# January – December 2006 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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**Fort Lewis Conservation Project**

# Project 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, including the Fort Lewis Fish and Wildlife Plan, The Integrated Natural Resources Management Plan, Endangered Species Management plans, the Pest Management Plan, the Installation Sustainability Program and the prairie and oak management plans. Such 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 where compatibilities exist.

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.

Fort Lewis uses many approaches to promote its regional conservation goals. Direct funding provides Fort Lewis, TNC and others with the opportunity to conduct habitat enhancement and species management on base. Fort Lewis' Forestry program also provides funding for habitat work. Additional funding from the Legacy and Army Compatible Use Buffer programs and other Defense sources facilitate improvements region wide. This multi-pronged approach has proven an effective catalyst to establish and energize local conservation partnerships. As the partnership has grown, so have the opportunities to reach our mutually held goals of sustainability.

## Fort Lewis Conservation Project
# Review of 2006

TNC's total conservation activity on Fort Lewis in 2006 exceeded that of any previous year. More was accomplished in virtually every category of activity compared to 2005. For example, the total cumulative area that we controlled Scotch broom to enhance prairie and oak habitat increased by 55% to over 2000 acres. Similarly, upland weeds and native prairie plant propagation have had notable increases. In addition, we took on some new tasks, such as habitat enhancement for the federally listed plant water howellia and bald eagle. Due to an increase in staffing, Fort Lewis Fish and Wildlife staff were able to make significant contributions to several joint projects this year, which facilitated conservation efforts.

The activity summary table below presents highlights of the conservation activities accomplished in 2006 with a comparison to 2005 activity. The amount of work that TNC performed is 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 mutual conservation goals.

**Summary of significant 2006 conservation actions on Fort Lewis, with 2005 comparison.**

| **Invasive Plant Control** | **2005** |
|---|---|
| • Controlled approximately 2074 acres of Scotch broom on:<br>  ○ 1680 acres of prairie for rare butterfly, streaked horned lark, Mazama pocket gopher and general prairie enhancement.<br>  ○ 394 acres of oak and pine to enhance understory structure, remove encroaching Douglas-fir and enhance western gray squirrel habitat. | 1340<br>990<br>350 |
| • Controlled 19 species of invasive weeds – five of which were in aquatic environments. | 11 |
| • Controlled colonial bentgrass on 34 acres of prairie. | 4 |
| • Removed and girdled encroaching Douglas-fir from about 387 acres of prairie. | 100 |
| **Enhancement Plantings** | |
| • Propagated and planted 67,380 prairie plants on Weir, Johnson and 13$^{th}$ Division Prairies. | 64,600 |
| • Planted 2110 shrubs and trees to enhance core western gray squirrel habitat. | 900 |
| • Planted 2000 woody plant species for riparian enhancement. | 175 |
| • Built and planted 3200 ft$^2$ of seed production beds with prairie plants. | 300 ft$^2$ |
| **Western Gray Squirrel Management** | |
| • Continued use of squirrel monitoring tubes to inform management. | |
| • Implemented eastern gray squirrel control experiment. | |
| **Miscellaneous Conservation Actions** | |
| • Initiated restoration work on William's Pipeline project through 13$^{th}$ Division Prairie. | |
| • Conducted two salmon spawning enhancements project at Halverson Springs and Chambers Lake spillway. | |

# INTRODUCTION

## Conservation at Fort Lewis

Fort Lewis and The Nature Conservancy (TNC) 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. For more than a decade, Fort Lewis resource managers have provided resources, support and guidance for the management of these critical habitats both on the Fort and in the region.

Conservation of these ecosystems and associated rare species is mutually important to both the Fort and TNC. The open structure of prairie and oak woodland habitat 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 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.

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.

## 2006 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.

Twenty task orders were active on Fort Lewis during 2006. These are listed below along with their TNC grant ID numbers. An additional contract with the Williams Pipe Company was developed to restore their recent pipeline upgrade work at 13th Division Prairie. For the purpose of grant tracking, the activities conducted under each task order are summarized in *Appendix I*.

| TABLE 1: 2006 FORT LEWIS ACTIVE TASK ORDERS | | | |
|---|---|---|---|
| Ft Lewis STHL FY 05 | 3849 | Ft Lewis Muck Creek | 3879 |
| Ft. Lewis Prairie Enhancement | 3861 | Ft Lewis Howellia | 3887 |
| Ft. Lewis Oak Enhancement | 3866 | Ft Lewis Inventory - Butterfly | 3900 |
| Ft. Lewis Oak and Pine | 3867 | Ft Lewis Squirrel Habitat | 3901 |
| Ft Lewis Cavity Creation | 3871 | Ft Lewis Weeds 2005 | 4806 |
| Ft Lewis Gophers 06 | 3872 | Ft Lewis Prairie FY 05 | 4807 |
| Ft Lewis Training Lands | 3873 | Ft Lewis Road Closure | 4808 |
| Ft Lewis Prairie FY 06 | 3874 | Ft Lewis WGS FY 05 | 4809 |
| Ft Lewis Oaks for Squirrels | 3875 | Williams Pipeline (Non-DOD) | 3010 |
| Ft Lewis Butterflies | 3876 | Legacy – Seed Production | 4816 |
| Ft Lewis Larks FY06 | 3877 | | |

# PRAIRIE HABITAT MANAGEMENT

Prairie management at Fort Lewis is guided by several converging conservation targets. Each conservation target has specific threats which must be addressed. Conservation targets include, the prairie habitat itself, rare prairie butterflies, Oregon vesper sparrow streaked horned lark, purple martin, western toad 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 ordinance 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, Oregon vesper sparrows, Mazama pocket gophers, western toad and several rare plants. They are heavily impacted by Scotch broom though the level of infestation has declined significantly over the past ten years because of intensive control efforts.

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, Oregon vesper sparrow, several rare plants 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.

