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To: Deputy Regional Director, Pacific Region, Portland, Oregon

From: State Supervisor, Oregon Fish and Wildlife Office, Portland, Oregon

Subject: Formal Consultation on the Willamette Valley Native Prairie Habitat Programmatic Safe Harbor Agreement for the Fender's Blue Butterfly

This document transmits the Oregon Fish and Wildlife Office's (OFWO) intra-service biological opinion (BO) on the proposed Willamette Valley Native Prairie Habitat Programmatic Safe Harbor Agreement for the Fender's blue butterfly (SHA). Conservation and restoration actions designed to specifically benefit the Fender's blue butterfly (*Icaricia icarioides fenderi*) and associated Kincaid's lupine (*Lupinus sulphureus* ssp. *kincaidii*) will occur on non-federal lands to be enrolled in Benton, Lane, Linn, Marion, Polk and Yamhill Counties in the Willamette Valley, Oregon. Other native prairie species are expected to benefit as well. The endangered Willamette daisy (*Erigeron decumbens* var. *decumbens*), threatened Nelson's checker-mallow (*Sidalcea nelsoniana*) and endangered Bradshaw's lomatium (*Lomatium bradshawii*) are included in this consultation because they may occur on lands to be enrolled and could be affected by project activities.

After reviewing the current status of the species, the environmental baseline for known populations, the effects of monitoring and habitat work, and the cumulative effects, we conclude that these activities will not jeopardize the continued existence of Fender's blue butterfly, Willamette daisy, Kincaid's lupine, Bradshaw's lomatium or Nelson's checker-mallow, nor will they destroy or adversely modify designated critical habitat for Fender's blue butterfly, Willamette daisy or Kincaid's lupine. The proposed activities will likely have short-term adverse affects, while contributing to the long-term restoration and recovery of the affected species and critical habitats.

Activities under the SHA have been designed to avoid impacts to listed fish and their designated critical habitats whenever possible. Because Fender's blue butterfly and Kincaid's lupine occur on upland prairie habitats, project areas will typically be upland sites and activities will occur away from watercourses. In addition, restrictions on timing and access and other protective

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measures specified in the SHA (e.g., wide buffers from watercourses) will ensure that there will be no adverse affects from most, if not all, SHA activities. Therefore, SHA activities that adhere to the fish-related BMPs will have no effect on listed fish and their critical habitats, and programmatic consultation was not requested for the following:

- Bull trout (*Salvelinus confluentus*) and its critical habitat
- Oregon chub (*Oregonichthys crameri*)
- Lower Columbia River coho salmon (*Oncorhynchus kisutch*) and its critical habitat
- Lower Columbia River Chinook salmon (*Oncorhynchus tshawytscha*) and its critical habitat
- Upper Willamette River Chinook salmon (*Oncorhynchus tshawytscha*) and its critical habitat
- Lower Columbia River steelhead trout *(Oncorhynchus mykiss)* and its critical habitat
- Upper Willamette River steelhead trout *(Oncorhynchus mykiss)* and its critical habitat

In the event that activities arise that may affect listed fish or their critical habitats, separate section 7 consultation(s) should be initiated under the Endangered Species Act (ESA), as needed.

Consultation History

This is the first programmatic SHA that has been developed for the Fender's blue butterfly. It is designed to encourage Fender's blue butterfly and Kincaid's lupine conservation and recovery efforts on non-federal lands. It was developed and will be administered by the OFWO and the Willamette Valley National Wildlife Refuge Complex. The programmatic approach will provide landowners with a streamlined process for obtaining regulatory assurances under a 25-year Endangered Species Act Section 10 "Enhancement of Survival" permit when they enroll their lands as Cooperators under the SHA and carry out eligible activities specified in site-specific plans for their properties. This Opinion is based on information provided in the SHA, literature and information available in the OFWO about the species addressed, and other recent ESA, section 7 consultations completed by the OFWO for similar activities (e.g., USFWS 2008b and 2008c).

BIOLOGICAL OPINION

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I. DESCRIPTION OF THE PROPOSED ACTION

The proposed action is to issue an ESA, Section 10 "Enhancement of Survival" permit to the OFWO for the programmatic SHA. This consultation covers associated prairie conservation and restoration activities that are designed to result in a net conservation benefit for the Fender's blue butterfly on non-federal lands, while providing assurances to landowners that they may return their enrolled property to baseline conditions for the butterfly after they have undertaken voluntary efforts to benefit the species. Activities may affect Fender's blue butterfly, Willamette daisy, Kincaid's lupine, Bradshaw's lomatium, Nelson's checker-mallow and designated critical habitat for Fender's blue butterfly, Willamette daisy, and Kincaid's lupine on non-federal lands in the Willamette Valley. The on-the-ground activities and best management practices discussed in this section serve as a menu of typical activities that will occur to conserve and restore habitat under this SHA. Activities will be chosen selectively and incorporated into site-specific plans as appropriate for properties to be enrolled. Categories of on-the-ground activities that may take place are: a) surveys and monitoring, b) removal of invasive non-native species and woody vegetation, c) revegetation, d) collection of Kincaid's lupine seed and plant material, e) reintroduction and augmentation of Kincaid's lupine, f) threat reduction and g) return to baseline. The overall goal of the SHA program is to promote implementation of Fender's blue butterfly conservation and recovery actions, while also benefiting Kincaid's lupine and other native prairie species.

A. Surveys and monitoring

Surveys may be conducted by individuals deemed qualified by the OFWO to determine the baseline for the covered species, to monitor responses to management activities, and to assess population health and trends. Fender's blue butterfly surveys may be done using observations for presence of the species at a site, non-destructive egg or larvae counts or a butterfly census. Monitoring of Kincaid's lupine may be accomplished by measuring the area of plant coverage or counting the number of lupine stems along a series of transects or plots. Other methods may be used as appropriate to meet the purposes of the monitoring effort upon approval by the OFWO.

Monitoring surveys may be conducted over the entire range of Fender's blue butterflies and Kincaid's lupine each year on lands that are enrolled or on lands under consideration for enrollment under this SHA in order to collect baseline information. Handling of individuals of these species is only to be done by individuals specifically permitted for this purpose and is to be kept to the minimum needed to complete the surveys. No more than five percent of the Fender's blue butterfly population on lands to be surveyed may be captured per week, throughout the flight season, for identification purposes.

B. Removal of invasive non-native species and woody vegetation

Upland prairie sites that do, or that could, support Fender's blue butterflies and Kincaid's lupine generally require routine treatment to remove woody vegetation and invasive exotic plants, such as Himalayan blackberry (*Rubus armeniacus*) and Scotch broom (*Cytisus*

scoparius), in order to maintain and enhance the native plant community and open prairie conditions.

i. Manual treatments

Manual maintenance typically involves eliminating woody vegetation and exotic species by hand or with hand tools, such as shovels, hoes, weed wrenches, lopping sheers, trowels, and weed pullers. These activities may be implemented year-round. However, the work will be conducted between mid-August and February whenever possible in habitat occupied by Fender's blue butterfly. Manual removal of woody vegetation and exotic species may occur on all portions of an enrolled property each year.

ii. Mechanical treatments - ground-level

In some situations, the use of mechanical treatments may be more appropriate than manual techniques, e.g., for controlling dense stands of tall fescue (*Festuca arundinacea*) or for releasing competition around numerous Kincaid's lupine plants and/or patches of native plants. Mechanical maintenance techniques include mowing, line trimming, grubbing, girdling trees, raking, and chain saw or mechanical removal of woody species. Mechanical maintenance activities in occupied Fender's blue butterfly habitat will primarily be conducted when the lupine and nectar plants have completed seed production and the butterflies are in diapause (i.e., mid-August through February), unless otherwise specified in a site-specific plan where the techniques and locations of the treatments will have no effect on listed species. Mechanical treatment to remove woody vegetation, exotic species and competing plants may occur on up to one-half of the occupied Fender's blue butterfly habitat on an enrolled property each year. One hundred percent of the area of those sites may be mechanically treated over time.

When mowing occupied Fender's blue butterfly habitat, mowers will be set to a blade height high enough to minimize the risk of gouging the ground, harming low-stature native plants, and impacting butterfly larvae (generally at least 10 to 15 centimeters (cm) [4 to 6 inches]). Tractor mowers that are rubber-tracked are preferred over wheeled mowers whenever practicable. Mowing may be conducted throughout sites with Fender's blue butterflies after lupine senescence and before lupine re-emergence (generally August 15 to March 1). After the butterfly flight season but before Kincaid's lupine senescence (generally June 30 through August 15), tractor mowing may occur no closer than 2 meters (m) (6 feet) from the nearest Kincaid's lupine plants. Mowing with hand-held mowers may be implemented during the Fender's blue butterfly flight season (generally May 1 to June 30) as long as a buffer of at least 8 m (25 feet) is maintained between the mower and any individual of a Kincaid's lupine plant.

Early spring tractor mowing (i.e., March 1 through May 15) may be used for management purposes only in habitat unoccupied by the butterfly. At unoccupied

butterfly sites with listed plants, the preferred timing for mowing will be in the fall and winter after listed plants have senesced for the season (generally August 15 through February). Spring mowing may be implemented at unoccupied sites with listed plants if needed to achieve the management objective and as long as a buffer of at least 2 m (6 feet) is maintained from the nearest listed plants. However, if needed to control serious infestations of weeds that reproduce mainly by seed (e.g., meadow knapweed [*Centaurea* x *pratensis*]), up to one half of the listed plant population at a site may be mowed in an effort to reduce seed set by non-native weeds. The mowers will generally be set to a height of 10 to 15 cm (4 to 6 inches) in order to reduce harm to low-stature native plants and minimize gouging the ground.

Line trimmers, which provide more precision than mowers, may be used in occupied habitat in early spring when necessary. Care will be taken to minimize the risk of injuring low-stature native plants and Fender's blue butterfly larvae with the line trimmers.

Raking may be used to reduce thatch build up. Rakes may be tractor-mounted or hand-held, and can help to gather and loosen thatch and leaf litter. Thatch that exceeds 10 to 20 percent cover can reduce native plant species diversity or rare plant habitat availability, and may also increase small mammal populations that damage native plants. Raking will occur after listed plants have senesced for the season. Efforts will be made to avoid disturbing underlying soil. At sites supporting Fender's blue butterfly populations, between one-quarter and one-third of the occupied habitat may be raked annually. Efforts will be made to identify and avoid individual, semi-senesced Nelson's checker-mallow. Tractors will be equipped with rubber tracks whenever practicable to minimize soil compaction. Thatch and leaf litter will be removed from significant prairie habitats.

iii. <u>Mechanical treatments – tilling, plowing, disking and sod rolling</u>

Tilling, plowing, disking and sod rolling may be used as management activities to kill or suppress invasive plant species and prepare sites for native vegetation establishment in areas that have been heavily infested with non-native and invasive plant species. These activities will not be conducted where they may adversely affect listed plants or butterflies (generally within 10 m [30 feet] of known populations). Erosion control measures and buffers will be maintained as needed to prevent soil run-off into adjacent watercourses. These activities may occur within oak savanna habitats. Care will be taken to avoid the root-zones of desirable trees and shrubs to the extent possible in order to minimize potential impacts to those plants.

A plow or tractor with a tiller attachment may be used to turn the soil up to 30 cm (12 inches) deep in the treatment area. This action disturbs the root system of the weeds and exposes them to sunlight, reducing the viability of the weed species. It also brings up the seed stock and promotes weed growth, which can then be treated by further disking or herbicide applications. Additional tilling and disking applications may be needed to promote and then suppress new weed growth, reducing the weed

seed stock in the soil. Once tilling, plowing and disking activities have been completed, the treated area will be further prepared by packing the soil to eliminate air pockets and create a surface crust that can help maintain surface moisture, and the area will be seeded or planted with native vegetation (Campbell 2004), especially potential nectar plants.

Sod rolling may be used to control invasive plant species, especially those with rhizomes such as reed canary grass. A bulldozer is used to roll away the top layer of soil and plant material, leaving a relatively intact soil layer beneath. The bulldozer pushes the vegetative mat and deposits the mat into windrows at the edge of the site. The invasive plant and sod windrows are composted in place, killing the invasive plant seeds and root material. Afterward, remaining soil can be re-used on site for site restoration activities. This technique will not be used where listed plants or butterflies are present but is suitable in adjacent habitats (generally no closer than 10 m [30 feet] from listed species) for site preparation prior to reintroduction or augmentation of listed or other native species.

iv. Prescribed fire

In the fall (i.e., mid-August through November), prescribed burns may be performed to discourage woody plant growth, remove accumulated leaf litter and duff, and encourage the spread of native prairie grasses and forbs. An annual burn unit (ABU) will be determined based on the individual site conditions and population sizes. Prescribed fire may be used to manage prairie habitats on the enrolled property each year, but the area that may be burned in any one year is limited on sites occupied by Fender's blue butterfly and Nelson's checker-mallow, as described below. A vegetative buffer (generally 15-m [50-feet] wide) and erosion control measures will be maintained along any adjacent watercourse as needed to avoid the risk of potential impacts to listed fish.

The ABU for sites supporting 100 or more adult Fender's blue butterflies may be a maximum of one-third of the occupied habitat. The ABU for sites with less than 100 adult Fender's blue butterflies may be up to a maximum of one-fourth of the occupied habitat. No more than half of any area occupied by Nelson's checker-mallow may be burned, because this species may not have completely senesced in the fall when prescribed burns are implemented. The center of the ABU will be within 100 meters of unburned occupied habitat, which can serve as a recolonization source. Once burned, a unit will not be re-burned for at least three years so that butterfly or plant populations may rebuild. The use of fire for habitat maintenance inherently increases the risk of accidentally impacting more habitat than originally intended. The responsible Parties will plan to burn approximately five percent less than the annual maximum so that the maximum allowable ABU will not be exceeded.

Large woody plants will be removed before burning to reduce fuel loads if feasible. Ignition of burn areas will be by hand using propane, fuses, or drip torches. Pre-burn hose lays, wet-lining, or fire retardant foam will be used to control and suppress fires.

However, fire retardant chemicals will be used sparingly near listed plant and butterfly populations, and will typically not be used where they could enter a watercourse that supports listed fish (generally 40 m [120 feet]). If situations arise that could result in impacts to listed fish, individual consultations will be completed as needed. Prescribed burns will be conducted in a manner consistent with state and local smoke management regulations. Vehicles will not be operated in areas where listed species occur. Additionally, where patch size allows, butterfly refugia within burn units will be protected with a fire break and/or watered down before burning.

During a burn year, management activities on sites occupied by Fender's blue butterfly will also be limited for adjacent units of the site. For example, if one-third of the site is burned, the remaining unburned portion of the site will not be mowed so that the maximum area affected by management activities is no more than one-third of the site.

When using prescribed fire as a management technique, additional consideration of subsequent annual treatments for the ABU will be necessary. That is, in the year following a burn, management of that unit will be limited to manual techniques and herbicide applications.

Occupied habitat that is scheduled to be burned may be used as a source for collecting Fender's blue butterfly eggs and larvae if an appropriate holding/rearing facility is available. Any eggs and larvae that are collected will be used to further research on Fender's blue butterfly. Research efforts may provide information that will improve the effectiveness of captive rearing, reintroduction, or augmentation techniques for future use at historical or declining sites that currently do not support a viable population, or to increase the stability of existing populations. While it is acknowledged that this activity may occur on lands enrolled under this SHA, a separate ESA 10(a)(1)(A) permit will be required for any associated collection, rearing and reintroduction of Fender's blue butterflies.

v. Herbicide Use

Herbicide application, used alone or in combination with other methods, may be used where appropriate to provide a feasible and effective strategy for controlling invasive species and preparing sites for native plant restoration. Specific herbicides anticipated for restoration and management under this SHA in occupied habitat (i.e., that supports either Kincaid's lupine or Fender's blue butterfly), or where occupied habitat may be affected, are described below. These herbicides were selected based upon their efficacy and relatively low risk to federally-listed species when applied as described. In addition to the guidelines specified for each herbicide below, the best management practices (BMPs) at the end of this section apply to all herbicide use anticipated under this SHA.

At sites supporting Fender's blue butterflies, the size of the area treated with herbicides will generally be limited to one-quarter to one-third of the occupied

habitat. Larger areas of treatment would only occur if the risk to butterflies was minimal and it was necessary to achieve the management objectives for the site. The seasonal use restrictions discussed below apply on sites where listed species and designated critical habitats are present. If neither is present, herbicide application may occur during other times of the year.

Triclopyr
Product(s): Garlon 3A® only with no surfactants
Purpose: This chemical is a systemic herbicide used to control woody and broadleaf plants (OSU 1996c). For the purposes of this SHA, it may be used to control woody species, including both native and non-native tree and shrub species (e.g., Oregon ash, Oregon white oak, English hawthorn, serviceberry, cascara, etc.) in order to maintain an early seral native prairie community (i.e., suitable habitat for the covered species).
Application methods: This chemical will be hand painted or directly wicked onto fresh cut stumps, within 24 hours of cutting. For broadleaf weed control, it will be applied primarily via spot foliar application using a hand-held wand or mounted on an all-terrain vehicle. No spraying will occur.
Surfactants: None.
Seasonal use: Application timing is limited to the summer dry period after native plants have senesced (typically August 15-October 31), and to allow for residual chemical to break down prior to fall rains.

