continue to be shaped and modified by natural processes. Islands should be further analyzed

during the study portion of the review if they provide habitat for a significant portion of a population, or key life cycle requirements for any resources of concern or listed species.

5. Potential wilderness areas should be relatively free of permanent structures or man-made alterations. Areas may be elevated to the study phase if existing structures or alterations can be removed or remediated within a reasonable timeframe, and prior to wilderness recommendation to the Secretary of the Interior.

Supplemental Values–the Wilderness Act states that an area of wilderness may contain ecological, geological, or other features of scientific, educational, scenic, or historical value. Supplemental values of the area are optional, but the degree to which their presence enhances the area's suitability for wilderness designation should be considered. The evaluation should be based on an assessment of the estimated abundance or importance of each of the features.

More detail on the factors considered and used for each assessment step follows.

Unit Size: Roadless areas meet the size criteria if any one of the following standards apply:

- An area with over 5,000 contiguous acres solely in Service ownership.
- A roadless island of any size. A roadless island is defined as an area surrounded by permanent waters or an area that is markedly distinguished from the surrounding lands by topographical or ecological features.
- An area of less than 5,000 contiguous Federal acres that is of sufficient size as to make practicable its preservation and use in an unimpaired condition, and of a size suitable for wilderness management.
- An area of less than 5,000 contiguous Federal acres that is contiguous with a designated wilderness, recommended wilderness, or area under wilderness review by another Federal wilderness managing agency such as the Forest Service, National Park Service, or Bureau of Land Management.

Outstanding Solitude or Primitive or Unconfined Recreation:

A designated wilderness area must provide outstanding opportunities for solitude or a primitive and unconfined type of recreation. Possession of only one of these outstanding opportunities is sufficient for an area to qualify as wilderness, and it is not necessary for one of these outstanding opportunities to be available on every acre. Furthermore, an area does not have to be open to public use and access to qualify under these criteria.

Opportunities for solitude refer to the ability of a visitor to be alone and secluded from other visitors in the area. Primitive and unconfined recreation means non-motorized, dispersed outdoor recreation activities that are compatible and do not require developed facilities or mechanical transport. Primitive recreation activities may provide opportunities to experience challenge and risk, self-reliance, and adventure.

Naturalness and Wildness: the area generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable.

This criterion must be evaluated in the context of current natural conditions and societal values and expectations without compromising the original intent of the Wilderness Act. It is well recognized that there are few areas remaining on the planet that could be truly classified as primeval or pristine, with even fewer, if any, existing in the conterminous United States. Likewise, few areas exist that do not exhibit some impact from anthropogenic influences, be it noise, light, or air pollution; water quality or hydrological manipulations; past and current land management practices; roads or trails, suppression of wildfires; invasions by non-native species of plants and animals; or public uses. While allowing for the near-complete pervasiveness of modern society on the landscape, the spirit of the Wilderness Act is to protect lands that still retain the wilderness qualities of being: 1) natural, 2) untrammeled, 3) undeveloped. These three qualities are cornerstones of wilderness character. For areas proposed or designated as wilderness, wilderness character must be monitored to determine baseline conditions and thereafter be periodically monitored to assess the condition of these wilderness qualities. Proposed and designated wilderness areas by law and policy are required to maintain wilderness character through management and/or restoration in perpetuity.

Defining the first two qualities (natural and untrammeled) requires knowledge and understanding of the ecological systems which are being evaluated as potential wilderness. Ecological systems are comprised of three primary attributes—composition, structure, and function. Composition is the components that make up an ecosystem, such as the habitat types, native species of plants and animals, and abiotic (physical and chemical) features. These contribute to the diversity of the area. Structure is the spatial arrangement of the components that contribute to the complexity of the area. Composition and structure are evaluated to determine the naturalness of the area. Function is the processes that result from the interaction of the various components both temporally and spatially, and the disturbance processes that shape the landscape. These processes include, but are not limited to, predator-prey relationships, insect and disease outbreaks, nutrient and water cycles, decomposition, fire, windstorms, flooding, and both general and cyclic weather patterns. Ecological functions are evaluated to determine the wildness or untrammeled quality of the area.

The third quality assessment is whether an area is undeveloped. Undeveloped refers to the absence of permanent structures such as roads, buildings, dams, fences, and other man-made alterations to the landscape. Exceptions can be made for historic structures or structures required for safety or health considerations, providing they are made of natural materials and relatively unobtrusive on the landscape.

D.2.4 Summary of Inventory Results and Conclusion

Table D-1 summarizes the above evaluation factors for each of the units that were delineated and evaluated as described in Section D.2.3.

In this inventory, none of the identified refuge units were found to meet the minimum wilderness criteria for size, outstanding opportunities for solitude and primitive/unconfined recreation, or naturalness. Thus, none of these areas are recommended for Wilderness Study.

Table D-1. Results of Wilderness Inventory for Nestucca Bay NWR

Refuge Unit	Size	Outstanding Opportunities for Solitude or Primitive/unconfined Recreation	Naturalness	Summary: Area Will Move Forward for Wilderness Study
Semidi Tract	No	NE	NE	No
Brooten Marsh	No	NE	NE	No
Utter Tract	No	NE	NE	No
North and Middle Pastures	No	NE	NE	No
Cannery Hill	No	NE	NE	No
Lyda Tract	No	NE	NE	No
Little Nestucca Restoration Area	No	NE	NE	No
Hagerty Tract	No	NE	NE	No
Neskowin Marsh North	No	NE	NE	No
Neskowin Marsh Main	No	NE	NE	No
Neskowin Marsh South	No	NE	NE	No

Notes:
NE – Not evaluated (once any wilderness criteria was not met, further evaluation was not conducted.)

D.3 References

Brophy, L.S. 2002. Siletz Bay NWR and Nestucca Bay NWR tidal marsh restoration and reference sites: baseline plant community monitoring and mapping. Green Point Consulting. Corvallis, OR. 98 pp.

U.S. Fish and Wildlife Service (USFWS). 2006. Little Nestucca River restoration project, Nestucca Bay National Wildlife Refuge, Tillamook County, Oregon. Oregon Coast National Wildlife Refuge Complex. Newport, OR. 66 pp.

Appendix E. Biological Resources of Concern

E.1 Introduction

Management direction of individual refuges is driven by refuge purposes and statutory mandates, coupled with species and habitat priorities. Management on a refuge should first and foremost address the individual refuge purposes. Additionally, management should address maintenance and, where appropriate, restoration of biological integrity, diversity, and environmental health as well as management for NWRS Resources of Concern. In this approach, the refuge contributes to the goals of the NWRS (601 FW 1) and achievement of the NWRS Mission.

In concert with this approach, and as an initial step in planning, the planning team identified resources of concern for Nestucca Bay National Wildlife Refuge (NWR or Refuge). As defined in the Policy on Habitat Management Plans (620 FW 1), resources of concern are:

> "all plant and/or animal species, species groups, or communities specifically identified in refuge purpose(s), System mission, or international, national, regional, State, or ecosystem conservation plans or acts. For example, waterfowl and shorebirds are a resource of concern on a refuge whose purpose is to protect 'migrating waterfowl and shorebirds.' Federal or State threatened and endangered species on that same refuge are also a resource of concern under terms of the respective endangered species acts (620 FW1.4G)."

To provide a framework for development of goals and objectives in the CCP, the planning team identified resources of concern, following the process outlined in the handbook Identifying Refuge Resources of Concern and Management Priorities: A Handbook (U.S. Fish and Wildlife Service [USFWS] 2008b).

E.2 Comprehensive Resources of Concern

A comprehensive list of potential resources of concern was created early in the planning process. The team identified species, species groups, and communities of concern, based upon a review of the Refuge's establishing history and purposes, a description of the key habitat types existing at the Refuge, and a review of numerous conservation plans (see Section 1.7 of the CCP), many of which highlight priority species or habitats for conservation. The Comprehensive Resources of Concern list is contained in Table E-1.

Table E-1. Nestucca Bay Refuge Table of Comprehensive Resources of Concern

Species/ Habitat	Refuge Purpose Species	BIDEH	Federal T&E	State T&E	BCC - BCR # 5 (Table 6)	BCC - 2008 Region 1 (Table 39)	BCC - National (Table 48)	BMC Region 1 Status	PIF Regional Important Species	State Wildlife Action Plan Priorities (SGCN)	Shorebird Plan- NP Regional Score	Waterbird Plan Category	NA Waterfowl Management Plan	Fisheries Status Review	OR Natural Heritage Program State Rank
Habitat															
Diverse coastal wetlands (tidal salt marsh) and upland buffers	X	X											X		
Freshwater Wetlands	X	X											X		
Coastal Bog Ecosystem	X	X											X		
Temperate Pacific Tidal Salt and Brackish Marsh		X											X		
Temperate Pacific Freshwater Emergent Marsh	X	X											X		
Temperate Pacific Intertidal Mudflat		X											X		
North Pacific Intertidal Freshwater Wetland		X											X		
North Pacific Hypermaritime Sitka Spruce Forest		X													
North Pacific Wet-Mesic Douglas-fir-Western Hemlock Forest		X													
North Pacific Lowland Riparian Forest and Shrubland		X													
North Pacific Bog and Fen	X	X											X		

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Species/ Habitat	Refuge Purpose Species	BIDEH	Federal T&E	State T&E	BCC - BCR # 5 (Table 6)	BCC - 2008 Region 1 (Table 39)	BCC - National (Table 48)	BMC Region 1 Status	PIF Regional Important Species	State Wildlife Action Plan Priorities (SGCN)	Shorebird Plan- NP Regional Score	Waterbird Plan Category	NA Waterfowl Management Plan	Fisheries Status Review	OR Natural Heritage Program State Rank
North Pacific Hypermaritime Shrub and Herbaceous Headland		X													
Lowland pastures (short-grass field)	X	X											X		
Festuca rubra Coastal Headland Herbaceous Vegetation		X													
Birds															
Migratory waterfowl	X														
Shorebirds	X				X	X	X	X							
Raptors	X				X	X	X	X	X						
Neotropical songbirds	X				X	X	X	X	X						
Greater white-fronted goose								GBBDC					X		
Black brant										X			X		
Aleutian Canada goose	X		DL	DL						X			X		S2
Cackling Canada goose								GBBDC					X		
Taverner's Canada goose													X		
Dusky Canada goose	X							GBBDC					X		S2
Lesser Canada goose													X		
Western Canada goose													X		
Tundra swan													X		
Wood duck								GBBDC							
Gadwall													X		

Table E-1. Nestucca Bay Refuge Table of Comprehensive Resources of Concern

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American wigeon								GBBDC					X		
Mallard								GBBDC					X		
Blue-winged teal													X		
Cinnamon teal													X		
Northern shoveler													X		
Northern pintail								GBBDC					X		
Green-winged teal													X		
Canvasback													X		
Redhead								GBBDC					X		
Ring-necked duck								GBBDC							S3
Greater scaup								GBBDC					X		
Lesser scaup								GBBDC					X		S3
Bufflehead															S2
Common loon								X							SH
Pied-billed grebe												H			
Horned grebe												H			S2
Western grebe					X										S2
California brown pelican			DL	LE				T/E		X					S2
Pelagic cormorant					X							H			
American bittern								X				H			
American bald eagle			DL	LT	X	X	X	T/E	X	X					
Northern harrier								BCC/N							S3
American peregrine falcon			DL	DL	X	X	X	BCC/N		X					S2
Sora												H			
Black-bellied plover											4				
Semipalmated plover											3				

Table E-1. Nestucca Bay Refuge Table of Comprehensive Resources of Concern

Species/ Habitat	Refuge Purpose Species	BIDEH	Federal T&E	State T&E	BCC - BCR # 5 (Table 6)	BCC - 2008 Region 1 (Table 39)	BCC - National (Table 48)	BMC Region 1 Status	PIF Regional Important Species	State Wildlife Action Plan Priorities (SGCN)	Shorebird Plan- NP Regional Score	Waterbird Plan Category	NA Waterfowl Management Plan	Fisheries Status Review	OR Natural Heritage Program State Rank
Killdeer											4				
Spotted sandpiper											3				
Greater yellowlegs											4				
Willet											2				
Lesser yellowlegs					X		X				2				
Whimbrel					X	X	X	BCC/N			4				
Marbled godwit					X	X	X	BCC/N			4				
Black turnstone								BCC/N			4				
Sanderling											4				
Western sandpiper											4				
Least sandpiper											3				
Dunlin							X				4				
Short-billed dowitcher					X	X	X	BCC/N			4				
Long-billed dowitcher											3				
Wilson's snipe											4				
Red-necked phalarope											4				
Red phalarope											4				
Glaucous-winged gull															S2
Caspian tern					X			BCC/ BCR		X					
Band-tailed pigeon			SOC	NS S				GBBDC	X	X					S3
Mourning dove								GBBDC							
Northern pygmy-owl									X						
Northern saw-whet owl									X						
Vaux's swift									X						

Table E-1. Nestucca Bay Refuge Table of Comprehensive Resources of Concern

Species/ Habitat	Refuge Purpose Species	BIDEH	Federal T&E	State T&E	BCC - BCR # 5 (Table 6)	BCC - 2008 Region 1 (Table 39)	BCC - National (Table 48)	BMC Region 1 Status	PIF Regional Important Species	State Wildlife Action Plan Priorities (SGCN)	Shorebird Plan- NP Regional Score	Waterbird Plan Category	NA Waterfowl Management Plan	Fisheries Status Review	OR Natural Heritage Program State Rank
Rufous hummingbird					X	X	X	BCC/N	X						
Belted kingfisher									X						
Pacific-slope flycatcher								X	X						
Steller's jay									X						
Chestnut-backed chickadee									X						
Bewick's wren							X	X							
Golden-crowned kinglet									X						
Varied thrush									X						
American pipit															SU
Orange-crowned warbler									X						
Townsend's warbler									X						
Hermit warbler								X	X						
MacGillivray's warbler									X						
Purple finch					X				X						
Red crossbill									X						
Mammals															
Mammals	X														
Humans	X														
Marine Mammals	X														
Hoary bat										X					S3
California myotis			NFS	SV						X					S3
Amphibians															
Amphibians	X														
Clouded salamander			NFS	SV						X					S3
Northern red-legged frog															S3

Table E-1. Nestucca Bay Refuge Table of Comprehensive Resources of Concern

Species/ Habitat	Refuge Purpose Species	BIDEH	Federal T&E	State T&E	BCC - BCR # 5 (Table 6)	BCC - 2008 Region 1 (Table 39)	BCC - National (Table 48)	BMC Region 1 Status	PIF Regional Important Species	State Wildlife Action Plan Priorities (SGCN)	Shorebird Plan- NP Regional Score	Waterbird Plan Category	NA Waterfowl Management Plan	Fisheries Status Review	OR Natural Heritage Program State Rank
Western toad			NFS	SV						X					S3
Reptiles															
Reptiles	X														
Invertebrates															
Invertebrates	X														
Oregon silverspot butterfly			LT	LT						X					
Fish															
Anadromous fish (Chinook salmon, coho salmon, chum salmon, steelhead)	X													X	
Resident fish	X														
Chinook salmon	X													X	SN R
Coho salmon	X		LT	SS						X				X	S2
Chum salmon	X		LT	SC						X				X	S2
Steelhead	X		C	SS						X				X	S2
Coastal cutthroat trout	X		SOC	SV						X					S3
Western brook lamprey			SOC	SS						X					
Pacific lamprey			SOC	SS						X					S3
Pacific smelt - Eulachon			LT												
Other															
Resident wildlife	X														
Endangered species	X				X	X	X								

Federal Status
LT = Threatened
LE = Endangered
C = Candidate
SOC = Species of Concern

State Status
LT = Threatened
LE = Endangered
C = Candidate
SS = Sensitive Species

NFS = No Federal status
DL = Delisted

SV = Sensitive species, vulnerable category
SC = Sensitive species, critical category
NSS = No state status
DL = Delisted

BMC Designations: BCC/N = Birds of Conservation Concern National, GBBDC = Gamebirds Below Desired Condition, T/E = Threatened or Endangered, BCC/BCR = Birds of Conservation Concern/BCR.

SGCN = Species of Greatest Conservation Needs in the Coast Range Ecoregion – Used Oregon Conservation Strategy document.

Shorebird Plan Ranking: 1 = No Risk, 2 = Low Concern, 3 = Moderated Concern, 4 = High Concern, 5 = Highly imperiled, including species listed as threatened or endangered.

Waterbird Plan Category of Conservation: H = High Concern (listed **only** species in the category of high concern).

North American Waterfowl Management Plan: Listed **only** species mentioned in the plan with breeding population objectives or listed habitat to restore/enhance.

Oregon Natural Heritage State Rank: used NatureServe Explorer database to determine state rank. State rank codes include: SX = Presumed Extirpated, SH = Possibly Extirpated, S1 = Critically Imperiled, S2 = Imperiled, S3 = Vulnerable, SU = Unrankable, SNR = Not Yet Ranked.

E.3 Priority Resources of Concern

The Priority Resources of Concern (Table E-2) were selected from the Comprehensive Resources of Concern list as particular indicators by which to gauge habitat conditions. The Priority Resources of Concern table includes focal species, including birds, fish, reptiles, amphibians, invertebrates, and plants that were selected as representatives or indicators for the overall condition of important refuge habitats. Most of the biological emphasis of the CCP is focused on maintaining and restoring these priority resources.

Several different conservation focal species may be listed for specific habitats to cover the variety of habitat structures and plant associations. In addition, species with specific “niche” ecological requirements may be listed as a focal species. Other species utilizing the habitat are generally expected to benefit as a result of management for the focal species.

Definitions for the column headings in Table E-2 are as follows:

- **Focal Species:** Species selected as representatives or indicators for the overall condition of the conservation target. In situations where the conservation target may include a broad variety of habitat structures and plant associations, several different conservation focal species may be listed. In addition, species with specific “niche” ecological requirements may be listed as a focal species. Management will be focused on attaining conditions required by the focal species. Other species utilizing the conservation target are generally expected to benefit as a result of management for the focal species.
- **Habitat Type:** The general habitat description utilized by the focal species.
- **Habitat Structure:** The specific and measurable habitat attributes considered necessary to support the focal species.
- **Life History Requirement:** The general season of use for the focal species.
- **Other Benefiting Species:** Other species that are expected to benefit from management for the selected focal species. The list is not comprehensive; see the Table of Potential Resources of Concern for the refuges for a more complete list.

Table E-2. Nestucca Bay National Wildlife Refuge Priority Resources of Concern

Focal Species	Habitat Type	Habitat Structure	Life History Requirement	Other Benefiting Species
Birds				
Dusky Canada goose	Agricultural lowland pastures	Short native and introduced grasses (2-4 inches); pastureland, adjacent to wetlands and estuaries	Wintering grounds, foraging habitat	Aleutian Canada goose, cackling Canada goose, Taverner's Canada goose, western Canada goose, lesser Canada goose, greater white-fronted goose, other waterfowl – duck species
Aleutian Canada goose (specifically Semidi Island birds)	Agricultural lowland pastures	Short grass (2-4 inches); pastureland, adjacent to wetlands and estuaries	Wintering grounds, foraging habitat	Dusky Canada goose, western Canada goose, lesser Canada goose, cackling Canada goose, Taverner's Canada goose, greater white-fronted goose, other waterfowl – duck species
Chestnut-sided chickadee	North Pacific Intertidal Freshwater Wetland Forest	This forested wetland is driven by daily tidal flooding of freshwater and associated soil saturation. Vegetation structure and composition are varied and depend on substrate characteristics and the tidal flooding regime of particular sites. Dominant species include *Picea sitchensis, Alnus rubra.*	Breeding and year-round for benefiting species	Spotted towhee, Varied thrush, Fox sparrow, wrentit, brown creeper, downy woodpecker, pileated woodpecker
Fish				
Chinook salmon	Riverine and stream habitat, freshwater marsh, coastal bog	Barrier free, rivers or streams connected to ocean, gravel channel beds, pools, water quality/chemistry/temperature conducive to fish production and survival	Anadromous fish rearing, spawning, foraging, year-round utilization	Coho salmon, chum salmon, steelhead, coastal cutthroat trout
Coho salmon	Riverine and stream habitat, freshwater marsh, coastal bog	Barrier free, rivers or streams connected to ocean, gravel channel beds, pools, water quality/chemistry/temperature conducive to fish production and survival	Anadromous fish rearing, spawning, foraging, year-round utilization	Chinook salmon, chum salmon, steelhead, coastal cutthroat trout

Table E-2. Nestucca Bay National Wildlife Refuge Priority Resources of Concern

Focal Species	Habitat Type	Habitat Structure	Life History Requirement	Other Benefiting Species
Chum salmon	Riverine and stream habitat, freshwater marsh, coastal bog	Barrier free, rivers or streams connected to ocean, gravel channel beds, pools, water quality/chemistry/temperature conducive to fish production and survival	Anadromous fish rearing, spawning, foraging, year-round utilization	Chinook salmon, coho salmon, steelhead, coastal cutthroat trout
Steelhead	Riverine and stream habitat, freshwater marsh, coastal bog	Barrier free, rivers or streams connected to ocean, gravel channel beds, pools, water quality/chemistry/temperature conducive to fish production and survival	Anadromous fish rearing, spawning, foraging, year-round utilization	Chinook salmon, coho salmon, chum salmon, coastal cutthroat trout
Coastal cutthroat trout	Riverine and stream habitat, freshwater marsh, coastal bog	Barrier free, rivers or streams connected to ocean, gravel channel beds, pools, water quality/chemistry/temperature conducive to fish production and survival	Anadromous fish rearing, spawning, foraging, year-round utilization	Chinook salmon, coho salmon, chum salmon, steelhead
Amphibians				
Clouded salamander	Freshwater marsh, coastal bog	Water quality/chemistry/temperature conducive to amphibian production and survival, vegetative cover	Year-round utilization to support and sustain life, breeding, foraging	Coastal tailed frog, northern red-legged frog, western toad
Northern red-legged frog	Freshwater marsh, coastal bog	Water quality/chemistry/temperature conducive to amphibian production and survival, vegetative cover	Year-round utilization to support and sustain life, breeding, foraging	Clouded salamander, coastal tailed frog, western toad
Western toad	Freshwater marsh, coastal bog	Water quality/chemistry/temperature conducive to amphibian production and survival, vegetative cover	Year-round utilization to support and sustain life, breeding, foraging	Clouded salamander, coastal tailed frog, northern red-legged frog
Invertebrates				
Oregon silverspot butterfly	Grassland meadow, upland, prairie	Native grassland, stabilized dunes with coastal prairie, early blue violet (*Viola adunca*) present or transplanted	Year-round utilization to support and sustain life, breeding, foraging	Misc invertebrates

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Appendix F. Statement of Compliance

STATEMENT OF COMPLIANCE
for Implementation of the
Nestucca Bay National Wildlife Refuge, Tillamook County, Oregon
Comprehensive Conservation Plan

The following executive orders and legislative acts have been reviewed as they apply to implementation of the Nestucca Bay National Wildlife Refuge (NWR or Refuge) Comprehensive Conservation Plan (CCP).

National Environmental Policy Act (1969), as Amended (42 U.S.C. § 4321 et seq.)
The planning process has been conducted in accordance with National Environmental Policy Act (NEPA) implementing procedures, with U.S. Department of the Interior and U.S. Fish and Wildlife Service (Service) procedures, and in coordination with the affected public. The requirements of NEPA (42 U.S. Code [U.S.C.] § 4321 et seq.) and its implementing regulations in 40 Code of Federal Regulations (CFR) 1500-1508 have been satisfied in the procedures used to reach decisions. These procedures included the development of a range of alternatives for the CCP; analysis of the likely effects of each alternative; and public involvement throughout the planning process. The start of the scoping period was announced through a *Federal Register* notice, news releases to local newspapers, the Service's refuge planning website, and a planning update. The draft CCP/environmental assessment (EA) was released for a 30-day public comment period. The affected public was notified of the availability of the document through a *Federal Register* notice, news releases to local newspapers, the Service's refuge planning website, and a planning update. Copies of the draft CCP/EA and/or planning updates were distributed to an extensive mailing list. In addition, the Service participated in a variety of public outreach efforts throughout the planning process (see Appendix J).

The CCP is programmatic in many respects and specific details of certain projects and actions cannot be determined until a later date depending on funding and implementation schedules. Certain projects or actions may require additional NEPA compliance.

National Historic Preservation Act (1966), as Amended (16 U.S.C. § 470 et seq.)
The management of the archaeological and cultural resources of the refuge will comply with the regulations of Section 106 of the National Historic Preservation Act. Historic properties will be maintained and repaired as funding becomes available. Maintenance and improvement of historic resources will result in positive impacts to cultural resources; however, determining whether a particular action has the potential to affect cultural resources is an ongoing process that occurs as step-down and site-specific project plans are developed. Should additional historic properties be identified or acquired in the future, the Service will comply with the National Historic Preservation Act if any management actions have the potential to affect these properties.

Executive Order 12372. Intergovernmental Review
Coordination and consultation with affected Tribal, local and State governments, other Federal agencies, and the landowners has been completed through personal contact by refuge staff, refuge supervisors and/or inclusion of the appropriate entities on the CCP mailing list.

Executive Order 13175. Consultation and Coordination with Indian Tribal Governments
As required under the Secretary of the Interior Order 3206—American Indian Tribal Rights, Federal Tribal Responsibilities, and the Endangered Species Act—the Project Leader notified and consulted interested tribes. Refuge staff consulted with representatives of The Confederated Tribes of Grand Ronde during the planning process.

Executive Order 12898. Federal Actions to Address Environmental Justice in Minority and Low-Income Populations
All Federal actions must address and identify, as appropriate, disproportionally high and adverse human health or environmental effects of its programs, policies, and activities on minority populations, low-income populations, and Indian Tribes in the United States. The CCP was evaluated and no adverse human health or environmental effects were identified for minority or low-income populations, Indian tribes, or anyone else.

Wilderness Preservation Act of 1964 (16 U.S.C. § 1131 et seq.)
The Service has evaluated the suitability of the Refuge for wilderness designation through the "Inventory" phase according to the guidelines of the Wilderness Review process as described in 610 FW 4. In this inventory no areas on the Refuge were found to meet the minimum wilderness criteria for size, naturalness or outstanding opportunities for solitude and primitive/unconfined recreation (see Appendix D for additional details).

Architectural Barriers Act of 1968, as Amended (42 U.S.C. § 4151 et seq.)
The Architectural Barriers Act requires access to Federal facilities for people with disabilities. Access for persons with disabilities has been considered during the planning process, and actions related to access are found in Chapter 2 of the CCP.

National Wildlife Refuge System Administration Act of 1966, as Amended (16 U.S.C. § 668dd-668ee)
This Act requires the Service to develop and implement a comprehensive conservation plan for each refuge. The CCP identifies and describes refuge purposes; the vision and goals for the Refuge; fish, wildlife, and plant populations and related habitats on the Refuge; archaeological and cultural values of the Refuge; issues that may affect populations and habitats of fish, wildlife, and plants; actions necessary to restore and improve biological diversity on the Refuge; and opportunities for wildlife-dependent recreation, as required by the Act.

During the CCP process, the refuge manager evaluated all existing and proposed uses at the Refuge. Priority wildlife-dependent uses (hunting, fishing, wildlife observation and photography, environmental education and interpretation) are considered automatically appropriate under Service policy and thus exempt from appropriate uses review. Compatibility determinations have been prepared for all uses found appropriate (see Appendices A and B).

Executive Order 13186. Responsibilities of Federal Agencies to Protect Migratory Birds
This Order directs agencies to take certain actions to further implement the Migratory Bird Treaty Act. A provision of the Order directs Federal agencies to consider the impacts of their activities, especially in reference to birds on the Fish and Wildlife Service's list of Birds of Conservation Concern. It also directs agencies to incorporate conservation recommendations and objectives in the North American Waterbird Conservation Plan and bird conservation plans developed by Partners in Flight into agency planning as described in Chapter 1. The effects to refuge habitats used by

migratory birds of habitat, public use, and cultural resources actions were assessed within Chapter 6 of the draft CCP/EA, which was incorporated by reference into this document.

Endangered Species Act (1973), as Amended (16 U.S.C. § 1531 et seq.)
This Act provides for the conservation of threatened and endangered species of fish, wildlife, and plants by Federal action and by encouraging the establishment of state programs. Documentation is required under Section 7 of the Act. Refuge policy requires the refuge manager to document issues that affect or may affect endangered species before initiating projects. Consultation on specific projects will be conducted prior to implementation to avoid any adverse impacts to these species and their habitats.

Coastal Zone Management Act, as Amended (16 U.S.C. § 1451 et seq.)
Section 307(c)(1) of the Coastal Zone Management Act of 1972 as amended, requires each Federal agency conducting or supporting activities directly affecting the coastal zone, to conduct or support those activities in a manner which is, to the maximum extent practicable, consistent with approved state coastal management programs. The implementation of the Nestucca Bay NWR CCP is consistent with the Coastal Zone Management Act.

Executive Order 11990. Protection of Wetlands
The CCP is consistent with Executive Order 11990 because CCP implementation will protect any existing wetlands.

Executive Order 11988. Floodplain Management
Under this order, federal agencies "shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains." The CCP is consistent with Executive Order 11988 because CCP implementation will maintain and enhance riverine, riparian, and wetland habitats located within floodplains on the Refuge, which will minimize flood impacts and continue to contribute to the natural and beneficial fish and wildlife resource values unique to the area.

Integrated Pest Management (IPM), 517 DM 1 and 7 RM 14
In accordance with 517 DM 1 and 7 RM 14, an integrated pest management (IPM) approach has been adopted to eradicate, control, or contain pest and invasive species on the Refuge. In accordance with 517 DM 1, only pesticides registered with the US Environmental Protection Agency (USEPA) in full compliance with the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and as provided in regulations, orders, or permits issued by USEPA may be applied on lands and waters under refuge jurisdiction.

See 602 FW 3, Exhibit 2 for other potential compliance requirements

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Chief, Division of Planning, Visitor Services, and Transportation

Date

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Appendix G. Integrated Pest Management

G.1 Background

IPM is an interdisciplinary approach utilizing methods to prevent, eliminate, contain, and/or control pest species in concert with other management activities on refuge lands and waters to achieve wildlife and habitat management goals and objectives. IPM is also a scientifically based, adaptive management process where available scientific information and best professional judgment of the refuge staff as well as other resource experts will be used to identify and implement appropriate management strategies that can be modified and/or changed over time to ensure effective, site-specific management of pest species to achieve desired outcomes. In accordance with 43 CFR 46.145, adaptive management will be particularly relevant where long-term impacts may be uncertain and future monitoring will be needed to make adjustments in subsequent implementation decisions. After a tolerable pest population (threshold) is determined considering achievement of refuge resource objectives and the ecology of pest species, one or more methods, or combinations thereof, will be selected that are feasible, efficacious, and most protective of non-target resources, including native species (fish, wildlife, and plants), and Service personnel, Service authorized agents, volunteers, and the public. Staff time and available funding will be considered when determining feasibility/practicality of various treatments.

IPM techniques to address pests are presented as CCP strategies (see Chapter 2 of this CCP) in an adaptive management context to achieve refuge resource objectives. In order to satisfy requirements for IPM planning as identified in the Director's Memo (dated September 9, 2004) entitled *Integrated Pest Management Plans and Pesticide Use Proposals: Updates, Guidance, and an Online Database*, the following elements of an IPM program have been incorporated into this CCP:

- Habitat and/or wildlife objectives that identify pest species and appropriate thresholds to indicate the need for and successful implementation of IPM techniques; and
- Monitoring before and/or after treatment to assess progress toward achieving objectives including pest thresholds.

Where pesticides would be necessary to address pests, this appendix provides a structured procedure to evaluate potential effects of proposed uses involving ground-based applications to refuge biological resources and environmental quality in accordance with effects analyses presented in Chapter 6 (Environmental Consequences) of the Nestucca Bay National Wildlife Refuge draft CCP/EA. Only pesticide uses that likely would cause minor, temporary, or localized effects to refuge biological resources and environmental quality with appropriate best management practices (BMPs), where necessary, would be allowed for use on the Nestucca Bay National Wildlife Refuge (NWR or Refuge).

This appendix does not describe the more detailed process to evaluate potential effects associated with aerial applications of pesticides. Moreover, it does not address effects of mosquito control with pesticides (larvicides, pupacides, or adulticides) based upon identified human health threats and presence of disease-carrying mosquitoes in sufficient numbers from monitoring conducted on a refuge. However, the basic framework to assess potential effects to refuge biological resources and environmental quality from aerial application of pesticides or use of insecticides for mosquito management would be similar to the process described in this appendix for ground-based treatments of other pesticides.

G.2 Pest Management Laws and Policies

In accordance with Service policy 569 FW 1 (Integrated Pest Management), plant, invertebrate, and vertebrate pests on units of the National Wildlife Refuge System can be controlled to ensure balanced wildlife and fish populations in support of refuge-specific wildlife and habitat management objectives. Pest control on federal (refuge) lands and waters also is authorized under the following legal mandates:

- National Wildlife Refuge System Administration Act of 1966, as amended (16 USC 668dd-668ee);
- Plant Protection Act of 2000 (7 USC 7701 *et seq*.);
- Noxious Weed Control and Eradication Act of 2004 (7 USC 7781-7786, Subtitle E);
- Federal Insecticide, Fungicide, and Rodenticide Act of 1996 (7 USC 136-136y);
- National Invasive Species Act of 1996 (16 USC 4701);
- Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (16 USC 4701);
- Food Quality Protection Act of 1996 (7 USC 136);
- Executive Order 13148, Section 601(a);
- Executive Order 13112; and
- Animal Damage Control Act of 1931 (7 USC 426-426c, 46 Stat. 1468).

Pests are defined as “living organisms that may interfere with the site-specific purposes, operations, or management objectives or that jeopardize human health or safety” from Department policy 517 DM 1 (Integrated Pest Management Policy). Similarly, 569 FW 1 defines pests as “invasive plants and introduced or native organisms that may interfere with achieving our management goals and objectives on or off our lands, or that jeopardize human health or safety.” 517 DM 1 also defines an invasive species as “a species that is non-native to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health.” Throughout the remainder of this CCP, the terms pest and invasive species are used interchangeably because both can prevent/impede achievement of refuge wildlife and habitat objectives and/or degrade environmental quality.

In general, control of pests (vertebrate or invertebrate) on the Refuge would conserve and protect the nation’s fish, wildlife, and plant resources as well as maintain environmental quality. From 569 FW 1, animal or plant species that are considered pests may be managed if the following criteria are met:

- Threat to human health and well being or private property, the acceptable level of damage by the pest has been exceeded, or State or local government has designated the pest as noxious;
- Detrimental to resource objectives as specified in a refuge resource management plan (e.g., comprehensive conservation plan, habitat management plan), if available; and
- Control would not conflict with attainment of resource objectives or the purposes for which the Refuge was established.

The specific justifications for pest management activities on the Refuge are the following:

- Protect human health and well being;
- Prevent substantial damage to important to refuge resources;
- Protect newly introduced or re-establish native species;

- Control non-native (exotic) species in order to support existence for populations of native species;
- Prevent damage to private property; and
- Provide the public with quality, compatible wildlife-dependent recreational opportunities.

In accordance with Service policy 620 FW 1 (Habitat Management Plans), there are additional management directives regarding invasive species found on the Refuge:

- "We are prohibited by Executive Order, law, and policy from authorizing, funding, or carrying out actions that are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere."
- "Manage invasive species to improve or stabilize biotic communities to minimize unacceptable change to ecosystem structure and function and prevent new and expanded infestations of invasive species. Conduct refuge habitat management activities to prevent, control, or eradicate invasive species."

