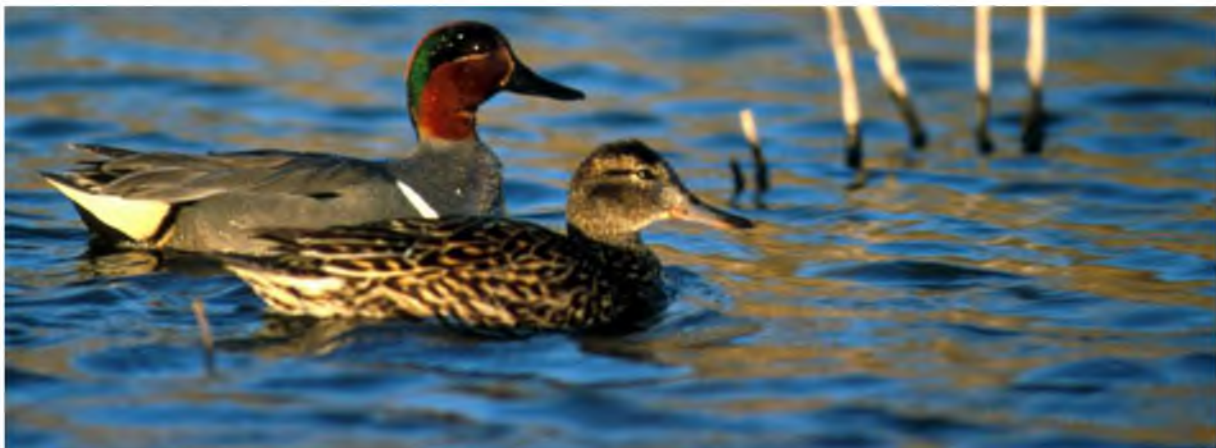




Inventory and Monitoring Plan

Pee Dee National Wildlife Refuge(s)



July 2015



Pee Dee National Wildlife Refuge

Inventory and Monitoring Plan

Signature Page

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Introduction

Pee Dee National Wildlife Refuge (NWR) was established in 1963 in the southern Piedmont geographic region of North Carolina. The original purpose for which the refuge was established was "... for use as an inviolate sanctuary, or for any other management purpose for migratory birds," including waterfowl and songbirds (Migratory Bird Conservation Act). The refuge's objectives include:

- *Resource Protection:* Through a continued land acquisition program, complete acquisition of lands within the approved refuge boundary to ensure protection of the area's natural and cultural resources and to help fulfill the refuge's commitment to ecosystem management within the Yadkin–Pee Dee River focus area.
- *Habitat Restoration:* With consideration to other goals and subsequent management programs, restore aquatic and terrestrial habitats throughout the refuge to provide for the needs of a diversity of native plant and animal communities including threatened and endangered species.
- *Resource Management:* Maintain the refuge through active management programs including forestry, cooperative farming, moist-soil and water management, prescribed burning, law enforcement, public use, biological monitoring, and wildlife surveys.
- *Dynamic Partnering:* Maintain a key role in the Yadkin–Pee Dee River Focus Area of the Savannah–Santee–Pee Dee Ecosystem by maintaining and expanding partnerships with individuals, communities, agencies, and organizations to accomplish mutually beneficial natural resource conservation goals.
- *Environmental Education and Interpretation:* Expand public awareness and appreciation of wildlife and associated habitats, natural science, land stewardship and ethics, and the Refuge System.
- *Wildlife-oriented Recreation:* Provide opportunities for refuge visitors to enjoy high quality, safe and wholesome wildlife-dependent recreational experiences that are compatible with the purpose for which the refuge was established.

The purpose of this Inventory and Monitoring Plan (IMP) is to describe and recommend what natural resource surveys will be conducted at the Pee Dee NWR for the next 15 years (2016 – 2031), or until the refuge Comprehensive Conservation Plan ([CCP](#)), Habitat Management Plan ([HMP](#)) or this IMP are revised. The majority of surveys considered in this plan address resource management objectives identified in the [Biological Review](#) (2006), the CCP (2008), the HMP (2013) and expert opinion from staff of the refuge and Raleigh Ecological Services (ES). Other surveys are a continuation of past monitoring conducted for tracking long-term trends in specific resources, understanding ecological interactions, or are part of regional and national survey efforts. This IMP was developed in accordance with the Inventory and Monitoring (I&M) policy (701 FW 2) for the National Wildlife Refuge System.

Methods

Prioritizing and Selecting Surveys

The ranking of priority surveys was conducted during a workshop held at the Pee Dee NWR office on October 29, 2014. Refuge staff participating in this process included Refuge Manager J.D. Bricken, Assistant Refuge Manager Greg Walmsley and a conversation with retired North Carolina Natural Heritage Program Botanist Bruce Sorie. Refuge staff was provided general guidance in this process by I & M Wildlife Biologist Wendy Stanton. Additional recommendations considered during the selection process were provided by the U.S. Fish and Wildlife Service's (Service) Southeast Region Division of Migratory Birds for priority migratory birds surveys by refuge and bird conservation regions (BCR). The Service's Southeast Region Division of Fisheries also provided recommendations on fisheries survey priorities. During the workshop, refuge staff reviewed background information for each survey that was previously entered into the Planning and Review of Inventory and Monitoring on Refuges (PRIMR) database. A second meeting was held at Raleigh Ecological Services on November 14, 2014 to discuss additional information needs at local scale levels for refuges, and landscape scale levels for the state of North Carolina and South Atlantic LCC region. Participants for this meeting included the Southeast Region I&M Branch Chief Laurel Barnhill, Raleigh ES Field Supervisor Pete Benjamin, Botanist Dale Suiter and I&M Wildlife Biologist Wendy Stanton. Additional recommendations and guidance were provided by the Southeast Region and National Inventory and Monitoring Networks. Following these two meetings and recommendations from Service Programs, the survey narratives in the PRIMR database were updated with current information. Lastly, a follow-up meeting will be held with refuge staff to discuss final survey rankings and refuge capacity to conduct surveys in May 2015.

Based on these workshops and recommendations, refuge staff generated a list of 25 current and anticipated surveys that they might utilize to gather information on status of refuge resources and to inform their management action decisions. This list was later refined to exclude general observations (reconnaissance) of refuge resources that do not require protocols or data management. The remaining 12 surveys then were assigned a priority score using an assessment tool (version 2.2) developed by the National I&M Coordination Team ([USFWS 2014](#)). This Simple Multi-Attribute Ranking Tool (SMART) evaluated the surveys based on 16 pre-defined criteria (Appendix A). These 16 criteria were reduced from the original 24 criteria recommended by the Natural Resource Program Center. After careful consideration, eight of these criteria were removed because they were either redundant or would not add discrimination among surveys in the Southeast. Prior to using the tool, refuge staff assigned each of the 16 criteria a weight (0-100) using a direct rating process based on the refuge's priority of importance to evaluate the surveys (Appendix A, Table A.1). The final prioritized list of surveys was divided into the following tiers based on priority of the survey and current refuge capacity to conduct the surveys during the time span of this plan. The selected surveys anticipated to be conducted include Tier 1 and Tier 2. The non-selected surveys include Tier 3 and the category for historic and reconnaissance.

Selected Surveys:

Tier 1 or “Current”- surveys are ranked as high priority and could be completed based on present station capacity, within the lifespan of the IMP.

Tier 2 or “Expected”- surveys are ranked as moderate to high station priority and could be completed over the timespan of the IMP with additional capacity obtained through non-station funding sources (e.g., regional biological funds, partners, grants, etc.).

Non-selected surveys:

Tier 3 or “Future”- surveys that were proposed, ranked low priority, and/or the chance of obtaining required capacity to conduct them is very low.

“Historic”, “Reconnaissance” or “Independent Research Project”- surveys are recently completed or discontinued, a one-time survey and therefore dropped from future consideration or mistakenly considered a survey but is actually reconnaissance. A current survey can be given a status of historical because it is no longer needed, not meeting its original objectives, or was found to be a very low priority and not worth continuing.

Overall, the priority list generated with the Survey Prioritization tool criteria (Appendix A) corresponded with management priorities. However, some final adjustments were needed to better align the survey priorities with the Refuge’s CCP, HMP, expert opinion and the capacity of the refuge to conduct the surveys. The final adjustments made to the refuge survey priorities are explained below:

1. Because of the on-going declines to bats from White Nose Syndrome, the potential impact from land-based wind energy development and habitat loss, bats were listed as a very high priority during the Ecological Services meeting resulting in elevating this survey to Tier 2.
2. Monitoring water quality, water flow and mussels in the Pee Dee River and Brown Creek were scored high with the Survey Prioritization tool. However, after further discussions with refuge and ES staff, it was decided this information is not needed because water quality is currently degraded and does not support mussels.
3. Currently, Pee Dee NWR has a small staff and does not have a refuge biologist. Thus, the refuge’s capacity is very limited to conduct many surveys. The option to use volunteers to conduct some of the surveys would have to be evaluated on a case by case basis and weighed against the additional workload placed on refuge staff to supervise volunteers. Preferably, volunteers with survey experience that require little or no supervision may be a viable option for completing certain surveys (e.g., Audubon Christmas Bird Count).

Estimating Capacity

The Southeast Region of the U.S. Fish and Wildlife Service has recently undergone extensive reductions in staffing and budgets as a response to federal spending constraints. As a result, the staff at Pee Dee NWR is not anticipated to increase through fiscal year 2016. Presently, the

refuge lacks a biologist and staffs four permanent employees including the refuge manager, assistant manager, administrative officer and one equipment operator. The consequence of these significant budget cuts and small staff play a major role in the estimation of capacity of Pee Dee NWR to be able to carry out desired inventory and monitoring activities in the near future. This IMP attempts to recognize the limitations of staffing and budgets while protecting the essential monitoring activities needed to fulfill the purposes of the refuge.

