January – December 2005 Annual Report

Fort Lewis Conservation Project

The Nature Conservancy
SAVING THE LAST GREAT PLACES ON EARTH

Fort Lewis is a key military installation and the most important conservation area in the Puget Trough region. The Nature Conservancy strives to assist Fort Lewis in the conservation of its natural resources within the framework of the Fort's military training mandate. Fort Lewis and The Nature Conservancy have shared interests because:

- ***Healthy natural ecosystems are essential for realistic and sustainable training lands.***
- ***Rare species recovery throughout the region reduces the burden of recovery on any single landowner or site.***
- ***Pest plants harm natural areas and reduce their suitability for military training.***

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2005 Overview

Fort Lewis continues to play a vital role in the regional effort to restore western Washington prairie and oak habitats. The Fort has the largest and best quality remnants of these threatened habitat types, and The Nature Conservancy is assisting the Fort to reach its conservation goals. Fort Lewis and The Nature Conservancy have a shared vision of conservation at the Fort which simultaneously promotes sustainable military training lands and robust natural ecosystems. The following three points provide a framework for this vision.

1. *Healthy natural ecosystems are essential for realistic and sustainable training lands.*
2. *Rare species recovery throughout the region reduces the burden of recovery on any single landowner or site.*
3. *Pest plants harm natural areas and reduce their sustainability for military training.*

The open structure of prairie and oak woodland habitats is highly desirable for military training and essential to many rare species. These habitats are currently threatened by invasive trees, shrubs and weeds that can quickly degrade large areas into dense woodlands and brush patches with reduced visibility and native diversity. It is realistic to pursue a vision of prairie and oak ecosystem management that supports sustainable military training and conservation values simultaneously.

Fort Lewis has developed a number of valuable plans to guide conservation actions. The Sustainability Initiative and the prairie and oak management plans demonstrate the Fort's commitment to conservation on its training lands and throughout the region. These plans share common goals with The Nature Conservancy's Ecoregional Planning and Conservation Area Plan, which identify prairie and oak habitats as critical conservation targets.

Robust native ecosystems are more resilient to the impacts of training and better able to support rare species. Degraded oak and prairie habitats can be restored and maintained to provide the open habitat structure that is beneficial to training and conservation. High quality natural areas that are used for compatible types of training can be managed to provide maximum conservation benefit. It is also important that critical natural processes, such as fire, be in place to help maintain desired habitat structures.

Invasion by pest plants is one of the most significant threats to the Fort's training lands. These pest plants degrade training areas, displace native plant and animal communities, and dramatically modify existing habitats. Once established, many of these invasives can be nearly impossible to eradicate using practical control measures. Known noxious weed infestations must be persistently and effectively controlled in training areas. New infestations need to be discovered and controlled before they degrade training lands and become unmanageable.

Proactive management of candidate and rare species can eliminate the need for them to become federally listed as threatened or endangered and greatly reduce regulatory burdens. Depending on species requirements, rare species habitat can be compatible with various types of military training. Rare species populations should be established and or enhanced in those areas. Core habitat can be of sufficient quality, size and distribution to support viable populations of targeted rare species.

Prairie and oak woodland conservation is most effective when conducted in a coordinated and comprehensive manner throughout the region. Region-wide proactive recovery efforts increase the likelihood of success. This is especially true with rare species recovery where the regulatory burden can be reduced for single landowners. Effective collaboration facilitates the sharing of information and techniques among partners and focuses recovery on the most appropriate sites in the region. Also, increased funding opportunities often result from cooperative recovery efforts.

The annual activity summary below presents highlights of the conservation activities accomplished in 2005. The scale of the work that we have performed provides evidence that we have gained the ability to conduct habitat conservation at the landscape level – an ability that is critical if we hope to achieve important conservation goals.

Summary of significant conservation activities on Fort Lewis, 2005.

Invasive Plant Control

• Controlled approximately 1340 acres of Scotch broom:
  o 990 acres of prairie for rare butterfly, streaked horned lark, Mazama pocket gopher and general prairie enhancement.
  o 350 acres of oak and pine were mowed to enhance understory structure, to remove encroaching Douglas-fir and enhance western gray squirrel habitat.

• Inspected and treated 594 known noxious weed infestations of 11 different species.
• Discovered an additional 166 noxious weed sites through surveys of disturbed areas and quality prairie.
• Removed and girdled encroaching Douglas-fir from about 100 acres of prairie.
Enhancement Plantings

• Propagated and planted 64,600 prairie plants on Weir, Johnson and 13th Division Prairies. Plantings were used for:
  o General prairie and butterfly enhancement.
  o Mesic prairie bioassay plots.
  o Road decommissioning.

• Planted 900 shrubs and trees to enhance core western gray squirrel habitat.
• Planted 175 woody riparian species at Halverson springs.
• Established almost 300 ft^2 of seed production beds for 30 species of prairie plants.
Western Gray Squirrel Management

• Developed a new and highly successful method for western gray squirrel monitoring using hair snagging tubes.
  o Established 181 and monitored hair snag sites in ‘downrange’ areas.
  o Prepared reports and presented poster on western gray squirrel monitoring.

• Developed Eastern Gray Squirrel Control Experiment Plan and facilitated control program.
Miscellaneous Conservation Actions
• Produced background paper on mesic prairie systems.
• Removed salmon passage barrier and enhanced stream banks near confluence of Muck Creek and Nisqually River.

INTRODUCTION

Conservation at Fort Lewis

Fort Lewis and The Nature Conservancy have had a long and successful partnership that is based on mutual interest in maintaining healthy prairie and oak ecosystems and rare species recovery. The Fort contains many of the largest and best quality remnants of the prairie/oak mosaic and is therefore the most important conservation area in the Puget Trough region.

Conservation of these ecosystems and associated rare species is mutually important to both the Fort and The Nature Conservancy (TNC). The open structure of prairie and oak woodland habitats is highly desirable for military training and essential to many rare species. These habitats are currently threatened by invasive trees, shrubs and weeds that can quickly degrade large areas into dense woodlands and brush patches with reduced visibility and native diversity. It is realistic to pursue a vision of prairie and oak ecosystem management that supports sustainable military training and conservation values simultaneously.

In total, the prairies and oak woodlands on Fort Lewis comprise a large area with a multiplicity of training and conservation needs. Noxious weeds can quickly become unmanageable and threaten continued degradation of important habitat structures in both oaks and prairies.

The onslaught of non-native invasive weeds has contributed to the decline of many native species. In the prairies, streaked horned lark, Mazama pocket gopher and several species of butterflies have suffered significant declines. Western gray squirrels are associated with oak habitats and have also declined dramatically. On-the-ground management for rare species largely includes controlling invasive pests and enhancing native habitat components such as planting species that provide important forage and structure. Also, redundant or undesirable road segments are regularly identified by Fort Lewis and targeted for decommissioning. Decommissioned roads can be restored to a more native condition which reduces habitat fragmentation.

Wet and mesic prairies are one of the least understood components of the south Puget prairie system. Prairie sites near water or with significant soil moisture were often the first sites to be settled and cultivated. As a result, there are few current or recorded examples of these ecological communities, and those that do exist are seriously degraded. There are opportunities on the Fort and in the region to enhance or re-establish prairie habitat in moist areas, but there is little information to guide the effort. Most of the work to-date has focused on filling that information gap.

Riparian sites have also received targeted conservation focus at Fort Lewis. Aside from the conservation values associated directly with the streams and the aquatic species they contain, riparian corridors are often a focal point for diversity in surrounding uplands. Conservation actions include controlling invasive weeds, enhancing native plant communities and improving stream channels that have been impacted by historic land management actions.

2005 Annual Report

This report provides an overview of the past year's conservation activities at Fort Lewis relating to the prairie/oak mosaic. It is a compilation of previous quarterly reports and provides general details relating to project objectives and outcomes. The report is divided into the following sections and subsections:

- Prairie Habitat Management
  - Scotch broom control
  - Propagation, enhancement plantings and rare plants
  - Rare butterflies
  - Streaked horned lark
  - Douglas-fir control
  - Wet prairies
- Oak, Pine and Western Gray Squirrel Habitat Enhancement
  - Western gray squirrel monitoring
  - Eastern gray squirrel control
  - Scotch broom and Douglas-fir control
  - Enhancement plantings
- Noxious Weeds
- Rare Species Recovery
- Road Decommissioning
- Riparian Enhancement

There were 20 task orders that were active in 2005. These are listed below along with their TNC grant ID numbers.

Prairies 2004	3910	Fir Removal 2004	3844
Prairies 2005	4807	Pine & Oaks	3867
Enhance Prairies	3861	White Oaks	3866
Horned Lark 04	3909	Noxious Weeds 2004	3832
Horned Lark 05	3849	Noxious Weeds 2005	4806
Riparian Oaks	3827	Roads 2004	4802
Butterflies 2004	3900	Roads 2005	4808
WGS 2004	3911	In-Stream	3803
WGS 2005	4809	WDFW Coop Position	3822 & 3845
Oak Habitat 2004	3840		
Squirrel Habitat	3901		

For the purpose of grant tracking, activities are summarized in *Appendix I*. This table identifies all actions accomplished under each of the 2005 active task orders.

PRAIRIE HABITAT MANAGEMENT

Prairie management at Fort Lewis is guided by several converging conservation targets which guide management actions. Each conservation target has specific threats which must be addressed. These targets include, the prairie habitat itself, rare prairie butterflies, streaked horned lark and Mazama pocket gopher. Each target has similar, yet distinct needs. By addressing a range of key targets, the variability of the prairie system should be largely captured in our conservation efforts.

Priority Prairie Management Areas

Although Fort Lewis has numerous opportunities for prairie enhancement, current resources are not sufficient to launch an intensive restoration effort on all potential sites. Instead, available resources must be thoughtfully allocated in order to sequentially improve conditions for priority prairie sites and conservation target species. Past and present prairie work has focused largely on the two main priority management areas: Johnson/Weir Prairies and 13th Division Prairie. Although Fort Lewis' Artillery Impact Area contains some of the very highest quality prairie, management activities must be severely limited in this area due to artillery training.

Johnson and Weir Prairies are some of the highest priority prairie areas for conservation on the Fort. They have high quality vegetation and the presence of conservation target species, including valley silverspot and Puget blue butterflies, Mazama pocket gophers and several rare plants. They are heavily impacted by Scotch broom though the level of infestation has declined over the past ten years because of intensive control efforts using mowing, herbicide application, brush cutting, pulling, and fire.

Thirteenth Division Prairie contains a matrix of degraded and higher quality prairie habitat. Portions of this prairie are now protected from heavy training impacts as riparian buffers and Special Use Areas. Even the most heavily degraded areas contain prairie soils thus providing an excellent opportunity for prairie restoration. Previous efforts to control Scotch broom on 13th Division Prairie have improved vegetation structure and have begun to reduce infestation levels in many areas. This prairie is home to several rare conservation target species including the streaked horned lark and Puget blue butterfly.

Another area of emphasis on Fort Lewis is the Muck Creek Corridor and its wet/mesic prairies. Muck Creek is one of the most significant tributaries for anadromous salmonids in the Lower Nisqually River. The creek is particularly important habitat for chum salmon, winter steelhead, and sea-run cutthroat trout. Coho salmon have also been documented in the creek. The broader Muck Creek riparian corridor has also become a focus for upland restoration. It contains areas of quality native prairie and serves as a significant wildlife corridor for the northeastern portion of the base. However, the corridor faces serious challenges from habitat modifying invasive weeds in both upland and riparian conditions. Because of its unique habitat conditions and

aquatic conservation target species, the Muck Creek corridor has been given a restoration emphasis.

The Prairies section of this report provides details on each of the following action components:

- Scotch broom control
- Propagation, enhancement plantings and rare plants
- Rare butterflies
- Streaked horned lark
- Douglas-fir control
- Wet prairies

Scotch Broom Control

Scotch broom continues to be one of the primary conservation actions necessary to maintain prairie habitat structure. With its ability to severely alter prairie structure, broom poses an extreme threat to virtually all prairie dependent species, including each of the current conservation target species.

Scotch broom management takes an integrated approach. A combination of mechanical cutting, hand-pulling, herbicide, fire and biological methods are employed to reach a desired state of minimal maintenance. Mowing has been used to successfully kill very mature broom plants and periodic mowing of younger plants (every 2-4 years) will restrict extensive seed production. Periodic mowing will not kill broom however, and some sorts of lethal control are required. This can be fire or herbicide treatment. These tools can be highly effective at reducing the amount of broom if the seed bank has been largely reduced. To get to this point of control, it is imperative that broom patches are not allowed to bloom extensively. Once broom has reached a very low infestation level, hand pulling becomes a practical maintenance strategy, even across large areas.

In addition, biological controls are being investigated by various agencies and universities. A few biological control agents are on the base, but their effectiveness is not expected to provide a satisfactory level of control. However, any tool that helps restrict seed production is a welcome addition.

2005 Summary

A significant amount of broom control occurred on the priority prairies in 2005. More than 725 acres were mowed and 263 acres were spot or wipe-on treated. In addition, the almost 200 acres that were mowed at the end of 2004 will not pose a large threat of seed production in 2006. Another boost to the broom control effort came from the Fort Lewis Forestry Department. An additional 314 acres of prairie on Johnson/Weir and 13th Division Prairies were burned, a treatment that is largely expected to kill broom plants. All of these areas do not pose a significant threat of seed production in 2006.

The broom control summary table below indicates locations, acreages and task orders for each action. The prairie maps in *Appendix II* provide past treatment locations and 2006 priority treatment areas.

SCOTCH BROOM SUMMARY TABLE

January-March

Scotch broom was mowed in the following locations:

- 100 acres of Scotch broom on Upper Weir Prairie. (Prairies04)
- 140 acres of Lower Weir Prairie.(Prairies05)
- 115 acres of Lower Weir Prairie (Noxious Weeds 04)
- 72 acres of Scotch broom on Upper Weir Prairie in coordination with call playback experiment. (STHL04)
- 63 acres of Scotch broom in high value lark habitat on 13th Division Prairie. (STHL04)

April-June • Mowed 121 acres of Scotch broom in the Muck Creek corridor (RipOaks).
July-September Scotch Broom spot treatment at the following sites: • 61 acres on Johnson Prairie (Prairies05); • 49 acres on 13th Division Muck Creek Triangle. (Weeds05) • 64 acres on South Weir Prairies. (Weeds05); • 24 acres on 13th Division Prairie (Instream)
October-December • Mowed 88 acres of Scotch broom on Upper Weir Prairie. (Prairies05) • Mowed about 10 acres of Scotch broom on Johnson Prairie. (Prairies05) • Spot sprayed 58 acres of Scotch broom that survived a prescribed fire on Johnson Prairie (Prairies05) • Wick on herbicide broom treatment on 7 acres of Johnson Prairie (Prairies05) • Initiated mowing at Pacemaker landing strip for STHL habitat enhancement. Completed about 15 acres of the 200+ acres planned. (STHL05)

Mowing Tasks

2005 mowing tasks had several enhancement targets: general prairie habitat enhancement, Muck Creek riparian corridor enhancement and streaked horned lark (STHL) habitat enhancement. See *Appendix II* for maps of activities on 13th Division and Johnson/Weir Prairies.

General Prairie Enhancement. General prairie enhancement mowings occurred at the Johnson/Weir Prairie Complex. In all about 450 acres were treated. These mowings will keep broom from blooming and producing seed in core prairie habitat for the next 2-3 years.

