Management Plan for Lupine Meadows

Greenbelt Land Trust

Prepared by Institute for Applied Ecology

FINAL PLAN

May 1, 2008

Website Version

Table of Contents

Prepared by:

Thomas N. Kaye
Institute for Applied Ecology
PO Box 2855
Corvallis, Oregon 97339
Phone: 541-753-3099
Web: www.appliedeco.org

Prepared for:

Greenbelt Land Trust
PO Box 1721
Corvallis, Oregon 97339
Phone: 541-752-9609
Web: www.greenbeltlandtrust.org

Acknowledgments:

Many individuals made important contributions to this document. Claire Fiegener of the Greenbelt Land Trust (GLT) was a constant source of information, ideas, and overall support. As members of the advisory group for this plan, Mark Wilson, Deborah Clark, Bob Altman, Paul Hammond, and Greg Fitzpatrick were extremely valuable sources of information, discussion, and feedback. Graduate students in the Department of Botany and Plant Pathology at Oregon State University and members of the Dead Botanists Society, including Beth Lawrence, Matt Blakely-Smith, Jessie Brunson, Liz Martinelli, Brian Knauss, John Syring, Nate Miller and Bob Fahey conducted extensive vegetation surveys at the site. Dick Brainerd also contributed substantially to the plant species lists developed for the site and was a steady source of feedback for this work.

Special Note:

This report has been modified from its original format by removing maps and/or appendices that include information on the location of rare and sensitive species.

1. Introduction

1.1 Site vision

Lupine Meadows is a spectacular collection of upland and wetland habitats capable of supporting a large diversity of plants and animals, including significant populations of endangered species. This Management Plan is based on a vision for the site that emphasizes habitat conservation, active restoration, and outreach opportunities to promote education about Willamette Valley ecosystems and restoration.

Habitat at Lupine Meadows will be managed for high species diversity and quality examples of Willamette Valley prairies. The upland and wetland prairies will be maintained in an open condition without excessive amounts of shrubs and trees. Healthy populations of Special Status Species, including species listed by the U.S. Fish and Wildlife Service as Threatened and Endangered, like Kincaid's lupine and Fender's blue butterfly, will be present. Their conservation will be linked to goals in the draft Recovery Plan for Western Oregon and Southwestern Washington Prairies (USWFS 2006). The site will be managed for acceptable levels of public access through recreation (if a connecting trail is built through the property), planned tours, volunteer and school restoration activities, and research projects by local scientists and students.

1.2 Executive summary

The Greenbelt Land Trust's vision for its 58 acre Lupine Meadows property is to protect, restore and manage rare native habitats and rare species to provide low-impact education, recreation and ecological research. In addition, the GLT desires to use Lupine Meadows to partner with public agencies and private landowners and organizations to promote restoration and management of native habitats in the Newton Creek area.

Upland and wetland prairie habitats are the most imperiled native habitats in the Willamette Valley and host most of the rare and listed plant and animal species in the ecoregion. The plan places the highest priority on restoration of these habitats and species, with emphasis on Fender's blue butterfly and Kincaid's lupine. The result at Lupine Meadows will be a grassland-dominated landscape, with some portions of ash swale and riparian corridors. Ongoing, long-term management will be necessary to maintain prairie habitats free of encroaching woody vegetation and invasive exotic species. An integrated approach including prescribed fire, manual and mechanical clearing, seeding with native species, herbicides and alternative methods will be necessary for this effort. Partnerships with Benton County and neighboring landowners and organizations will be necessary to preserve and restore these habitats.

Achieving the vision of native habitat restoration at Lupine Meadows will require external funding, phasing and experimentation to determine the best restoration methods, and cooperation from partners with similar interests. Adaptive management will be critical to the success of this undertaking.

1.3 Purpose of the plan

The purpose of this Management Plan for Lupine Meadows is to provide a clear description of the site and lay out objectives and actions needed to achieve a set of desired future conditions. This Plan does so by assessing the current condition of the site, describing a site vision, identifying goals and specific objectives overall and for each habitat type, outlining phases of restoration work, and identifying on-going management and monitoring needs. A primary goal of this plan is to identify needs and tasks for maintaining or expanding existing biological resources, such as Kincaid's lupine (namesake of the site) and Fender's blue butterfly, other rare species and significant habitats, and recommend steps for increasing native biodiversity.

The plan also discusses how to conduct educational activities at the site without impacting the significant resources present on the property. The property location in close proximity to Corvallis and Philomath provide an excellent opportunity for educational outreach to a variety of students and community groups.

1.4 Management plan process

This Management Plan is the result of a deliberate process to evaluate the sites condition and set targets for the habitats and human use. An advisory committee met on multiple occasions to discuss the site, this plan, its format and content. This group met first on 15 September 2003. New members were added and the group met again for a field review of the property during the summer of 2005, then again on 14 December 2005 to develop an outline of the plan. Committee members included Claire Fiegener (Greenbelt Land Trust), Tom Kaye (Institute for Applied Ecology), Deborah Clark (Oregon State University), Mark Wilson (Oregon State University), Bob Altman (American Bird Conservancy), Paul Hammond, and Greg Fitzpatrick (The Nature Conservancy). A draft outline was completed on February 12, 2006. The Draft Management Plan was completed on April 2, 2008, and was circulated to the United States Fish and Wildlife Service, Oregon Department of Fish and Wildlife and the advisory committee. Any suggested changes were incorporated and the final Plan was adopted on May 1, 2008.

Funding for preparation of the Management plan was provided by the United States Fish and Wildlife Service (USFWS) and Oregon Department of Fish and Wildlife through their Landowner Incentive Program. GLT also provided private funds from our donors to assist with preparation of the plan.

1.5 Inventories and studies

A variety of inventories and studies have been conducted in the West Corvallis/Philomath areas where Lupine Meadows is located, as well as on Lupine Meadows itself. They include the following:

- Corvallis Natural Features Inventory (City of Corvallis 2003).
- Wetland delineation and determination for the Lupine Meadows site (Rorick Environmental Services 2003)
- Herbaceous and woody plant cover of a Pacific Northwest upland prairie (Hempy 2003).
- Population estimate and management recommendations for Kincaid's lupine (*Lupinus sulphureus* ssp. *kincaidii*) at the Philomath/West Hills Rd. Property (Institute for Applied Ecology 2003).
- Lupine Meadows 2005 Vegetation Survey (Lawrence and Blakeley-Smith 2005).
- The 2006 Study of the Fender's blue butterfly in Benton, Polk, and Yamhill counties (Hammond 2007)
- Breeding season bird populations at Lupine Meadows 2004-2006 (Altman 2007)

Larger scale studies, reviews or plans that informed the vision of restoring rare, native habitats at Lupine Meadows include:

- Recovery Plan for Western Oregon and Southwestern Washington Prairie Species, Draft (USFWS 2007)
- The Oregon Conservation Strategy (ODFW 2006)
- Rare, Threatened and Endangered Species of Oregon (ORNHIC 2007)
- Willamette Valley-Puget Trough-Georgia Basin Ecoregional Assessment (Floberg et a. 2004)

1.6 Goals and objectives

The following goals (Table 1) were developed by the Lupine Meadows Advisory Committee with assistance from GLT staff and mirror those developed for the Owens Farm Management Plan. These goals targeting restoration of rare native habitats are intended to be compatible with the Oregon Conservation Strategy (ODFW 2006). The Strategy identifies wet prairie, upland prairie, savanna, and riparian habitats and species of the Willamette Valley as the rarest in the state.

Desired future conditions, objectives and specific tasks for each habitat type at Lupine Meadows are presented in section 4, *Habitats and management needs,* of this plan.

Table 1. Management goals for Lupine Meadows.

GOAL 1: PROTECT AND RESTORE Protect and restore native biodiversity and cultural resources.
GOAL 2: INCORPORATE EDUCATION and RECREATION Incorporate environmental and cultural education and passive recreation opportunities which are compatible with ecological restoration.
GOAL 3: PARTNERSHIPS Work with a variety of partner organizations on restoration and education opportunities. Encourage groups to use the site as a "learning lab" for conservation and restoration of rare Willamette Valley habitats.
GOAL 4: MONITOR Conduct baseline and periodic monitoring to evaluate changing site conditions.

2. Background information

2.1 Location and context of the site

Lupine Meadows is located in central Benton County, Oregon, on the west side of the Willamette Valley (Figure 1). The site provides a geographic link for habitats, natural processes, and nature-oriented recreation. Lupine Meadows maintains connectivity between upstream and downstream habitats of Newton Creek, helping to link upstream habitats on private land and the proposed Mary's River Interpretive Center property and other sites downstream to the south. These connections facilitate movement of plants, wildlife and fish allowing for dispersal and gene flow among populations. In combination with other private lands, Lupine Meadows is well situated to provide trail connections between the town of Philomath, the proposed Mary's River Interpretive Center and Bald Hill Park.

The 58 acre property is bounded on the north by West Hills Rd, on the west by 19th Street, on the south by Southern Pacific Railroad, and on the east by private property and an unnamed tributary of Newton Creek. Creeks and small drainages in this area generally flow east toward the Mary's and Willamette Rivers. Lupine Meadows is topographically situated between Newton Creek to the west and an unnamed tributary on the eastern edge of the property, and

these two waterways connect about a tenth of a mile south of the site. The City of Philomath is located within a quarter of a mile southwest of the property, and Corvallis is a few miles to the east. Much of the surrounding habitat is either urban (especially to the west and southwest), becoming more developed, or semi-rural/residential. Additional conservation opportunities in the immediate vicinity include the properties adjacent to, south and north of Lupine Meadows.

The 750 acre privately-owned Bald Hill Farms property to the north can also be seen as a conservation opportunity due to the mix of habitats and location between Bald Hill Park and Fitton Green Natural Area.

Much of the site is wetland, but a prominent feature of the property is a basalt hill or knob at the north end of the site that is covered by upland prairie. A wetland delineation of the property was conducted in 2003 (Rorick and Wilson 2003) and found that approximately 38 acres of the site is jurisdictional wetland. The property has a high diversity of native vegetation and birds.

Access to the site is via a driveway off of West Hills Road. The location of this driveway on a blind curve presents safety issues for access to the site. Due to the presence of a roadside drainage ditch on 19th Street is it is not currently possible to obtain vehicle access from the west side of the property. The GLT has investigated installation of culvert and driveway off of 19th St to provide access to the site.

No trails or other pedestrian access are currently present at the site. The presence of an operating railroad on tracks bordering the southern edge of the property makes pedestrian access from the south challenging. The northern portion of the property lies on a blind curve from 19th Street and thus pedestrian access from the north also poses a challenge

Benton County public works is also concerned about the degree of the curve on the west and north edge of the property and has looked at realigning the roadway. However, there is currently no designated funding for this roadwork.

2.2 Management and habitat history

Since 2004 the property has been managed primarily for conservation purposes. Prior to 2005, two horses were pastured at Lupine Meadows and were allowed to graze and move around freely for many years. The property was managed as a horse pasture and private family recreation area for about 20 years. A small barn near the north end of the property was used to house the horses. This barn was torn down in March 2008 due to its deteriorated condition. Horse pasturing at the site was terminated in 2005 and since then no cultivation or grazing practices have occurred at the site.

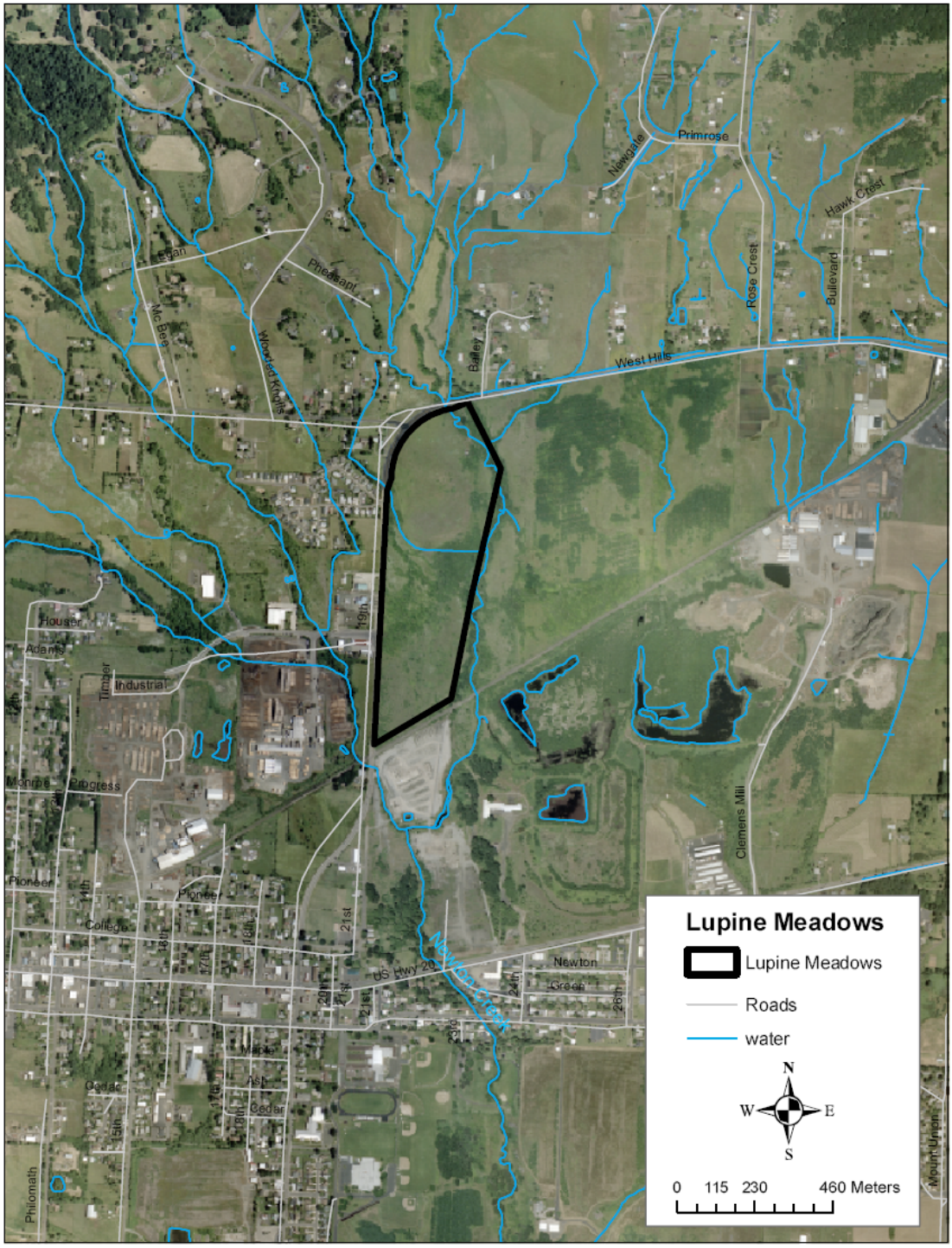


Figure 1. Lupine Meadows in the context of its surrounding landscape. Water-ways generally flow from north to south in this area.

Examination of aerial photographs compiled for the Soil Survey of Benton County from 1955-1970 show no obvious evidence of cultivation practices from that period. However, ditches placed roughly east-west near the center of the property suggest an attempt was made to partially drain a portion of the land. It is unclear when these ditches were established, but given the size of some of the trees along the ditches, we estimate they have been in place for at least 30 years. It is likely that some cultivation of the habitats for pasture grasses and hay took place in the past, but no recent agricultural use is evident. The impacts of these actions persist, however, especially in wetland prairies immediately adjacent to, and south of, the upland, where non-native grasses such as meadow foxtail (*Alopecurus pratensis*) now dominate and native grasses like tufted hairgrass (*Deschampsia cespitosa*) are largely absent.

Historic (back to 1936) aerial photographs of the Corvallis-Philomath area in general and Lupine Meadows in particular show very open prairies, with trees limited to riparian habitats. A map of the historic vegetation of the Willamette Valley created by The Nature Conservancy (Christy et al., 2005) shows that Lupine Meadows was entirely prairie at the time of Euro-American settlement. These prairies were maintained in an open state by frequent fires lit and managed by the Kalapuya Indians to promote food plants like camas and tarweed and manipulate game behavior. After settlement, wildland burning was largely suppressed, and increases in grasses and woody plants have occurred region-wide. At Lupine Meadows, ash trees (*Fraxinus oleracea*) have increased substantially in abundance and density, largely filling in an east-west band of habitat across the center of the property. In addition, pear trees (*Pyrus communis*) have invaded a substantial portion of the site, primarily in wetlands in the south half, and hawthorns (*Crateagus monogyna*) have colonized in scattered places on the upland prairie. Other non-native plants, including grasses, forbs, and shrubs, have established on the property in all habitats and currently pose a serious threat to native plant communities. To address these concerns, active management of the site was implemented prior to the completion of this plan. Scattered unwanted tree (primarily hawthorn) removal has occurred on the upland prairie with volunteer work parties and contractors, trees (mostly pears and some Oregon ash) have been removed over a portion of the southern wetland, and mowing has been contracted annually since 2004 on the upland. Seeding with a native plant mix was conducted on the upland in fall 2005 after heavy gopher activity exposed large areas of open soil. Glophysate was applied to patches of tall oatgrass (*Arrhenatherum elatius*) experimentally in the northwest part of the property in 2006. These activities and additional recommended actions are detailed below.