## SCOTCH BROOM CONTROL

Scotch broom control 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 involves an integrated approach. A combination of mechanical cutting, hand-pulling, herbicide, fire and biological methods are employed to reach a desired end-state of minimal maintenance. Mowing has been used to successfully kill very mature broom plants and periodic mowing of younger plants (every 2-3 years) will restrict extensive seed production. Periodic mowing does not effectively kill broom however, and lethal control measures such as fire or herbicide are required. 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.

### *2006 Review*

TNC was able to conduct about 1,680 acres of broom controlling activities on prairies in 2006. We mowed broom on 650 acres, hand-cut broom on 270 acres and spray treated 760 acres. In many of the highest priority prairies, years of integrated broom control is beginning to pay off. In these areas, broom densities and seed banks have declined. It appears we may have entered a new period of broom control on the high priority prairies, and in the future they should require a much reduced level of effort to keep the broom invasion at bay.

The broom control summary table below indicates locations, acreages and task orders for each action. The broom control prairie maps at the end of this section provide locations for 2006 broom treatments.

**SCOTCH BROOM SUMMARY TABLE**

**January-March**

- Improved Streaked horned lark habitat on 13th Division Prairie by mowing 115 acres of Scotch broom in core and surrounding habitat. (3849)

**April-June**

- *Muck Creek Triangle Mowing.* Mowed Scotch broom on three polygons of prairie totaling 116 acres (3861).
- *Johnson Mowing.* Mowed Scotch broom on three polygons of prairie totaling 70 acres (3861).
- *Upper Weir Mowing*. Mowed Scotch broom on two polygons of prairie totaling 152 acres (3861).
- *Lower Weir Mowing*. Mowed Scotch broom on two polygons of prairie totaling 55 acres

(3861).
- Conducted follow-up brush cutting to remove any Scotch broom which survived previous year's spray treatment and threatened to produce seed (3872):
  - 13th Division Prairie Muck Creek Triangle – total of 60 acres.
  - Johnson Prairie – total of 55 acres.
  - South Weir – total of 60 acres.
- *Johnson Prairie*. Brush cut low density Scotch broom in a 27-acre high quality prairie polygon (3872)
- *Upper Weir*. Brush cut low density Scotch broom that threatened to set seed in a 19-acre high quality prairie polygon and 50 acres of quality broom that had been recently been mowed (3872).
- Completed mowing and girdling work in Central Impact Area. Mowed at total of 43 acres in winter and spring 2006 (3875).

**July-September**
- *Johnson Prairie Mowing.* Mowed about 14 acres of lower quality prairie and the entire outside perimeter of the prairie was mowed back about 10 feet along the road edge (3872)
- *Upper Weir Mowing.* Mowed 21 acres on western edge under the oaks and a small 3 acre patch in the middle (3872)
- *Muck Creek Triangle Area Broom Spraying* - Treated about 125 acres in core and buffer areas (3874).
- *Johnson Prairie Broom Spraying* – Treated 132 acres throughout the prairie (3874).
- *Upper Weir Prairie Broom Spraying* – Sprayed 59 acres in the southern portion of the prairie (3874).
- *South Weir Broom Spraying* – Treated 10 acres on northeast side of pipeline (3874).
- *Broom Spray Test Plots* – treated 10 100m$^2$ plots to test treatment rates and products (3874).
- *Range 74/76 Broom Spraying* – Sprayed about 221 acres in streaked horned lark use area (3877).
- *Pacemaker Area Broom Spraying* – Sprayed about 203 acres of broom in core lark habitat (3877).

**October-December**
- *South Weir Broom Spraying.* Treated about 9 acres of broom as a trial of late season effectiveness (3874)
- *13th Division Broom Mowing.* Mowed two polygons of broom totaling 41 acres to enhance prairie habitat and facilitate future control of *P. recta* along Muck Creek (3887).
- *13th Division Broom Mowing.* Mowed two polygons of broom totaling 9 acres to enhance prairie habitat and facilitate future control of *P. recta* (3873).
- *13th Division Broom Mowing*. Mowed 10 acres of broom in high quality portion of prairie in Muck Creek Triangle Area (3876).

## *Tasks*

Broom control activities of 2006 are described in the sections below for each of the targeted prairie restoration sites. Each section provides a comprehensive look at how the control strategy of mowing, spraying, fire and cutting is working for each site and gives an outlook for upcoming requirements. All spray treatments were made with 1.5-2.5% Triclopyr ester with Nufilm as an adjuvant. Treatments made earlier in the season treatments were made with lower percentages, and concentrations gradually increased as plant activity slowed. Maps of the broom treatment areas are provided at the end of the broom section.

*Johnson Prairie.* Johnson remains one of the highest priority prairie habitats. We have made tremendous strides at Johnson Prairie over the past couple of years. Relentless

cutting of broom and prescribed burning over the past decade appears to have dramatically reduced the broom seed bank. Recent herbicide treatments have significantly reduced the number of broom plants throughout much of the site. Looking forward, the level of effort that will be required to manage broom is expected to be greatly reduced.

Prior to the summer, we were able to mow about 85 acres of taller broom that has been repeatedly mowed to control seed set. In addition, 82 acres were brush cut to control any plants that threatened to set seed by Fort Lewis and TNC crew. At the end of summer, when most of the native pant species had senesced, 132 acres of the cut and mowed broom was spot and boom sprayed. These plants had produced sufficient growth to allow effective control, but were still relatively short and minimal herbicide was required to gain effective coverage. Unfortunately, fire has been scarce on Johnson, and areas in the northeast, northwest and south were so dense with broom that boom spraying was the only means of control. However, it was a very dry and hot summer, and many native plants that normally would not have senesced did this year, greatly reducing the amount of non-target mortality.

The area that was burned in 2005 shows signs of minimal broom germination – a positive indication that the seed bank has been diminished.

Broom control in 2007 is expected to be a much simpler matter. There are no areas left in the prairie that still have untreated broom, so no mowing prior to spring is expected. Mature broom along the edges of the prairie can be mowed and sprayed further back from the roads. During the spring, prior to seed set, all flowering broom will be brush cut. During the last portion of summer, we will attempt to spot treat the entire prairie to control plants that were missed in 2006 or have since germinated. We are hopeful that after 2007 we will have reached a maintenance level for broom control where only minimal spot treatment or hand pulling will be required to keep broom from blooming.