Animal species damaging/destroying federal property and/or detrimental to the management program of a refuge may be controlled as described in 50 CFR 31.14 (Official Animal Control Operations). For example, the incidental removal of beaver damaging refuge infrastructure (e.g., clogging with subsequent damaging of water control structures) and/or negatively affecting habitats (e.g., removing woody species from existing or restored riparian) managed on refuge lands may be conducted without a pest control proposal. We recognize beavers are native species and most of their activities or refuge lands represent a natural process beneficial for maintaining wetland habitats. Exotic nutria, whose denning and burrowing activities in wetland dikes causes cave-ins and breaches, can be controlled using the most effective techniques considering site-specific factors without a pest control proposal. Along with the loss of quality wetland habitats associated with breaching of impoundments, the safety of refuge staff and public (e.g., auto tour routes) driving on structurally compromised levees and dikes can be threatened by sudden and unexpected cave-ins.

Trespass and feral animals also may be controlled on refuge lands. Based upon 50 CFR 28.43 (Destruction of Dogs and Cats), dogs and cats running at large on a national wildlife refuge and observed in the act of killing, injuring, harassing or molesting humans or wildlife may be disposed of in the interest of public safety and protection of the wildlife. Feral animals should be disposed by the most humane method(s) available and in accordance with relevant Service directives (including Executive Order 11643). Disposed wildlife specimens may be donated or loaned to public institutions. Donation or loans of resident wildlife species will only be made after securing State approval (50 CFR 30.11 [Donation and Loan of Wildlife Specimens]). Surplus wildlife specimens may be sold alive or butchered, dressed and processed subject to federal and state laws and regulations (50 CFR 30.12 [Sale of Wildlife Specimens]).

G.3 Strategies

To fully embrace IPM as identified in 569 FW 1, the following strategies, where applicable, would be carefully considered on the Refuge for each pest species.

G.3.1 Prevention

This would be the most effective and least expensive long-term management option for pests. It encompasses methods to prevent new introductions or the spread of the established pests to un-infested areas. It requires identifying potential routes of invasion to reduce the likelihood of infestation. Hazard Analysis and Critical Control Points (HACCP) planning can be used to determine if current management activities on a refuge may introduce and/or spread invasive species in order to identify appropriate BMPs for prevention. See http://www.haccp-nrm.org/ for more information about HACCP planning.

Prevention may include source reduction, using pathogen-free or weed-free seeds or fill; exclusion methods (e.g., barriers) and/or sanitation methods (e.g., wash stations) to prevent re-introductions by various mechanisms including vehicles, personnel, livestock, and horses. Because invasive species are frequently the first to establish newly disturbed sites, prevention would require a reporting mechanism for early detection of new pest occurrences with quick response to eliminate any new satellite pest populations. Prevention would require consideration of the scale and scope of land management activities that may promote pest establishment within un-infested areas or promote reproduction and spread of existing populations. Along with preventing initial introduction, prevention would involve halting the spread of existing infestations to new sites (Mullin et al. 2000). The primary reason for prevention would be to keep pest-free lands or waters from becoming infested. Executive Order 11312 emphasizes the priority for prevention with respect to managing pests.

The following would be methods to prevent the introduction and/or spread of pests on refuge lands:

- Before beginning ground-disturbing activities (e.g., disking, scraping), inventory and prioritize pest infestations in project operating areas and along access routes. Refuge staff would identify pest species on-site or within reasonably expected potential invasion vicinity. Where possible, the refuge staff would begin project activities in un-infested areas before working in pest-infested areas.
- The refuge staff would locate and use pest-free project staging areas. They would avoid or minimize travel through pest-infested areas, or restrict to those periods when spread of seed or propagules of invasive plants would be least likely.
- The refuge staff would determine the need for, and when appropriate, identify sanitation sites where equipment can be cleaned of pests. Where possible, the refuge staff would clean equipment before entering lands at on-refuge approved cleaning site(s). This practice does not pertain to vehicles traveling frequently in and out of the project area that will remain on roadways. Seeds and plant parts of pest plants would need to be collected, where practical. The refuge staff would remove mud, dirt, and plant parts from project equipment before moving it into a project area.
- The refuge staff would clean all equipment, before leaving the project site, if operating in areas infested with pests. The refuge staff would determine the need for, and when appropriate, identify sanitation sites where equipment can be cleaned.
- Refuge staff, their authorized agents, and refuge volunteers would, where possible, inspect, remove, and properly dispose of seed and parts of invasive plants found on their clothing and equipment. Proper disposal means bagging the seeds and plant parts and then properly discarding of them (e.g., incinerating).

- The refuge staff would evaluate options, including closure, to restrict the traffic on sites with on-going restoration of desired vegetation. The refuge staff would revegetate disturbed soil (except travel ways on surfaced projects) to optimize plant establishment for each specific site. Revegetation may include topsoil replacement, planting, seeding, fertilization, liming, and weed-free mulching as necessary. The refuge staff would use native material, where appropriate and feasible. The refuge staff would use certified weed-free or weed-seed-free hay or straw where certified materials are reasonably available.
- The refuge staff would provide information, training, and appropriate pest identification materials to permit holders and recreational visitors. The refuge staff would educate them about pest identification, biology, impacts, and effective prevention measures.
- The refuge staff would require grazing permittees to utilize preventative measures for their livestock while on refuge lands.
- The refuge staff would inspect borrow material for invasive plants prior to use and transport onto and/or within refuge lands.
- The refuge staff would consider invasive plants in planning for road maintenance activities.
- The refuge staff would restrict off-road travel to designated routes.

The following would be methods to prevent the introduction and/or spread of pests into refuge waters:

- The refuge staff would inspect boats (including air boats), trailers, and other boating equipment. Where possible, the refuge staff would remove any visible plants, animals, or mud before leaving any waters or boat launching facilities. Where possible, the refuge staff would drain water from motor, live well, bilge, and transom wells while on land before leaving the site. If possible, the refuge staff would wash and dry boats, downriggers, anchors, nets, floors of boats, propellers, axles, trailers, and other boating equipment to kill pests not visible at the boat launch.
- Where feasible, the refuge staff would maintain a 100-foot buffer of aquatic pest-free clearance around boat launches and docks or quarantine areas when cleaning around culverts, canals, or irrigation sites. Where possible, the refuge staff would inspect and clean equipment before moving to new sites or one project area to another.

These prevention methods to minimize/eliminate the introduction and/or spread of pests were taken verbatim or slightly modified from Appendix E of the U.S. Forest Service's *Preventing and Managing Invasive Plants Final Environmental Impact Statement* (2005).

G.3.2 Mechanical/Physical Methods

These methods would remove and destroy, disrupt the growth of, or interfere with the reproduction of pest species. For plants species, these treatments can be accomplished by hand, hand tool (manual), or power tools (mechanical) and include pulling, grubbing, digging, tilling/disking, cutting, swathing, grinding, shearing, girdling, mowing, and mulching of the pest plants.

For animal species, Service employees or their authorized agents could use mechanical/physical methods (including trapping) to control pests as a refuge management activity. Based upon 50 CFR 31.2, trapping can be used on a refuge to reduce surplus wildlife populations for a "balanced conservation program" in accordance with federal or state laws and regulations. In some cases, non-lethally trapped animals would be relocated to off-refuge sites with prior approval from the state.

Each of these tools would be efficacious to some degree and applicable to specific situations. In general, mechanical controls can effectively control annual and biennial pest plants. However, to control perennial plants, the root system has to be destroyed or it would resprout and continue to grow and develop. Mechanical controls are typically not capable of destroying a perennial plant's root system. Although some mechanical tools (e.g., disking, plowing) may damage root systems, they may stimulate regrowth producing a denser plant population that may aid in the spread depending upon the target species (e.g., Canada thistle). In addition, steep terrain and soil conditions would be major factors that can limit the use of many mechanical control methods.

Some mechanical control methods (e.g., mowing), which would be used in combination with herbicides, can be a very effective technique to control perennial species. For example, mowing perennial plants followed sequentially by treating the plant regrowth with a systemic herbicide often would improve the efficacy of the herbicide compared to herbicide treatment only.

G.3.3 Cultural Methods

These methods would involve manipulating habitat to increase pest mortality by reducing its suitability to the pest. Cultural methods would include water-level manipulation, mulching, winter cover crops, changing planting dates to minimize pest impact, prescribed burning (facilitate revegetation, increase herbicide efficacy, and remove litter to assist in emergence of desirable species), flaming with propane torches, trap crops, crop rotations that would include non-susceptible crops, moisture management, addition of beneficial insect habitat, reducing clutter, proper trash disposal, planting or seeding desirable species to shade or out-compete invasive plants, applying fertilizer to enhance desirable vegetation, prescriptive grazing, and other habitat alterations.

G.3.4 Biological Control Agents

Classical biological control would involve the deliberate introduction and management of natural enemies (parasites, predators, or pathogens) to reduce pest populations. Many of the most ecologically or economically damaging pest species in the United States originated in foreign countries. These newly introduced pests, which are free from natural enemies found in their country or region of origin, may have a competitive advantage over cultivated and native species. This competitive advantage often allows introduced species to flourish, and they may cause widespread economic damage to crops or out compete and displace native vegetation. Once the introduced pest species population reaches a certain level, traditional methods of pest management may be cost prohibitive or impractical. Biological controls typically are used when these pest populations have become so widespread that eradication or effective control would be difficult or no longer practical.

Biological control has advantages as well as disadvantages. Benefits would include reducing pesticide usage, host specificity for target pests, long-term self-perpetuating control, low cost/acre, capacity for searching and locating hosts, synchronizing biological control agents to hosts' life cycles, and the unlikelihood that hosts will develop resistance to agents. Disadvantages would include the following: limited availability of agents from their native lands, the dependence of control on target species density, slow rate at which control occurs, biotype matching, the difficulty and expense of conflicts over control of the target pest, and host specificity when host populations are low.

A reduction in target species populations from biological controls is typically a slow process, and efficacy can be highly variable. It may not work well in a particular area although it does work well in other areas. Biological control agents would require specific environmental conditions to survive over time. Some of these conditions are understood; whereas, others are only partially understood or not at all.

Biological control agents would not eradicate a target pest. When using biological control agents, residual levels of the target pest typically are expected; the agent population level or survival would be dependent upon the density of its host. After the pest population decreases, the population of the biological control agent would decrease correspondingly. This is a natural cycle. Some pest populations (e.g., invasive plants) would tend to persist for several years after a biological control agent becomes established due to seed reserves in the soil, inefficiencies in the agents search behavior, and the natural lag in population buildup of the agent.

The full range of pest groups potentially found on refuge lands and waters would include diseases, invertebrates (insects, mollusks), vertebrates, and invasive plants (the most common group). Often it is assumed that biological control would address many if not most of these pest problems. There are several well-documented success stories of biological control of invasive weed species in the Pacific Northwest including Mediterranean sage, St. Johnswort (Klamath weed) and tansy ragwort. Emerging success stories include Dalmatian toadflax, diffuse knapweed, leafy spurge, purple loosestrife, and yellow star thistle. However, historically, each new introduction of a biological control agent in the United States has only about a 30% success rate (Coombs et al. 2004). Refer to Coombs et al. (2004) for the status of biological control agents for invasive plants in the Pacific Northwest.

Introduced species without desirable close relatives in the United States would generally be selected as biological controls. Natural enemies that are restricted to one or a few closely related plants in their country of origin are targeted as biological controls (Center et al. 1997, Hasan and Ayres 1990).

The refuge staff would ensure introduced agents are approved by the applicable authorities. Except for a small number of formulated biological control products registered by USEPA under FIFRA, most biological control agents are regulated by the U.S. Department of Agriculture (USDA)-Animal Plant Health Inspection Service, Plant Protection and Quarantine (APHIS-PPQ). State departments of agriculture and, in some cases, county agricultural commissioners or weed districts, have additional approval authority.

Federal permits (USDA-APHIS-PPQ Form 526) are required to import biocontrols agents from another state. Form 526 may be obtained by writing:

USDA-APHIS-PPQ
Biological Assessment and Taxonomic Support
4700 River Road, Unit 113
Riverdale, MD 20737

Or through the internet at:

http://www.aphis.usda.gov/ppq/permits/bioligical/weedbio.html

The Service strongly supports the development, and legal and responsible use of appropriate, safe, and effective biological control agents for nuisance and non-indigenous or pest species.

State and county agriculture departments may also be sources for biological control agents or they may have information about where biological control agents may be obtained. Commercial sources should have an Application and Permit to Move Live Plant Pests and Noxious Weeds (USDA-PPQ Form 226 USDA-APHIS-PPQ, Biological Assessment and Taxonomic Support, 4700 River Road, Unit 113, Riverdale, MD 20737) to release specific biological control agents in a state and/or county. Furthermore, certification regarding the biological control agent's identity (genus, specific epithet, sub-species and variety) and purity (e.g., parasite free, pathogen free, and biotic and abiotic contaminants) should be specified in purchase orders.

Biological control agents are subject to 7 RM 8 (Exotic Species Introduction and Management). In addition, the refuge staff would follow the International Code of Best Practice for Classical Biological Control of Weeds (http://sric.ucdavis.edu/exotic/exotic.htm) as ratified by delegates to the X International Symposium on Biological Control of Weeds, Bozeman, MT, July 9, 1999. This code identifies the following:

- Release only approved biological control agents,
- Use the most effective agents,
- Document releases, and
- Monitor for impact to the target pest species, non-target species, and the environment.

Biological control agents formulated as pesticide products and registered by the USEPA (e.g., *Bti*) are also subject to PUP review and approval (see below).

A record of all releases would be maintained with date(s), location(s), and environmental conditions of the release site(s); the identity, quantity, and condition of the biological control agents released; and other relevant data and comments such as weather conditions. Systematic monitoring to determine the establishment and effectiveness of the release is also recommended.

NEPA documents regarding biological and other environmental effects of biological control agents prepared by another federal agency, where the scope is relevant to evaluation of releases on refuge lands, would be reviewed. Possible source agencies for such NEPA documents include the Bureau of Land Management, U.S. Forest Service, National Park Service, U.S. Department of Agriculture-Animal and Plant Health Inspection Service, and the military services. It might be appropriate to incorporate by reference parts or all of existing document(s) from the review. Incorporating by reference (43 CFR 46.135) is a technique used to avoid redundancies in analysis. It also can reduce the bulk of a Service NEPA document, which only must identify the documents that are incorporated by reference. In addition, relevant portions must be summarized in the Service NEPA document to the extent necessary to provide the decision maker and public with an understanding of relevance of the referenced material to the current analysis.

G.3.5 Pesticides

The selective use of pesticides would be based upon pest ecology (including mode of reproduction), the size and distribution of its populations, site-specific conditions (e.g., soils, topography), known efficacy under similar site conditions, and the capability to utilize best management practices (BMPs) to reduce/eliminate potential effects to non-target species, sensitive habitats, and potential to contaminate surface and groundwater. All pesticide usage (pesticide, target species, application rate, and method of application) would comply with the applicable federal (FIFRA) and state regulations pertaining to pesticide use, safety, storage, disposal, and reporting. Before pesticides can be used to eradicate, control, or contain pests on refuge lands and waters, pesticide use proposals (PUPs) would be prepared and approved in accordance with 569 FW 1. PUP records would provide a detailed, time-, site-, and target-specific description of the proposed use of pesticides on the Refuge. All PUPs would be created, approved or disapproved, and stored in the Pesticide Use Proposal System (PUPS), which is a centralized database only accessible on the Service's intranet (https://systems.fws.gov/pups). Only Service employees would be authorized to access PUP records for a refuge in this database.

Application equipment would be selected to provide site-specific delivery to target pests while minimizing/eliminating direct or indirect (e.g., drift) exposure to non-target areas and degradation of surface and groundwater quality. Where possible, target-specific equipment (e.g., backpack sprayer, wiper) would be used to treat target pests. Other target-specific equipment to apply pesticides would include soaked wicks or paint brushes for wiping vegetation and lances, hatchets, or syringes for direct injection into stems. Granular pesticides may be applied using seeders or other specialized dispensers. In contrast, aerial spraying (e.g., fixed wing or helicopter) would only be used where access is difficult (remoteness) and/or the size/distribution of infestations precludes practical use of ground-based methods.

Because repeated use of one pesticide may allow resistant organisms to survive and reproduce, multiple pesticides with variable modes of action would be considered for treatments on refuge lands and waters. This is especially important if multiple applications within years and/or over a growing season likely would be necessary for habitat maintenance and restoration activities to achieve resource objectives. Integrated chemical and non-chemical controls also are highly effective, where practical, because pesticide-resistant organisms can be removed from the site.

Cost may not be the primary factor in selecting a pesticide for use on a refuge. If the least expensive pesticide would potentially harm natural resources or people, then a different product would be selected, if available. The most efficacious pesticide available with the least potential to degrade environment quality (soils, surface water, and groundwater) as well as least potential effect to native species and communities of fish, wildlife, plants, and their habitats would be acceptable for use on refuge lands in the context of an IPM approach.

G.3.6 Habitat Restoration/Maintenance

Restoration and/or proper maintenance of refuge habitats associated with achieving wildlife and habitat objectives would be essential for long-term prevention, eradication, or control (at or below threshold levels) of pests. Promoting desirable plant communities through the manipulation of species composition, plant density, and growth rate is an essential component of invasive plant management (Masters et al. 1996, Masters and Sheley 2001, Brooks et al. 2004). The following three components of succession could be manipulated through habitat maintenance and restoration: site availability, species availability, and species performance (Cox and Anderson 2004). Although a single method (e.g., herbicide treatment) may eliminate or suppress pest species in the short term, the resulting gaps and bare soil create niches that are conducive to further invasion by the species and/or other invasive plants. On degraded sites where desirable species are absent or in low abundance, revegetation with native/desirable grasses, forbs, and legumes may be necessary to direct and accelerate plant community recovery, and achieve site-specific objectives in a reasonable time frame. The selection of appropriate species for revegetation would be dependent on a number of factors including resource objectives and site-specific, abiotic factors (e.g., soil texture, precipitation/temperature regimes, and shade conditions). Seed availability and cost, ease of establishment, seed production, and competitive ability also would be important considerations.

G.4 Priorities for Treatments

For many refuges, the magnitude (number, distribution, and sizes of infestations) of pest problems is too extensive and beyond the available capital resources to effectively address during any single field season. To manage pests in the Refuge, it would be essential to prioritize treatment of infestations. Highest priority treatments would be focused on early detection and rapid response to eliminate infestations of new pests, if possible. This would be especially important for aggressive pests potentially impacting species, species groups, communities, and/or habitats associated refuge purpose(s), NWRS resources of concern (federally listed species, migratory birds, selected marine mammals, and interjurisdictional fish), and native species for maintaining/restoring biological integrity, diversity, and environmental health.

The next priority would be treating established pests that appear in one or more previously un-infested areas. Moody and Mack (1988) demonstrated through modeling that small, new outbreaks of invasive plants eventually would infest an area larger than the established, source population. They also found that control efforts focusing on the large, main infestation rather than the new, small satellites reduced the chances of overall success. The lowest priority would be treating large infestations (sometimes monotypic stands) of well-established pests. In this case, initial efforts would focus upon containment of the perimeter followed by work to control/eradicate the established infested area. If containment and/or control of a large infestation is not effective, then efforts would focus upon halting pest reproduction or managing source populations. Maxwell et al. (2009) found treating fewer populations that are sources represents an effective long-term strategy to reduce of total number of invasive populations and decreasing meta-population growth rates.

Although state-listed noxious weeds would always be of high priority for management, other pest species known to cause substantial ecological impact would also be considered. For example, cheatgrass may not be listed by a state as noxious, but it can greatly alter fire regimes in shrub steppe habitats resulting in large monotypic stands that displace native bunch grasses, forbs, and shrubs. Pest control would likely require a multi-year commitment from the refuge staff. Essential to the long-term success of pest management would be pre- and post-treatment monitoring, assessment of the successes and failures of treatments, and development of new approaches when proposed methods do not achieve desired outcomes.

G.5 Best Management Practices (BMPs)

BMPs can minimize or eliminate possible effects associated with pesticide usage to non-target species and/or sensitive habitats as well as degradation of water quality from drift, surface runoff, or leaching. Based upon the Department of Interior Pesticide Use Policy (517 DM 1) and the Service Integrated Pest Management policy (569 FW 1), the use of applicable BMPs (where feasible) also would likely ensure that pesticide uses may not adversely affect federally listed species and/or their critical habitats through determinations made using the process described in 50 CFR part 402.

The following are BMPs pertaining to mixing/handling and applying pesticides for all ground-based treatments of pesticides, which would be considered and utilized, where feasible, based upon target- and site-specific factors and time-specific environmental conditions. Although not listed below, the most important BMP to eliminate/reduce potential impacts to non-target resources would be an IPM approach to prevent, control, eradicate, and contain pests.

G.5.1 Pesticide Handling and Mixing

- As a precaution against spilling, spray tanks would not be left unattended during filling.
- All pesticide containers would be triple rinsed and the rinsate would be used as water in the sprayer tank and applied to treatment areas.
- All pesticide spray equipment would be properly cleaned. Where possible, rinsate would be used as part of the make-up water in the sprayer tank and applied to treatment areas.
- The refuge staff would triple rinse and recycle (where feasible) pesticide containers.
- All unused pesticides would be properly discarded at a local "safe send" collection.
- Pesticides and pesticide containers would be lawfully stored, handled, and disposed of in accordance with the label and in a manner safeguarding human health, fish, and wildlife and prevent soil and water contaminant.
- The refuge staff would consider the water quality parameters (e.g., pH, hardness) that are important to ensure greatest efficacy where specified on the pesticide label.
- All pesticide spills would be addressed immediately using procedures identified in the refuge spill response plan.

G.5.2 Applying Pesticides

- Pesticide treatments would only be conducted by or under the supervision of Service personnel and non-Service applicators with the appropriate state or BLM certification to safely and effectively conduct these activities on refuge lands and waters.
- The refuge staff would comply with all federal, state, and local pesticide use laws and regulations as well as Departmental, Service, and NWRS pesticide-related policies. For example, the refuge staff would use application equipment and apply rates for the specific pest(s) identified on the pesticide label as required under FIFRA.
- Before each treatment season and prior to mixing or applying any product for the first time each season, all applicators would review the labels, MSDSs, and Pesticide Use Proposal (PUPs) for each pesticide, determining the target pest, appropriate mix rate(s), PPE, and other requirements listed on the pesticide label.
- A 1-foot no-spray buffer from the water's edge would be used, where applicable and where it does not detrimentally influence effective control of pest species.
- Use low-impact herbicide application techniques (e.g., spot treatment, cut stump, oil basal, Thinvert system applications) rather than broadcast foliar applications (e.g., boom sprayer, other larger tank wand applications), where practical.
- Use low-volume rather than high-volume foliar applications where low-impact methods above are not feasible or practical, to maximize herbicide effectiveness and ensure correct and uniform application rates.
- Applicators would use and adjust spray equipment to apply the coarsest droplet size spectrum with optimal coverage of the target species while reducing drift.
- Applicators would use the largest droplet size that results in uniform coverage.
- Applicators would use drift reduction technologies such as low-drift nozzles, where possible.
- Where possible, spraying would occur during low (average<7 mph and preferably 3 to 5 mph) and consistent direction wind conditions with moderate temperatures (typically <85°F).

- Where possible, applicators would avoid spraying during inversion conditions (often associated with calm and very low wind conditions) that can cause large-scale herbicide drift to non-target areas.
- Equipment would be calibrated regularly to ensure that the proper rate of pesticide is applied to the target area or species.
- Spray applications would be made at the lowest height for uniform coverage of target pests to minimize/eliminate potential drift.
- If windy conditions frequently occur during afternoons, spraying (especially boom treatments) would typically be conducted during early morning hours.
- Spray applications would not be conducted on days with >30% forecast for rain within 6 hours, except for pesticides that are rapidly rain fast (e.g., glyphosate in 1 hour) to minimize/eliminate potential runoff.
- Where possible, applicators would use drift retardant adjuvants during spray applications, especially adjacent to sensitive areas.
- Where possible, applicators would use a non-toxic dye to aid in identifying target area treated as well as potential over spray or drift. A dye can also aid in detecting equipment leaks. If a leak is discovered, the application would be stopped until repairs can be made to the sprayer.
- For pesticide uses associated with cropland and facilities management, buffers, as appropriate, would be used to protect sensitive habitats, especially wetlands and other aquatic habitats.
- When drift cannot be sufficiently reduced through altering equipment set up and application techniques, buffer zones may be identified to protect sensitive areas downwind of applications. The refuge staff would only apply adjacent to sensitive areas when the wind is blowing the opposite direction.
- Applicators would utilize scouting for early detection of pests to eliminate unnecessary pesticide applications.
- The refuge staff would consider timing of application so native plants are protected (e.g., senescence) while effectively treating invasive plants.
- Rinsate from cleaning spray equipment after application would be recaptured and reused or applied to an appropriate pest plant infestation.
- Application equipment (e.g., sprayer, ATV, tractor) would be thoroughly cleaned and PPE would be removed/disposed of on-site by applicators after treatments to eliminate the potential spread of pests to un-infested areas.
- Cleaning boots (or use rubber boots to aid in sanitation) and brush off clothing in a place where monitoring is feasible to control for new seed transportation.

G.6 Safety

G.6.1 Personal Protective Equipment

All applicators would wear the specific personal protective equipment (PPE) identified on the pesticide label. The appropriate PPE would be worn at all times during handling, mixing, and applying. PPE can include the following: disposable (e.g., Tyvek) or laundered coveralls; gloves (latex, rubber, or nitrile); rubber boots; and/or an NIOSH-approved respirator. Because exposure to concentrated product is usually greatest during mixing, extra care should be taken while preparing pesticide solutions. Persons mixing these solutions can be best protected if they wear long gloves, an apron, footwear, and a face shield.

Coveralls and other protective clothing used during an application would be laundered separately from other laundry items. Transporting, storing, handling, mixing and disposing of pesticide containers would be consistent with label requirements, USEPA and OSHA requirements, and Service policy.

If a respirator is necessary for a pesticide use, then the following requirements would be met in accordance with Service safety policy: a written Respirator Program, fit testing, physical examination (including pulmonary function and blood work for contaminants), and proper storage of the respirator.

G.6.2 Notification

The restricted entry interval (REI) is the time period required after the application at which point someone may safely enter a treated area without PPE. Refuge staff, authorized management agents of the Service, volunteers, and members of the public who could be in or near a pesticide treated area within the stated re-entry time period on the label would be notified about treatment areas. Posting would occur at any site where individuals might inadvertently become exposed to a pesticide during other activities on the Refuge. Where required by the label and/or state-specific regulations, sites would also be posted on its perimeter and at other likely locations of entry. The refuge staff would also notify appropriate private property owners of an intended application, including any private individuals who have requested notification. Special efforts would be made to contact nearby individuals who are beekeepers or who have expressed chemical sensitivities.

G.6.3 Medical Surveillance

Medical surveillance may be required for Service personnel and approved volunteers who mix, apply, and/or monitor use of pesticides (see 242 FW 7 [Pesticide Users] and 242 FW 4 [Medical Surveillance]). In accordance with 242 FW 7.12A, Service personnel would be medically monitoring if one or more of the following criteria is met: exposed or may be exposed to concentrations at or above the published permissible exposure limits or threshold limit values (see 242 FW 4); use pesticides in a manner considered "frequent pesticide use"; or use pesticides in a manner that requires a respirator (see 242 FW 14 for respirator use requirements). In 242 FW 7.7A, "**Frequent Pesticide Use** means when a person applying pesticide handles, mixes, or applies pesticides, with a Health Hazard rating of 3 or higher, for 8 or more hours in any week or 16 or more hours in any 30-day period." Under some circumstances, individuals may be medically monitored who use pesticides infrequently (see Section G.7.7), experience an acute exposure (sudden, short-term), or use pesticides with a health hazard ranking of 1 or 2. This decision would consider the individual's health and fitness level, the pesticide's specific health risks, and the potential risks from other pesticide-related activities. Refuge cooperators (e.g., cooperative farmers) and other authorized agents (e.g., state and county employees) would be responsible for their own medical monitoring needs and costs.

Standard examinations (at refuge expense) of appropriate refuge staff would be provided by the nearest certified occupational health and safety physician as determined by Federal Occupational Health.

G.6.4 Certification and Supervision of Pesticide Applicators

Appropriate refuge staff or approved volunteers handling, mixing, and/or applying or directly supervising others engaged in pesticide use activities would be trained and state or federally (BLM) licensed to apply pesticides to refuge lands or waters. In accordance with 242 FW 7.18A and 569 FW 1.10B, certification is required to apply restricted use pesticides based upon USEPA regulations. For safety reasons, all individuals participating in pest management activities with general use pesticides also are encouraged to attend appropriate training or acquire pesticide applicator certification. The certification requirement would be for a commercial or private applicator depending upon the state. New staff unfamiliar with proper procedures for storing, mixing, handling, applying, and disposing of herbicides and containers would receive orientation and training before handling or using any products. Documentation of training would be kept in the files at the refuge office.

G.6.5 Record Keeping

Labels and Material Safety Data Sheets

Pesticide labels and material safety data sheets (MSDSs) would be maintained at the refuge shop and laminated copies in the mixing area. These documents also would be carried by field applicators, where possible. A written reference (e.g., note pad, chalk board, dry erase board) for each tank to be mixed would be kept in the mixing area for quick reference while mixing is in progress. In addition, approved PUPs stored in the PUPS database typically contain website links (URLs) to pesticide labels and MSDSs.

Pesticide Use Proposals (PUPs)

A PUP would be prepared for each proposed pesticide use associated with annual pest management on refuge lands and waters. A PUP would include specific information about the proposed pesticide use including the common and chemical names of the pesticide(s), target pest species, size and location of treatment site(s), application rate(s) and method(s), and federally listed species determinations, where applicable.

In accordance with Service guidelines (Director's memo [December 12, 2007]), refuge staff may receive up to five-year approvals for Washington Office and field reviewed proposed pesticide uses based upon meeting identified criteria including an approved IPM plan, where necessary (see http://www.fws.gov/contaminants/Issues/IPM.cfm). For a refuge, an IPM plan (requirements described herein) can be completed independently or in association with a CCP or a habitat management plant (HMP) if IPM strategies and potential environmental effects are adequately addressed within appropriate NEPA documentation.

PUPs would be created, approved or disapproved, and stored as records in the Pesticide Use Proposal System (PUPS), which is centralized database on the Service's intranet (https://systems.fws.gov/pups). Only Service employees can access PUP records in this database.

Pesticide Usage

In accordance with 569 FW 1, the refuge project leader would be required to maintain records of all pesticides annually applied on lands or waters under refuge jurisdiction. This would encompass pesticides applied by other federal agencies, state and county governments, non-government applicators including cooperators and their pest management service providers with Service permission. For clarification, pesticide means all insecticides, insect and plant growth regulators, desiccants, herbicides, fungicides, rodenticides, acaricides, nematicides, fumigants, avicides, and piscicides.

The following usage information can be reported for approved PUPs in the PUPS database:

- Pesticide trade name(s)
- Active ingredient(s)
- Total acres treated
- Total amount of pesticides used (lbs. or gallons)
- Total amount of active ingredient(s) used (lbs.)
- Target pest(s)
- Efficacy (% control)

To determine whether treatments are efficacious (eradicating, controlling, or containing the target pest) and achieving resource objectives, habitat and/or wildlife response would be monitored both pre- and post-treatment, where possible. Considering available annual funding and staffing, appropriate monitoring data regarding characteristics (attributes) of pest infestations (e.g., area, perimeter, degree of infestation-density, % cover, density) as well as habitat and/or wildlife response to treatments may be collected and stored in a relational database (e.g., Refuge Habitat Management Database), preferably a geo-referenced data management system (e.g., Refuge Lands GIS) to facilitate data analyses and subsequent reporting. In accordance with adaptive management, data analysis and interpretation would allow treatments to be modified or changed over time, as necessary, to achieve resource objectives considering site-specific conditions in conjunction with habitat and/or wildlife responses. Monitoring could also identify short- and long-term impacts to natural resources and environmental quality associated with IPM treatments in accordance with adaptive management principles identified in 43 CFR 46.145.

G.7 Evaluating Pesticide Use Proposals

Pesticides would only be used on refuge lands for habitat management as well as croplands/facilities maintenance after approval of a PUP. In general, proposed pesticide uses on refuge lands would only be approved where there would likely be minor, temporary, or localized effects to fish and wildlife species as well as minimal potential to degrade environmental quality. Potential effects to listed and non-listed species would be evaluated with quantitative ecological risk assessments and other screening measures. Potential effects to environmental quality would be based upon pesticide characteristics of environmental fate (water solubility, soil mobility, soil persistence, and volatilization) and other quantitative screening tools. Ecological risk assessments as well as characteristics of environmental fate and potential to degrade environmental quality for pesticides would be documented in Chemical Profiles (see Section G.7.5). These profiles would include threshold values for quantitative measures of ecological risk assessments and screening tools for environmental fate that represent minimal potential effects to species and environmental quality. In general, only pesticide uses with appropriate BMPs (see Section G.4) for habitat management and cropland/facilities maintenance on refuge lands that would potentially have minor, temporary, or localized effects on refuge biological and environmental quality (threshold values not exceeded) would be approved.

G.7.1 Overview of Ecological Risk Assessment

An ecological risk assessment process would be used to evaluate potential adverse effects to biological resources as a result of a pesticide(s) proposed for use on refuge lands. It is an established quantitative and qualitative methodology for comparing and prioritizing risks of pesticides and conveying an estimate of the potential risk for an adverse effect. This quantitative methodology provides an efficient mechanism to integrate best available scientific information regarding hazard, patterns of use (exposure), and dose-response relationships in a manner that is useful for ecological risk decision-making. It would provide an effective way to evaluate potential effects where there is missing or unavailable scientific information (data gaps) to address reasonable, foreseeable adverse effects in the field as required under 40 CFR Part 1502.22. Protocols for ecological risk assessment of pesticide uses the Refuge were developed through research and established by the U.S. Environmental Protection Agency (2004). Assumptions for these risk assessments are presented in Section G.7.2, under Aquatic Exposure.

The toxicological data used in ecological risk assessments are typically results of standardized laboratory studies provided by pesticide registrants to the USEPA to meet regulatory requirements under FIFRA. These studies assess the acute (lethality) and chronic (reproductive) effects associated with short- and long-term exposure to pesticides on representative species of birds, mammals, freshwater fish, aquatic invertebrates, and terrestrial and aquatic plants. Other effects data publicly available would also be utilized for risk assessment protocols described herein. Toxicity endpoint and environmental fate data are available from a variety of resources. Some of the more useful resources can be found in Section G.7.5.

Table G-1. Ecotoxicity Tests Used to Evaluate Potential Effects to Birds, Fish, and Mammals to Establish Toxicity Endpoints for Risk Quotient Calculations

Species Group	Exposure	Measurement Endpoint
Bird	Acute	Median Lethal Concentration (LC_{50})
	Chronic	No Observed Effect Concentration (NOEC) or No Observed Adverse Effect Concentration (NOAEC)[1]
Fish	Acute	Median Lethal Concentration (LC_{50})
	Chronic	No Observed Effect Concentration (NOEC) or No Observed Adverse Effect Concentration (NOAEC)[2]
Mammal	Acute	Oral Lethal Dose (LD_{50})
	Chronic	No Observed Effect Concentration (NOEC) or No Observed Adverse Effect Concentration (NOAEC)[3]

[1]Measurement endpoints typically include a variety of reproductive parameters (e.g., number of eggs, number of offspring, eggshell thickness, and number of cracked eggs).
[2]Measurement endpoints for early life stage/life cycle typically include embryo hatch rates, time to hatch, growth, and time to swim-up.
[3]Measurement endpoints include maternal toxicity, teratogenic effects or developmental anomalies, evidence of mutagenicity or genotoxicity, and interference with cellular mechanisms such as DNA synthesis and DNA repair.