2.3 Ownership history

For many years up to 2004 Lupine Meadows was owned by a local family who used the property primarily as horse pasture and for personal recreation. The

Joseph Martin Trust purchased the property in 2004, and in June 2005 sold a conservation easement to the Greenbelt Land Trust. In June of 2007, GLT Properties, LLC, of which the Greenbelt Land Trust is the sole managing member, purchased the residual value of the property and now owns the property outright. Use of a separate LLC for outright ownership was necessary to address concerns regarding possible extinguishment of the conservation easement through merger. The Conservation Easement remains in place on the property.

2.4 Encumbrances from funding agencies on property

The Conservation Easement purchased in 2005 utilized three different sources of grant funding. The United States Fish and Wildlife Service (USFWS) contributed funding through their North American Wetlands Conservation Act (NAWCA) program and also through their Landowner Incentive Program (LIP). Both of these granting agencies required that a Notice of Grant Agreement be recorded in the deed records for the property. The Oregon Watershed Enhancement Board (OWEB) also provided funding for purchase of the easement and required that they be named as a third party beneficiary of the easement. In addition, OWEB provided funding for purchase of the remaining value of the property by GLT Properties, LLC in 2007.

2.5 Land use planning designations, zoning and easements

The 58 acre property is located within the Urban Growth Boundary of Philomath. It is designated as Industrial in the City's General Plan due to its location near two former mill sites located to the south and the still operating Georgia Pacific Mill to the west. The area where Lupine Meadows is located historically served as an important timber industrial site for Philomath and Benton County. However, over the last 10 years the two former mills located south of Lupine Meadows have been dismantled and the properties sold for other uses.

The property is zoned Industrial by Benton County. However, the presence of a large amount (38 acres) of jurisdictional wetlands made it difficult to develop the site for industrial use. A 1998 Wetlands Study of the Newton Creek Watershed, where the site is located, showed that there were over 400 acres of designated wetlands in the study area. The GLT worked with the City of Philomath and local economic development officials to make recommendations on properties within Newton Creek that should be conserved and those that may be appropriate for development. The Lupine Meadows site was designated as a priority for conservation and a supporting letter from the City of Philomath was obtained as part of our land acquisition process.

The GLT will work with Benton County to have the property rezoned to a more appropriate land use designation that reflects its protected status. The most appropriate designation would be as Open Space.

Surrounding land uses include a manufactured home park to the west across 19th St., industrially zoned lands to the east that contain an old Christmas tree farm, undeveloped industrial lands to the south and rural residential homes to the north across West Hills Road. The 750 acre Bald Hills Farms, zoned Exclusive Farm Use, is located directly across West Hills Road from Lupine Meadows

The Lupine Meadows site contains a number of existing easements that allow for water pipes, electrical and telephone services and communication lines. In addition, the conservation easement has a reservation for an additional 20 foot easement for a possible sanitary sewer line and water line. These easements were granted in order to allow for extension of public services to nearby properties that are within the City of Philomath Urban Growth Boundary. The terms of the Conservation Easement require that placement and design of these utilities give priority to protecting the wetlands resources and habitat values of the property.

2.6 Conservation easement

The conservation easement for Lupine Meadows recognizes the habitat and wildlife values of the site and has the purpose of retaining forever the natural and open space conditions of the property for the benefit of wildlife, water quality and native species. Uses that will significantly impair these values are prevented by the easement. It calls for the adoption of an approved Management Plan for the site that describes the resource values of the property and addresses the native species and habitat needs of the property, as well as plan for public access for recreation and educational purposes, and guide resource use activities such as harvest of native plant materials.

3. Overview of habitats and species

3.1 Habitat types

Four primary habitat types have been identified at Lupine Meadows including:

- Upland prairie
- Wetland prairie
- Ash swale and savanna
- Riparian forest

All of these are important habitat types in the Willamette Valley, and each may support one or more species of conservation concern. Each habitat type is described in detail in Section 4 (Habitat types and management needs). Vegetation surveys performed for this plan have resulted in extensive species lists (Appendix A) as well as a map of existing vegetation types and the current condition of each (Appendix B).

3.2 Wildlife

Many types of wildlife use Lupine Meadows for breeding or forage. Wildlife surveys at the site have focused on birds to date. Altman (2007) surveyed the site from 2004 through 2006 and found 66 bird species using the site (Appendix I), 34 of which likely use the site for breeding. Among the remaining species, most (27 species) breed in habitats in the vicinity (e.g., patches of coniferous forest, residential and urban areas), and use the site for non-breeding activities (e.g., migration and/or foraging). Four species are winter residents that were detected prior to leaving on their spring migration (i.e., American Pipit, Hermit Thrush, Ruby-crowned Kinglet, and Yellow-rumped Warbler). Spotted Towhee was the most abundant species in both riparian and Wetland prairie habitats, and Lesser Goldfinch was the most abundant bird in upland prairies.

No species listed as Threatened or Endangered by state or federal agencies were detected during surveys. However, sixteen species present at the site are recognized with "special status" by four agencies/organizations (Table 2). Among the most prominent of these is Oregon Vesper Sparrow, recognized by all four entities. Two singing males were present for about one month in 2004 although a female or nesting was never documented. Other species of interest include a couple pairs of Willow Flycatcher; a single detection of Acorn Woodpecker, a species which nests in oak habitat within one mile of the site; and a single detection of Western Meadowlark, which nests in grassland habitat just north of Lupine Meadows and likely occasionally forages on the property.

3.3 Plants

A total of 191 plant species have been documented at Lupine Meadows, 114 of which are native species (Lawrence and Blakeley-Smith 2005). Grasses dominate the low vegetation of both upland and wetland prairies, and some portions of these habitats have high quality remnants of native vegetation. Trees provide extensive habitat structure in riparian and ash swale/savanna habitats. Wild populations of three federally listed threatened and endangered species are currently found on the property and the available habitat is appropriate for several other rare or listed species.

Locations of all Special Status plant species at Lupine Meadows are mapped in Appendix C. The upland prairie in particular contains some areas of very high quality native prairie that supports populations of Kincaid's lupine (*Lupinus sulphureus* ssp. *kincaidii*) and Fender's blue butterfly (*Icaricia icarioides fenderi*), as well as seasonally nesting Oregon vesper sparrows (*Pooecetes gramineus affinus*). The abundance of Kincaid's lupine gives the site its name, Lupine Meadows. A small population of Willamette daisy (*Erigeron decumbens*) has been planted in the upland prairie as well. Patches of Howell's spring beauty (*Montia howellii*) occupy the highly disturbed soils of the area of upland habitat used for parking adjacent to the old barn in the northwest area of Lupine Meadows. The wetland prairie, ash swales and riparian areas support an existing small and scattered population of Nelson's checkermallow (*Sidalcea nelsoniana*), and the southern wetland prairie in particular may be suitable habitat for western bluebirds and western meadowlarks, especially with restored connectivity to adjacent open properties.

Table 2. Special status birds detected during breeding bird surveys at Lupine Meadows, 2004-2006, with conservation status as designated by four bird conservation entities (from Altman 2007).

Species	*USFWS* Birds of Conservation Concern	*ODFW* State Strategy Species	*TNC* Willamette Valley Ecoregional Target Species	*OR-WA PIF* Willamette Valley Focal Species
Acorn Woodpecker		X	X	X
American Kestrel				X
Bewick's Wren				X
Black-throated Gray Warbler			X	
Bushtit				X
Downy Woodpecker				X
Pacific-slope Flycatcher			X	
Rufous Hummingbird	X		X	
Swainson's Thrush				X
Vaux's Swift			X	
Vesper Sparrow (Oregon)	X	X	X	X
Willow Flycatcher (Little)		X	X	X
Western Wood-pewee			X	X
Western Bluebird		X	X	
Western Meadowlark		X		X
Yellow Warbler				X

3.4 Plant species of conservation concern recommended for introduction

Several rare species of conservation concern that are currently not known to occur at Lupine Meadows, but for which habitat is present, are recommended for

introduction to the site (Figure 2, Table 3). Large, viable populations of these species could be supported by the high-quality habitats present at Lupine Meadows, or habitat in moderate or poor quality could be restored to support them.

A few individuals of Willamette daisy (*Erigeron decumbens*) have been planted on the site (with the assistance of local school groups), but their success was poor and a larger colony of the species at Lupine Meadows would provide greater ecological significance and contribute to recovery of the species. Both upland and wetland prairie habitats may be suitable for the species, and some experimentation in both habitats may be necessary for successful introduction to the site.

Bradshaw's desert parsley (*Lomatium bradshawii*) historically occurred in wet prairies in Benton County, and is currently known from a small population approximately 1 mile east of Lupine Meadows. The species prefers wetland prairies dominated by tufted hairgrass (*Deschampsia cespitosa*) of the type that is prevalent in the southern 1/3 of Lupine Meadows. Introduction of a population to Lupine Meadows would be a substantial contribution to recovery needs for this species as detailed in the Recovery Plan for Western Oregon and Southwestern Washington Prairies.

Peacock larkspur (*Delphinium pavonaceum*) is a species that was formerly more widespread whose populations near Lupine Meadows are no longer present. Habitat for this species in the immediate vicinity to Philomath and Corvallis has declined substantially in recent years due to development, and introducing a population at Lupine Meadows could substantially improve conditions for the species in Benton County.

No populations of shaggy horkelia (*Horkelia congesta*) remain in the Corvallis-Philomath area. The closest remaining known sites are on private property near the Irish Bend School and at Finley National Wildlife Refuge, and the current conditions of those populations are unknown. Introduction of this species to Lupine Meadows could easily create the largest known population in Benton County.

Clustered goldenweed (*Pyrrocoma racemosa*) is one of Oregon's rarest plants, occurring in a single population center in wetlands west of Eugene. It is also found in California. The species historically occurred in the Corvallis area at Avery Park. Introduction of clustered goldenweed at Lupine Meadows represents a biologically significant event for this species and would create greater security for its long-term survival. A small population has been planted in the wetland prairie at the south end of the site, and these individuals are doing well, indicating that the habitat is suitable for additional plantings.

Introduction of golden paintbrush (*Castilleja levisecta*) may represent an exciting opportunity for plant conservation in Oregon. All remaining wild populations occur in Washington and British Columbia. This species is currently extinct in Oregon, with the exception of a small number of experimental populations in upland habitats, mostly on public lands. However, these attempts have not met with much success; plant mortality has been high and the experimental populations have declined to a handful of plants at each site. Currently, plant conservationists are interested in attempting additional experimental plantings, especially in wetland prairies in the Willamette Valley. Wetland prairies at Lupine Meadows are appropriate for this type of experimental introduction.

Populations of thinleaf pea (*Lathyrus holochlorus*) are known from throughout the Willamette Valley but few have been recently observed in Benton County. The species generally prefers moist conditions along hedgerows and at the edges for wooded areas with some sun reaching the plants. Habitat for this species at Lupine Meadows appears to be present, especially in the riparian forests and meadows, and possibly along the edges of ash swales.

Table 3. Species of conservation concern present at Lupine Meadows or recommended for introduction to the site.

Species	Status
Present at Lupine Meadows	
Fender's blue butterfly	Federal Endangered
Kincaid's lupine	State and Federal Threatened
Nelson's checkermallow	State and Federal Threatened
Howell's spring beauty	State Candidate
Oregon vesper sparrow	State Critical
Recommended for Introduction to Lupine Meadows	
Willamette daisy	State and Federal Endangered
Bradshaw's desert parsley	State and Federal Endangered
Peacock larkspur	State Endangered, Federal Species of Concern
Shaggy horkelia	State Candidate, Federal Species of Concern
Clustered goldenweed	ORNHIC List 2
Golden paintbrush	State Endangered and Federal Threatened
Thinleaf pea	Federal Species of Concern

Figure 2. Rare species present or for which habitat is available at Lupine Meadows. Left to right, top to bottom: Kincaid's lupine, Fender's blue butterfly, Nelson's checkermallow, Bradshaw's lomatium, Willamette daisy, golden paintbrush, shaggy horkelia, thinleaf pea, Howell's spring beauty, clustered goldenweed, peacock larkspur, and Oregon vesper sparrow. [photo credits: Fender's blue – Bruce Newhouse; clustered goldenweed – Wes Messinger; vesper sparrow – Rod Gilbert; all others – Tom Kaye]

3.5 Threats

There are several threats to the biological resources at Lupine Meadows that could alter the site substantially. These threats include, but are not necessarily limited to:

- *Non-native plants:* Weedy, invasive vegetation currently exists at the site and contributes to habitat problems in many areas. Non-native vegetation is the dominant threat throughout the site. Many problem species occur on the site and others that occur in the immediate vicinity could colonize the habitats, and if left unchecked, contribute to local habitat degradation.
- *Woody plant encroachment:* The spread of woody plants, both native and non-native, threatens the prairie communities at Lupine Meadows by changing the structure of the vegetation, casting shade, competing for nutrients and water, and attracting birds that perch and defecate the seeds of non-native plants.
- *Herbivory:* Various animal species graze and browse the vegetation and disturb soil on the site. Black tailed deer feed on the vegetation in all of the plant communities. Voles create trails on the soil surface, tunnel, and eat substantial amounts of vegetation in the upland and wetland prairies. Moles and pocket gophers tunnel and build mounds of disturbed soil the bury native vegetation and create seed beds for weedy plants. Together, these animals can substantially change the native habitats.
- *Overuse by public:* Public use of the site for various purposes brings with it risks of impact. Off trail hiking, trampling in sensitive areas, off road vehicle trespass, trash dumping, etc. are all potential problems. Even excessive hiking by well-intentioned members of the community could pose problems at the site.
- *Changes to hydrology:* Actions by nearby and adjacent landowners have the potential to change the local hydrology of Newton Creek and its tributaries thus impacting Lupine Meadows. These changes could significantly alter the wetland vegetation. Diversion of water courses, recontouring of slopes, installation or removal of drainage devices, and construction of catchment ponds (impoundments) are all possible up-stream actions that could affect water availability and flow through Lupine Meadows wetlands.

Each of these threats is addressed in this Management Plan, with the exception of changes to hydrology caused by alteration of flows upstream from the property. Changes to hydrology are most likely to occur upstream of Lupine Meadows on private or public lands beyond the authority of this plan or the Conservation Easement.

3.6 Wetland delineation and hydrology

A wetland delineation of the site was conducted in 2003 by Rorick Environmental Services and Loverna Wilson (Rorick and Wilson 2003). The consultants delineated three jurisdictional wetlands on the site that cover a total of 37.73 acres (Appendix D). They found that the site contains 10.13 acres of scrub shrub wetland, 3.46 acres of forested wetland, and 24.14 acres of emergent wetland. The vegetation in the wetlands consists of native wet prairie species, introduced pasture grasses, and Oregon ash forest.

The wetland delineation report noted that seeps and springs are common on hillsides in the Philomath area. Much of the bedrock in the area is basalt, and seeps form where permeable saturated zones within the basalt intersect the land surface. The permeable zones in the basalt often occur in the break between individual flows, but can also be caused by fractures or faults. These seeps are among the water sources for the larger wetlands at the site. All the wetlands gain water from a seasonally high water table, runoff from adjacent uplands, and direct precipitation. A ditch flows across wetlands west to east near the center of the property, in an apparent but largely unsuccessful attempt to drain the area. The hydrologic regime of riparian forest wetland is influenced by flooding from the creek.

3.7 Soil types and distributions

Soils at Lupine Meadows consist of fine textured dark silty clays and silty clay loams (Appendix E). In the wetlands, these include Bashaw clay and silty clay loam, and Witham silty clay loam. The upland soils are predominantly Dixonville silty clay loam, and to a lesser extent, Witham silty clay loam. Wetland soils of the Dayton silt loam series occur in the vicinity, especially to the immediate south, but are not found at Lupine Meadows itself.

Table 4. Summary of habitat types, rare species, desired future conditions and management needs at Lupine Meadows.