For the purposes of this IMP, capacity was estimated based on general information provided by the refuge staff and information in PRIMR (version 1.5.0) collected from an earlier Inventory & Monitoring Branch staff visit in 2012. Cost estimates for many of the current surveys listed in PRIMR were developed based on 4 general activities:

1. Design and pre-survey logistics (Protocol Development, Training Requirements)
2. Field Work (in and out of the door)
3. Data Management (Data entry checking)
4. Data Analysis and Reporting (summaries, adaptive management)

For each category, an index was created based on total hours for the survey activity. These estimates should be considered draft, as capacity changes from year to year as it is influenced by staffing and budget changes. Exact values, and cost estimates were not entered into PRIMR. Cost estimates already in PRIMR were reviewed and updated by refuge and I&M staff for currency.

Results: Selected Surveys

The final priority scores for the surveys are consistent with existing management plans and expected information needs. The following discussion summarizes the priorities assigned with the combination of the Survey Prioritization tool and evaluation of the factors listed above. The four most important information needs for the refuge included Forest Health Inventory Cruise, Integrated Waterbird Management and Monitoring (IWMM), bat abundance monitoring and landbird point counts. However, the priority of two of these four surveys was revised based on the refuge's capacity to conduct these surveys. The bat survey and breeding bird point counts were placed in the expected survey category (Tier 2).

The final prioritization placed two surveys in the Tier 1 category to be conducted over the time span of this IMP. Seven surveys were placed in the Tier 2 category because of their high priority but required additional capacity to complete within the time span of this IMP. Three surveys were placed in the Tier 3 category as future surveys but unlikely to be funded and 18 surveys were placed in the historic / reconnaissance / visitor services category (Appendix C). In conclusion, although some of the final rankings of surveys had minor revisions in priority, the majority were ranked based on the importance scored by use of the Survey Prioritization tool.

Table 1. Surveys selected for implementation at Pee Dee National Wildlife Refuge (FF04RNPD00) for the next 15 years (2016-2031).

Survey			Survey		Mgmt. Objectiv ^e ₆	Survey Area ⁷	Staff Time ⁸	Ann. Cost ⁹	Survey Timing ¹⁰	Survey Length ¹¹	Survey Coord. ¹²	Protocol	
Priority ¹	ID No. ²	Name ³	Type ⁴	Status ⁵								Citation ¹³	Status ¹⁴
1.1	12	Forest Condition Cruise Survey	CM	Current	HMP / 1.1, 1.2, 2.1, 3.1, 4.1, 1.3	Multiple management units: Forested units.	FWS: 0.01	\$10,962 1-time cost	When needed./ Recurring - every decade	2007- Indefinite	Contractor, Regional Forester Haven Barnhill	(none)	Initial Survey Instructions
1.2	14	Integrated Waterbird Management and Monitoring	CM	Current	HMP / 1.1, 5.5, 5.1, 5.3, 7.1, 1.3, 5.2	Multiple management units: null	FWS: 0.01	\$1,538	Every 2nd week Nov - Mar (total 8 ~ 4 hour surveys)/ Recurring every year	2015- Indefinite	J.D. Bricken Refuge Manager and Greg Walmsley, Assistant Refuge Manager	National Protocol Framework for IWMM	National Approved. Initial Survey Instructions
2.1	16	Mobile Acoustical Bat Monitoring	CM	Expected	HMP / 2.1, 1.2, 3.1	Regional	FWS: 0.01	\$1,154	June and July/ Recurring -- every year	2017- Indefinite	David Richardson, I&M terrestrial ecologist	(none)	Initial Survey Instructions
2.2	18	Landbird Point Counts	CM	Expected	HMP / 1.1, 1.2, 5.1, 4.1, 2.1, 5.2, 1.3, 6.1	Multiple management units: null	FWS: 0.01	\$7,692	April - June/ Recurring -- every three years	2018- Indefinite	Greg Walmsley, Assistant Manager	Landbird Monitoring Protocol	National Approved
2.3	13	Monitoring Vocal Anuran Communities	CM	Expected	HMP / 5.5, 1.2, 5.2, 6.1, 4.1, 2.1	Multiple management units:	FWS: 0.01	\$1,154	March - June/ Recurring -- every three years	2017- Indefinite	Wendy Stanton, I&M Wildlife Biologist	(none)	Initial Survey Instructions
2.4	2	Mid-Winter Waterfowl Survey	CB	Expected	HMP / 1.1, 5.5, 5.1, 5.3, 7.1, 6.1	Entire station	N/A	N/A	November - March/ Recurring -- every year	2001- Indefinite	John Stanton, Se Region Division Migratory Birds	(none)	Initial Survey Instructions

<i>Survey</i>			<i>Survey</i>		<i>Mgmt. Objectiv^e</i>	<i>Survey Area⁷</i>	<i>Staff Time⁸</i>	<i>Ann. Cost⁹</i>	<i>Survey Timing¹⁰</i>	<i>Survey Length¹¹</i>	<i>Survey Coord.¹²</i>	<i>Protocol</i>	
<i>Priority¹</i>	<i>ID No.²</i>	<i>Name³</i>	<i>Type⁴</i>	<i>Status⁵</i>								<i>Citation¹³</i>	<i>Status¹⁴</i>
2.5	3	Audubon's Christmas Bird Count	CB	Expected	CCP / I.C, I.A, I.B, I.C, II.C.3, II.A.4, II.B, II.E	National	FWS: 0.0	\$96	December / Recurring	1970-Indefinite	Don Fink	(none)	Initial Survey Instructions
2.6	17	Wood Duck Nest Box Monitoring	M	Expected	HMP / 5.5, 1.2, 5.2, 1.3	Multiple management units	FWS: 0.03	\$3,385	February-September	2020-Indefinite	Greg Walmsley, Assistant Manager	(none)	Initial Survey Instructions
2.7	4	Deer Herd Health Check	CB	Expected	HMP / 1.1, 2.1, 1.2, 6.1, 4.1, 7.1, 1.3	Entire station	FWS: 0.01	\$1,154	August-September/ Sporadic or Ad Hoc	1999-Indefinite	J.D. Bricken, Refuge Manager	(none)	Initial Survey Instructions

¹ The rank for each survey listed in order of priority.

² A unique identification number assigned by the computer. This number is prefaced by the station cost-center code [FF04RNPD00].

³ Short titles for the survey name, preferably the same names in station work plans.

⁴ Type of survey: I = Inventory; M = Monitoring; CM = Cooperative Monitoring.

⁵ Selected surveys planned for the lifespan of this IMP (e.g., Current, Expected)

⁶ The management plan and objectives that justify the described survey.

⁷ Station management unit names, entire station, or names of other landscape units included in survey.

⁸ Estimates of Service (FWS) and non-Service (Other) staff time needed to complete the survey (1 work year = 2080 hours = 1 FTE).

⁹ Average annual operations costs for conducting the survey (e.g., equipment, contracts, travel) not including staff time. \$ = \$0 to 4,999; \$\$ = \$5,000 to 24,999; TBD = to be determined.

¹⁰ Timing and frequency of survey field activities.

¹¹ The years during which the survey has been or will be conducted.

¹² Name and position of the Survey Coordinator for each survey.

¹³ Title, author, and version of the survey protocol (if there is no protocol to cite, enter None).

¹⁴ Scale of intended use (National Framework, Regional Framework, Site-specific) and stage of approval of the survey protocol (Initial Survey Instructions, Complete Draft, In Review, or Approved).

Survey Narratives

1.1 Forest Health Condition Cruise Survey (FF04RNP00-012)

Overview

The 2014 Southeast Region Workforce Plan identified migratory birds including waterfowl, landbirds and birds at risk as important priorities for Pee Dee NWR. In addition, the Southeast Region Division of Migratory Birds designated migratory landbirds and birds at risk as priority survey needs for the refuge. The refuge's bottomland hardwood and other forest habitats support many species of migratory birds.

In the mid-2000s, a comprehensive forest habitat inventory was conducted to evaluate forest habitat conditions relative to forest type and provided management recommendations to create desired forest conditions to maximize migratory bird use on the refuge. Over the next 15 years, as these adaptive management actions are implemented, this survey will be used to assess if forest habitat objectives have been met.

Objective(s)

This survey will be used to assess recommended management actions on forest composition, condition and structure to support refuge objectives in the CCP and HMP.

CCP objectives:

Wildlife and Habitat Management Objective II.E.1: During the first ten years of the plan, restore and maintain approximately 5,400 acres (2,185 hectares) of mixed pine-hardwoods, upland pine, and bottomland forests.

Wildlife and Habitat Management Objective II.E.3: Within five years of plan adoption, monitor landbird presence, abundance, distribution, and responses to management activities.

Wildlife and Habitat Management Objective II.E.4: Increase habitat patch size and provide connecting areas between similar habitat types of forests and/or scrublands to provide for the breeding, wintering, and stopover needs of several species of raptors.

Wildlife and Habitat Management Objective IV.A: During the life of the plan, restore and maintain the appropriate pine-to-hardwood ratio in upland mixed pine-hardwood stands.

Wildlife and Habitat Management Objective IV.B: During the life of the plan, restore and maintain 1,700 acres (688 hectares) of upland pine forests.

Wildlife and Habitat Management Objective IV.F.2: Over the life of the plan, remove 50 percent of sweetgum to increase productivity of mast-producing species.

HMP Objectives:

Bottomland Hardwood Habitat Objective 1.1: Continue to support waterfowl foraging areas in flooded bottomland hardwood habitat by retaining mast-producing mature trees and old growth stands wherever possible, particularly within ½ mile from water, removing sweetgum (focusing on areas where sweetgum occupies 50% or more of the stand density).

Bottomland Hardwood Habitat Objective 1.2: Continue to support bald eagle roosting and nesting habitats in bottomland hardwood habitat by retaining mature trees and old growth stands wherever possible, particularly within ½ mile from water, removing sweetgum (focusing on areas adjacent to emergent trees that could be used for roosting/nesting). This objective would also benefit other species such as the hooded warbler and Rafinesque's big-eared bat.

Bottomland Hardwood Habitat Objective 1.3: Achieve moderate canopy cover (56–62 percent) and understory vegetation density (26–71 percent) through selective removal of sweetgum to improve foraging habitat of prothonotary warblers and breeding habitat for Swainson's warblers. Focus efforts on bottomland hardwood stands that are at least 247 acres or riparian strips that are at least 90 feet wide.