Glyphosate
Product(s): Rodeo®, Roundup®, Aqua-Master® and Accord® with vegetative-based surfactant
Purpose: This chemical is a broad-spectrum, nonselective systemic herbicide used to control annual and perennial plants, including grasses, forbs, and woody species (OSU 1996b). For the purposes of this SHA, it will be used to control non-native and invasive grasses and forbs (e.g., reed canary grass, tall oatgrass, bull thistle, etc.).
Application methods: This chemical will primarily be applied via spot foliar application using a hand-held wand (backpack or ATV-mounted) or ATV-towed weed wipers. ATV or tractor-mounted boom sprayers will only be used in limited areas dominated by invasive plants.
Surfactants: Only vegetable oil-based surfactants will be utilized, such as Super Spread MSO (principal functioning agents: methyl soyate and nonylphenol ethoxylate blend).
Seasonal use: Application timing will be limited to February 1-August 15 for wipe-on application to allow for control of tall invasives while protecting native plants. Spray and wipe-on application will be permitted August 15-October 31, which is during the summer dry period after most native plants have senesced, and will allow for residual chemical to break down prior to fall rains.

2, 4-D Amine
Product(s): Weedar 64®) with vegetative-based surfactant

Purpose: This chemical is a systemic herbicide used to control many types of broadleaf plants (OSU 1996a). For the purposes of this SHA, it will be used to treat non-native and invasive broadleaf species (e.g., Canada thistle, tansy ragwort, etc.).
Application methods: This chemical will primarily be applied via spot foliar application using a hand-held wand (from either a backpack or ATV-mounted sprayer). ATV or tractor-mounted boom sprayers will only be used in limited areas dominated by invasive plants. Spot application may occur on cut stems utilizing mow and spray or wipe implements such as a Brown Brush Monitor.
Surfactants: Only vegetable oil-based surfactants will be utilized, such as Super Spread MSO (principal functioning agents: methyl soyate and nonylphenol ethoxylate blend).
Seasonal use: Application timing is limited to February 1–August 15 for wipe-on application to allow for control of tall invasives while protecting native plants. Spray and wipe-on application will be permitted August 15-October 31, which is during the summer dry period after most native plants have senesced, and will allow for residual chemical to break down prior to fall rains.

Clethodim
Product(s): Envoy® only with vegetative-based surfactant
Purpose: This chemical is a selective post-emergent herbicide used to control annual and perennial grasses (OSU 1996a). For the purposes of this SHA, it will be used to treat non-native and invasive grass species (e.g., tall fescue, tall oatgrass, false brome, etc.)
Application methods: This chemical will primarily be applied via spot foliar application using a hand-held wand (backpack or ATV mounted) or ATV-towed weed wiper. Limited application may occur utilizing ATV or tractor-mounted boom sprayers on limited areas dominated by invasive plants.
Surfactants: Only vegetable oil-based surfactants will be utilized, such as Super Spread MSO (principal functioning agents: methyl soyate and nonylphenol ethoxylate blend).
Seasonal use: Application timing is limited to June 1-October 25 on upland prairie sites and August 1-October 25 on wet prairie sites. Though native forbs may have not completely senesced by this time of year, they should not be affected by application of this herbicide since it is grass-specific. Applications during these periods will allow for residual chemical to break down prior to fall rains.

Sethoxydim and Fluazifop-P-butyl
Product(s): Poast® or Fusilade II with vegetative-based surfactant
Purpose: These chemicals are selective post-emergent herbicides used to control annual and perennial grasses (OSU 1996b). For the purposes of this SHA, these chemicals will be used to control non-native grasses (e.g., tall fescue, tall oatgrass, false brome, etc.)
Application methods: These chemicals will primarily be applied via spot foliar application using a hand-held wand (backpack or ATV mounted) or ATV-towed weed wipers. Limited application may occur utilizing ATV or tractor-mounted boom sprayers on limited areas dominated by invasive plants.

Surfactants: Only vegetable oil-based surfactants will be utilized, such as Super Spread MSO (principal functioning agents: methyl soyate and nonylphenol ethoxylate blend).
Seasonal use: Application timing is limited to the early season from February 15–May 15, as well as application between June 1-October 25 on upland prairie sites, and August 1-October 25 on wet prairie sites. Though native forbs may have not completely senesced by this time of year, they should not be affected by application of this herbicide since it is grass-specific. Applications during these periods will allow for residual chemical to break down prior to fall rains.

The BMPs below are designed to further reduce the risk of impacting non-target species, including Fender's blue butterfly, Kincaid's lupine and other listed plants. All applicable BMPs are to be followed whenever herbicides are used, and must be incorporated into any site-specific plan that involves the use of herbicides.

a) All manufacturer's label requirements and restrictions will be followed and recommendations will be used as appropriate (e.g., regarding application rates, use of surfactants, marking dies, foaming agents, weather conditions, personal protective equipment, etc.), while maintaining consistency with the guidelines described herein.

b) Herbicides will only be applied by licensed herbicide applicators.

c) Most activities covered under this SHA will occur on uplands, but in any case, herbicide treatments will occur at least 40 m (120 feet) away from any ephemeral or perennial watercourse where listed fish may occur unless otherwise needed to achieve project objectives.

d) Herbicide application will only occur during calm dry weather conditions to prevent drift and runoff; no spraying will occur during windy conditions (i.e., over seven miles per hour), when precipitation is occurring or has been forecasted to occur within 24 hours of application, or if an inversion is occurring.

e) Sprayers will be set to minimize drift (e.g., with low nozzle pressure, large droplet size, low nozzle height) to the extent practical and feasible.

f) Dyes may be used for herbicide applications to ensure complete and uniform treatment of invasive plants as well as to immediately indicate drift issues.

g) If Kincaid's lupine plants occur on the site, the plants must be marked in the field before senescence. Only grass-specific herbicides (i.e., clethodim and sethoxydim) may be sprayed before the Kincaid's lupine plants have completely senesced.

h) If Fender's blue butterfly occurs, or is suspected to occur, on the site, Kincaid's, spur and sickle-keeled lupine plants must be marked in the field before senescence and avoided to the extent possible. Herbicide may only be applied when the butterflies are in diapause.

i) If Nelson's checker-mallow occurs on the site, any application of triclopyr, glyphosate or 2,4-D will be by hand (e.g., with a backpack sprayer wand) and plants may be covered (e.g., with 5-gallon buckets or other suitable shielding) or otherwise protected (e.g., by clipping leaves to remove exposed green tissue) as needed to reduce the risk of herbicide affecting the plants. Any coverings used will be removed immediately after herbicide treatment.

The use of herbicides to control invasive plants and other unwanted vegetation is a management tool for restoration under this SHA. Since there are areas of scientific and management uncertainty, some future actions may require refinement or change over time as new information or data from monitoring is available. Changes in existing treatments or use of alternative techniques may be warranted to achieve conservation and recovery goals. Alternative herbicides to those above described may be used provided that they are of similar chemical composition and are likely to have similar effects to listed species. Any changes in the use of herbicides would be analyzed for impacts to listed species and critical habitat and consultation would be reinitiated as appropriate. If herbicides with entirely new chemical properties are proposed for use, an amendment to this SHA may be required.

vi. Solarization and Shade Cloth

Solarization involves the removal of heavily infested weed patches by tilling, then covering an area with plastic during the growing season. Elevated temperatures kill most of the target species. Follow-up with hand weeding may be necessary. Treated areas are typically seeded with native species. Solarization will only be implemented in habitat that is not occupied by Fender's blue butterfly, Kincaid's lupine or other listed plants.

Use of shade cloth is a technique to control monotypic weed infestations. Dark cloth is placed and fastened to the ground with stakes; the plants under the cloth die, and the cloth is subsequently removed after two years. Shade cloth will be installed during the growing season, but will not be used directly over any individuals of listed plants or within 20 m (65 feet) of Kincaid's lupine plants, to prevent inadvertent impacts to Fender's blue butterflies.

vii. Infrared Radiation

Infrared radiation is a thermal control weed management technique. Covered infrared radiators are passed over sites proposed for prairie restoration that no longer support Fender's blue butterflies, Kincaid's lupine or other listed species. The high

temperature damages the cellular structure and mostly kills weeds in early life stages (typically within several hours or few days). First signs of the effectiveness are change of leaf color and plant withering. Treated areas are typically seeded with native species. Infrared radiation treatment will only be implemented in unoccupied habitat.

C. Revegetation

Native plants may be seeded or planted to increase the cover and diversity of native vegetation on a project site, discourage potential spread and establishment of exotic and woody species and improve habitat for Fender's blue butterfly and other associated species. Adding native nectar plants to sites where native nectar plants are depauperate may be essential for successful butterfly habitat restoration (Alverson 2001 as cited in USFWS 2005a). Additionally, most of the current Fender's blue butterfly sites are isolated from one another and in order to "connect" these habitats for Fender's blue butterfly dispersal, native prairie habitat patches will need to be reestablished.

Revegetation will involve many of the treatments to remove exotic vegetation as previously described, followed by the planting of native species, including Kincaid's lupine. This work will be conducted in early spring or late winter in occupied habitat, while Fender's blue butterflies remain in diapause, and at some distance from extant Kincaid's lupine plants, where the inactive larvae may be present. Spot tilling may be used to control monotypic weed patches. Revegetation may occur on all enrolled lands each year.

Seed and plant parts from native prairie plants may be collected to create nursery stock for restoration projects, and a variety of native forbs, including nectar species for Fender's blue butterfly. If listed species occur at a site where collection of seeds or plant parts of non-listed plants is to take place, care will be taken to avoid trampling or otherwise harming listed plants.

D. Collection, storage and cultivation of Kincaid's Lupine seed and plant material

The collection of some leaves, flowers, and seeds from Kincaid's lupine plants found on the enrolled lands may be allowed to support various seed banking, propagation and scientific research efforts designed to benefit the species. Sources of plant material may need to be developed for reintroduction purposes, and for research that may be essential in identifying new management techniques and understanding existing habitat conditions. Unless and until new guidance becomes available that is likely to improve the success of propagation efforts, the protocols below will be followed.

i. <u>Plant material collection and transport</u>

Kincaid's lupine seed is contained in seed pods. Seed may be collected by gathering pods or by gathering loose seed if pods are open. Mesh bags may be tied over stems with developing fruits to capture the seeds as the fruits open. While Kincaid's lupine produces

rhizomes, propagation from root cuttings is not recommended. A limited number of leaves and flowers may be collected for research purposes.

Seed collection limits are as follows: up to 50 percent of seeds from populations of less than 50 individuals; up to 15 percent of seeds from populations of 50-500 individuals; and up to 25 percent of seeds from populations of over 500 individuals, or covering at least 60 square meters. The same limitations apply to the collection of leaves and flowers.

Before seeds are transferred to storage bags, they will be cleaned by hand or by sieve and blower. Collectors will use "breathable" containers to store and transport seed. Collectors will label all seed containers with the following information: 1) Name of plant; 2) Place of collection, and 3) Date of collection. During transport, seed will be stored in a cool, dry environment, avoiding heat (*i.e.*, trunk of car) or direct sunlight.

ii. Propagule storage

Seeds will be thoroughly dried and cleaned before long-term storage. Seeds will be stored in containers that are airtight and moisture proof to prolong their viability. To maintain dryness and deter insect predation, agents such as dry wood ash, diatomaceous earth, dry charcoal, lime, silica gel or paper may be added to storage containers. Seed material will be stored for no more than two years before cultivating or outplanting unless placed in a cold-storage facility.

iii. Propagule cultivation

Kincaid's lupine seeds will be scarified by scratching through the outside of the seed coat with a knife blade, flat metal file or sandpaper (Leininger 2001). Seed will also be cold stratified from 4 to 8 weeks at 1-8°C (35-46°F). Following scarification and cold stratification, seed will be placed at alternating temperatures such as 10°/20°C (50°F/68°F) either on germination paper or in pots with planting medium composed of standard potting mix and grown until suitable for outplanting.

Plants will be cultivated in greenhouses or nursery facilities so that individual populations are isolated in a manner that cross-pollination contamination does not occur. Mixing of genetic lines from source populations that are historically genetically isolated in the field can have deleterious effects due to out-crossing depression and could result in the loss of entire seed collection efforts, therefore mixing of genetic lines will be conducted with caution and according to a Service-approved genetic management program. Seed from field collections and their carefully maintained F1 progeny from the same population or populations from the same recovery zone may be cultivated for plant introduction activities. Under greenhouse cultivation, propagules and progeny from F1 and F2 generations may used for introduction into prairie habitat. Only the F1 generation should be used for subsequent propagation. The F2 generation propagules and plant plugs may be outplanted in the field, but further greenhouse propagation is not permitted. The F3 propagules or plant plugs will not be propagated or introduced into prairie habitat unless

genetic information suggests that negative effects of genetic drift or domestication have not occurred.

E. Reintroduction and augmentation of Kincaid's lupine

Kincaid's lupine has been extirpated from many of its historical locations, and its reestablishment and recovery may not be possible without reintroduction efforts on sites such as those enrolled under this Agreement. In addition, reintroductions or augmentation of existing lupine populations may be necessary to provide stepping-stone habitat that will provide connectivity between Fender's blue butterfly populations and new habitats that can be colonized (USFWS 2006a). Therefore, efforts may be made to reintroduce Kincaid's lupine to suitable habitats or augment existing populations on enrolled properties. Any sites used for reintroduction will be carefully selected, managed and monitored using the guidance and best management practices discussed below. Recovery plans, recovery policy, and current research findings will also be considered, as available, to provide the further direction on reintroduction efforts.

i. Seeding Kincaid's lupine

Non-native vegetation will be cleared in the immediate project area prior to seeding. Non-scarified seed may be planted after fall rains begin, generally from October to January, and scarified seed may be planted October to March. Seed will be sown at a depth of 0.25-1 cm (1/8-1/2 inches). In most instances, seed will be sown by hand. Seed may be sown with a no-till drill outside of areas where listed species occur and when soil is dry enough to support vehicle weight without soil compaction. In either case, seed will be sown in a manner that conforms to the density and spacing of the source populations, taking into consideration that significant pre-establishment mortality may occur and planting in higher densities may compensate for loss.

In order to assist with post-planting monitoring of introduction efforts, markers in the form of mapped grids, metal tags, or flags may be used to indicate locations of planted areas so they can be tracked over time. In addition, global positioning system-derived coordinates may be used to outline the areas.

ii. Planting Kincaid's lupine plugs

Plugs may be out-planted when soil is saturated by rain (i.e., generally November through April) and when the growing trends and cycles of individual plants from the greenhouse or nursery match that of plants growing in the field. Actively growing plugs should not be planted when natural plants are dormant. Habitat conditions (e.g., soil, topography, etc) should be similar to the habitat of source materials.

Plugs will be transplanted by hand into pre-excavated soil pits suitable to accommodate the plug along with soil amendments (including mix of planting and/or native soils) during fall and winter in upland prairie. No fertilizer will be used. Nitrogen-fixing *Bradyrhizobium* inoculum may be used to promote growth of root nodules. Plugs will

only be out-planted in well-restored native prairie with minimal weed densities, especially grasses and aggressive non-native plant species. Care will be taken to avoid trampling of listed species.

Planting should occur in a manner that conforms to the density and spacing of the source populations, taking into consideration that some pre-establishment mortality will occur and planting in higher densities may compensate for loss. In order to assist with post-planting monitoring of plant augmentation and reintroduction efforts, markers in the form of mapped grids, metal tags, or flags will indicate locations of planted rhizomes and plugs so they can be tracked over time.

F. Threat reduction

Land use practices and site conditions may be changed to improve conditions for the Fender's blue butterfly, Kincaid's lupine, and other associated species. For example, grazing can be destructive to Kincaid's lupine and other native plants if it removes vegetative and reproductive plant structures, or if it disturbs the substrate. Grazers can also increase the spread or introduce invasive species into habitats (USFWS 2006b). Therefore, practices such as fencing to exclude livestock from sensitive areas, or changing the seasonal usage, may be included in site-specific plans. Similarly, the use of herbicides for a Cooperator's on-going land management practices may be curtailed or eliminated near sites where listed species occur. Opportunities to include measures that reduce threats and further improve conditions for listed species will be determined on a site-specific basis using available information, including recovery plans. A detailed account of the threats to existing populations of Kincaid's lupine was provided in the Recovery Outline for *Lupinus sulphureus* spp. *kincaidii* (USFWS 2006b), and has been updated in a draft Recovery Plan that includes Kincaid's lupine (USFWS 2008a).