Current habitat type	Extent	Significant rare species present	Desired Future Conditions	Management needs
Upland prairie	19 acres	• Fender's blue butterfly • Kincaid's lupine • Oregon Vesper Sparrow	• No woody vegetation with the exception of small patches of native shrubs and isolated trees. • Upland prairie vegetation dominated exclusively by native plants, with a high species diversity and substantial cover of forbs. • Large, viable populations of Kincaid's lupine and Fender's blue butterfly. • Large, viable populations of Willamette daisy, shaggy horkelia, golden paintbrush. • Nesting habitat for vesper sparrow.	• Invasive weed control • Woody plant removal • Increase in native species diversity and abundance • Rare species population augmentation and introduction (e.g., Kincaid's lupine, Willamette daisy, shaggy horkelia, golden paintbrush).
Wetland prairie	20 acres	• Nelson's checkermallow (wild and planted) • Oregon vesper sparrow	• No woody vegetation with the exception of small patches of native shrubs and isolated trees. • Wetland prairie vegetation dominated exclusively by native plants, with a high species diversity and substantial cover of forbs. • Large, viable populations of Nelson's checkermallow. • Large, viable populations of Bradshaw's lomatium, Willamette daisy, golden paintbrush, Peacock larkspur, clustered goldenweed • Nesting habitat for vesper sparrow.	• Invasive weed control • Woody plant removal • Increase native species diversity and abundance • Rare species population augmentation and introduction (e.g., Bradshaw's lomatium, Willamette daisy, golden paintbrush, Peacock larkspur, clustered goldenweed) • Determination of recreational trail location
Ash swale/savanna	16 acres	• Nelson's checkermallow	• Patches of ash swale and areas with scattered ash trees in a savanna form. • Understory vegetation dominated exclusively by native plants, with a high species diversity and substantial cover of forbs.	• Invasive weed control • ash tree thinning • conversion of some areas to wet prairie • Rare species population augmentation and

Current habitat type	Extent	Significant rare species present	Desired Future Conditions	Management needs
				introduction (e.g., Nelson's checkermallow)
Riparian forest	2 acres	• Nelson's checkermallow	• Physical structure of large native trees. • Understory vegetation dominated exclusively by native plants. • Mature, shade-casting trees adjacent to waterways. • Stable population of Nelson's checkermallow with connectivity to plants in wetland prairies and ash swales. • Viable population of thinleaf pea.	• Maintenance of high forest canopy cover • Invasive weed control • Rare species population augmentation and introduction (e.g., Nelson's checkermallow, thinleaf pea)
Access areas, utilities and structures	1 acre	• Howell's spring beauty	• Accessibility by visitors to the site, with safe entrance and exit points and minimal impact to the biological resources of the property. • Pole building or covered area to provide shelter for on site work or educational tours. Agricultural use for native plant propagation.	• Clear identification, signing, and delineation from natural areas. • Weed control to prevent invasion of adjacent habitats. • Erosion control. • Restoration of unused areas.

4. Habitats and management needs

4.1 Desired future conditions, objectives and tasks

In this document, desired future conditions are the goals that the objectives and tasks are designed to fulfill. For each habitat type, this document states a set of desired future conditions (site-specific goals), specific objectives with numerical targets where applicable, and associated tasks and prescriptions to meet these objectives. In some cases, tasks and prescriptions meet multiple objectives, such as weed control, improvement of biodiversity, and endangered species population improvement.

Each of the objectives and tasks discussed below are linked to specific habitats and locations at Lupine Meadows. The map of current vegetation at the site consists of numbered map units corresponding to physical locations at the site. These objectives and tasks apply to all map units of the habitat type, unless specifically stated.

Although not identified specifically at this time, achievement of some management objectives may involve the use of livestock grazing and release of non-native species to biologically control non-natives and shape native plant communities to desired conditions. Also, placement of soil or gravel and changes in topography associated with trail construction may occur for meeting recreation and maintenance objectives, and installation of wildlife enhancement materials (such as logs, brush or soil, nesting boxes) may be necessary to improve habitats for some species.

4.2 Upland prairies

Habitat description

There are three types of upland prairie adjacent to one another at Lupine Meadows at the north end of the property. A total of 99 plant species have been documented from these habitats, 51 of them native (Appendix A). Upland prairie in generally good condition occupies the northeast section of the main hill (map unit 1) on soils of the Dixonville Silty Clay Loam series and supports all of the

Upland prairie habitat

Kincaid's lupine and Fender's blue butterflies at the site, as well as the majority of nectar plants for the butterfly. This map unit encompasses 7 acres and the vegetation is dominated by a moderate diversity of native forbs and non-native grasses. The most common native forbs include strawberry (*Fragaria virginiana*), lilies (e.g., Tolmie's mariposa, chocolate lily, *Brodiaea* spp.), Northwest cinquefoil (*Potentilla gracillis*), and western buttercup (*Ranunculus occidentalis*). Native grasses like Roemer's fescue are largely absent from the upland, which instead hosts invasive grass species like tall fescue (*Festuca arundinacea*) and sweet vernal grass (*Anthoxanthum odoratum*).

At the northeast foot of the hill (map unit 2) an area of deeper Witham Silty Clay Loam hosts upland vegetation also dominated by non-native grasses but with healthy populations of native forbs like Northwest cinquefoil. This area is relatively small (~1 acre) and more moist than the remaining upland prairie at the site.

The remaining majority of the hill is host to upland prairie that is in a degraded state (map unit 3, 11 acres). This part of the hill faces west and south and is exposed to harsher environmental conditions than the higher quality prairie in map unit 1. It is dominated by non-native grasses and forbs, and does not currently support Kincaid's lupine and Fender's blue butterfly, or significant amounts of nectar species. Instead, non-native grasses like tall fescue and tall oatgrass and forbs such as oxeye daisy (*Leucanthemum vulgare*) and Queen Anne's lace (*Daucus carrota*) are abundant, and large scale soil disturbance from gophers appears to be reducing overall plant cover and impeding the establishment of native vegetation, despite attempts to seed with a mixture of native plants species.

Distribution and abundance of rare species

Kincaid's lupine is an herbaceous perennial that reproduces by seed. Plants form clumps of basal leaves and eventually produce one or more flowering stems. This species also appears to spread vegetatively, though it is unknown to what extent vegetative growth might result in the formation of physiologically distinct clones. Kincaid's lupine requires insects for successful fertilization and seed formation (Kaye, 1999). Fender's blue butterfly lays its small white eggs on the undersides of Kincaid's lupine leaves. After eggs hatch, the larvae emerge and feed

Figure 3. Herbivory of Kincaid's lupine by larvae (right) of Fender's blue butterfly results in clusters of damaged stems, leaves, and growing points (left) because the larvae typically feed on young leaves and apical meristems.

on lupine leaves before over-wintering in the soil near the base of plants.

The butterflies are mature adults in May and June, when they fly, eat nectar, and mate. The females lay their eggs on the underside of lupine leaves. The eggs hatch in a few weeks, feed on lupine leaves (Figure 3) until late June or early July, then crawl under nearby vegetation and plant litter and enter diapause. They remain in that state until February or early March, when they begin feeding again on the newly emerging lupines. Near the end of April they pupate then re-emerge as butterflies in May (Schultz and Crone 1998). Management activities such as burning and mowing often occur in late summer and early fall, when Kincaid's Lupine have senesced and larvae are buried in plant debris.

Kincaid's lupine and Fender's blue butterfly are present at Lupine Meadows in map unit 1. It is possible that the butterflies use nectar resources in some habitats adjacent to the uplands, especially in map unit 2 and along the edge of the riparian forest (map unit 17), but most of their time appears to be spent on the upland hill itself with the lupine and the highest concentrations of nectar plants. A survey of the lupine population was conducted in 2003 to document the full extent of the population on the Lupine Meadows property as well as the adjacent north-facing road cut along West Hills Road and make recommendations (Institute for Applied Ecology 2003). A total of 210 m^2 of lupine foliar cover were documented, 65% (135 m^2) within Lupine Meadows and 35% (74 m^2) on the county-managed right-of-way along the road. No follow-up surveys have been conducted, but the population appears to have remained at least stable, if not increased, since that time.

Population estimates for Fender's blue butterfly at Lupine Meadows have been performed by Paul Hammond since 1999 for the U.S. Fish and Wildlife Service. His estimates have ranged from a low of 103 adults in 2000 to a high of 370 in 2006 (Hammond 2007). He stresses the importance of this site for conservation of the species especially in connection with the closest known large population, Butterfly Meadows (Starker Forest and OSU properties) nearby to the north. Hammond notes that the recent habitat improvements at Lupine Meadows through mowing and woody plant removal in the upland prairie appear to be increasing the butterfly population. Reintroduction of Kincaid's lupine at nearby Bald Hill Park is underway, and may provide habitat for Fender's blue. If the butterfly colonizes that site or is reintroduced there, an additional site for a more viable local population network may be established with connectivity to Lupine Meadows.

Kincaid's lupine has also recently been reintroduced at Fitton Green, a 308 acre natural area, owned by Benton County. Fitton Green is located approximately 1 mile northwest of Lupine Meadows and may also provide an additional site for a viable local population of Fender's blue.

Recent management actions

Up until 2005 the upland prairies were used as horse pasture. Since acquisition of the conservation easement by the Greenbelt Land Trust, mowing of the habitat has occurred annually, and large scale removal of woody vegetation has been accomplished. Habitat disturbed by gophers west of the summit of the hill was seeded with a mixture of native plants (species list in Appendix B) in 2005, but plant establishment from that seeding was difficult to detect. Tall oatgrass invasions on the southwest face of the knoll were experimentally treated in May of 2006 with glyphosate wiped-on above the co-occurring, shorter vegetation. Results suggested some reduction in vegetative cover of tall oatgrass and lower-statured native plants were not impacted negatively. Repeated applications would be necessary for effective control, and the timing would need to be earlier in the season to block seed production by the grass.

Desired future conditions (goals)

The desired future condition of the upland prairies at Lupine Meadows is linked to providing habitat for prairie plants and the animals and other organisms that depend on upland prairies, including threatened and endangered species. In addition, the habitat should provide significant opportunities for research to support prairie conservation, and demonstrate to the public and wildland managers an example of high-quality, native upland prairie.

Habitat structure, diversity and composition: With the exception of small patches of native shrubs and isolated trees, no woody vegetation will be present in the open prairie landscape. These species shade and inhibit the growth of prairie vegetation and are not consistent with high quality upland prairie. Small patches of native shrubs and widely scattered native trees are beneficial to birds and other animals and may be retained or planted at low density.

The vegetation of the upland prairie should be dominated exclusively by native plants, with a high species diversity and substantial cover of forbs. In addition, the upland prairie should have an abundance of flowering plants used as nectar sources for Fender's blue butterfly (Table 3).

Species of concern: Large, stable populations of both Kincaid's lupine and Fender's blue butterfly that are viable in the long-term should be present in the upland prairies at the site. In addition, populations of other species of concern (e.g., Willamette daisy, shaggy horkelia, golden paintbrush) should be present and flourishing if the upland habitat is found to be suitable for them. Nesting habitat for Oregon vesper sparrow should be present.

Habitat management objectives and tasks

Habitat structure, diversity and composition: Improve habitat quality by reducing woody vegetation, thatch accumulation, non-native plant abundance, herbivory, and increasing native plant diversity and abundance.

Specific objectives:

- Reduce woody vegetation to <10% of habitat, but retain some shrub patches and trees to provide habitat for song birds. Limit shrub patch size to 15 m^2. Retain shrub patches and scattered native trees at no more than two per acre.
- Reduce impacts from voles and create opportunities for seedling establishment by reducing thatch accumulation to <=10 % cover.
- Increase perennial forb abundance and diversity to 50% relative cover and >5 species per m^2.
- Increase native grass abundance to >15% cover.
- Increase abundance of showy native wildflowers.
- Control aggressive invasive weeds, especially blackberry, tall oatgrass, Queen Anne's lace, oxeye daisy, false-brome, Medusa head and other annual grasses, tall fescue and other perennial grasses, to a collective abundance of <= 10% cover. These species appear to be the worst invaders in the upland prairies.
- Detect and quickly eliminate new populations of invasive species (e.g., Scot's broom).
- Limit mole and/or pocket gopher populations to reduce soil turnover and seed beds for invasive species.
- Determine if deer are or become significant herbivores.

Tasks and prescriptions:

- *Remove woody vegetation:* Woody vegetation control was completed in summer and fall of 2005 through the use of volunteers and contract labor. Nearly all shrubs and trees were removed from the upland prairie, with the exception of a small number of shrub patches and individual trees. Little resprouting has occurred since treatment, and much of this has been controlled by fall mowing. Follow up work is not necessary at this time as long as some form of management that limits tree regeneration, such as mowing or burning, occurs in this area.
- *Mow regularly to reduce thatch build-up and reduce habitat for voles:* Mowing is the least expensive and most easily scheduled method of limiting thatch build up. The upland has been mowed annually since 2004 and thatch accumulation has been light. Continued annual or bi-annual mowing in the fall may be necessary unless non-native grasses are controlled in the upland habitat (see below). Controlled burning can be used to reduce thatch accumulation, but must be carefully planned, permitted and implemented to minimize negative impacts to Fender's blue butterfly. See tasks for rare species, below.

- *Apply herbicide to eliminate non-native grasses:* In the spring, spray half of upland habitat at any one time except dense lupine population areas with grass-specific herbicide (e.g., Poast) to kill non-native grasses, including tall fescue (*Festuca arundinacea*) and tall oatgrass (*Arrhenatherum elatius*). The latter grass is especially important to control at the western edge of map unit 3. Use of grass-specific herbicide in these prairies is recommended because native grasses are already absent or in extremely low abundance, but native forbs are locally abundance, especially in map unit 1. Field trials with grass-specific herbicide in habitats with heavy thatch have shown no negative effects on Fender's blue butterfly.
- *Seed with natives to improve diversity and coverage of desired grasses and forbs:* In fall of the same year of the grass-specific herbicide application, seed a diverse mix of native plant species, including Roemer's fescue (*Festuca roemeri*) and several forb species with an emphasis on nectar (as listed in Table 4) and showy plants (e.g., *Balsamorhiza deltoidea, Camassia* spp., *Plectritis congesta, Madia elegans, Clarkia* spp., *Erigeron speciosus*). See Appendix C for recommended upland prairie seed mix for Lupine Meadows. Apply seed with a seed drill if possible or through broadcast seeding. The seed drill may be most practical in map unit 3 if the majority of the site is bare soil after grass removal with herbicide; mowing may be necessary prior to seeding to reduce thatch and provide good seed to soil contact.
- *Use herbicide to control specific broad-leaf weeds:* In summer of the same year as the grass-specific herbicide application, apply glyphosate or other herbicide to Queen Anne's lace and oxeye daisy through spot spray, wipe, or wick-on methods to minimize non-target impacts and remove these species from the site, especially in map units 1 and 3.
- *Alternatively, mow-mid summer to control Queen Anne's lace, oxeye daisy:* An alternative to herbicide application may be summer mowing (late June), to reduce seed production and negatively impact these weeds. This mowing will have to be repeated annually for 2-5 years, and will be in addition to annual fall mowing to reduce thatch.
- *Conduct spraying and seeding experimentally at first, then at larger scale if successful.*
- *Use fertilizers to favor Kincaid's lupine growth.* Current research suggests that adding phosphorus and micronutrients to grassland habitats may benefit legumes more strongly than other species. Most plants are nitrogen limited, but many legumes, including Kincaid's lupine, have root symbionts that fix nitrogen from the atmosphere and make this nutrient available to the host plant. Therefore, fertilizing with non-nitrogen sources may be useful for promoting growth of the lupine without helping competing vegetation. If local research projects confirm this benefit, consider using this approach more widely at Lupine Meadows.
- *Use controlled burning to reduce thatch, control rodents, and stimulate desired species:* In fall two years after spraying and seeding, conduct a

controlled burn of the upland prairies, limiting burn to one third to one half of the lupine area to minimize negative impacts on Fender's blue butterfly. Burning of this type has been demonstrated to improve conditions for some prairie plants, including Kincaid's lupine, as well increase populations of Fender's blue.

- *Monitor changes in vegetation:* Install permanent plots or maintain existing photo points to track vegetation changes and determine if the thresholds in the objectives are being met.
- *Conduct Early Detection/Rapid Response for new invasive species:* Conduct annual surveys in summer for new populations of non-native species of conservation concern (such as Scot's broom), and if found, implement control measures (e.g., spray or pull).
- *Evaluate these techniques and schedule additional treatments:* Evaluate the effectiveness of these prescriptions and schedule additional treatments, as needed.

Species of concern

Establish or maintain large, stable populations of threatened, endangered and other sensitive species and contribute to their recovery goals.