Upland Pine Habitat Objective 2.1: During the first three years of the plan, restore and maintain 1,700 acres of upland pine improving conditions for brown-headed nuthatch and possibly support future RCWs. Desired future conditions of these pine uplands would include approximate minimum basal areas of 60-80 ft²/acres, greater than or equal to 60 percent grass/forb cover, and less than 40 percent shrub in the midstory. Prevent hardwoods from achieving canopy height.

Mixed Pine Hardwoods Habitat Objective 3.1: Maintain the mixed pine-hardwood component that exists in the ecotone between mesic hardwood stands and managed upland pine through maintaining 50-75 percent canopy cover, conducting initial dormant season burns on approximately 500 acres/yr and adjacent areas that are expected to be most suitable for hardwoods will be protected from these prescribed fires, retaining snags over 15 inches for cavity nesting species, create patches (50-100 acres), on sites with heavy midstory (sweetgum) encroachment (greater than 60 percent coverage), follow up with low intensity growing season burns 18 months after initial burn, consider use of mechanical methods to reduce midstory.

Wet Piedmont Longleaf Pine Forest Objective 4.1: Continue to protect and maintain approximately 30 acres of wet Piedmont longleaf pine forest through burning on a three-year rotation, using mechanical control of hardwood, and planting approximately 100 longleaf seeding and replace existing loblolly as tree mortality occurs.

Partner Roles

This survey is monitoring to inform management. U.S. Fish and Wildlife Service partners include the Southeast Region Forestry team under Regional Forester Haven Barnhill. The Regional Forestry team will conduct or assist with the cruises, evaluate management actions and if necessary provide recommendations to adapt future management actions to meet refuge objectives. The refuge's staff time and hours would include coordination and logistics for the forestry team. Additional costs to the refuge would include travel and per diem for the forestry team.

Protocol Needs

Currently an official protocol is not available. However, refuge specific initial survey instructions are being developed and updated at: ISI [Pee Dee NWR Forest Condition Survey](#)

1.2. Integrated Waterbird Management and Monitoring (FF04RNPD00-014)

Overview

The 2014 Southeast Region Workforce Plan identified the North American Waterfowl Management Plan as the top management priority for Pee Dee NWR. The Southeast Region Division of Migratory Birds designated the integrated waterbird management and monitoring [IWMM](#) as a priority survey for the refuge. A primary purpose of this protocol is to standardize waterbird and habitat monitoring during the non-breeding period at a local-scale. Resulting data can then be compiled and analyzed across broader geographic units (e.g., regional, national, etc.). At the local scale, it will allow managers to use adaptive management to improve habitat quality and optimize waterbird use of each site. At a regional scale, it will allow for optimum allocation of resources (funds and staff) to meet flyway waterbird population and habitat objectives. At the flyway scale, it will allow for identification of priority stopover and wintering habitats for waterbirds. This information is used to determine the relative importance of a management site to a waterbird guild, alter management to meet changing needs, and guide the development of management objectives.

The attribute and populations of interest are biological integrity and waterbirds including Pelecaniformes (ibises, herons, pelicans) and Anseriformes (swans, waterfowl, ducks, geese). Counts of wintering migratory waterfowl and wading birds and assessments of local habitat conditions in moist soil units, flooded farmlands, and bottomland hardwoods will be conducted. This survey is recurring every year and will be conducted semi-weekly from the end of November through the beginning of March. A total of eight approximately four-hour surveys would be completed.

Objective(s)

At the local scale, this survey will be used to assess adaptive management actions on intensely managed units for water birds and provide management recommendations to support refuge objectives in the CCP and HMP. In addition, the standardized waterbird and habitat data will be entered into the IWMM models to affect management decisions at larger geographic areas.

CCP Objectives:

Wildlife and Habitat Management Objective II.A.1: Over the course of the 15-year plan, begin to increase the ratio of natural vegetation (moist-soil units and green tree reservoir GTR) to flooded cropland by 30 percent to support Southern James Bay geese and ducks.

Wildlife and Habitat Management Objective II.A.2: During the life of the plan, monitor the Southern James Bay geese and duck distribution and migration chronology.

Wildlife and Habitat Management Objective II.A.4: During the life of the plan, protect wintering waterfowl from human disturbance by enforcing closure of waterfowl sanctuary areas.

Wildlife and Habitat Management Objective IV.C: Over the life of the plan, work to convert 25 percent of the flooded crop impoundments to moist-soil units.

Wildlife and Habitat Management Objective IV.D: During the life of the plan, increase the acreage of moist-soil units by at least 75 percent to provide native wetland vegetation as forage for wintering waterfowl.

Wildlife and Habitat Management Objective IV.E: Over the course of the plan, maintain 135 acres of a GRR to provide resting and feeding areas for wintering waterfowl.

HMP Objectives:

Bottomland Hardwood Habitat Objective 1.1: Continue to support waterfowl foraging areas in flooded bottomland hardwood habitat by retaining mast-producing mature trees and old growth stands wherever possible, particularly within ½ mile from water, removing sweetgum (focusing on areas where sweetgum occupies 50% or more of the stand density).

Wetlands Management Objective 5.2: Continue to maintain and monitor approximately 43 acres of moist soil units and evaluate the potential to convert Patterson and Ringneck Impoundments to increase moist soil units by 75%.

Partner Roles

At the refuge level, the information gathered from this survey is cooperative monitoring to inform management. The data collected can be rolled up to address management actions at the landscape and Atlantic flyway levels. Partners involved in the survey include; USFWS Division of Migratory Birds, USFWS Regions 3, 4, and 5, Southeast Region Inventory and Monitoring Branch, USGS, Ducks Unlimited, NC Wildlife Resources Commission and other state wildlife agencies.

Refuge staff will conduct the bi-weekly monitoring and either fax or email the data to Southeast Region Inventory and Monitoring biologist Wendy Stanton for data management in the centralized IWMM database for and analysis.

Protocol Needs

An approved national protocol framework for the IWMM approach ([Loges et. al. 2014](#)) is available in [ServCat](#). There is a current need to develop a site-specific protocol for the refuge. Once completed, this will be linked to this plan on the fishnet site and archived in ServCat.

2.1 Mobile Acoustical Bat Monitoring (FF04RNP00-16)

Overview

North American bat species have long been considered vulnerable but few species have been adequately monitored to establish baseline population levels. The level of threat to bats of eastern North America is increasing through a continued loss of permanent habitat, white nose syndrome, and wind-energy development. For these reasons, the Raleigh ES identified

bat surveys as being a high priority information need for refuges in North Carolina.

The attribute and population of interest are biological integrity and bat (Chiroptera) populations on the refuge. The survey will measure the species composition and relative abundance of bats using acoustical sampling during early summer along predefined roadside routes primarily within the existing acquisition boundary. These data will be geo-referenced to provide information about habitat use for ecological assessments for landscape analysis. Baseline occurrence information will be used to evaluate response by bats around forested management units on refuges. This survey will recur every year in June and July.

Objective(s)

This survey will measure the relative abundance of bats using acoustical sampling during early summer along predefined roadside routes primarily within the existing acquisition boundary. These data will be geo-referenced to provide information about habitat use for ecological assessments for landscape analysis. Baseline occurrence information will be used to evaluate response by bats around forested management units on the refuge and support refuge objectives in the CCP and HMP.

CCP Objective:

Wildlife and Management Objective I.E: During the first ten years of the plan, work with partners to document the presence or absence of Rafinesque's big-eared bats on the refuge and adapt management as required.

HMP Objective:

Bottomland Hardwood Habitat Objective 1.2: Continue to support bald eagle roosting and nesting habitats in bottomland hardwood habitat by retaining mature trees and old growth stands wherever possible, particularly within ½ mile from water, removing sweetgum (focusing on areas adjacent to emergent trees that could be used for roosting/nesting). This objective would also benefit other species such as the hooded warbler and Rafinesque's big-eared bat.

Partner Roles

The refuge currently does not have the capacity to conduct this survey. The data analysis and summary will be done by the Southeast Region Inventory and Monitoring Network. The data will be combined for regional and landscape level analysis in cooperation with other partners including USGS and USFS.

Protocol Needs

A national framework protocol needs to be developed in consort with other state and federal partners. Currently, there is a draft Southeast Region [Mobile Acoustical Bat Monitoring protocol \(Richardson 2012\)](#) stored on the fishnet site. In addition, refuge

specific [initial survey instructions for acoustical bat monitoring](#) are being developed and updated on the fishnet site.

2.2 Landbird Point Counts (FF04RNP00-018).

Overview

The 2014 Southeast Region Workforce Plan identified the landbirds and migratory birds at risk as important priorities for the refuge. The Southeast Region Division of Migratory Birds designated migratory landbirds and migratory birds at risk as priority survey needs for the refuge. The refuge's bottomland hardwood habitat supports many species of migratory and breeding neotropical migrants and other landbirds. Breeding bird point count surveys will be used as an index to evaluate effectiveness of management activities and status of landbird populations at local and landscape scale levels. This survey is recurring every three years during the breeding season ranging from April through June.

Objective(s)

The survey will measure the species composition and occupancy of breeding and migratory landbirds and other bird species on selected habitat and support refuge objectives in the CCP and HMP. The results of landbird point counts in the selected habitat units is an index for habitat quality and assists with evaluating management actions to support the CCP and HMP objectives.

CCP objectives:

Wildlife and Habitat Management Objective II.E.1: During the first ten years of the plan, restore and maintain approximately 5,400 acres (2,185 hectares) of mixed pine-hardwoods, upland pine, and bottomland forests.

Wildlife and Habitat Management Objective II.E.3: Within five years of plan adoption, monitor landbird presence, abundance, distribution, and responses to management activities.

Wildlife and Habitat Management Objective II.E.4: Increase habitat patch size and provide connecting areas between similar habitat types of forests and/or scrublands to provide for the breeding, wintering, and stopover needs of several species of raptors.

Wildlife and Habitat Management Objective IV.A: During the life of the plan, restore and maintain the appropriate pine-to-hardwood ratio in upland mixed pine-hardwood stands.

Wildlife and Habitat Management Objective IV.B: During the life of the plan, restore and maintain 1,700 acres (688 hectares) of upland pine forests.