G.7.2 Determining Ecological Risk to Fish and Wildlife

The potential for pesticides used on the Refuge to cause direct adverse effects to fish and wildlife would be evaluated using USEPA's Ecological Risk Assessment Process (USEPA 2004). This deterministic approach, which is based upon a two-phase process involving estimation of environmental concentrations and then characterization of risk, would be used for ecological risk assessments. This method integrates exposure estimates (estimated environmental concentration

[EEC] and toxicological endpoints [e.g., LC_{50} and oral LD_{50}]) to evaluate the potential for adverse effects to species groups (birds, mammals, and fish) representative of legal mandates for managing units of the NWRS. This integration is achieved through risk quotients (RQs) calculated by dividing the EEC by acute and chronic toxicity values selected from standardized toxicological endpoints or published effect (Table G-1).

$$RQ = EEC/Toxicological\ Endpoint$$

The level of risk associated with direct effects of pesticide use would be characterized by comparing calculated RQs to the appropriate Level of Concern (LOC) established by USEPA (1998 [Table G-2]). The LOC represents a quantitative threshold value for screening potential adverse effects to fish and wildlife resources associated with pesticide use. The following are four exposure-species group scenarios that would be used to characterize ecological risk to fish and wildlife on the Refuge: acute-listed species, acute-nonlisted species, chronic-listed species, and chronic-nonlisted species.

Acute risk would indicate the potential for mortality associated with short-term dietary exposure to pesticides immediately after an application. For characterization of acute risks, median values from LC_{50} and LD_{50} tests would be used as toxicological endpoints for RQ calculations. In contrast, chronic risks would indicate the potential for adverse effects associated with long-term dietary exposure to pesticides from a single application or multiple applications over time (within a season and over years). For characterization of chronic risks, the no observed concentration (NOAEC) or no observed effect concentration (NOEC) for reproduction would be used as toxicological endpoints for RQ calculations. Where available, the NOAEC would be preferred over a NOEC value.

Listed species are those federally designated as threatened, endangered, or proposed in accordance with the Endangered Species Act of 1973 (16 USC 1531-1544, 87 Stat. 884, as amended-Public Law 93-205). For listed species, potential adverse effects would be assessed at the individual level because loss of individuals from a population could detrimentally impact a species. In contrast, risks to nonlisted species would consider effects at the population level. A RQ<LOC would indicate the proposed pesticide use “may affect, not likely to adversely affect” individuals (listed species) and it would not pose an unacceptable risk for adverse effects to populations (non-listed species) for each taxonomic group (Table G-2). In contrast, an RQ>LOC would indicate a “may affect, likely to adversely affect” for listed species and it would also pose unacceptable ecological risk for adverse effects to nonlisted species.

Table G-2. Presumption of Unacceptable Risk for Birds, Fish, and Mammals (USEPA 1998)

Risk Presumption		Level of Concern	
		Listed Species	Non-listed Species
Acute	Birds	0.1	0.5
	Fish	0.05	0.5
	Mammals	0.1	0.5
Chronic	Birds	1.0	1.0
	Fish	1.0	1.0
	Mammals	1.0	1.0

Environmental Exposure

Following release into the environment through application, pesticides would experience several different routes of environmental fate. Pesticides which would be sprayed can move through the air (e.g., particle or vapor drift) and may eventually end up in other parts of the environment such as non-target vegetation, soil, or water. Pesticides applied directly to the soil may be washed off the soil into nearby bodies of surface water (e.g., surface runoff) or may percolate through the soil to lower soil layers and groundwater (e.g., leaching) (Baker and Miller 1999, Pope et al. 1999, Butler et al. 1998, Ramsay et al. 1995, EXTOXNET 1993). Pesticides which would be injected into the soil may also be subject to the latter two fates. The aforementioned possibilities are by no means complete, but it does indicate movement of pesticides in the environment is very complex with transfers occurring continually among different environmental compartments. In some cases, these exchanges occur not only between areas that are close together, but it also may involve transportation of pesticides over long distances (Barry 2004, Woods 2004).

Terrestrial Exposure

The ECC for exposure to terrestrial wildlife would be quantified using an USEPA screening-level approach (USEPA 2004). This screening-level approach is not affected by product formulation because it evaluates pesticide active ingredient(s). This approach would vary depending upon the proposed pesticide application method: spray or granular.

Terrestrial-spray application

For spray applications, exposure would be determined using the Kanaga nomogram method (USEPA 2004, USEPA 2012, Pfleeger et al. 1996) through the USEPA's Terrestrial Residue Exposure model (T-REX) version 1.2.3 (USEPA 2005). To estimate the maximum (initial) pesticide residue on short grass (<20 cm tall) as a general food item category for terrestrial vertebrate species, T-REX input variables would include the following from the pesticide label: maximum pesticide application rate (pounds active ingredient [acid equivalent]/acre) and pesticide half-life (days) in soil. Although there are other food item categories (tall grasses; broadleaf plants and small insects; and fruits, pods, seeds and large insects), short grass was selected because it would yield maximum EECs (240 ppm per lb. ai/acre) for worst-case risk assessments. Short grass is not representative of forage for carnivorous species (e.g., raptors), but it would characterize the maximum potential exposure through the diet of avian and mammalian prey items. Consequently, this approach would provide a conservative screening tool for pesticides that do not biomagnify.

For RQ calculations in T-REX, the model would require the weight of surrogate species and Mineau scaling factors (Mineau et al. 1996). Body weights of bobwhite quail and mallard are included in T-REX by default, but body weights of other organisms (Table G-3) would be entered manually. The Mineau scaling factor accounts for small-bodied bird species that may be more sensitive to pesticide exposure than would be predicted only by body weight. Mineau scaling factors would be entered manually with values ranging from 1 to 1.55 that are unique to a particular pesticide or group of pesticides. If specific information to select a scaling factor is not available, then a value of 1.15 would be used as a default. Alternatively, zero would be entered if it is known that body weight does not influence toxicity of pesticide(s) being assessed. The upper bound estimate output from the T-REX Kanaga nomogram would be used as an EEC for calculation of RQs. This approach would yield a conservative estimate of ecological risk.

Table G-3. Average Body Weight of Selected Terrestrial Wildlife Species Frequently Used in Research to Establish Toxicological Endpoints (Dunning 1984)

Species	Body Weight (kilograms)
Mammal (15 g)	0.015
House sparrow	0.0277
Mammal (35 g)	0.035
Starling	0.0823
Red-winged blackbird	0.0526
Common grackle	0.114
Japanese quail	0.178
Bobwhite quail	0.178
Rat	0.200
Rock dove (aka pigeon)	0.542
Mammal (1,000 g)	1.000
Mallard	1.082
Ring-necked pheasant	1.135

Terrestrial – granular application

Granular pesticide formulations and pesticide-treated seed would pose a unique route of exposure for avian and mammalian species. The pesticide is applied in discrete units which birds or mammals might ingest accidentally with food items or intentionally as in the case of some bird species actively seeking and picking up gravel or grit to aid digestion or seed as a food source. Granules may also be consumed by wildlife foraging on earthworms, slugs or other soft-bodied soil organisms to which the granules may adhere.

Terrestrial wildlife RQs for granular formulations or seed treatments would be calculated by dividing the maximum milligrams of active ingredient (a.i.) exposed (e.g., EEC) on the surface of an area equal to 1 square foot by the appropriate LD_{50} value multiplied by the surrogate's body weight (Table G-3). An adjustment to surface area calculations would be made for broadcast, banded, and in-furrow applications. An adjustment also would be made for applications with and without incorporation of the granules. Without incorporation, it would be assumed that 100% of the granules remain on the soil surface available to foraging birds and mammals. Press wheels push granules flat with the soil surface, but they are not incorporated into the soil. If granules are incorporated in the soil during band or T-band applications or after broadcast applications, it would be assumed only 15% of the applied granules remain available to wildlife. It would be assumed that only 1% of the granules are available on the soil surface following in-furrow applications.

EECs for pesticides applied in granular form and as seed treatments would be determined considering potential ingestion rates of avian or mammalian species (e.g., 10-30% body weight/day). This would provide an estimate of maximum exposure that may occur as a result of granule or seed treatment spills such as those that commonly occur at end rows during application and planting. The availability of granules and seed treatments to terrestrial vertebrates would also be considered by calculating the loading per unit area (LD_{50}/ft^2) for comparison to USEPA Level of Concerns (USEPA 1998). The T-REX version 1.2.3 (USEPA 2005) contains a submodel which automates Kanaga exposure calculations for granular pesticides and treated seed.

The following formulas would be used to calculate EECs depending upon the type of granular pesticide application:

- In-furrow applications assume a typical value of 1% granules, bait, or seed remain unincorporated.

$$mg\ a.i./ft.^2 = [(lbs.\ product/acre)(\%\ a.i.)(453{,}580\ mg/lbs)(1\%\ exposed))] / \{[(43{,}560\ ft.^2/acre)/(row\ spacing\ (ft.))] / (row\ spacing\ (ft.)\}$$

or

$$mg\ a.i./ft^2 = [(lbs\ product/1{,}000\ ft.\ row)(\%\ a.i.)(1{,}000\ ft\ row)(453{,}580\ mg/lb.)(1\%\ exposed)$$

$$EEC = [(mg\ a.i./ft.^2)(\%\ of\ pesticide\ biologically\ available)]$$

- Incorporated banded treatments assume that 15% of granules, bait, and seeds are unincorporated.

$$mg\ a.i./ft.^2 = [(lbs.\ product/1{,}000\ row\ ft.)(\%\ a.i.)(453{,}580\ mg/lb.)(1\text{-}\%\ incorporated)] / (1{,}000\ ft.)(band\ width\ (ft.))$$

$$EEC = [(mg\ a.i./ft.^2)(\%\ of\ pesticide\ biologically\ available)]$$

- Broadcast treatment without incorporation assumes 100% of granules, bait, seeds are unincorporated.

$$mg\ a.i./ft.^2 = [(lbs.\ product/acre)(\%\ a.i.)(453{,}590\ mg/lb.)] / (43{,}560\ ft.^2/acre)$$

$$EEC = [(mg\ a.i./ft.^2)(\%\ of\ pesticide\ biologically\ available)]$$

Where:

- *% of pesticide biologically available = 100% without species specific ingestion rates*
- *Conversion for calculating mg a.i./ft.^{2} using ounces: 453,580 mg/lb. /16 = 28,349 mg/oz.*

The following equation would be used to calculate an RQ based on the EEC calculated by one of the above equations. The EEC would be divided by the surrogate LD_{50} toxicological endpoint multiplied by the body weight (Table G-3) of the surrogate.

$$RQ = EEC / [LD_{50}\ (mg/kg) * body\ weight\ (kg)]$$

As with other risk assessments, an RQ>LOC would be a presumption of unacceptable ecological risk. An RQ<LOC would be a presumption of acceptable risk with only minor, temporary, or localized effects to species.

Aquatic exposure

Exposures to aquatic habitats (e.g., wetlands, meadows, ephemeral pools, water delivery ditches) would be evaluated separately for ground-based pesticide treatments of habitats managed for fish and wildlife compared with cropland/facilities maintenance. The primary exposure pathway for aquatic organisms from any ground-based treatments likely would be particle drift during the pesticide application. However, different exposure scenarios would be necessary as a result of contrasting application equipment and techniques as well as pesticides used to control pests on agricultural lands (especially those cultivated by cooperative farmers for economic return from crop yields) and facilities maintenance (e.g., roadsides, parking lots, trails) compared with other managed habitats on the Refuge. In addition, pesticide applications may be done <25 feet of the high water mark of aquatic habitats for habitat management treatments; whereas, no-spray buffers (≥25 feet) would be used for croplands/facilities maintenance treatments.

Habitat treatments

For the worst-case exposure scenario to non-target aquatic habitats, EECs (Table G-4) would be would be derived from Urban and Cook (1986) that assumes an intentional overspray to an entire, non-target water body (1-foot depth) from a treatment <25 feet from the high water mark using the max application rate (acid basis [see above]). However, use of BMPs for applying pesticides (see Section G.4.2) would likely minimize/eliminate potential drift to non-target aquatic habitats during actual treatments. If there would be unacceptable (acute or chronic) risk to fish and wildlife with the simulated 100% overspray (RQ>LOC), then the proposed pesticide use may be disapproved or the PUP would be approved at a lower application rate to minimize/eliminate unacceptable risk to aquatic organisms (RQ=LOC).

Table G-4. Estimated Environmental Concentrations (ppb) of Pesticides in Aquatic Habitats (1 foot depth) Immediately after Direct Application (Urban and Cook 1986)

Lbs/acre	EEC (ppb)
0.10	36.7
0.20	73.5
0.25	91.9
0.30	110.2
0.40	147.0
0.50	183.7
0.75	275.6
1.00	367.5

Table G-4. Estimated Environmental Concentrations (ppb) of Pesticides in Aquatic Habitats (1 foot depth) Immediately after Direct Application (Urban and Cook 1986)

Lbs/acre	EEC (ppb)
1.25	459.7
1.50	551.6
1.75	643.5
2.00	735.7
2.25	827.6
2.50	919.4
3.00	1103.5
4.00	1471.4
5.00	1839
6.00	2207
7.00	2575
8.00	2943
9.00	3311
10.00	3678

Cropland/Facilities Maintenance Treatments

Field drift studies conducted by the Spray Drift Task Force, which is a joint project of several agricultural chemical businesses, were used to develop a generic spray drift database. From this database, the AgDRIFT computer model was created to satisfy USEPA pesticide registration spray drift data requirements and as a scientific basis to evaluate off-target movement of pesticides from particle drift and assess potential effects of exposure to wildlife. Several versions of the computer model have been developed (i.e., v2.01 through v2.10). The Spray Drift Task Force AgDRIFT® model version 2.01 (SDTF 2003, AgDRIFT 2001) would be used to derive EECs resulting from drift of pesticides to refuge aquatic resources from ground-based pesticide applications >25 feet from the high water mark. The Spray Drift Task Force AgDRIFT model is publicly available at http://www.agdrift.com. At this website, click “AgDRIFT 2.0” and then click “Download Now” and follow the instructions to obtain the computer model.

The AgDRIFT model is composed of submodels called tiers. Tier I Ground submodel would be used to assess ground-based applications of pesticides. Tier outputs (EECs) would be calculated with AgDRIFT using the following input variables: max application rate (acid basis [see above]), low boom (20 inches), fine to medium droplet size, EPA-defined wetland, and a ≥25-foot distance (buffer) from treated area to water.

Use of Information on Effects of Biological Control Agents, Pesticides, Degradates, and Adjuvants

NEPA documents regarding biological and other environmental effects of biological control agents, pesticides, degradates, and adjuvants prepared by another federal agency, where the scope would be relevant to evaluation of effects from pesticide uses on refuge lands, would be reviewed. Possible source agencies for such NEPA documents would include the Bureau of Land Management, U.S. Forest Service, National Park Service, U.S. Department of Agriculture-Animal and Plant Health Inspection Service, and the military services. It might be appropriate to incorporate by reference parts or all of existing document(s). Incorporating by reference (40 CFR 1502.21) is a technique used to avoid redundancies in analysis. It also would reduce the bulk of a Service NEPA document, which only would identify the documents that are incorporated by reference. In addition, relevant portions would be summarized in the Service NEPA document to the extent necessary to provide the decision maker and public with an understanding of relevance of the referenced material to the current analysis.

In accordance with the requirements set forth in 43 CFR 46.135, the Service would specifically incorporate through reference ecological risk assessments prepared by the U.S. Forest Service (http://www.fs.fed.us/r6/invasiveplant-eis/Risk-Assessments/Herbicides-Analyzed-InvPlant-EIS.htm) and Bureau of Land Management (http://www.blm.gov/wo/st/en/prog/more/veg_eis.html). These risk assessments and associated documentation also are available in total with the administrative record for the Final Environmental Impact Statement entitled *Pacific Northwest Region Invasive Plant Program – Preventing and Managing Invasive Plants* (USFS 2005) and *Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic EIS* (PEIS) (BLM 2007). In accordance with 43 CFR 46.120(d), use of existing NEPA documents by supplementing, tiering to, incorporating by reference, or adopting previous NEPA environmental analyses would avoid redundancy and unnecessary paperwork.

As a basis for completing “Chemical Profiles” for approving or disapproving refuge PUPs, ecological risk assessments for the following herbicide and adjuvant uses prepared by the U.S. Forest Service would be incorporated by reference:

- 2,4-D
- Chlorsulfuron
- Clopyralid
- Dicamba
- Glyphosate
- Imazapic
- Imazapyr
- Metsulfuron methyl
- Picloram
- Sethoxydim
- Sulfometuron methyl
- Triclopyr
- Nonylphenol polyethylate (NPE) based surfactants

As a basis for completing “Chemical Profiles” for approving or disapproving refuge PUPs, ecological risk assessments for the following herbicide uses as well as evaluation of risks associated with pesticide degradates and adjuvants prepared by the Bureau of Land Management would be incorporated by reference:

- Bromacil
- Chlorsulfuron
- Diflufenzopyr
- Diquat
- Diuron
- Fluridone
- Imazapic
- Overdrive (diflufenzopyr and dicamba)
- Sulfometuron methyl
- Tebuthiuron
- Pesticide degradates and adjuvants (*Appendix D – Evaluation of risks from degradates, polyoxyethylene-amine (POEA) and R-11, and endocrine disrupting chemicals*)

Assumptions for Ecological Risk Assessments

There are a number of assumptions involved with the ecological risk assessment process for terrestrial and aquatic organisms associated with utilization of the USEPA's (2004) process. These assumptions may be risk neutral or may lead to an over- or under-estimation of risk from pesticide exposure depending upon site-specific conditions. The following describes these assumptions, their application to the conditions typically encountered, and whether or not they may lead to recommendations that are risk neutral, underestimate, or overestimate ecological risk from potential pesticide exposure.

- Indirect effects would not be evaluated by ecological risk assessments. These effects include the mechanisms of indirect exposure to pesticides: consuming prey items (fish, birds, or small mammals), reductions in the availability of prey items, and disturbance associated with pesticide application activities.
- Exposure to a pesticide product can be assessed based upon the active ingredient. However, exposure to a chemical mixture (pesticide formulation) may result in effects that are similar or substantially different compared to only the active ingredient. Non-target organisms may be exposed directly to the pesticide formulation or only various constituents of the formulation as they dissipate and partition in the environment. If toxicological information for both the active ingredient and formulated product are available, then data representing the greatest potential toxicity would be selected for use in the risk assessment process (USEPA 2004). As a result, this conservative approach may lead to an overestimation of risk characterization from pesticide exposure.
- Because toxicity tests with listed or candidate species or closely related species are not available, data for surrogate species would be most often used for risk assessments. Specifically, bobwhite quail and mallard duck are the most frequently used surrogates for evaluating potential toxicity to federally listed avian species. Bluegill sunfish, rainbow trout, and fathead minnow are the most common surrogates for evaluating toxicity for freshwater fishes. However, sheep's head minnow can be an appropriate surrogate marine species for coastal environments. Rats and mice are the most common surrogates for evaluating toxicity for mammals. Interspecies sensitivity is a major source of uncertainty in pesticide assessments. As a result of this uncertainty, data are selected for the most sensitive species

tested within a taxonomic group (birds, fish, and mammals) given the quality of the data is acceptable. If additional toxicity data for more species of organisms in a particular group are available, the selected data would not be limited to the species previously listed as common surrogates.

- The Kanaga nomogram outputs maximum EEC values that may be used to calculate an average daily concentration over a specified interval of time, which is referred to as a time-weighted-average (TWA). The maximum EEC would be selected as the exposure input for both acute and chronic risk assessments in the screening-level evaluations. The initial or maximum EEC derived from the Kanaga nomogram represents the maximum expected instantaneous or acute exposure to a pesticide. Acute toxicity endpoints are determined using a single exposure to a known pesticide concentration typically for 48 to 96 hours. This value is assumed to represent ecological risk from acute exposure to a pesticide. On the other hand, chronic risk to pesticide exposure is a function of pesticide concentration and duration of exposure to the pesticide. An organism's response to chronic pesticide exposure may result from either the concentration of the pesticide, length of exposure, or some combination of both factors. Standardized tests for chronic toxicity typically involve exposing an organism to several different pesticide concentrations for a specified length of time (days, weeks, months, years or generations). For example, avian reproduction tests include a 10-week exposure phase. Because a single length of time is used in the test, time response data are usually not available for inclusion into risk assessments. Without time response data it is difficult to determine the concentration which elicited a toxicological response.
- Using maximum EECs for chronic risk estimates may result in an overestimate of risk, particularly for compounds that dissipate rapidly. Conversely, using TWAs for chronic risk estimates may underestimate risk if it is the concentration rather than the duration of exposure that is primarily responsible for the observed adverse effect. The maximum EEC would be used for chronic risk assessments although it may result in an overestimate of risk. TWAs may be used for chronic risk assessments, but they would be applied judiciously considering the potential for an underestimate or overestimate of risk. For example, the number of days exposure exceeds a Level of Concern may influence the suitability of a pesticide use. The greater the number of days the EEC exceeds the Level of Concern translates into greater the ecological risk. This is a qualitative assessment, and is subject to reviewer's expertise in ecological risk assessment and tolerance for risk.
- The length of time used to calculate the TWA can have a substantial effect on the exposure estimates and there is no standard method for determining the appropriate duration for this estimate. The T-REX model assumes a 21-week exposure period, which is equivalent to avian reproductive studies designed to establish a steady-state concentration for bioaccumulative compounds. However, this does not necessarily define the true exposure duration needed to elicit a toxicological response. Pesticides, which do not bioaccumulate, may achieve a steady-state concentration earlier than 21 weeks. The duration of time for calculating TWAs would require justification and it would not exceed the duration of exposure in the chronic toxicity test (approximately 70 days for the standard avian reproduction study). An alternative to using the duration of the chronic toxicity study is to base the TWA on the application interval. In this case, increasing the application interval would suppress both the estimated peak pesticide concentration and the TWA. Another alternative to using TWAs would be to consider the number of days that a chemical is predicted to exceed the LOC.
- Pesticide dissipation is assumed to be first-order in the absence of data suggesting alternative dissipation patterns such as bi-phasic. Field dissipation data would generally be the most

pertinent for assessing exposure in terrestrial species that forage on vegetation. However, these data are often not available and it can be misleading particularly if the compound is prone to "wash-off." Soil half-life is the most common degradation data available. Dissipation or degradation data that would reflect the environmental conditions typical of refuge lands would be utilized, if available.

- For species found in the water column, it would be assumed that the greatest bioavailable fraction of the pesticide active ingredient in surface waters is freely dissolved in the water column.
- Actual habitat requirements of any particular terrestrial species are not considered, and it is assumed that species exclusively and permanently occupy the treated area, or adjacent areas receiving pesticide at rates commensurate with the treatment rate. This assumption would produce a maximum estimate of exposure for risk characterization. This assumption would likely lead to an overestimation of exposure for species that do not permanently and exclusively occupy the treated area (USEPA 2004).
- Exposure through incidental ingestion of pesticide contaminated soil is not considered in the USEPA risk assessment protocols. Research suggests <15% of the diet can consist of incidentally ingested soil depending upon species and feeding strategy (Beyer et al. 1994). An assessment of pesticide concentrations in soil compared to food item categories in the Kanaga nomogram indicates incidental soil ingestion would not likely increase dietary exposure to pesticides. Inclusion of soil into the diet would effectively reduce the overall dietary concentration compared to the present assumption that the entire diet consists of a contaminated food source (Fletcher et al. 1994). An exception to this may be soil-applied pesticides in which exposure from incidental ingestion of soil may increase. Potential for pesticide exposure under this assumption may be underestimated for soil-applied pesticides and overestimated for foliar-applied pesticides. The concentration of a pesticide in soil would likely be less than predicted on food items.
- Exposure through inhalation of pesticides is not considered in the USEPA risk assessment protocols. Such exposure may occur through three potential sources: spray material in droplet form at time of application, vapor phase with the pesticide volatilizing from treated surfaces, and airborne particulates (soil, vegetative matter, and pesticide dusts). The USEPA (1990) reported exposure from inhaling spray droplets at the time of application is not an appreciable route of exposure for birds. According to research on mallards and bobwhite quail, respirable particle size (particles reaching the lung) in birds is limited to maximum diameter of 2 to 5 microns. The spray droplet spectra covering the majority of pesticide application scenarios indicate that less than 1% of the applied material is within the respirable particle size. This route of exposure is further limited because the permissible spray drop size distribution for ground pesticide applications is restricted to ASAE medium or coarser drop size distribution.
- Inhalation of a pesticide in the vapor phase may be another source of exposure for some pesticides under certain conditions. This mechanism of exposure to pesticides occurs post application, and it would pertain to those pesticides with a high vapor pressure. The USEPA is currently evaluating protocols for modeling inhalation exposure from pesticides including near-field and near-ground air concentrations based upon equilibrium and kinetics-based models. Risk characterization for exposure with this mechanism is unavailable.
- The effect from exposure to dusts contaminated with the pesticide cannot be assessed generically as partitioning issues related to application site soils and chemical properties of the applied pesticides render the exposure potential from this route highly situation specific.
- Dermal exposure may occur through three potential sources: direct application of spray to terrestrial wildlife in the treated area or within the drift footprint, incidental contact with

contaminated vegetation, or contact with contaminated water or soil. Interception of spray and incidental contact with treated substrates may pose risk to avian wildlife (Driver et al. 1991). However, available research related to wildlife dermal contact with pesticides is extremely limited, except dermal toxicity values are common for some mammals used as human surrogates (rats and mice). The USEPA is currently evaluating protocols for modeling dermal exposure. Risk characterization may be underestimated for this route of exposure, particularly with high-risk pesticides such as some organophosphates or carbamate insecticides. If protocols are established by the USEPA for assessing dermal exposure to pesticides, they would be considered for incorporation into pesticide assessment protocols.

- Exposure to a pesticide may occur from consuming surface water, dew or other water on treated surfaces. Water soluble pesticides have the potential to dissolve in surface runoff and puddles in a treated area may contain pesticide residues. Similarly, pesticides with lower organic carbon partitioning characteristics and higher solubility in water have a greater potential to dissolve in dew and other water associated with plant surfaces. Estimating the extent to which such pesticide loadings to drinking water occurs is complex and would depend upon the partitioning characteristics of the active ingredient, soils types in the treatment area, and the meteorology of the treatment area. In addition, the use of various water sources by wildlife is highly species-specific. Currently, risk characterization for this exposure mechanism is not available. The USEPA is actively developing protocols to quantify drinking water exposures from puddles and dew. If and when protocols are formally established by the USEPA for assessing exposure to pesticides through drinking water, these protocols would be incorporated into pesticide risk assessment protocols.
- Risk assessments are based upon the assumption that the entire treatment area would be subject to pesticide application at the rates specified on the label. In most cases, there is potential for uneven application of pesticides through such plausible incidents such as changes in calibration of application equipment, spillage, and localized releases at specific areas in or near the treated field that are associated with mixing and handling and application equipment as well as applicator skill. Inappropriate use of pesticides and the occurrence of spills represent a potential underestimate of risk. It is likely not an important factor for risk characterization. All pesticide applicators are required to be certified by the state in which they apply pesticides. Certification training includes the safe storage, transport, handling, and mixing of pesticides; equipment calibration; and proper application with annual continuing education.
- The USEPA relies on Fletcher (1994) for setting the assumed pesticide residues in wildlife dietary items. The USEPA (2004) "believes that these residue assumptions reflect a realistic upper-bound residue estimate, although the degree to which this assumption reflects a specific percentile estimate is difficult to quantify". Fletcher's (1994) research suggests that the pesticide active ingredient residue assumptions used by the USEPA represent a 95th percentile estimate. However, research conducted by Pfleeger et al. (1996) indicates USEPA residue assumptions for short grass was not exceeded. Baehr and Habig (2000) compared USEPA residue assumptions with distributions of measured pesticide residues for the USEPA's UTAB database. Overall residue selection level tends to overestimate risk characterization. This is particularly evident when wildlife individuals are likely to have selected a variety of food items acquired from multiple locations. Some food items may be contaminated with pesticide residues whereas others are not contaminated. However, it is important to recognize differences in species feeding behavior. Some species may consume whole above-ground plant material, but others will preferentially select different plant structures. Also, species may preferentially select a food item although multiple food items

may be present. Without species specific knowledge regarding foraging behavior characterizing ecological risk other than in general terms is not possible.

- Acute and chronic risk assessments rely on comparisons of wildlife dietary residues with LC_{50} or NOEC values expressed as concentrations of pesticides in laboratory feed. These comparisons assume that ingestion of food items in the field occurs at rates commensurate with those in the laboratory. Although the screening assessment process adjusts dry-weight estimates of food intake to reflect the increased mass in fresh-weight wildlife food intake estimates, it does not allow for gross energy and assimilative efficiency differences between wildlife food items and laboratory feed. Differences in assimilative efficiency between laboratory and wild diets suggest that current screening assessment methods are not accounting for a potentially important aspect of food requirements.
- There are several other assumptions that can affect non-target species not considered in the risk assessment process. These include possible additive or synergistic effects from applying two or more pesticides or additives in a single application, co-location of pesticides in the environment, cumulative effects from pesticides with the same mode of action, effects of multiple stressors (e.g., combination of pesticide exposure, adverse abiotic and biotic factors) and behavioral changes induced by exposure to a pesticide. These factors may exist at some level contributing to adverse effects to non-target species, but they are usually characterized in the published literature in only a general manner limiting their value in the risk assessment process.
- It is assumed that aquatic species exclusively and permanently occupy the water body being assessed. Actual habitat requirements of aquatic species are not considered. With the possible exception of scenarios where pesticides are directly applied to water, it is assumed that no habitat use considerations specific for any species would place the organisms in closer proximity to pesticide use sites. This assumption produces a maximum estimate of exposure or risk characterization. It would likely be realistic for many aquatic species that may be found in aquatic habitats within or in close proximity to treated terrestrial habitats. However, the spatial distribution of wildlife is usually not random because wildlife distributions are often related to habitat requirements of species. Clumped distributions of wildlife may result in an under- or over-estimation of risk depending upon where the initial pesticide concentration occurs relative to the species or species habitat.
- For species found in the water column, it would be assumed that the greatest bioavailable fraction of the pesticide active ingredient in surface waters is freely dissolved in the water column. Additional chemical exposure from materials associated with suspended solids or food items is not considered because partitioning onto sediments likely is minimal. Adsorption and bioconcentration occurs at lower levels for many newer pesticides compared with older more persistent bioaccumulative compounds. Pesticides with RQs close to the listed species level of concern, the potential for additional exposure from these routes may be a limitation of risk assessments, where potential pesticide exposure or risk may be underestimated.
- Mass transport losses of pesticide from a water body (except for losses by volatilization, degradation and sediment partitioning) would not be considered for ecological risk assessment. The water body would be assumed to capture all pesticide active ingredients entering as runoff, drift, and adsorbed to eroded soil particles. It would also be assumed that pesticide active ingredient is not lost from the water body by overtopping or flow-through, nor is concentration reduced by dilution. In total, these assumptions would lead to a near maximum possible water-borne concentration. However, this assumption would not account for the potential to concentrate pesticide through the evaporative loss. This limitation may

have the greatest impact on water bodies with high surface-to-volume ratios such as ephemeral wetlands, where evaporative losses are accentuated and applied pesticides have low rates of degradation and volatilization.

- For acute risk assessments, there would be no averaging time for exposure. An instantaneous peak concentration would be assumed, where instantaneous exposure is sufficient in duration to elicit acute effects comparable to those observed over more protracted exposure periods (typically 48 to 96 hours) tested in the laboratory. In the absence of data regarding time-to-toxic event, analyses and latent responses to instantaneous exposure, risk would likely be overestimated.
- For chronic exposure risk assessments, the averaging times considered for exposure are commensurate with the duration of invertebrate life-cycle or fish-early life stage tests (e.g., 21-28 days and 56-60 days, respectively). Response profiles (time to effect and latency of effect) to pesticides likely vary widely with mode of action and species and should be evaluated on a case-by-case basis as available data allow. Nevertheless, because the USEPA relies on chronic exposure toxicity endpoints based on a finding of no observed effect, the potential for any latent toxicity effects or averaging time assumptions to alter the results of an acceptable chronic risk assessment prediction is limited. The extent to which duration of exposure from water-borne concentrations overestimate or underestimate actual exposure depends on several factors. These include the following: localized meteorological conditions, runoff characteristics of the watershed (e.g., soils, topography), the hydrological characteristics of receiving waters, environmental fate of the pesticide active ingredient, and the method of pesticide application. It should also be understood that chronic effects studies are performed using a method that holds water concentration in a steady state. This method is not likely to reflect conditions associated with pesticide runoff. Pesticide concentrations in the field increase and decrease in surface water on a cycle influenced by rainfall, pesticide use patterns, and degradation rates. As a result of the dependency of this assumption on several undefined variables, risk associated with chronic exposure may in some situations underestimate risk and overestimate risk in others.
- There are several other factors that can affect non-target species not considered in the risk assessment process. These would include the following: possible additive or synergistic effects from applying two or more pesticides or additives in a single application, co-location of pesticides in the environment, cumulative effects from pesticides with the same mode of action, effects of multiple stressors (e.g., combination of pesticide exposure, adverse abiotic [not pesticides] and biotic factors), and sub-lethal effects such as behavioral changes induced by exposure to a pesticide. These factors may exist at some level contributing to adverse effects to non-target species, but they are not routinely assessed by regulatory agencies. Therefore, information on the factors is not extensive limiting their value for the risk assessment process. As this type of information becomes available, it would be included, either quantitatively or qualitatively, in this risk assessment process.
- USEPA is required by the Food Quality Protection Act to assess the cumulative risks of pesticides that share common mechanisms of toxicity, or act the same within an organism. Currently, USEPA has identified four groups of pesticides that have a common mechanism of toxicity requiring cumulative risk assessments. These four groups are: the organophosphate insecticides, N-methyl carbamate insecticides, triazine herbicides, and chloroacetanilide herbicides.

G.7.3 Pesticide Mixtures and Degradates

Pesticide products are usually a formulation of several components generally categorized as active ingredients and inert or other ingredients. The term active ingredient is defined by the FIFRA as preventing, destroying, repelling, or mitigating the effects of a pest, or it is a plant regulator, defoliant, desiccant, or nitrogen stabilizer. In accordance with FIFRA, the active ingredient(s) must be identified by name(s) on the pesticide label along with its relative composition expressed in percentage(s) by weight. In contrast, inert ingredient(s) are not intended to affect a target pest. Their role in the pesticide formulation is to act as a solvent (keep the active ingredient is a liquid phase), an emulsifying or suspending agent (keep the active ingredient from separating out of solution), or a carrier (such as clay in which the active ingredient is impregnated on the clay particle in dry formulations). For example, if isopropyl alcohol would be used as a solvent in a pesticide formulation, then it would be considered an inert ingredient. FIFRA only requires that inert ingredients identified as hazardous and associated percent composition, and the total percentage of all inert ingredients must be declared on a product label. Inert ingredients that are not classified as hazardous are not required to be identified.