Specific objectives:

- Manage access to the habitat to minimize impacts to endangered and at-risk species. This means no trail construction on the hill, or, if needed, careful placement to avoid existing lupine and patches of nectar plants.
- Increase Kincaid's lupine abundance to improve habitat for Fender's blue butterfly and assist with objectives of the Recovery Plan. To meet the minimum recovery needs for a single site, the Kincaid's lupine population should exceed 60 m^2 in total vegetative cover with over 3 inflorescences per m^2 of lupine foliar cover (on average), and be within 6 km of another lupine site to provide connectivity for both the lupine and butterfly. These conditions are currently met at Lupine Meadows. To meet the full recovery objectives for the species in the local region, 2,000 m^2 in total vegetative cover of the species will be necessary when this subpopulation is combined with neighboring subpopulations like Butterfly Meadows. Plan for 1000 m^2 of lupine foliar cover at Lupine Meadows to contribute to this goal.
- Increase Fender's blue butterfly population size to assist with objectives of Recovery Plan (need to set population size objective).
- Provide conditions to support a stable Fender's blue butterfly population with average population growth rate of 1.1.
- Increase diversity and abundance of nectar plants, especially native plants with high quality nectar including *Sidalcea virgata, Eriophyllum lanatum, Calochortus tolmiei, Brodiaea* spp., *Heracleum lanatum* (near creek adjacent to east side of habitat), etc. (see Table 3). Achieve total nectar production of 0.2 mg nectar per m^2 of habitat (as recommended in Schultz and Dlugash 1999).

- Coordinate with neighboring landowners/managers to increase populations and improve connectivity between habitat patches.
- Reintroduce stable populations of Willamette daisy, golden paintbrush, and shaggy horkelia with >200 individuals, the minimum population size to contribute to the species recovery. The suitability of the upland habitat for these species may require experimental evaluation.

Table 3. Known or suspected nectar sources for adult Fender's blue butterflies.

Nectar plant common name	Scientific name
Wooly sunflower*	*Eriophyllum lanatum*
Rose checkermallow*	*Sidalcea virgata*
Tolmie's startulip*	*Calochortus tolmiei*
Blue flag†	*Iris tenax*
Common or great camas*	*Camassia quamash, C. leichtlinii*
Ookow†*	*Dichelostemma congestum*
Crown brodiaea†*	*Brodiaea coronaria*
Elegant cluster lily†*	*Brodiaea elegans*
Hyacinth brodiaea†	*Triteleia hyacinthina*
Narrow leaf onion*	*Allium amplectens*
Cow parsnip†*	*Heracleum lanatum* (suspected)
Kincaid's lupine*	*Lupinus sulphureus* ssp. *kincaidii*

*****Present at Lupine Meadows*

†*Suspected (probable but unconfirmed) nectar source*

Tasks and prescriptions:

- *Manage access:* Avoid the east slope and summit area of the hill in all plans for trail construction to avoid impacts to Kincaid's lupine and Fender's blue egg laying and local nectar habitat.
- *Coordinate with neighbors:* Contact nearby landowners that do or may have lupine and butterfly populations, including Starker Forests and Oregon State University, and initiate joint planning for these species in 2009.
- *Host workshops:* Together with partner organizations, conduct workshops for neighboring landowners who wish to improve habitat for Kincaid's lupine and/or Fender's blue butterfly.
- *Plant Kincaid's lupine:* Outplant seeds and/or greenhouse grown starts in and around the existing lupine population to increase the abundance of Kincaid's lupine at the site, with an emphasis on seed collected at Lupine Meadows or nearby sites like Butterfly Meadows. Plantings have occurred (but with limited success) in 2005 and 2006, and should be planned for future years. Make planting a regular event until the local population reaches 1000 m^2 of lupine foliar cover.

- *Plant other special status plant species:* Outplant greenhouse grown starts of Willamette daisy, shaggy horkelia and golden paintbrush. In Outplant 100 individuals each of Willamette daisy and shaggy horkelia from local seed sources, and continue plantings until the local population exceeds 200 plants.
- *Plan reintroduction of golden paintbrush:* Work with the Golden Paintbrush Recovery Team (based out of the USFWS office in Lacey, Washington) to plan outplantings for this species.
- *Improve nectar habitat for Fender's blue:* Outplant nectar plants through direct seeding activities associated with prairie habitat improvement and including nectar plants in Table 3. Also, plant greenhouse grown starts of these species. Initial targets are to outplant 100 rose checkermallow (*Sidalcea virgata*) plants and plan additional plantings for future years.
- *Monitor:* Develop and implement a monitoring plan (possibly annual) for lupine and butterfly populations and any other outplanted sensitive species to track changes in population size and document effects of treatments. Coordinate butterfly monitoring with USFWS because they have supported past monitoring with Paul Hammond.

4.3 Wetland prairie

Habitat description

Wetland prairie habitat

Wetland prairie is the most common vegetation type on the property, dominating the southern portion of the property and mixed among the forested wetlands in the central portion of the site. Wetland prairies (also called emergent wetlands) at Lupine Meadows are in good condition in some areas but are degraded in others (in terms of vegetation and habitat quality), and these have been mapped separately. A total of 86 plant species have been documented from these communities, 46 of them native (Appendix A). The soils of these wetlands are mostly Bashaw clay, which are deep, poorly drained hydric soils. Where wetland prairies are in good condition, tufted hairgrass (*Deshampsia cespitosa*) is the dominant native grass. High quality prairies are located in the southern portion of the property (map unit 4). Most of this southern prairie is native-dominated, but the diversity and abundance of native forbs is relatively low due to the high dominance of tufted

hairgrass. Nelson's checkermallow grows wild in some locations in this prairie, and it has also been planted in patches on the western side as well as at the south end. A small patch of native Mule's ear (*Wyethia angustifolia*) was found just north of the railroad tracks that designate the southern boundary of the property. Showy milkweed (*Asclepias speciosa*) was also found in the wetland prairie near the northeastern corner of map unit 4. Patches of shrub-scrub are common throughout the emergent wetland, where shrub encroachment has occurred. These patches are primarily composed of Oregon ash (*Fraxinus latifolia*), rose, hawthorn (*Crataegus monogyna*), and pear (*Pyrus communis*). Despite the relatively good cover of native grass in this area, several invasive pasture grasses including velvet grass (*Holcus lanatus*), meadow foxtail (*Alopecuris pratensis*), colonial bentgrass (*Agrostis capillaris*) and tall fescue (*Festuca arundinacea*) are common. Teasel (*Dipsacus fullonum*), blackberry, yellow parentucellia (*Parentucellia viscosum*), oxeye daisy (*Leucanthemum vulgare*), and common centaury (*Centaurium umbellatum*) are frequently encountered invasive forbs.

One patch of wetland prairie is located on Witham silty clay loam, a soil that is better drained than Bashaw soil, on the central-western edge of the parcel (map unit 5). The wetland vegetation that has developed here appears somewhat different than that further south in that it contains a greater number of species more common in upland prairies. This area appears to be a more moist version of the upland prairie in map unit 2 (also on Witham soil), and is in intermediate condition between high quality and degraded. Some native grass remains, but the area is dominated by non-native species.

Degraded wetland prairies are found in patches in a horseshoe-shaped arch around the upland prairies (map units 6-9). These areas have little or no native grasses remaining and are instead fully dominated by meadow foxtail and other non-native grasses. Very few native forbs are present. It is likely that these prairies were seeded to meadow foxtail by a previous owner to increase the forage potential for horses.

Distribution and abundance of rare species

Nelson's checkermallow is a long-lived perennial that occurs in wetland habitats. It spreads by seed and by local expansion of its root system. The species is gynodioecious, meaning the plants can be either hermaphroditic or female only. Female plants produce flowers with sterile anthers, and therefore require pollination from a hermaphroditic plant. This aspect of the species' biology can be significant to management if local population sizes are so small that only females are present, making seed set dependent on long-distance pollen movement. The wild population of Nelson's checkermallow at Lupine Meadows is small and very patchy, and some of the plants occur singly and isolated. Most individuals are located along a shallow, seasonal drainage that runs north-south in map unit 4. Other small patches have been found in ash swale (map units10,

11 and 13) and degraded wetland prairie (map unit 8) habitat types. Recently, however, outplanting of greenhouse grown checkermallows has been conducted to boost the resident population size.

The wetland prairies at Lupine Meadows are also potential habitat for several other species of concern, including Bradshaw's lomatium, Willamette daisy, golden paintbrush, Peacock larkspur, clustered goldenweed and Oregon vesper sparrow. Wild populations of these species have not been documented from the property, but they could be introduced. A small number of clustered goldenweed plants have already been planted at the site.

Recent management actions

The most significant recent management action in the wetland prairies has been the large-scale removal of woody vegetation from the western half of the southern prairie (map unit 4). This action was conducted in fall of 2006 by Rich Owen of RJ Consulting under contract with the Greenbelt Land Trust. All trees and shrubs except a few native trees were cleared from the area, and the debris was piled in the central portion of the prairie for later burning or chipping. Plantings of sensitive and other native plant species have also occurred in the southern wetland prairie. Nelson's checkermallow has been planted in three events during spring of 2005, 2006 and 2007 by IAE's outreach program (RARE partnership) with local schools (in this case, Philomath High School). All of these plantings have been conducted on the western side of map unit 4. Plantings in 2006 also included clustered golden weed (20 individuals) as well as the native self-heal (*Prunella vulgaris*). In addition, 250 Nelson's checkermallows were planted in the southeastern portion of the southern prairie by Steve Gisler of Oregon Department of Transportation during the winter of 2007. A total of 70 plants were the result of salvage transplanting (on 1/31/07) from a roadside in Philomath, while an additional 180 were grown from seed from the same population and outplanted on 3/22/07.

Before Ash Removal

After Ash Removal

Desired future conditions (goals)

The desired future condition of the wetland prairies at Lupine Meadows is linked to providing habitat for prairie plants and the animals and other organisms that depend on wetland prairies, including threatened and endangered species. In addition, the habitat should provide significant opportunities for research to support prairie conservation, and demonstrate to the public and wildland managers an example of high-quality, native wetland prairie.

Habitat structure, diversity and composition: With the exception of small patches of native shrubs and isolated trees, no woody vegetation will be present in the open prairie landscape. These species shade and inhibit the growth of prairie vegetation and are not consistent with high quality wetland prairie. Small patches of native shrubs and widely scattered native trees are beneficial to birds and other animals and may be retained or planted at low density.

The vegetation of the wetland prairie should be dominated exclusively by native plants, with a high species diversity and substantial cover of forbs. In addition, the wetland prairies adjacent to the uplands (map units 6-9) should have an abundance of camas as a nectar source for Fender's blue butterfly.

Species of concern: Large, stable populations of Nelson's checkermallow and Bradshaw's lomatium that are viable in the long-term should be present. In addition, a population of clustered goldenweed should be present, and populations of other species of concern (e.g., Willamette daisy, shaggy horkelia, golden paintbrush) should also be flourishing if the wetland habitat is found to be suitable for them. Nesting habitat for Oregon Vesper Sparrow should be present.

Habitat management objectives and tasks

<u>Habitat structure, diversity and composition</u>:

Specific objectives:

- Reduce woody vegetation to <10% of habitat, but retain some shrub patches and trees to provide habitat for song birds. Limit shrub patch size to 15 m^2. Retain shrub patches and scattered native trees at no more than two per acre. Target scattered woody vegetation in otherwise open areas first. Retain native berry-species, such as serviceberry (*Amelanchier alnifolia*), cascara (*Rhamnus pershianus*), and hawthorn (*Crataegus douglasii*), for bird use. Some of this work has already been performed in the western part of map unit 4.
- Reduce thatch accumulation to <=20 % cover, with the further objective of reducing vole impacts and creating space for establishment of native plant seedlings.

- Increase perennial forb abundance and diversity to >20% relative cover and >5 species per m^2.
- Increase native grass abundance to >40% cover in map units 6-9.
- Increase abundance of showy wildflowers, such as *Wyethia angustifolia, Camassia* spp.
- Control aggressive invasive weeds, especially blackberry, teasel (*Dipsacus fullonum*), pennyroyal (*Mentha pulegium*), and thistle (*Cirsium* spp.) to a collective abundance of <= 10% cover. A population of meadow knapweed has established on the roadside and should be treated soon before it invades Lupine Meadows. These species appear to be the worst invaders in the wetland prairies of map units 4 and 5. In map units 6-9, meadow foxtail is the dominant non-native species to eliminate and replace with native grasses and forbs.
- Detect and quickly eliminate new populations of invasive species (e.g., Scot's broom [*Cytisus scoparius*]).
- Evaluate the feasibility of creating vernal pools at the site, possibly in wetland areas in which tufted hairgrass has already been eliminated and restoration may need to be aggressive.
- Limit vole populations and associated herbivory.
- Determine if deer are or become significant herbivores.

Tasks and prescriptions:

- *Remove woody vegetation:* Woody vegetation control was implemented in fall of 2006 over the western portion of map unit 4. Nearly all shrubs and trees were removed with the exception of a small number of trees. Little or no resprouting has occurred since treatment. Remaining tree and shrub removal on the east side of map unit 4 and on all of map unit 5, as well as burning or chipping of the debris piles generated by the 2006 work, can occur in fall of future years to complete shrub and tree removal from the wetland prairies.
- *Conduct controlled burns:* Burn on a 3-4 year interval to reduce thatch, create openings for seedling establishment, stimulate growth of natives, and reduce vole abundance. Plan for and conduct a burn in the southern prairie (map unit 4).
- *Mow regularly:* Where the topography allows mowing (i.e., flat enough without substantial obstructions), mow to reduce thatch build-up and reduce habitat for voles. Mowing is the least expensive and most easily scheduled method of limiting thatch build-up. Mow in years when burning is not conducted. Mow map unit 5 as the top priority unless it is burned.
- *Apply herbicide to eliminate non-native grasses:* In the spring of 2008 (map units 5-9) and again in 2009 (map units 6-9), spray with a grass-specific herbicide (e.g., Poast) to kill non-native grasses, including meadow foxtail, velvet grass, and tall fescue, except where patches of native grass remain. Use of grass-specific herbicide in these prairies is recommended because native grasses are already absent or in extremely

low abundance. In areas with little or no forb cover (mostly in map units 6-9), glyphosate may be used and may be more effective.

- *Seed with natives to improve diversity and coverage of desired grasses and forbs:* Plan and implement fall seedings of map units 5-9 with a diverse mix of native plant species, including tufted hairgrass, sedges, and several forb species with an emphasis on competitive natives that generally do well from seed (e.g., *Ranunculus* spp., *Potentilla gracillis, Eriophyllum lanatum, Prunella vulgaris* and*, Plagiobothrys figuratus*) and showy plants like camas lily, mules ear, and *Cardamine penduliflora* (where especially most). In Map unit 4, seed heavily in fall of 2008 (after burning) with camas and other natives, and seed coyote thistle (*Eryngium petiolatum*) and *Cardamine penduliflora* into the lowest, wettest habitats. See Appendix D for recommended wetland prairie seed mix for Lupine Meadows. Apply seed with a seed drill if possible and/or through broadcast seeding. The seed drill may be most practical in map units 5-9 if the majority of the site is bare soil after grass removal with herbicide. Seeding after burns improves seedling establishment and should be prioritized after each burn as needed.
- *Use herbicide to control specific broad-leaf weeds:* During summer apply glyphosate or other herbicide to problematic weeds like teasel, blackberry, oxeye daisy, and pennyroyal through spot spray, wipe, or wick-on methods to minimize non-target impacts and remove these species from map units 4 and 5 and as needed in map units 6-9.
- *Alternatively, mow-mid summer to control tall weeds like teasel:* An alternative to herbicide application in the same map units as above may be summer mowing (late June), to reduce seed production and negatively impact these weeds. This mowing will have to be repeated annually for 2-5 years, and will be in addition to periodic fall mowing to reduce thatch.
- *Monitor changes in vegetation:* Install permanent plots or maintain existing photo points to track vegetation changes and determine if the thresholds in the objectives are being met.
- *Conduct Early Detection/Rapid Response for new invasive species:* Conduct annual surveys in summer for new populations of non-native species of conservation concern (such as Scot's broom), and if found, implement control measures (e.g., spray or pull). Use volunteers for this work as available.
- *Evaluate these techniques and schedule additional treatments:* Evaluate the effectiveness of these prescriptions and schedule additional treatments, as needed.

Species of concern
Establish or maintain large, stable populations of special status species and contribute to their recovery goals.

Specific objectives:

All species
- Manage access to the habitat to minimize impacts to endangered and at-risk species. This means trail construction avoids known populations or planned reintroduction sites.

Nelson's checkermallow
- Increase Nelson's checkermallow population size to 1,000 individuals to assist with objectives of the Recovery Plan.

Bradshaw's lomatium
- Reintroduce a population of 5,000 individuals in map unit 4 to assist with objectives of the Recovery Plan.
- If land managers of property to the immediate south (Mary's River Interpretive Center) are able to secure funding for their projects, work with them to seek reintroduction of 5,000 additional plants on adjoining habitat to create a collective population size of 10,000 plants to meet local Recovery Plan needs for this species.