*South Weir Prairie*. Similar to Johnson Prairie, the portion of South Weir west of the pipeline has been identified as one of the highest priority prairies and it has been treated with similar intensity and duration. In 2006, broom plants that were not killed in the 2005 spray treatment and threatened to set seed in 2006 were brush cut west of the pipeline. No other treatment happened in this area in 2006. East of the pipeline the prairie is greatly degraded and heavily infested with broom. A 9-acre portion was boom sprayed in October to test control effectiveness at the end of the spray window.

Looking ahead to 2007, there is a small patch of un-mowed broom on the southwest edge of the prairie that will be mowed prior to seed set. The entire area west of the pipeline is expected to be spot treated in late summer. After 2007, this area should mostly be in a low-maintenance condition, assuming that the seedbank has been largely depleted. East of the pipeline, the terrain makes control efforts difficult and more costly. The prairie is in poor condition and this area is of a lower priority. If other higher priority tasks are completed, and there is time and funding available, this area will be mowed or spray treated.

*Upper Weir Prairie*. Upper Weir has a mixture of conditions and treatment history. The highest quality portions are in the southwest, with poorer quality prairie in patches along the eastern side. The highest priority portions of this prairie have been intensively managed with a combination of mowing, brush cutting and herbicide and are on-track to reach low-maintenance level for broom control by 2008 or 2009, depending on the area.

During 2006, we mowed about 150 acres of broom along the southern border. One-third of this was higher quality; the remaining was low quality prairie that was mowed after the April 15 cutoff for mowing on quality sites. In late spring, broom plants that threatened to set seed on 70 acres of quality prairie were brush cut.

In late summer, 59 acres of the area that was mowed in spring were treated with Tryclopyr ester. Spot treatments were used in about 25 acres of higher quality prairie and boom spraying was used on about 34 acres of low quality prairie. We planned to treat the entire 152 acre spring mowed area, but operations were shut down unexpectedly due to access conflicts with pheasant hunters.

Much of the medium to lower quality prairie on the western edge of the prairie had an unfortunate set-back this year. The area had been mowed during winter of 2005, grew through the 2005 season to heights of 1-2 feet, and then unexpectedly bloomed in 2006. We thought that it would not bloom until after two seasons of growth. By the time it was determined that it would bloom, it was to late to mow and to dense to brush cut the 150 acre area, and it went to seed. We will mow it this winter, but these plants have been mowed repeatedly and have large root systems that can quickly respond to cutting. They are also very dense and have many patches of lupines that could be killed during a spray treatment. Fire is a critical tool in this area and every effort should be made to get a prescribed fire in 2007.

The remaining portions of Upper Weir that were mowed in 2006 are scheduled to be sprayed in 2007. In addition, lower priority will be given to mowed prairie along the eastern edge of the prairie, as time and resources allow.

*Lower Weir Prairie*. Lower Weir is scheduled for a usage change that would permit training by heavy vehicles. The higher quality eastern edge of the prairie may remain off limits to vehicles. Since prairie restoration resources are limited, and Lower Weir is largely of poorer quality, this prairie is not likely to receive as the same intensive treatment as the rest of the RTA. Available resources will be directed along the medium quality eastern edge. Fire should become the primary tool for broom control on this prairie.

In 2006, we were able to mow 55 low quality acres of broom in the northeast portion of the prairie late in the spring season to stop seed set. The higher quality areas in the southeast were in a similar condition as the broom that bloomed on Upper Weir, and we were unable to mow in time to stop seed set. This area is rich with *Aster curtis*, a species that does not senesce early and could be damaged by broom herbicide treatments. This is another high priority area for prescribed fire.

For 2007, we plan to mow the higher quality portion in the southeast this winter. Ideally, this would be followed by a prescribed fire in summer. If fire is unlikely, we will try to do careful spraying as late in the season as possible to wait for the *Aster curtis* to senesce if resources are available.

*13th Division – Muck Creek Triangle*. The Muck Creek Triangle (the area between Muck Creek and South Creek) is one of the highest priority prairies, in the same rank as Johnson and South Weir Prairies. This area has been intensively managed for broom as well, and is rapidly approaching a low maintenance condition.

This year we were able to build on last year's herbicide treatment. A small area of poorer quality untreated broom was mowed to the west of the road in winter. During spring the entire area to the east of the road was brush cut to control any broom that threatened to set seed. In summer, larger patches of previously missed broom were sprayed with Tryclopyr ester, primarily around the edges of the prairie.

The areas to the north and south of the Triangle are also of higher priority; the higher quality portions are next to the creeks. About 115 acres were mowed in the early spring. This same area, along with lower priority adjacent areas were sprayed with Tryclopyr ester in late summer – in total 125 acres were spot and boom sprayed

**Figure 1. Muck Creek Triangle Area south of South Creek showing low density dead broom.**

Not much mowing will be required for 2007. There are small patches in the lower quality portions that were missed with the spraying that should be mowed before seed set. Similarly, there will likely be plants in the higher quality, lower density portions that survived and need to be brush cut. At a minimum, the high to mid-quality portions of the Muck Creek Triangle Area will be spot treated in the coming summer unless they are likely to be burned. Lower quality areas will be treated as resources allow.

*13th Division – Pacemaker*. The Pacemaker area is the portion of 13th Division Prairie that provides core habitat for streaked horned lark, a federal candidate species. Portions of this area are of mid to high quality and have low density broom infestation. Other portions are highly degraded and overrun with broom and blackberry. The highest priority portion is adjacent to and to the west of the landing strip. Much of this core area has been intensively managed over the past few years. A large prescribed fire occurred in 2005. We mowed about 115 acres in the southern section in winter. In the summer, the higher quality northern portion was spot treated and the lower quality mid portion was spot and boom treated with Triclopyr ester. In total, over 200 acres were treated.