The USEPA (September 1997) issued Pesticide Regulation Notice 97-6, which encouraged manufacturers, formulators, producers, and registrants of pesticide products to voluntarily substitute the term “other ingredients” for “inert ingredients” in the ingredient statement. This change recognized that all components in a pesticide formulation potentially could elicit or contribute to an adverse effect on non-target organisms and, therefore, are not necessarily inert. Whether referred to as “inerts” or “other ingredients,” these constituents within a pesticide product have the potential to affect species or environmental quality. The USEPA categorizes regulated inert ingredients into the following four lists (http://www.epa.gov/opprd001/inerts/index.html):

- List 1 – Inert Ingredients of Toxicological Concern
- List 2 – Potentially Toxic Inert Ingredients
- List 3 – Inerts of Unknown Toxicity
- List 4 – Inerts of Minimal Toxicity

Several of the List 4 compounds are naturally-occurring earthen materials (e.g., clay materials, simple salts) that would not elicit toxicological response at applied concentrations. However, some of the inerts (particularly the List 3 compounds and unlisted compounds) may have moderate to high potential toxicity to aquatic species based on MSDSs or published data.

Comprehensively assessing potential effects to non-target fish, wildlife, plants, and/or their habitats from pesticide use is a complex task. It would be preferable to assess the cumulative effects from exposure to the active ingredient, its degradates, and inert ingredients as well as other active ingredients in the spray mixture. However, it would only be feasible to conduct deterministic risk assessments for each component in the spray mixture singly. Limited scientific information is available regarding ecological effects (additive or synergistic) from chemical mixtures that typically rely upon broadly encompassing assumptions. For example, the U.S. Forest Service (2005) found that mixtures of pesticides used in land (forest) management likely would not cause additive or synergistic effects to non-target species based upon a review of scientific literature regarding toxicological effects and interactions of agricultural chemicals (ATSDR 2004). Moreover, information on inert ingredients, adjuvants, and degradates is often limited by the availability of and access to reliable toxicological data for these constituents.

Toxicological information regarding "other ingredients" may be available from sources such as the following:

- TOMES (a proprietary toxicological database including USEPA's IRIS, the Hazardous Substance Data Bank, the Registry of Toxic Effects of Chemical Substances [RTECS]).
- USEPA's ECOTOX database, which includes AQUIRE (a database containing scientific papers published on the toxic effects of chemicals to aquatic organisms).
- TOXLINE (a literature searching tool).
- Material Safety Data Sheets (MSDSs) from pesticide suppliers.
- Other sources such as the Farm Chemicals Handbook.

Because there is a lack of specific inert toxicological data, inert(s) in a pesticide may cause adverse ecological effects. However, inert ingredients typically represent only a small percentage of the pesticide spray mixture, and it would be assumed that negligible effects would be expected to result from inert ingredient(s).

Although the potential effects of degradates should be considered when selecting a pesticide, it is beyond the scope of this assessment process to consider all possible breakdown chemicals of the various product formulations containing an active ingredient. Degradates may be more or less mobile and more or less hazardous in the environment than their parent pesticides (Battaglin et al. 2003). Differences in environmental behavior (e.g., mobility) and toxicity between parent pesticides and degradates would make assessing potential degradate effects extremely difficult. For example, a less toxic and more mobile, bioaccumulative, or persistent degradate may have potentially greater effects on species and/or degrade environmental quality. The lack of data on the toxicity of degradates for many pesticides would represent a source of uncertainty for assessing risk.

A USEPA-approved label specifies whether a product can be mixed with one or more pesticides. Without product-specific toxicological data, it would not be possible to quantify the potential effects of these mixtures. In addition, a quantitative analysis could only be conducted if reliable scientific information allowed a determination of whether the joint action of a mixture would be additive, synergistic, or antagonistic. Such information would not likely exist unless the mode of action would be common among the chemicals and receptors. Moreover, the composition of and exposure to mixtures would be highly site- and/or time-specific and, therefore, it would be nearly impossible to assess potential effects to species and environmental quality.

To minimize or eliminate potential negative effects associated with applying two or more pesticides as a mixture, the use would be conducted in accordance with the labeling requirements. Labels for two or more pesticides applied as a mixture should be completely reviewed, where products with the least potential for negative effects would be selected for use on the Refuge. This is especially relevant when a mixture would be applied in a manner that may already have the potential for an effect(s) associated with an individual pesticide (e.g., runoff to ponds in sandy watersheds). Use of a tank mix under these conditions would increase the level of uncertainty in terms of risk to species or potential to degrade environmental quality.

Adjuvants generally function to enhance or prolong the activity of pesticide. For terrestrial herbicides, adjuvants aid in the absorption into plant tissue. Adjuvant is a broad term that generally applies to surfactants, selected oils, anti-foaming agents, buffering compounds, drift control agents, compatibility agents, stickers, and spreaders. Adjuvants are not under the same registration requirements as pesticides and the USEPA does not register or approve the labeling of spray adjuvants. Individual pesticide labels identify types of adjuvants approved for use with it. In general, adjuvants compose a relatively small portion of the volume of pesticides applied. Selection of adjuvants with limited toxicity and low volumes would be recommended to reduce the potential for the adjuvant to influence the toxicity of the pesticide.

G.7.4 Determining Effects to Soil and Water Quality

The approval process for pesticide uses would consider potential to degrade water quality on and off refuge lands. A pesticide can only affect water quality through movement away from the treatment site. After application, pesticide mobilization can be characterized by one or more of the following (Kerle et al. 1996):

- Attach (sorb) to soil, vegetation, or other surfaces and remain at or near the treated area;
- Attach to soil and move off-site through erosion from runoff or wind;
- Dissolve in water that can be subjected to runoff or leaching.

As an initial screening tool, selected chemical characteristics and rating criteria for a pesticide can be evaluated to assess potential to enter ground and/or surface waters. These would include the following: persistence, sorption coefficient (K_{oc}), groundwater ubiquity score (GUS), and solubility.

Persistence, which is expressed as half-life (t½), represents the length of time required for 50% of the deposited pesticide to degrade (completely or partially). Persistence in the soil can be categorized as the following: non-persistent <30 days, moderately persistent = 30 to 100 days, and persistent >100 days (Kerle et al. 1996). Half-life data are usually available for aquatic and terrestrial environments.

Another measure of pesticide persistence is dissipation time (DT_{50}). It represents the time required for 50% of the deposited pesticide to degrade and move from a treated site; whereas, half-life describes the rate for degradation only. As for half-life, units of dissipation time are usually expressed in days. Field or foliar dissipation time is the preferred data for use to estimate pesticide concentrations in the environment. However, soil half-life is the most common persistence data cited in published literature. If field or foliar dissipation data are not available, soil half-life data may be used. The average or representative half-life value of most important degradation mechanism would be selected for quantitative analysis for both terrestrial and aquatic environments.

Mobility of a pesticide is a function of how strongly it is adsorbed to soil particles and organic matter, its solubility in water, and its persistence in the environment. Pesticides strongly adsorbed to soil particles, relatively insoluble in water, and not environmentally persistent would be less likely to move across the soil surface into surface waters or to leach through the soil profile and contaminate groundwater. Conversely, pesticides that are not strongly adsorbed to soil particles, are highly water soluble, and are persistent in the environment would have greater potential to move from the application site (off-site movement).

The degree of pesticide adsorption to soil particles and organic matter (Kerle et al. 1996) is expressed as the soil adsorption coefficient (K_{oc}). The soil adsorption coefficient is measured as micrograms of pesticide per gram of soil (µg/g) that can range from near zero to the thousands. Pesticides with higher K_{oc} values are strongly sorbed to soil and, therefore, would be less subject to movement.

Water solubility describes the amount of pesticide that would dissolve in a known quantity of water. The water solubility of a pesticide is expressed as milligrams of pesticide dissolved in a liter of water (mg/L or parts per million [ppm]). Pesticide with solubility <0.1 ppm are virtually insoluble in water, 100-1000 ppm are moderately soluble, and >10,000 ppm highly soluble (USGS 2000). As pesticide solubility increases, there would be greater potential for off-site movement.

The Groundwater Ubiquity Score (GUS) is a quantitative screening tool to estimate a pesticide's potential to move in the environment. It utilizes soil persistence and adsorption coefficients in the following formula.

$$\text{GUS} = \log_{10}(t_{½}) \times [4 - \log_{10}(K_{oc})]$$

The potential pesticide movement rating would be based upon its GUS value. Pesticides with a GUS <0.1 would considered to have an extremely low potential to move toward groundwater. Values of 1.0-2.0 would be low, 2.0-3.0 would be moderate, 3.0-4.0 would be high, and >4.0 would have a very high potential to move toward groundwater.

Water solubility describes the amount of pesticide dissolving in a specific quantity of water, where it is usually measured as mg/L or ppm. Solubility is useful as a comparative measure because pesticides with higher values are more likely to move by runoff or leaching. GUS, water solubility, t½, and K_{oc} values are available for selected pesticides from the OSU Extension Pesticide Properties Database at http://npic.orst.edu/ppdmove.htm. Many of the values in this database were derived from the SCS/ARS/CES Pesticide Properties Database for Environmental Decision Making (Wauchope et al. 1992).

Soil properties influence the fate of pesticides in the environment. The following six properties are mostly likely to affect pesticide degradation and the potential for pesticides to move off-site by leaching (vertical movement through the soil) or runoff (lateral movement across the soil surface).

- Permeability is the rate of water movement vertically through the soil. It is affected by soil texture and structure. Coarse textured soils (e.g., high sand content) have a larger pore size and they are generally more permeable than fine textured soils (i.e., high clay content). The more permeable soils would have a greater potential for pesticides to move vertically down through the soil profile. Soil permeability rates (inches/hour) are usually available in county soil survey reports.
- Soil texture describes the relative percentage of sand, silt, and clay. In general, greater clay content with smaller the pore size would lower the likelihood and rate water that would move through the soil profile. Clay also serves to adsorb (bind) pesticides to soil particles. Soils with high clay content would adsorb more pesticide than soils with relatively low clay content. In contrast, sandy soils with coarser texture and lower water holding capacity would have a greater potential for water to leach through them.
- Soil structure describes soil aggregation. Soils with a well-developed soil structure have looser, more aggregated, structure that would be less likely to be compacted. Both characteristics would allow for less restricted flow of water through the soil profile resulting in greater infiltration.
- Organic matter would be the single most important factor affecting pesticide adsorption in soils. Many pesticides are adsorbed to organic matter which would reduce their rate of downward movement through the soil profile. Also, soils high in organic matter would tend to hold more water, which may make less water available for leaching.
- Soil moisture affects how fast water would move through the soil. If soils are already wet or saturated before rainfall or irrigation, excess moisture would runoff rather than infiltrate into

the soil profile. Soil moisture also would influence microbial and chemical activity in soil, which affects pesticide degradation.
- Soil pH would influence chemical reactions that occur in the soil which in turn determines whether or not a pesticide would degrade, rate of degradation, and, in some instances, which degradation products are produced.

Based upon the aforementioned properties, soils most vulnerable to groundwater contamination would be sandy soils with low organic matter. In contrast, the least vulnerable soils would be well-drained clayey soils with high organic matter. Consequently, pesticides with the lowest potential for movement in conjunction with appropriate best management practices (see below) would be used in an IPM framework to treat pests while minimizing effects to non-target biota and protecting environmental quality.

Along with soil properties, the potential for a pesticide to affect water quality through runoff and leaching would consider site-specific environmental and abiotic conditions including rainfall, water table conditions, and topography (Huddleston 1996).

- Water is necessary to separate pesticides from soil. This can occur in two basic ways. Pesticides that are soluble move easily with runoff water. Pesticide-laden soil particles can be dislodged and transported from the application site in runoff. The concentration of pesticides in the surface runoff would be greatest for the first runoff event following treatment. The rainfall intensity and route of water infiltration into soil, to a large extent, determine pesticide concentrations and losses in surface runoff. The timing of the rainfall after application also would have an effect. Rainfall interacts with pesticides at a shallow soil depth (¼ to ½ inch), which is called the mixing zone (Baker and Miller 1999). The pesticide/water mixture in the mixing zone would tend to leach down into the soil or runoff depending upon how quickly the soil surface becomes saturated and how rapidly water can infiltrate into the soil. Leaching would decrease the amount of pesticide available near the soil surface (mixing zone) to runoff during the initial rainfall event following application and subsequent rainfall events.
- Terrain slope would affect the potential for surface runoff and the intensity of runoff. Steeper slopes would have greater potential for runoff following a rainfall event. In contrast, soils that are relatively flat would have little potential for runoff, except during intense rainfall events. In addition, soils in lower areas would be more susceptible to leaching as a result of receiving excessive water from surrounding higher elevations.
- Depth to groundwater would be an important factor affecting the potential for pesticides to leach into groundwater. If the distance from the soil surface to the top of the water table is shallow, pesticides would have less distance to travel to reach groundwater. Shallower water tables that persist for longer periods would be more likely to experience groundwater contamination. Soil survey reports are available for individual counties. These reports provide data in tabular format regarding the water table depths and the months during which it persists. In some situations, a hard pan exists above the water table that would prevent pesticide contamination from leaching.

G.7.5 Determining Effects to Air Quality

Pesticides may volatilize from soil and plant surfaces and move from the treated area into the atmosphere. The potential for a pesticide to volatilize is determined by the pesticide’s vapor pressure, which would be affected by temperature, sorption, soil moisture, and the pesticide’s water solubility.

Vapor pressure is often expressed in mm Hg. To make these numbers easier to compare, vapor pressure may be expressed in exponent form (I x 10^{-7}), where I represents a vapor pressure index. In general, pesticides with I<10 would have a low potential to volatilize; whereas, pesticides with I>1,000 would have a high potential to volatilize (Oregon State University 1996). Vapor pressure values for pesticides are usually available in the pesticide product MSDS or the USDA Agricultural Research Service (ARS) pesticide database.

G.7.6 Preparing a Chemical Profile

The following instructions would be used by Service personnel to complete Chemical Profiles for pesticides. Specifically, profiles would be prepared for pesticide active ingredients (e.g., glyphosate, imazapic) that would be contained in one or more trade name products that are registered and labeled with USEPA. All information fields under each category (e.g., Toxicological Endpoints, Environmental Fate) would be completed for a Chemical Profile. If no information is available for a specific field, then “No data are available in references” would be recorded in the profile. Available scientific information would be used to complete Chemical Profiles. Each entry of scientific information would be shown with applicable references.

Completed Chemical Profiles would provide a structured decision-making process utilizing quantitative assessment/screening tools with threshold values (where appropriate) that would be used to evaluate potential biological and other environmental effects to refuge resources. For ecological risk assessments presented in these profiles, the “worst-case scenario” would be evaluated to determine whether a pesticide could be approved for use considering the maximum single application rate specified on pesticide labels for habitat management and croplands/facilities maintenance treatments pertaining to refuges. Where the “worst-case scenario” likely would only result in minor, temporary, and localized effects to listed and non-listed species with appropriate BMPs (see Section G.5), the proposed pesticide’s use in a PUP would have a scientific basis for approval under any application rate specified on the label that is at or below rates evaluated in a Chemical Profile. In some cases, the Chemical Profile would include a lower application rate than the maximum labeled rate in order to protect refuge resources. As necessary, Chemical Profiles would be periodically updated with new scientific information or as pesticides with the same active ingredient are proposed for use on the Refuge in PUPs.

Throughout this section, threshold values (to prevent or minimize potential biological and environmental effects) would be clearly identified for specific information presented in a completed Chemical Profile. Comparison with these threshold values provides an explicit scientific basis to approve or disapprove PUPs for habitat management and cropland/facilities maintenance on refuge lands. In general, PUPs would be approved for pesticides with Chemical Profiles where there would be no exceedances of threshold values. However, BMPs are identified for some screening tools that would minimize/eliminate potential effects (exceedance of the threshold value) as a basis for approving PUPs.

Date: Service personnel would record the date when the Chemical Profile is completed or updated. Chemical Profiles (e.g., currently approved pesticide use patterns) would be periodically reviewed and updated, as necessary. The most recent review date would be recorded on a profile to document when it was last updated.

Trade Name(s): Service personnel would accurately and completely record the trade name(s) from the pesticide label, which includes a suffix that describes the formulation (e.g., WP, DG, EC, L, SP, I, II or 64). The suffix often distinguishes a specific product among several pesticides with the same active ingredient. Service personnel would record a trade name for each pesticide product with the same active ingredient.

Common chemical name(s): Service personnel would record the common name(s) listed on the pesticide label or material safety data sheet (MSDS) for an active ingredient. The common name of a pesticide is listed as the active ingredient on the title page of the product label immediately following the trade name, and the MSDS, Section 2: Composition/Information on Ingredients. A Chemical Profile is completed for each active ingredient.

Pesticide Type: Service personnel would record the type of pesticide for an active ingredient as one of the following: herbicide, desiccant, fungicide, fumigant, growth regulator, insecticide, piscicide, or rodenticide.

EPA Registration Number(s): This number (EPA Reg. No.) appears on the title page of the label and MSDS, Section 1: Chemical Product and Company Description. It is not the EPA Establishment Number that is usually located near it. Service personnel would record the EPA Reg. No. for each trade name product with an active ingredient based upon PUPs.

Pesticide Class: Service personnel would list the general chemical class for the pesticide (active ingredient). For example, malathion is an organophosphate and carbaryl is a carbamate.

CAS (Chemical Abstract Service) Number: This number is often located in the second section (Composition/Information on Ingredients) of the MSDS. The MSDS table listing components usually contains this number immediately prior to or following the % composition.

Other Ingredients: From the most recent MSDS for the proposed pesticide product(s), Service personnel would include any chemicals in the pesticide formulation not listed as an active ingredient that are described as toxic or hazardous, or regulated under the Superfund Amendments and Reauthorization Act (SARA), Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Toxic Substances Control Act (TSCA), Occupational Safety and Health Administration (OSHA), State Right-to-Know, or other listed authorities. These are usually found in MSDS sections titled “Hazardous Identifications”, “Exposure Control/Personal Protection”, and “Regulatory Information”. If concentrations of other ingredients are available for any compounds identified as toxic or hazardous, then Service personnel would record this information in the Chemical Profile by trade name. MSDS(s) may be obtained from the manufacturer, manufacturer’s website or from an on-line database maintained by Crop Data Management Systems, Inc. (see list below).

G.7.7 Toxicological Endpoints

Toxicological endpoint data would be collected for acute and chronic tests with mammals, birds, and fish. Data would be recorded for species available in the scientific literature. If no data are found for a particular taxonomic group, then “No data are available in references” would be recorded as the data entry. Throughout the Chemical Profile, references (including toxicological endpoint data) would be cited using parentheses (#) following the recorded data.

Mammalian LD_{50}: For test species in the scientific literature, Service personnel would record available data for oral lethal dose (LD_{50}) in mg/kg-bw (body weight) or ppm-bw. Most common test species in scientific literature are the rat and mouse. The lowest LD_{50} value found for a rat would be used as a toxicological endpoint for dose-based RQ calculations to assess acute risk to mammals (see Table G-1 in Section G.7.1).

Mammalian LC_{50}: For test species in the scientific literature, Service personnel would record available data for dietary lethal concentration (LC_{50}) as reported (e.g., mg/kg-diet or ppm-diet). Most common test species in scientific literature are the rat and mouse. The lowest LC_{50} value found for a rat would be used as a toxicological endpoint for diet-based RQ calculations to assess acute risk (see Table G-1 in Section G.7.1).

Mammalian Reproduction: For test species listed in the scientific literature, Service personnel would record the test results (e.g., Lowest Observed Effect Concentration [LOEC], Lowest Observed Effect Level [LOEL], No Observed Adverse Effect Level [NOAEL], No Observed Adverse Effect Concentration [NOAEC]) in mg/kg-bw or mg/kg-diet for reproductive test procedure(s) (e.g., generational studies [preferred], fertility, new born weight). Most common test species available in scientific literature are rats and mice. The lowest NOEC, NOAEC, NOEL, or NOAEL test results found for a rat would be used as a toxicological endpoint for RQ calculations to assess chronic risk (see Table G-1 in Section G.7.1).

Avian LD_{50}: For test species available in the scientific literature, Service personnel would record values for oral lethal dose (LD_{50}) in mg/kg-bw or ppm-bw. Most common test species available in scientific literature are the bobwhite quail and mallard. The lowest LD_{50} value found for an avian species would be used as a toxicological endpoint for dose-based RQ calculations to assess acute risk (see Table G-1 in Section G.7.1).

Avian LC_{50}: For test species available in the scientific literature, Service personnel would record values for dietary lethal concentration (LC_{50}) as reported (e.g., mg/kg-diet or ppm-diet). Most common test species available in scientific literature are the bobwhite quail and mallard. The lowest LC_{50} value found for an avian species would be used as a toxicological endpoint for dietary-based RQ calculations to assess acute risk (see Table G-1 in Section G.7.1).

Avian Reproduction: For test species available in the scientific literature, Service personnel would record test results (e.g., LOEC, LOEL, NOAEC, NOAEL) in mg/kg-bw or mg/kg-diet consumed for reproductive test procedure(s) (e.g., early life cycle, reproductive). Most common test species available in scientific literature are the bobwhite quail and mallard. The lowest NOEC, NOAEC, NOEL, or NOAEL test results found for an avian species would be used as a toxicological endpoint for RQ calculations to assess chronic risk (see Table G-1 in Section G.7.1).

Fish LC_{50}: For test freshwater or marine species listed in the scientific literature, Service personnel would record a LC_{50} in ppm or mg/L. Most common test species available in the scientific literature are the bluegill, rainbow trout, and fathead minnow (marine). Test results for many game species may also be available. The lowest LC_{50} value found for a freshwater fish species would be used as a toxicological endpoint for RQ calculations to assess acute risk (see Table G-1 in Section G.7.1).

Fish Early Life Stage (ELS)/Life Cycle: For test freshwater or marine species available in the scientific literature, Service personnel would record test results (e.g., LOEC, NOAEL, NOAEC, LOAEC) in ppm for test procedure(s) (e.g., early life cycle, life cycle). Most common test species available in the scientific literature are bluegill, rainbow trout, and fathead minnow. Test results for other game species may also be available. The lowest test value found for a fish species (preferably freshwater) would be used as a toxicological endpoint for RQ calculations to assess chronic risk (see Table G-1 in Section G.7.1).

Other: For test invertebrate as well as non-vascular and vascular plant species available in the scientific literature, Service personnel would record LC_{50}, LD_{50}, LOEC, LOEL, NOAEC, NOAEL, or EC_{50} (environmental concentration) values in ppm or mg/L. Most common test invertebrate species available in scientific literature are the honey bee and the water flea (*Daphnia magna*). Green algae (*Selenastrum capricornutum*) and pondweed (*Lemna minor*) are frequently available test species for aquatic non-vascular and vascular plants, respectively.

G.7.8 Ecological Incident Reports

After a site has been treated with pesticide(s), wildlife may be exposed to these chemical(s). When exposure is high relative to the toxicity of the pesticides, wildlife may be killed or visibly harmed (incapacitated). Such events are called ecological incidents. The USEPA maintains a database (Ecological Incident Information System) of ecological incidents. This database stores information extracted from incident reports submitted by various federal and state agencies and non-government organizations. Information included in an incident report is date and location of the incident, type, and magnitude of effects observed in various species, use(s) of pesticides known or suspected of contributing to the incident, and results of any chemical residue and cholinesterase activity analyses conducted during the investigation.

Incident reports can play an important role in evaluating the effects of pesticides by supplementing quantitative risk assessments. All incident reports for pesticide(s) with the active ingredient and associated information would be recorded.

G.7.9 Environmental Fate

Water Solubility: Service personnel would record values for water solubility (S_w), which describes the amount of pesticide that dissolves in a known quantity of water. S_w is expressed as mg/L (ppm). Pesticide S_w values would be categorized as one of the following: insoluble <0.1 ppm, moderately soluble = 100 to 1000 ppm, highly soluble >10,000 ppm (USGS 2000). As pesticide S_w increases, there would be greater potential to degrade water quality through runoff and leaching.

S_w would be used to evaluate potential for bioaccumulation in aquatic species [see **Octanol-Water Partition Coefficient (K_{ow})** below].

Soil Mobility: Service personnel would record available values for soil adsorption coefficient (K_{oc} [µg/g]). It provides a measure of a chemical's mobility and leaching potential in soil. K_{oc} values are directly proportional to organic content, clay content, and surface area of the soil. K_{oc} data for a pesticide may be available for a variety of soil types (e.g., clay, loam, sand).

K_{oc} values would be used in evaluating the potential to degrade groundwater by leaching (see **Potential to Move to Groundwater** below).

Soil Persistence: Service personnel would record values for soil half-life (t½), which represents the length of time (days) required for 50% of the deposited pesticide to degrade (completely or partially) in the soil. Based upon the t½ value, soil persistence would be categorized as one of the following:

non-persistent <30 days, moderately persistent = 30 to 100 days, and persistent >100 days (Kerle et al. 1996).

Threshold for Approving PUPs:

If soil t½ ≤100 days, then a PUP would be approved without additional BMPs to protect water quality.

If soil t½ >100 days, then a PUP would only be approved with additional BMPs specifically to protect water quality. One or more BMPs such as the following would be included in the ***Specific Best Management Practices (BMPs)*** *section to minimize potential surface runoff and leaching that can degrade water quality:*

- *Do not exceed one application per site per year.*
- *Do not use on coarse-textured soils where the ground water table is <10 feet and average annual precipitation >12 inches.*
- *Do not use on steep slopes if substantial rainfall is expected within 24 hours or ground is saturated.*

Along with K_{oc}, soil t½ values would be used in evaluating the potential to degrade groundwater by leaching (see **Potential to Move to Groundwater** below).

Soil Dissipation: Dissipation time (DT_{50}) represents the time required for 50% of the deposited pesticide to degrade and move from a treated site; whereas, soil t½ describes the rate for degradation only. As for t½, units of dissipation time are usually expressed in days. Field dissipation time would be the preferred data for use to estimate pesticide concentrations in the environment because it is based upon field studies compared to soil t½, which is derived in a laboratory. However, soil t½ is the most common persistence data available in the published literature. If field dissipation data are not available, soil half-life data would be used in a Chemical Profile. The average or representative half-life value of most important degradation mechanism would be selected for quantitative analysis for both terrestrial and aquatic environments.

Based upon the DT_{50} value, environmental persistence in the soil also would be categorized as one of the following: non-persistent <30 days, moderately persistent = 30 to 100 days, and persistent >100 days.

Threshold for Approving PUPs:

If soil DT_{50} ≤100 days, then a PUP would be approved without additional BMPs to protect water quality.

If soil DT_{50} >100 days, then a PUP would only be approved with additional BMPs specifically to protect water quality. One or more BMPs such as the following would be included in the ***Specific Best Management Practices (BMPs)*** *section to minimize potential surface runoff and leaching that can degrade water quality:*

- *Do not exceed one application per site per year.*
- *Do not use on coarse-textured soils where the ground water table is <10 feet and average annual precipitation >12 inches.*

- *Do not use on steep slopes if substantial rainfall is expected within 24 hours or ground is saturated.*

Along with K_{oc}, soil DT_{50} values (preferred over soil t½) would be used in evaluating the potential to degrade groundwater by leaching (see Potential to Move to Groundwater below), if available.

Aquatic Persistence: Service personnel would record values for aquatic t½, which represents the length of time required for 50% of the deposited pesticide to degrade (completely or partially) in water. Based upon the t½ value, aquatic persistence would be categorized as one of the following: non-persistent <30 days, moderately persistent = 30 to 100 days, and persistent >100 days (Kerle et al. 1996).

Threshold for Approving PUPs:

If aquatic t½ ≤100 days, then a PUP would be approved without additional BMPs to protect water quality.

*If aquatic t½ >100 days, then a PUP would only be approved with additional BMPs specifically to protect water quality. One or more BMPs such as the following would be included in the **Specific Best Management Practices (BMPs)** section to minimize potential surface runoff and leaching that can degrade water quality:*

- *Do not exceed one application per site per year.*
- *Do not use on coarse-textured soils where the ground water table is <10 feet and average annual precipitation >12 inches.*
- *Do not use on steep slopes if substantial rainfall is expected within 24 hours or ground is saturated.*

Aquatic Dissipation: Dissipation time (DT_{50}) represents the time required for 50% of the deposited pesticide to degrade or move (dissipate); whereas, aquatic t½ describes the rate for degradation only. As for t½, units of dissipation time are usually expressed in days. Based upon the DT_{50} value, environmental persistence in aquatic habitats also would be categorized as one of the following: non-persistent <30 days, moderately persistent = 30 to 100 days, and persistent >100 days.

Threshold for Approving PUPs:

If aquatic DT_{50} ≤100 days, then a PUP would be approved without additional BMPs to protect water quality.

*If aquatic DT_{50} >100 days, then a PUP would only be approved with additional BMPs specifically to protect water quality. One or more BMPs such as the following would be included in the **Specific Best Management Practices (BMPs)** section to minimize potential surface runoff and leaching that can degrade water quality:*

- *Do not exceed one application per site per year.*
- *Do not use on coarse-textured soils where the ground water table is <10 feet and average annual precipitation >12 inches.*
- *Do not use on steep slopes if substantial rainfall is expected within 24 hours or ground is saturated.*

Potential to Move to Groundwater: Groundwater Ubiquity Score (GUS) = $\log_{10}$(soil t ½) x [4 – $\log_{10}(K_{oc})$]. If a DT_{50} value is available, it would be used rather than a t½ value to calculate a GUS score. Based upon the GUS value, the potential to move toward groundwater would be recorded as one of the following categories: extremely low potential <1.0, low—1.0 to 2.0, moderate—2.0 to 3.0, high—3.0 to 4.0, or very high >4.0.

Threshold for Approving PUPs:

If GUS ≤4.0, then a PUP would be approved without additional BMPs to protect water quality.

If GUS >4.0, then a PUP would only be approved with additional BMPs specifically to protect water quality. One or more BMPs such as the following would be included in the ***Specific Best Management Practices (BMPs)*** *section to minimize potential surface runoff and leaching that can degrade water quality:*

- *Do not exceed one application per site per year.*
- *Do not use on coarse-textured soils where the ground water table is <10 feet and average annual precipitation >12 inches.*
- *Do not use on steep slopes if substantial rainfall is expected within 24 hours or ground is saturated.*

Volatilization: Pesticides may volatilize (evaporate) from soil and plant surfaces and move off-target into the atmosphere. The potential for a pesticide to volatilize is a function of its vapor pressure that is affected by temperature, sorption, soil moisture, and the pesticide's water solubility. Vapor pressure is often expressed in mm Hg. To make these values easier to compare, vapor pressure would be recorded by Service personnel in exponential form (I x 10^{-7}), where I represents a vapor pressure index. In general, pesticides with I<10 would have low potential to volatilize; whereas, pesticides with I >1,000 would have a high potential to volatilize (Oregon State University 1996). Vapor pressure values for pesticides are usually available in the pesticide product MSDS or the USDA Agricultural Research Service (ARS) pesticide database (see References).

Threshold for Approving PUPs:

If I ≤1,000, then a PUP would be approved without additional BMPs to minimize drift and protect air quality.

If I >1,000, then a PUP would only be approved with additional BMPs specifically to minimize drift and protect air quality. One or more BMPs such as the following would be included in the ***Specific Best Management Practices (BMPs)*** *section to reduce volatilization and potential to drift and degrade air quality:*

- D*o not treat when wind velocities are <2 or >10 mph with existing or potential inversion conditions.*
- *Apply the large-diameter droplets possible for spray treatments.*
- *Avoid spraying when air temperatures >85°F.*
- *Use the lowest spray height possible above target canopy.*
- *Where identified on the pesticide label, soil incorporate pesticide as soon as possible during or after application.*

Octanol-Water Partition Coefficient (K_{ow}): The octanol-water partition coefficient (K_{ow}) is the concentration of a pesticide in octanol and water at equilibrium at a specific temperature. Because octanol is an organic solvent, it is considered a surrogate for natural organic matter. Therefore, K_{ow} would be used to assess potential for a pesticide to bioaccumulate in tissues of aquatic species (e.g., fish). If K_{ow} >1,000 or S_w<1 mg/L and soil t½>30 days, then there would be high potential for a pesticide to bioaccumulate in aquatic species such as fish (USGS 2000).

Threshold for Approving PUPs:

If there is not a high potential for a pesticide to bioaccumulate in aquatic species, then the PUP would be approved.

If there is a high potential to bioaccumulate in aquatic species (K_{ow}>1,000 or S_w<1 mg/L and soil t½>30 days), then the PUP would not approved, except under unusual circumstances where approval would only be granted by the Washington Office.

Bioaccumulation/Bioconcentration: The physiological process where pesticide concentrations in tissue would increase in biota because they are taken and stored at a faster rate than they are metabolized or excreted. The potential for bioaccumulation would be evaluated through bioaccumulation factors (BAFs) or bioconcentration factors (BCFs). Based upon BAF or BCF values, the potential to bioaccumulate would be recorded as one of the following: low – 0 to 300, moderate – 300 to 1,000, or high >1,000 (Calabrese and Baldwin 1993).

Threshold for Approving PUPs:

If BAF or BCF≤1,000, then a PUP would be approved without additional BMPs.

If BAF or BCF>1,000, then a PUP would not approved, except under unusual circumstances where approval would only be granted by the Washington Office.

Worst-Case Ecological Risk Assessment

Max Application Rates (acid equivalent): Service personnel would record the highest application rate of an active ingredient (ae basis) for habitat management and cropland/facilities maintenance treatments in this data field of a Chemical Profile. These rates can be found in Table CP.1 under the column heading “Max Product Rate – Single Application (lbs/acre – AI on acid equiv basis)”. This table would be prepared for a Chemical Profile from information specified in labels for trade name products identified in PUPs. If these data are not available in pesticide labels, then write “NS” for “not specified on label” in this table.

EECs: An estimated environmental concentration (ECC) represents potential exposure to fish and wildlife (birds and mammals) from using a pesticide. EECs would be derived by Service personnel using an USEPA screening-level approach (USEPA 2004). For each max application rate [see description under **Max Application Rates (acid equivalent)**], Service personnel would record 2 EEC values in a Chemical Profile; these would represent the worst-case terrestrial and aquatic exposures for habitat management and croplands/facilities maintenance treatments. For terrestrial and aquatic EEC calculations, see description for data entry under **Presumption of Unacceptable Risk/Risk Quotients**, which is the next field for a Chemical Profile.

Presumption of Unacceptable Risk/Risk Quotients: Service personnel would calculate and record acute and chronic risk quotients (RQs) for birds, mammals, and fish using the provided tabular formats for habitat management and/or cropland/facilities maintenance treatments. RQs recorded in a Chemical Profile would represent the worst-case assessment for ecological risk. See Section G.7.2 for discussion regarding the calculations of RQs.

For aquatic assessments associated with habitat management treatments, RQ calculations would be based upon selected acute and chronic toxicological endpoints for fish and the EEC would be derived from Urban and Cook (1986) assuming 100% overspray to an entire 1-foot deep water body using the max application rate (ae basis [see above]).

For aquatic assessments associated with cropland/facilities maintenance treatments, RQ calculations would be done by Service personnel based upon selected acute and chronic toxicological endpoints for fish and an EEC would be derived from the aquatic assessment in AgDRIFT® model version 2.01 under Tier I ground-based application with the following input variables: max application rate (acid basis [see above]), low boom (20 inches), fine to medium/coarse droplet size, 20 swaths, EPA-defined wetland, and 25-foot distance (buffer) from treated area to water.