II. STATUS OF THE SPECIES AND DESIGNATED CRITICAL HABITAT

Prairie restoration activities under the SHA program may occur on non-federal lands within Benton, Lane, Linn, Marion, Polk and Yamhill Counties of the Willamette Valley, Oregon. This area coincides with the entire range of Fender's blue butterfly. The Willamette daisy occurs exclusively in these counties as well. The majority of the range for Kincaid's lupine, Bradshaw's lomatium and Nelson's checker-mallow occurs within the area covered by this program, although these species occur in other Oregon counties and in southwestern Washington as well. Therefore, this section covers the status of each species across all or most of its range.

A. Fender's blue butterfly (*Icaricia icarioides fenderi*)

Listing Status, Critical Habitat and Recovery Plan

Fender's blue butterfly was listed as endangered, without critical habitat, on January 25, 2000 (USFWS 2000). A draft Recovery Plan that includes this species (Draft Recovery Plan for the Prairie Species of Western Oregon and Southwestern Washington) was published in August of 2008 (USFWS 2008a).

Critical habitat for the Fender's blue butterfly was designated on October 6, 2006 (USFWS 2006a). Critical habitat units have been designated in Benton, Lane, Polk and Yamhill Counties, Oregon.

The primary constituent elements of critical habitat for the Fender's blue butterfly are the habitat components that provide: (1) early seral upland prairie or oak savanna habitat with undisturbed subsoils that provides a mosaic of low growing grasses and forbs, and an absence of dense canopy vegetation allowing access to sunlight needed to seek nectar and search for mates; (2) larval host-plants: *Lupinus sulphureus* ssp. *kincaidii* (Kincaid's lupine), *L. arbustus* (longspur lupine), or *L. albicaulis* (sickle-keeled lupine); (3) adult nectar sources, such as: *Allium acuminatum* (tapertip onion), *Allium amplectens* (narrow-leaved onion), *Calochortus tolmiei* (Tolmie's mariposa lily), *Camassia quamash* (common camas), *Cryptantha intermedia* (clearwater cryptantha), *Eriophyllum lanatum* (common woolly sunflower), *Geranium oreganum* (Oregon geranium), *Iris tenax* (Oregon iris), *Linum angustifolium* (pale flax), *Linum perenne* (blue flax), *Sidalcea campestris* (meadow checker-mallow), *Sidalcea malviflora* ssp. *virgata* (rose checker-mallow), *Vicia cracca* (bird vetch), *V. sativa* (common vetch) and *V. hirsute* (tiny vetch); and (4) stepping stone habitat: undeveloped open areas with the physical characteristics appropriate for supporting the short-stature prairie, oak savanna plant community (well drained soils), within and between natal lupine patches (about 2 km [1.2 miles]), necessary for dispersal, connectivity, population growth, and, ultimately, viability. Critical habitat does not include human-made structures existing on the effective date of the rule and not containing one or more of the primary constituent elements, such as buildings, aqueducts, airports, and roads, and the land on which such structures are located.

Population Trends and Distribution

The historic distribution of Fender's blue butterfly is not precisely known due to the limited information collected on this species prior to its description in 1931. Although the type specimen for this butterfly was collected in 1929, few collections were made between the time of the subspecies' discovery and Macy's last observation of the Fender's blue on May 23, 1937, in Benton County, Oregon (Hammond and Wilson 1992). Uncertainty regarding the butterfly's host plant caused researchers to focus their survey efforts on common lupine species known to occur in the vicinity of Macy's collections. Fifty years passed before the butterfly was found again.

Fender's blue butterfly was rediscovered in 1989 at the McDonald Research Forest, Benton County, Oregon; it was found to be associated primarily with *Lupinus sulphureus* ssp. *kincaidii*, a rare lupine, and occasionally *L. arbustus* or *L. albicaulis* (Hammond and Wilson 1993). Recent surveys have determined that Fender's blue butterfly is endemic to the Willamette Valley and persists at about 30 sites on remnant prairies in Yamhill, Polk, Benton, and Lane counties (Hammond and Wilson 1993, Schultz 1996, Schultz *et al.* 2003, U.S. Fish and Wildlife Service unpublished data). Fender's blue butterfly populations occur on upland prairies characterized by native bunch grasses (*Festuca* spp.) The association of Fender's blue butterfly with upland prairie is mostly a result of its dependence on *Lupinus sulphureus* ssp. *kincaidii*, although Fender's blue butterfly often uses wet prairies for nectaring and dispersal habitat. Sites occupied by Fender's blue butterfly are predominantly

located on the western side of the Willamette Valley, within 33 km (21 miles) of the Willamette River. A recent synthesis of existing data found the current rangewide number of butterflies to be about 3,000 to 5,000 individuals (Schultz *et al*. 2003). Fewer than ten sites with populations of 100 adult butterflies or more are known. On 30 sites surveyed for Fender's blue butterfly on non-federal lands between 2000 and 2007, the average estimated number of butterflies per site, averaged across years, was 144. The median number of butterflies (averaged across sites and years) was 51, with a low of 2 and a high of 1040 (U.S. Fish and Wildlife Service, unpublished data).

Life History and Ecology

Adult Fender's blue butterflies live approximately 10 to 15 days and apparently rarely travel farther than 2 km (1.2 miles) over their entire life span (Schultz 1998). Although only limited observations have been made of the early life stages of Fender's blue butterfly, the life cycle of the species likely is similar to other subspecies of *Icaricia icarioides* (Hammond and Wilson 1993). The life cycle of Fender's blue butterfly may be completed in one year. An adult Fender's blue butterfly may lay approximately 350 eggs over her 10 to 15-day lifespan, of which perhaps fewer than two will survive to adulthood (Schultz 1998, Schultz *et al*. 2003). Females lay their eggs on perennial lupines (*Lupinus sulphureus* ssp. *kincaidii*, *L. arbustus* or occasionally *L. albicaulis*), which are the larval food plants during May and June (Ballmer and Pratt 1988). Newly hatched larvae feed for a short time, reaching their second instar in the early summer, at which point they enter an extended diapause. When the lupine plant senesces, diapausing larvae remain in the leaf litter at or near the base of the host plant through the fall and winter. Larvae become active again in March or April of the following year, although some larvae may be able to extend diapause for more than one season depending upon the individual and environmental conditions. Once diapause is broken, the larvae feed and grow through three to four additional instars, enter their pupal stage, and, after about two weeks, emerge as adult butterflies in May and June (Schultz *et al.* 2003).

Fender's blue butterflies have limited dispersal ability. Adult butterflies may remain within 2 km (1.2 miles) of their natal lupine patch (Schultz 1998), although anecdotal evidence exists of adult Fender's blues dispersing as far as 5 to 6 km (3.1 to 3.7 miles) (Hammond and Wilson 1992, Schultz 1998); dispersal of this magnitude is not likely anymore because of habitat fragmentation. At large patches like the main area at Willow Creek in Lane County, 95 percent of adult Fender's blue butterflies are found within 10 m (33 feet) of lupine patches (Schultz 1998).

Habitat Characteristics

Habitat requirements for Fender's blue butterfly include lupine host plants (*Lupinus sulphureus* ssp. *kincaidii* or *L. arbustus*, and occasionally *L. albicaulis*) for larval food and oviposition sites and native wildflowers for adult nectar food sources. Nectar sources used most frequently include *Allium amplectens*, *Calochortus tolmiei*, *Sidalcea malviflora* ssp. *virgata*, *Eriophyllum lanatum* and *Geranium oreganum* (Wilson *et al.* 1997, York 2002, Schultz *et al.* 2003). Non-native vetches (*Vicia sativa* and *V. hirsuta*) are also frequently used as nectar sources, although they are inferior to the native nectar sources (Schultz *et al.* 2003). Population size of Fender's blue butterfly has been found to correlate directly with the abundance of native nectar sources (Schultz *et al.* 2003). At least 5 ha (12 acres) of high

quality habitat are necessary to support a population of Fender's blue butterflies (Crone and Schultz 2003, Schultz and Hammond 2003); most prairies in the region are degraded and of low quality, and thus a much larger area is likely required to support a viable butterfly population.

Lupinus sulphureus ssp. *kincaidii* is the preferred larval host plant at most known Fender's blue butterfly populations. At two sites, Coburg Ridge and Baskett Butte, Fender's blue butterfly feeds primarily on *Lupinus arbustus*, even though *Lupinus sulphureus* ssp. *kincaidii* is present (Schultz *et al.* 2003). A third lupine, *Lupinus albicaulis*, is used by Fender's blue butterfly where it occurs in poorer quality habitats (Schultz *et al.* 2003). It is interesting to note that Fender's blue butterfly has not been found to use *Lupinus latifolius* (broadleaf lupine), a plant commonly eaten by other subspecies of *Icaricia icarioides*, even though it occurs in habitats occupied by the butterfly (Schultz *et al.* 2003).

Reasons for Listing

Habitat loss, encroachment into prairie habitats by shrubs and trees due to fire suppression, fragmentation, invasion by non-native plants and elimination of natural disturbance regimes all threaten the survival of Fender's blue butterfly. Few populations occur on protected lands; most occur on private lands which are not managed to maintain native prairie habitats. These populations are at high risk of loss to development or continuing habitat degradation (USFWS 2000).

The prairies of western Oregon and southwestern Washington have been overtaken by non-native plants, which shade out or crowd out important native species. Fast growing non-native shrubs (*Rubus armeniacus* [Armenian blackberry] and *Cytisus scoparius* [Scotch broom]), non-native grasses such as *Arrhenatherum elatius* (tall oatgrass), and non-native forbs, such as *Centaurea* x *pratensis* (meadow knapweed), can virtually take over the prairies, inhibiting the growth of the lupine larval host plants and native nectar sources (Hammond 1996, Schultz *et al.* 2003). When these highly invasive non-native plants become dominant, they can effectively preclude butterflies from using the native plant species they need to survive and reproduce (Hammond 1996). In the absence of a regular disturbance regime, native trees and shrubs also threaten to overtake prairie habitats; common native species found to encroach on undisturbed prairies include *Pseudotsuga menziesii* (Douglas-fir), *Quercus garryana* (Oregon white oak), *Fraxinus latifolia* (Oregon ash), *Crataegus douglasii* (Douglas' hawthorn) and *Toxicodendron diversilobum* (poison oak).

Habitat fragmentation has isolated the remaining populations of Fender's blue butterfly to such an extent that butterfly movement among suitable habitat patches may now occur only rarely, which is not expected to maintain the population over time (Schultz 1998). The rarity of host lupine patches and fragmentation of habitat are seen today as the major ecological factors limiting reproduction, dispersal, and subsequent colonization of new habitat (Hammond and Wilson 1992, 1993, Hammond 1994, Schultz 1997, Schultz and Dlugosch 1999). Extirpation of remaining small populations is expected from localized events and probable low genetic diversity associated with small populations (Schultz and Hammond 2003).

Recent population viability analyses have determined that the Fender's blue butterfly is at high risk of extinction throughout most of its range (Schultz and Hammond 2003). Even the largest populations have a poor chance of survival over the next 100 years (Schultz *et al.* 2003).

Conservation Measures

Biologists from Federal and state agencies and private conservation organizations are engaged in active research and monitoring programs to improve the status of Fender's blue butterfly. Recent research has focused on population viability analyses (Schultz and Hammond 2003), metapopulation dynamics and the effects of habitat fragmentation (Schultz 1998), population response to habitat restoration (Wilson and Clark 1997, Kaye and Cramer 2003, Schultz *et al.* 2003), and developing protocols for captive rearing (Shepherdson and Schultz 2004).

Recent studies have shown that Fender's blue butterfly populations respond positively to habitat restoration. Mowing, burning and mechanical removal of weeds have all resulted in increasing Fender's blue butterfly populations. At two sites in the West Eugene Wetlands (The Nature Conservancy's Willow Creek Natural Area and the Bureau of Land Management's Fir Butte site), both adults and larval Fender's blue butterflies have increased in number following mowing to reduce the stature of herbaceous non-native vegetation, although the response to habitat restoration is often complicated by other confounding factors, such as weather fluctuations (Schultz and Dlugosch 1999, Fitzpatrick 2005, Kaye and Benfield 2005a). Wilson and Clark (1997) conducted a study on the effects of fire and mowing on Fender's blue butterfly and its native upland prairie at Baskett Slough National Wildlife Refuge in the Willamette Valley. Although fire killed all larvae in burned patches, female Fender's blue butterflies from the nearby unburned source patch were able to colonize the entire burned area, including lupine patches that were 107 m (350 feet) from the unburned source plants. They found that Fender's blue butterfly eggs were 10 to 14 times more abundant in plots that were mowed or burned compared to undisturbed, control plots. Woody plants were reduced 45 percent with burning and 66 percent with mowing.

Fender's blue butterfly population trends have been correlated with lupine vigor; high leaf growth appears to produce larger butterfly populations. At the U.S. Army Corps of Engineers' Fern Ridge Reservoir, the Fender's blue butterfly population has increased dramatically since fall mowing of lupine patches has been implemented. The abundance of Fender's blue butterfly eggs was found to be correlated with the abundance of Kincaid's lupine leaves at a number of study sites (Kaye and Cramer 2003); egg abundance increased substantially at sites which had been treated to control non-native weeds (Schultz *et al.* 2003).

Fender's blue butterfly populations occur on public lands or lands that are managed by a conservation organization at the U.S. Fish and Wildlife Service's Baskett Slough National Wildlife Refuge, the Army Corps of Engineers' Fern Ridge Reservoir, the Bureau of Land Management's West Eugene Wetlands, The Nature Conservancy's Willow Creek Preserve and Coburg Ridge easement, and on a small portion of Oregon State University's Butterfly Meadows in the McDonald State Forest. All of these parcels have some level of

management for native prairie habitat values. The U.S. Fish and Wildlife Service's Partners for Fish and Wildlife Program works with private landowners to restore wildlife habitats; native prairie restoration and Fender's blue butterfly recovery are key focus areas of the program in the Willamette Valley.

B. Willamette daisy (*Erigeron decumbens* var. *decumbens*)

Listing Status, Critical Habitat and Recovery Plan

Willamette daisy was listed as endangered, without critical habitat, on January 25, 2000 (USFWS 2000). A draft Recovery Plan that includes this species (Draft Recovery Plan for the Prairie Species of Western Oregon and Southwestern Washington) was published in August of 2008 (USFWS 2008a).

Critical habitat was designated on October 6, 2006 (USFWS 2006a). Critical habitat units for Willamette daisy have been designated in Benton, Lane, Linn, Marion and Polk Counties, Oregon. The primary constituent elements of critical habitat are the habitat components that provide early seral upland prairie or oak savanna habitat with a mosaic of low growing grasses, forbs, and spaces to establish seedlings or new vegetative growth, with an absence of dense canopy vegetation providing sunlight for individual and population growth and reproduction, and with undisturbed subsoils and proper moisture and protection from competitive invasive species. Critical habitat does not include human-made structures existing on the effective date of the rule and not containing one or more of the primary constituent elements, such as buildings, aqueducts, airports, and roads, and the land on which such structures are located.

Population Trends and Distribution

Willamette daisy is endemic to the Willamette Valley of western Oregon. Herbarium specimens show a historical distribution of Willamette daisy throughout the Willamette Valley; frequent collections were made in the period between 1881 and 1934, yet no collections or observations were recorded from 1934 to 1980, and the plant was presumed to be extinct (Clark *et al.* 1993, Gisler 2004). The species was rediscovered in 1980 in Lane County, Oregon, and has since been identified at more than 30 sites. Willamette daisy has been collected in Benton, Clackamas, Lane, Linn, Marion, Polk, Yamhill, and Washington Counties, Oregon, but today the species occurs in Benton, Lane, Linn, Marion, and Polk Counties, Oregon; at those sites, there are about 116 ha (286 acres) of occupied habitat.

Population size may fluctuate substantially from year to year. Monitoring at the Oxbow West site, near Eugene, found 2,299 Willamette daisy plants in 1999, 2,912 plants in 2000, and only 1,079 plants in 2001 (Kaye 2002). The population at Baskett Butte declined to 48 percent of the original measured population between 1993 and 1999 (Clark 2000, Ingersoll *et al.* 1993, 1995). Detecting trends in Willamette daisy populations is complicated by the biology and phenology of the species. For instance, Kagan and Yamamoto (1987) found it difficult to determine survival and mortality between years because of sporadic flowering from year to year. They suggested that some plants may not flower in some years, as indicated by the sudden appearance of large plants where they were not previously recorded, and the disappearance and later re-emergence of large plants within monitoring plots. In

addition, Clark *et al.* (1993) stated that non-reproductive individuals can be very difficult to find and monitor due to their inconspicuous nature, and that the definition of individuals can be complicated when flowering clumps overlap.

Life History and Ecology

Willamette daisy is an herbaceous perennial that occurs as single plants or clumps of genetically identical ramets (Clark *et al.* 1993). It blooms in June and early July and produces seeds in late summer (Cronquist 1955). Seedlings emerge in late winter or early spring, and plants require two to four years in the wild to reach flowering size. Large plants appear to spread vegetatively, but this spread is localized around the established plant (Clark *et al.* 1995). Field investigators have developed a distance-based rule for consistently differentiating closely-spaced plants. If it is unclear that two adjacent clumps are united underground, they are assumed to be distinct individuals if they are separated by 7 cm (3 inches) or more. Clumps closer than 7 cm (3 inches) are assumed to be part of the same plant (Kaye and Benfield 2005b).