For 2007, the area mowed in 2006 may need to be mowed again to control seed set. This will need to be evaluated later in the season and mowing must occur before breeding/nesting season. The entire core area should either be prescribe burned or treated with herbicide to control broom in the summer. If resources are available, the core lark habitat management area should be expanded by initiating broom mowing (and fire) to begin depleting the broom seed bank.

*Central Impact Area Prairie.* The CIA prairie is of medium to low quality and heavily infested with broom through much of the area. Access to this area is extremely limited, which restricts management options. We have been able to get access to the CIA on a somewhat annual basis, and have managed to keep the broom from going to seed. Unless we can get late summer herbicide access for about one week, the only chance we have to control the broom is to get a prescribed fire to kill it.

Fall 2005 and spring 2006, we managed to mow the entire prairie. The largest portion (43 acres) was mowed in the spring. It is possible that the broom will bloom in 2007. This area should be a priority for burning.

*Artillery Impact Area – Range 74.* The AIA has some of the best quality prairie areas, but like the CIA, access is limited and heavy equipment is prohibited off of established roads. The majority of the AIA suffers only scattered infestations of Scotch broom, mostly occurring where roads or other bare patches have halted spread of the frequent ordinance initiated fires. One such area is near Range 74, an area important to streaked horned lark.

During summer 2006, we spot treated 220 acres of broom (including some patches of blackberry, cottonwood and fir) in the Range 74 area. Much of the area had fairly sparse infestations. This area should be revisited in 2007 to control surviving broom plants as access and resources allow. Future control options are severely limited and long-term strategies must be opportunistic.

*Weed Mowing.* In fall 2006, we mowed several patches of broom where known infestations of *Potentilla erecta* have been discovered. In total, 50 acres were mowed. This mowing will facilitate spring treatments of these weeds and temporarily improve grassland structure.