See Section G.7.2 for more details regarding the calculation of EECs for aquatic habitats for habitat management and cropland/facilities maintenance treatments.

For terrestrial avian and mammalian assessments, RQ calculations would be done by Service personnel based upon dietary exposure, where the “short grass” food item category would represent the worst-case scenario. For terrestrial spray applications associated with habitat management and cropland/facilities maintenance treatments, exposure (EECs and RQs) would be determined using the Kanaga nomogram method through the USEPA’s T-REX version 1.2.3. T-REX input variables would include the following: max application rate (acid basis [see above]) and pesticide half-life (days) in soil to estimate the initial, maximum pesticide residue concentration on general food items for terrestrial vertebrate species in short (<20 cm tall) grass.

For granular pesticide formulations and pesticide-treated seed with a unique route of exposure for terrestrial avian and mammalian wildlife, see Section G.7.2 for the procedure that would be used to calculate RQs.

All calculated RQs in both tables would be compared with Levels of Concern (LOCs) established by USEPA (see Table G-2 in Section G.7.2). If a calculated RQ exceeds an established LOC value (in brackets inside the table), then there would be a potential for an acute or chronic effect (unacceptable risk) to federally listed (T&E) species and nonlisted species. See Section G.7.2 for detailed descriptions of acute and chronic RQ calculations and comparison to LOCs to assess risk.

Threshold for Approving PUPs:

If RQs≤LOCs, then a PUP would be approved without additional BMPs.

If RQs>LOCs, then a PUP would only be approved with additional BMPs specifically to minimize exposure (ecological risk) to bird, mammal, and/or fish species. One or more BMPs such as the following would be included in the ***Specific Best Management Practices (BMPs)*** *section to reduce potential risk to non-listed or listed species:*

- *Lower application rate and/or fewer number of applications so RQs≤LOCs*
- *For aquatic assessments (fish) associated with cropland/facilities maintenance, increase the buffer distance beyond 25 feet so RQs≤LOCs.*

Justification for Use: Service personnel would describe the reason for using the pesticide based control of specific pests or groups of pests. In most cases, the pesticide label would provide the appropriate information regarding control of pests to describe in the section.

Specific Best Management Practices (BMPs): Service personnel would record specific BMPs necessary to minimize or eliminate potential effects to non-target species and/or degradation of environmental quality from drift, surface runoff, or leaching. These BMPs would be based upon scientific information documented in previous data fields of a Chemical Profile. Where necessary and feasible, these specific practices would be included in PUPs as a basis for approval.

If there are no specific BMPs that are appropriate, then Service personnel would describe why the potential effects to refuge resources and/or degradation of environmental quality is outweighed by the overall resource benefit(s) from the proposed pesticide use in the BMP section of the PUP. See Section G.4 of this document for a complete list of BMPs associated with mixing and applying pesticides appropriate for all PUPs with ground-based treatments that would be additive to any necessary, chemical-specific BMPs.

References: Service personnel would record scientific resources used to provide data/information for a chemical profile. Use the number sequence to uniquely reference data in a chemical profile.

The following on-line data resources are readily available for toxicological endpoint and environmental fate data for pesticides:

1. California Product/Label Database. Department of Pesticide Regulation, California Environmental Protection Agency. (http://www.cdpr.ca.gov/docs/label/labelque.htm#regprods)

2. ECOTOX database. Office of Pesticide Programs, U.S. Environmental Protection Agency, Washington, D.C. (http://cfpub.epa.gov/ecotox/)

3. Extension Toxicology Network (EXTOXNET) Pesticide Information Profiles. Cooperative effort of University of California-Davis, Oregon State University, Michigan State University, Cornell University and University of Idaho through Oregon State University, Corvallis, Oregon. (http://extoxnet.orst.edu/pips/ghindex.html)

4. FAO specifications and evaluations for plant protection products. Pesticide Management Unit, Plant Protection Services, Food and Agriculture Organization, United Nations. (http://www.fao.org/WAICENT/FAOINFO/AGRICULT/AGP/AGPP/Pesticid/)

5. Human health and ecological risk assessments. Pesticide Management and Coordination, Forest Health Protection, U.S. Department of Agriculture, U.S. Forest Service. (http://www.fs.fed.us/foresthealth/pesticide/risk.htm)

6. Pesticide Chemical Fact Sheets. Clemson University Pesticide Information Center. (http://entweb.clemson.edu/pesticid/Document/Labels/factshee.htm)

7. Pesticide Fact Sheets. Published by Information Ventures, Inc. for Bureau of Land Management, Department of Interior; Bonneville Power Administration, U.S. Department of Energy; and Forest Service, U.S. Department of Agriculture. (http://infoventures.com/e-hlth/pesticide/pest-fac.html)

8. Pesticide Fact Sheets. National Pesticide Information Center. (http://npic.orst.edu/npicfact.htm)

9. Pesticide Fate Database. U.S. Environmental Protection Agency, Washington, D.C. (http://cfpub.epa.gov/pfate/home.cfm).

10. Pesticide product labels and material safety data sheets. Crop Data Management Systems, Inc. (CDMS) (http://www.cdms.net/pfa/LUpdateMsg.asp) or multiple websites maintained by agrichemical companies.

11. Registered Pesticide Products (Oregon database). Oregon Department of Agriculture. (http://www.oda.state.or.us/dbs/pest_products/search.lasso)

12. Regulatory notes. Pest Management Regulatory Agency, Health Canada, Ontario, Canada. (http://www.hc-sc.gc.ca/pmra-arla/)

13. Reptile and Amphibian Toxicology Literature. Canadian Wildlife Service, Environment Canada, Ontario, Canada. (http://www.cws-scf.ec.gc.ca/nwrc-cnrf/ratl/index_e.cfm)

14. Specific Chemical Fact Sheet – New Active Ingredients, Biopesticide Fact Sheet and Registration Fact Sheet. U.S. Environmental Protection Agency, Washington, D.C. (http://www.epa.gov/pestidides/factsheets/chemical_fs.htm)

15. Weed Control Methods Handbook: Tools and Techniques for Use in Natural Areas. The Invasive Species Initiative. The Nature Conservancy. (http://tnsweeds.ucdavis.edu/handbook.html)

16. Wildlife Contaminants Online. U.S. Geological Survey, Department of Interior, Washington, D.C. (http://www.pwrc.usgs.gov/contaminants-online/)

17. One-liner database. 2000. U.S. Environmental Protection Agency, Office of Pesticide Programs, Washington, D.C.

Chemical Profile

Date:			
Trade Name(s):		**Common Chemical Name(s):**	
Pesticide Type:		**EPA Registration Number:**	
Pesticide Class:		**CAS Number:**	
Other Ingredients:			

Toxicological Endpoints

Mammalian LD_{50}:	
Mammalian LC_{50}:	
Mammalian Reproduction:	
Avian LD_{50}:	
Avian LC_{50}:	
Avian Reproduction:	
Fish $LC_5$0:	
Fish ELS/Life Cycle:	
Other:	

Ecological Incident Reports

Environmental Fate

Water solubility (S_w):	
Soil Mobility (K_{oc}):	
Soil Persistence (t½):	
Soil Dissipation (DT_{50}):	
Aquatic Persistence (t½):	
Aquatic Dissipation (DT_{50}):	
Potential to Move to Groundwater (GUS score):	
Volatilization (mm Hg):	
Octanol-Water Partition Coefficient (K_{ow}):	
Bioaccumulation/Bioconcentration:	**BAF:** **BCF:**

Worst Case Ecological Risk Assessment

Max Application Rate **(ai lbs/acre – ae basis)**	**Habitat Management:** **Croplands/Facilities Maintenance:**
EECs	**Terrestrial (Habitat Management):** **Terrestrial (Croplands/Facilities Maintenance):** **Aquatic (Habitat Management):** **Aquatic (Croplands/Facilities Maintenance):**

Habitat Management Treatments:

Presumption of Unacceptable Risk		**Risk Quotient (RQ)**	
		Listed (T&E) Species	**Nonlisted Species**
Acute	Birds	[0.1]	[0.5]
	Mammals	[0.1]	[0.5]
	Fish	[0.05]	[0.5]
Chronic	Birds	[1]	[1]
	Mammals	[1]	[1]
	Fish	[1]	[1]

Cropland/Facilities Maintenance Treatments:

Presumption of Unacceptable Risk		**Risk Quotient (RQ)**	
		Listed (T&E) Species	**Nonlisted Species**
Acute	Birds	[0.1]	[0.5]
	Mammals	[0.1]	[0.5]
	Fish	[0.05]	[0.5]
Chronic	Birds	[1]	[1]
	Mammals	[1]	[1]
	Fish	[1]	[1]

Justification for Use:

Specific Best Management Practices (BMPs):	
References:	

Table CP.1 Pesticide Name

Trade Name[a]	Treatment Type[b]	Max Product Rate – Single Application (lbs/acre or gal/acre)	Max Product Rate - Single Application (lbs/acre - AI on acid equiv basis)	Max Number of Applications Per Season	Max Product Rate Per Season (lbs/acre/season or gal/acre/season)	Minimum Time Between Applications (Days)

[a]From each label for a pesticide identified in pesticide use proposals (PUPs), Service personnel would record application information associated with possible/known uses on Service lands.
[b]Treatment type: H – habitat management or CF – cropland/facilities maintenance. If a pesticide is labeled for both types of treatments (uses), then record separate data for H and CF applications.

G.10 References

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Appendix H. Acronyms, Glossary, and Scientific Names

H.1 Acronyms

ABA	Architectural Barriers Act
ABC	American Bird Conservancy
ACG	Aleutian Canada Goose
ADA	Americans with Disabilities Act
ADF&G	Alaska Department of Fish and Game
AOU	American Ornithologists' Union
ARPA	Archaeological Resources Protection Act
Audubon	National Audubon Society
BCC	Birds of Conservation Concern
BIDEH	Biological Integrity, Diversity, and Environmental Health
BMC	Birds of Management Concern
BMPs	Best Management Practices
CCP	Comprehensive Conservation Plan
CD	Compatibility Determination
CFR	Code of Federal Regulations
CLMA	Cooperative Land Management Agreement
Complex	Oregon Coast National Wildlife Refuge Complex
CWA	Clean Water Act
DBH	Diameter at Breast Height
DCP	Disease Contingency Plan
DLCD	Department of Land Conservation and Development
DSL	Oregon Department of State Lands
EA	Environmental Assessment
EDRR	Early Detection Rapid Response
EE	Environmental Education
EIS	Environmental Impact Statement
ENSO	El Niño/Southern Oscillation
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FIRFA	Federal Insecticide, Fungicide, and Rodenticide Act
FLTFA	Federal Land Transaction Facilitation Act
FMEP	Fishery Management and Evaluation Plan
FMP	Fire Management Plan
FR	Federal Register
FWS	U.S. Fish and Wildlife Service (also, Service, USFWS)
GHG	Greenhouse Gases
GIS	Geographic Information System
GPS	Global Positioning System
HMP	Habitat Management Plan
HUC	Hydrologic Unit Code
IAE	Institute for Applied Ecology
IBAs	Important Bird Areas
IPCC	Intergovernmental Panel on Climate Change
IPM	Integrated Pest Management

JGEMS	Jane Goodall Environmental Middle School
LCC	Land Conservation Cooperative
LE	Law Enforcement
LWCF	Land and Water Conservation Fund
LWD	Large Woody Debris
MHHW	Mean Higher High Water
MHW	Mean High Water
MLLW	Mean Lower Low Water
MLW	Mean Low Water
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MSL	Mean Sea Level
MTL	Mean Tide Level
NAGPRA	Native American Graves Repatriation Act
NAS	National Academy of Sciences
NASA	National Aeronautics and Space Administration
NAVD88	North American Vertical Datum 1988
NEPA	National Environmental Policy Act
NGO	Non-governmental Organization
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOA	Notice of Availability
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NRCS	National Resources Conservation Service
NRHP	National Register of Historic Places
NWR	National Wildlife Refuge
NWRS	National Wildlife Refuge System
ODEQ	State of Oregon Department of Environmental Quality
ODF	State of Oregon Department of Forestry
ODFW	State of Oregon Department of Fish and Wildlife
OPRD	State of Oregon Parks and Recreation Department
ORNHIC	Oregon Natural Heritage Information Center
OSB	Oregon Silverspot Butterfly
PCE	Primary Constituent Element
PDO	Pacific Decadal Oscillation
PFC	Pacific Flyway Council
PFMC	Pacific Fisheries Management Council
PFT	Permanent full time
PIF	Partners in Flight
PRBO	Point Reyes Bird Observatory
PUP	Pesticide Use Proposal
R1	Region 1 of the FWS (WA, OR, HI, ID)
RNA	Research Natural Area
ROC	Resource of Concern
SAMMS	Service Asset Management System
SCORP	Statewide Comprehensive Outdoor Recreation Plan
SHPO	State Historic Preservation Office
SLAMM	Sea Level Affecting Marshes Model

SMU	Species Management Unit
T & E	Threatened or Endangered Species
TMDL	Total Maximum Daily Load
U.S.C.	United States Code
USDA	U.S. Department of Agriculture
USDI	U.S. Department of the Interior (also, DOI)
USEPA	U.S. Environmental Protection Agency (also, EPA)
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USHCN	U.S. Historical Climatology Network

H.2 Glossary

Adaptive Management. Refers to a process in which policy decisions are implemented within a framework of scientifically driven experiments to test predictions and assumptions inherent in a management plan. Analysis of results help managers determine whether current management should continue as is or whether it should be modified to achieve desired conditions.

Alternative. 1. A reasonable way to fix the identified problem or satisfy the stated need (40 CFR 1500.2). 2. Alternatives are different means of accomplishing refuge purposes and goals and contributing to the System mission (Service Manual 602 FW 1.6).

Anadromous. A fish that hatches in freshwater, migrates to the ocean to live and grow, and returns to freshwater to spawn.

Approved refuge boundary. A project boundary which the Regional Director of the U.S. Fish and Wildlife Service approves upon completion of the planning and environmental compliance process. An approved refuge boundary only designates those lands which the Fish and Wildlife Service has authority to acquire and/or manage through various agreements. Approval of a refuge boundary does not grant the Fish and Wildlife Service jurisdiction or control over lands within the boundary, and it does not make lands within the refuge boundary part of the National Wildlife Refuge System. Lands do not become part of the National Wildlife Refuge System unless they are purchased or are placed under an agreement that provides for management as part of the Refuge System.

BIDEH. Biological integrity, diversity and environmental health represented by native fish, wildlife, plants and their habitats as well as those ecological processes that support them.

Biological Diversity. The variety of life and its processes, including the variety of living organisms, the genetic differences among them, and the communities and ecosystems in which they occur (Service Manual 052 FW 1.12B). The System's focus is on indigenous species, biotic communities, and ecological processes. Also referred to as Biodiversity.

Biological Integrity. Composition, structure, and function at the genetic, organism, and community levels that are consistent with natural conditions and the biological processes that shape communities, along with organisms and their genetic material.

Compatible Use. A proposed or existing wildlife-dependent recreational use or any other use of a national wildlife refuge that, based on sound professional judgment, will not materially interfere with or detract from the fulfillment of the National Wildlife Refuge System mission or the purposes of the national wildlife refuge (Service Manual 603 FW 2.6). A compatibility determination supports the selection of compatible uses and identifies stipulations or limits necessary to ensure compatibility.

Comprehensive Conservation Plan (CCP). A document that describes the desired future conditions of a refuge or planning unit and provides long-range guidance and management direction to achieve the purposes of the refuge; helps fulfill the mission of the Refuge System; maintains and, where appropriate, restores the ecological integrity of each refuge and the Refuge System; and meets other mandates (Service Manual 602 FW 1.6).

Concern. See definition of issue.

Cover Type. The type of vegetation in an area. Often referred to as percent cover or the % of ground covered by vegetation type (e.g., 20% shrub cover).

Cultural Resources. The remains of sites, structures, or objects used by people in the past.

Cultural Resource Inventory. A professionally conducted study designed to locate and evaluate evidence of cultural resources present within a defined geographic area. Inventories may involve various levels, including a background literature search, a comprehensive field examination to identify all exposed physical manifestations of cultural resources, or a sample inventory to project site distribution and density over a larger area. Evaluation of identified cultural resources to determine eligibility for the National Register follows the criteria found in 36 CFR 60.4 (Service Manual 614 FW 1.7).

Demography. The study of life-history parameters such as adult survival, fledgling success, number of broods raised per year.

Disturbance. Significant alteration of wildlife behavior or habitat structure and composition. May be natural (e.g., fire) or human-caused events (e.g., aircraft over flight).

Ecosystem. A dynamic and interrelating complex of plant and animal communities and their associated non-living environment.

Ecosystem Management. Management of natural resources using system-wide concepts to ensure that all plants and animals in ecosystems are maintained at viable levels in native habitats and basic ecosystem processes are perpetuated indefinitely.

Endangered Species (Federal). A plant or animal species listed under the Endangered Species Act that is in danger of extinction throughout all or a significant portion of its range.

Endangered Species (State). A plant or animal species in danger of becoming extinct or extirpated in Oregon within the near future if factors contributing to its decline continue. Populations of these species are at critically low levels or their habitats have been degraded or depleted to a significant degree.

Environmental Assessment (EA). A concise public document, prepared in compliance with the National Environmental Policy Act, that briefly discusses the purpose and need for an action, alternatives to such action, and provides sufficient evidence and analysis of impacts to determine whether to prepare an environmental impact statement or finding of no significant impact (40 CFR 1508.9).

Environmental Health. The composition, structure, and functioning of soil, water, air, and other nonliving features comparable with historical conditions, including the natural processes that shape the environment.

Finding of No Significant Impact (FONSI). A document prepared in compliance with the National Environmental Policy Act, supported by an environmental assessment, that briefly presents why a Federal action will have no significant effect on the human environment and for which an environmental impact statement, therefore, will not be prepared (40 CFR 1508.13).

Fire Regime. A natural fire regime is a general classification of the role fire would play across a landscape in the absence of modern human mechanical intervention, but including the influence of aboriginal burning.

Focal Resources. Plant and animal species that are most representative of refuge purposes, BIDEH, and other FWS and ecosystem priorities. Conservation and management of these species would guide refuge management in the future. See Priority Resources of Concern and Other Benefiting Species.

Forb. A broad-leaved, herbaceous plant; for example, a columbine.

Friends Group. Any formal organization whose mission is to support the goals and purposes of its associated refuge and the National Wildlife Refuge Association overall. Includes friends organizations and cooperative and interpretive associations.

Goal. A descriptive, open-ended, and often broad statement of desired future conditions that conveys a purpose, but does not define measurable units (Service Manual 602 FW 1.6).

Habitat. Suite of existing environmental conditions required by an organism for survival and reproduction. The place where an organism typically lives.

Habitat Type. See Vegetation Type.

Habitat Restoration. Management emphasis designed to move ecosystems to desired conditions and processes, and/or to healthy ecosystems.

Integrated Pest Management (IPM). Methods of managing undesirable species such as invasive plants: education, prevention, physical or mechanical methods of control, biological control, responsible chemical use, and cultural methods.

Invasive Species. A nonnative species whose introduction causes or is likely to cause economic or environmental harm. Also referred to as exotic or non-native species.

Inventory. A survey that documents the presence, relative abundance, status, and/or distribution of abiotic resources, species, habitats, or ecological communities at a particular time. Often referred to as baseline inventory.

Issue. Any unsettled matter that requires a management decision (e.g., a Service initiative, opportunity, resource management problem, a threat to the resources of the unit, conflict in uses, public concern, or the presence of an undesirable resource condition) (Service Manual 602 FW 1.6).

Management Alternative. See Alternative.

Migration. The seasonal movement from one area to another and back.

Mission Statement. Succinct statement of a unit's purpose and reason for being.

Monitoring. The process of collecting information through time to determine changes in the status and/or demographics of abiotic resources, wildlife or plants, habitat, or ecological communities.

National Environmental Policy Act of 1969 (NEPA). Requires all agencies, including the Service, to examine the environmental impacts of their actions, incorporate environmental information, and use public participation in the planning and implementation of all actions. Federal agencies must integrate NEPA with other planning requirements, and prepare appropriate NEPA documents to facilitate better environmental decision making (40 CFR 1500).

National Wildlife Refuge (Refuge or NWR). A designated area of land, water, or an interest in land or water within the National Wildlife Refuge System.

National Wildlife Refuge System (Refuge System or NWRS). All lands, waters, and interests therein administered by the Service as wildlife refuges, wildlife ranges, wildlife management areas, waterfowl production areas, and other areas for the protection and conservation of fish and wildlife, including those that are threatened with extinction.

National Wildlife Refuge System Mission. The mission is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

Native Species. Species that normally live and thrive in a particular ecosystem.

Non-Governmental Organization (NGO). Any group that is not comprised of Federal, State, tribal, county, city, town, local, or other governmental entities.

Noxious species. Any plant or plant product that can directly or indirectly injure or cause damage to crops (including nursery stock or plant products), livestock, poultry, or other interests of agriculture, irrigation, navigation, the natural resources of the United States, the public health, or the environment. Control of these species is mandated by law.

Objective. An objective is a concise target statement of what will be achieved, how much will be achieved, when and where it will be achieved, and who is responsible for the work. Objectives are derived from goals and provide the basis for determining management strategies. Objectives should be attainable and time-specific and should be stated quantitatively to the extent possible. If objectives cannot be stated quantitatively, they may be stated qualitatively (Service Manual 602 FW 1.6).

Obligate Species. Species that require a specific habitat type or plant species for their existence.

Ocean Acidification. The ongoing decrease in the pH of the Earth's oceans, caused by their uptake of anthropogenic carbon dioxide from the atmosphere.

Other Benefiting Species. Native species, other than priority resources of concern and focal resources that would benefit from management actions.

Paleontology. The study of prehistoric life, including organisms' evolution and interactions with each other and their environments.

Passerine. See songbird

Pinniped. A suborder of carnivores that are marine mammals, have flippers, and eat mostly fish and marine invertebrates (e.g., sea lions, seals).

Plant Association. A classification of plant communities based on the similarity in dominants of all layers of vascular species in a climax community.

Plant Community. An assemblage of plant species unique in its composition; occurs in particular locations under particular influences; a reflection or integration of the environmental influences on the site such as soils, temperature, elevation, solar radiation, slope, aspect, and rainfall; denotes a general kind of climax plant community (e.g., Sitka spruce).

Preferred Alternative. This is the alternative determined (by the decision maker) to best: achieve a refuge's purpose(s), vision, and goals; contributes to the Refuge System mission; addresses the significant issues; and is consistent with principles of sound fish and wildlife management.

Priority Public Use. One of six uses authorized by the National Wildlife Refuge System Improvement Act of 1997 to have priority if found to be compatible with the purposes of a national wildlife refuge or wetland management district. Each of the six uses are wildlife-dependent, recreational uses—hunting, fishing, wildlife observation, photography, environmental education, and interpretation.

Priority Resources of Concern. Habitats that are most representative of refuge BIDEH, as well as other FWS and ecosystem priorities that were chosen as resources that would guide refuge management in the future. See Focal Resources.

Public. Individuals, organizations, and groups; officials of Federal, state, and local government agencies; Indian tribes; and foreign nations. It may include anyone outside the core planning team. It includes those who may or may not have indicated an interest in Service issues and those who do or do not realize that Service decisions may affect them.

Purpose(s) of the Refuge. The purpose of a refuge is specified in or derived from the law, proclamation, executive order, agreement, public land order, donation document, or administrative memorandum establishing, authorizing, or expanding a refuge, refuge unit, or refuge subunit (Service Manual 602 FW 1.6).

Refuge Goal. See Goal.

Refuge Purposes. See Purposes of the Refuge.

Restoration. One or more actions that lead to the reestablishment of original or native conditions.

Scoping. The process of obtaining information from the public for input into the planning process for actions and decisions of the U.S. Fish and Wildlife Service.

Songbirds. (Also Passerines) A category of birds that are medium to small, perching land birds. Most are territorial singers and migratory.

Step-down Management Plans. Step-down management plans provide the details necessary to implement management strategies identified in the Comprehensive Conservation Plan (Service Manual 602 FW 1.6).

Strategy. A specific action, tool, or technique or combination of actions, tools, and techniques used to meet unit objectives (Service Manual 602 FW 1.6).

Succession. The observed process of change in the species structure of an ecological

Threatened Species (Federal). Species listed under the Endangered Species Act that are likely to become endangered within the foreseeable future throughout all or a significant portion of their range.

Threatened Species (State). A plant or animal species likely to become endangered in Oregon within the near future if factors contributing to population decline or habitat degradation or loss continue.

Tidelands. Submerged lands and beaches that are located between ordinary high tide and extreme low tide.

Wildlife-dependent Recreational Use. Use of a national wildlife refuge or wetland management district that involves hunting, fishing, wildlife observation, photography, environmental education, or interpretation. The National Wildlife Refuge System Improvement Act of 1997 specifies that these are the six priority public uses of the Refuge System.

Vegetation Type, Habitat Type, Forest Cover Type. A land classification system based upon the concept of distinct plant associations.

Vision Statement. A concise statement of the desired future condition of the planning unit, based primarily upon the System mission, specific refuge purposes, and other relevant mandates (Service Manual 602 FW 1.6).

H.3 Scientific Names

The following tables contain the common and scientific names of plants and animals that are mentioned in this CCP.

Table H-1. Common and Scientific Names of Plants Mentioned in this CCP

Common Name	Scientific Name
Annual ryegrass	*Lolium multiflorum*
Baltic rush	*Juncus balticus*

Table H-1. Common and Scientific Names of Plants Mentioned in this CCP

Common Name	Scientific Name
Beach strawberry	*Fragaria chiloensis*
Bigleaf maple	*Acer macrophyllum*
Black hawthorne	*Crataegus douglasii*
Black twinberry	*Lonicera involucrata*
Blue wildrye	*Elymus glaucus*
Blueberry	*Vaccinium alaskaensis*
Bog cranberry	*Vaccinium oxycoccos*
Bracken fern	*Pteridium aquilinum*
Bull thistle	*Cirsium vulgare*
California aster	*Aster chilensis*
California brome	*Bromus carinatus*
California oatgrass	*Danthonia californica*
Canada goldenrod	*Solidago canadensis*
Cascara	*Rhamnus purshiana*
Common camas	*Camassia quamash*
Coontail	*Ceratophyllum demersum*
Creeping bentgrass	*Agrostis stolonifera*
Douglas' aster	*Symphotrichum subspicatum*
Douglas-fir	*Pseudotsuga menziesii*
Douglas spirea	*Spiraea douglasii*
Dune goldenrod	*Solidago spathulata*
Dune thistle	*Cirsium edule*
Early blue violet	*Viola adunca*
Eelgrass	*Zostera marina*
English ivy	*Hedera helix*
European beachgrass	*Ammophila arenaria*
False huckleberry	*Menziesia ferruginea*
Fleshy jaumea	*Jaumea carnosa*
Giant burreed	*Sparganium eurycarpum*
Gorse	*Ulex europaeus*
Gray red fescue	*Festuca rubra pruinosa*
Hairy cat's ear	*Hypochaeris radicata*
Hardstem bulrush	*Scirpus acutus*
Hedgehog dogtail grass	*Cynosaurus echinatus*
Henderson's checkermallow	*Sidalcea hendersonii*
Himalayan blackberry	*Rubus armeniacus*
Hooker willow	*Salix hookeriana*
Indian thistle	*Cirsium edule*
Japanese eelgrass	*Zostera japonica*
Lotus	*Lotus* spp.
Lyngby's sedge	*Carex lyngbyei*
Medusahead	*Taeniantherum caputmedusae*
New Zealand white clover	*Trifolium* spp.

Table H-1. Common and Scientific Names of Plants Mentioned in this CCP

Common Name	Scientific Name
Nootka rose	*Rosa nutkana*
Orchardgrass	*Dactylis glomerata*
Pacific crabapple	*Malus fusca*
Pacific dogwood	*Cornus nuttallii*
Pacific silverweed	*Potentilla anserina* spp. *pacifica*
Pearly everlasting	*Anaphalis margaritacea*
Perennial ryegrass	*Lolium perenne*
Pickleweed	*Salicornia virginica*
Pohlia moss	*Pohlia sphagnicola*
Purple loosestrife	*Lythrum salicaria*
Queen Anne's lace	*Daucus carota*
Ranunculus	*Ranunculus* spp.
Red alder	*Alnus rubra*
Red fescue	*Festuca rubra*
Red huckleberry	*Vaccinium parvifolium*
Reed canarygrass	*Phalaris arundinacea*
Round-leaved sundew	*Drosera rotundifolia*
Russet cotton grass	*Eriophorun chamissonis*
Rush spp.	*Juncus* spp.
Salal	*Gaultheria shallon*
Salmonberry	*Rubus spectabilis*
Saltmarsh or smooth cordgrass	*Spartina alterniflora*
Saltmeadow cordgrass	*Spartina patens*
Scotch broom	*Cytisus scoparius*
Seashore saltgrass	*Distichlis spicata*
Seaside arrowgrass	*Triglochin maritima*
Shore pine or lodgepole pine	*Pinus contorta var. contorta*
Sitka sedge	*Carex sitchensis*
Sitka spruce	*Picea sitchensis*
Skunk cabbage	*Symplocarpus foetidus*
Slough sedge	*Carex obnupta*
Small-flowered woodrush	*Luzula parviflora*
Smooth cordgrass or saltmarsh cordgrass	*Spartina alterniflora*
Smooth Labrador's tea	*Ledum glandulosum*
Soft brome	*Bromus mollis*
Sphagnum moss	*Sphagnum fuscum*
Swamp loosestrife	*Decodon verticillatus*
Sweet vernal grass	*Anthoxanthum odoratum*
Tall-oatgrass	*Arrhenatherum elatius*
Tansy ragwort	*Senecio jacobaea*
Thimbleberry	*Rubus parvifloris*
Trailing blackberry	*Rubus ursinus*
Trapper's tea	*Ledum glandulosum*

Table H-1. Common and Scientific Names of Plants Mentioned in this CCP

Common Name	Scientific Name
Tufted hairgrass	*Deschampsia cespitosa*
Water foxtail	*Alopecurus geniculatus*
Water lily	*Nymphae* spp.
Water parsley	*Oenanthe sarmentosa*
Wax myrtle	*Morella cerifera*
Western hemlock	*Tsuga heterophylla*
Western red cedar	*Thuja plicata*
Western sword fern	*Polystichum munitum*
White clover	*Trifolium repens*
Wigeon grass	*Ruppia* spp.
Yarrow	*Achillea millefolium*

Table H-2. Common and Scientific Names of Mammals Mentioned in this CCP

Common Name	Scientific Name
Arctic fox	*Alopex lagopus*
Beaver	*Castor canadensis*
Black bear	*Ursus americanus*
Black-tailed deer	*Odocoileus hemionus*
Bobcat	*Lynx rufus*
California myotis	*Myotis californicus*
Cat feral	*Felis domestica*
Deer mouse	*Peromyscus maniculatus*
Harbor seal	*Phoca vitulina*
Hoary bat	*Lasiurus cinereus*
Marsh shrew	*Sorex bendirii*
Mink	*Mustela vison*
Muskrat	*Ondatra zibethicus*
Nutria	*Myocastor coypus*
Oregon vole	*Microtus oregoni*
Raccoon	*Procyon lotor*
Red fox	*Vulpes fulva*
River otter	*Lutra canadensis*
Roosevelt elk	*Cervus canadensis roosevelti*
Vagrant shrew	*Sorex vagrans*

Table H-3. Common and Scientific Names of Birds Mentioned in this CCP

Common Name	Scientific Name
Aleutian Canada goose	*Branta canadensis leucopareia*
American kestrel	*Falco sparverius*
American bald eagle	*Haliaeetus leucocephalus*
American bittern	*Botaurus lentiginosus*
American pipit	*Anthus rubescens*
American robin	*Turdus migratorius*

Table H-3. Common and Scientific Names of Birds Mentioned in this CCP

Common Name	Scientific Name
American wigeon	*Anas americana*
Band-tailed pigeon	*Columba fasciata*
Barrow's goldeneye	*Bucephala islandica*
Belted kingfisher	*Ceryle alcyon*
Bewick's wren	*Thryomanes bewickii*
Black brant	*Branta bernicla*
Black scoter	*Melanitta nigra*
Black turnstone	*Arenaria melanocephala*
Black-bellied plover	*Pluvialis squatarola*
Blue grouse	*Dendragapus obscurus*
Blue-winged teal	*Anas discors*
Bufflehead	*Bucephala albeola*
Cackling Canada goose	*Branta canadensis minima*
California brown pelican	*Pelecanus occidentalis*
Canada geese	*Branta canadensis*
Canvasback	*Aythya valisineria*
Caspian tern	*Hydroprogne caspia*
Cedar waxwing	*Bombycilla cedrorum*
Chestnut-backed chickadee	*Parus rufescens*
Cinnamon teal	*Anas cyanoptera*
Common goldeneye	*Bucephala clangula*
Common loon	*Gavia immer*
Common merganser	*Mergus merganser*
Common raven	*Corvus corax*
Common yellowthroat	*Geothlypis trichas*
Dunlin	*Calidris alpina*
Dusky Canada goose	*Branta canadensis occidentalis*
Gadwall	*Anas strepera*
Glaucous-winged gull	*Larus glaucescen*
Golden-crowned kinglet	*Regulus satrapa*
Gray jay	*Perisoreus canadensis*
Great blue heron	*Ardea herodias*
Great horned owl	*Bubo virginianus*
Greater scaup	*Aythya marila*
Greater white-fronted goose	*Anser albifrons*
Greater yellowlegs	*Tringa melanoleuca*
Green heron	*Butorides virescens*
Green-winged teal	*Anas crecca*
Golden-crowned kinglet	*Regulus satrapa*
Hairy woodpecker	*Picoides villosus*
Hammond's flycatcher	*Empidonax hammondii*
Harlequin duck	*Histrionicus histrionicus*
Hermit thrush	*Catharus guttatus*

Table H-3. Common and Scientific Names of Birds Mentioned in this CCP

Common Name	Scientific Name
Hermit warbler	*Dendroica occidentalis*
Hooded merganser	*Lophodytes cucullatus*
Horned grebe	*Podiceps auritus*
Killdeer	*Charadrius vociferus*
Least sandpiper	*Calidris minutilla*
Lesser Canada goose	*Branta canadensis parvipes*
Lesser scaup	*Aythya affinis*
Lesser yellowlegs	*Tringa flavipes*
Lewis's woodpecker	*Melanerpes lewis*
Long-billed dowitcher	*Limnodromus scolopaceus*
Long-tailed duck	*Clangula hyemalis*
MacGillivray's warbler	*Oporornis tolmiei*
Mallard	*Anas platyrhynchos*
Marbled godwit	*Limosa fedoa*
Marbled murrelet	*Brachyramphus marmoratus*
Marsh wren	*Cistothorus palustris*
Mourning dove	*Zenaida macroura*
Northern flicker	*Colaptes auratus*
Northern harrier	*Circus cyaneus*
Northern pintail	*Anas acuta*
Northern pygmy-owl	*Glaucidium gnoma*
Northern saw-whet owl	*Aegolius acadicus*
Northern shoveler	*Anas clypeata*
Northern spotted owl	*Strix occidentalis*
Olive-sided flycatcher	*Contopus cooperi*
Orange-crowned warbler	*Vermivora celata*
Osprey	*Pandion haliaetus*
Pacific wren	*Troglodytes pacificus*
Pacific-slope flycatcher	*Empidonax difficilis*
Pelagic cormorant	*Phalacrocorax pelagicus*
Peregrine falcon	*Falco peregrinus*
Pied-billed grebe	*Podilymbus podiceps*
Pileated woodpecker	*Dryocopus pileatus*
Purple finch	*Carpodacus purpureus*
Red crossbill	*Loxia curvirostra*
Red phalarope	*Phalaropus fulicarius*
Red-breasted nuthatch	*Sitta canadensis*
Red-breasted merganser	*Mergus serrator*
Redhead	*Aythya americana*
Red-necked phalarope	*Phalaropus lobatus*
Red-winged blackbird	*Agelaius phoeniceus*
Ring-necked duck	*Aythya collaris*
Ruddy duck	*Oxyura jamaicensis*

Table H-3. Common and Scientific Names of Birds Mentioned in this CCP

Common Name	Scientific Name
Rufous hummingbird	*Selasphorus rufus*
Sanderling	*Calidris alba*
Savannah sparrow	*Passerculus sandwichensis*
Semipalmated plover	*Charadrius semipalmatus*
Short-lilled dowitcher	*Limnodromus griseus*
Snow goose	*Chen caerulescens*
Song sparrow	*Melospiza melodia*
Sora	*Porzana carolina*
Spotted sandpiper	*Actitis macularius*
Steller's jay	*Cyanocitta stelleri*
Surf scoter	*Melanitta perspicillata*
Swainson’s thrush	*Catharus ustulatus*
Taverner’s Canada goose	*Branta canadensis taverneri*
Townsend’s warbler	*Dendroica townsendi*
Tundra swan	*Cygnus columbianus*
Vancouver Canada goose	*Branta canadensis fulva*
Varied thrush	*Ixoreus naevius*
Vaux’s swift	*Chaetura vauxi*
Virginia rail	*Rallus limicola*
Western Canada goose	*Branta canadensis moffitti*
Western grebe	*Aechmophorus occidentalis*
Western meadowlark	*Sturnella neglecta*
Western sandpiper	*Calidris mauri*
Western tanager	*Piranga ludoviciana*
Whimbrel	*Numenius phaeopus*
White-crowned sparrow	*Zonotrichia leucophrys*
White-winged scoter	*Melanitta fusca*
Willet	*Tringa semipalmata*
Willow flycatcher	*Empidonax traillii*
Wilson’s snipe	*Gallinago delicata*
Wilson’s warbler	*Wilsonia pusilla*
Winter wren	*Troglodytes troglodytes*
Wood duck	*Aix sponsa*
Yellow-rumped warbler	*Dendroica coronata*

Table H-4. Common and Scientific Names of Amphibians and Reptiles Mentioned in this CCP

Common Name	Scientific Name
Clouded salamander	*Aneides ferreus*
Ensatina salamander	*Ensatina eschscholtzii*
Garter snake	*Thamnophis sirtalis*
Long-toed salamander	*Ambystoma macrodactylum*
Northern red-legged frog	*Rana aurora*
Northwestern salamander	*Ambystoma gracile*

Table H-4. Common and Scientific Names of Amphibians and Reptiles Mentioned in this CCP

Common Name	Scientific Name
Pacific giant salamander	*Dicamptodon tenebrosus*
Pacific tree frog	*Hyla regilla*
Red-legged frog	*Rana aurora*
Rough-skinned newt	*Taricha granulosa*
Tailed frog	*Ascaphus truei*
Western red-backed salamander	*Plethodon vehiculum*
Western toad	*Bufo boreas*

Table H-5. Common and Scientific Names of Invertebrates Mentioned in this CCP

Common Name	Scientific Name
Amphipod	*Corophium* spp.
Baltic clam	*Macoma balthica*
Dungeness crab	*Metacarcinus magister*
Ghost shrimp	*Callianassa californiensus*
Hydaspe fritillary	*Speyeria hydaspe*
Mud shrimp	*Upogebia pugettensis*
New Zealand mudsnail	*Potamopyrgus antipodarum*
Oregon silverspot butterfly	*Speyeria zerene hippolyta*
Softshell clam	*Mya arenaria*

Table H-6. Common and Scientific Names of Fish Mentioned in this CCP

Common Name	Scientific Name
Buffalo sculpin	*Enophrys bison*
Chinook salmon	*Oncorhynchus tshawytscha*
Chum salmon	*Oncorhynchus keta*
Coastal cutthroat trout	*Oncorhynchus clarki clarki*
Coho salmon	*Oncorhynchus kisutch*
English sole	*Parophrys vetulus*
Green sturgeon	*Acipenser medirostris*
Pacific lamprey	*Entosphenus tridentatus*
Pacific smelt (eulachon)	*Thaleichthys pacificus*
Pacific staghorn sculpin	*Leptocottus armatus*
Shiner perch	*Cymatogaster aggregata*
Sockeye salmon	*Oncorhynchus nerka*
Steelhead	*Oncorhynchus mykiss*
Western brook lamprey	*Lampetra planeri*

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Appendix I. CCP Team Members

The CCP was developed primarily by the core team members. The team sought expert advice and review from other professionals from several different agencies and organizations. Extended team members provided critical input during wildlife and habitat and visitor services reviews early in the process and continued to provide review and comment as the document evolved. Core and extended team members are listed below.