Other species of concern
- Reintroduce stable populations of Willamette daisy, golden paintbrush, peacock larkspur, clustered goldenweed, and shaggy horkelia with >200 individuals, the minimum population size to contribute to recovery. The suitability of the wetland habitat for some of these species (golden paintbrush and shaggy horkelia) may require experimental evaluation. If reintroduction of Willamette daisy is successful, creation of a much larger population, up to 10,000 individuals, would achieve local recovery goals for the species.

Tasks and prescriptions:

- *Plant Nelson's checkermallow:* Continue working with outreach programs to grow and plant Nelson's checkermallow at Lupine Meadows with the assistance of school groups. Emphasize local seed sources in the Philomath area and elsewhere in Benton County. Plantings have occurred in 2005-07, and should be planned for future years. Outplant 200 greenhouse starts in map unit 4 as an initial step. Make planting a regular event until the local population reaches 5000 plants.
- *Seed Bradshaw's lomatium:* Obtain seed of Bradshaw's lomatium, grow plants pots, and outplant them to the site in map unit 4 in spring. Plant at least 100 individuals in each year. Make planting a regular event until the

local population reaches 5000 plants, but re-evaluate success after initial palntings. Switch to direct seeding in the fall if seed resources become more plentiful.

- *Plant Willamette daisy:* Outplant greenhouse grown starts of Willamette daisy. In spring, outplant 100 individuals from local seed sources into map units 4 or 5. Make planting a regular event until the local population reaches 2000 plants, but re-evaluate success after initial plantings.
- *Plant shaggy horkelia:* Outplant greenhouse grown starts of shaggy horkelia. In spring, outplant 100 individuals shaggy horkelia from local seed sources into map units 4 or 5, and repeat annually until the population exceeds 200.
- *Plan reintroduction of golden paintbrush:* Work with the Golden Paintbrush Recovery Team (based out of the USFWS office in Lacey, Washington) to plan outplantings for this species. Note: this species may grow well in wetlands or in transitional habitats between wetland and uplands and is included here because it is still unknown how well this species will do in wetland prairies. Attempts to reintroduce it at Lupine Meadows could inform recovery actions elsewhere.
- *Coordinate with neighbors:* Contact nearby landowners that do or may have Nelson's checkermallow and/or Bradshaw's lomatium populations and initiate joint planning for these species.
- *Monitor population sizes:* Develop and implement a monitoring plan in for special status species to track changes in population size and document effects of treatments.

4.4 Ash swale and savanna

Habitat description

Ash swales at Lupine Meadows are abundant and occur primarily as a broad band of Oregon ash (*Fraxinus oreganus*) trees across the central portion of the site in an east-west orientation. An ash swale also occurs at the north end of the property just south of the parking area. Among the ash swale map units, the trees vary in age and stature, and the condition of the understory vegetation ranges from relatively high quality areas dominated by native plants to degraded areas with a patchy mix of non-native shrubs and grasses. A total of 42 plant species have been documented from the ash swales, 45% non-native

Ash swale habitat, with large trees mapped as ash savanna

(Lawrence and Blakeley-Smith 2005). *Lobaria* sp., a lichen indicative of generally high air quality commonly occurs on ash trunks. A ditch runs west-east through the central ash forest in an apparent attempt to drain the wetlands, but this is partially filled-in and some branches of it under the closed canopy of ash on the east site of the site are shallow. Oregon ash, a few Oregon white oaks, and other trees associated with water courses are mapped separately as riparian forest.

Map units 10 and nearby 11 are extensive stands of Oregon ash with a shaded understory that is in generally good condition, probably because most shrub and weed invasion has been inhibited by the shady conditions. The trees are relatively tall (up to 20 m) and appear to be of one age class, probably about 30 years old. Common understory species include large-leaved avens (*Geum macrophyllum*), camas, great hedge nettle (*Stachys mexicana*), clustered dock (*Rumex conglomeratus*), and wild false caraway (*Peridiridia gairdneri*). Map unit 12 is a relatively young stand of ash, most of which is in poor condition with an understory dominated by non-native grasses, but where in good condition has abundant camas (*Camassia quamash*) and Oregon saxifrage (*Saxifraga oregana*). Map unit 13, on the central-west side of the property, is also relatively young and it is mixed with patches of wetland prairie invaded by shrubs. One area that is especially wet hosts a large patch of cattails (*Typha latifolia*) under the ash canopy near the western boundary of the property. Blackberry and rose are common in openings and make foot travel difficult in some areas. Stands of larger, open grown ash occur in the central area of the property and are mapped as ash savanna (map units 14 and 15) because of the wide crown stature of the trees. These stands contain the largest ash trees on the site and are considered important habitat for birds and plants.

Distribution and abundance of rare species

Nelson's checkermallow occurs as widely scattered individuals and patches under the forest canopy in map units 10 and 12, and has been planted along the south edge of map unit 13.

Recent management actions

No recent management actions have been conducted in this habitat type at Lupine Meadows.

Desired future conditions (goals)

Ash swales at Lupine Meadows should vary in tree density, but be open enough on the forest floor to support a diverse community of native herbaceous plants. Gaps and small openings (as in map unit 13) should support wetland prairie vegetation in general, as well as native shrubs. This habitat should be used by bird species and wildlife and support a diversity of organisms. The future vision

for the ash swales and ash savanna include providing opportunities for research to support conservation of this habitat type and demonstrate to the public and wildland managers an example of high-quality ash groves on wetland soils.

Habitat structure, diversity and composition: The vegetation of ash-dominated habitats should be composed exclusively of native plants, with a high species diversity and substantial cover of forbs, grasses, and grasslike plants (e.g., sedges) in the understory. Gaps in ash swale communities (especially in map unit 13) should grade into wetland prairie conditions, and have significant patches of shrubs to provide structure supportive of wildlife. The large, open grown ash should be standing in a savanna-like density, with few other ash trees adjacent to them.

Species of concern: Nelson's checkermallow should be distributed in patches in and around ash swales, including in gaps, along edges, and under low-density tree canopy.

Habitat management objectives and tasks

Habitat structure, diversity and composition:
Objectives:

- Restore ash savanna landscape in selected areas (map unites 14 and 15) by removing young and small trees to increase the spacing around the large, open grown ashes.
- Increase forb abundance and diversity (including Nelson's checkermallow) by thinning trees in selected swales to increase light reaching the ground and seeding with native plants. Increase perennial forb abundance and diversity to >10% cover and >2 species per m^2. Recommend seeding or planting native buttercups.
- Reduce ash seedling recruitment by selectively removing female trees.
- Increase abundance of showy wildflowers, such as buttercup (*Ranunculus orthorhinchus* and *R. alismaefolius*), Willamette Valley bittercress (*Cardamine penduliflora*) and camas.
- Increase abundance of native forbs along edges and in some gaps.
- Control aggressive invasive weeds, especially those found in adjacent wetland prairies (e.g., teasel, pennyroyal, thistle, blackberry, sweetbrier rose [*Rosa eglanteria*], hawthorn, and pear), to a collective abundance of <= 10% cover. These species appear to be the worst invaders in the wetlands in general.
- Remove obstructions to equipment and access from the site, especially the old wire fencing.
- Watch for and quickly eliminate invasions of new weeds.
- Evaluate the feasibility of converting some areas of ash swale and ash thicket to wetland prairie.

Tasks and prescriptions:

- *Thin around large trees:* Remove all non-open grown ashes within 25 m of and inside map units 14 and 15 in fall.
- *Thin ash thickets:* Increase light reaching the forest floor by thinning ash trees in map units 10 and 13 (southwest end). In addition, limit the spread of ash back into the swale and into adjacent wetland prairie by selectively thinning female trees in fall, especially in map unit 10 and 13. After cutting, wipe stumps with herbicide to prevent resprouting.
- *Seed and plant natives:* Increase native plant abundance and diversity by seeding species like buttercup, Willamette Valley bittercress, sedge (*Carex obnupta*) and planting bulbs of camas in fall.
- *Plant native shrubs:* In fall, plant native shrubs including rose spiraea (*Spiraea douglasii*), Nootka rose (*Rosa nootkana*), and common viburnum (*Viburnum ellipticum*).
- *Remove and restore portion of ash swale in map unit 12:* Remove young ash trees from southeastern half of map unit 12, and reseed the area with tufted hairgrass and other native plants to restore it to wetland prairie in fall.
- *Remove old fence:* Remove old east-west cross-fence from map units 13 and 10.
- *Apply herbicide to eliminate non-native shrubs:* In spring of 2008 spray with Garlon/Crossbow to kill non-native shrubs, especially in map unit 13 and the southern edge of map unit 10.
- *Monitor changes in vegetation:* Install permanent plots or maintain existing photo points to track vegetation changes and determine if the thresholds in the objectives are being met.
- *Conduct Early Detection/Rapid Response for new invasive species:* Conduct annual surveys in summer for new populations of non-native species of conservation concern (such as Scot's broom), and if found, implement control measures (e.g., spray or pull).
- *Evaluate these techniques and schedule additional treatments:* Evaluate the effectiveness of these prescriptions and schedule additional treatments, as needed.

Species of concern:
Objectives:

- Increase the abundance of Nelson's checkermallow in the ash swale communities.

Tasks and prescriptions:

- In spring, plant 50 Nelson's checkermallow in patches throughout the ash swale communities, with emphasis on edges between ash stands and prairies.

4.5 Riparian forest

Habitat description

Riparian forest occurs along the stream entering from the north and bordering the northeastern edge of the property. Two types of riparian forest occur at Lupine Meadows, one dominated by Oregon ash (map unit 16) and another dominated by Oregon ash and Hooker's willow (*Salix hookeriana*) (map unit 17). These habitats are important for providing shade to the watercourses. They have 65 species of plants, 40% of which are non-native. Blackberry and other non-native plants have become abundant and problematic over large portions of the understory especially in map unit 16.

Riparian forest habitat

Distribution and abundance of rare species

Nelson's checkermallow occurs as a few scattered individuals in map unit 16. Another, similar species, field checkermallow (*Sidalcea campestris*) also occurs in and along the edges of this habitat. Field checkermallow is not listed as an endangered species by the US Fish and Wildlife Service or the state of Oregon, but it is an increasingly uncommon native plant.

Recent management actions

No recent management actions have been conducted in this habitat type at Lupine Meadows.

Desired future conditions (goals)

The desired future condition of the riparian forest is a healthy, weed-free riparian area with a diversity of plants in the understory and habitat for birds and other wildlife. The forest should have a closed or nearly-closed canopy to provide shade over the creek and contribute to cool water temperatures for fish populations. As trees age and die, their limbs and trunks will fall into the creek and provide habitat structure for fish and other aquatic organisms.

Habitat structure, diversity and composition: The vegetation of the riparian forest should be composed exclusively of native plants, with a high species diversity and substantial cover of forbs, grasses, and grasslike plants (e.g., sedges) in the

understory. Tree diversity should include Oregon ash, as well as big leaf maple (*Acer macrophyllum*) and black cottonwood (*Populus trichocarpa*), with aging trees dropping large woody debris into the creek.

Species of concern: Nelson's checkermallow should be distributed in patches in under the canopy and along forest-prairie edges.

Habitat management objectives and tasks

Habitat structure, diversity and composition:
Objectives:

- Maintain existing high canopy cover over Newton Creek tributaries.
- Increase perennial forb abundance and diversity to >10% cover and >2 species per m^2.
- Control aggressive invasive weeds such as teasel, pennyroyal, thistle, and blackberry to a collective abundance of <= 10% cover. Thistles and blackberry, in particular, appear to be the worst invaders in the riparian forests. False brome has been reported from the riparian forest just east of the property boundary; coordinating with the neighbor may be necessary to control this invasive grass before it spreads to the Lupine Meadows property.
- Watch for and quickly eliminate invasions of new weeds.

Tasks and prescriptions:

- *Avoid disturbance:* Avoid trail construction or other disturbances in the riparian forest.
- *Plant natives:* Increase native plant abundance and diversity by seeding species like buttercup, sedge (*Carex ubnupta*), and large avens (*Geum macrophyllum*) and planting bulbs of camas, trillium (*Trillium ovatum* and *T. albidum*) and trout lily (*Erythronium oreganum*) in fall.
- *Control weeds:* Spot spray with glyphosate to control non-native plants in the understory in spring.

4.6 Access areas, utilities and structures

Description of driveways, parking area, barn, water and electricity

Access to Lupine Meadows is provided by a main entrance and two side access gates. The main entrance is on the north end of the property off of West Hills Road. This access point is gated, and vehicles may enter through the gate onto a partially graveled road. This road leads south about 200 meters to a wide parking area that used to contain a small horse barn. (map unit 19). The barn was removed in March 2008 due to its poor structural condition. A culvert under

the road allows the creek on the west side of the road to pass east into the riparian area on the northeast side of the property.

A gate on the east side of the property from 19th Street provides access to Lupine Meadows for larger equipment without having to pass through the main gate on the north side. A second gate at the southwest corner of the property, also on 19th Street, provides access for larger equipment but will require a hardened access (culvert and gravel) to cross the existing ditch.

Water and power are provided to the site in the vicinity of the barn. Power is delivered via overhead lines from the north. A well provides water to the site, and the well is powered by an electric pump. A small shed houses the pump at the well head.

Posting signs

Some signs may be needed on the property to direct traffic, post restrictions, identify resources or other purposes. The type and location of these signs will be determined by the Greenbelt Board of Directors as part of an approved site plan.

Parking area

Distribution and abundance of rare species

Howell's spring beauty (*Montia howellii*) occurs in the gravel parking area. This species, while considered somewhat rare, prefers highly disturbed habitats, especially parking areas with some muddy soil during the winter.

Recent management actions

No recent management actions have been conducted directly in this portion of Lupine Meadows.

Power line, well-pump house (left) and barn (right).

However, woody plant (blackberries, fruit and hawthorn trees) removal has occurred immediately adjacent to the parking area as well as on the upland knob.

In the past, the north road and parking area were used primarily for farm and recreational uses. The barn was used as a horse shed and the area around it was used for stabling and feeding horses. The soil was chronically disturbed in this area due to concentrated horse use and vehicle traffic. This has resulted in a degraded condition of the current vegetation, which is completely dominated by non-native plants.

Desired future conditions (goals)

Access locations to the site will be maintained and their impacts on the site will be kept to a minimum. Utilities (power and water) will remain on site to provide support for maintenance and restoration activities. An open air shelter to accommodate educational visits to the property may be installed and a greenhouse for propagation of native plants used in restoration may be placed on the property. A site plan shall be approved by the Greenbelt Board of Directors to assure that the conservation values of the property are not harmed by locating or using these amenities on the property.

The north road and parking area will continue to serve as the primary access to Lupine Meadows, although the parking area may be reduced in size. Areas adjacent to the barn and the parking area that were disturbed in the past will be restored to native vegetation, or soils will be stabilized with non-invasive non-native plants. In addition, access and parking areas will be clearly defined to reduce impacts on adjacent habitats. Howell's spring beauty will continue to thrive in the parking area, and non-native, invasive vegetation will be eliminated and if reinvasions occur, they will be dealt with promptly.

<u>Habitat management objectives and tasks</u>:
Objectives:

- Clearly define the road and parking areas as separate from natural areas to reduce casual vehicular and foot traffic in to adjacent habitats.

- Control aggressive invasive weeds to prevent expansion into adjacent natural vegetation.

- In the parking area, harden the surface with gravel to reduce erosion, mowing needs, and fire hazard.

- Replace barn with a smaller structure for tool and equipment storage and accommodate a covered dining/viewing area for recreational use.

- Restore unused access and farm areas to native vegetation of wetland or upland prairie, as appropriate.

- Watch for and quickly eliminate invasions of new weeds.

- Howell's spring beauty is found in this area, and it is adapted to driveway-level disturbance. No change in management is suggested.

Tasks and prescriptions:

- *Delineate road and parking area:* Install signs as needed to indicate parking area and remind visitors to stay on roadways and paths. Design and install signs in spring.
- *Gravel the parking area:* Place gravel in the parking area to a depth sufficient to reduce erosion and prevent plant growth.
- *Replace barn with equipment shed and covered area:* Remove the old barn, design new structure, and replace the barn with a smaller shed with enclosed, locked area for tool and equipment storage, as well as a covered area with benches or picnic table for recreation use.
- *Control non-native plants:* Use glyphosate to control non-native vegetation in the unused access and farm areas, as well as portions of the parking area (avoiding open soil areas supporting Howell's spring beauty), in fall.
- *Stabilize soil in parking area:* Sow seeds of disturbance tolerant grasses and forbs to hold soil in the parking area (e.g., California oatgrass, blue wildrye, yarrow). Native plants are preferred here, but some non-invasive, non-native species may be suitable. Initiate this work in fall (after herbicide application described in the previous task).
- *Restore unused access and farm areas:* In fall, seed the area around the barn with native species with a seed drill or hand spreader.
- *Use Early Detection and Rapid Response to catch and control new weed infestations:* Monitor and treat new invasions of weeds as needed.