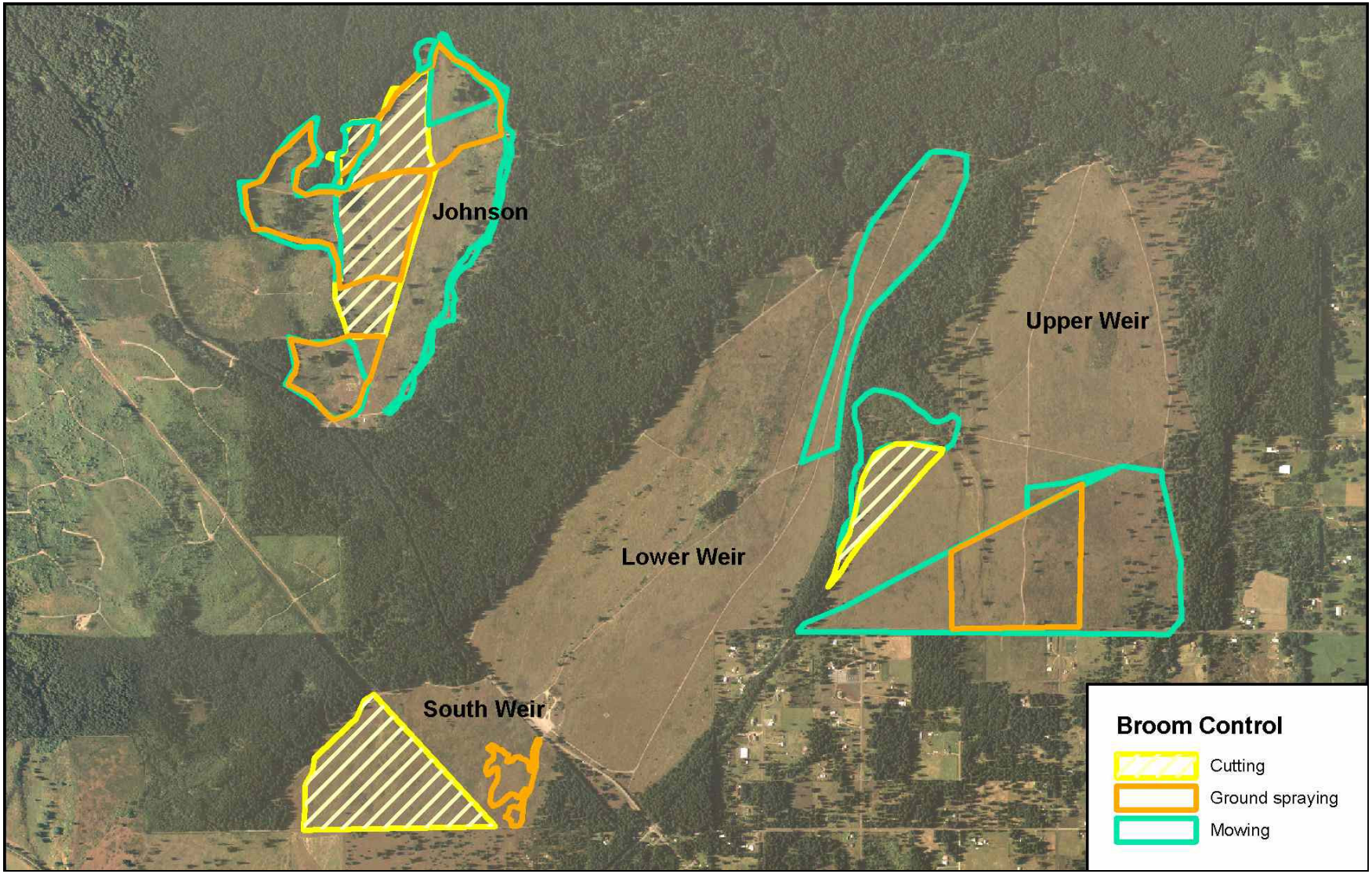



**Figure 2. Map of broom control activities at the Fort Lewis Rainier Training Area.**

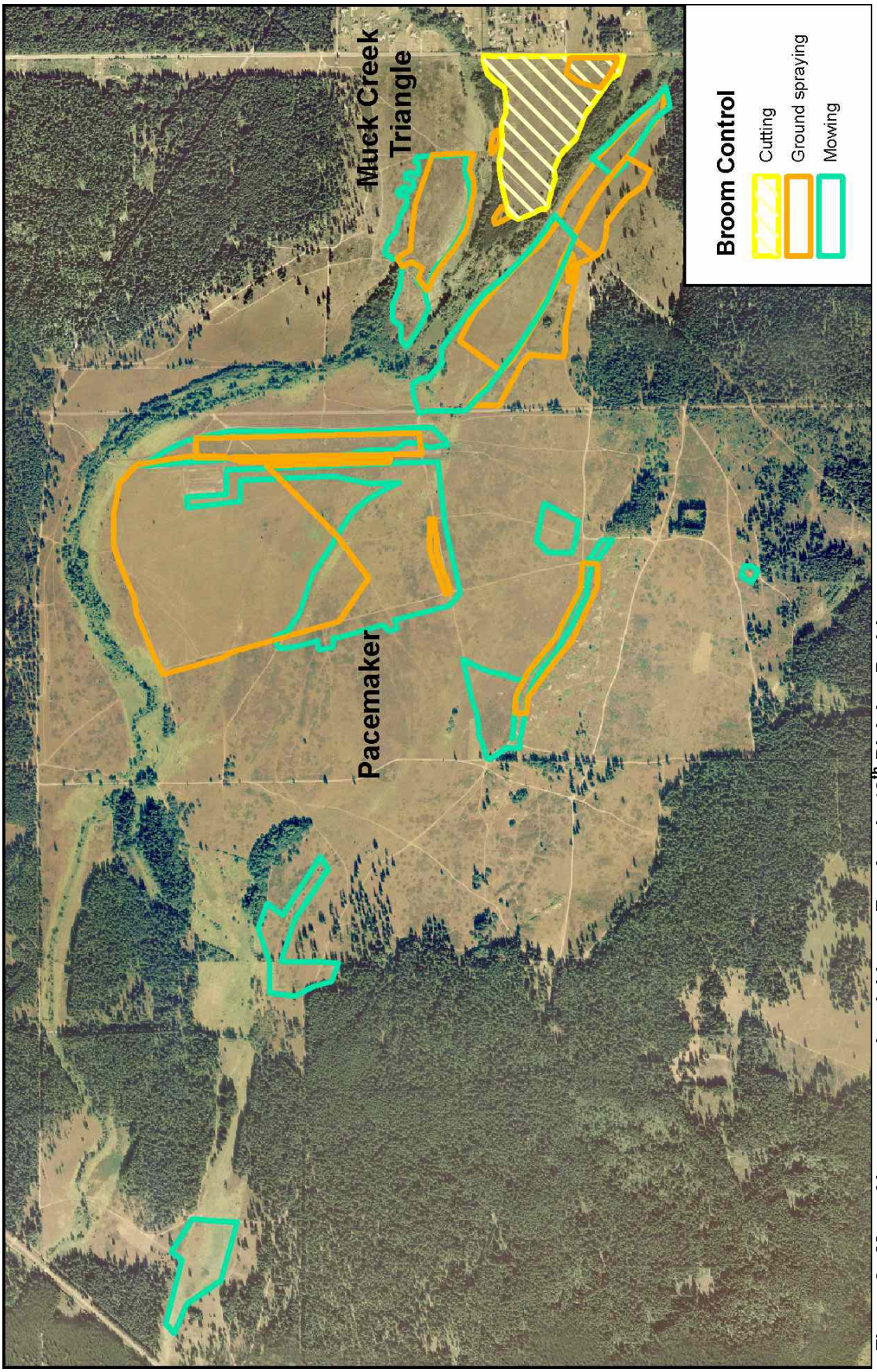



**Figure 3. Map of broom control activities at Fort Lewis 13th Division Prairie.**


**Figure 4. Map of broom control activities at Fort Lewis Artillery and Central Impact Areas.**

## PASTURE GRASS CONTROL

With the significant decline of Scotch broom in priority prairie areas, non-native invasive pasture grasses have been given an increased control emphasis. Eurasian grasses pose a tremendous threat to native prairies. Many of these species are able to quickly degrade habitat quality and negatively impact native plant and animal populations.

This was the third year of gradually ramped up use of the grass specific herbicide Poast. Use has increased from small test plots to larger enhancement blocks. Poast is labeled as a grass specific herbicide that does not harm forbs. With proper timing, Poast is able to impact pasture grasses and does not harm the dominant native Roemer's fescue grass. Many species of non-native grasses have not shown immediate control, and likely will require repeated treatments to eradicate.

Control of tall oatgrass, a highly invasive pasture grass, will be reported in the invasive weed section of this report. This species still largely occurs in discrete infestations and is not ubiquitous across the prairies. In past years, we tried to treat tall oatgrass simultaneously with colonial bentgrass, with less than desirable results. Tall oatgrass needs to be treated sooner in the spring, and delaying treatment to better control colonial bentgrass has resulted in less-than-adequate control of the oatgrass.

### *2006 Review*

Upland prairie pasture grass control in 2006 consisted of Poast spraying on about four acres established for large-scale Collins plots and about 20 acres over eight planting enhancement plots. An additional 10 acres was treated as part of the streaked horned lark habitat enhancement survey (see lark section). Other pasture grass treatments are discussed under subsequent sections of this report.

Throughout the prairies, large areas were treated with Poast to control tall oatgrass. These treatments had varying effects on the oatgrass, but did impact the colonial bentgrass. Tall oatgrass treatments are discussed under the invasive weeds section.

After two years of treatments, it is looking promising that we will be able to gain control of bentgrass with minimal impact to native fescue and forbs. Some signs of stress were noticed on forbs this year, but it is thought that the crop oil surfactant may have caused some phototoxicity. We will evaluate other adjuvants for future treatments.