Core Planning Team

Name	Title	Organization
Roy Lowe	Project Leader, Oregon Coast National Wildlife Refuge Complex	USFWS
Rebecca Chuck	Deputy Project Leader, Oregon Coast National Wildlife Refuge Complex	USFWS
Shawn Stephensen	Refuge Biologist, Oregon Coast National Wildlife Refuge Complex	USFWS
Dave Ledig	South Coast Refuge Manager, Oregon Coast National Wildlife Refuge Complex	USFWS
Dawn Grafe	Supervisory Park Ranger	USFWS
Jane Bardolf (departed 8/2011)	Conservation Planner, Division of Planning, Visitor Services, and Transportation, Region 1	USFWS
Khemarith So (became planner in 10/2011)	Conservation Planner, Division of Planning, Visitor Services, and Transportation, Region 1	USFWS

Extended Planning Team and Reviewers

Name	Area of Assistance	Organization
Robyn Thorson	General review	USFWS
Robin West	General review	USFWS
Ben Harrison	CCP quality and consistency	USFWS
Bob Flores	General Review	USFWS
Chuck Houghten	CCP quality and consistency	USFWS
Scott McCarthy	CCP quality and consistency	USFWS
Mike Marxen	Visitor services goals and objectives	USFWS
Cathy Sheppard (retired)	Realty Issues	USFWS
Wayne Hill	Realty issues	USFWS
Dave Drescher	GIS coordination and mapping	USFWS
Brad Bortner (retired)	Migratory Birds	USFWS
Fred Paveglio (retired)	Biological goals and objectives	USFWS
Kevin Kilbride	Biological goals and objectives, Integrated Pest Management	USFWS
Joe Engler	Biological goals and objectives	USFWS

Extended Planning Team and Reviewers

Name	Area of Assistance	Organization
Bridgette Flanders-Wanner	Biological goals and objectives	USFWS
Nick Valentine	Cultural Resources	USFWS
Erin Carver	Socio-economics	USFWS
Sam Lohr	Fisheries	USFWS
Scott Neumann	Law enforcement issues	USFWS
Daniel Huckel	Law enforcement issues	USFWS
Nicole McCarthy	Technical writing and editing	USFWS
Lara Bjork	Technical editing	SWCA Environmental Consultants
Malini Roberts	Technical editing	SWCA Environmental Consultants
Joan Jewett	Public involvement/communication	USFWS
Patrick Stark	Layout and design	USFWS
Eric Anderson	Geese	USFWS
Jock Beall	Geese	USFWS
Molly Monroe	Geese	USFWS
Anne Walker	Oregon Silverspot Butterfly	USFWS
Debbie Pickering	Oregon coastal prairie; Oregon Silverspot Butterfly	The Nature Conservancy
Todd Hoddenpyl	Law enforcement issues	Oregon State Police
Robin Sears	Visitor services and law enforcement issues	Oregon Parks and Recreation Department
Brad Bales	Waterfowl	Oregon Department of Fish and Wildlife
Tony D'Andrea	Shellfish	Oregon Department of Fish and Wildlife
Dan Avery	Estuarine habitat and fish	Oregon Department of Fish and Wildlife
Herman Biederbeck	Hunting, fishing, elk	Oregon Department of Fish and Wildlife
Laura Brophy	Tidal marsh ecology and plant communities	Green Point Consulting
Michael Karnosh	Tribal interests	Confederated Tribes of the Grand Ronde
David Harrelson	Tribal interests	Confederated Tribes of the Grand Ronde
Brandy Humphries	Tribal interests	Confederated Tribes of the Grand Ronde
Timothy Fisher	Visitor Services	Bureau of Land Management
Rudy Schuster	Visitor Services	USGS – Fort Collins

Appendix J. Public Involvement

Public involvement was sought throughout the development of the CCP, starting in June 2010 with the preparation of a Public Outreach Plan. Public involvement strategies included face-to-face meetings or phone conversations with key agencies, federally elected officials (or their aides), Tribal representatives, and local refuge users. The Refuge also held open houses and sent planning updates to inform the public, invite discussion, and solicit feedback. This CCP was developed concurrently with CCPs for two other refuges within the Oregon Coast National Wildlife Refuge (NWR) Complex (Bandon Marsh and Siletz Bay NWRs), so briefings and planning updates covered all three refuges.

A mailing list (postal and email) of approximately 650 persons and organizations is maintained at the Refuge Complex for Bandon Marsh, Nestucca Bay, and Siletz Bay NWRs and was used to distribute planning updates and public meeting announcements. Below is a brief summary of the events, meetings, and outreach tools that were used in our public involvement efforts.

Meetings with Congressional Representatives and/or Their Aides:

- April 7, 2011. Project Leader Roy Lowe met with Jeremiah Baumann of Senator Jeff Merkley's staff to update the Senator's office on the status of the CCP process. Location: Washington, D.C.
- April 7, 2011. Project Leader Roy Lowe met with Michele Miranda of Senator Ron Wyden's staff to update the Senator's office on the status of the CCP process. Location: Washington, D.C.
- April 7, 2011. Project Leader Roy Lowe met with Ethan Pittleman of Representative Kurt Schrader's staff to update the Representative's office on the status of the CCP process. Location: Washington, D.C.
- March 30, 2012. Project Leader Roy Lowe met with Adrian Deveny of Senator Jeff Merkley's staff to discuss the CCP planning process and draft alternatives. Location: Washington, D.C.
- March 30, 2012. Project Leader Roy Lowe met with Michele Miranda and Alexandra Hackbarth of Senator Ron Wyden's staff to discuss the CCP planning process and draft alternatives. Location: Washington, D.C.
- March 30, 2012. Project Leader Roy Lowe met with Ethan Pittleman and Laura Wilkeson of Representative Kurt Schrader's staff to discuss the CCP planning process and draft alternatives. Location: Washington, D.C.
- August 24, 2012. Project Leader Roy Lowe met with Laura Wilkeson of Representative Kurt Schrader's staff to update her on the CCP planning process and orient her to the refuge. Location: Nestucca Bay NWR.

Meetings with Tribal Officials:

- October 26, 2011. Project Leader Roy Lowe, the staff CCP team, and USFWS Planner Khem So met with Confederated Tribes of Grand Ronde to discuss preliminary alternatives. Location: Grand Ronde Tribal Office, Grand Ronde, Oregon.

Meetings with Local Elected Officials:

- November 10, 2011. Project Leader Roy Lowe met with Tillamook County Commissioner Mark Labhart while attending on-site meeting of Neskowin Coastal Hazards Committee. Discussed the preliminary draft alternatives outlined in CCP Planning Update #2 as well as the future of the community's tsunami escape trail across refuge lands.

Meetings with Local/Regional Community Organizations Involving CCP Issues:

- November 10, 2011. Project Leader Roy Lowe attended an on-site meeting of Neskowin Coastal Hazards Committee to discuss the preliminary draft alternatives outlined in CCP Planning Update #2 including the future of the tsunami evacuation trail across refuge lands.
- October 9, 2012. Project Leader Roy Lowe presented the Bandon Marsh NWR/Ni-les'tun Restoration to approximately 30 members of the Portland Audubon Society in Portland, OR. The Bandon Marsh, Nestucca Bay, and Siletz Bay CCPs were discussed at the end of the presentation, and comments on management were solicited.
- April 15, 2012. October 9, 2012. Project Leader Roy Lowe presented the Bandon Marsh NWR/Ni-les'tun Restoration to approximately 20 people at the Birding & Blues Festival in Pacific City, OR. The Bandon Marsh, Nestucca Bay, and Siletz Bay CCPs were discussed at the end of the presentation, and comments on management were solicited.

Meetings with Agency Representatives:

- March 17, 2010. Representatives from ODFW, Oregon DSL, NOAA Fisheries, The Nature Conservancy, Green Point Consulting, and other USFWS programs participated in the on-site Nestucca Bay NWR Wildlife and Habitat Review.
- April 14, 2010. Representatives from OPRD, ODFW, Oregon State Police, BLM, U.S. Geological Survey, Oregon Coast Visitors Association, and the USFWS extended team participated in the on-site Nestucca Bay NWR Visitor Services Review.
- December 1, 2010. Representatives from the Region 1 Regional Office and refuge project leaders met with the ODFW to discuss the CCP process and other issues of interest. Location: Tualatin River NWR, Sherwood, OR.
- August 20, 2011. Project Leader Roy Lowe met with ODFW Director Roy Elicker during NOAA MPOC dedication event in Newport, OR, and updated him on the status of the Nestucca Bay, Siletz Bay, and Bandon Marsh CCPs.
- February 16, 2012. Project Leader Roy Lowe and refuge staff meet with ODFW representatives David Nuzum and Dave Stewart to discuss ODFW's comments regarding draft alternatives for hunting and fishing. Location: ODFW offices, Tillamook, OR.

Public Open Houses/Scoping Sessions:

- November 30, 2010. Public scoping meeting at the Kiawanda Community Center, Pacific City, OR.
  Purpose and format: To provide information on CCP process and preliminary issues to be addressed. The public scoping meeting was in an open-house format. At the open house, refuge staff and the lead planner explained the CCP process; refuge purposes, vision, and management; and preliminary management issues, concerns, and opportunities that had been identified early in the planning process. They also answered questions from attendees and took written comments.
  Attendance: A total of 20 private citizens and representatives from various organizations attended the open houses, providing comments on the issues and opportunities presented.
- November 16, 2011. Public Draft Alternatives meeting at the Kiawanda Community Center, Pacific City, OR.
  Purpose and format: To gather public input on the draft alternatives for Nestucca Bay NWR. The draft alternatives meeting was in an open-house format. At the open house, refuge staff gave a presentation on the CCP process, progress to date, how the draft alternatives were developed, and future opportunities for public input. The public was invited to submit comments either in writing or verbally. The attendees then had the opportunity to visit four

tables staffed by refuge staff and the lead planner. Each table had a scribe to record verbal comments.
Attendance: Approximately 32 people attended the meeting.

Other Meetings:

- August 17, 2010. Preplanning briefing for Region 1 Refuge Chief and staff, USFWS Regional Office, Portland, OR. Refuge CCP team participated by videoconference.
- May 23-25, 2011. Facilities Review attended by CCP team, contractors from Vigil-Agrimis, and Visitor Services and Communication staff from USFWS Regional Office.
- July 27, 2011. Draft Alternatives briefing for Region 1 Refuge Chief and staff, USFWS Regional Office, Portland, OR. Refuge CCP team participated by videoconference.

Press Coverage: (all three refuges)

- November 5, 2010. News release announcing public scoping meetings sent to 17 newspapers and other online venues. The news release resulted in articles being written or published in the following venues. This list may not be inclusive.
    - November 5, 2010 http://www.fws.gov/oregoncoast/news.html
    - November 19, 2010 Medford Mail Tribune
    - November 19, 2010 Pacific City Sun
    - November 25, 2010 Daily Astorian
    - November 26, 2010 and December 2 and 9, 2010 Bandon Western World
    - November 27, 2010 Newport News-Times
    - November 29, 2010 Tillamook Headlight Herald
    - November 29, 2010 Oregon Birders On Line posting
    - December 1, 2010 Lincoln City News Guard
    - December 4, 2010 TheWorldLink.com (Coos Bay)
    - January 31, 2011 Neskowin Community Association online
- October 28, 2011. News release announcing availability of preliminary draft alternatives and public open house meetings sent to 17 coastal newspapers and other online venues and resulted in articles in the following media. This list may not be inclusive.
    - October 28, 2010 http://www.fws.gov/oregoncoast
    - October 31, 2011 Salem Statesman Journal
    - November 2, 2011 Lincoln County Birder and Nature Observation online
    - November 3, 2011 Bandon Western World
    - November 22, 2011 Lincoln City News Guard
    - November 4, 2011 Pacific City Sun
- September 18, 2012. News release announcing availability of the draft CCP/EAs for public review and comment sent to 17 coastal newspapers and other online venues and resulted in articles in the following media. This list is not inclusive.
    - September 21, 2012 Lincoln City News Guard (Wildlife refuge plans available for review)
    - September 27, 2012 Bandon Western World (USFWS releases marsh plans)
- December 21, 2012. News release announcing availability of the draft waterfowl hunt plans for public review and comment sent to 19 coastal newspapers and other media and resulted in following articles. This list is not inclusive.
    - December 28, 2012 Pacific City Sun (Public comment wanted on waterfowl hunting plan)

  - January 2, 2013 Salem Statesman Journal (Waterfowl hunt plans for Oregon coastal refuges open for comments)
  - January 3, 2013 The World (Influence hunting at Bandon Marsh)
  - January 7, 2013 The World (Help draft plan for Bandon waterfowl hunting)

Planning Updates:

- November 2010: Planning Update #1 sent to a mailing list of approximately 380 recipients, including private individuals, government agencies, and non-governmental organizations. The planning update included information on how and where to send comments as well as notification of upcoming public open house meetings. In addition, the Planning Update was posted on the refuge website, and copies were available at the CCP open houses and at the refuge office.
- November 2011: Planning Update #2, summarizing preliminary draft alternatives, was distributed to a mailing list of approximately 400 recipients. This planning update included notice of the upcoming public open house meeting and provided information on how and where to comment. In addition, the Planning Update was posted on the refuge website.
- September 2012: Planning Update #3 was distributed to a mailing list of approximately 600 recipients and posted on the refuge website. This planning update announced the availability of draft CCP/EAs for public review and comment, provided information on how and where to comment, summarized the public involvement to date, and detailed the different draft management alternatives.
- April 2013: Planning Update #4, announcing the completion of the final CCPs, will be released concurrently with this document. This planning update will summarize comments received on the draft CCP/EAs, detail the Refuges' management directions, and provide information on how and where to obtain copies of the final plans.

Other Tools:

- Website at http://www.fws.gov/oregoncoast/ccp_nes_slz_bdm.htm featuring CCP information, planning updates, maps, press releases, and scoping forms.
- March 2010: Letters sent to invited participants for the Wildlife and Habitat Review.
- April 2010: Letters sent to invited participants for the Visitor Services Review.
- August 25, 2011: Letters sent from Refuge to extended team members updating them on the planning process draft alternatives and inviting their participation. Team agencies included ODFW and OPRD.
- August 25, 2011: Letters sent from Refuge to the Confederated Tribes of Grand Ronde updating them on the planning process draft alternatives and inviting their participation.

Federal Register Notices:

- November 29, 2010: Federal Register published Notice of Intent to Prepare a Draft Comprehensive Conservation Plan and Associated NEPA Document; and Notice of Public Meetings (75 FR 73121).
- September 17, 2012: Federal Register published Notice of Availability of the Draft Comprehensive Conservation Plan and Environmental Assessment; and request for comments (77 FR 57107).
- Federal Register Notice of Availability of the Final Comprehensive Conservation Plan and Finding of No Significant Impact for Environmental Assessment published concurrently with release of this document.

Appendix K. Comments Received During Public/Agency Review Period and Service Responses

K.1 Introduction

The U.S. Fish and Wildlife Service (USFWS or Service) received comments from 18 entities regarding the Draft Comprehensive Conservation Plan/Environmental Assessment (CCP/EA) for Nestucca Bay National Wildlife Refuge (NWR or Refuge) during the 30-day comment period (Table K-1). Comments from nine of those entities also addressed the Bandon Marsh and Siletz Bay NWRs Draft CCP/EAs, which were being developed concurrently. All written comments were reviewed and organized so that an objective analysis, summary, and presentation of the comments could be made.

Each original piece of correspondence was assigned an identification number and identified with the last name and first initial of the individual commenter who signed the letter. Note that for simplicity's sake, the word "letter" is generally used throughout this appendix to refer to any comment or reference document received, whether by letter, fax, email, or comment form. Multiple correspondences from a commenter are counted as one comment letter.

To help analyze the nature and extent of comments received, a number of themes and subthemes were identified within the letters. Comments were coded with the identified themes. Due to the similarity of written comments received, similar comments on a theme were grouped together, and the Service response applies to the comments as a group. Comments that fell outside the scope of the CCP were also considered and were responded to as appropriate.

Table K-1. Source of Comments

Affiliation/Entities	Number of Commenters (September 17, 2012 through October 22, 2012)
State Agencies	1
Organizations	2
General Public	15
Total	**18**

K.2 Changes Made to the Final CCP

The CCP planning team reviewed and evaluated all of the comments received during the Draft CCP/EA comment period. In some cases, the management direction has been either clarified or modified based upon these comments. Table K-2 shows the major changes between the draft and the final CCP. For additional information, see Chapter 2 and Figure 2-1 in the CCP.

Table K-2. Summary of Changes to Management Direction between the Draft and Final CCP

Key Theme/issue	Alternative C in Draft CCP	Management Direction in Final CCP
Grasslands		
Pasture management	346 acres managed as pasture. Continue to manage and maintain pastures through Cooperative Land Management Agreements (CLMAs), including grazing and silaging fields, fertilizing, weed control, and maintaining fences and ditches. Evaluate and monitor water quality, control nuisance mammals where necessary to protect dikes and ditches.	No change from draft plan.
Upland coastal prairie restoration	Restore 25 acres of native prairie, including control of non-native plants, removal of encroaching woody plants, seeding and planting of native prairie grasses and forbs, and periodic disturbance to maintain restored habitat. Focus on habitat parameters necessary to support introduction of nonessential, experimental population of threatened Oregon silverspot butterfly.	Restore up to 25 acres of native prairie by 2028 through a phased restoration project. Methods include control of non-native plants, removal of encroaching woody plants, seeding and planting of native prairie grasses and forbs, and periodic disturbance to maintain restored habitat. Focus is on habitat parameters necessary to support introduction of nonessential, experimental population of threatened Oregon silverspot butterfly.
Mixed upland grasslands	14 acres maintained and managed until restoration to upland coastal prairie is funded. Techniques will include targeted control of reed canarygrass, mowing and silage, and mechanical removal of encroaching woody species.	No change from draft plan.
Forest		
Sitka spruce-western hemlock forest	214 acres actively managed. Continue control of invasive species. Use appropriate forest management techniques to thin trees where needed.	No change from draft plan.
Wetland Habitats		
Salt marsh	208 acres protected and maintained. Monitor and control invasive species using appropriate integrated pest management (IPM) techniques. Monitor salmonid use. Outplanting of rare, native species (e.g., Henderson's checkermallow) to increase native vegetation presence.	No change from draft plan.
Intertidal mudflat	19 acres protected. Monitor for invasive and nuisance species and utilize appropriate IPM	No change from draft plan.

Table K-2. Summary of Changes to Management Direction between the Draft and Final CCP

Key Theme/issue	Alternative C in Draft CCP	Management Direction in Final CCP
	techniques to control. Work with Oregon Department of State Lands to cooperatively manage resources and treat/monitor invasive species.	
Forested lagg – Neskowin Marsh	61 acres protected. Monitor for invasive and nuisance species and utilize appropriate IPM techniques to control.	Same as draft plan but also: Designate as Research Natural Area (RNA).
Coastal bog – Neskowin Marsh	70 acres protected with additional site-specific monitoring. Monitor and control invasive species using IPM techniques. Conduct additional monitoring of water quality for off-site contaminants. Conduct plot-based sampling for swamp loosestrife.	Same as draft plan but also: Designate as RNA.
Freshwater emergent wetland – Neskowin Marsh	33 acres protected and maintained. Monitor for invasive and nuisance species and utilize IPM techniques to control. Monitor water quality. Conduct hydrological study to assess management options.	Same as draft plan but also: Designate as RNA.
Neskowin Marsh tsunami evacuation trail	Keep tsunami evacuation trail open. Conduct a hydrologic study. Modify footbridge to enhance safety and accessibility. Modify trail and footbridge to enhance hydrologic connectivity based on results of hydrologic study. Mark trail with tsunami evacuation signs.	Same as in draft plan but also: Vegetation management will be conducted. The Service acknowledges that the trail floods annually following heavy rainfall, as does the adjacent Hawk Road that leads to the trail. The Service will install reflective markers on both sides of the trail to outline the trail route during flooding or at night.
Forested wetlands and stream-riparian habitat (wet-mesic Sitka spruce-western hemlock forest)	6 acres of forested wetlands and stream-riparian habitat protected and maintained. Continue invasive species control.	No change from draft plan.
Wildlife – listed species		
Oregon silverspot butterfly	1 experimental population introduced. Continue establishment and maintenance of life cycle habitat parameters (larval host plants and adult nectar plants) for listed Oregon silverspot butterfly (OSB). Following coastal prairie restoration and successful establishment of high-quality Oregon silverspot butterfly habitat, introduce a nonessential experimental population of Oregon silverspot butterfly onto restored prairie.	No change from draft plan.

Table K-2. Summary of Changes to Management Direction between the Draft and Final CCP

Key Theme/issue	Alternative C in Draft CCP	Management Direction in Final CCP
Monitoring and Research		
Status monitoring	Continue current status monitoring and collect additional data on fish, amphibians, small mammals, plants, migratory songbirds, soil accretion, water levels, forest diseases, and pests.	No change from draft plan.
Effectiveness monitoring	Monitor CCP and other step-down plan objectives. Conduct long-term monitoring associated with the effectiveness of salt marsh restoration projects including salmonid use, vegetation response, and water quality parameters.	No change from draft plan.
Research and scientific assessments	Identify priority research needs and cooperate with partners to accomplish. Conduct hydrological assessment at Neskowin Marsh. Nominate Neskowin Marsh as an RNA.	No change from draft plan.
Wildlife Observation and Photography		
Cannery Hill Unit	Trail and parking lots at Cannery Hill remain open. Develop Powerline Trail, a new loop trail, “Discovery Trail,” and goose observation deck in the lower parking lot.	No change from draft plan.
Little Nestucca Restoration Area	Develop north end of old roadbed into spur road trail to an observation point and allow year-round public access on this trail. Create gravel parking lot on west end of restoration site.	No change from draft plan.
Brooten Marsh	Allow wildlife observation and photography throughout unit.	No change from draft plan.
Neskowin Marsh Unit	Area remains closed to observation and photography.	No change from draft plan.
Environmental Education		
Environmental education (EE)	Develop a fully functioning, year-round EE program with full-time EE specialist, Nature Discovery Backpack program, and other partner-driven EE programs. Utilize volunteers to deliver on-site EE programs.	No change from draft plan.
Interpretation		
Interpretation	Continue existing programming on Cannery Hill and develop additional interpretive facilities and programs in conjunction with new trails at Cannery Hill and Little Nestucca Restoration Area.	No change from draft plan.

Table K-2. Summary of Changes to Management Direction between the Draft and Final CCP

Key Theme/issue	Alternative C in Draft CCP	Management Direction in Final CCP
Hunting		
Waterfowl hunting	Allow waterfowl hunting 7 days per week on Brooten Marsh (108 acres) and mouth of Little Nestucca River (33 acres).	No change from draft plan.
Fishing		
Fishing	Actively pursue opportunities to provide bank fishing access on the Little Nestucca River. Create gravel parking lot on east end of restoration site.	Allow bank fishing on the east end of the Little Nestucca Restoration Area following development of access trail and gravel parking lot.
Clamming	Allow clamming adjacent to Brooten Marsh.	Same as draft plan but with the following clarification: Adjacent to Brooten Marsh, allow clamming per Oregon Department of Fish and Wildlife (ODFW) regulations and subject to Oregon Department of Agriculture and ODFW shellfish safety closures.
Facilities		
Facilities	Keep some existing structures and facilities. Replace residence with a bunkhouse and small administrative office. Add 10 additional parking spaces. Remodel the north bay of the maintenance shop to accommodate two offices.	Same as draft plan but also: Utilize habitat-appropriate native plants for landscaping around buildings, kiosks, and other public use facilities.
Climate Change Adaptation		
Reduce carbon footprint	Replace current vehicles with more fuel-efficient vehicles. Any new or replaced facilities will be appropriately sized and energy-efficient. Use energy-efficient land management techniques where feasible and in line with management goals. Explore ways of offsetting carbon balance, such as carbon sequestration.	No change from draft plan.

K.3 Summary of Comments Received and Service Responses

Wildlife and Habitat Management

1. **Comment:** A primary goal of the Refuge should be to restore refuge lands to pre-European conditions.

   Response: The Service agrees with the goal of restoring refuge lands to historic conditions, defined as the conditions we believe were present prior to substantial human-related changes to the landscape (601 FW 3). The National Wildlife Refuge System Administration Act, as amended, directs the Service to ensure that the biological integrity, diversity, and environmental health (BIDEH) of the National Wildlife Refuge System (NWRS or Refuge System) are maintained for the benefit of present and future generations of Americans. The BIDEH policy (601 FW 3) defines *biological integrity* as “the biotic composition, structure, and functioning at genetic, organism, and community levels comparable with historic conditions, including the natural biological processes that shape genomes, organisms, and communities.” *Biological diversity* is defined as “the variety of life and its processes, including the variety of living organisms, the genetic differences among them, and communities and ecosystems in which they occur.” *Environmental health* is defined as the “composition, structure, and functioning of soil, water, air, and other abiotic features comparable with historic conditions, including the natural abiotic processes that shape the environment.” In simple terms, elements of BIDEH are represented by native fish, wildlife, plants, and their habitats, as well as those ecological processes that support them. The BIDEH policy directs refuges to move toward historic conditions unless (a) this would conflict with refuge purpose; (b) no feasible alternative exists for accomplishing refuge purpose other than management for non-historic conditions; or (c) management for non-historic conditions would make a greater contribution to BIDEH at a larger landscape scale (Schroeder et al. 2004).

2. **Comment:** Support for the increased habitat monitoring and management activities presented in Alternative C, the preferred alternative.

   Response: The Service acknowledges the support for habitat monitoring and management activities presented in the preferred alternative.

3. **Comment:** Livestock grazing and mowing can negatively affect habitat and cause avian mortality at nest sites. However, grazing and mowing can benefit shorebird habitat by keeping vegetation down.

   Response: Refuge pasture management strategies are based on recognition of the importance of short grass habitats to wintering geese, particularly the declining dusky Canada goose. To provide high-quality winter forage for the geese, the pastures are kept short and actively growing during the period when the geese are not using the pastures (April through October) through the use of livestock grazing and frequent mowing. These activities together are more economical than mowing alone and have resulted in the availability of quality wintering habitat for geese. The Service intends to continue both practices throughout the life of the CCP.

   The grazing program is managed through CLMAs with local dairy farmers. CLMAs include best management practices for manure and fertilizer application setbacks from ditches, application timing, and field rehabilitation. Because the refuge pastures are grazed and mowed throughout the growing season, grass does not grow tall enough to encourage ground nesting by birds. However, the grazing and mowing practices will continue to provide shorebird foraging habitat by keeping vegetation down and creating muddy edges. Pasture ditches are fenced to prohibit cattle from directly accessing waterways.

4. **Comment:** Support for the continued restoration of natural hydrological functions to enhance and/or restore; protect; and maintain mudflats and salt marsh habitat for the benefit of economically important fish species and non-game wildlife species, including shorebirds.

   Response: As stated within Chapter 4 of the CCP, the Refuge System is directed to consider and provide protection for the broad spectrum of fish, wildlife, and habitat resources found on the Refuge and in the associated ecosystem that represents the BIDEH of refuge habitat. To meet this directive, one goal of the Refuge System is to conserve and restore, where appropriate, critical ecosystems (e.g., tidal and freshwater marshes) and ecological processes (e.g., natural hydrological conditions) characteristic of those ecosystems. In addition, the Service identifies resources of concern that are:

   > "all plant and/or animal species, species groups, or communities specifically identified in refuge purpose(s), System mission, or international, national, regional, state, or ecosystem conservation plans or acts. For example, waterfowl and shorebirds are a resource of concern on a refuge whose purpose is to protect 'migrating waterfowl and shorebirds.' Federal or State threatened and endangered species on that same refuge are also a resource of concern under terms of the respective endangered species acts (620 FW 1.4G)…"
   >
   > "Habitats or plant communities are resources of concern when they are specifically identified in refuge purposes, when they support species or species groups identified in refuge purposes, when they support NWRS resources of concern, and/or when they are important in the maintenance or restoration of biological integrity, diversity, and environmental health."

   Therefore, resources of concern for a refuge may be a species or species group, or the habitat/plant community that supports a priority species/species groups. At Nestucca Bay NWR this includes salt marsh and freshwater habitats that support economically and culturally important fish species as well as non-game wildlife, including shorebirds. The Service's intention is to use a "surrogate species" approach, which utilizes individual species or a suite of species to represent the habitat and/or management needs of a larger set of species (USFWS 2012e). Climate change and sea level rise will also be of increasing importance in setting management direction for all low-lying lands and waters within the Refuge.

5. **Comment:** Support for the restoration of coastal prairie habitat on Cannery Hill and the Service's intention to reintroduce a population of the threatened Oregon silverspot butterfly. The goal of coastal prairie restoration by 2018 is overly optimistic.

   Response: The Service acknowledges the comment in support of the preferred alternative's strategies to restore upland coastal prairie habitat and eventually introduce and sustain a nonessential, experimental population of the Oregon silverspot butterfly within restored high-quality upland coastal prairie habitat. We concede that the goal of restoration by 2018 is likely overly ambitious, and we will revise this alternative within the CCP to reflect that our goal is to restore up to 100 percent of this habitat through a phased restoration project by completing portions gradually over the next 15 years. We are working closely with the Institute for Applied Ecology, which specializes in prairie restoration, to ensure that this restoration progresses in a scientifically sound and adaptive manner and that it not only includes native coastal grasses and forbs but also emphasizes the species and structure required by the Oregon silverspot butterfly.

6. **Comment:** Support for the protection of the unique habitats of Neskowin Marsh through the implementation of proposed goals and strategies, including RNA designation.

   Response: The Service acknowledges the comment in support of the goals, objectives, and strategies of the preferred alternative and RNA designation of Neskowin Marsh. Because RNAs are managed to maintain the natural features for which they were established, and to maintain natural processes, they are excellent areas for studying ecosystems or their component parts and for monitoring succession and other long-term ecological change. Non-manipulative research and monitoring activities are also encouraged in RNAs. The Service hopes that by designating Neskowin Marsh as an RNA, it will encourage further scientific interest in this unique coastal bog ecosystem.

7. **Comment:** Support for protecting and maintaining wet-mesic Sitka spruce-western hemlock forest and preventing invasive plants from spreading.