4.7 Outreach

Desired future conditions (goals)

Lupine Meadows will be available for field trips, research projects, and recreation. Impacts to habitats and Special Status Species will be negligible or kept to an acceptable minimum. The upland (especially map unit 1) and wetland prairies (map unit 4), ash swales (map unit 10), and riparian forests (map unit 16) are well suited for use as demonstration sites for high quality reference conditions

Students from Philomath High School planting Nelson's checkermallow with IAE.

as well as successful restoration techniques (once implemented), and for opportunities for research into prairie ecology and habitat restoration for Kincaid's lupine, Fender's blue butterfly, Nelson's checkermallow, Bradshaw's lomatium, clustered goldenweed, Willamette daisy, shaggy horkelia, and golden paintbrush and other species.

Specific objectives:

- Coordinate volunteer work crews of restoration projects like trail building and brush clearing.
- Work closely with partner organizations to devise curriculum, signage and educational materials for the site.
- Work with schools to include students and teachers in restoration projects and Special Status Species management and reintroductions.
- Partner with professors and classes at OSU and other institutions to develop research projects for habitat conservation.
- Seek connections with land managers and plan field trips to demonstrate restoration successes and discuss innovated management treatments.
- Plan for and construct a trail network through the site to provide safe and sustainable access and connectivity with other future trail systems while avoiding or minimizing impacts to sensitive habitats. Trail planning and construction should be located to minimize safety concerns for hikers accessing West Hills Road near blind curve. If neighboring properties are acquired trail access points may be moved to avoid conflicts with traffic hazards.

Tasks and prescriptions:

- *Volunteer coordination:* Organize volunteers to assist with trail building beginning in 2010 or when funding is available
- *Develop signage and educational outreach materials that are appropriate for multiple age groups and languages*.
- *Outreach to schools:* Coordinate plant production and plantings of Special Status Species, nectar plants, and other native species with schools through local outreach programs like IAE's RARE Partnership (on going). Offer field trips to school groups.
- *University partnerships:* Hold an orientation meeting for OSU and other institution's professors and students to introduce them to the site, discuss possible research opportunities, and acquaint them with the limits to the types of research permitted on the property.
- *Connections with land managers:* Lead regular field tours to the site in combination with other Greenbelt Land Trust holdings (such as Owens Farm) for land managers.
- *Plan and build a trail system:* Complete a plan for a trail route through the property, develop a funding plan and begin installation. Avoid trail routes through sensitive habitats in favor of those that approach sensitive areas from the side and that use existing hardened surfaces.

5. Site uses

All site uses will be consistent with the terms of the land protection documents governing the property and will not diminish any of the site's conservation values.

5.1 Use of the site for research, recreation and education

Research

Scientific studies at the site should be encouraged but will be limited to those with minimal or no destructive sampling (e.g., removal of large amounts of native vegetation, severe soil disturbance, alteration of hydrology). The goals of research at the site should include improvement of conditions in native ecosystems. Treatment area sizes should be small enough to limit risks of unexpected, harmful results.

Recreation

The property may be used to encourage appreciation of nature and local habitats, but such use will occur only where and when it will not cause undue harm to the site. It is anticipated that a trail system may be placed at Lupine Meadows to provide pedestrian access and connectivity to future trail systems in the vicinity (such as between the proposed Mary's River Interpretive Center and property owned and managed by Bald Hill Farms). Over the next five years, GLT and partners will create a public use interpretive trail plan that addresses location of trails and protection of the site's habitat values. Any trails will be located in a manner to avoid sensitive species and habitats on the site, and will specifically avoid the most sensitive areas on the northern hill within habitat of Kincaid's lupine and Fender's blue butterfly. Horseback riding will not be permitted at the site. Dogs will also be prohibited. Wildflower picking will be prohibited. Until a trail system is planned and installed, access to the site will be through supervised tours only. These visits may happen year-round, but access to the hill, where Kincaid's lupine and Fender's blue butterfly occur, will be prohibited from the beginning of March through June. Once trails are established, visitors will be restricted to the trail except during guided events. If trails are constructed through wetland areas, a raised board walk may be necessary if year-round use is intended. A raised platform for viewing butterflies on the knoll may be appropriate if visitor usage of this site is high enough to cause significant damage to habitats or harassment of the butterflies.

Education

Participation of school groups with activities at Lupine Meadows represents and an important opportunity for educational outreach in our area. School groups have and should continue to visit the site to assist with restoration and management activities and to tour the site as an example of Willamette Valley ecosystems. Recently, Philomath High School students have assisted with a successful program through the Institute for Applied Ecology to grow native and endangered species and outplant them to the site. In addition, the site can serve as a demonstration site for groups of land managers and members of the public interested in prairie conservation, restoration and management.

5.2 Use of biological resources

Because Lupine Meadows contains high quality habitat for wetland and upland prairie, the site may be identified as a source of plant materials (e.g., seeds, cutting, divisions) for use at other locations. These activities may be permitted under this plan with first priority given to on-site needs for these resources to support restoration of Lupine Meadows itself. In addition, in areas that are currently highly disturbed (such as around the parking lot) and during restoration, some species can be planted and grown on site to provide plant materials. Wild collection of seed from existing populations of native plants (including species of concern) may also be conducted to support their restoration on-site and elsewhere.

6. Monitoring

A series of seven photo points are established at Lupine Meadows. The objectives are the photo points are to document conditions at the site and track changes through time in response to management treatments and natural processes. These photo points are distributed throughout the property (Appendix D) in strategic locations. At each location photos are taken in four directions. Photo points are currently unmarked in the field, and Greenbelt Land Trust staff utilize a form with the previous years' photo points to help find the photo stations and retake the images. Photos are retaken in summer.

Additional monitoring to meet specific objectives for the site may also be needed. For example, quantitative monitoring of the vegetation may be necessary to measure the response of each habitat type to treatments and evaluate the effectiveness of management actions.

7. Habitat management log

Keeping careful records of management actions at Lupine Meadows will assist with long-term management of the site. A Habitat Management Log for the property will provide a single repository for this information and make tracking actions, as well as evaluating the success of management treatments, more efficient. This log should contain:

- Dates and objectives of management treatments
- Maps and descriptions of treatment locations
- Information on species seeded or planted at the site, with provenance
- Dates and results of monitoring, with evaluation of treatment effects

8. Additional information needs

Additional surveys to document the baseline conditions at Lupine meadows are still needed. Specifically, surveys to document the following groups of organisms have not been conducted, but could provide important information for improving management at the site to maximize native biodiversity:

- Populations of mammals, reptiles and amphibians
- Important insect groups, such as native pollinators
- Fish use of the Newton Creek tributary

9. Literature cited

Altman, B. 2007. Breeding season bird populations at Lupine Meadows, 2004-2006. Prepared for Greenbelt Land Trust, Corvallis, Oregon.

Christy, J.A., E.R. Alverson, M.P. Dougherty, S.C. Kolar, C.W. Alton, S.M. Hawes, L. Ashkenas and P. Minear. 2005. Historical vegetation of the Willamette Valley, Oregon, 1851-1910. ArcMap shapefile, Version 7.0. Oregon Natural Heritage Information Center, Oregon State University. Portland, OR.

City of Corvallis. 2003. Natural Features Inventory Final Report. City of Corvallis Parks and Recreation Department, Corvallis, Oregon.

Floberg, J., M. Goering, G. Wilhere, C. MacDonald, C. Chappell, C. Rumsey, Z. Ferdana, A. Holt, P. Skidmore, T. Horsman, E. Alverson, C. Tanner, M. Bryer, P. Iachetti, A. Harcombe, B. McDonald, T. Cook, M. Summers, D. Rolph. 2004. Willamette Valley-Puget Trough-Georgia Basin Ecoregional Assessment, Volume One: Report. Prepared by The Nature Conservancy with support from the Nature Conservancy of Canada, Washington Department of Fish and Wildlife, Washington Department of Natural Resources (Natural Heritage and Nearshore Habitat programs), Oregon State Natural Heritage Information Center and the British Columbia Conservation Data Centre.

Hammond, P.C. 2007. The 2006 study of the Fender's blue butterfly (*Icaricia icarioides fenderi*) in Benton, Polk and Yamhill Counties. Unpublished report to Oregon Department of State Lands and U.S. Fish and Wildlife Service.

Hempy, K. 2003. Herbaceous and woody plant cover of a Pacific Northwest upland prairie. Report for BOT 540 with Dr. Mark Wilson.

Institute for Applied Ecology. 2003. Population estimate and management recommendations for Kincaid's lupine (*Lupinus sulphureus* ssp. *kincaidii*) at the Philomath/West Hills Rd. Property (Cuniff). Submitted to Greenbelt Land Trust, Corvallis, Oregon.

Lawrence, B. and M. Blakeley-Smith. 2005. Lupine Meadows 2005 Vegetation Survey. Unpublished report on file at Institute for Applied Ecology.

Noss, R., E. LaRoe, and J. M. Scott. 1995. Endangered ecosystems of the United States: a preliminary assessment of loss and dregadation. Pages 1-58. U.S. Dept. of the Interior, National Biological Service, Washington, D.C.

ODFW. 2006. The Oregon Conservation Strategy. Oregon Department of Fish and Wildlife, Salem, Oregon.

ORNHIC. 2004. Rare, threatened and endangered species of Oregon. Oregon Natural Heritage Information Center, Oregon State University, Portland, Oregon.

Rorick, N. and L.M. Wilson. 2003. Wetland delineation and determination of the Newton Creek Site. Rorick Environmental Services. Submitted to Greenbelt Land Trust, Corvallis, Oregon.

Schultz, C. B. and K. Dlugosch. 1999. Effects of declining food resources on populations of the Fender's blue butterfly (*Icaricia icarioides fenderi*). Oecologia 119: 231-238.

Appendix A. Vascular plants of Lupine Meadows.

Species list integrated from various surveys (adapted from Lawrence and Blakeley-Smith 2005).

					Wetland			
Genus	**Species**	**Common Name**	**Native or introduced**	**Upland prairie**	**Wetland prairie**	**Riparian forest**	**Ash swale**	**Parking area**
Acer	*macrophyllum*	big leaf maple	N			x		
Achillea	*millefolium*	yarrow	N	x	x			
Agrostis	*capillaris*	Colonial bentgrass	I		x	x		
Agrostis	*capillaris*	bentgrass	I		x	x		x
Aira	*caryophyllea*	silver hairgrass	I	x				
Allium	*amplectens*	slim-leaf onion	N		x	x		
Alopecurus	*pratensis*	meadow foxtail	I	x	x	x		
Amelanchier	*alnifolia*	Saskatoon serviceberry	N	x				
Anaphalis	*margaritacea*	pearly everlasting	N	x				
Anthoxanthum	*odoratum*	sweet vernal grass	I	x				
Asclepias	*speciosa*	showy milkweed	N		x			
Aster	*hallii*	Hall's aster	N	x				
Avena	*fatua*	wild oat	I	x				
Barbarea	*sp.*	winter cress	I	x				
Bellis	*perennis*	English daisy	I	x				
Brachypodium	*sylvaticum*	false-brome	I	x			x	
Briza	*minor*	little quaking grass	I	x	x			
Brodiaea	*coronaria*	harvest lily	N	x	x			
Brodiaea	*elegans*	elegant cluster lily	N	x				
Bromus	*mollis*	soft brome	I	x	x			
Bromus	*rigidus*	ripgut brome	I	x				
Callitriche	*stagnalis*	starwort	N		x			
Calochortus	*tolmiei*	Tolmei's mariposa;cats-ear	N	x				
Camassia	*leichtlinii*	Leichtlin's camas	N	x		x		
Camassia	*quamash*	common camas	N		x	x		
Campanula	*scouleri?*	pale bluebell	N			x	x	
Cardamine	*nutalli*	spring beauty	N	x				
Cardamine	*oligorsperma*	little western bittercress	N	x				
Carex	*densa*	dense sedge	N		x		x	
Carex	*deweyana*	Dewey sedge	N					
Carex	*lanuginosa*	wooly sedge	N					
Carex	*leporina*	hare's-foot sedge	N					
Carex	*tumulicola*	foothill sedge	N	x				
Carex	*unilateralis*	one-side sedge	N		x		x	

					Wetland			
Genus	**Species**	**Common Name**	**Native or introduced**	**Upland prairie**	**Wetland prairie**	**Riparian forest**	**Ash swale**	**Parking area**
Centaurium	*umbellatum*	common centaury	I	x	x	x		x
Cerastium	*glomeratum*	mouse-eared chickweed	I	x	x			
Cerastium	*viscosum*	sticky chickweed	I	x				
Cirsium	*arvense*	canada thistle	I			x	x	
Cirsium	*vulgare*	bull thistle	I		x	x		
Clarkia	*amoena*	farewell-to-spring	N	x				
Clarkia	*purpurea*	purple godetia	N	x				
Cornus	*sericea*	dogwood	N			x		
Crataegus	*sp.*	hawthorn	N/I	x	x	x	x	
Crepis	*capillaris*	smooth hawksbeard	I	x				
Cynosurus	*cristatus*	crested dogtail	I	x	x	x		x
Cynosurus	*echinatus*	bristly dogtail	I	x	x		x	
Dactylus	*glomerata*	orchard grass	I	x				
Danthonia	*californica*	California oatgrass	N	x	x		x	
Daucus	*carota*	QueenAnne's lace	I	x	x			
Delphinium	*menziesii*	larkspur	N		x			
Deschampsia	*cespitosa*	tufted hairgrass	N		x			
Deschampsia	*elongata*	slender hairgrass	N			x		
Dianthus	*armeria*	grass pink; Deptford pink	I	x				
Dichelostemma	*congestum*	field cluster-lily	N	x				
Dipsacus	*fullonum*	teasel	I		x		x	
Dodecatheon	*hendersonii*	Henderson's shooting star	N	x				
Eleocharis	*palustris*	creeping spikerush	N		x			
Elymus	*glaucus*	blue wild rye	N	x	x	x		
Epilobium	*ciliatum*	fringed willow	N		x			
Epilobium	*densiflora*	dense spike-primrose	N		x			
Epilobium	*paniculatum*	tall annual willowherb	N		x			
Erigeron	*decumbens*	Pacific fleabane	N	x (planted)				
Eriophyllum	*lanatum*	wooly sunflower	N	x	x			
Erodium	*cicutarium*	redstem stork's bill	I	x				
Festuca	*arundinacea*	tall fescue	I	x	x	x		
Festuca	*roemeri?*	Roemer's fescue	N		x			
Fragaria	*vesca*	woodland strawberry	N			x		
Fragaria	*virginiana*	Virginia strawberry	N	x	x	x		
Fraxinus	*latifolia*	Oregon ash	N		x	x	x	
Fritillaria	*affinis/lanceolata*	Chocolate Lily	N	x				
Galium	*aparine*	Cleavers bedstraw	N	x		x	x	

					Wetland			
Genus	**Species**	**Common Name**	**Native or introduced**	**Upland prairie**	**Wetland prairie**	**Riparian forest**	**Ash swale**	**Parking area**
Galium	*parisiense*	Lamarck's bedstraw	I	x				
Galium	*trifidum*	small bedstraw	N				x	
Geranium	*carolinianum*	Carolina geranium	I		x			
Geranium	*dissectum*	cutleaf geranium	I	x	x	x		
Geranium	*molle*	dovefoot geranium	I	x				
Geum	*macrophyllum*	large-leaf avens	N			x	x	
Gratiola	*neglecta*	clammy hedgehyssop	N		x			
Grindelia	*integrifolia*	Puget Sound gumweed	N		x			
Habenaria	*dilatata*	leafy white orchid	N		x			
Hedera	*helix*	English ivy	I			x		
Holcus	*lanatus*	velvet grass	I	x	x	x	x	x
Hordeum	*jubatum*	foxtail barley	N		x			
Hypericum	*perforatum*	St.John's wort	I	x	x		x	x
Hypochaeris	*radicata*	hairycats-ear	I	x		x		
Juncus	*arcticus*	artic rush	N		x			
Juncus	*bufonius*	toad rush	N		x			
Juncus	*effusus*	common rush	N		x		x	
Juncus	*ensifolius*	swordleaf rush	N			x	x	
Juncus	*patens*	spreading rush	N		x			
Juncus	*tenuis*	slender rush	N		x			
Lactuca	*serriola*	prickly lettuce	I			x		
Lamium	*purpureum*	red dead-nettle	I			x		
Leontodon	*nudicalis*	hairy hawkbit	I	x				
Leucanthemum	*vulgare*	oxeye daisy	I	x	x		x	x
Ligustricum	*apiifolium*	celery-leaved lovage	N				x	
Linum	*angustifolium*	flax	I	x	x			
Lithophragma	*parviflora*	woodland star	N	x				
Lolium	*sp.*	annual rye grass	I	x				
Lomatium	*nudicaule*	naked-stemmed hogfennel	N	x				
Lomatium	*triternatum*	hogfennel	N	x				
Lotus	*corniculus*	bird's-foot trefoil	I					x
Lotus	*purshiana*	Spanish clover	N	x	x			
Lupinus	*micranthus*	field lupine	N	x				
Lupinus	*polyphyllus*	large-leaved lupine	N		x	x		
Lupinus	*sulphureus* ssp. *kincaidii*	Kincaid's lupine	N	x				
Luzula	*campestris*	hairy wood rush	N	x	x			
Madia	*sativa*	coast tarweed	N	x				