**PASTURE GRASS CONTROL SUMMARY TABLE**
**April-June**

- Conducted Poast treatments for large-scale Collins plots on about 4 acres total (3874).
- Applied Poast on pasture grasses on 8 plots totaling about 20 acres for butterfly and prairie habitat enhancement project (3876).
- Controlled pasture grass on about 10 acres of the lark enhancement plots. (3877)
- Sprayed Poast to small area around the rare plant Popcorn flower (*Plagiobothrys)* to control invading grasses (3874).
- Sprayed glyphosate to control grasses for future mesic prairie planting plots (3874).

### *Tasks*

All of the following treatments were made 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. Maps of treatment areas are at the end of this section.

*Collins Large-Scale Plots*. A component of the Collins prairie enhancement project was to increase the size of the small scale plots to evaluate the scalability of the results. Two large plots (about 2 acres each) were established in spring and treated with Poast. Additional treatments will follow the same prescriptions as the smaller plots during 2007.

*Enhancement plots.* All of the previously established upland and mesic prairie enhancement plots were treated with Poast this spring to control colonial bentgrass and facilitate establishment of plantings. For several of these plots, it is the second Poast treatment, and shows promising signs that the bentgrass has been severely impacted with minimal indication of damage to fescue and other forbs.

*Plagiobothrys*. A population of the locally rare plant *Plagiobothrys* is located in the eastern half of 13th Division Prairie. This population occurs in a minor road, around a mud puddle. The infrequent vehicle traffic likely keeps the invasive grasses under check and allows the rare annual to germinate and produce seed. We tried to expand the open ground by controlling grasses with Poast in a small portion of the area. However, the treatment had sever impacts to the *Plagiobothrys* and may have killed several individuals before seed could be set. It is possible that the surfactant is responsible for the damage done. Future treatments will be carefully conducted in light of this information.