The fruits of Willamette daisy are single-seeded achenes, like those of other *Erigeron* species, and have a number of small capillary bristles (the pappus) attached to the top, which allow them to be distributed by the wind. Population size can substantially affect reproductive success in this species. Populations of Willamette daisy with fewer than 20 individuals appear to suffer a high rate of reproductive failure due to inbreeding depression and reduced probability of being pollinated by a compatible mate (Wise and Kaye 2006).

A variety of insects have been observed to visit the flowers of Willamette daisy; potential pollinators include solitary bees (*Ceratina* sp., *Megachile* sp., *Nomada* sp., *Halictus ligatus*, and *Ashmeadiella* sp.), beetles (*Meligethes nigrescens* and *Acanthoscelides pauperculus*), flies (*Toxomerus marginata*, *T. occidentalis* and *Tachina* sp.), and butterflies (*Phyciodes campestris*) (Kagan and Yamamoto 1987, Clark *et al.* 1993, Jackson 1996, Gisler 2004).

Habitat Characteristics

Willamette daisy typically occurs where woody cover is nearly absent and where herbaceous vegetation is low in stature (Clark *et al.* 1993). It occurs in both wet prairie grasslands and drier upland prairie sites. The wet prairie grassland community is typically dominated by *Deschampsia cespitosa* (tufted hairgrass), *Danthonia californica* (California oatgrass) and a number of Willamette Valley endemic forbs. It is a flat, open, seasonally wet prairie with bare soil between the pedestals created by the bunching *Deschampsia cespitosa* (Kagan and Yamamoto 1987). On drier upland prairie sites, associated species commonly include *Aster hallii*, *Festuca idahoensis* ssp. *roemeri* (Roemer's bunchgrass) and *Toxicodendron diversilobum* (Meinke 1982, Clark *et al.* 1993). Willamette daisy prefers heavier soils, and has been found on the following soil associations: Bashaw, Briedwell, Chehulpum, Dayton, Dixonville, Dupee, Hazelair, Marcola, Natroy, Nekia, Pengra, Philomath, Salkum, Saturn, Stayton, and Witzel.

Reasons for Listing

Like many native species endemic to Willamette Valley prairies, Willamette daisy is threatened by habitat loss due to urban and agricultural development, successional

encroachment into its habitat by trees and shrubs, competition with non-native weeds, and small population sizes (Kagan and Yamamoto 1987, Clark *et al.* 1993, Gisler 2004). The U.S. Fish and Wildlife Service (2000a) estimated that habitat loss is occurring at 80 percent of the remaining 84 remnants of native prairies occupied by Willamette daisy and *Lupinus sulphureu*s ssp. *kincaidii*. At the time of its listing, we estimated that 24 of the 28 extant Willamette daisy populations occurred on private lands and, "without further action, are expected to be lost in the near future" (USFWS 2000).

Populations occurring on private lands are the most vulnerable to threats of development, because state and Federal plant protection laws have little effect on private lands, although publicly owned populations are not immune from other important limitations or threats to the species. For instance, Clark *et al.* (1993) identified four populations protected from development on public lands (Willow Creek, Basket Slough National Wildlife Refuge, Bald Hill Park, and Fisher Butte Research Natural Area), but stated that even these appear to be threatened by the proliferation of non-native weeds and successional encroachment of brush and trees. Likewise, vulnerability arising from small population sizes and inbreeding depression may be a concern for the species, regardless of land ownership, especially among 17 of the 28 remaining sites that are smaller than 3.5 ha (8 acres) (USFWS 2000). Given that the majority of populations are on private lands, working with private landowners is critical if we are to promote the eventual conservation and recovery of Willamette daisy.

Conservation Measures

Some research has been conducted on the ecology and population biology of Willamette daisy, effective methods for habitat enhancement, and propagation and reintroduction techniques (Ingersoll *et al.* 1993, 1995, Clark *et al.* 1995, 1997, Wilson and Clark 1997, Kaye and Kuykendall 2001b, Leininger 2001, Kaye *et al.* 2003b). The results of these studies have been used to direct the management of Willamette daisy populations at sites that are managed for native prairie values.

The efficacy of mowing and burning as tools to restore habitat for Willamette daisy is under investigation. Preliminary findings indicate that Willamette daisy responded with increased crown cover in mowed plots as compared to unmowed plots; this study is continuing and will also evaluate the effects of fire on Willamette daisy (Kaye *et al*. 2003b).

Several studies have investigated the feasibility of growing Willamette daisy in controlled environments for augmentation of wild populations. Cold stratification or seed-coat scarification is necessary for successful germination (Clark *et al.* 1995, Kaye and Kuykendall 2001b). Stem and rhizome cuttings have also been used successfully to establish plants in the greenhouse (Clark *et al.* 1995, Wilson *et al.* 2001). Attempts to establish Willamette daisy at new sites has shown that transplanting cultivated plants is much more effective than sowing seeds directly (Kaye *et al.* 2003a). It is likely that conservation of Willamette daisy may require augmenting small populations with propagated individuals (Clark *et al*. 1995). Seeds of this species have been banked at the Berry Botanic Garden in Portland, Oregon (Berry Botanic Garden 2005).

Habitat for Willamette daisy occurs on public lands or lands that are managed by a conservation organization at the U.S. Fish and Wildlife Service's Baskett Slough National Wildlife Refuge, the U.S. Army Corps of Engineers' Fern Ridge Reservoir, the Bureau of Land Management's West Eugene Wetlands, and The Nature Conservancy's Willow Creek Preserve. All of these parcels have some level of management for native prairie habitat values. The U.S. Fish and Wildlife Service's Partners for Fish and Wildlife Program works with private landowners to restore wildlife habitats; native prairie restoration is a key focus area of the program in the Willamette Valley.

C. Bradshaw's lomatium (*Lomatium bradshawii*)

Listing Status, Critical Habitat and Recovery Plan

Bradshaw's lomatium (also known as Bradshaw's desert-parsley) was listed as endangered, without critical habitat, on September 30, 1988 (USFWS 1988). A draft Recovery Plan that includes this species (Draft Recovery Plan for the Prairie Species of Western Oregon and Southwestern Washington) was published in August of 2008 (USFWS 2008a).

Population Trends and Distribution

Bradshaw's lomatium was historically overlooked and poorly documented, and there were no known collections between 1941 and 1969, leading to the assumption that the taxon might be extinct. By 1980, following a study of the species, six populations of the species had been located, including one large population (Kagan 1980). Since 1980, over 40 new sites have been discovered, including three large populations.

For many years Bradshaw's lomatium was considered an Oregon endemic, its range limited to the area between Salem and Creswell, Oregon (Kagan 1980). However, in 1994, two populations of the species were discovered in Clark County, Washington. There are currently about 38 occurrences of Bradshaw's lomatium in three populations centers located in Benton, Lane, Linn, and Marion Counties, Oregon (Gisler 2004, Oregon Natural Heritage Information Center 2004). Most of these populations are small, ranging from about 10 to 1,000 individuals, although the two largest sites each have over 100,000 plants.

Some populations that were large when discovered have since declined in size substantially. A large population at Buford Park near Eugene, Oregon, dropped from about 23,000 plants in 1993 to just over 3,000 plants in 1994 (Greenlee and Kaye 1995), and continued to decline to less than 1,000 plants in 1999. Herbivory by a booming vole population was the suspected to be the cause of the decline. The Washington populations, though fewer in number, are larger in population size, with one site estimated to have over 800,000 individuals (U.S. Fish and Wildlife Service unpublished data).

Life History and Ecology

Bradshaw's lomatium blooms in the spring, usually in April and early May. The flowers have a spatial and temporal separation of sexual phases, presumably to promote outcrossing, resulting in protandry on a whole plant basis, and protogyny within the flowers. A typical population is composed of many more vegetative plants than reproductive plants. The plant is pollinated by insects. Over 30 species of solitary bees, flies, wasps and beetles have been

observed visiting the flowers (Kaye and Kirkland 1994, Jackson 1996). The very general nature of the insect pollinators probably buffers Bradshaw's lomatium from the population swings of any one pollinator (Kaye 1992).

Bradshaw's lomatium does not spread vegetatively and depends exclusively on seeds for reproduction (Kaye 1992). The large fruits have corky thickened wings, and usually fall to the ground fairly close to the parent. Fruits appear to float somewhat, and may be distributed by water. The fine-scale population patterns at a given site appear to follow seasonal, microchannels in the tufted hairgrass prairies, but whether this is due to dispersal, habitat preference, or both, is not clear (Kaye 1992, Kaye and Kirkland 1994).

In a genetic study that included six populations of Bradshaw's lomatium, the species displayed little population differentiation but the level of diversity was high across the species (Gitzendanner 2000). Isolated populations in Washington appear to have lower levels of diversity, but they do not appear to be genetically differentiated from the other populations of the species, consistent with historical gene flow among all populations, and a recent bottleneck in the Washington populations.

The species generally responds positively to disturbance. Low intensity fire appears to stimulate population growth of Bradshaw's lomatium. The density and abundance of reproductive plants increased following fires (Kaye and Pendergrass 1998, Pendergrass *et al.* 1999), although monitoring showed the effects to be temporary, dissipating after one to three years. Frequent burns may be required to sustain population growth, as determined from population models (Caswell and Kaye 2001, Kaye *et al.* 2001).

Habitat Characteristics

Bradshaw's lomatium is restricted to wet prairie habitats. These sites have heavy, sticky clay soils or a dense clay layer below the surface that results in seasonal hydric soils. Most of the known Bradshaw's lomatium populations occur on seasonally saturated or flooded prairies, which are found near creeks and small rivers in the southern Willamette Valley (Kagan 1980). The soils at these sites are dense, heavy clays with a slowly permeable clay layer located between 15 and 30 cm (6 and 12 inches) below the surface. This slowly permeable clay layer, which results in a perched water table in winter and spring, allows soils to be saturated to the surface or slightly inundated during the wet season. The soils include Dayton silt loams, Natroy silty clay loams or Bashaw clays; other soils on which the species has been found include Amity, Awbrig , Coburg, Conser, Courtney, Cove, Hazelair, Linslaw, Oxley, Panther, Pengra, Salem, Willamette, and Witzel.

Less frequently, Bradshaw's lomatium populations are found on shallow, basalt areas in Marion and Linn County near the Santiam River. The soil type is characterized as Stayton Silt Loam; it is described as well drained, in alluvium underlain by basalt (Kaye and Kirkland 1994). The shallow depth to bedrock, 50 cm (20 inches) or less, results in sites which are poorly suited to agriculture. This soil type occurs at scattered locations in sites with deeper soils belonging to the Nekia-Jory association, which were originally vegetated by grassland and oak savanna (Alverson 1990). Bradshaw's lomatium at these sites occurs in areas with very shallow soil, usually in vernal wetlands or along stream channels.

Bradshaw's lomatium is often associated with *Deschampsia cespitosa*, and frequently occurs on and around the small mounds created by senescent *Deschampsia cespitosa* plants. In wetter areas, Bradshaw's lomatium occurs on the edges of *Deschampsia cespitosa* or sedge bunches in patches of bare or open soil. In drier areas, it is found in low areas, such as small depressions, trails or seasonal channels, with open, exposed soils. The grassland habitat of Bradshaw's lomatium frequently includes these species: *Carex* spp., *Danthonia californica*, *Eryngium petiolatum* (coyote-thistle), *Galium cymosum* (bedstraw), *Grindelia integrifolia* (Willamette Valley gumweed), *Hordeum brachyantherum* (meadow barley), *Juncus* spp., *Luzula campestris* (field woodrush), *Microseris laciniata* (cut-leaved microseris), and *Perideridia* sp. (yampah) (Siddall and Chambers 1978, Kagan 1980). In most sites, introduced pasture grasses (*Anthoxanthum odoratum* [sweet vernal grass], *Holcus lanatus* [velvet grass], *Poa pratensis* [Kentucky bluegrass], *Agrostis capillaries* [colonial bentgrass], *Dactylis glomerata* [orchard-grass]and *Festuca arundinacea* [tall fescue]) are present.

Reasons for Listing

Expanding urban development, pesticides, encroachment of woody and invasive species, herbivory and grazing are threats to remaining Bradshaw's lomatium populations (USFWS 1988). The majority of Oregon's Bradshaw's lomatium populations are located within a 16-km (10-mile) radius of Eugene. The continued expansion of this city is a potential threat to the future of these sites. Even when the sites themselves are protected, the resultant changes in hydrology caused by surrounding development can alter the species' habitat (Meinke 1982, Gisler 2004). The majority of sites from which herbarium specimens have been collected are within areas of Salem or Eugene which have been developed for housing and agriculture (Siddall and Chambers 1978). The populations in Washington occur on private lands and are not protected (Gisler 2004).

Populations occurring on roadsides are at risk from maintenance activities, and from adverse effects of management on adjacent lands. Pesticide use on agricultural fields and herbicide application adjacent to roads may harm Bradshaw's lomatium populations across its range. There is concern that pesticides kill the pollinators necessary for plant reproduction; Bradshaw's lomatium does not form a seed bank, therefore, any loss of pollinators (and subsequent lack of successful reproduction) could have an immediate effect on population numbers (Kaye and Kirkland 1994). Herbicides may drift, and even when Bradshaw's lomatium is not the target, applications near a population may damage or kill the plants outright. For example, an herbicide application on private land adjacent to the William L. Finley National Wildlife Refuge drifted onto the refuge and damaged or killed Bradshaw's lomatium plants in 2006 (Jock Beall, U.S. Fish and Wildlife Service, Corvallis, Oregon, pers. comm., 2008).

One of the most significant threats is the continued encroachment into prairie habitats by woody vegetation. Historically, Willamette Valley prairies were periodically burned, either by wildfires or by fires set by Native Americans (Johannessen *et al.* 1971). Since Euro-American settlers arrived, fire suppression has allowed shrubs and trees to invade grassland habitat, which ultimately will replace the open prairies with woody plant communities.

Conservation Measures

Extensive research has been conducted on the ecology and population biology of Bradshaw's lomatium, effective methods for habitat enhancement, and propagation and reintroduction techniques (Kagan 1980, Kaye 1992, Kaye and Kirkland 1994, Kaye and Meinke 1996, Caswell and Kaye 2001, Kaye and Kuykendall 2001b, Kaye *et al.* 2003a). The results of these studies have been used to direct the management of the species at sites managed for wet prairies.

Propagation studies have found that long-term (8 weeks) cold stratification was necessary to fully break dormancy in this species (Kaye *et al.* 2003a). Bradshaw's lomatium plants can be grown from seed in a greenhouse environment (Kaye *et al.* 2003a). Plants may be successfully established at existing populations or new locations through out-planting of greenhouse-grown plants. Fertilizing transplants may have a negative effect on survival in some cases. Direct seeding has a relatively high success rate (17 to 38 percent), and is improved by removal of competing vegetation (Kaye and Kuykendall 2001b, Kaye *et al.* 2003a). Seeds of this species have been banked at the Berry Botanic Garden in Portland, Oregon (Berry Botanic Garden 2005) and the University of Washington Botanic Garden.

Studies of the effects of cattle grazing on Bradshaw's lomatium populations show mixed results. Grazing in the springtime, when the plants are growing and reproducing, can harm the plants by biomass removal, trampling and soil disturbance; however, late-season livestock grazing, after fruit maturation, has been observed to lead to an increase in emergence of new plants, and the density of plants with multiple umbels, although it did not alter survival rates or population structure (Drew 2000). Observed increases in seedlings may be due to small disturbances in the soil, a reduction of shading by nearby plants, and reduced herbivory by small mammals.

Populations of Bradshaw's lomatium occur on public lands or lands that are managed by a conservation organization at the U.S. Fish and Wildlife Service's William L. Finley and Oak Creek units of the Willamette Valley National Wildlife Refuge Complex, the U.S. Army Corps of Engineers at Fern Ridge Reservoir, the Bureau of Land Management at the West Eugene Wetlands, The Nature Conservancy at Willow Creek Natural Area and Kingston Prairie Preserve, and Lane County at Howard Buford Recreation Area. All of these parcels have some level of management for native prairie habitat values. The U.S. Fish and Wildlife Service's Partners for Fish and Wildlife Program works with private landowners to restore wildlife habitats; native prairie restoration is a key focus area of the program in the Willamette Valley.

D. Kincaid's lupine (*Lupinus sulphureus* ssp. *kincaidii*)

Listing Status, Critical Habitat and Recovery Plan

Kincaid's lupine was listed as threatened, without critical habitat, on January 25, 2000 (USFWS 2000). A recovery outline for the species was published in 2006 (USFWS 2006b), and a draft Recovery Plan that includes this species (Draft Recovery Plan for the Prairie Species of Western Oregon and Southwestern Washington) was published in August of 2008 (USFWS 2008a).