Riparian Enhancement. 115 acres of broom were mowed under the Riparian Oaks task order for habitat improvement along the Muck Creek Corridor in 13th Division Prairie. There were three treatment sites: the Cultural Area; north of Pacemaker; and the Muck Creek Triangle Area.

Streaked Horned Lark Habitat Enhancement. Mowing for lark habitat under the Streaked Horned Lark (STHL) 2004 task order occurred during winter quarter. 72 acres were mowed on Upper Weir in conjunction with a STHL call playback experiment conducted by Washington Department of Fish and Wildlife (WDFW). Recordings of STHL vocalizations were played in the mowed area to see if any lark would be attracted to use the area. However, frequent monitoring of the site did not indicate any use of the area by the lark.

An additional 63 acres of high quality lark habitat at Pacemaker were also treated under the STHL 2004 task order. Further work around Pacemaker was initiated on the STHL 2005 task order in December, but only 10-15 acres out of the 200 acres planned were mowed before the end of the year.

Spot Treatment

Chemical control was delayed this year due to an extended growing season. Most native forbs typically senesce by mid-July, which allows spray activity to progress with limited risk of damage to native plants. Likely as a result of the cool and wet spring, native forbs did not senesce until late July, and spray work did not begin until the beginning of August. Garlon 4 becomes less effective on broom as the summer comes to an end. Many of the areas treated later in the season (South Weir and parts of Johnson Prairies) exhibit reduced response to the herbicide and it is possible that some follow-up treatment will be warranted. This will be determined in late-winter when buds begin to flush.

In all, 200 acres of broom were treated with a combination of spot spraying in less dense areas and areas with non-senesced native cover, and boom spraying in areas with dense broom and senesced native forbs. About 7 acres were treated with a wipe on applicator.

An additional 58 acres were treated in the 2005 Johnson Prairie burn unit. Broom survival after the fire was patchy. In addition, the Triangle area of 13th Division Prairie was revisited and broom plants that had been previously missed were re-treated. Both of these activities occurred in October, and effectiveness remains to be seen.

2006 Outlook

The core prairie sites have received broom treatment for numerous years, and in many areas should have a significantly reduced seed bank. When these areas of broom are allowed to flower and produce seed in abundance, the seed bank is replenished and the effects of previous treatments are largely removed. *It is critically important to prevent widespread blooming in core areas.*

There are 750 acres of medium to high priority prairie on Johnson/Weir and 13th Division Prairies that have a likelihood of producing abundant seed in 2006 (see map in *Appendix II* for areas planned for treatment). These areas will be our broom control targets for the coming year prior to seed set. Those areas most likely to produce seed will be treated first. Areas that are uncertain to produce seed will be monitored and treated prior to seed burst as needed. Sites with significant native forbs will not be mowed after April 15 until plants have largely senesced in the summer. (Mowing can occur in lower quality prairie so long as it does not interfere with sensitive animal species.)

Soon after native forbs have senesced in July, we will focus our work on herbicide treatment in high priority core areas that have a reduced seed bank. Exact locations for treatment will depend on successfulness of previous herbicide treatments and any 2006 prescribed burn locations. We expect to be able to control 250-300 acres with spot and boom treatments.

PROPAGATION, ENHANCEMENT PLANTINGS AND RARE PLANT SPECIES

Prairie plant propagation is an important component of the prairie program. Seed collected from the prairies is used to propagate seedlings, which are strategically planted to meet the following objectives:

- Promote general species diversity in prairies;
- Fill available growing space after invasive plant control, road closures, etc;
- Enhance forage opportunities for conservation target animal species;
- Increase the counts of rare plant species; and
- Create managed seed banks.

Plantings and direct seeding are used to improve general prairie diversity. Core prairie conservation areas may have certain plant species underrepresented and plantings can be an effective way to increase their overall abundance. Likewise, core quality areas can be expanded or connected by planting a diversity of prairie species. Plantings and direct seeding can also be used to fill growing space that becomes available in a prairie after a non-native plant control treatment, disturbance or road closure.

Food sources are often the primary limiting factor for rare animal species. Plantings are used to increase the abundance of food sources for conservation target animals (primarily butterflies). They can also facilitate improvement, expansion and establishment of core habitat areas and improve connectivity between core areas.

Some prairie plant species have become extremely rare at Fort Lewis and are likely on the verge of extirpation. Under the direction of Fort Lewis Fish and Wildlife, TNC is initiating a project to produce seed and plugs of these species to strengthen their populations on the Fort and the region. Rare plant species are planted in general enhancement/food source plantings and also in targeted locations. A set of these species are being established in managed seed beds to generate a long-term seed source and take pressure off of wild plants.

2005 Summary

Altogether, 64,605 prairie plants were propagated and planted on Weir, Johnson and 13th Division Prairies in the spring and fall seasons. Plantings will enhance habitat for butterflies, establish wet prairie bioassay/habitat enhancement plots, and reduce prairie habitat fragmentation by re-vegetating roads decommissioned by the Fort. In addition, we ramped up our seed and plug production capacities to increase the number and diversity of forb species available for future plantings on the Fort. See prairie maps in *Appendix II* for locations and *Appendix III table 7 for* an overview of species of plantings.

PRAIRIE PROPAGATION AND PLANTING SUMMARY TABLE
January-March

- Planted three dry prairie enhancement/bioassay plots with 843 plugs north of the Muck Creek Triangle. (RipOaks)
- Initiated test of new method for harsh paintbrush butterfly host enhancement on Johnson and 13th Division Prairie. (Prairies05)

- Planted 20,443 prairie plants into roads decommissioned on Upper Weir Prairie. (Roads04)
- Planted 14,242 plants to improve butterfly habitat and prairie plant communities at Johnson, South Weir and 13th Division Prairies. (Prairies05)

April-June

- Planted 1933 plugs in 12 enhancement/bioassay mesic species bioassay plots at the Muck Creek cultural site and the north side of 13th Division. (RipOaks)
- Planted 967 plugs in 6 enhancement/bioassay mesic species bioassay plots at the landfill enhancement site. (RipOaks)
- Controlled invasive grasses in previously planted bioassay plots. (Prairies05)
- Initiated 2005 prairie plant seed collection and propagated plants for fall 2005 planting. (Prairies05)
- Monitored prairie enhancement plantings at 13th Division Prairie to determine plant survival with different pretreatments. (Prairies05)

July-September

- Propagated over 29,000 prairie plant species for fall 05 and spring 06 enhancement plantings (Prairies 05 and Roads 05)
- Seed collection. Collected seed from 30 species of prairie plants. (Prairies 05 and Roads 05)

October-December

- Planted 20,477 prairie plants on Weir, Johnson, and 13th Division Prairies. (Prairies05)
- Planted seed plots for 30 species in 24 beds that will supply seed for Collins research plots and general restoration in fall 2006. (Roads05, Prairies05)
- Planted 6,000 plugs of Roemer's fescue and direct seeded 27 species of prairie plants on Upper Weir road closure. (Roads 05)

Prairie Plantings

Several areas were planted in the winter and spring of 2005. General enhancement plots were planted at South Weir and 13th Division Prairies. A butterfly resource plot was planted at Johnson Prairie. Three dry site enhancement/bioassay plots were established at 13th Division north of the Muck Creek Triangle. Eighteen mesic enhancement/bioassay plots were established: 12 at 13th Division Prairie and six at the landfill. Lastly, the Upper Weir road decommissioning was planted.

During fall of 2005, the general enhancement plots Johnson, South Weir and 13th Division prairies were augmented with more plugs and additional planting and seeding occurred at the Upper Weir road decommissioning.

See *Appendix II* for maps of plantings and *Appendix III Table 7* for an inventory of species planted by location. Descriptions of plantings follow.

General and Butterfly Plantings. General and butterfly enhancement plantings were done at Johnson, South Weir and 13th Division Prairies. 14,242 were planted in the winter and an additional 20,477 were planted in the fall (see *Appendix III table 7*). Planting areas were selected that have been degraded to some extent by habitat

modifying non-native grasses but that do not have a high density Scotch broom infestation.

One area on the 13th Division Prairie and one area in northern Johnson Prairie were planted prior to 2005 with species important for Taylor's checkerspot and valley silverspot butterflies. The 2005 winter quarter Johnson Prairie butterfly resource plantings were designed to further enhance the area for rare butterflies. Other enhancement plantings on South Weir Prairie and 13th Division Prairie were designed to improve overall prairie quality by increasing Roemer's fescue cover and to provide some additional butterfly resources. A total of 34,419 plants were planted for general enhancement. *Table 7* in *Appendix III* provides an inventory of all species planted for each location.

In June, TNC staff measured experimental prairie enhancement plantings at 13th Division Prairie to determine plant survival in the field following a variety of pre-treatments. Re-measurements are to occur annually each June and future measurements will yield more meaningful results. As expected, we found little difference between the two treatments (grass specific herbicide, burning) and control plots. However, overall survival of plugs was slightly less than 50% across all plantings, with significant variability between species. See *Table 8* in *Appendix III* for survival results of some key planted species.

Enhancement/Bioassay Plots. These plots are designed to provide potentially limiting resources to rare grassland species in addition to providing a bioassay of edaphic conditions for upland prairie species. During the winter, three dry species prairie enhancement/bioassay plots were established north of Muck Creek Triangle area. A transect of three 10 x 10m plots was established perpendicular to the vegetation gradient in areas dominated by non-native grasses along Muck Creek. They were planted with species generally associated with xeric upland prairie beginning in fall 2004 and finishing in winter 2005. (See *Appendix III Table 7* for list of species).

In spring, an additional 18 enhancement/bioassay plots were established: 12 at 13th Division Prairie and six at the North Fort Landfill site. Four groups of three 5 x 5m plots were planted in mid April with mesic/wet prairie species. Six bioassay plots were planted with the same species on the largest cell of the landfill. Survival of these plants will be used to give an initial indication whether or not these species are appropriate and at what moisture level relative to the current vegetation. (See *Appendix III Table 7* for list of species).

These plots were treated with Poast in May 2005 to control the dense exotic grasses. Initial observations indicate that the exotic grasses were suppressed by the Poast but there has been significant re-growth.

Road Decommissioning Planting. Two of the road sections decommissioned in 2005 were on Upper Weir Prairie (See Road Decommissioning section of this report). The prairie roads were ripped by Fort Lewis Forestry using a grader set to approximately a

six inch depth. This broke up the highly compacted surface of the road. The ends of these roads were blockaded with logs and low growing shrubs associated with prairies (tall Oregon grape) were planted at the road ends. The initial planting was designed to establish a base of Roemer's fescue which is a fundamental component, and the largest percentage of cover, in the *Festuca roemeri*/*Aster curtis* plant community. *Figure 4* in *Appendix II* shows the Upper Weir closure areas in blue lines.

During the summer of 2005, it was discovered that the seed used to propagate the fescue used in this planting had been contaminated with non-native red-fescue seed – this in spite of quality control measures and independent lab testing of purity. The road plantings were quickly sprayed with Roundup. Follow-up monitoring indicated virtually 100% mortality, and in the fall the site was re-planted with fescue plugs and seeded with a mix of prairie species. The seed used in this mixture was relatively old and viability is difficult to predict.

Seed Collection
Seed from 30 species of prairie plants was collected and cleaned by staff and volunteer crews during the late spring and early summer. This seed will be used for future prairie enhancement plantings and seed production. Seed was collected from on and off base sites and funded from multiple sources. Additional seed was collected by Fort Lewis staff and given to TNC for storage. Extra precautions were used to maintain quality harvest of Romer's fescue seed. List of species and amounts of seed collected is included in *Appendix III Table 9.*

Planting Area Management - Invasive Grasses
Invasive grass control in enhancement plot areas is believed to be critical for improving vegetation structure in these areas and for increasing survival of transplanted native prairie plants. Four prairie planting areas on 13th Division were treated with Poast herbicide to control invasive grasses. These areas were sprayed using a tractor mounted boom sprayer applying the herbicide at a rate of 2 pints per acre along with crop oil concentrate (to improve absorption by targeted plants) and dye in water. Initial results indicate that the invasive grasses in the sprayed areas have been heavily impacted by this treatment. As most of these grasses are perennials, and Poast generally does not kill perennial grasses in a single application, these areas are likely to require treatment in spring 2006 for a high level of control. See prairie maps in *Appendix II.*

Propagation
More than 29,000 prairie plants were propagated in early summer that are intended for fall and spring planting at Fort Lewis. See *Table 10* in *Appendix III* for a list of species propagated.

Seed Production
Planted seed plots for 30 species in 24 beds that will supply seed for Collins research plots and restoration propagation in fall 2006. Seed bed dimensions are 4X30 feet. Species planting list is provided in *Appendix III Table 11*. Approximately 15 of the rarest prairie plant species on the Fort will be added to this seed production effort in 2006.

2006 Outlook

In 2006, propagation and planting will focus on planting in the currently established prairie and butterfly enhancement plots, taking simple proactive steps to recover the most rare plants on the Fort's prairies and re-vegetating roads decommissioned by the Fort. Enhancement plantings will shift from a former ration of about 5:1 in favor of *Festuca roemeri* to a more diverse forb rich butterfly host and nectar species mix. Our rare plant recovery project will propagate seeds and plugs of the rarest prairie plants. Plantings on decommissioned roads will emphasize the most durable prairie species.

Enhancement Plantings. We will plant a rich diversity of forb species in the eight currently established enhancement areas. These areas have been planted with over 10,000 *Festuca roemeri* and varying amounts of prairie forbs. The *Festuca roemeri* is the most critical component of the structure in these prairies. Now that it has been established throughout these enhancement areas, we will focus almost exclusively on planting forbs—particularly forbs that are important for butterflies.

Rare Plant Species. The rarest plant species that are confined to prairies and have fewer than 5 populations or fewer than 100 individual plants will be propagated by seed and plugs. Most of these species are not globally rare and none of them are listed under the U.S. Endangered Species Act. Three plant species are listed by the Washington State Natural Heritage Program with some degree heightened conservation value within the state of Washington. *Aster curtis* is listed rare/uncommon and sensitive and is a federal species of concern. *Balsamorhiza deltoidea* is listed as imperiled and *Aster hallii* as threatened by Washington state.

There are 27 prairie plant species on Fort Lewis that are in danger of extirpation on the Fort or are rare throughout the region. Six of these may have already vanished in the past decade and any of fifteen others could vanish in any given year. For all of these species we will install a 12 ft^2 seed bed. For all of the perennial species we will attempt to produce 200 plugs from seed collected at the Fort. The resulting plants and seed will be split between the site of the original population and new sites with similar ecological characteristics and less potential damage from vehicular traffic or other disturbance.

In all our outplanting areas we will manage the invasive pasture grasses that can choke out native plantings and degrade habitat structure for prairie animals. The herbicide Poast along with repeated mowing in some areas can suppress and eventually eradicate most of these pasture grasses from enhancement areas. These control methods each require repeated application—at least two years for Poast herbicide and more than four years for mowing.

Road Decommissioning. The Upper Weir road decommissioning plantings from 2005 will be monitored to determine their status and, if necessary, we will plant additional prairie plants. In addition, we will work with Fort Lewis to revegetate areas adjacent to the planned road improvement on Upper Weir Prairie.