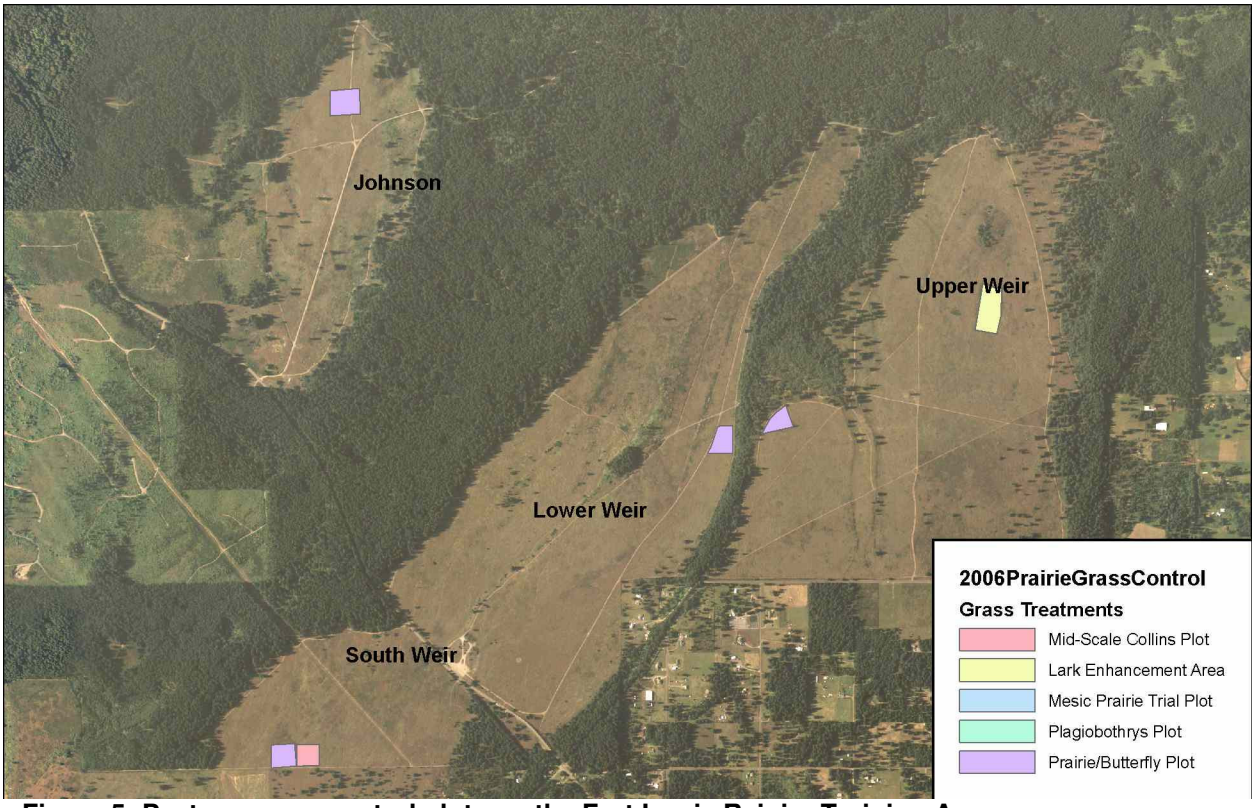



**Figure 5: Pasture grass control plots on the Fort Lewis Rainier Training Area.**

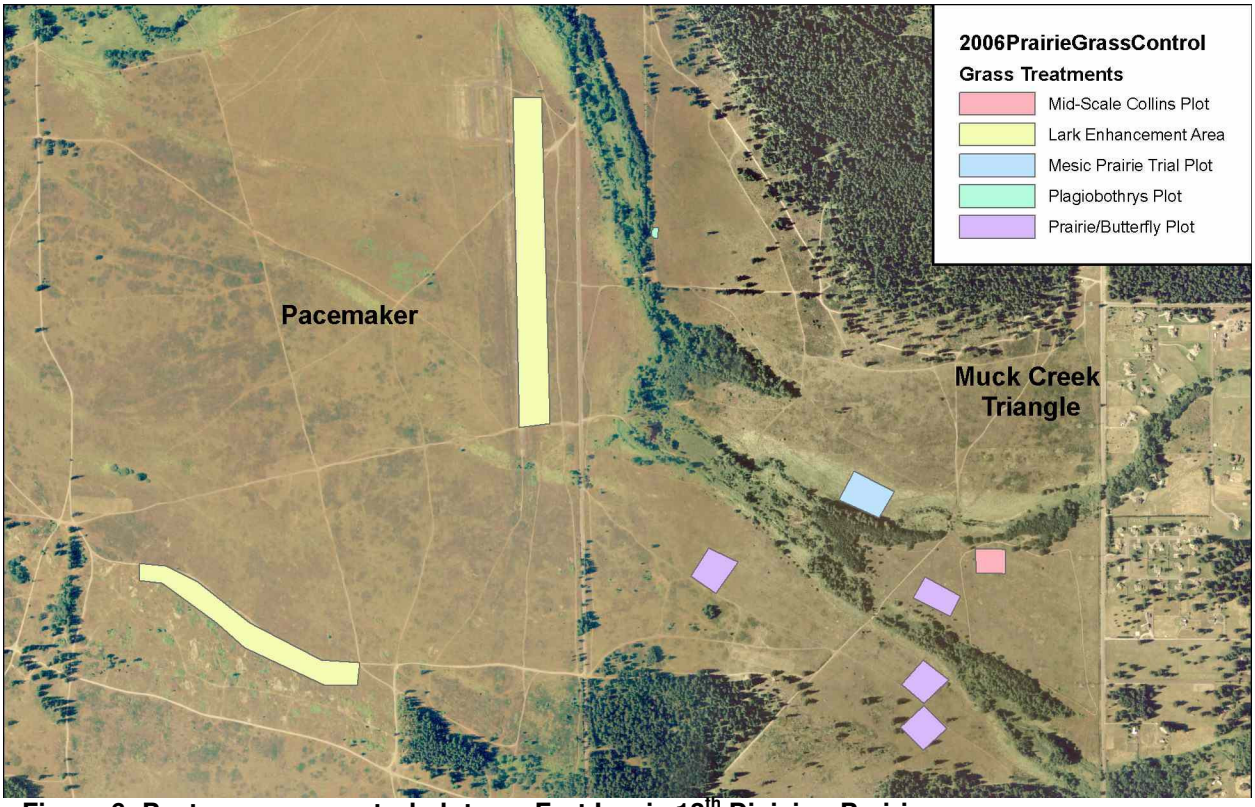



**Figure 6: Pasture grass control plots on Fort Lewis 13th Division Prairie.**

## 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.

### *2006 Review*

Altogether, 67,380 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 Figures 8 and 9 for an overview of species of plantings.

**PRAIRIE PROPAGATION AND PLANTING SUMMARY TABLE**

**January-March**

- Propagated 23,000 plugs for fall 2006 and Winter 2007 (4808 & 3861)
- Established 480 square feet of seed production beds for prairie plant species. This augments the 2400 square feet established for the Collins project (4808).
- Germinated 8 out of 27 targeted locally rare Fort Lewis prairie plant species for seed production and enhancement planting (4808).

- Planted 21,400 plugs of prairie plants in three planting location at 13th Division, South Weir and Upper Weir Prairies (3861).

**April-June**

- Transplanted plugs into 260 square feet of beds for rare plant seed production (3861).
- Maintained 60,000 plugs for planting in fall 2006 and winter 2007.
- Conducted enhancement planting plot measurements on plots at Morgan Prairie and Glacial Heritage (3874).

**July-September**

- Collected seed from 44 species of prairie plants (3874).
- Maintained 50,000 plugs for planting in fall 2006 and winter 2007.
- Initiated seed bed construction (Legacy)

**October-December**

- Planted 35,000 native fescue plugs for pipeline restoration following spray treatment with Roundup to control weeds (Pipeline)
- Sowed 12,000 plugs of *Viola adunca* and *Castilleja hispida* for fall 2007 outplanting (3874).
- Built 40 propagation tables and installed irrigation for legacy propagation (Legacy)
- Planted 10,900 prairie forbs into Fort Lewis seed plots (Legacy)
- Planted 2520 plugs at the Muck Creek Triangle enhancement plot (3874).
- Completed construction and sowing of 50 legacy prairie seed beds with irrigation (Legacy)

### *Prairie Plantings*

A significant amount of the 2006 plug production was diverted to boost the Legacy seed production project. Plugs of select plant species were planted into seed beds at Shotwell's or into the enhancement seed plots at Fort Lewis. These plugs essentially boost the seed production timeline by one-year for the species planted. However, the 2006 fall enhancement planting effort was significantly diminished.

*Winter 2006 Enhancement Plantings. .* A total of 21,400 plugs were planted in three locations at the end of winter quarter. Two of the plantings were for general prairie enhancement and the third was for the Upper Weir Prairie road closure. See prairie planting maps at the end of this section for planting locations. The table below provides a summary for each planting.

- *13th Division Prairie*. Two enhancement plots were planted with 8200 plugs south of South Creek. This is a continuation of previous enhancement planting efforts designed to improve habitat in the last known location used by Taylor's checkerspot butterflies and an area currently used by Puget blues. Plants have been selected that are known to be important host and nectar resources for these butterflies. We believe that these plantings are improving the habitat such that it will be possible, with Fort Lewis support, to reintroduce Taylor's checkerspots in the near future.
- *South Weir Prairie*. This is an ongoing planting enhancement plot, that was planted with 6500 plugs. It is located adjacent to TNC's Morgan property which is undergoing significant butterfly focused habitat enhancement. This area is part of the Johnson/Weir Prairie complex, that currently supports Puget blue and valley silverspot butterflies. With sufficient enhancement, it may be able to support other rare butterflies.
- *Upper Weir Enhancement Area*. 6700 plugs were planted into the Upper Weir enhancement area.

- *Upper Weir Road Closure*. The site was prepped under a prior task order. Much of the prairie vegetation on Upper Weir Prairie is in excellent condition but this habitat is somewhat fragmented by roads. Two roads that pass through high quality prairie were decommissioned and these plantings were designed to restore the native prairie plant community on the old roadbed.