Critical habitat was designated on October 6, 2006 (USFWS 2006a). Critical habitat units for Kincaid's lupine have been designated in Benton, Lane, Polk and Yamhill Counties, Oregon, and Lewis County, Washington. The primary constituent elements of critical habitat are the habitat components that provide: (1) early seral upland prairie or oak savanna habitat with a mosaic of low growing grasses, forbs, and spaces to establish seedlings or new vegetative growth, with an absence of dense canopy vegetation providing sunlight for individual and population growth and reproduction, and with undisturbed subsoils and proper moisture and protection from competitive invasive species; and (2) the presence of insect pollinators, such as bumblebees (*Bombus mixtus* and *B. californicus*), with unrestricted movement between existing lupine patches, critical for successful lupine reproduction. Critical habitat does not include human-made structures existing on the effective date of the rule and not containing one or more of the primary constituent elements, such as buildings, aqueducts, airports, and roads, and the land on which such structures are located.

Population Trends and Distribution

Kincaid's lupine is found in dry upland prairies from Lewis County, Washington, in the north, south to the foothills of Douglas County, Oregon; however, most of the known and historical populations are found in the Willamette Valley. Historically, the species was documented from Vancouver Island, British Columbia, Canada (Dunn and Gillet 1966), but has not been located in that region since the 1920s (Kaye 2000). Kincaid's lupine is currently known at about 57 sites, comprising about 160 ha (395 acres) of total coverage (Kaye and Kuykendall 1993, Wilson *et al.* 2003). Until the summer of 2004, Kincaid's lupine was known from just two extant populations in Washington, in the Boistfort Valley in Lewis County, more than 160 km (100 miles) from the nearest population in the Willamette Valley. In 2004, two small populations were found at Drew's Prairie and Lacamas Prairie to the east of the Boistfort Valley in Lewis County; only one plant was observed at Drew's Prairie, and more than 40 plants were found at Lacamas Prairie (Caplow and Miller 2004, Ted Thomas, U.S. Fish and Wildlife Service, Lacey, Washington, pers. comm., 2006). Before Euro-American settlement of the region, Kincaid's lupine was likely well distributed throughout the prairies of western Oregon and southwestern Washington; today, habitat fragmentation has resulted in existing populations that are widely separated by expanses of unsuitable habitat.

Monitoring the size of Kincaid's lupine populations is challenging because its pattern of vegetative growth renders it difficult to distinguish individuals (Wilson *et al.* 2003). Instead of counting plants, most monitoring for this species relies on counting the number of leaves per unit area, partly because there is a strong correlation between Fender's blue butterfly egg numbers and lupine leaf density (Schultz 1998, Kaye and Thorpe 2006). Leaf counts are time consuming, however, and recent evaluations have shown that lupine cover estimates are highly correlated with leaf counts, much faster to perform, and useful for detecting population trends (Kaye and Benfield 2005a).

Life History and Ecology

Flowering begins in April and extends through June. As the summer dry season arrives, Kincaid's lupine becomes dormant, and is completely senescent by mid-August (Wilson *et*

al. 2003). Pollination is largely accomplished by small native bumblebees (*Bombus mixtus* and *B. californicus*), solitary bees (*Osmia lignaria*, *Anthophora furcata*, *Habropoda* sp., *Andrena* spp., *Dialictus* sp.) and occasionally, European honey bees (*Apis mellifera*) (Wilson *et al.* 2003). Insect pollination appears to be critical for successful seed production (Wilson *et al.* 2003).

Kincaid's lupine reproduces by seed and vegetative spread. It is able to spread extensively through underground growth. Individual clones can be several centuries old (Wilson *et al.* 2003), and become quite large with age, producing many flowering stems. Excavations and morphological patterns suggest that plants 10 m (33 feet) or more apart can be interconnected by below-ground stems, and that clones can exceed 10 m (33 feet) across (Wilson *et al.* 2003). As part of a genetic evaluation, collections taken from small populations of Kincaid's lupine at the Baskett Slough National Wildlife Refuge were found to be genetically identical, indicating that the population consists of one or a few large clones (Liston *et al.* 1995). Reproduction by seed is common in large populations where inbreeding depression is minimized and ample numbers of seeds are produced. In small populations, seed production is reduced and this appears to be due, at least in part, to inbreeding depression (Severns 2003).

Kincaid's lupine is vulnerable to seed, fruit and flower predation by insects, which may limit the production of seeds. Seed predation by bruchid beetles and weevils and larvae of other insects has been documented, and may result in substantially reduced production of viable seed (Kaye and Kuykendall 1993, Kuykendall and Kaye 1993). Floral and fruit herbivory by larvae of the silvery blue butterfly (*Glaucopsyche lygdamus columbia*) has also been reported (Kuykendall and Kaye 1993, Schultz 1995). The vegetative structures of Kincaid's lupine support a variety of insect herbivores, including root borers, sap suckers and defoliators (Wilson *et al.* 2003). Kincaid's lupine is the primary larval host plant of the endangered Fender's blue butterfly (Wilson *et al.* 2003). Female Fender's blue butterflies lay their eggs on the underside of Kincaid's lupine leaves in May and June; the larvae hatch several weeks later and feed on the plant for a short time before entering an extended diapause, which lasts until the following spring (Schultz *et al.* 2003). Kincaid's lupine, like other members of the genus *Lupinus*, is unpalatable to vertebrate grazers. Kincaid's lupine forms root nodules with *Rhizobium* spp. bacteria that fix nitrogen, and also has vesicular-arbuscular mycorrhizae, which may enhance the plant's growth (Wilson *et al.* 2003).

Habitat Characteristics

In the Willamette Valley and southwestern Washington, Kincaid's lupine is found on upland prairie remnants where the species occurs in small populations at widely scattered sites. A number of populations are found in road rights-of-way, between the road shoulder and adjacent fence line, where they have survived because of a lack of agricultural disturbance. Common native species typically associated with Kincaid's lupine include: *Festuca idahoensis* ssp. *roemeri*, *Danthonia californica*, *Calochortus tolmiei*, *Eriophyllum lanatum*, and *Fragaria virginiana* (wild strawberry). The species appears to prefer heavier, generally well-drained soils and has been found on 48 soil types, typically Ultic Haploxerolls, Ultic Argixerolls, and Xeric Palehumults (Wilson *et al.* 2003).

In Douglas County, Oregon, Kincaid's lupine appears to tolerate more shaded conditions, where it occurs at sites with canopy cover of 50 to 80 percent (Barnes 2004). In contrast to the open prairie habitats of the more northerly populations, in Douglas County, tree and shrub species dominate the sites, including *Pseudotsuga menziesii*, *Quercus kelloggii* (California black oak), *Arbutus menziesii* (Pacific madrone), *Pinus ponderosa* (ponderosa pine), *Calocedrus decurrens* (incense cedar), *Arctostaphylos columbiana* (hairy manzanita) and *Toxicodendron diversilobum*.

In contrast to historical ecosystem composition, invasive non-native species are a significant component of Kincaid's lupine habitat today. Common invasives include: *Arrhenatherum elatius*, *Brachypodium sylvaticum* (slender false brome), *Dactylis glomerata*, *Festuca arundinacea*, *Rubus armeniacus* and *Cytisus scoparius* (Wilson *et al.* 2003). In the absence of fire, some native species, such as *Toxicodendron diversilobum* and *Pteridium aquilinum* (bracken fern), invade prairies and compete with Kincaid's lupine.

Reasons for Listing

The three major threats to Kincaid's lupine populations are habitat loss, competition from non-native plants and elimination of historical disturbance regimes (Wilson *et al.* 2003). Habitat loss from a wide variety of causes (*e.g.*, urbanization, agriculture, silvicultural practices and roadside maintenance) has been the single largest factor in the decline of Kincaid's lupine (USFWS 2000). Land development and alteration in the prairies of western Oregon and southwestern Washington have been so extensive that the remaining populations are essentially relegated to small, isolated patches of habitat. Habitat loss is likely to continue as private lands are developed; at least 49 of 54 sites known to be occupied by Kincaid's lupine in 2000 when the species was listed were on private lands and are at risk of being lost unless conservation actions are implemented (USFWS 2000).

Habitat fragmentation and isolation of small populations may be causing inbreeding depression in Kincaid's lupine. The subspecies was likely wide-spread historically, frequently outcrossing throughout much of its range, until habitat destruction and fragmentation severely isolated the remaining populations (Liston *et al.* 1995). There is some evidence of inbreeding depression, which may result in lower seed set (Severns 2003). Hybridization between Kincaid's lupine and *Lupinus arbustus* has been detected at Baskett Slough National Wildlife Refuge (Liston *et al.* 1995).

Invasion by a few aggressive plant species is a threat to many prairies and the presence of other non-native species within degraded prairies contributes to lower prairie quality and concomitant reduced population viability of native species, including Kincaid's lupine. Some aggressive non-native plants form dense monocultures, which compete for space, water and nutrients with the native prairie species, and ultimately inhibit the growth and reproduction of Kincaid's lupine by shading out the plants (Wilson *et al.* 2003).

Most prairie sites require frequent disturbances to hold back the natural succession of trees and shrubs. Before settlement by Euro-Americans, the regular occurrence of fire maintained the open prairie habitats essential to Kincaid's lupine. The loss of a regular disturbance regime, primarily fire, has resulted in the decline of prairie habitats through succession by

native trees and shrubs, and has allowed the establishment of numerous non-native grasses and forbs. When this species was listed, we estimated that 83 percent of upland prairie sites were succeeding to forest in the range of Kincaid's lupine (USFWS 2000).

Conservation Measures

Active research efforts have focused on restoring the essential components of Kincaid's lupine habitat by mimicking the historical disturbance regime with the application of prescribed fire, mowing and manual removal of weeds. Research and habitat management programs for Kincaid's lupine have been implemented at several sites, including Baskett Slough National Wildlife Refuge, Bureau of Land Management's Fir Butte site and The Nature Conservancy's Willow Creek Preserve (Wilson *et al.* 2003, Kaye and Benfield 2005a). Prescribed fire and mowing before or after the growing season have been effective in reducing the cover of invasive non-native plants; following treatments, Kincaid's lupine has responded with increased leaf and flower production (Wilson *et al.* 2003). Research has also been conducted on seed germination, propagation and reintroduction of Kincaid's lupine (Kaye and Kuykendall 2001a, 2001b, Kaye and Cramer 2003, Kaye *et al.* 2003a). Seeds of this species have been banked at the Berry Botanic Garden in Portland, Oregon (Berry Botanic Garden 2005).

The Bureau of Land Management, Umpqua National Forest and U.S. Fish and Wildlife Service completed a programmatic conservation agreement for Kincaid's lupine in Douglas County, Oregon, in April 2006 (Roseburg Bureau of Land Management *et al*. 2006). The objectives of the agreement are: (1) to maintain stable populations of the species in Douglas County by protecting and restoring habitats, (2) to reduce threats to the species on Bureau of Land Management and Forest Service lands, (3) to promote larger functioning metapopulations, with increased population size and genetic diversity, and (4) to meet the recovery criteria in the Recovery Outline for the species (USFWS 2006b).

Populations of Kincaid's lupine occur on public lands or lands that are managed by a conservation organization at the U.S. Fish and Wildlife Service's William L. Finley National Wildlife Refuge and Baskett Slough National Wildlife Refuge, the Army Corps of Engineers' Fern Ridge Reservoir, Bureau of Land Management units in Lane and Douglas Counties, the Umpqua National Forest, The Nature Conservancy's Willow Creek Preserve, and at a small portion of Oregon State University's Butterfly Meadows in the McDonald State Forest. All of these parcels have some level of management for native prairie habitat values. The U.S. Fish and Wildlife Service's Partners for Fish and Wildlife Program works with private landowners to restore wildlife habitats; native prairie restoration is a key focus area of the program in the Willamette Valley.

E. Nelson's checker-mallow (*Sidalcea nelsoniana*)

Listing Status, Critical Habitat and Recovery Plan

Nelson's checker-mallow was listed as threatened, without critical habitat, on February 12, 1993 (USFWS 1993). A draft Recovery Plan that includes this species (Draft Recovery Plan for the Prairie Species of Western Oregon and Southwestern Washington) was published in August of 2008 (USFWS 2008a).

Population Trends and Distribution

In the past, Nelson's checker-mallow has been collected in Benton, Clackamas, Linn, Marion, Polk, Tillamook, Yamhill, and Washington Counties, Oregon, and Cowlitz and Lewis Counties, Washington. Nelson's checker-mallow is currently know from about 65 sites, distributed from southern Benton County, Oregon, northward through the central and western Willamette Valley, to Cowlitz and Lewis Counties, Washington (CH2MHill 1997, USFWS 1998). This species also occurs in several higher elevation west slope Coast Range meadows that flank the western Willamette Valley in Yamhill, Washington and Tillamook Counties, Oregon. Known populations range in elevation from 45 to 600 m (145 to 1,950 feet).

In the Willamette Valley, populations of Nelson's checker-mallow occur at low elevations (below 200 m [650 feet]) within a mosaic of urban and agricultural areas, with concentrations around the cities of Corvallis and Salem. In the Coast Range, Nelson's checker-mallow populations range in elevation from 490 to 600 m (1,600 to 1,960 feet), and are found in open, grassy meadows within a larger matrix of coniferous forest.

Life History and Ecology

In the Willamette Valley, Nelson's checker-mallow begins flowering as early as mid-May, and continues through August to early September, depending upon the moisture and climatic conditions of each site. Coast Range populations experience a shorter growing season and generally flower later and senesce earlier. Nelson's checker-mallow inflorescences are indeterminate, and often simultaneously exhibit fruits, open flowers, and unopened buds. Seeds are deposited locally at or near the base of the parent plant and may be shed immediately or persist into winter within the dry flower parts that remain attached to the dead stems. Above-ground portions of the plant die back in the fall, usually followed by some degree of regrowth at the base, with the emergence of small, new leaves that persist through the winter directly above the root crown. It is not uncommon for some plants to continue producing some flowers into the fall and early winter, although this is usually limited to one or two small stems per plant, with little consequent seed production (USFWS 1998).

Perfect-flowered Nelson's checker-mallow are protandrous, with complete temporal separation of male and female phases in individual flowers (Gisler and Meinke 1998). This prevents self-fertilization, and combined with the bottom-to-top foraging observed among most bee visitors, also discourages selfing through geitonogamy. Outcrossing is encouraged because pollinators leave male-phase flowers at the top of one raceme and then fly to female phase flowers on the bottom of the next raceme. Some selfing will still occur in perfect-flowered plants, however, due to within-plant, between-raceme foraging. Female plants, which lack male flowers, are obligately outcrossed (Gisler and Meinke 1998). In most Willamette Valley (but not Coast Range) populations, female (male-sterile) Nelson's checker-mallow plants vastly outnumber perfect plants. Nelson's checker-mallow is also capable of vegetative expansion via rhizomes or laterally spreading root systems that form multiple crowns bearing distinct clusters of flowering stems (CH2MHill 1986, Glad *et al.* 1994).

Nelson's checker-mallow is pollinated by a variety of insects, including at least 17 species of bees, 3 species of wasps, 9 species of flies, 6 species of beetles, and 5 species of lepidopterans (Gisler 2003). Three species of bumblebees (*Bombus californicus, B. sitkensis* and *B. vosnesenskii*) were the most common and active pollinators (Gisler 2003). One solitary bee pollinator, *Diadasia nigrifrons*, is a checker-mallow specialist, and may also pollinate Nelson's checker-mallow in the Willamette Valley (Gisler and Meinke 1998).

Pre-dispersal seed predation by weevils (*Macrorhoptus sidalceae*) is extremely high in many populations, and may severely curtail, if not virtually eliminate, seed survival in many populations (Gisler and Meinke 1998). The weevils appear to be restricted to Willamette Valley, southwestern Washington and lower Coast Range populations (around Grand Ronde), but do not infest the Coast Range populations in Yamhill, Tillamook, and Washington Counties. The weevils are native, host-specific, and are themselves parasitized by tiny undescribed wasps (Gisler and Meinke 1998).

Four other native *Sidalcea* species are found within the geographic range of Nelson's checker-mallow (Hitchcock and Cronquist 1973, Gisler 2004). *Sidalcea malviflora* ssp. *virgata* is typically shorter and begins flowering earlier than the other checker-mallows in the region, tends to occupy somewhat dryer, more upland sites, and has forked or branched stem hairs and distinctively deep pink to rose-colored flowers. *Sidalcea campestris* is the tallest checker-mallow in the region, and can be distinguished by its large, pale pink to white flowers. *Sidalcea cusickii* (Cusick's checker-mallow) occurs only within the extreme southern portion of Nelson's checker-mallow range, barely extending north of the city of Eugene, Oregon, and is discernable by generally forked stem hairs, broad calyx lobes, and prominently veined petals. *Sidalcea hirtipes* (Bristly-stem checker-mallow) has a longer and fuzzier calyx, longer petals, and longer hair on the stem; its range overlaps that of Nelson's checker-mallow in the Coast Range and Lewis County, Washington. *Sidalcea hirtipes* is itself considered endangered in Washington by the state's Natural Heritage Program (Washington Natural Heritage Program 2005).