RARE BUTTERFLIES

The Fort Lewis Military Installation is regionally important because it contains the largest remaining prairies in South Puget Sound which provide critical habitat for a number of rare and declining butterfly species. These include: the mardon skipper (*Polites mardon*), Taylor's checkerspot *(Euphydryas editha taylori),* zerene fritillary (*Speyeria zerene bremnerii*), and the Puget blue (*Icaricia icarioides blackmorei*). The first two species, the skipper and checkerspot, are candidates for federal listing under the Endangered Species Act (ESA). Within Fort Lewis, they are currently restricted to a single locale, the Artillery Impact Area (AIA). The other two butterfly species exhibit a more widespread distribution on Fort Lewis prairies.

The 2004 report entitled *Habitat Enhancement for Rare Butterflies on Fort Lewis Prairies* by Cheryl Fimbel provides a good outline for management strategies for rare prairie butterflies. Three prairies in the Fort Lewis landscape are identified as high priority sites on which to enhance the composition, structure and processes of prairie habitat. The selection was limited to three prairies in order to concentrate resources into high quality habitat patches in three locales, rather than scattering resources widely across multiple prairies, with fewer significant improvements. The three high priority prairies, the Artillery Impact Area, the 13th Division Research Natural Area (RNA), and Johnson Prairie, were chosen based on their current and historical use by rare butterflies, availability of native prairie vegetation, the presence of diverse structural features, and compatible land uses.

2005 Summary

Though initially committed for 2005, funding specifically targeted towards butterfly work was pulled during a DOD budget shortfall. A small amount of funding was left over from a previous task order (TNC#3900) and this was used to jumpstart a butterfly inventory project on Lower Weir with the expectation that the additional funds were pending. When the 2005 funds were pulled, the project stopped well before completion.

Funding from the 2005 prairie enhancement task order was used to enhance butterfly habitat (see the Prairie Planting section of this report). It was also used to provide technical support for Taylor's checkerspot translocation planning: WDFW prepared a draft translocation plan and TNC's biologist Dan Grosboll assisted with the technical review. The plan should be finalized in early 2006.

January-March
• Planted 10,643 plants to improve butterfly habitat and prairie plant communities. (Prairies 05).
July-September
• Initiated Butterfly inventory at Lower Weir Prairie, but did not receive anticipated follow-up funding to complete task (Butterfly04)
September-December
• Provided technical support for Taylor's checkerspot translocation planning. (Prairies05)

2006 Outlook

Assuming butterfly actions are funded in 2006, we anticipate the following actions will be accomplished:

Rear Taylor's Checkerspot in Captivity. This part of the project will largely be performed in a subcontract with the Oregon Zoo. The Nature Conservancy will be responsible for providing plants for the caterpillars to eat in captivity, advice on captive rearing techniques, and will jointly oversee the rearing effort at the Zoo. Staff from the Washington Department of Fish and Wildlife will be responsible for permitting and approval of the project. It is estimated that 200-300 larvae will be reared in this effort.

Monitoring and Survey for Prairie Butterflies. Lower Weir Prairie will be monitored between May and September 2006. A mutually agreed on work plan for this monitoring will be developed no later than May 1, 2005. This monitoring and survey effort will include two days every 7-10 days for monitoring on Lower Weir Prairie, availability for opportunistic surveys of the Artillery Impact Area.

A long term plan for the monitoring of prairie butterflies on Fort Lewis will be developed. It will include a review of monitoring and survey efforts in other endangered grassland systems, recommendations for scientifically defensible long term monitoring, and a clear model for feedback of the resulting data into restoration and land management decisions. The plan will be reviewed by Fort Lewis, expert peer and WDFW.

STREAKED HORNED LARK

The Streaked horned lark (STHL) (*Eremophila alpestris strigata*) is a federal candidate species for listing under the Endangered Species Acts. It is a priority for conservation on Fort Lewis which has three of the five known South Puget Sound populations. STHL are a grassland species that requires very wide open expanses and short, low density vegetation. Scotch broom and many sod forming pasture grasses create overly dense and tall habitat structure that is not suitable to the lark.

STHL are primarily found on airfields in the south sound area. Airfields meet their requirements for wide open spaces and sparse vegetation. There is only one population on Fort Lewis that TNC has access to perform enhancement actions: Pacemaker Airfield, an unused landing strip in 13th Division. This provides a core habitat area of some 250 acres surrounded by much larger open prairie. Scotch broom is a primary current threat to this habitat.

2005 Summary

Much of the funded work for STHL during the past year focused on surveys of populations on Fort Lewis and research of specific potentially limiting aspects of the bird's biology. This work was done in cooperative partnership with the WDFW headed by Scott Pearson. His work for the year is summarized in the report titled Range-wide Streaked Horned Lark Assessment and Preliminary Conservation Strategy, which was submitted to all partners at the end of summer quarter. In addition, he and Bob Altman produced the Streaked Horned Lark Assessment and Conservation Plan. This document outlines the critical steps for conserving Streaked Horned Lark populations

The 2005 STHL funding provided additional funding to conduct direct habitat enhancement. This year, enhancement work primarily consisted of mowing scotch broom. See the table below for an overview of work performed and the Prairie Broom section for details. Augmenting the mowing work, Fort Lewis conducted a prescribed burn on over 100 acres in the core lark habitat of 13th Division Prairie.

January-March
• Mowed 72 acres of Scotch broom on Upper Weir Prairie in coordination with call playback experiment. (STHL04) • Mowed 63 acres of Scotch broom in high value lark habitat on 13th Division Prairie. (STHL04)
April-June?
• WDFW monitored lark nests, mapped territories and conducted population surveys at McChord Airfield, 13th Division Prairie and Gray Army Airfield. (STHL05) • WDFW surveyed for lark presence in several locations on Fort Lewis and discovered a population on Range 74. (STHL05)
July-September
• Scott Pearson (WDFW) completed field work and prepared a final report. (STHL05)

October-December

- Initiated mowing at 13th Division Pacemaker landing strip for lark habitat enhancement. Completed about 15 acres of the 200+ acres planned for completion by end of February 2006 (STHL05)
- Scott Pearson submitted the final Streaked Horned Lark Assessment and Recovery Plan (STHL05)

Call Playback Test

Seventy-two acres of Upper Weir Prairie were mowed in spring in order to support a call playback experiment conducted by WDFW biologist Scott Pearson. Though STHL are not known to utilize Upper Weir, it was considered a possibility that call playbacks might entice use. Monitoring of Upper Weir during the playback period did not detect any lark presence.

2006 Outlook

Fort Lewis Fish and Wildlife has requested prescribed fire for close to 400 acres adjacent to Pacemaker landing strip to enhance STHL habitat. It is currently planned that 200 acres will be mowed at the beginning of 2006. Many areas are in need of lethal Scotch broom control and depending on what happens with the fires, several areas around Pacemaker will be targeted for spot herbicide treatment.

STHL Habitat Enhancement Test Plots. TNC staff, in collaboration with Scott Pearson have designed a medium scale habitat enhancement test plot design that will be implemented with spring herbicide treatments that follow a prior broom mowing. It will test the functionality and practicality of enhancing heavily degraded prairie areas with little to no remaining native vegetation with repeated use of herbicide and planted Roemer's fescue. Poast and Garlon will be used to control forbs and sod grasses.

DOUGLAS-FIR CONTROL

Douglas-fir encroachment has long posed a serious threat to prairies. Prior to European and U.S. settlement, prairie fires largely kept Douglas-fir from colonizing prairies and oaks. Since the cessation of widespread fire, the trees have steadily taken over large tracts of former prairie. The threat continues. Prescribed fires, girdling and mechanical removal are effective methods of control.

2005 Summary

During winter Quarter, more than 800 encroaching small (<12 in. DBH) Douglas-fir were removed from Lower and South Weir Prairies.

During fall quarter, TNC worked with Fort Lewis Fish and Wildlife crew to girdle large and cut down small Douglas-fir trees on about 75 acres of the AIA (See map below)

DOUGLAS_FIR CONTROL SUMMARY TABLE

January-March

- Controlled 804 conifers encroaching into Lower and South Weir Prairie.(Prairies04)

October-December

- Worked with Fort Lewis crew to girdle Douglas-fir on approximately 75 acres of the Artillery Impact Area (EnhancePrairies)

2006 Douglas-Fir Outlook

The northeast corner of Johnson Prairie has become significantly encroached upon by Douglas-fir trees. A well established native population of *Viola adunca* are in this area and rare butterflies have regularly been found using the area. It is an important area to maintain as prairie habitat.

TNC will also continue to work in the AIA and CIA as access allows.

Map of area treated for Douglas-fir in AIA.

WET PRAIRIE

Wet and mesic prairies are one of the least understood components of the south Puget prairie system. Prairie sites near water or with significant soil moisture were often the first sites to be settled and cultivated. As a result, there are few current or recorded examples of these ecological communities, and those that do exist are seriously degraded.

It is suspected that wet prairie sites played important roles in the overall system. There are opportunities on the Fort and in the region to enhance or re-establish prairie habitat in moist areas, but there is little information to guide the effort. Most of the work to-date has focused on filling that information gap.

2005 Summary

There were two main tasks related to wet prairies this year. The first was to establish a series of bioassay plots over a range of soil moisture conditions and plant a set of native prairie plants in each. This design will hopefully help determine what species are most suited to wet prairie soils. The second project was to contract out the development of a wet prairie background paper. This task was undertaken by Richard Easterly, Debra Salstrom and Chris Chappell and completed in the fall.

Both tasks were funded under the Riparian Oaks task order. The bioassay plots are reported under Prairie Propagation and Planting section.

WET PRARIE SUMMARY TABLE
January-March • Planted three dry prairie enhancement/bioassay plots with 843 plugs. (RipOaks)
April-June • Planted mesic prairie bioassay plantings in 12 plots along Muck Creek and 6 plots at the North Fort Landfill. (RipOaks)
July-September • Measured soil moisture levels in mesic prairie bioassay plots (RipOaks)
October-December • Background paper on mesic prairie to guide restoration efforts finalized (RipOaks)

Mesic and Landfill Bioassay Plots. This task is reported in detail under the Prairie Propagation and Planting section of this report.

Wet Prairie Background Paper. This project was contracted out to Salstrom and Easterly Eco-logic, Botanical consulting. These consultants have extensive experience with Puget Prairies and have worked successfully with other military installations. Salstrom and Easterly investigated the available scientific and historic literature, visited extant prairie sites, compared and contrasted Puget Trough prairies with Willammette Valley wet prairies and provided guidance for restoration actions. The paper was

coauthored by Chris Chappel from the Washington Natural Heritage Program and extensive outside review from prairie experts, including Fort Lewis personnel, was incorporated. The paper was submitted to Fort Lewis for review at the end of summer. No modifications were suggested and the paper is considered finalized.

Several aspects of wet southern Puget Sound prairies were highlighted in the paper. First, wet prairie is nearly extinct in this region. This is likely because wet/mesic prairie areas were the first areas selected for agriculture. The only known occurrence of wet prairie that is significantly dominated by native species is at the Scatter Creek Wildlife Area. Second, this plant community or habitat type may be crucial for the recovery of several species of concern in the region. Finally, there is little information available about the species composition or the ecological function of this system which points toward the need for more research.

2006 Wet Prairie Outlook

There is no funding dedicated to wet prairie specifically but, as part of our overall prairie enhancement strategy, we will take several actions to restore and enhance wet prairie areas. We will continue to monitor bioassay plantings initiated in 2004 and 2005. These will inform our future wet/mesic prairie restoration actions. In addition, we will initiate weed control on a 10 acre area along Muck Creek to prepare these areas for future plantings. The major weed in this area is quackgrass and it requires 2-4 years of control efforts before native species can be planted.

OAK, PINE AND WESTERN GRAY SQUIRREL ENHANCEMENT;

The Oregon white oak woodlands were a critical component of the prairie/oak mosaic that was historically a dominant part of the south sound region. They provided necessary habitat for species like the western gray squirrel. In addition, a unique population of native western Washington ponderosa pine is found at the fort.

Many of the former south sound oak and pine woodlands and savannas have been lost to land development, timber harvesting, and the lack of wildfire which once restrained other aggressive tree and brush species. As a result, the remaining pockets of oak and pine are often degraded in habitat structure and threatened by severe competition and excessive fire hazard.

The western gray squirrel (WGS) is listed as threatened in the state of Washington, and is a federal species of concern for the western Washington region. Populations are small, scattered and declining, primarily due to the loss and fragmentation of oak woodland associated habitat. The only known extant population of western gray squirrels remaining in western Washington is found on Fort Lewis. This population was identified as a focal conservation target for the South Sound region, and appears to be persisting at very low numbers.

Several actions are underway that will improve prospects for western gray squirrels at the Fort. Habitat enhancement actions include planting additional food resources for squirrels, control of pest plants, and improving habitat structure through control invasive woody species. Population monitoring provides information for targeted habitat enhancement and is a means to evaluate success of treatments. Monitoring also detects eastern gray squirrels (EGS) and is used to plan control measures.

Habitat enhancement actions are currently focused on core WGS habitat which includes portions of the CIA and areas to the east and southeast of the CIA. Current funding levels are sufficient to make slow gains on long-term core habitat improvement, but limit our ability to enhance additional areas. Fortunately, the Fort Lewis Forestry Department has taken an active interest in oak and pine habitat, and has made strides to improve stands of suppressed oaks outside of the WGS core.

This section of the report provides details on each of the management elements related to oaks, pines and WGS. These include:

- WGS monitoring
- EGS control
- Scotch broom and Douglas-fir control
- Enhancement plantings

WESTERN GRAY SQUIRREL MONITORING.

Western gray squirrels on Fort Lewis are relatively difficult to survey because they are wary of people and adept at avoiding detection. A relatively new squirrel survey technique was tested in 2005. This method utilizes baited PVC pipes and adhesive strips as hair-snagging devices, and proved to be successful at detecting the presence of squirrels in wooded stands on Fort Lewis. In conjunction with this, a WGS monitoring program report was developed, a scientific poster was presented and a WGS monitoring database was created and implemented.

The collection of squirrel hairs in tubes is a relatively simple and inexpensive way of identifying the presence of squirrels in an area. As the animals enter the tubes to gain food, some of their hairs remain on sticky tape affixed to the top of the tube at either end. A whole walnut in the shell is wired or glued into the middle of the tube, and serves as bait. The tubes are placed directly on the ground at the base of a tree, and stabilized with small sticks, rocks, or branches. Additional walnuts and /or hazelnuts or acorns are scattered in and around the tube to attract squirrels to the vicinity of the tube.

WGS MONITORING SUMMARY TABLE

January-March

- Prepared the report titled 'Western gray squirrel monitoring and research in South Puget Sound' to provide a summary of the pilot monitoring program, and review options for further research. (WGS04)
- Presented poster, coauthored by personnel from Fort Lewis and The Nature Conservancy, at the NW Scientific Association meeting entitled 'The role of science in western gray squirrel enhancement in oak woodlands of South Puget Sound'. (WGS04)
- Monitored 100+ western gray squirrel hair sampling tubes across the sampling area. (WGS04)
- Developed Access/Arcmap data management system for squirrel and squirrel habitat data. (WGS04)

April-June

- Monitored 90 western gray squirrel hair sampling tubes across the sampling area. (WGS05)
- Installed 11 squirrel monitoring tubes at new locations and constructed 70. (WGS05)
- Identified 76 hair samples collected over the previous 5 months. (WGS05)
- Commenced measurements of gray squirrels and Douglas squirrels' hairs for a confidence rating scheme to increase objectivity for identification of squirrel hairs by a range of people. (WGS05)

July-September

- Monitored 62 tubes. (WGS05)
- Installed an additional 11 monitoring tubes. (WGS05)
- Conducted 13 foot surveys. (WGS05)

October-December

- Monitored 122 tubes which yielded 90 hair samples. (WGS05)
- Intensive WGS monitoring of Lake DeBalon prior to and after timber harvest. (WGS05)

General Monitoring

There are currently a total of 181 hair snag monitoring sites for gray squirrels in downrange areas of the Fort Lewis Military Installation. The majority of these hair tube monitoring sites are concentrated in the priority conservation zone for western gray squirrels (also known as the Squirrel Triangle). This area is bounded by State Route 507 to the east, the western edge is the railroad tracks that run N-S along the eastern edge of the CIA, and the northern boundary is defined by the runway of the McChord Air Force Base (*See Appendix II, Figure 3*). Other tubes have more recently been placed in stands north of the AIA, and in oak stands in the CIA.