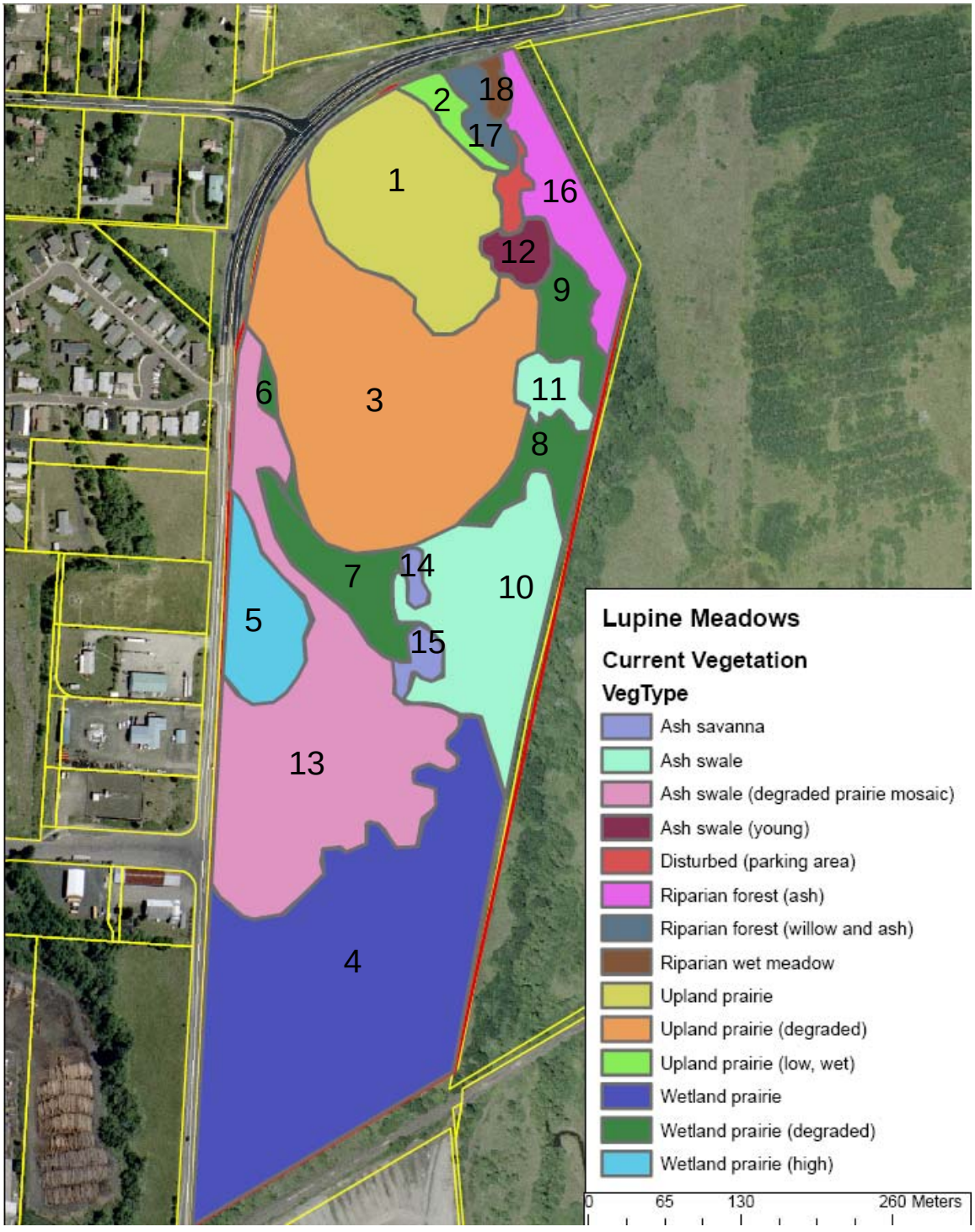
					Wetland			
Genus	**Species**	**Common Name**	**Native or introduced**	**Upland prairie**	**Wetland prairie**	**Riparian forest**	**Ash swale**	**Parking area**
Malus	*fusca*	wild crab apple	I	x				
Marah	*oreganus*	old-man-of-the-ground	N	x				
Mentha	*arvensis*	field mint	I		x			
Mentha	*pulegium*	pennyroyal	I		x		x	x
Microseris	*laciniatus*	cutleaf silverpuffs	N	x				
Montia	*fontana*	annual water miners lettuce	N		x			
Montia	*linearis*	miner's lettuce	N		x			
Myosotis	*discolor*	blue and yellow forget-me-not	I	x	x	x	x	x
Myosotis	*laxa*	small forget-me-not	N					
Narcissus	*sp.*	daffodil	I					
Navarretia	*intertexta*	navarretia	N					
Oemleria	*cerasiformis*	indian plum	N	x				
Oenanthe	*sarmentosa*	water parsley	N			x		
Orthocarpus	*pusillus*	dwarf owl-clover	N	x				
Osmorhiza	*chilensis*	common sweet cicely	N				x	
Parentucellia	*viscosum*	yellow parentucellia	I	x	x		x	x
Perideridia	*gairdneri*	wild false caraway	N			x		
Piperia	*elegans*	elegant rein-orchard	N	x				
Plantago	*lanceolata*	English plantain	I	x				
Plantago	*major*	broad-leaved plantain	I			x		
Poa	*annua*	annual blugrass	I	x	x			
Poa	*pratensis*	bluegrass	I	x	x	x	x	x
Poa	*trivialis*	rough bluegrass	I		x			
Polygonum	*bistortoides*	American bistort	N			x		
Polypodium	*glycerhiza*	licorice fern	N			x		
Polystichum	*munitum*	swordfern	N			x		
Populus	*balsamifera*	black cottonwood	N		x			
Potentilla	*gracilis*	Northwest cinquefoil	N	x	x	x		
Prunella	*vulgaris var. lanceolata*	self-heal	N	x	x	x	x	x
Pseudotsuga	*menziesii*	Douglas fir	N	x				
Pyrus	*communis*	common pear	I		x	x	x	
Quercus	*garryana*	Oregon white oak	N	x	x	x		
Ranunculus	*aquatilis*	white water buttercup	N			x		
Ranunculus	*occidentalis*	western buttercup	N	x		x		
Ranunculus	*orthorhynchus*	straight-beak buttercup	N		x	x		
Ranunculus	*uncinatus*	least buttercup	N				x	

					Wetland			
Genus	**Species**	**Common Name**	**Native or introduced**	**Upland prairie**	**Wetland prairie**	**Riparian forest**	**Ash swale**	**Parking area**
Rhamnus	*purshianus*	cascara	N	x		x		
Rhus	*diversiloba*	poison-oak	N	x		x	x	
Rorippa	*nasturtium-aquaticum*	water cress	I				x	
Rosa	*eglanteria*	eglantine;sweetbrier	I	x	x	x	x	
Rosa	*nootkana*	common wild rose	N					
Rosa	*pisocarpa*	clustered rose	N	x				
Rubus	*discolor*	Himalayan blackberry	I	x	x	x	x	
Rubus	*ursinus*	wild/trailing blackberry	N	x		x		
Rumex	*acetosella*	sour dock	I	x				
Rumex	*conglomeratus*	clustered dock	I		x	x		
Rumex	*crispus*	curly dock	I		x	x	x	
Salix	*hookeriana*	Hooker's willow	N			x	x	
Salix	*scouleriana*	Scouler's willow	N				x	
Sanicula	*bipinnatifida*	purple snakeroot	N	x				
Sanicula	*crassicaulus*	Pacific sanicle	N	x		x		
Saxifraga	*integrifolia*	broad-leaved saxifrage	N					
Saxifraga	*oregana*	Oregon saxifrage	N			x		
Scandix	*pectin-veneris*	shepherd's needle	I					x
Senecio	*jacobaea*	Tansey ragwort	I					
Sherardia	*arvensis*	bluefield madder	I	x	x			
Sidalcea	*nelsoniana*	Nelson's checker-mallow	N		x	x		
Sidalcea	*virgata*	showy wild hollyhock	N	x	x			
Sisyrhinchium	*sarmentosum*	blue-eyed grass	N	x	x			
Solanum	*dulcamara*	bittersweet nightshade	I				x	
Sonchus	*asper*	prickly sowthistle	I		x		x	
Stachys	*mexicana*	great hedge nettle	N			x		
Symphoricarpos	*albus*	common snowberry	N			x	x	
Taeneatherum	*caput-medusa*	Medusa-head grass	I	x				
Taraxacum	*officinale*	common dandelion	I	x				
Tellima	*grandiflora*	big flowe rtellima	N			x	x	
Torilis	*arvensis*	spreading hedge-parsley	I	x		x		
Trifolium	*dubium*	small hop cloverd	I		x			x
Trifolium	*repens*	white clover	I			x		
Trifolium	*subterraneum*	subterranean clover	I	x				
Typha	*latifolia*	broadleaf cattail	N			x	x	
Urtica	*urens*	dog nettle	N				x	

					Wetland			
Genus	**Species**	**Common Name**	**Native or introduced**	**Upland prairie**	**Wetland prairie**	**Riparian forest**	**Ash swale**	**Parking area**
Valerianella	*locusta*	European corn salad	I	x				
Veronica	*americana*	American speedwell	N		x		x	
Veronica	*scutellata*	marsh speedwell	N		x			
Veronica	*serpyllifolia var. serpyllifolia*	thyme-leaf speedwell	I		x			
Vicia	*americana*	American vetch	N			x	x	
Vicia	*cracca*	tufted vetch	I	x				
Vicia	*hirsuta*	hairy vetch	I	x	x	x		
Vicia	*sativa*	common vetch	I	x	x			
Vicia	*tetrasperma*	slender vetch	I		x			
Vulpia	*bromoides*	brome fescue	I	x				
Wyethia	*angustifolia*	mule's ears	N		x			
Zigadenus	*venenosus*	meadowdeath camas	N	x	x	x		

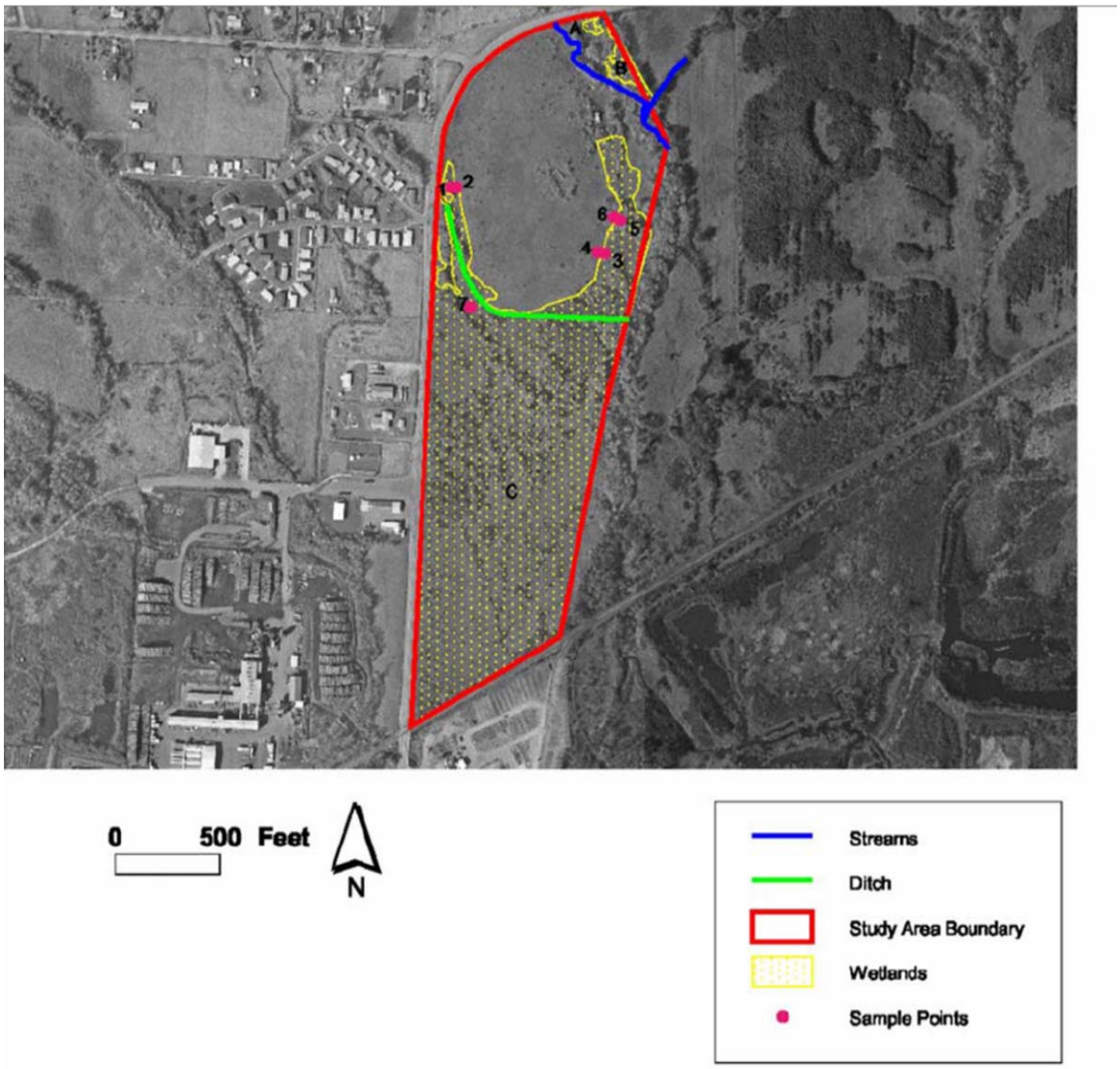
Appendix B. Map of current vegetation.

Map units are numbered and referenced in the text.

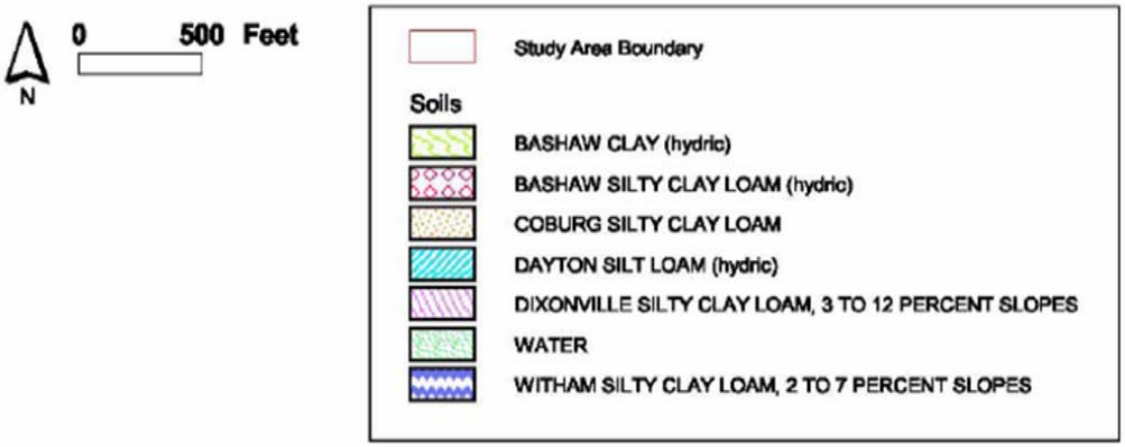


Appendix C has been removed because it contains rare species location information.