There is a strong potential for interspecific hybridization among Nelson's checker-mallow and its congeners in the region, although there are some ecological and genetic reproductive barriers to prevent it from occurring (Gisler 2003, 2004). Nelson's checker-mallow flowers later in the year than sympatric populations of *Sidalcea malviflora* ssp. *virgata*, but allopatric populations sometimes overlap in flowering periods. The two species are sexually compatible, thus human-mediated movement of the plants could result in formation of hybrids. Nelson's checker-mallow and *S. cusickii* are also fully compatible, and they also share pollinators and flowering times, but their geographic ranges are parapatric, with nearest populations narrowly separated by less than a mile at the south end of Finley National Wildlife Refuge (Gisler 2004). If these species come into contact through human-mediated dispersal, hybridization could easily occur. Nelson's checker-mallow is frequently found growing together with *S. campestris*, and they also share pollinators and flowering times, but they exhibit very low sexual compatibility (probably due to chromosomal pairing problems resulting from polyploidy) (Gisler 2004). Reproductive barriers among all the checker-mallows likely evolved in response to selective pressure against hybridization; managers

should be aware of the potential for hybridization as plants are moved around within the region.

Habitat Characteristics

In the Willamette Valley, Nelson's checker-mallow is known from wet prairies and stream sides. Although occasionally occurring in the understory of *Fraxinus latifolia* woodlands or among woody shrubs, Willamette Valley Nelson's checker-mallow populations usually occupy open habitats supporting early seral plant species. These native prairie remnants are frequently found at the margins of sloughs, ditches, and streams, roadsides, fence rows, drainage swales and fallow fields. Soil textures of the occupied sites vary from gravelly, well drained loams to poorly drained, hydric clay soils (CH2MHill 1986, Glad *et al.* 1994).

Some of the native plants commonly associated with Nelson's checker-mallow in the Willamette Valley include: *Achillea millefolium* (yarrow), *Juncus effusus* (common rush), *Carex* spp (sedge), *Spiraea douglasii* (western spiraea), *Crataegus douglasii*, *Geum macrophyllum* (large-leaved avens), and *Fraxinus latifolia* (Oregon Department of Agriculture 1995). Most sites have been densely colonized by invasive weeds, especially introduced forage grasses; common non-native species found with Nelson's checker-mallow include: *Festuca arundinacea*, *Rosa* spp. (rose), *Cirsium arvense* (Canada thistle), *Hypericum perforatum* (common St. John's wort), *Rubus* spp. (blackberry), *Phleum pratense* (timothy), *Holcus lanatus*, *Vicia* spp., *Chrysanthemum leucanthemum* (oxeye-daisy), *Agrostis tenuis* (colonial bent-grass), *Alopecurus pratensis* (meadow foxtail), *Phalaris arundinacea* (red canary grass), *Geranium* spp. (geranium), *Lotus corniculatus* (bird's-foot trefoil) and *Daucus carota* (wild carrot)(Oregon Department of Agriculture 1995).

Coast Range Nelson's checker-mallow populations typically occur in open, wet to dry meadows, intermittent stream channels, and along margins of coniferous forests, with clay to loam soil textures (Glad *et al.* 1987). These areas generally support more native vegetation than Willamette Valley sites. Native plants commonly associated with Nelson's checker-mallow in the Coast Range include: *Senecio triangularis* (spear-head senecio), *Fragaria virginiana*, *Juncus* spp., *Carex* spp., and *Achillea millefolium*; non-native associated species often include *Senecio jacobaea* (tansy ragwort), *Holcus lanatus, Phleum pretense.*

A variety of animal species are associated with Nelson's checker-mallow. Stems and inflorescences are commonly eaten by deer and elk. Nelson's checker-mallow flowers are visited by a diverse assemblage of insects, including leafcutter bees (Megachilidae), honey bees (Apidae), bumble bees (Bombidae), hover flies (Syrphidae), butterflies (Hesperiidae), and pollen-foraging beetles (Cerambycidae and Meloidae). The species is also a host for various phytophagous insects such as aphids (Aphididae), stinkbugs (Pentatomidae), scentless plant bugs (Rhopalidae), spotted cucumber beetles (Chrysomelidae), plant bugs (Miridae), milkweed bugs (Lygaeidae), spittlebugs (Cercopidae), butterfly larvae (Lycaenidae: *Strymon melinus*; Nymphalidae: *Vanessa anabella*), and in the Willamette Valley, weevils (Curculionidae: *Macrohoptus sidalcae*). Other insects found in association with Nelson's checker-mallow include ants (Formicidae) and earwigs (Forficulidae) (Bureau of Land Management 1985; CH2M Hill 1986; Oregon Department of Agriculture 1995).

Reasons for Listing

Nelson's checker-mallow is threatened by urban and agricultural development, ecological succession that results in shrub and tree encroachment of open prairie habitats, and competition with invasive weeds (USFWS 1993).

At many Willamette Valley sites, seedling establishment is inhibited by the dense thatch layer of non-native grasses (Gisler 2004). Other factors specific to Nelson's checker-mallow include pre-dispersal seed predation by weevils (Gisler and Meinke 1998), the potential threat of inbreeding depression due to small population sizes and habitat fragmentation (Gisler 2003).

Conservation Measures

Extensive research has been conducted on the ecology and population biology of Nelson's checker-mallow, methods of seed predator control, and propagation and reintroduction techniques (Gisler and Meinke 1998, Bartels and Wilson 2001, Gisler and Meinke 2001, Gisler 2003, Wilson 2004). The results of these studies have been used to direct the management of the species at sites managed for wet prairies.

Studies of the reproductive ecology of Nelson's checker-mallow have shown that it has a highly complex breeding system that facilitates both outcrossing and selfing (Gisler and Meinke 1998); this study also suggested that control of seed predation by native weevils may be needed to enhance reproductive success at some populations which are heavily infested with weevils. Research into habitat management techniques indicates that burning may not be directly beneficial to Nelson's checker-mallow, and that caution should be used in management of native prairie fragments with populations of Nelson's checker-mallow (Bartels and Wilson 2001, Wilson 2004). The species has proved to be readily grown in controlled environments, and several approaches have successfully cultivated healthy plants for augmentation of existing populations (Gisler 2003). Seeds of this species have been banked at the Berry Botanic Garden in Portland, Oregon (Berry Botanic Garden 2005) and the University of Washington Botanic Garden.

Populations of Nelson's checker-mallow are protected on lands managed by the U.S. Fish and Wildlife Service at William L. Finley and Baskett Butte National Wildlife Refuges, the Confederated Tribes of the Grand Ronde in Polk County, and by the Bureau of Land Management at Walker Flat in Yamhill County, Oregon. In December 2007, Ridgefield National Wildlife Refuge, in Clark County, Washington, outplanted 2530 seedlings to establish a new population of Nelson's checker-mallow at the refuge; monitoring and management of the new population is ongoing. The U.S. Fish and Wildlife Service's Partners for Fish and Wildlife Program works with private landowners to restore wildlife habitats; native prairie restoration is a key focus area of the program in the Willamette Valley.

III. ENVIRONMENTAL BASELINE

Status of the Species and Critical Habitat in the Action Area

The action area for this SHA is existing and potential prairie habitats on non-federal lands within the range of the Fender's blue butterfly in the Willamette Valley, Oregon. This action area coincides with the entire range of Fender's blue butterfly and Willamette daisy. Kincaid's lupine, Bradshaw's lomatium and Nelson's checker-mallow occur outside of the area covered by this program at a few sites in other Oregon counties and in southwestern Washington. Since the action area is the entire range, or nearly the entire range, of Fender's blue butterfly, Willamette daisy, Kincaid's lupine, Bradshaw's lomatium and Nelson's checker-mallow, the Status of the Species and Critical Habitat discussed in the previous section essentially constitutes the environmental baseline.

Factors Affecting the Species' Environment in the Action Area

The baseline for consultation includes state, tribal, local and private actions already affecting the species or that will occur contemporaneously with the consultation in progress. Unrelated Federal actions affecting the same species or critical habitat that have completed formal or informal consultation are also part of the environmental baseline, as are Federal and other actions within the action area that may benefit listed species or critical habitat. Other Federal actions affecting Fender's blue butterfly, the listed plants, or their designated critical habitat that required formal section 7 consultation with our office include: habitat management plans for the Army Corps of Engineers' (Corps), Bureau of Land Management (BLM) and Service (Baskett Slough Refuge complex), Service programmatic consultations for western Oregon prairie restoration activities and the Partners for Fish and Wildlife Program, the Service issuance of section 10(a)(1)(A) recovery permits, restoration and species enhancement by the Service, Federal Highway Administration highway and bridge construction, and recreation development by the Corps and BLM. None of the completed section 7 consultations reached a jeopardy finding for Fender's blue butterfly, Willamette daisy, Kincaid's lupine, Bradshaw's lomatium or Nelson's checker-mallow nor a finding of adverse modification of designated critical habitat for Fender's blue butterfly, Willamette daisy, or Kincaid's lupine.

IV. EFFECTS OF THE ACTION

The effects of the action to the five listed species and three critical habitat designations are discussed below by activity category, and for the SHA program assurances. The effects analysis for the five listed species (Fender's blue butterfly, Willamette daisy, Kincaid's lupine, Bradshaw's lomatium and Nelson's checker-mallow) addresses the likely short- and long-term responses of individuals of the listed butterfly and plant species to the various activities. The effects analyses for the three critical habitat designations (for Fender's blue butterfly, Kincaid's lupine and Willamette daisy) focus on the short- and long-term effects to the primary constituent elements (PCEs) of critical habitat. A complete description of the primary constituent elements can be found above in section II.

Because it is impossible to predict the exact number of landowners that may enroll in the SHA, for purposes of evaluating the effects of this action, we are assuming enrollment of up to 50 properties during the term of the SHA. This assumption is based on enrolling an average of 3-4 properties per year over a 15 year period. We believe this estimate is reasonable based on current landowners that have expressed interest in the program. The Service will monitor this assumption through implementation of the program and reinitiate consultation as appropriate.

A. Surveys and monitoring

There will be no effect to Fender's blue butterfly or its critical habitat from visual surveys for adults, eggs or larvae. However, up to five percent of the butterfly population may be captured per week throughout the flight season for identification purposes on sites that are censused, and therefore may be disturbed by handling. Individuals will be netted and released. Any mortality that occurs is expected to be negligible. There will be no effect to listed plants or their critical habitats from surveys or monitoring.

B. Removal of invasive non-native species and woody vegetation

i. Manual treatments

Targeted manual removal of invasive plants is not likely to adversely affect listed species, and will not adversely affect designated critical habitat. It is possible that some listed plants, butterfly nectar plants or butterfly larvae could be trampled or compressed, but care will be taken to avoid using access routes where listed species occur. Ultimately, the effects will be beneficial by removing invasive plants that compete with native plants, including listed species, for space, light and nutrients.

ii. Mechanical treatments - ground-level

There are likely to be short-term adverse effects of mowing, however the long-term effects of mowing have been shown to be almost exclusively beneficial. Extensive research has been conducted in the last decade on the effects of various mowing regimes on rare species; these studies have shown that mowing is an important tool for restoring native prairies and increasing populations of Fender's blue butterfly and listed prairie plants.

Mowing in habitat patches with eggs or larvae of Fender's blue butterfly at any time during the year may crush or otherwise kill a small number of individuals of these life stages of the butterfly. Studies in the southern Willamette Valley have found that both adult and larval Fender's blue butterflies increased in number following mowing to reduce the stature of herbaceous non-native vegetation, (Fitzpatrick 2005, Kaye and Benfield 2005a). A study on the effects of fire and mowing on Fender's blue butterfly and native upland prairie at Baskett Slough National Wildlife Refuge found that Fender's blue butterfly eggs were 10 to 14 times more abundant in plots that were mowed or burned compared to undisturbed, control plots; woody plants were reduced 66 percent with mowing (Wilson and Clark 1997). At the U.S. Army Corps of Engineers' Fern Ridge Reservoir, the Fender's blue butterfly population has increased dramatically since fall mowing of lupine patches has been implemented (Messinger 2006). Fender's blue butterfly population trends have been correlated with lupine vigor; high leaf growth appears to produce larger butterfly populations. The abundance of Fender's blue butterfly eggs was found to be correlated with the abundance of Kincaid's lupine leaves at a number of study sites (Kaye and Cramer 2003); egg abundance increased

substantially at sites which had been treated to control non-native weeds (Schultz *et al.* 2003)

Spring mowing within patches of listed or nectar plants may remove much of the above ground growing parts of the plants, which would reduce growth and reproductive success for that year. Fall mowing is not likely to have any adverse effects to listed plants, as the above ground portions of the plants will have senesced. Nelson's checker-mallow may be an exception, as it may not become senescent by the beginning of the fall mowing window; in these cases, loss of some of the above ground growing parts of the plant can be expected. Research on prairie management techniques has shown that mowing is an effective method for reducing non-native plants, with generally positive effects to native prairie species (including nectar sources). Annual fall mowing has significant positive effects on Kincaid's lupine, including increased leaf, flower and foliar cover (Kaye and Thorpe 2006). A recent study found that Willamette daisy did not respond with increased crown cover in mowed plots, but suggests that the indirect effects (*e.g.*, reduced cover of invasive plants) positively affect the species (Thorpe and Kaye 2006). A two-year study on the effects of mowing and burning on Nelson's checker-mallow found that the species did not respond positively to mowing in the short-term, although the reduction in cover of competing woody plants would likely benefit Nelson's checker-mallow in the long-term (Wilson 2004).

Soil compaction by mowing equipment may adversely affect listed plants and Fender's blue butterfly larvae and eggs. The likelihood of this effect is expected to be small and may be reduced by the use of rubber tracks on tractors used for mowing, whenever practicable.

The effect of mowing on designated critical habitat for Fender's blue butterfly, Kincaid's lupine and Willamette daisy is a short-term reduction in some PCEs with clear long-term benefits. Spring mowing will temporarily reduce the cover of native prairie species, which would be an adverse effect to that PCE for each of the three species. It will also reduce the cover of larval host plants and reduce the availability of nectar sources for Fender's blue butterfly. Concomitantly, spring mowing will have beneficial effects to critical habitat for all three species as it removes competing non-native plant species. Fall mowing is not likely to have any adverse effects to the PCEs of designed critical habitat for any of the species. Both spring and fall mowing have clear beneficial effects in the long-term; mowing has been shown to be one of the most effective techniques for increasing native prairie species cover and reducing the dominance of competitive invasive species (Kaye and Benfield 2005a, Messinger 2006).

Removal of woody vegetation by cutting, thinning, removing tree stumps or girdling trees will have no adverse effects to listed species or designated critical habitat. The effects will be beneficial, as these activities will result in the removal of encroaching woody plants that replace native prairie plants and increase the value of habitats for native species.

Raking to remove thatch build up will occur after listed plants have senesced for the season, and will have minimal adverse effects to listed plants. Soil compaction by raking equipment may adversely affect listed plants, nectar sources and Fender's blue butterfly larvae and eggs. The likelihood of this effect is expected to be small and may be reduced by the use of rubber tracks on tractors used for raking whenever practicable. Nelson's checker-mallow, which may not completely senesce in the fall, may be injured by raking equipment; however, effects to this species will be minimized or avoided by identifying incompletely senesced individuals, and avoiding them when raking. Ultimately, the effects of raking will be beneficial to all listed plants and other prairie plant species, as reduction in thatch build up will open habitat for native prairie species, and may also reduce the abundance of herbivorous rodents.

Raking may have some adverse effects to larvae and eggs of Fender's blue butterfly, which may be present in the thatch layer near their larval host plants. At sites with Fender's blue butterfly populations, the extent of raking will be limited to one-quarter to one-third of the site. In the event that all butterfly larvae and eggs are killed or exposed to predators by raking, the site limits will ensure that butterfly populations are not reduced to such an extent that the persistence of the population will be at risk.

Raking will have only beneficial effects to designated critical habitat for Fender's blue butterfly, Willamette daisy and Kincaid's lupine. Raking will reduce thatch, allowing native prairie species cover to increase.

iii. Mechanical treatments – tilling, plowing, disking and sod rolling

Tilling, plowing and disking will be used to control weedy vegetation, but will not be conducted where these activities may adversely affect listed plants or butterflies (generally no closer than 10 m [30 feet] from known populations). Erosion control measures and buffers will be maintained as needed to prevent soil run-off into adjacent watercourses. This technique will have no adverse effects to listed species or designated critical habitat. The long-term effects of these treatments will be entirely beneficial, as they create enhanced prairie patches that become available for colonization by listed and other native prairie species.