Results from hair tube monitoring to date are depicted in *Appendix II Figure 6* which shows the species of gray squirrels detected at each sampling site. Recent results from monitoring reveal that eastern gray squirrels are being detected at existing and new tube locations more often than western gray squirrels (see Table 1 below). It also appears that previous sites where western gray squirrels predominated according to the monitoring data, are changing to 'mixed' sites, yielding hairs of both species concurrently.

Table 1. Summary of changes in species detections for period Jul–Dec, 2005.

Category of Species Change at Tube Sites	**Qty.**
Existing tube sites with no prior detections now yielding eastern gray squirrel hairs	13
Existing tube sites with no prior detections now yielding western gray squirrel hairs	2
Tube site previously yielding western gray squirrel hairs, now yielding eastern hairs	3
New tube site yielding eastern gray squirrel hairs	5
New tube site yielding western gray squirrel hairs	1

DeBalon Oak Release Monitoring

Monitoring of gray squirrel hairs was intensified in the DeBalon oak stand to follow the short-term effects of the oak release timber operation on the resident squirrels. Prior to the cutting, which began in early December, 2005, western gray squirrel hairs were consistently obtained from hair tubes in the interior of the stand. Walking surveys in the fall of 2005, and hair tube monitoring yielded evidence of eastern gray squirrels in stands to the west and north of the DeBalon stand. Hair tubes were checked approximately weekly during and immediately after the cutting operation in the stand. *Appendix II Figure 3* shows locations of DeBalon monitoring tubes. Results are as follow:

Table 2: DeBalon oak release monitoring

2005 Sample Period	**Timber Cutting Phase**	**Species Detected**
23 Nov. – 9 Dec.	Just prior to and during cutting	WGS
9 Dec. – 17 Dec.	During timber felling and piling	WGS & EGS
17 Dec. – 26 Dec.	Post timber felling	EGS
26 Dec. – 3 Jan.	Post timber felling	EGS

Based on this data, it appears that eastern gray squirrels are more prevalent in the stand than they were prior to the timber activity, and the reverse is true for the western gray squirrels. These results represent short-term impacts. The stand will continue to be monitored for long-term impacts.

WGS Monitoring Database

A squirrel tube monitoring database was developed and implemented to enhance both data presentation and use. A GIS database was created to allow the examination and analysis of the tube monitoring results. The database contains all of the pertinent information gained from the monitoring including the site description, date, species identified, and vegetation data. With this database, enhancement efforts and EGS trapping efforts can be directed more effectively. Database updating will inform management efforts by providing information on seasonal movements, relative abundance, EGS range, as well as responses to enhancement efforts for both the eastern and western gray squirrel.

WGS Science Poster

A poster was developed for presentation at the 78th annual Northwest Scientific Association meeting, held the 23rd-26th of March at Oregon State University in Corvallis, Oregon. The tube monitoring results, as well as implications for western gray squirrel management were presented. The poster was developed collaboratively with Fort Lewis staff. An abstract of the poster is provided below.

THE ROLE OF SCIENCE IN WESTERN GRAY SQUIRREL ENHANCEMENT IN OAK WOODLANDS OF SOUTH PUGET SOUND

Sanders Freed, The Nature Conservancy of Washington, Olympia, WA
Cheryl Fimbel, The Nature Conservancy of Washington, Olympia, WA.
Todd Zuchowski, Fort Lewis Public Works Environmental and Natural Resources Division, Fort Lewis, WA

Western gray squirrels are extremely rare, wary, and sensitive to disturbance in the Puget Sound lowlands of western Washington. A pilot project was implemented to test a non-invasive survey technique to determine the current distribution of western and eastern gray squirrels in historic western gray squirrel habitat on the Fort Lewis Military Base for the purpose of guiding and evaluating management actions in Oregon white oak – conifer woodlands. We baited and distributed 123 hair snagging tubes in historic western gray squirrel habitat and monitored them at two – six week intervals for the presence of hairs. Dorsal guard hairs were identified to squirrel species based on their color banding patterns under 30X magnification. A total of 77 tubes yielded 146 hair samples: 45 samples contained western gray squirrel hairs, and 79 contained eastern gray squirrel hairs. Oak – conifer woodlands yielding hairs of western gray squirrels are targeted for foot surveys to provide data on trends in relative abundance of squirrels. A data base that integrates distribution and relative abundance data through time is being developed to produce maps to guide and evaluate management actions. Hair snagging tubes, combined with foot surveys, show promise as a non-invasive approach to providing information on the distribution and relative abundance of a rare and secretive squirrel population to guide and evaluate management actions designed to enhance its population.

2006 Squirrel Monitoring Outlook

The EGS control program requires a substantially increased monitoring effort (see EGS Control section in this report). Monitoring will be increased throughout the trapping area at the Squirrel Triangle. About 100 additional hair snag tubes will be built and installed. Tubes in the trapping area will be monitored intensively at first and gradually taper off. This effort should begin in earnest in February and continue through the year. Additional help will be hired.

Relationships between vegetation classification types and squirrel presence will also be evaluated in the coming year to look for patterns of use by WGS and EGS. Vegetation typing systems will be evaluated for applicability to the monitoring program.

EASTERN GRAY SQUIRREL CONTROL

Introduced EGS have been widely associated with declining native squirrel populations. Though it was initially thought that the EGS would have difficulty establishing in the non-urban woodlands used by the WGS, recent tube monitoring results have shown a steady and alarming expansion and frequency of EGS in the remaining WGS core habitat area.

Though initially conceived of as a small scale test project, it became apparent that the EGS population was at the beginning of a rapid colonization cycle. Once established, EGS have been near impossible to control in other parts of the world. Therefore, it was decided that a much broader control program was needed immediately and the program was expanded to include the entire WGS core habitat area.

2005 Summary

EGS CONTROL SUMMARY TABLE

January-March

- Researched feasibility and case studies relating to EGS control at Fort Lewis. (WGS05)
- Prepared draft of EGS control plan and submitted for review to WDFW. (WGS05)

July-September

- Incorporated review comments into second draft of EGS control plan and received approval from WDFW (WGS05)
- Prepared collection permit for EGS and received approval from WDFW. (WGS05)

The EGS Control Plan was drafted by TNC and submitted for review to Fort Lewis and WDFW. After lengthy discussion, comments were incorporated into the final draft. The control plan was submitted by Fort Lewis to WDFW with the collection permit application. The application was approved at the end of summer. Trapping will be conducted early winter 2006.

The trapping protocol is described in the EGS Control Plan, which calls for a series of two-week baiting periods, during which the live traps are wired open. This will build familiarity with the trap and the food source. After each bait period, traps will be activated and checked daily and re-baited for eight days. At the end of the first three-week session the traps will be moved to the next location and the process will repeat for a period of three months.

Any captured WGS will be ear-tagged and released. EGS will be euthanized in a manner that is professionally recognized as the most humane. Stomachs and uteruses will be collected from EGS and given to WDFW for evaluation.

Specific details are available in the Fort Lewis Eastern Gray Squirrel Experiment Plan.

DOUGLAS-FIR AND SCOTCH BROOM CONTROL

Douglas-fir and Scotch broom are the primary plant species currently threatening oak, pine and WGS habitats. These woody species are able to quickly dominate the understory of oak and pine woodlands and savannas, completely altering the historically more open structure. This creates undesirable qualities for the WGS and greatly increases fire fuel loads. In addition, Douglas fir is able to grow up through pine and oak canopies and eventually dominate. The same broom and fir control strategies used on the prairies can be applied to the wooded habitats.

2005 Summary

Treated over 350 acres of pine and oak habitat. Broom and other brush was mowed, Douglas-fir were cut or girdled and dense patches of pine were thinned. See *Figure 5* in *Appendix II* for a map of enhancement activities.

BROOM AND DF CONTROL SUMMARY TABLE

January-March

- Controlled Scotch broom in 47 acres of oak edge of Upper Weir Prairie. (OakHabitat04)
- One day of oak release in center of CIA. (WGS05)

April-June

- Mowed Scotch broom in 51 acres at Mumford Hill Oaks in TA13. (OakHabitat04)
- Mowed Scotch broom in 23 acres of TA 11. (WGS05)
- Pulled Scotch Broom in the Prairie Oak Preserve (POP). (WGS05)
- Mowed approximately 30 acres in the center of the Central Impact Area (WGS05)
- Completed approximately 24 acres of Central Impact Area Douglas-fir and Scotch broom control in Ponderosa pine savanna next to Range 18. (FirRemoval04)
- Completed habitat enhancement and Scotch broom control method comparison between skid loader/drum mower (28 acres) and tractor/brush hog (11 acres) in TA 10 pine savanna. (FirRemoval04)

October-December

- Initiated mowing in TA 10 area for oak and squirrel habitat enhancement; completed 38 acres. (WhiteOak)
- 110 acres of Pine enhancement in CIA near Range 18. (Pine&Oaks)
- POP Scotch broom pulling and brush cutting. (WhiteOak)

Central Impact Area Enhancement

Center of CIA. During the three days of access (one day in winter and two days in spring), approximately 30 acres were mowed under oak and pine along the entire northern and western edge of the CIA prairie with two tractors. Oak and pine release was accomplished by girdling and felling Douglas-fir with chain saws. In addition, the Washington Conservation Corp crew brush cut edge areas which were difficult to mow

Range 18. Approximately 24 acres of Ponderosa pine savannah in the CIA was treated during spring and summer 2005 next to Range 18. An additional 110 acres were treated during Christmas week. Encroaching and competing Douglas-fir trees were removed or girdled around existing Ponderosa pines and oaks. All Douglas-fir within a 5 meter radius of Ponderosa pine was targeted for treatment. More aggressive girdling and felling occurred during this year's project, producing more immediate results in the form of increased light penetration. Felled Douglas-fir were limbed up to speed decomposition. Scotch broom was brush cut throughout the work area, although the majority occurred along the perimeter road and within the field of fire of Range 18.

TA 10

This area of Ponderosa pine in TA 10 (*Appendix II Figure 5*) recently had a Douglas-fir removal and subsequent explosion of scotch boom resulted. Due to the difficulty of mowing Scotch broom in a thinned stand of Ponderosa pine, a contractor was hired to mow the area with a specialized tracked vehicle with front mounted drum mower. The mowing contractor was Forest Restoration Services out of Portland, OR. The skid mower was contracted for a one week period. Mowing proved to be very difficult with numerous stumps and fox holes. In fact, breakdowns caused early contract termination.

With the remaining funds available, The Nature Conservancy Prairie Restoration Crew was left to mow as much as possible. Mowing was difficult and slow due to rough terrain and numerous Ponderosa pine seedlings to avoid. The density of small pines often necessitated brush cutters to remove Scotch broom. Total acreage treated by the TNC and WCC crew was 11.3 acres. Approximately 38 acres of the total 53 acre area was completed. The remaining area will be treated in 2006 with forestry pine and oak enhancement funding.

POP

The Prairie Oak Preserve (POP) is a small oak woodland on the northern edge of Fort Lewis which serves as an outreach opportunity and educational prairie/ oak woodland. Numerous native species have been planted in recent years including Idaho fescue, prairie violet, Oregon sunshine and goldenrod. Each year TNC and Fort Lewis sponsor a planting day with the school adjacent to the POP. The proximity to the school prevents the application of herbicides on site, and concerns about the large number of forbs already planted on site reduces the acceptability of tractor mowing, thus, Scotch broom control requires manual removal. Given the large number of seedling Scotch broom invading the site, hand pulling and occasional weed wrenching adequately accomplishes removal efforts. Using the WCC for 3 days, approximately 1/4 acre was hand pulled in spring and an additional ½ acre was pulled and brush cut in fall.

Other Enhancement

TA 11. Training Area 11 was recently identified as a priority site for oak woodland restoration. The oak woodlands in this training area are quite extensive and recent (post 1995) western gray squirrel sightings have been recorded. Current tube monitoring has yet to reveal any use by western gray squirrels, although this area has

several habitat characteristics identified as essential to western gray squirrel occupation. These include numerous large old oak trees with interlocking canopies, multiple large old Ponderosa pines, and proximity to water.

Twenty-six acres were treated to remove invasive Scotch broom and Douglas-fir by tractor mowing and brush cutting. These actions produce more attractive WGS habitat and reduce fuel loading. In all, 22.6 acres were treated.

TA 13 Mumford Hill. Mumford Hill is an additional oak woodland targeted as a priority habitat with potential for western gray squirrel occupation. Mumford Hill is located on the far southern edge of TA 13, adjacent to SR 507 and the town of Roy. The oak woodland is composed of numerous large oaks and several large Ponderosa pines interspersed with open prairie. This site is currently being monitored by hair snagging tubes, although no western gray squirrels have been detected. The Mumford Hill oak woodland has recently been expanded by a Douglas-fir thinning and oak release. Given the relatively recent logging, limited mowing occurred due to slash and stump concerns. Brush cutting occurred where accessible. Approximately 51 acres were mowed and brush cut.

2006 Outlook

Figure 5 of *Appendix II* shows the areas targeted for broom mowing in 2006, prioritized by polygon. These areas have been prioritized based on whether they have been treated before, likelihood of producing significant seed in 2006 and active or potential use by WGS. It is likely that all of the high priority polygons and most of the medium priority polygons will be treatable in 2006 with current funding.

We plan to work with Fort Lewis to test the use of broadleaf herbicide on broom around oaks. Test areas should be relatively small and provide a variety of conditions: different sizes and densities of oaks and broom.

In addition, it is hopeful that Fort Lewis will conduct some burning under oaks in 2006. This would greatly assist with broom and fir control.

ENHANCEMENT PLANTINGS.

Two types of plantings are currently being used to enhance oak habitat. General enhancement plantings are designed to expand or create areas of quality oak habitat and tend to be larger and sprawling.

Food island plantings are designed to provide additional foraging opportunities to the western gray squirrel within the corridor between the two known population strongholds on Fort Lewis: Lake DeBalon and Shaver Lake. Plants are established in consolidated blocks, and consist of the following species: Oregon white oak, serviceberry, Indian plum and hazelnut (see layout design in *Appendix III Table 12*). Food islands will increase connectivity between the two populations, encouraging genetic and individual exchange, while reducing the risks for the two potentially isolated small populations.

2005 Summary

Approximately 560 potted shrubs and trees were planted in 20 WGS food islands throughout the "Squirrel Triangle". An additional 300 were planted in general enhancement plantings at Shaver Lake and Lake DeBalon. See *Appendix II Figure 5* for map of planting areas.