Wildlife and Habitat Management Objective IV.F.2: Over the life of the plan, remove 50% of sweetgum to increase productivity of mast-producing species.

HMP Objectives:

Bottomland Hardwood Habitat Objective 1.1: Continue to support waterfowl foraging areas in flooded bottomland hardwood habitat by retaining mast-producing mature trees and old growth stands wherever possible, particularly within ½ mile from water, removing sweetgum (focusing on areas where sweetgum occupies 50% or more of the stand density).

Bottomland Hardwood Habitat Objective 1.2: Continue to support bald eagle roosting and nesting habitats in bottomland hardwood habitat by retaining mature trees and old growth stands wherever possible, particularly within ½ mile from water, removing sweetgum (focusing on areas adjacent to emergent trees that could be used for roosting/nesting). This objective would also benefit other species such as the hooded warbler and Rafinesque's big-eared bat.

Bottomland Hardwood Habitat Objective 1.3: Achieve moderate canopy cover (56–62 percent) and understory vegetation density (26–71 percent) through selective removal of sweetgum to improve foraging habitat of prothonotary warblers and breeding habitat for Swainson's warblers. Focus efforts on bottomland hardwood stands that are at least 247 acres or riparian strips that are at least 90 feet wide.

Upland Pine Habitat Objective 2.1: During the first three years of the plan, restore and maintain 1,700 acres of upland pine improving conditions for brown-headed nuthatch and possibly support future RCWs. Desired future conditions of these pine uplands would include approximate minimum basal areas of 60-80 ft²/acres, greater than or equal to 60 percent grass/forb cover, and less than 40 percent shrub in the midstory. Prevent hardwoods from achieving canopy height.

Mixed Pine Hardwoods Habitat Objective 3.1: Maintain the mixed pine-hardwood component that exists in the ecotone between mesic hardwood stands and managed upland pine through maintaining 50-75 percent canopy cover, conducting initial dormant season burns on approximately 500 acres/yr and adjacent areas that are expected to be most suitable for hardwoods will be protected from these prescribed fires, retaining snags over 15 inches for cavity nesting species, create patches (50-100 acres), on sites with heavy midstory (sweetgum) encroachment (greater than 60 percent coverage), follow up with low intensity growing season burns 18 months after initial burn, consider use of mechanical methods to reduce midstory.

Wet Piedmont Longleaf Pine Forest Objective 4.1: Continue to protect and maintain approximately 30 acres of wet Piedmont longleaf pine forest through burning on a three-year rotation, using mechanical control of hardwood, and planting approximately 100 longleaf seeding and replace existing loblolly as tree mortality occurs.

Grasslands and Old Field Management Objective 6.1: Maintain a mosaic of grasslands and early successional scrub/shrub habitats in various stages of succession on approximately 800 acres of right-of-way and in old fields to support a variety of breeding birds that utilize these areas.

Partner Roles

The refuge currently does not have the capacity to conduct this monitoring. At the refuge level, the information gathered from this survey is cooperative monitoring to inform adaptive management. The standardized data collected will be combined for regional and landscape analysis. Partners include the USFWS Division of Migratory Birds, and Southeast, Midwest and Northeast Regions.

Protocol Needs

An approved national protocol framework for landbird monitoring for the Midwest and Northeast Regions, Version 1 ([Knutson et. al. 2008](#)) is available [under reference #15537 in ServCat](#). There is a current need to develop a site-specific protocol for the refuge which would be stored and updated in ServCat.

2.3 Monitoring Vocal Anuran Communities (FF04RNP00-013)

Overview

There is a growing concern about the worldwide decline of amphibian populations, and in particular localized extinctions ([Blaustein et. al. 1994](#), [Wake 1991](#)). One of the most diverse amphibian communities in the world occurs in the Southeast. Due to their specialized life histories, dependence on various habitats and sensitivity to environmental stressors, amphibian communities are recognized as good indicators of ecosystem health and change. Most south Atlantic refuges lack baseline data on amphibian species composition and standardized monitoring data. Specifically, information is lacking that evaluates the effects of management actions on amphibian species distribution, diversity, community structure, function, and composition at selected sites. This survey will measure vocal anuran (frogs and toads) occupancy, species richness and phenology of selected Hylidae species (tree frogs). The survey would be conducted every three years between March through June.

Objective(s)

The survey will measure the species composition and occupancy of vocal anurans in selected habitats and support refuge objectives in the HMP. This survey was selected because monitoring for vocal anuran communities within select management units or unique habitats will address specific management objectives or questions concerning effects on amphibians. In addition, due to different management treatments on units there may be a need to assess if those strategies are indirectly having a positive or negative input on amphibians as indicators for ecosystem health.

HMP objectives:

Bottomland Hardwood Habitat Objective 1.1: Continue to support waterfowl foraging areas in flooded bottomland hardwood habitat by retaining mast-producing mature trees and old growth stands wherever possible, particularly within ½ mile from water, removing sweetgum (focusing on areas where sweetgum occupies 50% or more of the stand density).

Upland Pine Habitat Objective 2.1: During the first three years of the plan, restore and maintain 1,700 acres of upland pine improving conditions for brown-headed nuthatch and possibly support future RCWs. Desired future conditions of these pine uplands would include approximate minimum basal areas of 60-80 ft²/acres, greater than or equal to 60 percent grass/forb cover, and less than 40 percent shrub in the midstory. Prevent hardwoods from achieving canopy height.

Mixed Pine Hardwoods Habitat Objective 3.1: Maintain the mixed pine-hardwood component that exists in the ecotone between mesic hardwood stands and managed upland pine through maintaining 50-75 percent canopy cover, conducting initial dormant season burns on approximately 500 acres/yr and adjacent areas that are expected to be most suitable for hardwoods will be protected from these prescribed fires, retaining snags over 15 inches for cavity nesting species, create patches (50-100 acres), on sites with heavy midstory (sweetgum) encroachment (greater than 60 percent coverage), follow up with low intensity growing season burns 18 months after initial burn, consider use of mechanical methods to reduce midstory.

Wet Piedmont Longleaf Pine Forest Objective 4.1: Continue to protect and maintain approximately 30 acres of wet Piedmont longleaf pine forest through burning on a three-year rotation, using mechanical control of hardwood, and planting approximately 100 longleaf seeding and replace existing loblolly as tree mortality occurs.

Grasslands and Old Field Management Objective 6.1: Maintain a mosaic of grasslands and early successional scrub/shrub habitats in various stages of succession on approximately 800 acres of right-of-way and in old fields to support a variety of breeding birds that utilize these areas.

Partner Roles

The refuge currently does not have the capacity to conduct this monitoring. At the refuge level, the information gathered from this survey is cooperative monitoring to inform adaptive management. The standardized data collected will be combined for regional and landscape analysis. Partners include the Southeast Region Inventory and Monitoring Network and the National Park Service Southeast Coast Network (NPS-SECN).

Protocol Needs

The NPS-SECN has an official protocol used on [SECN National Parks](#) (Byrne et. al. 2013) and is available on the Service's fishnet site. This protocol has been piloted on several refuges in North Carolina. There is a current need to develop a site-specific protocol for the refuge which would be stored and updated in ServCat. Currently, [initial survey instructions](#) for the refuge are being updated on the fishnet site.

2.4 Mid-Winter Waterfowl Survey (FF04RNP00-002)

Overview

The 2014 Southeast Region Workforce Plan and Division of Migratory Birds identified the North American Waterfowl Management Plan as the top management priority for Pee Dee NWR. The mid-winter waterfowl survey is a nationwide effort to survey wintering waterfowl in suitable habitats across the four flyways. For the Atlantic Flyway, this survey is conducted from Maine through Florida during the last week in December through the first week in January. It is designed to assess population trends and distribution of wintering waterfowl along the flyway. The data are included in population models to assist with identifying harvest levels, survival rates and population trends. At the local level, this survey monitors the population trends of waterfowl using the refuge and affects management decisions.

Objective(s)

These data provide an index for population trends of wintering, migratory waterfowl at multiple landscape spatial scales including the refuge, the Atlantic flyway and national. In addition, at the refuge level, the survey supports objectives in the CCP and HMP.

CCP objectives:

Wildlife and Habitat Management Objective II.A.1: Over the course of the 15-year plan, begin to increase the ratio of natural vegetation (moist-soil units and GTR) to flooded cropland by 30 percent to support Southern James Bay geese and ducks.

Wildlife and Habitat Management Objective II.A.2: During the life of the plan, monitor the Southern James Bay geese and duck distribution and migration chronology.

Wildlife and Habitat Management Objective II.A.4: During the life of the plan, protect wintering waterfowl from human disturbance by enforcing closure of waterfowl sanctuary areas.

Wildlife and Habitat Management Objective IV.C: Over the life of the plan, work to convert 25 percent of the flooded crop impoundments to moist-soil units.

Wildlife and Habitat Management Objective IV.D: During the life of the plan, increase the acreage of moist-soil units by at least 75 percent to provide native wetland vegetation as forage for wintering waterfowl.

Wildlife and Habitat Management Objective IV.E: Over the course of the plan, maintain 135 acres (55 hectares) of a green tree reservoir to provide resting and feeding areas for wintering waterfowl.

HMP Objectives:

Bottomland Hardwood Habitat Objective 1.1: Continue to support waterfowl foraging areas in flooded bottomland hardwood habitat by retaining mast-producing mature trees and old growth stands wherever possible, particularly within ½ mile from water, removing sweetgum (focusing on areas where sweetgum occupies 50% or more of the stand density).

Wetlands Management Objective 5.1: Continue to maintain approximately 214 acres of flooded crop impoundments as indicated by annual refuge waterfowl use data by providing 80 acres of unharvested corn to meet minimum population goals for 15,000 waterfowl.

Wetlands Management Objective 5.2: Continue to maintain and monitor approximately 43 acres of moist soil units and evaluate the potential to convert Patterson and Ringneck Impoundments to increase moist soil units by 75 percent.

Wetlands Management Objective 5.5: Maintain 135 acres of a greentree reservoir keeping it dry once every three years to ensure the survival and recruitment of trees (with an emphasis on mast-producing species) and provide sufficient water levels to support wildlife.