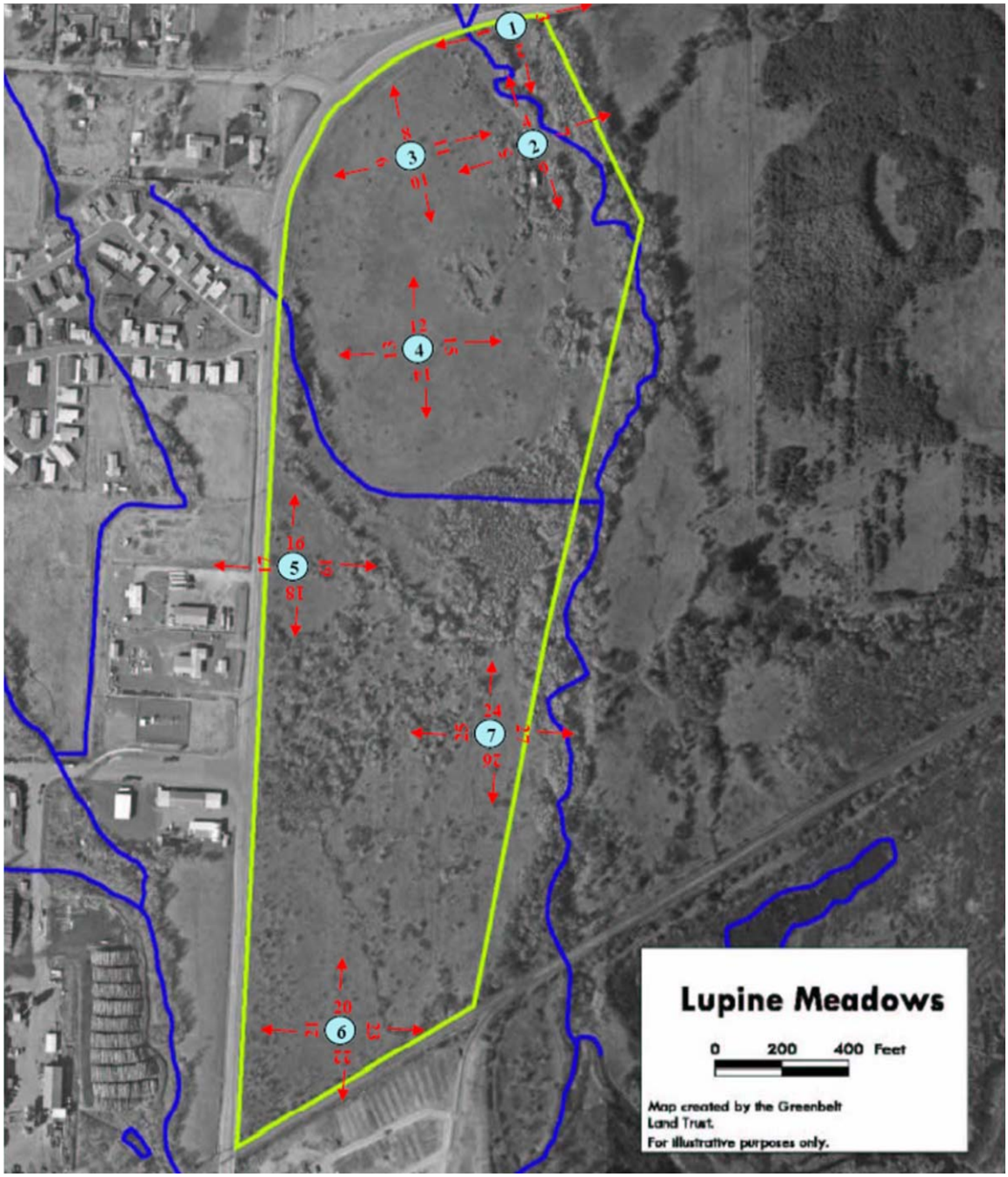
Appendix D. Wetland delineation. Map from Rorick and Wilson (2003).



Appendix E. Soil types and distributions. Map from Rorick and Wilson (2003).



Appendix F. Photo points.



Appendix G. Seed mix used in 2005 on upland prairie habitat in map unit 3.

Forbs
Achillea millefolium
Agoseris grandiflora
Clarkia purpurea var*. quadrivulnera*
Collinsia grandiflora
Collomia grandiflora
Eriophyllum lanatum
Gilia capitata
Lomatium nudicaule
Lotus unifoliatus
Madia elegans
Perideridea oregana
Potentilla gracillis
Prunella vulgaris var*. lanceolata*
Ranunculus occidentalis

Grasses
Danthonia californica
Festuca roemeri

Appendix H. Recommended species for seed mixes for prairie restoration and enhancements in 2008 and later years.

Seed mixes can be drawn from these lists based on seed availability and preference.

Upland prairie

Forbs

Achillea millefolium	common yarrow	Perennial
Balsamorhiza deltoidea	deltoid balsamroot	Perennial
Brodiaea coronaria	crown brodiaea	Perennial
Calochortus tolmiei	Tolmie star-tulip	Perennial
Camassia leichtlinii ssp. suksdorfii	Suksdorf's large camas	Perennial
Clarkia amoena	farewell to spring	Annual
Clarkia purpurea	winecup clarkia	Annual
Claytonia perfoliata	miner's lettuce	Annual, Perennial
Collinsia grandiflora	giant blue eyed Mary	Annual
Collomia grandiflora	grand collomia	Annual
Cynoglossum grande	Pacific hound's tongue	Perennial
Daucus pusillus	American wild carrot	Annual
Dichelostemma congestum	ookow	Perennial
Dodecatheon hendersonii	mosquito bills	Perennial
Eriophyllum lanatum	common woolly sunflower	
Fragaria virginiana ssp. platypetala	Virginia strawberry	Perennial
Fritillaria affinis	checker lily	Perennial
Geranium oreganum	Oregon geranium	Perennial
Gilia capitata	bluehead gilia	Annual, Perennial
Heracleum lanatum		Perennial
Iris tenax	toughleaf iris	Perennial
Lathyrus nevadensis	Sierra pea	
Linanthus bicolor	true babystars	Annual
Lomatium nudicaule	barestem biscuitroot	Perennial
Lomatium triternatum	nineleaf biscuitroot	Perennial
Lomatium utriculatum	common lomatium	Perennial
Madia elegans	common madia	Annual
Madia glomerata	mountain tarweed	Annual
Microseris laciniata	cutleaf silverpuffs	Perennial
Nemophila menziesii var. atomaria	baby blue eyes	Annual

Packera macounii	Siskiyou Mountain ragwort	Perennial
Plectritis congesta	shortspur seablush	Annual
Potentilla gracilis	slender cinquefoil	
Prunella vulgaris ssp. lanceolata	lance selfheal	Perennial
Ranunculus occidentalis	western buttercup	Perennial
Sidalcea virgata		
Silene hookeri	Hooker's silene	Perennial
Sisyrinchium bellum	western blue-eyed grass	Perennial
Sisyrinchium idahoense	Idaho blue-eyed grass	Perennial
Solidago canadensis	Canada goldenrod	Perennial
Symphyotrichum hallii	Hall's aster	Perennial
Trifolium eriocephalum	woollyhead clover	Perennial
Trifolium variegatum	whitetip clover	Annual
Triteleia hyacinthina	white brodiaea	Perennial
Viola adunca	hookedspur violet	Perennial
Viola nuttallii ssp. praemorsa		Perennial
Wyethia angustifolia	California compassplant	Perennial
Zigadenus venenosus	meadow deathcamas	Perennial

Grasses and grasslike plants

Achnatherum lemmonii	Lemmon's needlegrass	Graminoid
Bromus carinatus	California brome	Graminoid
Carex tumulicola	splitawn sedge	Graminoid
Danthonia californica	California oatgrass	Graminoid
Elymus glaucus	blue wildrye	Graminoid
Elymus trachycaulus	slender wheatgrass	Graminoid
Festuca roemeri	Roemer's fescue	Graminoid
Koeleria macrantha	prairie Junegrass	Graminoid
Vulpia microstachys	small fescue	Graminoid

Wetland prairie

Forbs

Achillea millefolium	common yarrow	Perennial
Allium amplectens	narrowleaf onion	Perennial
Asclepias fascicularis	Mexican whorled milkweed	Perennial
Asclepias speciosa	showy milkweed	Perennial
Brodiaea coronaria	crown brodiaea	Perennial
Camassia leichtlinii	large camas	Perennial
Camassia quamash	small camas	Perennial

Clarkia amoena	farewell to spring	Annual
Downingia elegans	elegant calicoflower	Annual
Downingia yina	cascade calicoflower	Annual
Epilobium brachycarpum	tall annual willowherb	Annual
Epilobium densiflorum	denseflower willowherb	Annual
Eriophyllum lanatum	common woolly sunflower	Annual, Perennial
Eryngium petiolatum	rushleaf eryngo	Perennial
Fragaria virginiana ssp. platypetala	Virginia strawberry	Perennial
Fritillaria affinis	checker lily	Perennial
Geranium oreganum	Oregon geranium	Perennial
Geum macrophyllum	largeleaf avens	Perennial
Gratiola ebracteata	bractless hedgehyssop	Annual
Grindelia integrifolia	Puget Sound gumweed	Perennial
Heracleum lanatum		Perennial
Lasthenia glaberrima	smooth goldfields	Annual
Lomatium dissectum	fernleaf biscuitroot	Perennial
Lomatium nudicaule	barestem biscuitroot	Perennial
Lomatium utriculatum	common lomatium	Perennial
Lotus formosissimus	seaside bird's-foot trefoil	Perennial
Lotus pinnatus	meadow bird's-foot trefoil	Perennial
Lotus unifoliolatus var. unifoliolatus	American bird's-foot trefoil	Annual
Lupinus polyphyllus	bigleaf lupine	Perennial
Lupinus rivularis	riverbank lupine	Perennial
Madia elegans	common madia	Annual
Madia glomerata	mountain tarweed	Annual
Microseris laciniata	cutleaf silverpuffs	Perennial
Montia linearis	narrowleaf minerslettuce	Annual
Orthocarpus bracteosus	rosy owl's-clover	Annual
Plagiobothrys figuratus	fragrant popcornflower	Annual
Plectritis congesta	shortspur seablush	Annual
Potentilla gracilis	slender cinquefoil	Perennial
Prunella vulgaris ssp. lanceolata	lance selfheal	Perennial
Ranunculus alismifolius	plantainleaf buttercup	Perennial
Ranunculus occidentalis	western buttercup	Perennial
Ranunculus orthorhynchus	straightbeak buttercup	Perennial
Rumex salicifolius	willow dock	Perennial
Saxifraga oregana	Oregon saxifrage	Perennial
Sidalcea campestris	meadow checkerbloom	Perennial
Sisyrinchium idahoense	Idaho blue-eyed	Perennial

	grass	
Symphotrichum hallii	Hall's aster	Perennial
Triteleia hyacinthina	white brodiaea	Perennial
Vicia americana	American vetch	Perennial
Wyethia angustifolia	California compassplant	Perennial
Zigadenus venenosus	meadow deathcamas	Perennial

Grasses and grasslike plants

Agrostis exarata	spike bentgrass	Perennial
Beckmannia syzigachne	American sloughgrass	Annual
Carex aurea	golden sedge	Perennial
Carex densa	dense sedge	Perennial
Carex feta	greensheath sedge	Perennial
Carex obnupta	slough sedge	Perennial
Carex pellita	woolly sedge	Perennial
Carex tumulicola	splitawn sedge	Perennial
Carex unilateralis	lateral sedge	Perennial
Danthonia californica	California oatgrass	Perennial
Deschampsia caespitosa	tufted hairgrass	Perennial
Glyceria occidentalis	northwestern mannagrass	Perennial
Hordeum brachyantherum	meadow barley	Perennial
Juncus tenuis	poverty rush	Perennial
Koeleria macrantha	prairie Junegrass	Perennial

Appendix I. Species detected during breeding bird surveys at Lupine Meadows April-June 2004-2006, breeding status, and comments on occurrence. From Altman (2007).

Species	Status	Comments
American Crow	B	Regularly detected throughout the site; 1-2 pairs may nest in riparian habitat
American Kestrel	N	Few detections; mostly on wires near road
Acorn Woodpecker	N	One bird recorded once near entrance gate
American Goldfinch	B	Regularly detected throughout the site
American Pipit	W	One detection; flyover in early May
American Robin	B	Regularly detected throughout the site
Barn Swallow	N	Few detections; could potentially nest in barn, but not confirmed
Black-capped Chickadee	B	Regularly detected throughout the site except for upland prairie
Bewick's Wren	B	Regularly detected throughout the site except for upland prairie
Brewer's Blackbird	B	Few detections in upland prairie and flyovers; may breed in edge habitat along road
Brown-headed Cowbird	B	Few detections throughout the site; likely parasitizes nesting birds on the site
Black-headed Grosbeak	B	Regularly detected throughout the site except for upland prairie
Brown Creeper	N	One detection in riparian
Black-throated Gray Warbler	N	1-2 detections per year; likely migrants or nearby breeders
Bushtit	B	Regularly detected throughout the site except for upland prairie
California Quail	B	Few detections in prairies; likely nesting on site
Canada Goose	N	Mostly flyover detections; use fields nearby in late winter and early spring
Cooper's Hawk	B	1 pair nested in dense trees near point 3 in 04; may not nest on site every year
Cedar Waxwing	B	Regularly detected throughout the site except for upland prairie
Common Yellowthroat	B	Regularly detected throughout the site except for upland prairie
Dark-eyed Junco	N	One detection in early June; likely post-breeding dispersal from nearby conifer forest breeding habitat
Downy Woodpecker	B	Regularly detected in riparian; 1-2 pairs may be nesting
Evening Grosbeak	N	Likely breeds in coniferous forest in the area; mostly flyover and off-site detections
European Starling	B	Regularly detected in riparian, mostly up near barn
Hermit Thrush	W	One detection in early May in riparian; late wintering bird
House Finch	B	Regularly detected throughout the site except for upland prairie
House Sparrow	N	Nest in association with houses across the road; forage some on property
House Wren	N	Two detections in upland prairie edges
Hutton's Vireo	B	Few detections in riparian and wet prairie/shrub; 1-2 breeding pairs likely
Killdeer	N	Few detections mostly in prairies or flyovers
Lazuli Bunting	B	Regularly detected at south edge of upland prairie and some in wet prairie/shrub; 2-4 nesting pairs likely
Lesser Goldfinch	B	Regularly detected in all habitats, but especially upland prairie and wet prairie shrub
Mourning Dove	B	Few detections in all habitats
Northern Flicker	B	Regularly detected throughout the site except for upland prairie
Orange-crowned Warbler	B	Regularly detected throughout the site except for upland prairie
Pine Siskin	N	Few detections; likely breeds in coniferous forest in the vicinity
Pacific-slope Flycatcher	B	Few detections; only one pair nesting near Point 3
Purple Finch	B	Regularly detected throughout the site except for upland prairie

Red-breasted Nuthatch	N	Few detections in riparian; likely breeds in coniferous forest in the vicinity
Ring-necked Pheasant	N	Few detections in upland prairie; mostly heard off-site
Rock Dove	N	Few detections; all flyovers
Red-tailed Hawk	N	Few detections; mostly on poles near upland prairie; could nest in riparian but not confirmed
Rufous Hummingbird	B	Regularly detected throughout the site except for upland prairie
Red-winged Blackbird	N	Few detections; mostly flyovers
Ruby-crowned Kinglet	W	Two detections of lingering wintering birds in the first week of May
Savannah Sparrow	B	Few detections; all in upland prairie
Song Sparrow	B	Regularly detected throughout the site except for upland prairie
Spotted Towhee	B	Regularly detected throughout the site except for upland prairie
Steller's Jay	N	Few detections in riparian mostly; likely nests in conifer forest nearby
Swainson's Thrush	B	Regularly detected throughout the site except for upland prairie
Tree Swallow	N	One detection of fly-through in upland prairie
Turkey Vulture	N	Few detections; all flyovers
Vaux's Swift	N	Few detections; all flyovers
Vesper Sparrow	N?	See text of report for details
Violet-green Swallow	N	Few detections; all flyovers
Warbling Vireo	B	Few detections in riparian; probably one nesting pair
White-crowned Sparrow	B	Few detections; all in upland prairie
Western Meadowlark	N	One detection on telephone pole at edge of upland prairie; likely nests in nearby fields
Willow Flycatcher	B	Few detections in wet prairie/shrub and riparian; probably 2-3 nesting pairs
Wilson's Warbler	N	Few detections in riparian and wet prairie/shrub of migrants
Western Scrub Jay	B	Regularly detected throughout the site except for upland prairie
Western Tanager	N	Few detections in riparian; likely breeds in forests nearby
Western Wood-pewee	B	Regularly detected throughout the site except for upland prairie
Yellow-rumped Warbler	W	Three detections in riparian of late wintering birds
Yellow Warbler	N	One detection in riparian

B = breeding at Lupine Meadows based on confirmation of breeding or high likelihood based on repeated observations, a pair observed, or nesting behaviors during the breeding season
N = likely not breeding at Lupine Meadows based on few observations and/or unsuitable breeding habitat, but likely breeding nearby in other habitats with some use of Lupine Meadows
W = wintering species that doesn't breed at Lupine Meadows or nearby