OAK PLANTING SUMMARY TABLE
January-March
• Planted twenty "food islands" that each contained 28 plants important to western gray squirrel habitat resources. (WGS04)
April-June
• Continued plantings at Shaver Lake and Lake DeBalon, consisting of 300 plants. (WGS04)
October-December
• Brush cut around all enhancement plantings. (WhiteOaks)

Plantings

Food Island Plantings. TNC planted 20 food islands consisting of Oregon white oak, serviceberry, Indian plum and hazelnut. These will provide future foraging opportunities to WGS in both core habitat and corridor areas between core populations. (See *Appendix II Figure 5* for a planting map)

General Enhancement Plantings. Lake DeBalon, which was first planted in fall 2004, received an additional spring planting, bringing the total to 330 food producing plants including Oregon white oak (*Quercus garryana*), Oregon ash (*Fraxinus latifolia*), big leaf maple (*Acer macrophyllum*), California hazelnut (*Corylus cornuta*), Indian plum (*Oemleria cerasiformis*), and serviceberry (*Amelanchier alnifolia*). Shaver Lake, which is just north of Chambers Lake, is the other population center of western gray squirrels on Fort Lewis. Two-hundred-twenty plants of similar composition to those at Lake DeBalon were planted. (See *Appendix II Figure 5* for a planting map)

Planting Maintenance

WCC crew members visited all previous planting sites in early fall and cut back competing undesirable brushy species. It is important to maintain plantings for the first few years until plants are well established and ahead of the competition.

2006 Outlook

An additional 20 food islands are planned for spring of 2006 and an additional 1440 plants will be established in general enhancement planting areas. These plantings will expand and bolster current planting locations.

The food island planting design currently identifies Ponderosa pine as an important component. However, the pine are not great seed producers and good crop years are infrequent. If 2006 should turn out to be a good crop year, every effort should be made to secure an abundant supply of seed for future propagation and enhancement plantings.

NOXIOUS WEEDS

One of the most significant threats to the natural environment on the Fort today comes from invasion by exotic pest plants. These pest plants degrade training areas, displace native plant and animal communities, and modify existing habitats across the base. Once established, many of these species can be next to impossible to eradicate using practical control measures.

Numerous pest plants occur on Fort Lewis. Species such as Scotch broom have negatively impacted many training areas across the base. Species such as the knapweeds and sulfur cinquefoil are currently found in much more limited distributions across the base, and some have the potential to seriously degrade habitat and training land function.

This section focuses on noxious weed species other than Scotch broom and pasture grasses associated with enhancement plantings; these are addressed in detail in the Prairie and Oaks sections.

General Management Strategies

All known locations of noxious weed species in priority habitat areas and likely vector locations have been recorded in GIS format. Each year, all infestations are scheduled for inspection and control as needed. Any new discoveries of pest plants will similarly be documented and scheduled for treatment. In addition, at approximately three-year intervals, weed surveys will be conducted throughout priority habitat areas and likely vector locations.

Furthermore, TNC surveys over 20 miles of road for tansy ragwort and responds to additional occurrences identified by county weed boards.

2005 Summary

From late spring through summer, 594 known noxious weed infestation sites of 11 different species were treated by TNC and WCC crew members (access to Range 93 was not granted and one site did not get visited). An additional 166 sites were discovered through surveys of disturbed areas and quality prairie in over 13,000 acres. All new locations were GPS'd and information on infestation and treatments are currently being recorded for incorporation into GIS. See *Table 3* below for summary information on the 2005 control effort.

April-June

- Initiated control treatments for incipient habitat modifying pest plants. (NW05)
- Initiated surveys for pest plants. (NW05)

July-September

- Visited and controlled all known infestations of noxious weeds. (NW05)
- Surveyed for additional sites on over 13,000 acres and discovered 166 new infestation sites. (NW05)
- Tansy Ragwort. Surveyed and controlled tansy on over 23 miles of priority road edge and responded to more that 16 control requests from county weed officials. (NW05)
- Treated approximately 20 acres of sulfur cinquefoil on and around Muck Creek decommissioning. (Roads04)

October-December

- Submitted 2005 noxious weed data to Fort Lewis Fish and Wildlife.

General Noxious Weed Control

A list of the species and numbers of previously known and newly discovered sites is provided below. Each site is also represented in the GIS data submitted to Fort Lewis in fall 2005.

Table 3: Noxious weed infestation sites controlled and discovered at Fort Lewis.

	Infestation sites known prior to 2005			Sites discovered in 2005		
Species	**# Sites**	**# Sites Treated**	**Comments**	**# Sites Discovered**	**# Sites Treated**	**Comments**
Tall oatgrass	8	8	Cut seed heads on Johnson Prairie; missed window of opportunity for spray.	2	0	Discovered too late in season to treat.
Knapweed, diffuse	152	152		64	64	
Knapweed, meadow	5	5		0	-	
Knapweed, spotted	45	45		24	24	
Knapweed spp.	108	108		10	10	
Poinson hemlock	1	1	Treated by Pest Shop	0	-	
Blueweed	3	3		5	-	
Leafy Spurge	3	2	No access to Range 93	0	-	
Mouse-eared hawkweed	239	239	Most sites in adjacent ~30 acre area.	0	-	
Sulfur cinquefoil	30	30		61	32	
Dalmation toadflax	1	1		0	-	
Tansey	23.3 miles of priority road searched and responded to over 16 sites identified by Pierce and Thurston Counties					
TOTALS	**595**	**594**		**166**	**130**	

Tansy Ragwort

All together, TNC crew members surveyed and controlled tansy on over 23 miles of priority road edge at Fort Lewis and responded to more than 16 control requests from county weed officials.

Muck Creek Road Decommission

TNC treated approximately 20 acres of sulfur cinquefoil on and around Muck Creek road decommissioning.

2006 Outlook

The 2006 noxious weed control effort will follow roughly the same approach as in past years: known infestation sites will be visited and treated as appropriate and data will be recorded in GIS compatible format. Current plans are to hire a weed specialist to manage the planning and data management.

We also plan to implement use of the Weed Management Inventory System (WIMS) for 2006. This is a system that combines field GIS/GPS data logging systems that are cross-linked with a master weed database. Crews will be able to navigate to known infestation sites, record actions taken and log new infestations in the field and upload to the main database. All data will be convertible to ArcGIS formatting.

As an expansion to the past scope of work, TNC will take on management of aquatic weeds related to habitat enhancement for salmon, bald eagles and the federally listed plant water howellia. The scope of this work will be developed in the first quarter of 2006.

RARE PRAIRIE SPECIES RECOVERY

Several species that are dependent on prairie and woodland habitat have become extremely rare and are currently under review by the United States Fish and Wildlife Service for designation as threatened or endangered. The Nature Conservancy is assisting Fort Lewis in developing proactive techniques to recover several of these species in order to support the goals of the Fort's sustainability initiative. Work has been initiated to enhance habitats and determine limiting factors for western gray squirrel, streaked horned lark, Mazama pocket gophers and several prairie-dependent butterflies. These steps should help current populations to expand and create conditions where new populations can become established. The information and techniques developed for Fort Lewis will also assist conservationists throughout the region, thus enabling successful regional recovery actions. It is hoped that these proactive steps will lead to species recovery before they are listed under the Endangered Species Act.

Although TNC is involved in many rare species recovery activities, much of what occurs is at the regional level is beyond the scope of this report. This report only addresses rare species activities that are directly related to on-the-ground conservation actions that took place in 2005 at Fort Lewis.

Rare species conservation actions often cannot be viewed as only benefiting a single species. Many of the actions taken for one species work to the good of all prairie/oak dependent species and the system itself. (For example, Scotch broom infestations are a threat for all rare species that rely on the prairie/oak mosaic.) Because of this interconnection, rare species are addressed in detail under the habitat sections with which their conservation actions are associated.

TNC has managed a cooperative position with the WDFW using funds from Fort Lewis to conduct rare species recovery in the region. These funds support one-half of a WDFW wildlife biologist position that has been held by Mary Linders. Numerous actions were undertaken over the past year which are outlined in Mary's annual report (see *Appendix IV*).

Rare Butterflies

See Prairie Butterflies section of this report and Mary Linder's report in *Appendix Iv* for information on rare butterflies.

Streaked Horned Lark

See streaked horned lark section of the Prairie section for information.

Western Gray Squirrel

See Oaks section of this report for information on western gray squirrel.

Mazama Pocket Gopher

Pocket gopher recovery actions for years have been tied directly to general prairie enhancement. Though there is currently not a great deal of guidance for their recovery, it has generally been understood that the gophers are a fairly adaptable species, and will opportunistically feed on non-native plant species. Their biggest threat is the invasion of grasslands by woody species. Therefore, prairie broom and fir control actions have been tied to gopher recovery.

2006 will be the first year that specific funding has been secured for pocket gopher recovery actions on Fort Lewis. It is likely that most of the funds will go to habitat enhancement. Monitoring protocols are currently being developed by WDFW and it is possible that future funding may be dedicated to population assessments. See Mary Linders report in *Appendix IV* for more information.

ROAD DECOMMISSIONING

Decommissioning roads that are not needed for military training or other Fort Lewis priorities is a good way to improve habitat for wildlife. It also has the potential to reduce maintenance costs, reduce unauthorized access, and to improve excessively roaded areas for military training. Roads are selected for decommissioning by Fort Lewis Fish and Wildlife staff in coordination with Range Control and military trainers.

2005 Summary

Four road sections totaling approximately 2 miles were decommissioned in 2005. They were selected because of their potential benefits to wildlife and for their redundancy. None of the decommissioned roads were needed for Fort Lewis activities.

The first road section bordered Fiander Lake, a wetland vitally important for western toad breeding. The second was section along Muck Creek near the eastern edge of the Artillery Impact Area. This section ran through the middle of a patch of sulfur cinquefoil (*Potentilla recta*) which is a Washington State listed Noxious Weed with seeds readily dispersed by vehicles. In addition this road passed through a wetland and was impassible in wet seasons.

The final two road sections were on Upper Weir Prairie. The Upper Weir Prairie roads passed through high quality prairie areas thus adding to their fragmentation. The decommissioned roads will add additional prairie habitat. Each of these roads presented a different challenge for successful decommissioning.

ROAD DECOMMISSIONING SUMMARY TABLE

January-March

- Barricaded road entrances at 8 locations. (Roads04)
- Planted 561 shrubs and trees in decommissioned roads at Fiander Lake and Muck Creek. (Roads04)
- Planted 20443 prairie plants into roads decommissioned on Upper Weir Prairie. (Roads04)

July-September

- Installed mulch around winter plantings (Roads04)
- Watered Muck Creek decommission plantings (Roads05)

October-December

- Additional blockades and signage at Fiander Lake and Muck Creek closures. (Roads05)
- Planted 6,000 plugs of Roemer's fescue and direct seeded 27 species of prairie plants on Upper Weir road closure. (Roads05)
- Initiated plant propagation tasks under this Task Order: purchased pots for growing prairie plants and built raised beds for prairie plants. (Roads05)

Fiander Lake Road

During winter quarter, the two ends of the road that follows the southern edge of Fiander Lake were barricaded with logs and stumps salvaged in nearby areas. In addition, large logs and forest debris from nearby areas were placed in the road in numerous locations throughout its length. The road was also planted with native tree and shrub species. A total of 70 plants were placed in the first 25m of each end on the road and an additional 223 plants were scattered throughout the road. Plants were put in conditions appropriate for each species (i.e. willow in wet areas, tall Oregon grape in drier sunnier areas). The species planted are listed in *Table 4*. Mulch was spread to a depth of approximately two inches around the plantings.

Table 4: Road decommissioning plantings.

Species	Fiander Lake Road	Muck Creek Road	Weir Prairie Roads
Oregon white oak		4	
Bitter cherry	30	10	
Big leaf maple	10		
Douglas fir	20	10	
Grand fir	15	10	
Sitka spruce	4		
Oregon Ash	10	10	
Western red cedar	20		
Red osier dogwood		50	
Indian plum	10	10	
Mock orange	15	10	
Ninebark	10		
Baldhip rose	20		
Nootka rose	20	10	
Pacific willow	125	50	
Red elderberry	15	5	
Blue elderberry	3	2	
Salmonberry	10		
Vine maple	10		
Pacific dogwood	3		
Spirea	8	2	
Tall Oregon grape	5	15	20
Kinnikinick			76
Early goldenrod			82
Wild strawberry			38
Cutleaf microseris			130
Oregon sunshine			97
Roemer's fescue			20,000
Total	**363**	**198**	**20,443**

During summer, the road barriers were compromised. Barricades and obstacles were fortified during the fall with larger trees and anchored cables. In addition, Fort Lewis Fish and Wildlife planted more woody species and spread mulch around heavily impacted road areas.

Muck Creek Road

The Muck Creek road decommissioning has sulfur cinquefoil present in many areas along the road. This weed can only be controlled with herbicides. Because of this complication, the plantings on this road were significantly less dense than in other roads. Areas with significant sulfur cinquefoil were not planted because they will be treated to control the weed and treatments could damage plantings.

The two ends of the Muck Creek road were barricaded with logs and stumps salvaged in nearby areas. In mid-April, Fort Lewis Fish and Wildlife coordinated delivery of additional large stumps to the road ends.

A total of 40 plants were placed in the first 25m of each end on the road and an additional 118 plants were scattered in wet areas without sulfur cinquefoil on the road

(see *Table 4*). Mulch was spread to a depth of approximately two inches around the plantings at the road ends. These plantings were watered during the summer dry season.

Upper Weir Prairie Roads

The two road stretches decommissioned on Upper Weir Prairie are described in the Prairie Propagation and Planting section of this report.

2006 Outlook

No additional roads funding was secured for 2006. Future decommissioning work will be done and reported under prairie enhancement.

Furthermore, work that was planned for completion under the Roads 2005 task order will not occur. Originally, a main north-south road on Upper Weir was going to be improved by building up the road prism to help confine traffic to a narrower tread. This work is now scheduled for completion by DOD personnel. After the Roads 2005 task order has expired in February 2006, the shoulders of this stretch of road will be planted with native prairie plants.

The Upper Weir projects will be monitored for successful establishment of native species. Additional maintenance will be conducted as required. The sulfur cinquefoil will be controlled and monitored under the noxious weeds program.

RIPARIAN ENHANCEMENT.

Riparian zones are an important piece of any ecosystem and prairies and oak woodlands are no exception. Aside from the conservation values associated directly with the streams and aquatic species they contain, riparian corridors are often a focal point for diversity in surrounding uplands. For example, western gray squirrels are closely associated with water sources, and soils near streams often provide a gradient of moisture conditions that support greater diversities of plant and animal species.

Muck Creek is considered the most significant tributary for anadromous salmonids in the Lower Nisqually River. The creek is particularly important habitat for chum salmon, winter steelhead and sea-run cutthroat trout. Coho salmon have also been documented in the creek.

The broader Muck Creek riparian corridor has also become a focus for upland restoration. It contains areas of quality native prairie and serves as a significant wildlife corridor for the northeastern portion of the base. However, the corridor faces serious challenges from habitat modifying invasive weeds in both upland and riparian conditions. Examples include Scotch broom, diffuse knapweed, reed canarygrass, Himalayan blackberry and others.

Most habitat aspects of Muck Creek are in good condition but the extensive invasion of stream channel choking reed canarygrass has been identified as a significant threat to salmonid habitat. In addition, Himalayan blackberry may have long term negative impacts on habitat because it prevents the establishment of native trees and shrubs that could provide more shade and eventually large woody debris input.

Because of its unique habitat conditions, the Muck Creek corridor has been given a targeted restoration emphasis.

2005 Summary

Two task orders were active that focused on riparian activity. The Riparian Oaks task order focused on restoring and enhancing habitat along the Muck Creek corridor. The In-stream task order was intended to accomplish channel and riparian enhancements. Each task order is discussed below.