Cropland Management Objective 7.1: Continue to maintain approximately 1,080 acres of croplands (grains and soybeans) under the cooperative farming program where 20 percent of crop is left unharvested to benefit wildlife species.

Partner Roles

The refuge currently does not have the capacity to conduct this monitoring. The NC Wildlife Resource Commission and the USFWS Division of Migratory Birds currently conduct this aerial survey on an annual basis.

Protocol Needs

A national framework protocol needs to be developed in consort with other state and federal partners. Currently, refuge specific [initial survey instructions](#) are being developed and updated on the fishnet site.

2.5 Audubon's Christmas Bird Count (FF04RNPD00-003)

Overview

The Audubon Christmas Bird Count (CBC) results can help to identify bird response to habitat management and assess long-term trends of habitat and populations. The CBC survey is a long-term, citizen science survey and uses a national, centralized database to submit data and generate summary reports. This survey is recurring annually during the last week in December.

Objective(s)

The survey will measure the species composition and occupancy of wintering bird species on selected habitat and supports refuge CCP objectives.

CCP Objectives:

Wildlife and Habitat Management Objective II.B.2: Over the life of the plan, monitor and protect shorebirds utilizing the refuge.

Wildlife and Habitat Objective II.C.1: Over the life of this plan, manage refuge impoundments to provide high-quality foraging habitat for wading birds using water level manipulation.

Wildlife and Habitat Objective II.C.2: Within the next three years, begin gathering data to make decisions regarding wading bird conservation and management effectiveness.

Wildlife and Habitat Objective II.C.4: Within the next three years, work with the Service's Southeast Regional Migratory Bird Program to develop population and/or habitat objectives that more explicitly link the refuge's contributions to Joint Venture objectives for priority species.

Wildlife and Habitat Management Objective II.E.3: Within five years of plan adoption, monitor and bird presence, abundance, distribution, and responses to management activities.

Wildlife and Habitat Management Objective II.E.4: Increase habitat patch size and provide connecting areas between similar habitat types of forests and/or scrublands to provide for the breeding, wintering, and stopover needs of several species of raptors.

Partner Roles

The refuge currently does not have the capacity to conduct this monitoring without volunteers. The partners involved include the National Audubon Society, North Carolina Audubon Society, Carolina Bird Club, and private citizens.

Protocol Needs

The Audubon Christmas Bird Count does not have a national framework protocol but provides general [guidelines](#) for citizen science procedures.

2.6 Wood Duck Nest Box Monitoring (FF04NPD00-017)

Overview

The 2014 Southeast Region Workforce Plan and Division of Migratory Birds identified the North American Waterfowl Management Plan as the top management priority for Pee Dee NWR. The North American Waterfowl Management Plan includes conservation goals for Wood Ducks. Wood Ducks are cavity-nesting waterfowl. Artificial nest boxes are used to supplement the decline of natural nest cavities due to habitat loss. The nest boxes are monitored for productivity, evidence of depredation and condition of the boxes. Nesting females in the boxes are opportunistically banded. These data are used to ascertain the effectiveness of the nest box program. Results of monitoring may trigger nest box repairs and maintenance, addition of new boxes, or relocation of nest boxes if evidence of dump-nesting occurs.

Monitoring Wood Duck nest box productivity includes documenting evidence and timing of nesting activity, number of recently laid eggs, number of hatched eggs, number of unhatched eggs and/or dead ducklings, evidence of depredation and condition of the nest box. Productivity checks occur twice a month from March-August

Objective(s)

These data provide productivity information for breeding wood ducks on the refuge and supports objectives in the CCP and HMP.

CCP Objectives:

Wildlife and Habitat Management Objective IV.E: Over the course of the plan, maintain 135 acres (55 hectares) of a green tree reservoir to provide resting and feeding areas for wintering waterfowl.

Wildlife and Habitat Management Objective IV.F.2: Over the life of the plan, remove 50 percent of sweetgum to increase productivity of mast-producing species

HMP Objectives:

Bottomland Hardwood Habitat Objective 1.1: Continue to support waterfowl foraging areas in flooded bottomland hardwood habitat by retaining mast-producing mature trees and old growth stands wherever possible, particularly within ½ mile from water, removing sweetgum (focusing on areas where sweetgum occupies 50% or more of the stand density).

Wetlands Management Objective 5.2: Continue to maintain and monitor approximately 43 acres of moist soil units and evaluate the potential to convert Patterson and Ringneck Impoundments to increase moist soil units by 75 percent.

Partner Roles

The refuge currently does not have the capacity to conduct this monitoring. Potential partners include the Carolina Bird Club, Audubon Society and NC Wildlife Resources Commission. However, at this time no capacity is provided by these partners.

Protocol Needs

Refuge specific [initial survey instructions](#) are being developed.

2.7 Deer Herd Health Check (FF04RNP00-004)

Overview

White-tailed deer (*Odocoileus virginianus*) hunting is a popular public use activity on the refuge. The data from these surveys are used to assess the overall condition of the health of the deer herd, provide an estimate of how close the population is to the carrying capacity of the habitat on the refuge, and can inform the level of harvest. This health evaluation is conducted by veterinarians with the Southeastern Cooperative Wildlife Disease Study (SCWDS). Refuge staff assists with randomly collecting five deer from the population on the refuge. Data collected include parasitology, serologic/microbiologic, pathologic information, and interpretive comments and comparisons with previous health checks.

The attribute and population of interest are biological integrity and infections and disease of white-tailed deer. This survey combines various metrics of internal and external pathogens, indicator microbes and other condition measurements to assess the overall health of the deer herd population on the refuge and determine if the population is approaching the carrying capacity of the habitat. This survey is conducted on a six to eight year rotation and informs decisions for hunt management on the refuge.

Objective(s)

Information gathered from this survey is used to support refuge objectives in the CCP and HMP and contribute to a long-term partnerships with the NC Wildlife Resources Commission and local community.

CCP objectives:

Visitor Services Objective IIb: Within five years of plan implementation, work with the NC Wildlife Resources Commission and Southeastern Cooperative Wildlife Disease Study to evaluate the refuge's deer population and health status to set harvest quotas.

HMP objectives:

Cropland Management Objective 7.1: Continue to maintain approximately 1,080 acres of croplands (grains and soybeans) under the cooperative farming program where 20 percent of crop is left unharvested to benefit wildlife species.

Partner Roles

This survey is cooperative baseline monitoring. The partners involved in the survey include the NC Wildlife Resources Commission and the SCWDS with the College of Veterinary Medicine at the University of Georgia. The information is shared with the NC Wildlife Resources Commission. Often the state biologists are invited to assist with the spotlighting used to sample the deer. Data entry, analysis, and reporting are performed by SCWDS staff.

Protocol Needs

Currently, there is not an official protocol to conduct this monitoring. Based on unofficial SCWDS guidelines; refuge staff and SCWDS veterinarians randomly locate five individual deer (of both genders) at night with a spotlight, sacrifice target animals, and then veterinarians perform the health assessment and blood work including screening for parasites and organ level functions for various diseases. A report is provided to the refuge and Regional Office with the necropsy results and explanations of the findings.

More information can be found at: <http://www.vet.uga>.

Initial survey instructions specific to the refuge are being developed and updated on the fishnet site under the [ISI for deer herd health check](#).

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Appendix A. Criteria and Weights Used to Prioritize Surveys (Southeast Region)

This section defines the 16 criteria that can be used alone or in conjunction with the Survey Prioritization Tool to help prioritize surveys conducted on refuge lands. Each criterion is grouped under one of seven themes that describe a survey's general contribution to a refuge's needs, or broader needs. Rating values (1-2, 1-3, or 1-4) that are used to score each survey are also given for each criterion. Users should confer with I&M staff to determine if a standard set of criteria exist for their Region and if specific interpretations of those criteria are required. Clarification and examples for interpreting the posed questions of each criterion are shown in blue italicized font. Some criteria may reference a Natural Resources Management Plan (NRMP; analogous to an HMP, e.g., in R8), and the pertinent scores that can be incorporated into the IMP prioritization process, within parentheses.

NOTE: Originally, 24 criteria were recommended by the Natural Resource Program Center to prioritize survey needs. After careful consideration and discussion, the list of 24 criteria was reduced to the following 16 criteria for use in Region 4. Eight criteria were removed because they were either redundant, or would not add discrimination among surveys in the Southeast (Table 1). Any of these 8 criteria may be added back into the Survey Prioritization Tool during the prioritization process if a refuge considers them to be of importance. Region 4 removed criteria themed around capacity (money and personnel) in the initial survey prioritization process, as these criteria center on survey implementation rather than survey need. When discussing survey implementation, personnel, funding and timing are critical considerations to optimize surveys conducted on refuge lands.

1. Refuge Priorities and Management Needs

B. CCP or Other Management Plan Objectives

How many refuge CCP or other management plan objectives (e.g., HMP, NRMP, Fire Management Plan, Recovery Plan, Integrated Pest Management Plan) are met by the focus of this survey?

Example 1: A survey of staff gauge readings for water levels in representative units can be used to evaluate a range of wetland habitat objectives including seasonal, emergent, and permanent types.

Example 2: An Early Detection Rapid Response survey can be used to discover the presence of highly invasive plant species in multiple refuge habitats.

1. Does not address an objective
2. Addresses one objective
3. Addresses two objectives
4. Addresses three or more objectives

C. NWRS Objectives

Does the survey provide information to evaluate if the refuge is achieving regional or national objectives and priorities of the NWRS such as those defined from Southeast Region Workforce Alignment Plan (e.g., N. American Waterfowl Management Plan, T&E Species, migratory birds in decline and priority “at risk” species), Biological Integrity, Diversity, and Environmental Health (BIDEH); NWR Resources of Concern (e.g., migratory birds, anadromous fishes, marine mammals); and compatibility of refuge uses especially wildlife-dependent recreation)? *Federally listed species are addressed under criterion 4A so they should not be considered as a NWR Resources of Concern under this criterion. For BIDEH, only consider surveys addressing the highest measure of biological integrity, which is viewed as those intact and self-sustaining habitats and wildlife populations existing during historic conditions (see 601 FW 3.10).*

1. No
2. One objective
3. Two objectives
4. Three or more objectives

D. Management Utility (Decision Support) for the Refuge

Does the survey provide data for recurring management decisions, especially as part of an existing decision framework that is implemented on a regular basis?