Sod rolling will be used to control invasive species. This technique will not be used where listed plants or butterflies are present, but may occur in adjacent habitats (generally no closer than 10 m [30 feet] from listed species) for site preparation prior to reintroduction or augmentation of listed or other native species. This technique will have no adverse effects to listed species or designated critical habitat. The long-term effects of this treatment will be entirely beneficial, as it creates enhanced prairie patches that become available for colonization by listed prairie species on sites that are severely degraded.

iv. Prescribed fire

There may be short-term adverse effects of prescribed fire, however the long-term effects have been shown to be almost exclusively beneficial. Extensive research has been conducted in the last decade on the effects of prescribed fire on native prairie habitats and their associated species; these studies have shown that burning is an important tool for restoring native prairies and increasing populations of Fender's blue butterfly and listed prairie plants.

The immediate effects of fire on Fender's blue butterfly are certainly adverse. Fall burning likely kills all or most of the eggs and larvae in the burned patch. However, burning dramatically improves the habitat quality for the butterflies which move into the burned patch in the following flight season. The limits to burning at sites occupied by Fender's blue butterfly are designed to maximize the positive response of butterflies. At sites supporting 100 or more adult Fender's blue butterflies, the size of the burn unit will be no more than one-third of the occupied habitat actively used by butterflies. At sites supporting fewer than 100 adult Fender's blue butterflies, the size of the burn unit will be no more than one quarter of the occupied habitat. The center of the burn unit will be within 100 meters of unburned occupied habitat, which can serve as a recolonization source. These limits are supported by a modeling study that determined that burning one-third of an occupied site each year resulted in the greatest population growth rate (Schultz and Crone 1998).

Empirical studies have also shown that fire benefits the species. Wilson and Clark (1997) conducted a study on the effects of fire and mowing on Fender's blue butterfly and its native upland prairie at Baskett Slough National Wildlife Refuge in the Willamette Valley. Although fire killed all larvae in burned patches, female Fender's blue butterflies from the nearby unburned source patch were able to colonize the entire burned area, including lupine patches that were 107 m (350 feet) from the unburned source plants. They found that Fender's blue butterfly eggs were 10 to 14 times more abundant in plots that were mowed or burned compared to undisturbed, control plots. Woody plants were reduced 45 percent with burning and 66 percent with mowing. The frequency and extent of burning have strong effects on Fender's blue butterfly populations.

In 2007, there were approximately 3,500 adult Fender's blue butterflies at surveyed sites on non-federal lands (based on 2007 counts of adult Fender's blue butterflies on non-federal lands, U.S. Fish and Wildlife Service unpublished data). If half of these sites were enrolled in the SHA, and one-third of all occupied habitats were burned in one year, all of the eggs and larvae associated with about 580 adult butterflies could be killed. No data exist that would allow us to meaningfully estimate a more precise number. These losses are highly likely to be more than offset by the improved habitat quality and increased butterfly populations in the following year.

Prescribed burning under this restoration program will occur after listed plants have senesced. Fire is likely to kill seeds found at or near the surface of the soil; below ground structures of these perennial plants are not likely to be destroyed by burning but injury may occur to rhizomes close to the soil surface. Prescribed fire generally results in increased vigor of listed plants. Fall burning has been effective in reducing the cover of

invasive non-native plants; following treatments, Kincaid's lupine responds with increased leaf and flower production (Wilson *et al.* 2003), and Bradshaw's lomatium responds positively to fire (Pendergrass *et al.* 1999). Populations of golden paintbrush have responded to fire with increased flowering and recruitment in subsequent years (Dunwiddie *et al*. 2001).

Heavy equipment used in prescribed burning may cause soil compaction that could adversely affect the listed plants and Fender's blue butterfly eggs and larvae. These effects will be minimized by the timing of burning to after mid-August when most of the listed plants have senesced. In addition, care will be taken to ensure that vehicular routes avoid listed species.

Nelson's checker-mallow may not have completely senesced in the fall when prescribed burns are implemented. For this reason, no more than one half of the habitat occupied by this species at any site may be burned. Some Nelson's checker-mallow plants may die, but the restriction on burn area will preserve at least half of the population at each site, which may serve as a recolonization source for the burned area.

There are likely to be short-term adverse effects to designated critical habitat from prescribed fire, as it will temporarily remove cover of native prairie vegetation, a PCE of critical habitat for Fender's blue butterfly, Willamette daisy and Kincaid's lupine. However, the long-term effect of burning on critical habitat will be strongly positive.

v. Herbicide Use

Six types of chemicals are anticipated for use under this program: triclopyr, glyphosate, 2,4-D amine, clethodim, sethoxydim and fluazifop-P-butyl. These chemicals were selected for their low or non-toxic effects to fish, invertebrates, birds and mammals, as well as their targeted nature in addressing certain categories of invasive plants *(i.e.*, specific to trees, grasses, or broadleaf plants). Protections that include buffers from watercourses, application timing restrictions, specific environmental conditions required and application protocols are specified to ensure that chemical treatments covered under this programmatic consultation will have no effect to listed fish and their critical habitats and will minimize risks to other listed and sensitive species. New information about ways to reduce risks and improve the efficacy of various chemicals and application methods may be used to refine methods in the future, as long as effects are comparable to those considered in this programmatic consultation.

Area size limits for chemical applications have been specified for sites occupied by Fender's blue butterflies to minimize the short-term loss of available habitat. At sites supporting Fender's blue butterflies, the size of the area treated with herbicides will be no more than one-third of the occupied habitat actively used by butterflies.

Triclopyr will be applied by hand to freshly cut trees and may be spot-applied for broadleaf weed control. Application and timing restrictions will ensure that listed plants have senesced for the year (with the possible exception of Nelson's checker-mallow), and

that Fender's blue butterfly larvae are in diapause, thereby minimizing or completely avoiding any adverse effects to listed plants and butterfly from triclopyr application. If Nelson's checker-mallow occurs on the site, any application will be by hand and plants may be covered (e.g., with 5-gallon buckets or other suitable shielding) or otherwise protected (e.g., by clipping leaves to remove exposed green tissue) as needed to reduce the risk of herbicide affecting the plants. Sucoff *et al.* (2001) studied the effects of an herbicide containing a combination of glyphosate and triclopyr on the development of Karner blue butterfly (*Lycaeides melissa samuelis*) eggs and larvae, a species similar to Fender's blue, and found egg hatching was significantly lower in eggs that were drenched in the herbicide, but no discernable reduction in pupation or adult survivorship. Therefore, by limiting triclopyr application to periods of Fender's blue butterfly diapause and listed plant senescent periods, minimal, if any, adverse effects to the species are expected.

Glyphosate is the only chemical included in this program that kills both broadleaf and grass species. Application and timing restrictions will ensure that listed plants have senesced for the year (with the possible exception of Nelson's checker-mallow), and that Fender's blue butterfly larvae are in diapause, thereby minimizing or completely avoiding any adverse effects to listed plants and butterfly from glyphosate application. The additional protective measures for treating areas with Nelson's checker-mallow discussed above will be used. A study in the Willamette Valley of the effects of several herbicides, including glyphosate and fluazifop-P-butyl found no reduction in Kincaid's lupine vigor or Fender's blue butterfly populations following applications, and in most trials, the abundance of those species increased (Clark *et al.* 2004). A study examining the effects of glyphosate on the development of Karner blue butterfly (*Lycaeides melissa samuelis*) eggs and larvae, a species similar to Fender's blue, found small negative effects to eggs that were drenched in the herbicide, but no discernable reduction in pupation or adult survivorship (Sucoff *et al.* 2001). Therefore, by limiting glyphosate application to periods of Fender's blue butterfly diapause and listed plant senescent periods, minimal, if any, adverse effects to the species are expected.

Timing restrictions for application of 2,4-D amine will ensure that listed plants are entirely or semi-senesced, and butterfly larvae are in diapause, thereby minimizing or completely avoiding any adverse effects to listed plants and butterflies and their critical habitats from 2,4-D amine application. The additional protective measures for treating areas with Nelson's checker-mallow will be used. By limiting 2,4-D amine application to butterfly diapause period and covering or otherwise protecting Nelson's checker-mallow when applying herbicides to invasive plants, adverse effects to Nelson's checker-mallow, Fender's blue butterfly and its critical habitat will be avoided.

Clethodim, sethoxydim and fluazifop-P-butyl will be used for treating invasive grass species. All listed plants in the action area are broadleaf species, therefore no adverse effect from treatments using grass-specific chemicals to listed plants or their designated critical habitat will occur. These grass-specific chemicals may have adverse effects to diapaused larvae of Fender's blue butterfly. However, where known populations of Fender's blue butterfly exist, Kincaid's, spur and sickle-keeled lupine plants must be

marked in the field before senescence and avoided to the extent possible to prevent larvae from coming into contact with herbicides. Herbicide may only be applied when the butterflies are in diapause. Initial studies on the effects of grass-specific herbicides on blue butterflies have been equivocal. In one study on Puget blue butterflies (*Icaricia icarioides blackmoreii*), effects of Fusilade sprayed on post-diapause larvae were undetectable; in another small herbicide application, Fusilade and Poast were sprayed on cabbage white butterfly (*Artogeia rapae*) larvae, with resulting survivorship of about 90 percent in control plots, but only 60 percent in those treated with Poast or Fusilade (Russell and Schultz, unpublished data cited in Schultz *et al.* 2007). These studies suggest that there could be some mortality to Fender's blue butterfly larvae from use of grass-specific herbicides. We cannot calculate the number of larvae that will be killed or injured by incidental exposure to grass-specific herbicides, but expect the actual effect to be very low (likely less than five percent killed or injured) given the targeted application methods and timing restrictions specified.

Soil compaction by foot traffic and vehicles used to administer chemical treatments may adversely affect listed plants and Fender's blue butterfly larvae and eggs. The likelihood of this effect is expected to be small and will be minimized by carefully selecting access routes designed to avoid trampling or compressing listed species.

The effect of chemical treatments on designated critical habitat for Fender's blue butterfly, Kincaid's lupine and Willamette daisy is a short-term reduction in some PCEs with clear long-term benefits. Herbicide treatment may temporarily reduce the cover of native prairie species, which would be an adverse effect to a PCE for each of the three species. It may also reduce the availability of nectar sources for Fender's blue butterfly. In the long-term, use of chemical treatments to restore prairie habitat for the Fender's blue butterfly and listed plants will benefit these species and increase the availability of habitat containing PCEs by controlling invasive woody species and non-native plants and providing open areas for native plants and nectar sources for Fender's blue butterfly to become established.

vi. Solarization and Shade Cloth

Solarization and shade cloth will be used to control weedy vegetation in habitat that is not occupied by listed species. These techniques will have no adverse effects to listed species or designated critical habitat. The long-term effects of these treatments will be entirely beneficial, as they are designed to enhance and restore degraded prairie patches and make them available for colonization by listed and other native prairie species.

vii. Infrared Radiation

Infrared radiation will not be used in habitats occupied by listed species. There may be short-term adverse effects to designated critical habitat, as it may temporarily remove cover of native prairie vegetation, a PCE of critical habitat for Fender's blue butterfly, Willamette daisy and Kincaid's lupine. It could also reduce the availability of nectar plants for the butterfly over the short-term. However, the long-term effect of treating

critical habitats using infrared radiation will be strongly positive because it will reduce invasive species and promote native prairie plants. Additionally, treated areas will typically be seeded with native species. Therefore, treatments involving infrared radiation will have no adverse effects to listed species, but may adversely affect designated critical habitat temporarily. The long-term effects will be entirely beneficial, as degraded prairie patches will be enhanced and restored to make them available for colonization by listed prairie species.

C. Revegetation

Revegetation efforts will improve habitats for listed species by restoring and augmenting the native components of prairie habitats upon which listed species depend. On sites occupied by Fender's blue butterfly, revegetation will be done in early spring or late winter when the butterflies are in diapause, and at some distance from extant Kincaid's lupine plants, where the inactive larvae may be present. Care will be taken to avoid trampling or otherwise harming listed plants. Therefore, the effects of plant material collection and revegetation will be entirely beneficial to listed plants, Fender's blue butterfly and designated critical habitat for Fender's blue butterfly, Kincaid's lupine and Willamette daisy by resulting in increased cover of native species, less coverage of invasive and woody species, and higher quality and quantity of prairie habitats.

D. Collection, storage and cultivation of Kincaid's Lupine seed and plant material

Adverse effects to Kincaids' lupine will be minimized by the protocols to be followed, which include limited timing and collection methods, and a maximum percentage of plant material per population that can be harvested. All harvested propagules will be removed from the collection site, and will not be available for natural germination and recruitment in the wild. As a result, lupine may experience a loss in reproductive potential. However, the negative effect is expected to be very small as limits on collection have been established based on the size of the wild population, and are designed to minimize the effect to the population. Seed mortality in natural habitats, whether through failure to germinate or recruit into the next generation, occurs at much higher levels than proposed for seed collection. The collection limits allowed on the enrolled lands under the SHA are not expected to have adverse effects to wild populations (Menges *et al*. 2004).

Recent research on cultivation of listed plants in the Willamette Valley has shown that Kincaid's lupine and other species can be successfully grown in greenhouses or cultivated plots (Kaye and Kuykendall 2001b, Gisler 2003, Kaye and Brandt 2005). Adverse effects from cultivation of listed plants may occur from reduced natural selection, small effective population size that leads to genetic drift, and inbreeding depression. These potentially negative effects will be minimized by the practices specified in the project description. Propagule transport, storage and cultivation will have no additional effects to listed plant populations in the wild beyond those already considered in the collection phase.

There will be no effect to designated critical habitat for Fender's blue butterfly, Kincaid's lupine or Willamette daisy from collection, transport, propagation or cultivation of listed species.

E. Reintroduction and augmentation of Kincaid's lupine

Some of the outplanted individual plants may die in the first season after planting, but these losses are expected to be small relative to the number of seedlings that would die in wild populations. Planting seeds or seedlings into restoration sites could have some adverse effect to existing populations of listed species at those sites, although these effects are likely to be minimal as care will be taken to minimize trampling or other disturbance to listed plants. Soil compaction by foot traffic may adversely affect listed plants and Fender's blue butterfly larvae and eggs, but the likelihood and potential extent of this effect is expected to be small.

The requirement to use only seeds or propagules from nearby populations, or populations from similar habitat types will preclude adverse effects associated with introducing non-compatible populations of cultivated or wild seed into restoration sites.

In general, the effects of population augmentation and reintroduction will be beneficial to Kincaid's lupine and Fender's blue butterfly, resulting in larger populations and wider distribution in the wild. The effects on designated critical habitat for Fender's blue butterfly, Kincaid's lupine and Willamette daisy will be entirely beneficial, resulting in increased cover of native prairie species.

F. Threat reduction and net conservation benefit

Site-specific plans will be developed to outline the conservation, restoration or enhancement activities that will occur on lands as they are enrolled in the SHA program. Measures that could be incorporated to reduce threats and further improve conditions for listed species may be identified after consideration of land uses on properties to be enrolled, threats, opportunities and other available information, including any applicable recovery plans. Any measures that are added to reduce threats are expected to benefit listed species over the long-term. Site-specific plans will provide a mechanism to establish the activities that will lead to a net conservation benefit on enrolled properties.

The enrolled properties will contribute to the conservation and recovery of the Fender's blue butterfly and listed plants by enhancing the quantity and/or quality of suitable habitat for existing populations or for newly established populations. The enrolled properties will increase the distribution of Fender's blue butterfly within its historic range through establishment of new populations or through habitat improvements that promote natural movement of existing populations into previously inaccessible or unsuitable habitats. Management actions undertaken on the enrolled properties, as described in the Agreement, are beneficial to the Fender's blue butterfly and listed plants and are consistent with the goals of recovery and long-term survival.

Although management activities will have limited short-term adverse effects on listed species and critical habitat addressed in this consultation, the longer term outcomes will result in beneficial effects to species and critical habitats. Habitat restoration and enhancement activities are likely to increase the reproduction, numbers and distribution of the listed species.

G. Return to baseline

The primary goal of the SHA is to achieve a net conservation benefit for the Fender's blue butterfly by implementing activities that will increase, improve and stabilize butterfly habitats and populations. Benefits to the species will be realized over the 15-year life of the SHA and beyond. Assurances will be provided to landowners that they will be able to return their enrolled lands to baseline levels for the butterfly after voluntary actions designed to benefit the species have been carried out. Consequently, an undeterminable number of butterflies in various life stages, and any listed plants associated with their habitats, may be lost if and when the habitat is returned to the baseline condition in the future.

In some cases, occupied habitat on the enrolled lands may exist in a degraded or low quality state (i.e. isolated plants or areas that lack adequate plant associations for breeding and feeding). In these situations, baseline determinations may employ an estimate of the total or aggregated plant cover that contributes to butterfly habitat, and a baseline-level equivalent may be established that considers Fender's blue butterfly habitat quality and location in addition to the quantity of habitat. A return to baseline conditions on these properties could result in an area of equivalent habitat value that is in a different location or that is smaller in extent, but of much higher quality, than the original habitat. A shift in habitat location or establishing higher quality habitat, even if the habitat area is reduced, can be more valuable for the butterfly by improving habitat connectivity, increasing available resources, and reducing the distances butterflies need to travel to forage, reproduce and disperse. In any case, even after a return to baseline conditions, a net conservation benefit for the butterfly must be expected in order for lands to be eligible for enrollment under the SHA program.