RIPARIAN ENHANCEMENT SUMMARY
January-March

- Planted 1606 trees and shrubs along Muck Creek to improve oak woodland and riparian habitat. (RipOaks)
- Completed initial site preparation at Halverson Springs including Scotch broom and Himalayan blackberry control. (Instream)
- Obtained trees and shrubs for habitat plantings in project area. (Instream)

April-June
- Excavator contracted for late August Halverson Springs restoration. (Instream)
- Completed Halverson Springs restoration planting. (Instream)
- Mowed 121 acres of Scotch broom in the Muck Creek corridor. (RipOaks)
- Planted mesic prairie bioassay plantings in 12 plots along Muck Creek. (RipOaks)

July-September
- Obtained materials for future Halverson Springs restoration work (Instream)
- Obtained 2300 potted plants for future riparian enhancement plantings. (Instream)
- Removed fish passage barrier culvert near Muck Creek/Nisqually River area. (Instream)
- Mowed seed production/enhancement plots at 13th Division Cultural Area (Instream).

Riparian Oaks

This task order focused on restoring and enhancing habitat along the Muck Creek corridor; an area managed as riparian/wetland buffer and a Special Use Area. It contains significant potential habitat for rare species and it has the potential to serve as a connecting corridor between patches of high quality habitat on 13th Division Prairie and eventually may serve as part of a corridor connecting other prairie areas.

This corridor currently has four major vegetation types—woody riparian, wet/mesic prairie, and xeric upland prairie and some scattered copses of oak and more extensive oak woodlands. Our actions enhanced each of these target areas.


Figure 1: Woody riparian planting north of Muck Creek Triangle.

Woody Riparian Plantings

Two woody riparian plantings were completed along Muck Creek—one near the eastern end of 13th Division Prairie (Figure 1) and the other near the western end in a cultural site (Figure 2). A wide array of native woody riparian plants was planted in these areas (Table 5). Woody riparian enhancement plantings will encourage wildlife usage along the Muck Creek corridor by providing both cover and foraging opportunities. Also, stream conditions will be improved directly through shading and stream bank stabilization, and indirectly by native species providing competition for the pervasive reed canarygrass that has been identified as a severe problem in the creek.


Figure 2: Woody riparian planting in Cultural Area on Muck Creek.

Wet/Mesic Species Bioassay Plantings. Bioassay plantings are discussed under the Prairie Planting section of this report.

13th Division Scotch Broom Mowing. This task is reported in detail in the Prairie Scotch broom section of this report.

Table 5: Riparian plantings along Muck Creek (1606 total planted).

Species	Number
Western red cedar	20
Oregon white oak	55
Bitter cherry	120
Big Leaf Maple	75
Oregon Ash	50
Red Osier Dogwood	75
Indian plum	110
Mock orange	100
Nine bark	50
Nootka rose	120
Pacific willow	400
Salmon berry	150
Tall Oregon grape	95
Pacific dogwood	2
Spirea	90
Blue elderberry	59
Serviceberry	35

In-Stream

In the original scope of work for this task order, two major in-stream restoration projects were planned – one at Halverson Springs and the other at Preacher Creek. Though planning, administration and some enhancement work were completed, neither of the projects were ultimately finished.

TNC staff prepared a Joint Aquatic Resource Permit for Fort Lewis to submit for the Halverson Springs project. The project was almost implemented, but fell through when Fort Lewis was unable to get the aquatic permit approved before termination of the in-stream task order. Once approved, the JARPA is valid for three years and will be useful for future in-stream task orders.

The Preacher Creek project was postponed due to of concerns about unexploded ordinance. The area is currently on the list to be cleared of ordinance by the military, but resources to complete the task are in scarce supply and there is no expected date for the work to occur.

Since it was not possible to accomplish most of the original scope of work, additional tasks were developed that were consistent with the task order. Below is a summary of the work completed under this task order:

- **Halverson Springs** –JARPA was prepared and submitted to Fort Lewis. 175 woody species were planted in area adjacent to the spring and five acres of Scotch broom were mowed.
- **Muck Creek** – Subcontracted removal of an old "shotgun culvert" crossing on Muck Creek near the mouth confluence of the Nisqually River. No JARPA was required and project was completed quickly without any difficulties.
- **Potted Plants** – Purchased and put into nursery storage 2300 potted plants for future riparian restoration work.
- **13th Division Triangle Area** – Enhanced 24 acres of quality prairie along the Muck Creek riparian corridor using chemical weed control. This task is described in the Prairie Broom Control section of this report.

- **13th Division Cultural Site** - Mowed along Muck Creek for a riparian enhancement/seed production project that will be conducted by Fort Lewis Fish and Wildlife.

2006 Outlook

Funding for additional riparian and in-stream work is likely to be provided to conduct bald eagle habitat enhancement. Specifics of this potential 2006 task order have not been planned.

APPENDIX I – TASK ORDER OVERVIEW

Table 6: Summary of all tasks completed in 2005 arranged by Fort Lewis task order (with TNC grant numbers).

Prairies 04 (3910)

- Mowed 100 acres of Scotch broom on Upper Weir Prairie.
- Controlled 804 conifers encroaching into Lower and South Weir Prairie.

Prairies 2005 (4807)

- Mowed Scotch broom on 140 acres of Lower Weir Prairie.
- Mowed 88 acres of Scotch broom on Upper Weir Prairie.
- Mowed about 10 acres of Scotch broom on Johnson Prairie.
- Spot sprayed 58 acres of Scotch broom that survived a prescribed fire on Johnson Prairie
- Spot treated Scotch broom on 61 acres of Johnson Prairie ;
- Wick on herbicide broom treatment on 7 acres of Johnson Prairie
- Controlled invasive grasses in previously planted enhancement areas.
- Seed collection. Collected seed from 30 species of prairie plants.
- Propagated over 29,000 prairie plant species for fall 05 and spring 06 enhancement plantings (Prairies 05 and Roads 05)
- Monitored prairie enhancement plantings to determine plant survival with different pretreatments.
- Planted 10,643 plants to improve butterfly habitat and prairie plant communities.
- Planted 14,242 plants to improve butterfly habitat and prairie plant communities.
- Planted 20,477 prairie plants on Weir, Johnson, and 13th Division Prairies.
- Planted seed plots for 30 species in 24 beds that will supply seed for Collins research plots and general restoration in fall 2006.
- Provided technical support for Taylor's checkerspot translocation planning.

Enhance Prairies (3861)

- Worked with Fort Lewis crew to girdle Douglas-fir on approximately 75 acres of the Artillery Impact Area.

STHL 2004 (3909)

- Mowed 72 acres of Scotch broom on Upper Weir Prairie in coordination with call playback experiment.
- Mowed 63 acres of Scotch broom in high value lark habitat on 13th Division Prairie.

STHL 2005 (3849)

- Initiated mowing at Pacemaker landing strip for Streaked horned lark habitat enhancement. Completed about 15 acres of the 200+ acres planned.
- WDFW monitored lark nests, mapped territories and conducted population surveys at McChord Airfield, 13th Division Prairie and Gray Army Airfield.
- Scot Pearson (WDFW) completed field work and prepared a final report.

Butterfly 2004 (3900)

- Initiated Butterfly inventory at Lower Weir Prairie, but did not receive anticipated follow-up funding to complete task

Fir Removal 04 (3844)

- Completed approximately 24 acres of CIA Douglas-fir and Scotch broom control in Ponderosa pine savanna next to Range 18.
- Completed habitat enhancement and Scotch broom control method comparison between skid loader/drum mower (28 acres) and tractor/brush hog (11 acres) in TA 10 pine savanna.

Noxious Weeds 2004 (3832)

- Mowed 115 acres of Lower Weir Prairie.

Noxious Weeds 2005 (4806)

- Spot treated Scotch broom on 49 acres of 13th Division Muck Creek Triangle.
- Spot treated Scotch broom on 64 acres of South Weir Prairies.
- Visited and controlled all known infestations of noxious weeds.
- Surveyed for additional sites on over 13,000 acres and discovered 166 new infestation sites.
- Surveyed and controlled tansy on over 23 miles of priority road edge and responded to more that 16 control requests from county weed officials.
- Submitted 2005 noxious weed data to Fort Lewis Fish and Wildlife in fall.

Roads 2004 (4802)

- Treated approximately 20 acres of sulfur cinquefoil on and around Muck Creek decommissioning.
- Barricaded road entrances at 8 locations.
- Planted 561 shrubs and trees in decommissioned roads at Fiander Lake and Muck Creek.
- Planted 20443 prairie plants into roads decommissioned on Upper Weir Prairie.
- Installed mulch around winter plantings.

Roads 2005 (4808)

- Additional blockades and signage installed at Fiander Lake and Muck Creek closures.
- Planted 6,000 plugs of Roemer's fescue and direct seeded 27 species of prairie plants on Upper Weir road closure.
- Planted seed plots for 30 species in 24 beds that will supply seed for Collins research plots and general restoration in fall 2006. (Roads05 & Prairies05)
- Initiated plant propagation tasks under this Task Order: purchased pots for growing prairie plants and built raised beds for prairie plants.
- Watered Muck Creek decommission plantings.

WGS 2004 (3911)

- Prepared the report titled 'Western gray squirrel monitoring and research in South Puget Sound' to provide a summary of the pilot monitoring program, and review options for further research. (WGS04)
- Presented poster, coauthored by personnel from Fort Lewis and The Nature Conservancy, at the NW Scientific Association meeting entitled 'The role of science in western gray squirrel enhancement in oak woodlands of South Puget Sound'.
- In winter, monitored 100+ western gray squirrel hair sampling tubes across the sampling area.
- Developed Access/Arcmap data management system for squirrel and squirrel habitat data.
- Completed plantings at Shaver Lake and Lake DeBalon, consisting of 300 plants.
- Planted twenty "food islands" that each contained 28 plants that are important western gray squirrel habitat resources.

WGS 2005 (4809)

- Researched feasibility and case studies relating to EGS control at Fort Lewis.
- Prepared draft of EGS control plan and submitted for review to WDFW.
- Incorporated review comments into second draft of EGS control plan and received approval from WDFW
- Prepared collection permit for EGS and received approval from WDFW.
- In spring, monitored 90 western gray squirrel hair sampling tubes across the sampling area.
- In spring, installed 11 squirrel monitoring tubes at new locations and constructed 70 new tubes.
- Identified 76 hair samples collected over the first 5 months of tube monitoring.
- Commenced measurements of gray squirrels and Douglas squirrels' hairs for a confidence rating scheme to increase objectivity for identification of squirrel hairs by a range of people.
- In summer, monitored 62 tubes.
- In summer, installed an additional 11 monitoring tubes.
- Conducted 13 foot surveys.
- In fall, monitored 122 tubes which yielded 90 hair samples.
- Conducted intensive WGS monitoring of Lake deBalon prior to and after timber harvest.
- Mowed Scotch broom in 23 acres of TA 11.
- Pulled Scotch Broom in the Prairie Oak Preserve.
- Mowed approximately 30 acres in the center of the CIA.

Oak Habitat 2004 (3840)

- Mowed Scotch broom in 47 acre oak edge of Upper Weir Prairie.
- Mowed Scotch broom in 51 acres at Mumford Hill Oaks in TA13.

White Oak (3866)

- Initiated mowing in Squirrel Triangle area for oak and squirrel habitat enhancement; completed 38 acres.
- Prairie Oak Preserve (POP) Scotch broom pulling and brush cutting.
- Brush cut around all enhancement plantings.

Pine and Oaks (3867)

- Mowed brush, thinned pine and girdled fir on approximately 110 acres of Pine enhancement in CIA near Range 18.

Riparian Oaks (3827)

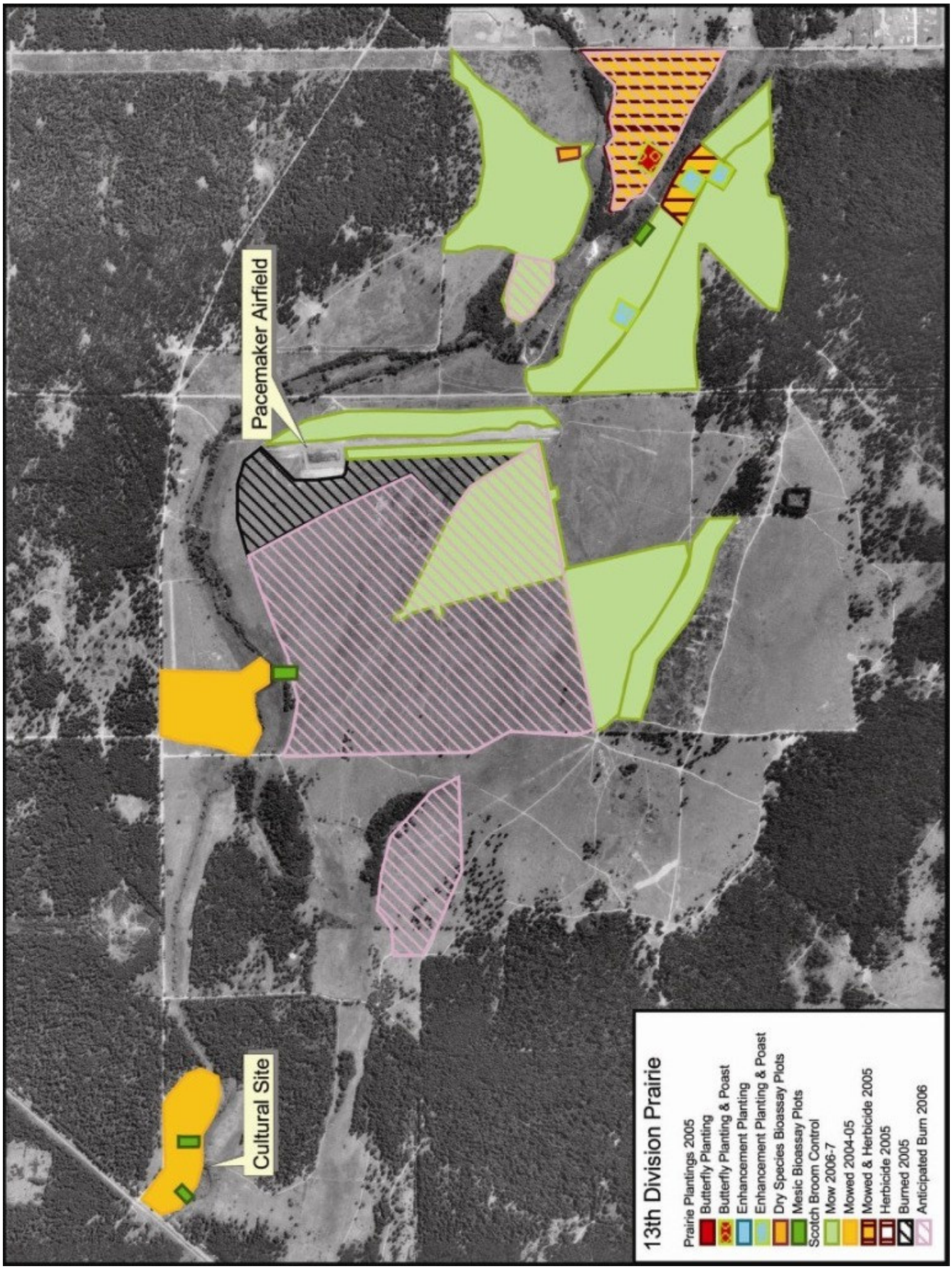
- Mowed 121 acres of Scotch broom in the Muck Creek corridor.
- Planted 1933 plugs in 12 enhancement/bioassay mesic species bioassay plots along Muck Creek.
- Planted mesic prairie bioassay plantings in 12 plots along Muck Creek.
- Planted 967 plugs in 6 enhancement/bioassay mesic species bioassay plots at the landfill enhancement site.
- Planted three dry prairie enhancement/bioassay plots with 843 plugs.
- Planted 1606 trees and shrubs along Muck Creek to improve oak woodland and riparian habitat.
- Measured soil moisture levels in mesic prairie bioassay plots.
- Contracted background paper on mesic prairie to guide restoration efforts finalized.