Surveys providing information to either directly evaluate or serve as indicators of high-priority management actions can be considered as earning a 3 or 4 rating for this criterion.

1. No set application for the refuge
2. May have management implications, but they are not explicitly defined
3. Has management implications, but no current decision framework
4. Part of an existing adaptive management decision framework

2. Partner Priorities and Management Needs

A. FWS Programs

Does the survey provide information that directly contributes to evaluating the status and trends of resources that are a priority for another FWS regional or national program (e.g., Migratory Birds, Fisheries, Water Resources/Hydrology *other than ESA species*)? *Example 1: North American Breeding Bird survey, North American Amphibian Monitoring program, Mid-Winter Waterfowl Survey and Circumpolar Biodiversity Monitoring Network are priority surveys for regional or national FWS programs.*

1. Does not address a management priority identified by a FWS regional or national program or initiative
2. Addresses a management priority identified by 1 FWS regional or national program or initiative
3. Addresses a management priority identified by 2 FWS regional or national programs or initiatives
4. Addresses a management priority identified by ≥ 3 FWS regional or national programs

or initiatives

B. FWS Partners

Does the survey address an identified priority of a conservation partner, such as a Landscape Conservation Cooperative(s) (LCC), state agencies, or other conservation partner?

These priorities should be obtained from documents such as the State Wildlife Action and Joint Venture plans. The staff should document where they obtained these priorities and if they were high- or medium-level priorities. The refuge itself does not count as a partner.

1. Does not focus a management priority identified by FWS partners (e.g., LCC, state agency)
2. Focus on a management priority identified by one FWS partner (e.g., LCC, state agency)
3. Focus on a management priority identified by two FWS partners (e.g., LCC, state agency)
4. Focus on a management priority identified by three or more FWS partners (e.g., LCC, state agency)

3. Ecological Applications

A. FWS Surrogate Species

Does the survey focus on a surrogate species selected by the FWS?

1. No
2. Yes, one FWS surrogate species
3. Yes, two FWS surrogate species
4. Yes, three or more FWS surrogate species

C. Survey Breadth

The focus of the survey is:

1. A single species or abiotic parameter
2. Multi-species or multi-abiotic parameters
3. A community – multi-trophic level or biota
4. An ecosystem – biotic community and abiotic parameters

4. Additional Legal Mandates

A. Listed species or vegetation communities

Is the objective of the survey a species or vegetation community federally listed under ESA, state listed (threatened or endangered only), ranked by the state's natural heritage program (S1 or S2 rank only), globally ranked by NatureServe (G1 or G2 rank only), or globally listed on The IUCN Red List of Threatened Species (Critically Endangered, Endangered, or Vulnerable only)?

1. Not state, federally or globally ranked

2. Yes, state listed or ranked by state's natural heritage program
3. Yes, globally listed by NatureServe or IUCN
4. Yes, federally listed under the ESA as threatened or endangered

5. Immediacy of Need

A. Controversy

Does the survey support decision-making to address an action or management decision related to refuge resources that is controversial to an external party?

Note: Document why the refuge staff knows or suspects an action is controversial because the interpretation can vary from person to person. Controversy can be associated with the general public, specific interest group(s) (e.g., animal rights activist, cooperative farmers), or one or more conversation partners. This criterion is focused on a high level of known or suspected controversy from outside interests where the Service could be litigated, refuge actions that could result in a precedent setting action, or severely damage a working relationship with the state or other conversation partner. This criterion does not pertain to suspected or known issues among refuge staff members and/or other FWS employees. Examples of controversy include changes to livestock grazing, predator control, and changes to harvest regulations or water allocation.

1. Not controversial and little to no potential for controversy
2. Not currently controversial, but potentially or suspected of controversy
3. Known controversy, but data or immediate management action is not currently needed but may be in the near future
4. Pressing controversy; data required to support immediate management action

B. Threat

Does the survey support decision-making to monitor and mitigate a known or suspected Threat to refuge resources?

Note: This criterion scores surveys addressing known or suspected threats. It does not apply to baseline monitoring intended to detect new (i.e., unknown) threats or changes. If surveys are determined from a Natural Resources Management Plan (e.g., R8), focus on the threat reduction strategies identified in that plan and use adopt the scoring strategy shown in parentheses. Examples of threats may include invasive species, pollutants or toxins, and climate change.

1. No existing threat or potential for a threat to Refuge resources (the survey does not relate to threat reduction strategies)
2. No known threat, but potential for a threat to Refuge resources (Yes, supports decision making to address a threat reduction strategy with a score of __[e.g. 2.5])
3. Known threat to Refuge resources, but immediate management action is not currently needed but may be in the near future (Yes, supports decision making to address a threat reduction strategy with a score of _____[e.g. 3.0])
4. Urgent threat to Refuge resources; immediate data are needed to support management action (Yes, supports decision making to address a threat reduction strategy with a score of __[e.g. 3.5])

6. Scope and Scale

A. Baseline data

Does the survey provide high-priority information that contributes to baseline data needs?

Example: Inventories of species guilds (e.g., invertebrates, plants, reptiles) or abiotic parameters (soils, waters).

1. No
2. Yes

B. Survey Scope

What proportion (%) of the species', subspecies', or communities' (i.e., vegetation) geographic range under U.S. jurisdiction will be covered by the survey on the refuge?

Note: Surveys of abiotic factors affecting these species or vegetation communities should also be considered for this criterion. Example 2: 60% of the wintering waterfowl in the Pacific Flyway use wetlands in the Central Valley of California including the San Luis NWRC. Monitoring water levels by reading staff gauges weekly from October to March in managed wetlands is an important abiotic survey to indicate if there are sufficient acres of suitable foraging habitat to support 60% of the wintering waterfowl. Because water is essential to maintain refuge wetlands for wintering waterfowl, "survey coverage" would equate to waterfowl population surveys and score 3. Example: 75% of Laysan Albatross population nest on Midway NWR. Conducting a survey to monitor the breeding population size on the refuge would cover >10% of the entire species' population and score 3.

1. Low: Survey covers <1% of the species' or communities' population/range
2. Medium: Survey covers 1-10% of the species' or communities' population/range
3. High: Survey covers ≥10% of the species' or communities' population/range

C. Spatial Scale

What is the largest scale at which survey results will be applied for resource management?

Note: Only surveys with a protocol that establishes methods for data management and analysis are scored higher than a 1. The area of inference for larger-scale surveys (e.g., North American Amphibian Monitoring Program) should be considered from the refuge perspective unless the refuge directly contributes to analyses at a larger scale. This criterion is applicable to surveys covering areas on and adjacent to the refuge. Example: If a refuge participates and contributes to a regional survey involving neighboring US Forest Service lands, then this criterion would apply.

1. Small scale: Applicable to only a single refuge or sites on a refuge
2. Medium scale: Applicable to a few refuges, a refuge complex, or includes the refuge and a small area beyond the refuge boundary
3. Large scale: Applicable to multiple refuges/complexes across an entire ecoregion, LCC, or region
4. Continental scale: Component of a large landscape level survey (e.g., North American Breeding Bird Survey, North American Amphibian Monitoring Program, and Circumpolar Biodiversity Monitoring Network)

7. Protocol

A. Sampling Design

At what stage of development is the sampling design?

Note: The I&M initiative has a standardized format for survey protocols that contain 8 critical elements. A survey protocol with all elements and has been peer-reviewed meets this criterion.

1. Survey has no written sampling design
2. The sampling design is in development (drafted)
3. The sampling design is in formal review
4. There is a published or I&M-approved sampling design

B. Field Methods

At what stage of development is the field method protocol?

1. Survey has no written field methods
2. The field methods are in development (drafted)
3. The field methods are in formal review
4. There is a published set or I&M approved protocol for field methods

C. Data management, analysis, and reporting

At what stage of development is the data management, analysis, and reporting?

1. Survey has no written protocol for data management, analysis, and reporting
2. Written protocol for data management, analysis, and reporting is in development (drafted)
3. Written protocol for data management, analysis, and reporting is in formal review
4. There is a published record or I&M approved protocol guiding data management, analysis, and reporting

Table A.1. Criteria originally recommended by the Natural Resource Program Center, but removed for purposes in Region 4. These eight criteria were removed because they were either redundant, or would not add discrimination among surveys in the Southeast. Any of these 8 criteria may be added back into the Prioritization Tool during the prioritization process if a refuge considers them to be of importance.

Criteria REMOVED by Region 4	Justification
1A. Refuge Purpose	This criterion is covered in 1B. Removed to avoid duplication.
3B. Refuge Processes	Refuge ecological processes can be addressed in 3C.
4B. Other Legal Mandates	Few examples in R4 where there are legal mandates other than those covered by ESA, state lists, rankings by Heritage Programs, IUCN global Red List, or NatureServe rankings (these covered in 4A).
6D. Integration with Other Survey	Many surveys are integrated on R4 refuges to assess overall management success. However, surveys should not have to be completely dependent on each other to provide useful information.
6E. Attribute Quality and Scope	This criterion is covered in 7A, B, and C.
8A. Monetary	The purpose of prioritizing surveys in Region 4 is based on biological needs and objectives. All cost considerations are dealt with more explicitly by asking the refuge staff to estimate the labor and funding required to complete each survey after the prioritization process.
8B. Personnel	The purpose of prioritizing surveys in Region 4 is based on biological needs and objectives. All cost considerations are dealt with more explicitly by asking the refuge staff to estimate the labor and funding required to complete each survey after the prioritization process.
8C. Security/Source of Funding	The purpose of prioritizing surveys in Region 4 is based on biological needs and objectives. All cost considerations are dealt with more explicitly by asking the refuge staff to estimate the labor and funding required to complete each survey after the prioritization process.

Table A.2. The refuge's weighted criteria used to rank refuge surveys with the Survey Prioritization tool.