Return of participating properties to baseline condition is not expected to occur all at the same time in the future; therefore, the loss at any one time during return to baseline condition would be restricted to those butterflies and listed plants on individual properties as they are returned to baseline. Restoration efforts within designated critical habitats may be negated if enrolled lands are returned to baseline conditions. While any landowner may choose to return his or her enrolled lands to baseline conditions, we anticipate that many landowners will have a continued interest in conserving the species and will opt to maintain their native prairie habitats well into the future. In addition, landowners are required to notify the OFWO 60 calendar days in advance of any planned activity that the Cooperator reasonably anticipates will result in "take" (i.e. death, injury or other harm) of the covered species on the enrolled property. We anticipate this will help to minimize potential losses, since in these instances the OFWO will have the opportunity to collect and relocate any remaining butterflies or listed plants from areas to be affected if appropriate and feasible. The OFWO is also to be notified of any proposed or pending transfer of ownership so that the new

owners can be contacted and invited to continue the existing Certificate of Inclusion or enter into a new agreement that would benefit listed species on the enrolled property.

None of the losses during SHA implementation or a return to baseline conditions are expected to jeopardize the continued existence of the species; habitat improvements associated with implementation of the SHA are anticipated to increase the butterfly population over time. While the extent to which the numbers and distribution of butterflies or listed plants will improve as a result of SHA activities is unknown, net increases in butterflies, listed plants and other associated native prairie species are expected to greatly exceed any losses associated with implementation of SHA activities or return to baseline conditions.

V. CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

The Service anticipates all existing threats to the species that were discussed for each species in section II, the status of the species, are reasonably certain to continue. These include: degradation of native prairie habitats by invasive non-native plants and encroaching woody vegetation, agriculture and forest practices, commercial and residential development, road construction and road maintenance.

The extent of effects from current and future development and human activities in the action area is unknown. However, prairie habitats are expected to become more fragmented as land is converted to other uses, continue to be invaded by non-native plants and be colonized by woody vegetation. The effect to Fender's blue butterfly, Willamette daisy, Bradshaw's lomatium, Kincaid's lupine and Nelson's check-mallow is likely to be fewer populations and reduced numbers of individuals, further threatening these declining species. Critical habitat for Fender's blue butterfly, Willamette daisy, and Kincaid's lupine is likely to be degraded or reduced as encroachment by invasives and woody vegetation continues and land is converted to other uses. The purpose of the SHA program is to slow the rate and potentially reduce the extent of habitat degradation and loss of the Fender's blue butterfly and other species that occur on and near its habitats.

VI. CONCLUSION

After reviewing the current status of Fender's blue butterfly, Willamette daisy, Bradshaw's lomatium, Kincaid's lupine and Nelson's check-mallow, designated critical habitat for Fender's blue butterfly, Kincaid's lupine and Willamette daisy, the current status of the species in the action area, the effects of the proposed action, and the cumulative effects within the action area, it is the Service's conclusion that the action, as proposed, is not likely to jeopardize the continued existence of Fender's blue butterfly or the five listed plants, and is not likely to adversely modify designated critical habitat for Fender's blue butterfly, Willamette daisy or Kincaid's lupine.

Although many of the restoration activities will result in short-term adverse effects to listed species and critical habitats, timing and areal limits and other best management practices will minimize adverse effects to listed species and critical habitats. Over the long-term, conservation and restoration activities covered by the SHA will result in restoration of prairie habitats within the Willamette Valley, Oregon, which will enhance and expand on existing populations of Fender's blue butterfly and other listed species and contribute to their recovery.

A. No jeopardy finding

This no jeopardy finding is supported by the following:

i. None of the proposed activities are likely to permanently decrease reproduction, numbers, or distribution of Fender's blue butterfly, Willamette daisy, Bradshaw's lomatium, Kincaid's lupine or Nelson's check-mallow. In fact, habitat conservation and restoration activities are likely to increase the reproduction, numbers and distribution of the five species.

ii. The listed plants, nectar source plants, and secondary host plants for Fender's blue butterfly will generally be dormant during management activities, and thus, management activities will not adversely impact plants but will provide enhanced growing conditions. Prescribed burns may kill a small number of Willamette daisy, Bradshaw's lomatium, or Nelson's checkermallow individuals; studies have shown, however, that the species respond positively to fire, and populations tend to increase in the 2-3 years following a burn. Mechanical mowing will generally be done outside of occupied habitats and after plants have senesced; thus adverse impacts from mowing will be very small, and temporary. Monitoring activities are anticipated to have little or no adverse affect on plants.

iii. Harassment and mortality of butterflies affected by monitoring, habitat maintenance and restoration activities are expected to be very low. Recent research indicates that few larvae are killed by mowing, and the population generally rebounds in the year after treatment. Planting of nectar plants will improve habitat and benefit the viability of Fender's blue butterfly populations over time.

iv. The majority of the anticipated mortality to Fender' blue butterfly from restoration activities is associated with prescribed fire. Implementing burns in accordance with the project description provides reasonable certainty that, following treatment, Fender's populations will not only rebound but likely increase in size.

v. Management activities that are implemented when plants are growing (*e.g.*, spring mowing, weed treatment) will be done in a manner that minimizes effects to listed plants. Although some plants will be negatively affected, the improved habitat quality and reduction in competition from invasive plants will result in larger, more robust populations of the listed species.

vi. Techniques used to control woody and weed plant expansions will improve habitat quality for Fender's blue butterfly and the listed plants.

vii. Planting of nectar plants will improve habitat and benefit the viability of Fender's populations over time.

viii. While Fender's blue butterflies and listed plants may be lost on properties that are returned to baseline conditions, the SHA program does not permit loses of the butterfly below baseline levels. Activities on all enrolled lands are expected to benefit the butterfly and its habitat, including Kincaid's lupine as its host plant, such that net gains in butterfly and lupine populations are expected overall.

B. No adverse modification of critical habitat

This finding of no adverse modification of designated critical habitat is supported by the following:

i. Raking, mowing, and burning will have a beneficial effect on Fender's blue butterfly, Kincaid's lupine and Willamette daisy critical habitat because it would allow the reduction or removal of thick thatch buildup and provide bare soil spaces for seedlings and new vegetative growth of Kincaid's lupine, Willamette daisy and other low growing grasses and forbs to establish.

ii. The remaining prairie restoration and management treatments will ultimately benefit critical habitat for Fender's blue butterfly, Kincaid's lupine and Willamette daisy by acting to reduce the succession of dense canopy vegetation which block sunlight necessary for Fender's blue butterfly to seek nectar and search for mates and which block sunlight necessary for the plants' growth and reproduction. These treatments will increase the availability of stepping stone habitat between natal lupine patches necessary for dispersal and connectivity of Fender's blue butterfly and pollinators of Kincaid's lupine and will reduce the occurrence of invasive plants which compete with Kincaid's lupine and Willamette daisy.

iii. Native prairie plant population augmentation and enhancement will increase the availability of larval host plants, adult nectar sources, and other low growing grasses and forbs necessary for Fender's blue butterfly.

iv. Baseline conditions for Fender's blue butterfly will be maintained or improved on enrolled lands.

VII. INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. Harm is further defined to include significant habitat modification

or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the proposed action is not considered to be prohibited taking under the Act provided that such taking is in compliance with this Incidental Take Statement.

The proposed SHA and the discussions herein clearly identify anticipated impacts to affected species likely to result from the proposed taking and the measures that are necessary and appropriate to minimize those impacts. All conservation measures described in the proposed SHA, together with any section 10(a)(1)(A) permit issued with respect to the proposed SHA, are hereby incorporated by reference as reasonable and prudent measures and terms and conditions within this Incidental Take Statement pursuant to 50 CFR 402.14(i). Such terms and conditions are non-discretionary and must be undertaken for the exemptions under section 10(a)(1)(A) and section 7(o)(2) of the Act to apply. If the permittee fails to adhere to these terms and conditions, the protective cover of the section 10(a)(1)(A) and section 7(o)(2) may lapse.

Generally, section 9 take prohibitions do not apply to listed plant species on non-federal lands and sections 7(b)(4) and 7(o)(2) of the Act generally do not apply to listed plant species. Therefore, listed plants typically do not have to be included in the incidental take permit. However, limited protection of listed plants from take is provided to the extent that the Act prohibits the removal and reduction to possession of Federally listed endangered plants or the malicious damage of such plants on areas under Federal jurisdiction, or the destruction of endangered plants on non-federal areas in violation of State law or regulations or in the course of any violation of a state criminal trespass law. In approving a SHA and issuing an enhancement of survival permit during the intra-Service section 7 consultation, the Service must determine that the permit will not "jeopardize the continued existence" of listed plants. This finding has been made, as discussed above in section VI.

The measures described below are non-discretionary, and must be undertaken by the Service for the exemption in section 7(o)(2) to apply. The Service must monitor the impact of incidental take and report the progress of the action and its impact on the species to the Service as specified in this incidental take statement.

A. Amount or extent of take anticipated

Based on the proposed SHA and on the analysis of the effects of the proposed action provided above, the Service anticipates that incidental take of Fenders' blue butterfly may occur as a result of the proposed action. Individuals in various life stages will be taken as a result of return of enrolled lands to baseline conditions. Incidental take from some SHA conservation and restoration activities will also occur, but will be difficult to detect because the presence and number of individuals is difficult to determine within a project area and detecting a dead or impaired specimen is highly unlikely.

Although the Service anticipates Fender's blue butterfly will be incidentally harassed and harmed (killed or injured) as a result of SHA activities, accurately quantifying these effects is

difficult. For instance, injured butterflies that fly off to areas well beyond the project corridor before dying or that are consumed by birds, bats or other predators because of injuries, are not likely to be located for estimating take. Additionally, larvae and eggs that are trampled, mowed over, or removed during raking and removal of thatch layer will be extremely difficult to find in order to quantify incidental take. Therefore, even though take is expected to occur, data are not available and are not sufficient to enable the Service to estimate an exact number of individuals which are incidentally taken for most of the proposed activities. For this reason, we will specify the amount or extent of incidental take associated with prescribed burning using the maximum percent of existing habitat area that could be treated on an annual basis as a surrogate. Incidental take associated with the other restoration and maintenance activities will be estimated as a percentage of the population at each site. Incidental take associated with the return to baseline conditions on enrolled lands is estimated based on recent survey data for non-federal lands, an estimated number of properties to be enrolled, and an estimated percentage of enrolled properties to be returned to baseline.

We anticipate the following maximum annual incidental take of Fender's blue butterfly associated with these activities:

i. Mowing, use of manual and power tools, tilling, disking, plowing, and surveys and monitoring may cause death or injury of a small percentage of larvae and eggs in the action area due to crushing during soil compaction by mowers and other vehicles, suction by mower or trampling by foot traffic that is expected to be negligible to the population. A small percentage of adults may be harmed by the short-term reduction in host plants or nectar sources that result from these activities, but this amount is also expected to be negligible to the population.

ii. Chemical treatment activities have been designed to reduce the risk of harming butterflies, their host plants and nectar sources, and minimize exposure of larval Fender's blue butterflies to herbicides. We cannot calculate the number of larvae that will be killed or injured by incidental exposure to herbicide, or adults that will be harmed by the loss of host or nectar plants, but given the targeted application methods specified, we expect any death or injury to be less than five percent of larvae or adults in the action area.

iii. Prescribed fire may result in 100 percent mortality of larvae on portions of all parcels that are burned, which could be as much as one-third of each site enrolled in the SHA in any given year. In 2007, there were approximately 3,500 adult Fender's blue butterflies at surveyed sites on non-federal lands (based on 2007 counts of adult Fender's blue butterflies on non-federal lands, U.S. Fish and Wildlife Service unpublished data). If half of these sites were enrolled in the SHA, and one-third of all occupied habitats were burned in one year, all of the eggs and larvae associated with about 580 adult butterflies could be killed.

iv. Raking may result in the death or injury of a negligible percentage of larvae and eggs in the action area due to crushing or removal from habitat during removal of duff and litter layer.

v. Return to baseline conditions may result in mortality or displacement of individuals that are not captured and successfully relocated. Return to baseline conditions may also reduce the quality and quantity of host plants and nectar sources, reducing the likelihood of butterfly survival and successful reproduction. Assuming that 50 properties become enrolled during the term of the SHA, and SHA activities lead to the occurrence of 144 butterflies per property (which was found to be the average number per non-federal site surveyed between 2000 and 2007; see discussion in section II. A.) above baseline conditions, losses due to return to baseline are estimated to be 7,200 butterflies over the 25-year life of the section 10(a)(1)(A) permit. This estimate is based on the total estimated number of butterflies potentially gained on enrolled properties. Return to baseline on enrolled lands would generally occur during the 15-year period from years 10 through 25 of the permit after conservation and restoration activities have been implemented. However, we believe this estimate of losses overestimates potential losses because 1) enrolling 50 properties and increasing butterfly populations by 144 individuals on each is a high aspirational goal, 2) we anticipate that many landowners will likely continue their efforts to benefit the species rather than returning their properties to baseline conditions, 3) landowners that return their properties to baseline conditions might not impact 100 percent of the population on their lands, and 4) efforts will be made to collect and relocate butterflies to mitigate potential losses.

B. Effect of the take

In this BO, the Service has determined that the level of anticipated take is not likely to result in jeopardy to the Fender's blue butterfly.

C. Reasonable and prudent measures

The Service believes the precautions described in the proposed action and SHA provide all needed measures to minimize take. Annual reporting on the implementation and outcome of activities carried out under the SHA will assist the Service in ensuring that effects to the Fender's blue butterfly are consistent with the biological opinion.

D. Terms and conditions

The reporting requirements specified in the SHA will also serve to meet the reporting requirement for this consultation. Specifically, the Permittee (i.e., OFWO) will also provide an annual report by December 31st for the prior fiscal year that summarizes significant activities and accomplishments for the period, including 1) any new Cooperators enrolled during the reporting period, a description of newly enrolled lands, management activities to be carried out, and expected benefits to the covered species, 2) actions taken to date on enrolled lands in relation to each of the management and conservation activities described in the SHA, Certificates of Inclusion and Permit, and 3) supplemental information such as

additional comments and copies of photos, data, scientific papers, or other products related to activities covered under this SHA, as available. Cooperators are to provide annual summaries of significant activities and accomplishments for the fiscal year period, including 1) actions taken to date on enrolled lands in relation to each of the management and conservation activities described in the site-specific plan, Certificate of Inclusion and Permit, 2) "take" of covered species, and 3) any supplemental information such as additional comments, observations and copies of photos, data, scientific papers, or other products related to activities covered under this SHA, as available.

In addition, per the SHA, the OFWO and Cooperators will describe in general terms the monitoring programs for various enrolled lands, along with any results and findings for the year. Annual reports are designed to provide information concerning the effects and effectiveness of the SHA's conservation actions on the covered species, as well as to determine if the conservation actions the OFWO and Cooperators undertake meet the SHA's standard of benefiting the covered species. The monitoring reports will document any changes in the covered species population or the habitat associated with that species on the enrolled lands over time, and will denote whether the data provided is from the Permittee (i.e., the OFWO), Cooperator, professional scientist or other specific individual or entity. The OFWO will maintain a current list of Cooperators and will indicate when each Cooperator's enrolled lands were last visited. It is anticipated that every property will be visited at least once every 1-3 years.

Reports will be maintained at the Fish and Wildlife Service's Oregon Fish and Wildlife Office, which is located at the following address:

Oregon Fish and Wildlife Office
2600 SE 98th Avenue, Suite 100
Portland, OR 97266

VIII. CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

In order for the Service to maintain awareness of current habitat quality, species status, and actions that can be taken to minimize or avoid adverse effects or to benefit the listed species and habitats affected by the SHA, the OFWO will maintain any relevant information obtained on the enrolled lands and make it available in the files associated with the SHA.

The Service will seek to identify Cooperators that are willing to voluntarily support an elevated baseline on their enrolled lands. In those cases, the assurances Cooperators receive will allow a

future return to conditions that provide a net benefit to the Fender's blue butterfly over the baseline conditions present at the time of enrollment.

IX. REINITIATION – CLOSING STATEMENT

This concludes formal consultation on the OFWO's programmatic SHA for Fender's blue butterfly that may affect Fender's blue butterfly, Willamette daisy, Bradshaw's lomatium, Kincaid's lupine, Nelson's checker-mallow, and designated critical habitat for Fender's blue butterfly, Kincaid's lupine, and Willamette daisy. As required by 50 CFR Part 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, and operations that are causing such take must be stopped, and formal consultation must be reinitiated.

If you have any further questions regarding this consultation, please contact Jennifer Thompson or Lee Folliard at (503) 231-6179.

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