In-stream (4803)

- Completed initial site preparation at Halverson Springs including Scotch broom and Himalayan blackberry control.
- Completed Halverson Springs restoration planting.
- Removed fish passage barrier culvert near Muck Creek/Nisqually River area.
- Spot treated Scotch broom on 24 acres fn 13th Division Prairie
- Obtained materials for future Halverson Springs restoration work
- Obtained 2300 potted plants for future riparian enhancement plantings.
- Mowed seed production/enhancement plots at 13th Division Cultural Area.

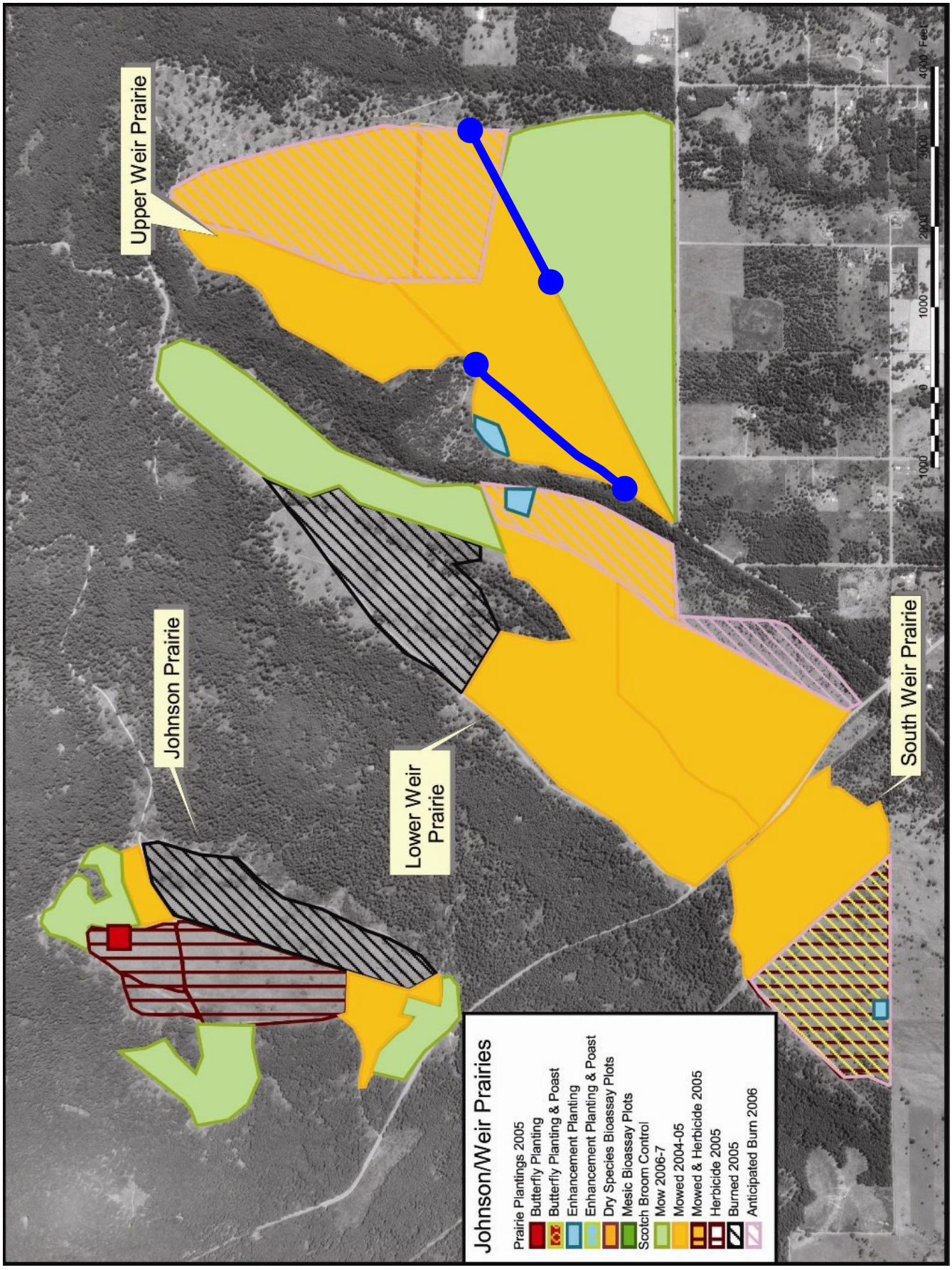
APPENDIX II – MAPS

Figure 3: Map of 13th Division enhancement activity from fall 2004 to expected work for early 2006.



APPENDIX II – MAPS

Figure 4: Map of Johnson/Weir enhancement activity from fall 2004 to expected work for early 2006.



APPENDIX II – MAPS

Figure 5: Map of Squirrel Triangle enhancement activity from fall 2004 to expected work for early 2006.

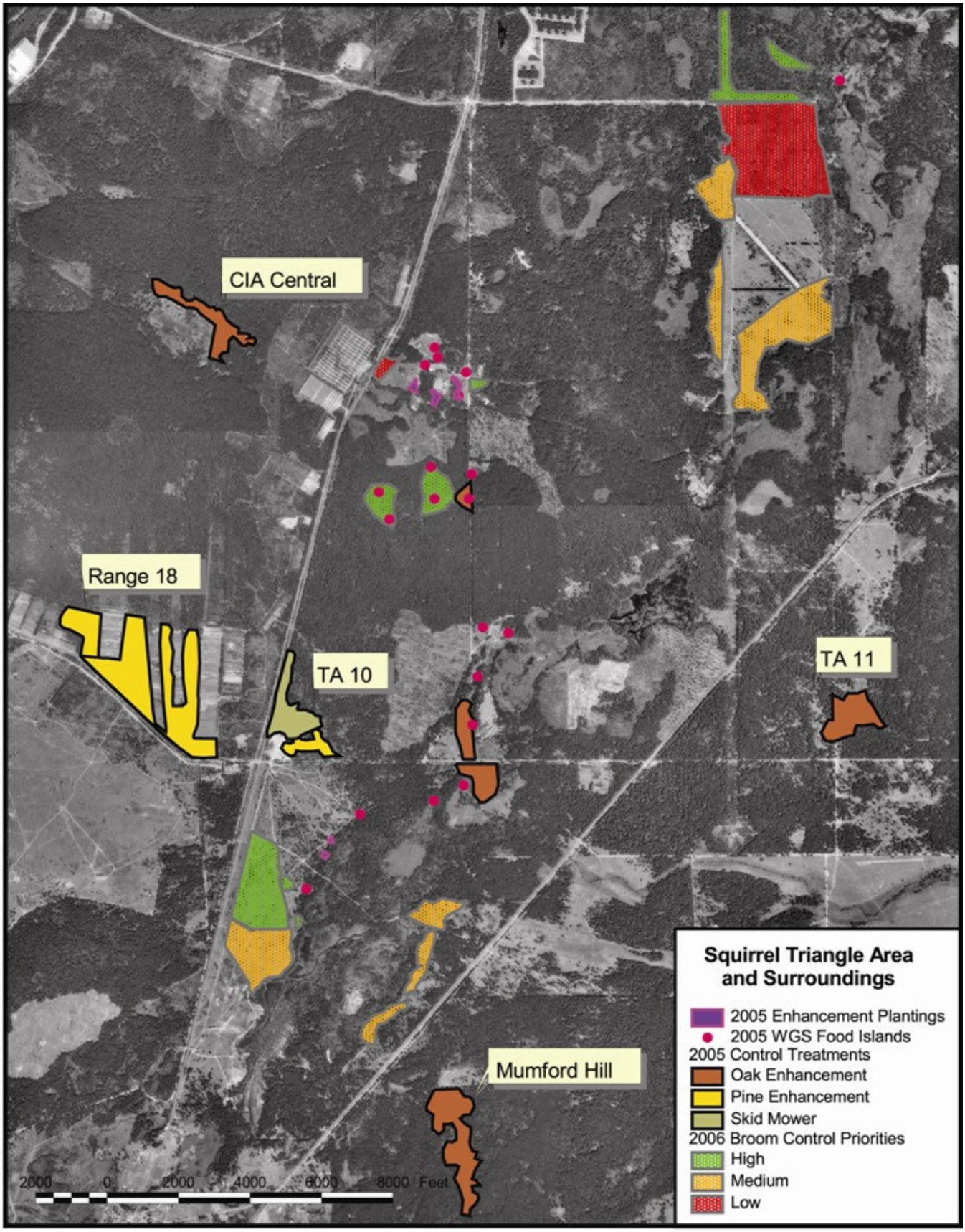
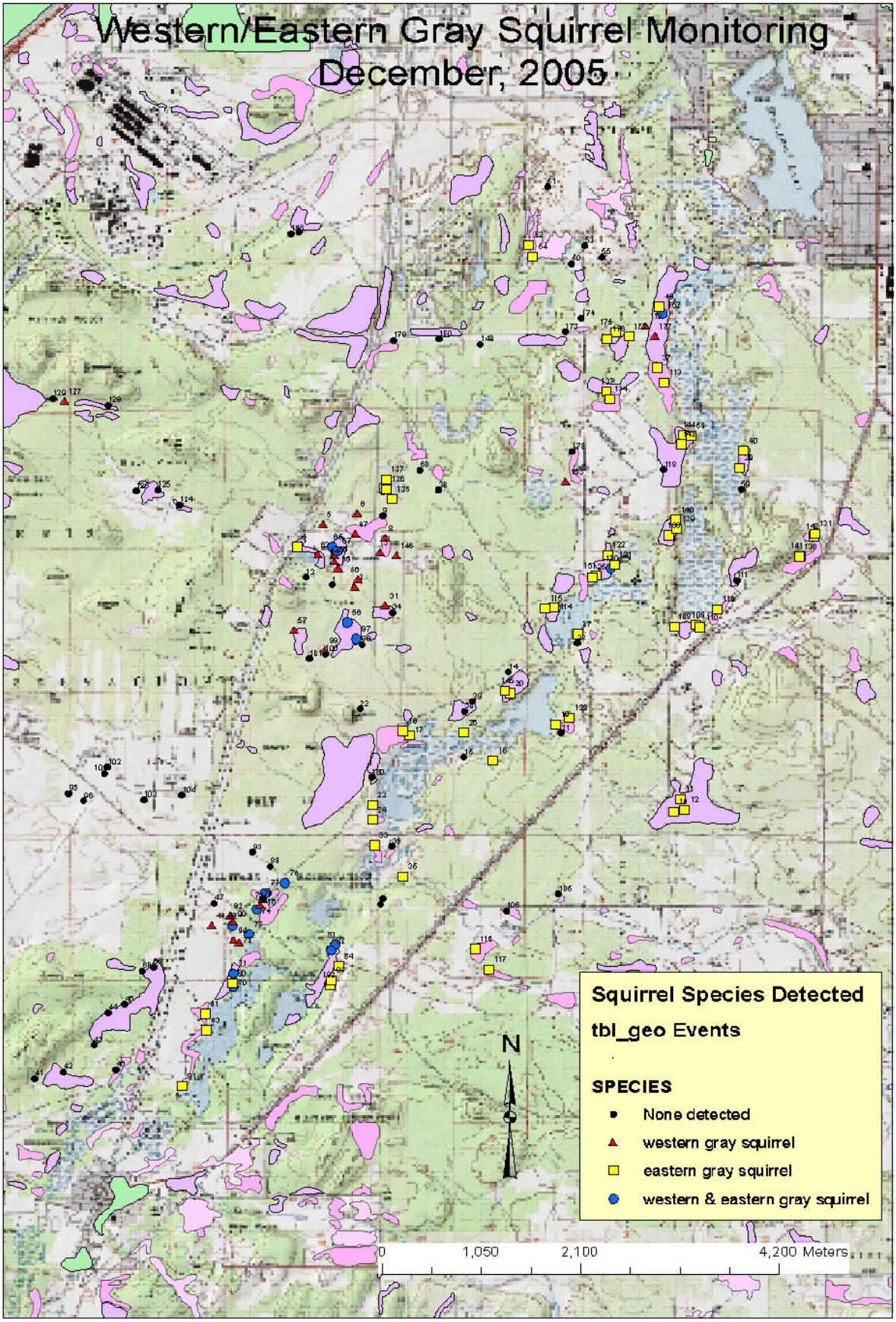


Figure 6. Map showing locations of hair snag tubes and species detected at tube locations through December, 2005 on the Fort Lewis Military Reservation.



APPENDIX III – PROPAGATION AND PLANTING TABLES

Table 7: 2005 Prairie planting list for all planting projects on Fort Lewis.

		Butterfly and General Prairie Enhancement Plots			Dry Species Prairie Bioassay Planting Plots					Butterfly and General Prairie Enhancement Plots				
Species	**Common Name**	**Johnson Prairie Butterfly**	**S. Weir Prairie**	**13th Div. Prairie**	**Plot 1**	**Plot 2**	**Plot 3**	**Upper Weir Road Planting**	**Bioassay plots: twelve at 13th Division, Six at the landfill**	**S. Weir Prairie**	**13th Div. Triangle**	**Johnson Prairie**	**Upper Weir Road Planting**	**Totals**
Achillea millefollium	Yarrow									12				**12**
Aqualegia formosa	Red columbine								90		10			**100**
Aster curtus	White-top aster									100		40		**140**
Balsamorhiza deltoidea	Puget balsamroot									50				**50**
*Camassia leichtlinii**	Giant camas								120					**120**
*Camassia quamash**	Blue camas								120					**120**
Campanula rotundifolia	Scot's bluebell									250				**250**
Carex inops	Long stolon sedge								180					**180**
Castilleja hispida	Harsh paintbrush	171			1	20	20		60	0	1500	200		**1972**
*Danthonia californica**	California oatgrass								60					**60**
Erigeron speciousus	Showy fleabane		90				192		180	300	200	0		**962**
Eriophyllum lanatum	Oregon sunshine	20					110		360	500		500		**1490**
Festuca idahoensis var. roemeri	Roemer's fescue		2950	10500				20443	800	6000	5000	1000	6000	**52693**
Fragaria virginiana	Broadpetal strawberry		42			40			120	25	40			**267**
Hirecium cyanoglossoides	Hounds tongue hawkweed									100				**100**
Juncus effusus									90					**90**
Juncus tenuous									90					**90**
Lomatium triternatum	Nine-leaved lomatium		43		135					200	0	0		**378**
Lomatium utriculatum	Spring gold		108		35		35			200	350	200		**928**
Lupinus albicaulis	Sickle-keeled lupine									200				**200**
Lupinus polyphyllus	Large leaved lupin								90					**90**
Microseris laciniata	Cutleaf microseris		12		135				180	100	0	0		**427**
Potentilla gracilis	Slender cinquefoil				2		2		90	300				**394**
Ranunculus occidentalis	Western buttercup				3	3				400				**406**
Sisynrinchium idahoense	Blue-eyed grass								180					**180**
Solidago missouriensis	Prairie Goldenrod									50				**50**
Solidago spathulata	Spikelike Goldenrod		48			70	22			300				**300**
Viola adunca	Early blue violet	200	58		10		8			1000	0	1000		**2276**
Wyethia angustifolia	Mule's Ears								90		50			**140**
	Totals	**391**	**3351**	**10500**	**321**	**133**	**389**	**20443**	**2900**	**10087**	**7150**	**2940**	**6000**	**64605**
		Winter/Spring Plantings								**Fall Plantings**				

Table 8: First season survival in enhancement planting experiment for selected species and for all native planted forbs.