   Response: The Service acknowledges the comment in support of protecting and maintaining wet-mesic Sitka spruce-western hemlock forest by implementation of strategies in the preferred alternative, including IPM strategies to prevent and control invasive species.

8. **Comment:** Support for enhancing, protecting, and maintaining aquatic habitat with additional woody debris and channel diversification that will benefit salmonids.

   Response: The Service acknowledges the supportive comments regarding the Refuge's intention to enhance, protect, and maintain aquatic habitat for the benefit of salmonids. Additional large woody debris and channel diversification will provide beneficial habitat for the entire life cycle of salmonids.

9. **Comment:** A strategy for reconnecting aquatic habitats on the Refuge with floodplains and upper watersheds should be added.

   Response: We acknowledge that reconnecting aquatic habitats on the Refuge with floodplains and upper watersheds is an important regional strategy and that habitat management and improvement is the key to protecting and enhancing salmonid populations, particularly coho salmon. Because much of the most important coho habitat is on private lands or on Siuslaw National Forest lands, we will coordinate with ODFW, the U.S. Forest Service, and other partners to support physical habitat restoration actions listed in the Oregon Coast Coho Conservation Plan for the Nestucca watershed (http://www.dfw.state.or.us/fish/CRP/docs/coastal_coho/final/Coho_Plan.pdf).

Invasive Species Management

10. **Comment:** The Refuge should eradicate all non-native species from refuge-managed lands. The long-term eradication of non-native species should take precedence over any concerns about incidental damage to native species caused by eradication efforts, and the use of lethal means (e.g., the hunting of nutria) is encouraged if it is the most cost-effective method.

Response: Throughout the CCP, the terms *pest* and *invasive species* are used interchangeably because both can prevent/impede achievement of refuge wildlife and habitat objectives and/or degrade environmental quality. Service policy (569 FW 1) defines *pests* as "invasive plants and introduced or native organisms that may interfere with achieving our management goals and objectives on or off our lands, or that jeopardize human health or safety." Department of the Interior policy (517 DM 1) defines an *invasive species* as "a species that is non-native to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health."

The control of non-native and invasive species on the Refuge is proactive and receives high management priority. The likelihood of incidental damage to native species caused by eradication efforts must be determined before implementing IPM techniques. A cost-benefit analysis regarding effects to native species health and population plays a critical role in determining the most effective method to control invasive species with least harm to native species. Decisions to use particular tools and techniques and criteria for their use to control invasive species are based on numerous factors and considerations (e.g., the particular species being targeted, associated natural history characteristics, proximity to sensitive resources and non-target species, etc.). While the CCP provides overall direction and priority for the control of invasive species, naming specific treatments for the variety of possible problems would be premature. IPM is an interdisciplinary approach utilizing methods to prevent, eliminate, contain, and/or control pest species in concert with other management activities on refuge lands and waters to achieve wildlife and habitat management goals and objectives. Considering refuge objectives and the ecology of pest species, once a pest species population reaches a threshold, one or more methods would be selected that are feasible, efficacious, and most protective of non-target resources, including native species (fish, wildlife, and plants), Service personnel, Service-authorized agents, volunteers, and the public. Staff time and available funding will be considered when determining feasibility/practicality of various treatments. Such methods may include lethal removal of individual animals when those methods do not pose a significant threat to non-target animals.

11. **Comment:** Refuge management should use the principles of Early Detection Rapid Response (EDRR), which calls for regular monitoring for invasive plant species and rapid attack of species that pose a significant threat to key habitats. Support for the strategies intended to prevent the establishment or dominance of non-native Japanese eelgrass within the estuary.

    Response: For Nestucca Bay NWR, the magnitude of pest problems is beyond the available capital resources to expect control or eradication during any single field season; therefore it is essential to prioritize treatment of infestations. Some non-native species that are pervasive on refuge lands are the subject of long-term control efforts and will continue to be a high priority for refuge resources. Other non-native species, such as Japanese eelgrass, have not yet been reported on refuge lands but would represent a definite threat to refuge resources if found. The EDRR model will be used to find and verify the identity of new invasive species as early after entry as possible, when eradication and control are still feasible and less costly. The Service will embark on a systematic effort to eradicate, contain, or control newly discovered invasive species and isolated infestations of a previously established, non-native species, while the infestation is still localized. Regardless of whether the invasive species is well established or newly introduced, it will be essential that the refuge prioritize pre- and post-treatment monitoring, assessment of the successes and failures of treatments, and development of new approaches when proposed methods do not achieve desired outcomes.

Inventory, Monitoring, Research, and Assessments

12. **Comment:** Support for the monitoring activities identified in the CCP including water quality, non-native species, sedimentation rate, mudflats (and associated species), and climate change parameters. The Service should coordinate monitoring efforts with other agencies across the region and identify potential research projects.

    Response: The Service acknowledges and appreciates the support for increased emphasis on monitoring. When taking any conservation action at a site, we agree that monitoring of actual outcomes is necessary to evaluate the effectiveness of our programs and our progress toward goals and objectives. Outcome-based monitoring, together with assumption-driven research, will help us ensure that our work is adaptive. We also acknowledge the importance of coordinating refuge efforts with other monitoring sites along the coast, particularly monitoring of parameters related to climate change.

    During planning, we make many assumptions about how wildlife populations respond to their environment. Research that tests the validity of these assumptions and their relevance to our management activities is a high priority; however, lack of resources often hinders refuge staff from clearly articulating research needs in a timely and thorough manner and from recruiting researchers to assist in conducting the research. For this reason, refuge-specific research priorities identified in the CCP, such as pasture management and response of geese populations, are not developed further within the CCP. Proposed research requests will be analyzed using the criteria in the Compatibility Determination for Research, Scientific Collecting and Surveys (Appendix B of the CCP); if the research has the potential to meet the information needs of the Refuge and contribute to our capacity for adaptive management, the Service will permit and assist the research to the greatest extent possible.

13. **Comment:** Research should be conducted in a rigorous and scientifically valid manner that includes peer review and publication of results. These results plus all relevant archived reports should be converted to digital formats and made available for use by other researchers, managers, and the interested public.

    Response: The Service is committed to using sound science in its decision-making and to providing the public with information of the highest quality possible. The Service is instituting data standards to improve the quality and compatibility of its data. This approach will increase opportunities to share data and reduce incidents of redundant data development. Federal agencies are required to publish guidelines for ensuring the quality, objectivity, utility, and integrity of information we use and disseminate, and to provide mechanisms for allowing the public to seek correction of that information. In order to ensure the quality and credibility of the scientific information the Refuge uses to make decisions, the Service has implemented a formal "peer review" process for influential scientific documents following the Office of Management and Budget memorandum "Final Information Quality Bulletin for Peer Review" (available online at http://www.whitehouse.gov/sites/default/files/omb/memoranda/fy2005/m05-03.pdf).

14. **Comment:** What is the invertebrate availability to shorebirds at Nestucca Bay, and are there available high-tide roost areas for shorebirds?

    Response: Shorebirds make less use of Nestucca Bay mudflats than some other estuaries along the Oregon coast. Several goals and objectives within the CCP (Objective 4.2, Protect and maintain intertidal mudflats and Objective 9.1, Conduct inventory and monitoring surveys) include strategies to conduct monitoring of habitat parameters to determine stop-over feeding and loafing habitat quality for shorebirds. Results of this monitoring, along with habitat assessments, will allow the Service to determine if it is possible to improve areas for shorebird use at Nestucca Bay NWR.

Neskowin Tsunami Evacuation Trail

15. **Comment:** The design, maintenance, practicality, and accessibility of the community-designated tsunami evacuation trail through Neskowin Marsh should be carefully considered. The safety and navigability of the footbridge during winter storm surges is in doubt. Will the Service maintain the trail regularly? The quality and utility of the trail should be improved to serve as a more reliable local evacuation route. How will changes to the tsunami trail affect neighboring land owners?

    Response: The Service will continue to maintain the existing trail for local residents to use as an unofficial tsunami evacuation route. Vegetation management will be conducted, but the trail surface will remain as it currently is. The footbridge over Meadow Creek will be improved for accessibility and durability. The Service acknowledges that the trail floods annually following heavy rainfall, as does the adjacent Hawk Street that leads to the trail. The Service has installed reflective markers on both sides of the trail to outline the trail route during flooding or at night. Individuals using the trail do so at their own risk, which will require wading if the trail is flooded. Residents should be aware that during a subduction zone earthquake, the trail may receive damage prior to the arrival of a tsunami; however for some nearby residents, this may be their only timely escape route.

    If the results of a hydrologic study indicate that the existing old road bed that serves as the trail is adversely impacting the marsh, any alterations of the roadbed will include a design that continues its use as a trail and that does not negatively impact the adjacent privately owned golf course.

Public Access

16. **Comment:** The Service should charge a fee that could be used on the Refuge to support road, facilities, and habitat maintenance programs, and these fees should be only used for the Oregon Coast NWR Complex.

    Response: In 2004, Congress passed the Federal Lands Recreation Enhancement Act, which allows the government to charge a fee for recreation use of public lands managed by the USFWS and other federal land management agencies. The Service collects fees at more than 100 national wildlife refuges. At least 80 percent of all fees collected at a refuge are reinvested back into that refuge to provide quality recreational facilities and opportunities to visitors. The remaining 20 percent is used in that geographic region. The Service may not use recreation fees to pay for biological monitoring of threatened and endangered species;

however, fees could be used to support visitor facilities and potentially habitat maintenance in areas open to public access. At this time, the Service has neither the resources nor the level of visitation to justify having a fee program. The Service will refer to established criteria to determine if charging a fee and establishing a fee collection system are warranted at some point in the future.

Wildlife Observation and Photography

17. **Comment:** Support for the development of the Powerline Trail. The trail should extend easterly along the dike to provide additional opportunity to view habitat frequented by shorebirds.

    Response: The Service acknowledges support for the improvement of the trail that follows the power line right-of-way at Cannery Hill. This seasonal trail will be open to wildlife viewing and photography from April 1 through September 30. The Service will extend the trail easterly along the dike, but this extension will be very limited in length as portions of the dike are in private ownership.

18. **Comment:** Disappointment that wildlife observation and photography were prohibited in some areas. The Service should allow these uses on more areas.

    Response: Minimizing human disturbance to wildlife, specifically wintering geese and waterfowl, is a priority for the Service at Nestucca Bay NWR. The Service is committed to providing pasture and wetland habitat where wildlife can feed and rest undisturbed. Therefore management strategies to reduce disturbance to wildlife must include areas that are closed to all public use, including wildlife observation and photography, to provide such sanctuary. The Service has offered multiple strategies to allow wildlife observation and photography, which are outlined in Chapter 2, Goal 10.

19. **Comment:** Support for facilities to support wildlife observation with specific recommendations about the design of photography/observation blinds. Support for the construction of additional facilities in support of wildlife observation and photography including an auto tour route.

    Response: The Service acknowledges the request for additional facilities in support of wildlife observation and photography. The Service has included the construction of additional facilities in support of wildlife observation and photography in the CCP, including the construction of a goose observation deck in the lower parking lot at Cannery Hill, construction of a walking trail along the old roadbed in the Little Nestucca Restoration Area and improvement of a seasonal trail (April through September) along the current power line right-of-way at Cannery Hill. These trails will allow visitors to engage in interpretation, environmental education, wildlife observation, and photography. The Service does not have plans to build any observation/photography blinds currently but will take the recommendations of the commenters into consideration if we design and build any in the future. The Service did not consider an auto tour route as the topography of the landscape, the limited acreage, and environmental impact of such makes this option unfeasible.

20. **Comment:** Support for banning the usage of audio playback devices to attract birds or other wildlife.

Response: Human activities on a refuge must be compatible with the primary wildlife purposes of each refuge. The use of audio playback devices is an issue of growing concern to the Service, because the use of technology for birding and wildlife photography continues to increase and evolve. The reason for concern is that when a song is played in a bird's territory, that bird's response to the so-called intruder is recognized by neighboring rivals. As a result, birds that are otherwise too shy and secretive to expose themselves are lured out into the open by the sound of a potential rival, thereby making them more vulnerable to predation. Use of audio playback appears to cause undue stress on the bird, causing the territorial male to waste energy chasing a perceived intruder and distracting birds from more important, energy-intensive activities including nest building, incubation, and/or searching for food. Some birders will use bird calls in the field to verify a call they have heard. On a refuge they may play the call quietly so only they are able to hear it or use headphones, which minimize any potential impact on birds in the wild. When audio playback is used to elicit a response from birds in the wild, there are two refuge regulations that apply: 50 Code of Federal Regulations (CFR) 27.51 prohibits disturbing and attempting to disturb wildlife on any national wildlife refuge; in addition, 50 CFR 27.72 prohibits "the operation or use of audio devices including radios, recording and playback devices, loudspeakers ... so as to cause unreasonable disturbance to others in the vicinity." Use of audio devices to lure birds violates at least one if not both of these regulations. We do not allow the use of audio playback devices on Nestucca Bay NWR for the purpose of getting birds to respond since it can disturb wildlife and other visitors and would be difficult if not impossible to avoid violating refuge regulations in doing so.

Environmental Education and Interpretation

21. **Comment:** The Service should provide information in the form of brochures or kiosks on the ethics of watching wildlife.

    Response: Interpretation is identified as one of the priority public uses of the Refuge System. As part of the CCP, the Service intends to develop additional interpretive trails and informational brochures so visitors can learn about geese, native coastal prairie, and habitat restoration on Nestucca Bay NWR with an ultimate goal of enhancing visitors' appreciation, understanding, and enjoyment of the Refuge's natural resources. Interpretation will also be used to help enlist the cooperation of visitors by sharing refuge rules and regulations in a manner that encourages them to minimize disturbance and respectfully care for the Refuge and its wildlife.

22. **Comment:** Support for the expansion and development of interpretive trails, observational overlooks, and environmental education programs.

    Response: The Service acknowledges the support to expand environmental education programs on the Refuge. The Service believes environmental education plays a key role in encouraging current and future generations to engage in environmentally responsible behavior like supporting the protection of habitat for wildlife through the Refuge System. The Service has several strategies to support environmental education (Chapter 2, Goal 11), including the addition of an Environmental Education Specialist.

Hunting and Fishing

23. **Comment:** Opposition to duck hunting in a wildlife refuge setting due to the sound of gunshots and the lack of sanctuary. The term “refuge” implies sanctuary, and allowing the killing of animals is an oxymoron or in direct conflict to the idea of a “refuge.” Allowing duck hunting will alienate artists, preservationists, wildlife photographers, bird watchers, and other passive observers of the Refuge. The Refuge should be allowed to maintain its natural balance without recreational hunting and fishing.

    Response: The National Wildlife Refuge System Administration Act (16 U.S.C. 668dd - 668ee, et seq.), as amended by the National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57) recognizes that wildlife-dependent recreational uses including hunting and fishing, when determined to be compatible with the mission of the NWRS and the purposes of the Refuge, are legitimate and appropriate uses of national wildlife refuges. Hunters and anglers actively support wildlife conservation through tangible actions such as buying licenses and paying special excise taxes on hunting and fishing equipment. Hunters make substantial contributions to conservation primarily through fees from the Federal Duck Stamp program, which hunters must purchase to legally shoot waterfowl. Funds from the sale of the Federal Duck Stamp have been used to purchase more than 5 million acres of habitat for the Refuge System. The duck stamp program was initiated in 1934 by hunters themselves, who recognized the need to protect dwindling wildlife populations.

    During the preparation of this CCP, the question of whether to allow waterfowl hunting was given careful consideration along with the need to provide sanctuary for waterfowl and other wildlife. It is acknowledged that waterfowl hunting has the potential to harm habitats or non-target wildlife on refuges; however, the waterfowl hunting opportunity on Nestucca Bay NWR was designed with measures and restrictions to ensure it does not negatively affect other refuge priority objectives, including providing undisturbed areas for wintering geese and areas where visitors can engage in wildlife observation, photography, interpretation, and environmental education. Specifically, the lowland pastures, which are very important wintering sanctuary for dusky Canada geese, are not open to waterfowl hunting.

    The Service also considered whether adding to the waterfowl harvest totals by establishing a new hunting program would significantly contribute to population changes of the other waterfowl species using the Refuge. We also considered whether the provision of opportunities for bank fishing along the Little Nestucca River would lead to a more than a negligible impact on sport fish in the river. The numbers of waterfowl expected to be taken from Nestucca Bay NWR are expected to make up an extremely small proportion of local, State, or Pacific Flyway total harvest. Both hunting and fishing will be permitted in accordance with carefully designed State regulations and seasons, so these activities are not expected to have more than a negligible impact on waterfowl and sport fish populations. The Service believes the hunting and fishing programs at Nestucca Bay NWR can be implemented without causing unreasonable conflicts with other public use and management programs.

24. **Comment:** Allowing duck hunting on Nestucca Bay NWR could endanger the safety of the general public, including those traveling along Highway 101 and any visitors viewing or photographing wildlife in areas that are also open to hunting at the same time.

Response: The Service acknowledges the concern about the safety of the general public, including those traveling along Highway 101 and any visitors viewing or photographing wildlife in areas that are also open to hunting at the same time. At Nestucca Bay NWR, waterfowl hunting and wildlife observation will be allowed at the same time only on the Brooten Marsh Unit, and there will be no hunting on refuge lands adjacent to Highway 101. At the Bandon Marsh Refuge on the south coast of Oregon, these activities have been allowed at the same time since 1985, and there have been no recorded conflicts to date. Weather and estuary conditions are similar at Nestucca Bay. In general, the preferred weather for successful waterfowl hunting is very different from the preferred weather for wildlife observation, which minimizes the occurrence of the two activities in the same place at the same time. We will continue to monitor the hunting program for potential resource and visitor conflicts, and if needed we will modify the program accordingly.

25. **Comment:** Support for waterfowl hunting.

    Response: The Service acknowledges the support of waterfowl hunting on Brooten Marsh and at the mouth of the Little Nestucca River.

26. **Comment:** Inadvertent catch of coho salmon by anglers could occur due to the opening of bank fishing within the Little Nestucca Restoration Area. The Service too readily dismisses coho salmon bycatch concerns by asserting that impacts to coho will be minimized through following state and federal regulations, education via handouts, and by the small scope and limited capacity of the fishery. Thus, further analysis of whether these measures are adequate to address incidental mortality of threatened coho is required. The broader and cumulative impacts of incidental capture injury and mortality in the greater context of the Little Nestucca River, the entire watershed, and other neighboring wildlife refuges (i.e., Bandon Marsh and Siletz Bay NWRs) should also be analyzed. In addition, the final CCP should include angling regulations beyond those enumerated in state and local guidelines in order to minimize lethal impacts of accidental capture (e.g., barbless hooks, temporal restrictions, and the use of artificial lures).

    Response: Sport fishing in waters containing coho salmon is a recreational fishing activity approved by the National Marine Fisheries Service (NMFS). Amendment 13 to the Pacific Coast Salmon Plan (PFMC 1999) provides an overarching management plan for ocean and freshwater fisheries affecting Oregon Coast coho salmon that guides allowable impacts annually. NMFS has consulted on this plan and issued a Section 7 Supplemental Biological Opinion and Incidental Take Statement approving implementation of Amendment 13. Annual fishing impacts to coho salmon including ocean salmon fisheries, coho fishing in the estuaries and rivers, and incidental impacts from trout, steelhead, and salmon fishing must be within the guidelines of this plan.

    Fishing for and conservation of coho salmon is provided for in the Fishery Management and Evaluation Plans (FMEPs), developed by ODFW with NMFS concurrence, pursuant to Limit 4 of the Endangered Species Act 4(d) Rule (65 FR 42422, July 10, 2000) and the Section 7 Supplemental Biological Opinion and Incidental Take Statement, Amendment 13 to the Pacific Coast Salmon Plan. Incidental capture mortality to coho salmon is included in the annual analysis that ODFW reports to NMFS. Salmonid populations and capture rate (take) in all coastal watersheds are closely monitored by ODFW. Adjustments to fishing regulations are made when salmonid populations do not meet established criteria in the FMEPs. The

Service has coordinated extensively with ODFW on the feasibility and appropriateness of providing angler access along the lower Little Nestucca River.

The proposed fishing within Nestucca Bay NWR will be located on a remaining segment of dike that separates the tidal marsh restoration area from the Little Nestucca River. Anglers will be fishing within the state-owned and regulated waters and tidelands of the lower Little Nestucca River from the refuge-owned bank. They will not be fishing in the refuge-owned tidal marsh restoration area. The stretch of the Little Nestucca River Estuary where bank fishing will occur is already open to fishing by boat, and several adjacent landowners hold a legal easement within the Refuge that allows them access to this site to bank fish. The proposal to allow fishing within the Refuge at the specified location does not constitute opening a new portion of the estuary to sport fishing, as the entire estuary is already open. The Refuge's proposal will allow public access to the refuge-owned bank, which will allow additional fishing access to State-administered waters.

The USFWS has no authority to regulate fishing activity, including gear restrictions, on state-owned and regulated waters and tidelands. Requiring anglers to use barbless hooks while fishing from the refuge-owned bank would be confusing and unreasonably burdensome to anglers. For example, anglers fishing from the bank below mean high water or from a boat would be on State-owned lands and not subject to a barbless hook regulation while those standing above mean high water would be subject to the barbless hook regulation. Thus, instead of including refuge-specific angling regulations beyond those enumerated in State guidelines, the USFWS in concert with ODFW will promote the use of barbless hooks while fishing within the estuary. Proper signage will be posted for anglers to read. Effects on coho salmon from the additional bank fishing access proposed by the Refuge are expected to be negligible. ODFW publishes annual fishing regulations, and we do not generally re-list State regulations within the CCP.

Visitor Facilities

27. **Comment:** The Service should use native plants that provide natural food for birds and other wildlife at any buildings, kiosks, or visitor areas.

    Response: The Service supports the use of native plantings around its facilities to provide food, cover, and loafing habitat for birds and other wildlife. The strategy for the use of habitat-appropriate plants for landscaping around buildings, kiosks, and other public use facilities has been integrated into the CCP within Chapter 2, Goal 14 concerning the need to provide facilities and materials that welcome and orient visitors to natural wonders of fish and wildlife that use Nestucca Bay NWR.

Outreach

28. **Comment:** The Service should actively engage the birding community in volunteer opportunities that arise on the Refuge.

    Response: The Service recognizes the importance of working with the birding community and with volunteers. The Service already works with many birding groups, including Lincoln City Audubon and the Audubon Society of Portland, to carry out some of the tasks associated with refuge management (e.g., interpretation, invasive species control). The Service recognizes that groups such as these and their volunteers are key components of the successful management of refuge lands and are vital to the Refuge's biological and public use programs and projects.

Adaptive Management

29. **Comment:** The Refuge should develop a regular schedule of management review and involve participation from partners and other peers as part of adaptive management.

    Response: Adaptive management is a standard operating procedure for implementation of the CCP. The inventory, monitoring, and research strategies in Chapter 2 were identified to evaluate progress towards achieving the refuge purposes, vision, and goals. The Inventory and Monitoring step-down plan to be completed within approximately five years of CCP completion will prioritize inventory, monitoring, and research activities. Through adaptive management, evaluation of monitoring and research results may indicate the need to modify refuge objectives or strategies in order to achieve desired results. Much of the success of adaptive management depends upon a well-structured collaboration between refuge personnel and scientists from partner agencies or organizations who are experts in the area of management interest to design an iterative scheme of decision, action, and monitoring (Moore et al. 2011).

    Per USFWS policy (602 FW 3), CCP review is mandated at least annually to determine whether revisions are required. Plan revision is required when significant new information becomes available, ecological conditions change, major refuge expansion occurs, or when the need is identified during plan review. A revision should occur every 15 years or sooner, if necessary.

Land Protection

30. **Comment:** Support for the Service to continue negotiating with willing sellers to acquire lands within the existing approved refuge boundary.

    Response: The Service acknowledges and appreciates the support.

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Appendix L. Waterfowl Hunt Plan

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Nestucca Bay National Wildlife Refuge

Waterfowl Hunt Plan

Prepared by:
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January 2013

Recommended by: ______________________ Date: 1/22/13
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Approved by: ______________________ Date: 1-23-13
Regional Chief, National Wildlife Refuge System

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Nestucca Bay National Wildlife Refuge Waterfowl Hunt Plan

1. Introduction

In December 2012, the Nestucca Bay National Wildlife Refuge (NWR or Refuge) Comprehensive Conservation Plan and Environmental Assessment (CCP/EA or CCP) (USFWS 2012a) was approved by the U.S. Fish and Wildlife Service (USFWS or Service) Regional Director. The CCP will guide the management of Nestucca Bay NWR for 15 years. It was finalized after several years of extensive planning and public participation, and it resolved several key issues on the Refuge, including waterfowl hunting. The Nestucca Bay NWR CCP/EA describes and analyzes three alternatives and summarizes the planning effort, public comments, and USFWS responses. It is incorporated by reference as part of this Waterfowl Hunt Plan and is available at the following website: http://www.fws.gov/oregoncoast/ccp_nes_slz_bdm.htm/. Supporting documents include the Finding of No Significant Impact (FONSI) (December 2012) and the Waterfowl Hunting Compatibility Determination (CCP Appendix B; also appended to this Waterfowl Hunt Plan and incorporated by reference). In accordance with the CCP and its associated FONSI, the USFWS will open 141 acres of Nestucca Bay NWR Refuge to the hunting of ducks and coots, hereafter referred to as waterfowl hunting, seven days per week, on Brooten Marsh (108 acres) and the mouth of Little Nestucca River (33 acres). All lands within Nestucca Bay NWR will remain closed to goose hunting.

1.1. About the Refuge

Nestucca Bay Refuge lands are located near Pacific City and Neskowin, in Tillamook County, Oregon (Figure 1). The Refuge was established in 1991 with the acquisition of a 370-acre dairy farm and has since been expanded to 1,010 acres. Nestucca Bay NWR was established to protect wintering habitat for the Aleutian Canada goose, which was federally listed as endangered in 1967 and delisted in 2001, and for the declining dusky Canada goose; and to protect diverse coastal wetland habitats and upland habitat buffers for a variety of migratory waterfowl, shorebirds, raptors, songbirds, anadromous fish, and other wildlife. In 2002, Nestucca Bay NWR was expanded to include the Neskowin Marsh Unit (228 acres), located about 2.5 miles south of the Nestucca Bay Unit. The Neskowin Marsh Unit incorporates unique freshwater wetland and bog habitats and wildlife resources not found within the original refuge boundary, and is located outside of the Nestucca River watershed.

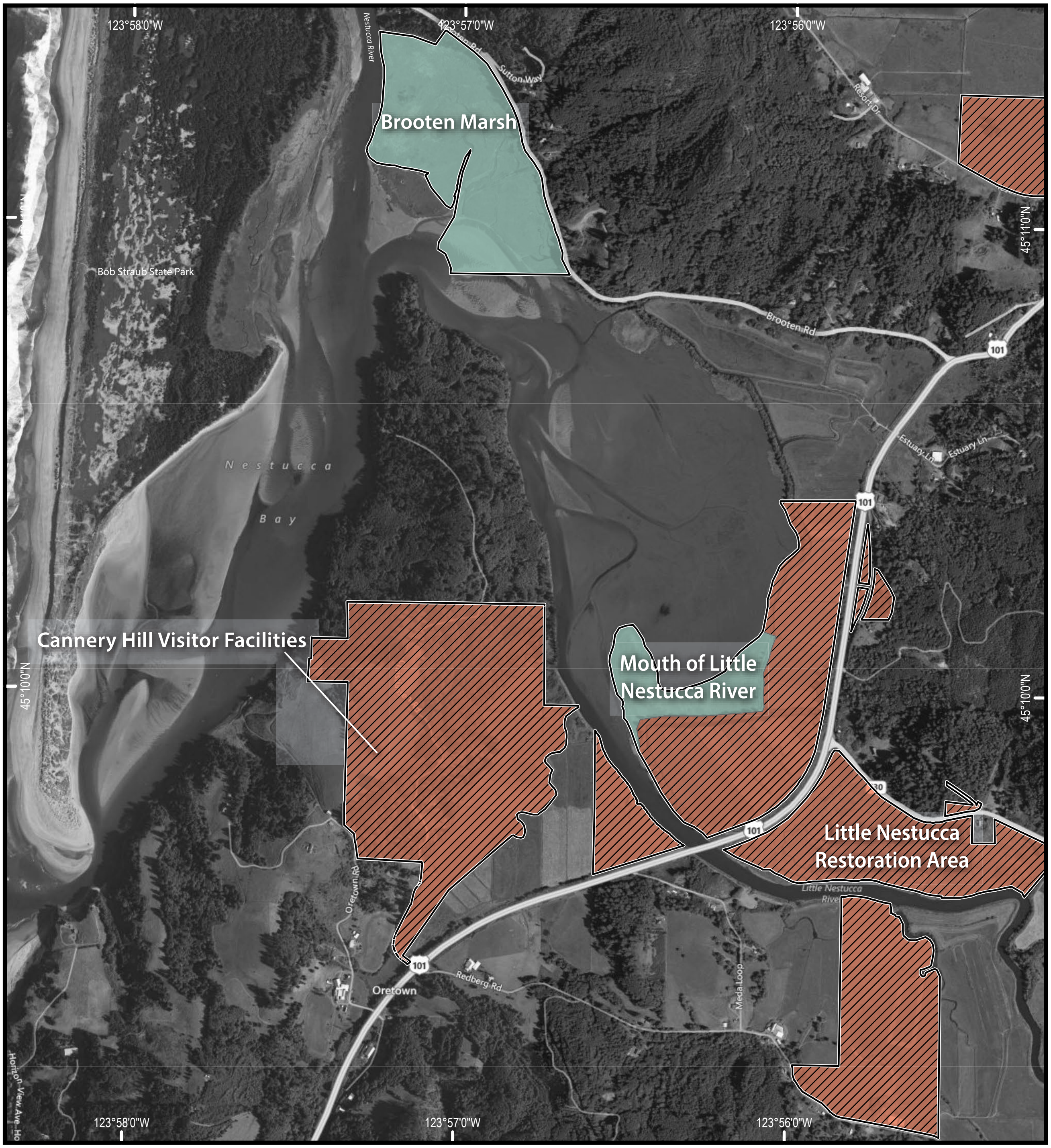
Nestucca Bay NWR provides important winter habitat for the formerly endangered Aleutian Canada goose and serves as an important overwintering site for up to 18% of the declining population of the dusky Canada goose. Other subspecies of Canada geese, collectively known as white-cheeked geese, using refuge pastures include Taverner’s, cackling, lesser, and western. The freshwater wetlands and estuarine habitats support thousands of migratory waterfowl and shorebirds. The riverine and estuarine habitats provide essential habitat for Chinook salmon, threatened coho salmon, chum salmon, steelhead trout, and coastal cutthroat trout. Mammals such as marsh shrews, Oregon voles, muskrats, beaver, mink, river otters, and raccoons are common in the marshes and wetter pastures, and harbor seals forage over flooded tidal flats. Deer and elk graze the marsh and pasture grasses. Riparian forest patches and the valley forested wetlands support small mammals as well as many amphibians and reptiles such as long-toed and Pacific giant salamanders, rough-skinned newts, Pacific tree frogs, and garter snakes.

Forested areas on the Refuge are used as breeding habitat by neotropical songbirds including Swainson's thrush, Wilson's warbler, orange-crowned warbler, and western tanager. The forest is also used on a year-round basis by other songbirds including chestnut-backed chickadee, Pacific wren, golden-crowned kinglet, varied thrush, and song sparrow. The recently delisted California brown pelican uses the open waters within Nestucca Bay as foraging habitat in summer and early fall. Peregrine falcon observations are numerous from fall through spring. Cannery Hill, located on the upper portion of the Nestucca Bay Unit, has several bald eagle perching sites.

Nestucca Bay NWR was established with the following purposes:

> "to conserve (a) fish or wildlife which are listed as endangered species or threatened species … or (b) plants" [16 U.S. Code (U.S.C.) 1534 (Endangered Species Act of 1973)].
>
> "for the development, advancement, management, conservation, and protection of fish and wildlife resources" [U.S.C. 742f(a)(4)] … "for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude" [16 U.S.C. 742f (b)(1) (Fish and Wildlife Act of 1956)].
>
> "for use as an inviolate sanctuary, or for any other management purpose, for migratory birds" [16 U.S.C. 715d (Migratory Bird Conservation Act)].
>
> "for conservation purposes" [7 U.S.C. 2002 (Consolidated Farm and Rural Development Act)].
>
> For "the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to fulfill international obligations contained in various migratory bird treaties and conventions" [16 U.S.C. 3901(b), 100 Stat. 3583 (Emergency Wetlands Resources Act of 1986)].

Figure 1 ***Nestucca Bay National Wildlife Refuge Waterfowl Hunt Area***

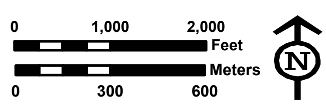


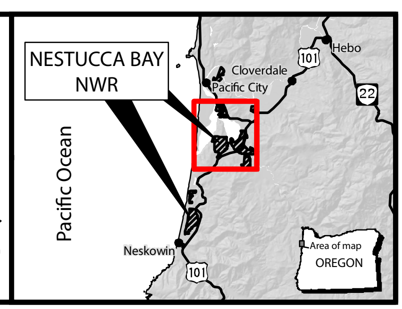
LEGEND

- Refuge Managed Lands (Fee Title or Easement)
- Waterfowl hunting to be allowed 7 days per week
- Area closed to all hunting

All other Refuge lands not depicted on this map are closed to all hunting.

Hunters must comply with Refuge and ODFW regulations.





Map Date: 11/30/2012 File: 13-018-2.mxd Data Source: Refuge Boundaries from USFWS/R1; Roads from ESRI; Imagery from Bing Maps

The following principles guided the development of the recently completed CCP/EA for Nestucca Bay NWR (USFWS 2012a). The Nestucca Bay NWR Waterfowl Hunt Plan will guide the implementation of the waterfowl hunt program as detailed in the CCP. These principles are consistent with refuge purposes, the National Wildlife Refuge System (NWRS or Refuge System) mission and goals, the NWRS Improvement Act (Public Law 105-57), USFWS policies, and international treaties.

- Enhance, maintain, and protect refuge habitats (including lowland pastures; upland prairie and mixed upland grasslands; upland forests; forested wetlands; and estuarine, freshwater and stream-riparian habitats) and other lands for the benefit of migratory birds and other wildlife.
- Gather sufficient scientific information to guide responsible adaptive management decisions.
- Provide visitors compatible wildlife-dependent public use opportunities that foster an appreciation and understanding of the Refuge's fish, wildlife, plants, and their habitats, and have limited impacts to wildlife.
- Initiate and nurture relationships and develop cooperative opportunities to promote the importance of the Refuge's wildlife habitat, and support refuge stewardship.
- Protect and manage the Refuge's cultural resources, and identify new ways to gain an understanding of the Refuge's history and cultural resources.