FINAL CRITERIA WEIGHTING MATRIX			
Criteria Category	Record	Criteria	3 Weights
1. Refuge Priorities and Management Needs	2	1B. CCP or Other Management Plan Objectives	0.08403
	3	1C. NWRS Objectives	0.06723
	4	1D. Management Utility (Decision Support) for the Refuge	0.07563
2. Partner Priorities and Management Needs	5	2A. FWS Program Need	0.05882
	6	2B. FWS Partner Need	0.05042
3. Ecological Application	7	3A. FWS Surrogate Species	0.04202
	9	3C. Survey Breadth	0.06723
4. Additional Legal Mandates	10	4A. Listed Species or Vegetation Communities	0.07563
5. Immediacy of Need	12	5A. Controversy	0.03361
	13	5B. Threat	0.07563
6. Scope and Scale	14	6A. Baseline Data	0.07563
	15	6B. Survey Scope	0.07563
	16	6C. Spatial Scale	0.07563
7. Protocol	19	7A. Sampling Design Stage	0.04202
	20	7B. Field Methods Stage	0.04202
	21	7C. Data Management, Analysis, and Reporting	0.05882

Appendix B. Prioritization Scores and Status All Ranked Surveys

This table shows the values used to prioritize and select the surveys likely to be conducted through 2031 at Pee Dee National Wildlife Refuge. Prioritization scores were generated for candidate surveys by refuge staff using 16 criteria for each survey (Appendix A). Scores were then used as a starting reference to assign the surveys into tiers. Finally, survey status was assigned by considering the capacity available for conducting each survey to completion: “Current” surveys are those that can be done with station funds alone; “Expected” surveys will possibly be conducted, but additional capacity is needed from non-station funding sources to conduct and the staff felt it was more likely than not that capacity would be realized during the span of the IMP; “Future” surveys are those not very likely to be conducted because of low priority or very limited chance in securing the capacity to do them; “Historical” surveys are those no longer needed to address management objectives. Surveys selected for the IMP (status = Current or Expected) are shown in blue. Non-selected surveys (status = Future or Historical) are not included in Table 1 of the IMP.

Table B.1. Priority scores from the Survey Prioritization tool for all considered surveys.

		Prioritization		Survey	IMP	Survey
No.	Survey Name	Score	Tier ^a	Status	Status	Priority
12	Forest Health Condition	0.839	1	Current	Selected	1.1
14	IWMM (waterfowl) ^a	0.831	1	Current	Selected	1.2
16	Bat	0.655	2	Expected	Selected	2.1
18	Landbird point counts	0.780	2	Expected	Selected	2.2
13	Vocal anuran/herp	0.605	2	Expected	Selected	2.3
2	Mid-winter waterfowl survey	0.831	2	Expected	Selected	2.4
3	Audubon CBC	0.751	2	Expected	Selected	2.5
17	Wood duck boxes	0.657	2	Expected	Selected	2.6
4	Deer herd health ^a	0.598	2	Expected	Selected	2.7
4	Water quality & flows	0.805	3	Future	Non-Selected	
9	Fish inventory (eDNA?)	0.757	3	Future	Non-Selected	
21	WODU Banding	0.000	3	Future	Non-selected	

	Non-Selected Surveys^b	Prioritization		Survey	IMP	Survey
No.	Survey Name	Score	Tier^a	Status	Status	Priority
5	Mussels	0.805			Non-Selected	
6	Breeding Bird Survey	0.780			Non-Selected	
8	Migration surveys	0.780			Non-Selected	
11	MSU	0.665			Non-Selected	
16	Mourning dove	0.575			Non-Selected	
17	Marsh/wading birds	0.531			Non-Selected	
18	Shorebirds	0.531			Non-Selected	

^a Tier 1--The highest priority surveys that the Project Leader estimates can be conducted with existing staffing and funding.

Tier 2--Surveys that the Project Leader sees as second priority for the station, or high priority surveys that would require an increase in operational capacity.

Tier 3--Lower priority surveys that are currently being conducted or are anticipated but would require the major reallocation of staff and capacity.

When no tier is designated it means that Refuge staff determined that survey was no longer necessary to conduct.

^b Non-Selected Surveys were not included in Tiers, survey status or survey priority.

Appendix C. Brief Description of Non-selected Surveys

Table C.1. The following surveys will be conducted in the future if new capacity becomes available.

Survey Name	Description	Survey Status
Wood Duck Banding	Capture, band, identify age and sex of Wood Ducks; Submit data to USGS Bird Banding Lab	Future
eDNA	Determine presence/absence of fish and mussel species	Future
Water quality/flow	Monitor water quality and flow conditions in the Brown Creek	Future

Table C.2. Non-selected surveys or non-survey activities excluded from the IMP.

Activity Name	Description	Reason for Exclusion
Early Detection of Invasive Plants	Opportunistic, location and documentation of invasive plants to implement early detection and rapid response	Not a survey; Reconnaissance
Red-cockaded Woodpecker	Monitor as per recovery plan. Not documented on refuge.	Discontinued Historic
Schweintz Sunflower	Not documented on refuge as per IMP meetings, FWS and NC Natural Heritage Program botanists	Discontinued; Historic
Mourning Dove Banding	Band Mourning Doves in partnership with state	Discontinued; Historic
Breeding Bird Survey	Landbird objectives covered by landbird point counts.	Discontinued; Visitor Services
Migration Surveys	Landbird objectives covered by landbird point counts.	Not a survey; Reconnaissance
Pollination / Butterfly Surveys	Identify and record species and numbers of butterflies on refuge.	Reconnaissance; Visitor Services
Deer Check Station	Important public use and state partnership Self registration available: http://www.ncwildlife.org/	Not a survey; Visitor Services/ Historic
Nightjar Surveys	Document presence of Nightjars on refuge	Discontinued;

		Historic
Bobwhite Quail	Record Bobwhite Quail calls in spring.	Discontinued; Historic
Shorebird Surveys	Document shorebird presence on refuge.	Discontinued; Historic
Marsh/Wading Bird Surveys	Document marsh and wading bird presence on refuge.	Discontinued Historic
Moist Soil Unit	Monitor plants and water levels in MSUs. Included in IWMM Survey Protocol	Discontinued; Historic
Monitoring Avian Productivity & Survivorship (MAPS)	Mark and recapture landbirds with mist nets	Discontinued; Historic
Robust Redhorse	One historic record, currently not documented on refuge.	Discontinued Historic
Fish Inventory in Visitor Use Ponds	Document fish presence in ponds for fishing	Discontinued; Visitor Services
Mussels	Document Mussels presence/absence. Included in eDNA surveys.	Discontinued; Historic
Fox Squirrel	Document presence of fox squirrels on refuge.	Discontinued Historic

Appendix D. Environmental Action Statement (EAS) for Pee Dee National Wildlife Refuge Inventory and Monitoring Plan

Within the spirit and intent of the Council on Environmental Quality's regulations for implementing the National Environmental Policy Act (NEPA) (40 CFR 1500-1508), and other statutes, orders, and policies that protect fish and wildlife resources, I have established the following administrative record and determined that the following proposed action does not require additional NEPA documentation.

Proposed Action, Alternatives, and NEPA Documentation

The proposed action is to implement an Inventory and Monitoring Plan (IMP) for the Pee Dee National Wildlife Refuge (NWR). This IMP provides specific guidance for surveys of Pee Dee NWR's fish, wildlife, plant, habitat, and abiotic resources to fulfill the Pee Dee NWR's purposes and help achieve Pee Dee NWR's goals and objectives. There are no considered alternatives to the IMP given administrative requirement to complete this step-down plan.

In accordance with 43 CFR 46.205 and 40 CFR 1508.4, surveys within this IMP are covered by the following Departmental categorical exclusion because they would not have significant environmental effects.

"Research, inventory, and information collection activities directly related to the conservation of fish and wildlife resources which involve negligible animal mortality or habitat destruction, no introduction of contaminants, or no introduction of organisms not indigenous to the affected ecosystem." 516 DM 8.5B(1).

for *Jeffery Bricken*, acting project leader
Jeffery Bricken, Project Leader

07/20/2015
Date

Reference:

U.S. Fish and Wildlife Service. 2008. Pee Dee National Wildlife Refuge Comprehensive Conservation Plan. USFWS. Atlanta. GA. Available under ServCat reference # 20305: <https://ecos.fws.gov/ServCat/Reference/Profile/20305> or <http://www.fws.gov/southeast/planning/PDFdocuments/PeeDeeFinal/PeeDeeFinalCCP.pdf>

IMP Revision Signature Page

IMP Revisions Pee Dee National Wildlife Refuge

<i>Action</i>	<i>Signature /Printed Name</i>	<i>Date</i>
Survey list and priority changed:		
Submitted By:	Refuge Manager/Project Leader	
Reviewed By:	Regional I&M Coordinator	
Approved By:	Refuge Supervisor	



**Station Survey Instructions for Tier I
Surveys for the Pee Dee National Wildlife
Refuge
Inventory and Monitoring Plan**



July 2015

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Survey Instructions

Purpose

Documenting survey design and methods maintains the scientific integrity of refuge biological programs and guards against information loss over time. The Survey Instructions format was developed to assist refuges in recording important biological survey information and will enhance survey integrity by ensuring that survey procedures are clear and consistent. It will provide additional benefits, including: Serve as Initial Survey Instructions (ISI) (701 FW 2), and an initial step in development of formal NWRS survey protocols; Capture information valuable in development of Inventory and Monitoring Plans (IMP); Augment survey information in the Planning and Review of Inventory and Monitoring ([PRIMR](#)) database; Reveal multi-refuge and landscape-level data inference opportunities.

Using the Initial Survey Instructions Free Form

The free form is an alternative to the more structured fillable-Field Form. Similarly, staff should use this tool for all on-going surveys, particularly those high priority refuge-based surveys where formal protocols are not applicable. The information provided in the ISI form should be as thorough and complete as possible, keeping in mind that it may be the instructions available to another to stand in for current staff and will be the documentation linked to the Inventory & Monitoring Plan. Upload completed ISI to [Fishnet](#) site and link it to the survey record in PRIMR for long-term reference. Regional I&M staff ecologists can assist refuge staff with completing the Survey Instructions. If the Survey Instructions are updated over time, we recommend saving updates as versions (e.g., version 2.0).