Species	**Number planted (November 2004)**	**Number still living (June 2005)**
Achillea millefollium	33	21
Aster curtus	99	44
Campanula rotundifolia	33	12
Castilleja hispida	297	98
Erigeron speciousus	99	63
Eriophyllum lanatum	297	212
Potentilla gracilis	99	80
Ranunculus occidentalis	99	46
Viola adunca	297	217
Silene scoluleri	33	5
Solidago missouriensis	99	60
Solidago spathulata	99	39
All native planted forbs	**2187**	**1010**

APPENDIX III – PROPAGATION AND PLANTING TABLES

Table 9: 2005 TNC seed collection inventory (volume measured in mL).

Botanical Name	Common Name	Glacial	Jarisch	Johnson	Morgan	Shotwell	13th Division	Weir	Wolfhaven	Total (mL)
Achillea millefolium	Yarrow	51.0								**51.0**
Antennaria microphylla	Rosy Pussytoes	600								**600.0**
Aquilegia formosa	Red Columbine	12.0								**12.0**
Aster curtus	White-topped Aster	125							400	**525.0**
Balsamorhiza deltoidea	Puget Balsamroot	Volume not currently available								
Brodiaea congesta	Compact Harvest Lily	0.6								**0.6**
Brodiaea coronaria	Harvest Brodiaea	3.0								**3.0**
Camassia quamash	Common Camas	65								**65.0**
Campanula rotundifolia	Common Harebell	7.0								**7.0**
Carex pensylvanica	Long-stolen Sedge (C. inops)	4.0			1.0				2.0	**7.0**
Castilleja hispida	Harsh Paintbrush						70.0			**70.0**
Danthonia	Danthonia species	100								**100.0**
Danthonia californica	California Oatgrass--Hairy?							600		**600.0**
Danthonia spicata	Poverty Oatgrass--Non-hairy?							100		**100.0**
Delphinium nuttallii	Larkspur	12.0								**12.0**
Dodecatheon hendersonii	Broad-leaved Shooting Star	2.0						0.5		**2.5**
Erigeron speciosus	Showy Fleabane		9500	1700						**11200.0**
Eriophyllum lanatum	Oregon Sunshine	75.0		22.0					60.0	**157.0**
Festuca roemerii	Roemer's Fescue	Volume not currently available								
Fritillaria lanceolata	Chocolate Lily						25.0			**25.0**
Hieracium cynoglossoides	Hound's Tongue Hawkweed	2.0								**2.0**
Koeleria cristata	Prairie June Grass									**0.0**
Lomatium nudicaule	Bare-stemmed Desert Parsley						400.0			**400.0**
Lomatium triternatum	Nine-leaved Desert Parsley	200		130						**330.0**
Lomatium utriculatum	Spring Gold	690								**690.0**
Lupinus albicaulis	Sickle-keeled lupine	12.0								**12.0**
Lupinus bicolor	Bicolor Lupine	0.5				3.7				**4.2**
Lupinus lepidus v. lepidus	Nooka Lupine	5.0						1.0		**6.0**
Luzula campestris	Many-flowered Wood-rush	3.7						0.7		**4.4**
Microseris laciniata	Cut-leaf Microseris	1230	1000					1600		**3830.0**
Panicum occidentale	Western Panicum	3.0			1.0					**4.0**
Panicum scribnerianum	Few-flowered Panicum	0.3								**0.3**
Plectritis congesta	Sea Blush--Dan's	0.6								**0.6**
Potentilla gracilis	Graceful Cinguefoil	39.0								**39.0**
Prunella vulgaris v. lanceolata	Self-heal or Heal-all	18.0								**18.0**
Ranunculus occidentalis	Western Buttercup	50.0								**50.0**
Silene scouleri v.scouleri	Scouler's Campion	1.2								**1.2**
Solidago ??	Probably SOMI									**200.0**
Solidago missouriensis	Missouri Goldenrod	4150								**4150.0**
Solidago spathulata	Spikelike Goldenrod	1700	600		50.0					**2350.0**
Trillium choropetalum	Small-flowered Trillium	2.5								**2.5**
Trillium ovatum	Western Trillium	4.3								**4.3**
Viola adunca v. adunca	Early Blue Violet	20.0	17.5							**37.5**
Zigadenus venenosus	Death Camas	100.0								**100.0**

APPENDIX III – PROPAGATION AND PLANTING TABLES

Table 10: TNC plant production for fall 2005 and spring 2006 projects on Fort Lewis.

Plant Production 2005		**Ft Lewis Prairie**	**Ft Lewis Road**
Plant Name			
Roemer's fescue	*Festuca idahoensis var. roemeri*	10,000	10,000
Oregon sunshine/woolly sunflower	*Eriophyllum lanatum*	1,000	800
Early blue violet	*Viola adunca*	2,000	
Harsh paintbrush	*Castilleja hispida*	1,800	
White-top aster	*Aster curtus*	150	
Broadpetal strawberry	*Fragaria virginiana var. playpetala*	50	100
Prairie Goldenrod	*Solidago missouriensis*	50	
Spikelike Goldenrod	*Solidago spathulata*	300	300
Western buttercup	*Ranunculus occidentalis*	400	
Slender cinquefoil	*Potentilla gracilis*	300	
Showy fleabane	*Erigeron speciousus*	500	
Cutleaf microseris	*Microseris laciniata*	100	50
Sickle-keeled lupine	*Lupinus albicaulis*	200	100
Red Columbine	*Aquilegia formosa*	50	
Many flowered Wood-Rush	*Luzula campestris*	200	100
Mule's Ears	*Wyethia angustifolia*	50	25
Houndstounge Hawkweed	*Hieracium cynoglossoides*	100	50
Bluebell	*Campanula rotundifolia*	250	50
TOTALS		**17,500**	**11,575**

Table 11: Seed bed production indicated as a fraction of a 4X30' raised bed.

Seed bed	**Bed size**
Festuca roemeri	2
Sea blush (*Plectritis congesta*)	1/3
Small flowered blue eyed Mary (*Collinsia parviflora*)	1/3
Great camas (*Camassia leichtlinii*)	1/10
Sickle keel lupine (*Lupinus albicaulis*)	1
Armeria maritima v.californica	1/3
Aster chilensis ssp. hallii	1/10
Castilleja hispida	1
Cerastium arvense	1/10
Clarkia amoena	1/10
Aster curtus	1
Balsamorhiza deltoidea	1
Danthonia californica	1
Danthonia spicata v. pinetorum	1/3
Erigeron philadelphicus	1/10
Erigeron speciosus v. speciosus	1
Eriophyllum lanatum v. achillaeoides	1
Gaillardia aristata	1/10
Linanthus bicolor v. bicolor	1/10
Lomatium utriculatum	1
Perideridia gairdneri	1/10
Psoralea physodes	1/10
Sisyrinchium angustifolium	1/10
Senecio macounii	1/10
Solidago missouriensis v. tolmieana	1
Solidago spathulata v. neomexicana	1
Trifolium microcephalum	1/10
Trifolium tridentatum	1/10
Viola praemorsa	1/10
Viola adunca	1

Table 12**.** Planting block design for food islands. Each cell in the figure represents a 1m square. Acorns will be planted around the outside of the block within 5m of planting. Oregon white oak = QUGA, Ponderosa pine = PIPO, California hazel = COCO, Indian plum = OECE, serviceberry = AMAL

QUGA		**COCO**		**OECE**	**AMAL**		**COCO**		**QUGA**
COCO		**PIPO**					**PIPO**		**COCO**
				OECE	**OECE**				
OECE		**AMAL**					**AMAL**		**OECE**
AMAL		**AMAL**					**AMAL**		**AMAL**
				OECE	**OECE**				
COCO		**PIPO**					**PIPO**		**COCO**
QUGA		**COCO**		**AMAL**	**OECE**		**COCO**		**QUGA**

2005 Annual Report
South Puget Sound Grasslands Project
Mary Linders

Taylor's checkerspot translocation plan: In an effort to stem recent declines and secure the status of this species in South Puget Sound by increasing the number of occupied sites, a plan was written to guide and synchronize development of captive rearing and translocation methods. The plan includes detailed information on status and natural history, current results of the captive rearing program housed at the Oregon Zoo, background information on other butterfly translocations, potential reintroduction sites, habitat conditions, release methods, site criteria, and a monitoring strategy. Numerous meetings were conducted to solicit input on the plan from a number of taxa experts, regional biologists and land managers. The captive rearing program will provide animals for the translocation experiments and a control against field conditions that will enable a deeper understanding of mortality rates and sources in the field. Animals will also be taken from wild sources and used together with captive reared animals in paired field experiments. The goal of initial experiments is to illuminate potential limiting factors and assess the response of released animals to their new environment. Subsequent releases will build on these results. The projects outlined in the plan will also assist us in determining what role, if any, captive rearing will play in future reintroduction efforts. The plan is structure such that minor modification would be required to move it from an experimental approach to a formalized plan for re-establishing populations throughout South Puget Sound.

Taylor's checkerspot captive rearing: In order to develop recovery tools for Taylor's checkerspot, a pilot effort to captive rear these butterflies was initiated by the Washington Department of Fish and Wildlife in 2003. Captive rearing was moved to the Oregon Zoo in 2004 in an effort to 1) refine captive rearing techniques, 2) corroborate the 2003 results with a larger sample size (387 larvae were collected), and 3) learn about the behavior, physiology, and husbandry requirements of Taylor's checkerspot in captivity. The 2004 effort resulted in lower survival rates compared to 2003, with no adult butterflies eclosing in the spring of 2005. Adjustments were made to existing methods in spring 2005 to try and reduce mortality during diapause, the period of highest mortality. Source populations were changed to include Fort Lewis as well as the Bald Hills. A total of 490 eggs were collected from the wild. Results to date indicate that captive rearing has been very successful at minimizing mortality in the egg and pre-diapause larval stages relative to rates reported for wild populations of a related subspecies. Close coordination and oversight of the work at the Zoo has been crucial to understanding how best to move forward with the captive rearing effort. Source populations have been carefully monitored in order to assess impacts of removing eggs and larvae from the wild. Egg and larval surveys have increased our knowledge of life history and fueled experimental design. A visit with Dr. Gordon Pratt, Assistant Professor at the University of California-Riverside, provided insight into his success in rearing the federally endangered Quino checkerspot. We continue to work closely with Dr. Pratt on methods development and release techniques.

Mardon skipper captive rearing: In order to secure existing populations of mardon skipper and provide animals for future translocations, a captive rearing project for mardon skippers was also initiated by WDFW in 2003. Captive rearing of mardon skippers was also moved to the Oregon Zoo in 2004. Skippers are notoriously difficult to rear due to their failure to lat eggs in captivity as well as problems with timing of development. Progress was made in getting skippers to lay eggs in flats of grass covered by small mesh tents. The number of eggs laid with

this method was at least as good as any other method to date, but developing larvae required much less care and overall survival was higher. Larvae were allowed to develop through diapause hidden in these flats. Careful examination of the flats in the spring of 2005 revealed numerous grass nests that had been constructed by the larvae. A few of the survivors diapaused as larvae rather than pupating in October, as they have on previous occasions. Ultimately, one of approximately 100 eggs eclosed as an adult. The survival to adulthood of this one individual was significant, because it was no worse than would be expected in the wild, and most importantly, the timing of eclosion was consistent with observations in the wild. In the process, we gained tremendous insight into the life history of this species by making detailed observations of the larva as it moved in and out of its grass nest to forage. It spent the vast majority of its time hidden away, however. In the past, rearing methods dictated that larvae be moved from one clean Petri dish to another, which meant there was a constant need to reconstruct these nests. The physiological cost of this activity was likely significant. Captive rearing was not reinitiated in spring 2005 due to a lack of funds and concern about the status of source populations. However based on these results and the visit with Dr. Pratt, a new "hands off" method for rearing mardon skippers will be proposed for spring 2006.

Western gray squirrel recovery: The draft western gray squirrel recovery plan was distributed to all counties in the state for review. Comments were incorporated into the draft plan, which is to be released for a 90-day public comment period in February of 2006. Final approval of the plan should occur shortly thereafter. This recovery plan has received an unusual amount of scrutiny, but has remained intact with respect to the recovery goals and status of the species. Internal meetings were held with WDFW staff to discuss the issue of augmenting the Fort Lewis population. A translocation plan will be completed in 2006 with a proposed translocation expected in the fall. Close coordination with Fort Lewis is aimed at reducing impacts to squirrels resulting from roadkill mortality and harvest operations. Eastern gray squirrel population monitoring and removal is being conducted in coordination with Fort Lewis, TNC and WDFW staff. This effort is expected to factor significantly in increasing the stability of the existing western gray squirrel population by reducing competition for food and nest sites.

Mazama pocket gopher: Trapped and relocated pocket gophers from a site scheduled for development in February 2006. Pocket gophers can be difficult to live-trap and this test allowed us to gather information on mound and tunnel characteristics and confirm occupancy by moles vs. gophers. This pilot project provides a foundation with which to test future monitoring of mound complexes to produce a technique with validated confidence measures. A total of 22 gophers were trapped and relocated to Wolf Haven to become part of a new educational focus on the prairie ecosystem. A database was also established to track capture and release locations as well as sex, weight and other capture-related information; a database to analyze mound characteristics will also be established. A visit to the source site indicated that about 10-12 gophers appear to remain occupy that site; these animals will be captured in 2006, time permitting. Mound characteristics indicate that moles have moved into many of the areas where gophers were removed, suggesting competition between these species is occurring in the field.

Candidate Conservation Agreement: The Candidate Conservation Agreement is designed to improve the status of a list of federal candidate species and other state-listed and candidate species associated with the Puget Sound prairie-oak woodland-wetland complex. Through this process we have worked with cooperators to insure that scientifically defensible methods are used to assess impacts and benefits to the species of interest in this process and to insure that occupied and potential habitat is included in the enrolled lands. Technical oversight has been provided to insure that key aspects of the life history and status of these species is incorporated into the process. Close attention is being paid to insure that opportunities for recovery are also

included, because restoration of these species cannot occur if they are simply maintained in their current state.

Agency liaison: Close coordination with WDFW and Fort Lewis staff has increased the level of communication between these agencies, while increasing the number of joint projects and level of cooperation. New opportunities for research, monitoring and translocation of federal candidate and state-listed species have been identified. A cooperative agreement is being established that will further increase the ability of these agencies to work closely and effectively with one another as they pursue their respective roles as wildlife and land managers jointly engaged in recovery efforts for a set of common species.

White-breasted nuthatch reintroduction: Consulted with Bob Altman and Gary Slater on assessment of sites for potential white-breasted nuthatch reintroductions both on and off of Fort Lewis. Worked to insure that habitat modification for nuthatches did not interfere with potential reoccupation by western gray squirrels. Coordination with relevant parties will continue as this effort proceeds in 2006.