1.2. Waterfowl Hunting Opportunities on the Refuge and Surrounding Areas

There is currently no official hunt program on the Nestucca Bay NWR. The tidelands adjacent to the Refuge are owned and managed by the Oregon Division of State Lands and are legally open to hunting. Some waterfowl hunting does occur on the State-owned tidelands and the hunting is managed by the Oregon Department of Fish and Wildlife (ODFW). Nestucca Bay NWR currently offers four of the six wildlife-dependent activities of the NWRS including wildlife observation and photography, environmental education, and interpretation. The Refuge was closed to all public uses until October 2008 when a portion of Cannery Hill was opened. The Pacific View Trail, the Viewing Deck, and the lower parking lot at Cannery Hill offer good opportunities for wildlife observation and photography. The best season for viewing geese and other species of waterfowl on the Refuge is from November to March. The Refuge offers a few environmental education programs on-site, and all environmental education programs are informal and led by refuge volunteers, interns, or staff. During the summer, refuge staff and volunteers lead a series of interpretive events that provide opportunities for the public to learn more about the wildlife and habitats of Nestucca Bay. These events include nature photography, guided bird walks, historical talks on the early settlers of the area, and more. The Refuge has partnered with the Tillamook Estuaries Partnership to develop a water trail for the Nestucca and Little Nestucca Rivers, which has been designated as a National Recreation Trail.

Public waterfowl hunting opportunities in the area surrounding Nestucca Bay NWR are limited, with the next nearest opportunities occurring on Tillamook Bay. Public waterfowl hunting in the Nestucca Bay area has primarily occurred on the State-owned tidelands of Nestucca Bay off Brooten Road near Pacific City, and access is largely by boat (D. Nuzum, ODFW, pers. comm.). The tidelands are managed by the Division of State Lands, and hunting pressure within Nestucca Bay is fairly low. There is demand for public waterfowl hunting in the Nestucca Valley, especially those lands that have walk-in access and do not require the use of a boat. Allowing waterfowl hunting on Brooten Marsh and the mouth of the Little Nestucca River will increase hunting opportunities in the area for hunters with or without a boat.

On State-owned tidelands of Nestucca Bay during the 2010-2011 hunting season, hunters harvested very few ducks, and the harvest numbers are considered to be below reportable levels (B. Reishus, ODFW, pers. comm.) Waterfowl harvest data are unavailable because only a small number of hunters pursue waterfowl in the Nestucca Bay area, and no hunters were surveyed for harvest information during the 2011-2012 hunting season. Most hunting occurs in October and November, and tides influence hunting times. After November the birds disperse to flooded pastures or move further inland, and there is almost no hunting occurring in the bay.

2. Conformance with Statutory Authorities

National wildlife refuges are guided by the mission and goals of the NWRS, the purposes of an individual refuge, USFWS policy, and laws and international treaties. Relevant guidance includes the NWRS Administration Act of 1966, as amended by the NWRS Improvement Act of 1997, Refuge Recreation Act of 1962, and selected portions of the Code of Federal Regulations (CFR) and the Fish and Wildlife Service Manual.

The mission of the NWRS is "to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans" (NWRS Administration Act of 1966 as amended, 16 U.S.C. 668dd-668ee).

The NWRS Improvement Act of 1997 provides guidelines and directives for the administration and management of all areas in the NWRS. The Act also recognized that wildlife-dependent recreational uses involving hunting, fishing, wildlife observation, photography, environmental education, and interpretation, when determined to be compatible with the mission of the Refuge System and purposes of a refuge, are legitimate and appropriate public uses of the NWRS. Compatible wildlife-dependent recreational uses are the priority public uses of the NWRS, and they receive priority consideration in planning and management.

Conformance of refuge uses with refuge purposes is determined through a formal compatibility determination process. Compatibility means that the use will not materially interfere with or detract from the fulfillment of the purposes of a refuge or the mission of the NWRS (603 FW 2). The waterfowl hunt program, as described below in Section 5, was determined to be compatible with refuge purposes, with stipulations (see CCP Appendix B).

The initial cost of establishing a waterfowl hunt program on the Nestucca Bay NWR was estimated at $12,000 (USFWS 2012a). Annual costs to administer the waterfowl hunt on the Refuge, if fully staffed, were estimated in 2012 at approximately $7,000. Waterfowl hunting will be permitted in accordance with State and Federal regulations and seasons. Refuge-specific regulations will also govern waterfowl hunting activities (see Section 7.1).

3. Statement of Objectives

Waterfowl hunting objectives and strategies in the Nestucca Bay NWR CCP were designed to provide a quality hunting experience that meets refuge guidelines and policies. Opening the Refuge to waterfowl hunting will provide a quality, safe opportunity for hunters to hunt ducks and coots while minimizing impacts to other wildlife and other recreational users. A quality waterfowl hunting experience on the Refuge is defined as having (1) a high priority on safety; (2) clear and concise regulations that are readily available; (3) minimal conflict with wildlife and habitat objectives; (4) minimal conflict with other priority public use activities; and (5) minimal conflict with neighboring lands.

4. Assessment

4.1. Flyway, Regional, and Local Analysis

4.1.1. Flyway Analysis

Waterfowl follow distinct, traditional migration corridors, also known as "biological flyways," in their annual travels between breeding and wintering areas. Since 1948, waterfowl have been managed through four administrative "Flyways" that are based on those migration paths: the Atlantic, Mississippi, Central, and Pacific Flyways. The review of the policies, processes, and procedures for waterfowl hunting are covered in a number of documents (Flyways.us 2012).

The National Environmental Protection Act (NEPA) considerations by the USFWS for hunted migratory game bird species are addressed by the programmatic document, "Final Supplemental Environmental Impact Statement: Issuance of Annual Regulations Permitting the Sport Hunting of Migratory Birds (FSES 88-14)," filed with the Environmental Protection Agency on June 9, 1988. The Service published a Notice of Availability for this document in the Federal Register (FR) on June 16, 1988 (53 FR 22582) and the Record of Decision on August 18, 1988 (53 FR 31341). Annual NEPA considerations for waterfowl hunting frameworks are covered under a separate environmental assessment and FONSI. Further, in a notice published in the Federal Register on September 8, 2005 (70 FR 53776), the USFWS announced its intent to develop a new Supplemental Environmental Impact Statement (SEIS) for the migratory bird hunt program. Public scoping meetings were held in the spring of 2006, as detailed in the Federal Register on March 9, 2006 (71 FR 12216). The Service released the draft SEIS on July 9, 2010 (75 FR 39577).

Because the Migratory Bird Treaty Act stipulates that all hunting seasons for migratory game birds are closed unless specifically opened by the Secretary of the Interior, the Service annually promulgates regulations (50 CFR Part 20) establishing the Migratory Bird Hunting Frameworks. The frameworks are essentially permissive in that hunting of migratory birds would not be permitted without them. Thus, in effect, Federal annual regulations both allow and limit the hunting of migratory birds.

The Migratory Bird Hunting Frameworks provide season dates, bag limits, and other options for the States to select. The outcome is intended to result in a level of harvest that is appropriate based upon biological assessments prepared annually by the USFWS. These biological assessments detail the overall status of migratory game bird populations. In North America, the process for establishing waterfowl hunting regulations is conducted annually. In the United States, the process involves a number of scheduled meetings (e.g., Flyway Study Committees, Flyway Councils, USFWS Regulations Committee) in which information regarding the status of waterfowl populations and their habitats is presented to individuals within the agencies responsible for setting hunting regulations. In addition, public hearings are held and the proposed regulations are published in the Federal Register to allow public comment.

For waterfowl, these annual assessments include the Breeding Population and Habitat Survey, which is conducted throughout portions of the United States and Canada and is used to establish an annual waterfowl population status report (for example, USFWS 2012b). In addition, the number of waterfowl hunters and resulting harvest are closely monitored through both the Harvest Information Program and the "Wing Bee," which utilizes duck wings sent in from a sample of hunters to compute the species composition of the duck harvest (see http://central.flyways.us/surveys/surveys-conducted/wing-bee for more information). Since 1995, such information has been used to support the Adaptive Harvest Management (AHM) process (USFWS 2012c) for setting duck hunting regulations. Under AHM, a number of decision-making protocols taking into account population models and environmental conditions iteratively determine the choice (package) of predetermined regulations (appropriate levels of harvest) that constitute the framework offered to the States that year. In Oregon, the ODFW Commission then selects season dates, bag limits, shooting hours, and other options from the Pacific Flyway package. The Commission's selections can be more restrictive, but cannot be more liberal than AHM allows. Thus, the level of hunting opportunity afforded each State increases or decreases each year in accordance with the annual status of waterfowl populations.

Each national wildlife refuge considers the cumulative impacts to hunted migratory species through the Migratory Bird Hunting Frameworks published annually in the Service's regulations on migratory bird hunting. Season dates and bag limits for national wildlife refuges open to hunting are never longer or larger than the applicable State regulations. In fact, based upon the findings of an environmental assessment developed when a refuge opens a new hunting activity, season dates and bag limits may be more restrictive than the State allows.

Oregon is within the Pacific Flyway, which also includes those states and portions of states west of the Continental Divide, including Alaska. The most recent (2011-2012) duck harvest for the Pacific Flyway was 3.2 million birds, which represents approximately 20% of the estimated 15.8 million (±6%) ducks harvested in the United States during the 2011-2012 waterfowl hunting season (Raftovich et al. 2012).

4.1.2. Regional and Local Analysis

Every year, the Service conducts surveys that are used to estimate waterfowl hunting activity, success, and harvest by species. Results are used by the USFWS and State wildlife agencies, in part, to establish season lengths and bag limits designed to maintain healthy, sustainable waterfowl populations. During the 2011-2012 waterfowl hunting season, hunters in Oregon harvested an estimated 480,300 (±24%) ducks and 65,400 (±20%) geese (Raftovich et al. 2012). On the State-owned tidelands of Nestucca Bay during the 2010-2011 hunting season, hunters harvested very few ducks and the numbers are considered to be below reportable levels (B. Reishus, ODFW, pers. comm.) Waterfowl harvest data are unavailable because only a small number of hunters pursue waterfowl in the Nestucca Bay area and no hunters were surveyed for harvest information during the 2011-2012 hunting season. At any given time there are generally only one to two hunting parties in the Bay because of limited space. Consequently, waterfowl hunters tend to self-limit their numbers. Most hunting occurs in October and November and tides influence hunting times. After November the birds disperse to flooded pastures or move further inland and there is almost no hunting occurring in the Bay. The amount of waterfowl harvest is not expected to have a measureable effect on refuge waterfowl population numbers.

The most heavily harvested duck species in Oregon are mallard, American wigeon, northern pintail, green-winged teal, and northern shoveler (Raftovich et al. 2012). The most abundant duck species at

Nestucca Bay during the mid-winter waterfowl survey include mallard, northern pintail, American wigeon, green-winged teal, and bufflehead (USFWS unpublished data). In 2012, continental populations of mallard, green-winged teal, northern shoveler, and scaup were all above their long-term averages (Raftovich et al. 2012). American wigeon and northern pintails were 17% and 14%, respectively, below their long-term average. Hunters are permitted to harvest American coots, but this species is uncommon on the Refuge and coots are not popular with Oregon hunters. Overall waterfowl harvest levels in the local area surrounding Nestucca Bay NWR represent a very small portion of the waterfowl production for the State and the Pacific Flyway and of the total harvest based on production surveys and mid-winter surveys. Given the low harvest rates of all these species relative to the State harvest, Nestucca Bay NWR harvest numbers are expected to make up a very small proportion of local, State, or Pacific Flyway harvest, and the refuge hunt program will not significantly contribute to population changes of these species.

4.2. Are wildlife populations present in numbers sufficient to sustain optimum population levels for priority refuge objectives other than hunting?

Ducks are plentiful in late fall through early winter, utilizing refuge wetlands and flooded lowland pastures. Waterfowl numbers vary during the winter depending on habitat conditions and yearly variables such as weather and breeding production. Tidal salt marsh restoration along the Little Nestucca River has provided additional quality wetland habitat within the Refuge and can support large numbers of waterfowl. Hundreds of dabbling ducks (e.g., mallard, northern pintail, green-winged teal, American wigeon) also use the pastures as foraging habitat when the fields have standing water or are flooded during the winter months.

Along the Oregon coast, including Nestucca Bay, mid-winter waterfowl surveys are conducted during the first two weeks in January as part of a continent-wide protocol. Observers count ducks, geese, swans, and American coots from a fixed-wing aircraft, and an overall abundance is estimated (USFWS unpublished data). During the mid-winter waterfowl surveys from 1986 to 2009, the overall mean count of waterfowl on Nestucca Bay and surrounding pastures was 1,534 individuals (USFWS unpublished data). The lowest count was 161 individual birds recorded in 1986 and the largest was 3,678 in 1995. These data are collected from a fixed-wing aircraft at an altitude of 200-300 feet and traveling 80-120 miles per hour (mph), which limits ability to survey all areas and all habitats and count every individual present. The mid-winter waterfowl survey serves as an index for comparative purposes and is not necessarily representative of the number of ducks that may be present within the entire geographic area. However, general abundance and population trends can be inferred from the results of the mid-winter waterfowl survey. Waterfowl abundance is also usually lower during the January mid-winter survey compared to fall months, when birds are concentrated on the bay prior to dispersing throughout the area due to field and seasonal wetland flooding (R. Lowe, USFWS, pers. comm.). Refuge counts for ducks have ranged from 2,000 to 3,400 over the past several winters (USFWS 2012a).

It is not anticipated that waterfowl hunting will negatively affect priority refuge objectives or wildlife populations on the Refuge. Based on conversations with the OSP officers and ODFW biologists, who include Nestucca Bay in their area of responsibility, hunter use of and harvest from Nestucca Bay are relatively low (D. Nuzum, ODFW, pers. comm.). Due to limitations posed by tides and weather, the acreage being opened on Nestucca Bay NWR for waterfowl hunting will add only limited opportunity for expansion of public waterfowl hunting opportunities on Nestucca Bay. Given the low waterfowl harvest rates relative to the wintering duck population, the refuge hunt program will not significantly contribute to waterfowl population changes and the area should support a sustainable harvest.

In addition, the Nestucca Bay NWR waterfowl hunt has been designed with measures and restrictions to ensure it does not negatively affect other refuge priority objectives. For example:

- The lowland pastures, which are very important wintering sanctuary for dusky Canada geese, are not open to waterfowl hunting.
- The Refuge is within the Northwest Oregon Goose Permit Zone and the majority of refuge lands are located in the goose hunting closure area (ODFW 2012, p. 18).
- The hunt areas are limited in size and location, to ensure that sufficient sanctuary for waterfowl is available.
- Hunter outreach and education will be part of the waterfowl hunt program, to reduce wildlife disturbance and the potential for conflict among visitors.

4.3. Is there competition for habitat between target species and other wildlife?

A wide variety of other migratory and resident birds use the estuary and refuge tidal marsh where the waterfowl hunt will take place. In addition to ducks and geese, key species or groups using these habitats during waterfowl hunt periods include wading birds, raptors, and shorebirds. Canada geese and dabbling ducks use the pastures as foraging habitat when the fields have standing water or are flooded during the winter months. Areas that will remain closed to waterfowl hunting, including the flooded pastures, will provide sanctuary to waterfowl and other wildlife. The USFWS will also maintain a sanctuary area at the Little Nestucca Restoration Area where hunting will not be allowed thereby allowing birds to feed and rest relatively undisturbed. See the Nestucca Bay NWR CCP/EA (USFWS 2012a) and the Waterfowl Hunting Compatibility Determination (CCP Appendix B) for additional description of effects on wildlife and habitat. Competition between species targeted by the waterfowl hunt program and other wildlife or their habitats is not considered a limiting factor.

4.4. Are there unacceptable levels of predation by target species on other wildlife species?

Not applicable.

5. Description of Waterfowl Hunt Program

5.1. Areas of the Refuge That Support Populations of the Target Species

Nestucca Bay NWR provides important wintering and migration (stop-over) habitat for a variety of ducks and geese. Surveys and observations have indicated waterfowl make significant use of the open bay, mudflats, and tidal marsh with heaviest use occurring from September through January and again during spring migration. Waterfowl also use the lowland pastures during the winter months since the lowlands are often flooded due to heavy rainfall. Waterfowl utilize both private and refuge pasturelands. Waterfowl are also observed on the Little Nestucca Restoration Area and Nestucca Bay itself; however, the highest use areas are the lowland pastures when standing water is present. Key habitats where waterfowl concentrate in the estuary are included both in the refuge waterfowl hunt area and in the area remaining closed to waterfowl hunting. Some of the important resting and feeding habitats on the Refuge, including the pastures, will remain closed to waterfowl hunting in order to provide undisturbed (sanctuary) areas for waterfowl and other birds.

5.2. Areas to Be Opened to Public Hunting

The USFWS will establish a waterfowl hunt program for ducks and coots on Brooten Marsh and the mouth of Little Nestucca River of the Nestucca Bay NWR. Brooten Marsh is a 108-acre salt marsh located where the Nestucca River joins the Little Nestucca River. The mouth of the Little Nestucca River is located just upstream of Brooten Marsh and consists of 33 acres of tidal marsh (Figure 1). Opening refuge lands within Brooten Marsh and at the mouth of the Little Nestucca River will not only enhance waterfowl hunting in Nestucca Bay but it will also decrease the uncertainty of legal hunt boundaries and eliminate the issue of hunters trespassing over refuge lands to access the State hunting areas. The mouth of the Little Nestucca River will only be open to waterfowl hunting and will remain closed to all other public uses year-round.

5.3. Species to Be Taken, Hunting Periods, Hunting Access

Waterfowl hunters will be allowed to hunt ducks and coots seven days per week both on Brooten Marsh and at the mouth of the Little Nestucca River. Goose hunting will remain closed on all lands within Nestucca Bay NWR. The Oregon Department of Fish and Wildlife allows goose hunting in certain areas of the Nestucca Valley and some refuge lands are within the State's designated goose hunt area. However, although some refuge lands are within the State's hunt area, all refuge lands will remain closed to goose hunting to provide sanctuary for wintering geese and reduce depredation on private lands. Waterfowl will be taken in accordance with State, Federal and refuge-specific regulations. Waterfowl hunters must possess only federally approved nontoxic shotshells while in the field.

For Brooten Marsh, hunters will access the area either via boat or by walking in from a pull-out along Brooten Road near the southeast corner of the marsh. The USFWS plans to improve a trail that leads from this pull-out to Brooten Marsh to support this and other wildlife-dependent uses planned for the area. Access to the mouth of the Little Nestucca River is only possible via boat. There are three public boat launches nearby that hunters occasionally use to launch their watercraft. One launch is located within Bob Straub State Park. The other two launches are managed by Tillamook County. One is located on Brooten Road just south of the entrance to Pacific City while the other one is on the south bank of the Little Nestucca River along Meda Loop Road and 200 yards east of U.S. Highway 101.

For both hunt areas, access to Nestucca Bay NWR lands will be allowed from one hour before sunrise to one hour after sunset. Refuge waterfowl hunting hours will be in accordance with State regulations listed in the Game Bird Shooting Hour Table (ODFW 2012). Construction of permanent blinds will not be allowed; however, hunters will be allowed to use portable blinds or blinds constructed of on-site dead vegetation or driftwood under the condition that they either be removed or disassembled at the end of each day. Bag limits and hunting seasons on Nestucca Bay NWR will conform to ODFW regulations.

Although dogs are prohibited on the Refuge outside of vehicles on Nestucca Bay NWR, they are a vital part of the waterfowl hunting tradition and can reduce the loss of waterfowl to the hunter's bag and hence prevent waste and reduce the overall impact to the resource. Because of their role, both as part of the waterfowl hunting tradition and their contribution to increasing the likelihood of retrieval of birds that have been shot, dogs used in the act of waterfowl hunting will be allowed on the Nestucca Bay NWR per Service Policy in 50 CFR 32.26.21. Hunters are encouraged to use dogs as an aid to retrieving waterfowl during the hunting season, however, dogs must remain under control of the handler at all times. Dogs must be in a vehicle or on a leash until being used for hunting.

5.4. Justification for the Permit, If One Is Required

No refuge-issued permit is required. However, hunters must comply with all State and Federal regulations regarding waterfowl hunting, including provisions outlined in 50 CFR 32.2, which states:

- Each person shall secure and possess the required State license and waterfowl validation.
- Each person 16 years of age and older shall secure and possess a Federal Migratory Bird Hunting Stamp while hunting migratory waterfowl.
- Each person shall comply with the terms and conditions authorizing access or use of wildlife refuges.

5.5. Procedures for Consultation and Coordination with the State

ODFW was involved in the needs assessment and design of the waterfowl hunt during the preparation of the Nestucca Bay NWR CCP/EA. ODFW supported the preferred alternative described in the CCP/EA and approved by the USFWS Regional Director. Waterfowl hunting will continue on State tidelands adjacent to refuge lands, and the USFWS will manage the waterfowl hunt program on refuge lands. Refuge law enforcement officers will coordinate regularly with OSP officers to conduct law enforcement, outreach, and education, and to enforce bag limits, species limits, and the requirement for federally approved nontoxic shot.

5.6. Methods of Control and Enforcement

The following methods will be used to control and enforce hunting regulations:

- Refuge and waterfowl hunting area boundaries will be clearly posted.
- The Refuge will develop an informational sheet on the rules and regulations of waterfowl hunting at Nestucca Bay NWR.
- Access to the Refuge will be prohibited from one hour after sunset to one hour before sunrise.
- The USFWS will conduct law enforcement patrols on a regular basis to ensure compliance with State and Federal waterfowl hunting regulations as well as refuge-specific regulations pertinent to the hunt, including compatibility stipulations (see Compatibility Determination, CCP Appendix B).
- USFWS law enforcement staff will coordinate with OSP officers and other law enforcement agencies. OSP officers will patrol State lands when available to help ensure compliance with laws and hunting regulations. Concurrent jurisdiction will allow OSP officers as well as Tillamook County Sheriff Department officers authority on refuge lands as well.
- Information and hunting area maps will be made available on the refuge website, at the refuge headquarters in Newport, and at ODFW offices.
- USFWS will work with ODFW to include a description of the Nestucca Bay Refuge hunting program and pertinent regulations in the annual State of Oregon Game Bird Regulations publications.

5.7. Funding and Staffing Requirements

Administering the waterfowl hunt will require refuge staff time to coordinate with ODFW and the local community, develop an informational "tear sheet" with regulations for the waterfowl hunt, produce news releases, respond to hunter inquiries, conduct hunter and visitor outreach, minimize conflicts among users, coordinate with OSP, conduct law enforcement, maintain boundary posting and hunter information sites, monitor impacts to wildlife and habitat and visitor use, and ensure public safety (see CCP Appendix B). Minimal additional funds will be required to improve the hunter access off Brooten Road.

This new hunt program was described in the Nestucca Bay NWR CCP, specifically in the Compatibility Determination and the Implementation Appendix (CCP Appendices B and C). Full implementation will become possible only with increased funding and staffing to assist in enforcement, outreach, and monitoring. Implementation during at least the first few years of the program will be done with existing staffing, so it will redirect some effort from other high-priority habitat and public use programs. Because of the proximity of State tidelands, close coordination will be needed between Oregon Coast NWR Complex staff and ODFW and OSP personnel. This coordination will be necessary to effectively conduct outreach and enforcement and to implement regulations.

Surveying and posting Nestucca Bay NWR waterfowl hunting boundaries will be accomplished prior to the start of the 2013-2014 waterfowl hunting season. Law enforcement and outreach efforts to educate waterfowl hunters about the boundaries and regulations involving waterfowl hunting on Nestucca Bay NWR will commence following publication of the final CCP and Waterfowl Hunt Plan.

6. Measures Taken to Avoid Conflicts with Other Management Objectives

The Nestucca Bay NWR waterfowl hunt program was designed to provide a quality waterfowl hunting opportunity, while minimizing or eliminating conflicts with refuge purposes, goals, and management objectives. These objectives include a focus on estuarine and other habitat restoration and reduction in human disturbance to fish and wildlife. Refuge objectives also include providing the public with safe, compatible, and accessible wildlife viewing opportunities that reduce conflicts between refuge users (see the Nestucca Bay NWR CCP [USFWS 2012a] and the Waterfowl Hunting Compatibility Determination [CCP Appendix B]).

6.1. Biological Conflicts

Human disturbance to wintering birds and other wildlife using the tidal marshes within the hunt area of Nestucca Bay NWR will occur as a result of waterfowl hunting activity. Migratory and wintering waterfowl require access to areas with adequate food reserves and areas where they can loaf and roost undisturbed. They generally minimize time in flight and maximize foraging time because flight requires considerably more energy than any other activity, except egg laying. In addition to direct mortality of individual hunted birds, human disturbance associated with waterfowl hunting includes loud noises such as those produced by shotguns and boat motors. This disturbance, especially when repeated over a period of time, can cause waterfowl to change feeding habits, feed only at night, lose weight, or abandon feeding areas. Prolonged and extensive disturbances may cause large numbers of waterfowl to temporarily or permanently leave disturbed areas (Madsen 1985).

Spatial regulation of hunting activity in the form of providing sanctuaries, or non-hunted areas, is the most common strategy to reduce disturbance caused by hunting. In tidal areas, high-tide roosts present an obvious first choice for sanctuary areas, although night-time roosts may differ from those used by day. Bregnballe and Madsen (2004) found that to increase species diversity in hunted areas, a sanctuary area with quality feeding and resting habitat should be located adjacent to the hunt area. The number of migratory birds that a site can support can be increased if birds can escape a short distance to sanctuary. Thus, sanctuary areas are very important to minimize disturbance to waterfowl populations to ensure their continued use of Nestucca Bay. Sanctuary areas also maintain waterfowl in juxtaposition to hunting areas which may increase harvest opportunities. The Refuge's flooded lowland pastures as well as the Little Nestucca Restoration Area, which is across the pastures and east of U.S. Highway 101, will remain closed to waterfowl hunting, providing these areas of sanctuary throughout the entire waterfowl hunting season.

Other management strategies to reduce biological conflicts include temporal restrictions such as hunting only certain days per week, or only allowing hunting part of the day. By itself, intermittent hunting is generally not found to be the most effective way to minimize hunting disturbance effects (Fox and Madsen 1997). Because minimizing disturbance to wintering waterfowl and providing waterfowl hunting opportunities on refuges are both priorities for the USFWS, it is common for refuges to manage hunt programs with intermittent hunting in the form of non-hunt days. However, the waterfowl hunt program at Nestucca Bay NWR will not be intermittent in order to provide consistent management with the existing hunt program on adjacent State lands and waters. This is necessary to prevent confusion by hunters using Brooten Marsh and the greater Nestucca Bay, as the boundaries are difficult to distinguish and to post due to frequent strong tides. This will also provide more waterfowl hunting opportunity, which could otherwise be constrained by varying tidal conditions from day to day.

Boating activity associated with waterfowl hunting during the fall and winter can alter distribution, reduce use of particular habitats or entire areas by waterfowl and other birds, alter feeding behavior and nutritional status, and cause premature departure from areas (Knight and Cole 1995). Because of the potential safety hazard posed by boating in an area with strong tidal influence, waterfowl hunters often use motorized boats to engage in waterfowl hunting on State tidelands within Nestucca Bay. Disturbance from motorized boats can occur even when waterfowl densities are low, depending upon boats' noise, speed, and capability to cover extensive areas in a short amount of time. However, boat use by waterfowl hunters is expected to be minimal since boat access into Nestucca Bay is challenging due to the availability of correct weather conditions (e.g., winds <15 mph) and high-tide waters to fill tidal channels or cover the mudflats.

The waterfowl hunt program on Nestucca Bay NWR will also include the following restrictions to reduce biological impacts: (1) hunting of ducks and coots only; (2) limited waterfowl hunting areas, which will be posted and enforced; (3) a requirement to use only federally approved nontoxic shot; (4) sufficient feeding and resting habitat for waterfowl in areas closed to waterfowl hunting (i.e., sanctuary); and (5) periodic biological and social monitoring and evaluation of the waterfowl hunt program, including feedback from users to determine if objectives are being met. Refuge waterfowl hunting hours will be in accordance with State regulations listed in the Game Bird Shooting Hour Table, and access into refuge waterfowl hunting areas will be allowed one hour before sunrise through one hour after sunset.

6.1.1. Impacts to Non-target Species

The refuge hunt program indirectly impacts species other than those targeted by hunters. The presence of hunters and dogs, sounds of gunfire, and the sight of hunters traveling to and from hunt areas can disturb other wildlife species such as great blue heron, bald eagle, great egret, and northern harrier which forage in refuge wetlands and waterbodies. This disturbance, especially when repeated over a period of time, may result in some wildlife species altering feeding habits or moving to other areas during the active waterfowl hunting season. Waterfowl hunting will occur outside of the breeding season for these avian species. Accidental shootings of non-game birds are believed to be negligible. Hunters' foot trails and temporary blinds in Brooten Marsh and the mouth of the bay could slightly alter wetland vegetation; however, these impacts and those to refuge fish populations and other wildlife are expected to be negligible (see the Waterfowl Hunting Compatibility Determination [CCP Appendix B] for additional discussion of impacts to non-target species).

6.2. Public Use Conflicts

While hunting and wildlife observation and photography will be available to the public on Brooten Marsh during the same time of year, the direct impacts to refuge visitors engaged in the other priority public uses either via foot or boat during the hunting season are expected to be minor. The hunt period occurs during the time of year when the activities of wildlife observation and photography receive the lowest amount of use by visitors due to rainy and windy weather. Another factor limiting participation in wildlife observation and photography is the difficulty involved in walking through Brooten Marsh due to the abundance of large woody debris, lack of trails, and long distance. The USFWS does not expect any impacts to occur to other priority public uses at the mouth of the Little Nestucca River as this area will only be open to waterfowl hunting and will remain closed to all other public uses year-round.

Offering hunting at Brooten Marsh and the mouth of the Little Nestucca River is not expected to directly impact refuge visitors using other areas of Nestucca Bay NWR during the hunt season due to the distance of hunters from Cannery Hill and the Little Nestucca River Restoration Area. To ensure safety and minimize conflict between hunters and people engaged in wildlife observation and photography, the USFWS will provide information about the waterfowl hunt program's boundaries and seasons to the general public and those utilizing other refuge programs. Information will be provided on the refuge website, in the refuge office, and in the ODFW game bird regulations handbook. In addition, law enforcement patrols will be conducted on a regular basis to contact the public and ensure compliance with State, Federal, and refuge regulations. The refuge law enforcement staff will also monitor and collect data on the hunt program's participation and activities to ensure it does not interfere with other wildlife-dependent uses. If necessary, using the best available science and data, the program will be modified accordingly to ensure the program meets the goals and objectives of the Refuge.

6.3. Administrative Conflicts

There are no administrative conflicts at this time.

7. Conduct of the Hunt

7.1. Refuge-specific Hunting Regulations

- Hunting of ducks and coots is allowed on refuge lands at Brooten Marsh and the mouth of the Little Nestucca River seven days per week.
- Only federally approved nontoxic shot may be used or be in hunters' possession while hunting on the Refuge.
- Only portable blinds or blinds constructed of on-site dead vegetation or driftwood may be used. All blinds, decoys, shotshell hulls, and other personal equipment and refuse must be removed from the Refuge at the end of each day.
- Access to the Refuge will be prohibited from one hour after sunset to one hour before sunrise.
- The use or possession of alcoholic beverages while hunting is prohibited.
- Hunters are encouraged to use dogs as an aid to retrieving waterfowl during the hunting season; however, dogs must remain under control of the handler at all times. Dogs must be in a vehicle or on a leash until they are in the marsh as a part of the hunt.
- Hunters may enter closed areas of the Refuge only to retrieve downed birds.

7.2. Anticipated Public Reaction to the Hunt

Waterfowl hunting was discussed at two public meetings held in conjunction with the CCP process. Comments were solicited on waterfowl hunting through a variety of methods, including the public meetings, presentations, planning updates, and the release of the draft CCP/EA. The USFWS received comments regarding opening Nestucca Bay NWR to waterfowl hunting. Some commenters supported opening the Refuge to waterfowl hunting seven days per week, while others supported keeping the Refuge closed to hunting or offered specific concerns regarding public safety or the appropriateness of allowing hunting on a refuge. Offering compatible wildlife-dependent recreation opportunities such as hunting, fishing, wildlife observation, and photography is a refuge priority. Public input was considered and efforts were made to design the hunt program to meet the NWRS and refuge-specific goals and objectives, provide a safe and high-quality experience, minimize wildlife disturbance, provide improved wildlife sanctuary, reduce or avoid conflicts with other refuge users, and minimize confusion for hunters. A summary of public comments and the USFWS's responses can be found in Appendix K (Summary of Public Comment and the Service's Responses) in the CCP (USFWS 2012a).

7.2.1. Adjacent Landowners and Economy

The planned opening of acres of 141 acres of tidal marsh within Nestucca Bay NWR to duck and coot hunting will add to the limited public waterfowl hunting opportunities in the Nestucca Valley. The economic benefits of allowing waterfowl hunting on Nestucca Bay NWR are associated with the money hunters spend on a variety of goods and services for trip-related and equipment-related purchases. Trip-related expenditures include food, lodging, transportation, and other incidental expenses. Equipment expenditures consist of guns, ammunition, decoys, hunting dogs, and special hunting clothing. Waterfowl hunters who hunt ducks spend an average of $568 annually (Carver 2008) on the activity. Because Nestucca Bay NWR has been closed to waterfowl hunting since it was established there is no baseline on which to formulate the current economic benefits of waterfowl hunting on the Refuge. Noting current trends in waterfowl hunting on adjacent State lands, a significant increase or decrease in hunting levels is not anticipated by opening refuge lands to waterfowl hunting. Consequently it is not anticipated that opening refuge lands to waterfowl hunting will have a significant impact on the local community or its economy.

7.3. Hunter Application and Registration Procedures (if applicable)

Not applicable. This will be a free-roam hunt waterfowl hunt area which will require no applications or registrations to hunt.

7.4. Media Selection for Announcing and Publicizing the Hunt

The Refuge has a standard list of local and regional media contacts for news releases. A news release announcing the waterfowl hunting opportunities will be sent out prior to the first waterfowl hunting season and annually thereafter. Notices will also be posted on the refuge website and at other appropriate locations. This new hunting opportunity will also be defined in the ODFW game bird hunting regulations handbook (ODFW 2012).

7.5. Hunter Requirements

Hunters are required to be familiar with all State, Federal, and refuge-specific regulations. Refuge-specific regulations will be available on the refuge website and refuge waterfowl hunting tear sheet, at the designated access points for waterfowl hunters, and in the ODFW game bird hunting regulations (ODFW 2012).

1. **Age (if restrictions are imposed by the State)**

   Age requirements will be in accordance with ODFW requirements.

2. **Allowable equipment (dogs, vehicles, blinds, sporting arms, ammunition)**

   Requirements will be in accordance with ODFW and refuge regulations.

3. **License and permits**

   a. All duck and merganser hunters must have a valid Oregon hunting license, State Harvest Information Program validation, and a signed Federal Waterfowl (Duck) Stamp. Residents and nonresidents must possess a Resident Waterfowl Validation or Nonresident Game Bird Validation, respectively.

   b. If hunting coots: hunters are required to be in possession of the above permits (a) except that a Federal Duck Stamp is not required.

   c. If hunting sea ducks (harlequin duck, scoter, long-tailed duck, and eider): hunters are required to be in possession of the above permits (a) and a Sea Duck Permit.

4. **Reporting harvest**

   Hunters must fulfill all ODFW reporting requirements.

5. Hunter training and safety (if required by State)

Hunters must fulfill all ODFW requirements for training and hunter safety classes.

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National Wildlife Refuge System Information
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The mission of the U.S. Fish & Wildlife Service is working with others to conserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people.

Cover Photo
Nestucca Bay from the north looking south
Roy W. Lowe/USFWS

Inset Photos
Semidi Islands Aleutian Canada goose
Roy W. Lowe/USFWS

Juvenile coho salmon
Katrina Mueller/USFWS

Wildlife observers at Nestucca Bay
USFWS