Survey name: Forest Condition Cruise Survey (1.1)

Conducted by: Pee Dee NWR

Information Current as of: July 2015

Submitted by and contact information: Wendy Stanton,
Southeast Region Inventory and Monitoring Branch
wendy_stanton@fws.gov

Overview: In the mid-2000s, a comprehensive forest habitat inventory was conducted to evaluate forest habitat conditions relative to forest type and provided management recommendations to create desired forest conditions to maximize migratory bird use on the refuge. As funding becomes available, these recommended silvicultural treatments are being implemented on the refuge. Over the next 15 years, as selected stands are thinned, cruises will be conducted to evaluate management actions, reassess forest composition, condition and structure to support refuge objectives in the CCP and HMP.

Target species/taxa/community: Forest habitats including; bottomland hardwoods, mixed pine hardwood; and upland pine.

Design: This survey is part of a collaborative Regional survey. The Coordinating organization and contact information:

USFWS Southeast Region Forestry Team

Regional Forester Haven Barnhill

Haven_Barnhill@fws.gov

A simple cruise grid is generated using SilvAssit (GIS extension) and cruise points are established at equal distances across all habitats within the sample area. Within sampled stands, there are 594 ft (9 chains) between each point and points lie in cardinal directions from each other and are marked with GPS waypoints. The survey timing will depend on site conditions and will occur as management actions are conducted on selected forest stands. The primary metrics collected are forest condition and structure.

Methods: In conjunction with refuge staff, priority areas are selected across the refuge and identified for inventory. Focus is on areas believed to have reasonable long-term probability of management thru silviculture. This approximate 2.5% inventory will be conducted using point sampling (10BAF prism). A simple cruise grid will be generated using SilvAssit (GIS extension) and cruise points will be established at equal distances across all habitats within the sample area. Within sampled stands, there are 594 ft (9 chains) between each point and points lie in cardinal directions from each other.

Two person teams will conduct the cruise and hand held data loggers (trimble nomad) will be used to log data with soloForest providing spatial reference to navigate to each point and TCruise software being used to record forest inventory data at each point. The hydrologic forest type (called stratum on template) will be identified at each point as either:

- Swamp Forest (cypress, cypress-tupelo)
- Wet bottomland (overcup oak-bitter pecan, black willow, laurel oak-red maple)
- Moist Bottomland (sugarberry-elm-ash, oak-elm-ash, oak-sweetgum)
- Dry bottomland (cherrybark oak, post-oak-blackgum)
- Levee forest (cottonwood-sycamore, sweet pecan-boxelder)
- Unknown

Both plot level and tree level data will be recorded at each point. Plot level variables include canopy cover, midstory abundance, understory cover, cane abundance, abundance of vines in canopy, presence of invasive species and abundance of regeneration (separated into shade tolerant and intolerant). Plot level data are ocular estimates taken from the cruise point and are recorded in ranges relative to DFC guidelines.

- Canopy cover (vertical sunlight blockage) will be estimated as follows: <50% cover, 50-80% cover and >80% cover.
- Midstory abundance are trees typically 10'-30' tall and ocular estimates of midstory (horizontal vision obstruction estimate) will be <25%, 25-40% and >40%.
- Understory woody vegetation (ex. shrubs <10' tall) will be estimated as being <25%, 25-40% or >40% shrub cover in the plot area.

- Cane abundance will be estimated around plot center as being none, sparse (1-25%), moderate (25-50%) or abundant (>50%) cane coverage.
- Abundance of vines in trees will be estimated as being none, sparse (1-25%), moderate (25-50%) or abundant (>50%) of trees in plot having vines.
- Invasives (none, Chinese privet, trifoliate orange, kudzu, Chinaberry, Japanese climbing fern and “other spp”) will be noted at each point (or if observed anywhere in the nearby vicinity).
- Regeneration – both seedlings and advanced regen in 1/100 acre (11.8ac) subplot. Quick estimates only
 - Shade Intolerant (I) species
 - Moderate (intermediate) Shade Tolerance Regen (M)
 - Tolerant Regen (T)
 - None
 - Sparse
 - moderate
 - abundant

Tree level information for all trees determined to be “in” using a 10BAF prism will be recorded at each point and data logged will include species, DBH, merchantable height, note if tree is a super-emergent (dom as opposed to codom) and note presence of cavities by size (none, small = <4”, medium = 4-10” and large >10”

Large (min 6” x 10’) down woody debris will be logged as a tree (species code DD) and DBH/length estimated so that approximate volume of down woody debris can be calculated. Product categories include Pulpwood, Sawtimber and Cull.

- Pulpwood is 6” dbh to 4” top with height in 5’ increments and maximum 26” dbh.
- Sawtimber is 14” dbh to 12” top with height in logs.
- Non-merchantable timber should be recorded as product class cull (CL). Auto Assign product for all SNAGS

Note: Products are auto-assigned in tcruise based upon these specifications. Manually downgrade as needed and specify culls.

If a point falls on road/edge atypical of general area, walk 1 chain into woods to collect data.

Data Management: Data will be entered into and analyzed with TCruise software. Data storage will include hardcopy and TCruise software, file cabinet. Paper copies will be held by regional office and refuge office.

Reporting: The regional forester will generate the report for the refuge. The refuge will archive the report onto ServCat.

Other Information: Each inventory is customized to address refuge specific needs, but generally include traditional timber cruise information (tree species, dbh, ht, product, etc) along with numerous habitat variables ranging from groundcover abundance and structure, shrub, midstory and canopy density, invasives, vines, snags, cavities, down woody debris, etc. Most of the plot level variables are simple ocular estimates as this allows for adequate general analysis of condition relative to DFCs but is likely more variable than using techniques to actually measure these variables as this would be too time consumptive for our needs.

Cite Resources: Regional Forester Haven Barnhill (personal communication and email)

Version	Completed by	Date	Comments/material updated
1.0	Wendy Stanton	2/13/2015	Comprehensive forest inventory
1.1	Wendy Stanton	6/18/2015	Survey specific to selected managed stands

Survey name: Integrated Waterbird Management and Monitoring (1.2)

Conducted by: Pee Dee NWR and other refuges in Southeast, Northeast and Midwest Regions.

Information Current as of: July 2015

Submitted by and contact information: Wendy Stanton,
Southeast Region Inventory and Monitoring Branch
wendy_stanton@fws.gov

Overview: The 2014 Southeast Region Workforce Plan identified the North American Waterfowl Management Plan as the top management priority for Pee Dee NWR. The Southeast Region Division of Migratory Birds designated the integrated waterbird management and monitoring (IWMM) as a priority survey for the refuge. A primary purpose of this protocol is to standardize waterbird and habitat monitoring during the non-breeding period at a local-scale. Resulting data can then be compiled and analyzed across broader geographic units (e.g., regional, national, etc.). At the local scale, it will allow managers to use adaptive management to improve habitat quality and optimize waterbird use of each site. At a regional scale, it will allow for optimum allocation of resources (funds and staff) to meet flyway waterbird population and habitat objectives. At the flyway scale, it will allow for identification of priority stopover and wintering habitats for waterbirds. This information is used to determine the relative importance of a management site to a waterbird guild, alter management to meet changing needs, and guide the development of management objectives.

Counts of wintering migratory waterfowl and wading birds and assessments of local habitat conditions in moist soil units, flooded farmlands, and bottomland hardwoods will be conducted. This survey is recurring every year and will be conducted semi-weekly from the end of November through the beginning of March. A total of eight approximately four-hour surveys would be completed.

At the local scale, this survey will be used to assess adaptive management actions on intensely managed units for water birds and provide management recommendations to support refuge objectives in the CCP and HMP. In addition, the standardized waterbird and habitat data will be entered into the IWMM models to affect management decisions at larger geographic areas.

Target species/taxa/community: Waterbirds including Pelecaniformes (ibises, herons, pelicans) and Anseriformes (swans, waterfowl, ducks, geese)

Target habitats: Flooded impoundments, flooded croplands, tracts of bottomland hardwood forests.

Design: This survey is part of a collaborative State, Regional and National survey.

The Coordinating organizations and contact information:
USFWS, Division of Migratory Birds, Inventory and Monitoring, National Wildlife Refuges.
Supervisor Wildlife Biologist John Stanton, john_stanton@fws.gov

The national protocol framework can be found on ServCat:
<https://ecos.fws.gov/ServCat/Reference/Profile/29343>

Methods: Refuge specific instructions are in development. In the interim, management units will be surveyed every two weeks from November-March, during the wintering migratory waterfowl season. The primary metrics collected include habitat parameters, number of waterfowl by species, weather conditions, and disturbance levels. Data will be collected by refuge staff and faxed or emailed to I&M Wildlife Biologist to enter into the centralized IWMM database.

Data Management: Data will be entered into MS Access IWMM database and centralized IWMM database (released for use July 2015). Data will also be stored on refuge computers, and paper copies will be stored in refuge filing cabinets. Raw data is checked for accuracy and checked again after entering into the centralized database.

Reporting: The centralized IWMM database can produce numerous reports.

Other Information: As the refuge specific instructions are developed, maps and survey routes will be included with the ISI.

Cite Resources: The IWMM Website portal: <http://iwmmprogram.ning.com/>
Loges BW, Tavernia BG, Wilson AM, Stanton JD, Herner-Thogmartin JH, Casey J, Coluccy JM, Coppen JL, Hanan M, Heglund PJ, Jacobi SK, Jones T, Knutson MG, Koch KE, Lonsdorf EV, Laskowski HP, Lor SK, Lyons JE, Seamans ME, Stanton W, Winn B, and Ziemba LC. 2014. National protocol framework for the inventory and monitoring of nonbreeding waterbirds and their habitats, an Integrated Waterbird Management and Monitoring Initiative (IWMM) approach. Natural Resources Program Center, Fort Collins, CO.

Version	Completed by	Date	Comments/material updated
1.0	Wendy Stanton	5/6/2014	Initial refuge survey instructions to implement IWMM protocol in interim to development of refuge specific survey.