*Fall 2006 Enhancement Plantings.* The plugs that were important to butterfly enhancement or were not used in the Legacy seed production project were either planted for prairie enhancement in fall of 2006 or will be planted in winter 2007. Fall planted plugs were planted at the Muck Creek Triangle site in an area that has been treated with Poast. This area is a potential future release site for the Taylor's checkerspot butterfly. Several species were bare root plants from Fourth Corner Nursery. The table below indicates which species were planted.

**TABLE 2: Summary table of species planted on Fort Lewis during 2006**

| Plug Species | Winter South Weir Prairie | Winter Upper Weir Prairie Road | Winter 13th Division Prairie | Fall Muck Creek Triangle | Fall Legacy seed plots | Fall Pipeline | Totals |
|---|---|---|---|---|---|---|---|
| *Microseris laciniata* | 60 | 180 | 90 | | 1078 | | **1408** |
| *Armeria maritima* | | | | 50 | | | **50** |
| Early goldenrod *(Solidago spathulata*) | 784 | 882 | 784 | | 375 | | **2825** |
| Harsh paintbrush (*Castilleja hispida*) | | | 98 | | | | **98** |
| Nine-leaved lomatium (*Lomatium triternatum*) | 294 | 225 | 196 | 200 | 490 | | **1405** |
| *Lomatium nudicaule* | | | 112 | | 392 | | **504** |
| Oregon sunshine (*Eriophyllum lanatum*) | 402 | 1,583 | 772 | | 1600 | | **4357** |
| Roemer's fescue (*Festuca idahoensi*) | 3,000 | 3,000 | 3,880 | | | 35,000 | **44880** |
| Showy fleabane (*Erigeron speciousus*) | 728 | 450 | 993 | | 1825 | | **3996** |
| Slender leaved cinquefoil (*Potentilla gracilis*) | 286 | | | | 310 | | **596** |
| Small flowered wood-rush (*Luzula campestris*) | 98 | 72 | 196 | | | | **366** |
| *Lupinus lepidus* | | | | 100 | | | **100** |
| Spring gold (*Lomatium utriculatum*) | 520 | 0 | 882 | 200 | | | **1602** |
| Western buttercup *(R. occidentalis*) | 268 | 320 | 228 | 500 | | | **1316** |
| White-top aster (*Aster curtus*) | 15 | | | | 75 | | **90** |
| *Lomatium utriculatum* | | | | | 1470 | | **1470** |
| *Solidago missouriensis* | | | | | 850 | | **850** |
| *Achellia millefolium (BR)* | | | | 100 | | | **100** |
| *Anaphalis margaritacea (BR)* | | | | 50 | | | **50** |
| *Balsamorhiza deltoides (BR)* | | | | 150 | | | **150** |
| *Cammassia leichtlini (BR)* | | | | 100 | | | **100** |
| *Carex inops (BR)* | | | | 300 | | | **300** |
| *Danthonia californica (BR)* | | | | 500 | | | **500** |
| *Delphinium menziesii (BR)* | | | | 20 | | | **20** |
| *Fritillaria affinis (BR)* | | | | 50 | | | **50** |
| *Prunella vulgara (BR)* | | | | 100 | | | **100** |
| *Sisyrinchium idahoensis (BR)* | | | | 100 | | | **100** |
| **Totals** | **6,455** | **6,712** | **8,231** | **2,520** | **8,465** | **35,000** | **67,383** |

*Pipeline Restoration*
In mid-2006, TNC contracted with Williams Pipeline Company to restore the portion of their pipeline upgrade project that crossed 13th Division Prairie at the Muck Creek Triangle. Of the almost one-mile project area, about 800 feet passes through higher quality prairie, 400 feet goes through medium quality prairie, 800 feet through riparian and aquatic habitat and the remainder through degraded prairie habitat. The disturbed area is adjacent to a Fort Lewis road and averages about 70 feet in width.

During fall quarter, the prairie areas within the Triangle and to the south of the triangle were sprayed with Aquamaster (glyphosate) to control weeds. These were then planted with 35,000 native fescue plugs approximately on a 1'X1' spacing. There was not sufficient topsoil to cover the entire width of the restoration area and additional soil will be brought in along the entire site once weeds have been controlled and the flood waters have receded. A series of spray treatments will be administered to control weeds along the pipeline during spring and summer to control invasive weeds. The prairie sections will be planted and direct seeded in Fall 2007. The aquatic areas may require additional time to control canarygrass and may not be planted until fall 2008.

*Enhancement Planting Survival Assessment.* In 2005, enhancement plots were established at Glacial Heritage and Morgan Prairie. These have been measured for survival each spring. This data is available and will be evaluated in comparison with spring 2007 measurements. This assessment will help inform planting strategies at Fort Lewis and other South Sound prairies.

*Legacy Seed Production*
During fall quarter, 40 raised seed beds were built filled with soil, sown with seed and set up with irrigation. These beds are primarily intended to supply seed of rare and difficult to manage annual prairie plants. Additional beds have been established for general seed production of plant species that are highly adaptable and suitable for general prairie enhancement. A custom soil mix was developed with consultation from other growers that consists of 50% medium aged ground bark, 20% sand, 15% pumice, 10% compost and 5% cora. Also, 50 propagation tables were built with irrigation, for propagation of legacy species for direct planting into seed beds.

As of the end of December, all beds have been either direct seeded of plugged with their targeted species. See the diagram below that depicts bed layouts and target species.

In addition, several plugs were sown and planted for establishment in permanent seed/prairie enhancement plots at Fort Lewis at the 13th Division Prairie Cultural Site. See Table 2 above for list of species. These plugs were planted into beds that had been prepared in degraded prairie by laying down thick layers of cardboard and compost. In total, 10,900 plugs were established in the plots. The propagation table below shows what species were planted in these seed plots.

**Figure 7a: Legacy project seedbed layout with species and sowing dates.**

| | |
|---|---|
| Legacy Rhinanthis Christ-galli sown Oct. 24 '06 | Legacy Collinsia parviflora sown Dec 12 2006 |
| Legacy Gilia capitata sown Oct 24 '06 low priority, might be yanked to make room for something else | Legacy Viola adunca trnsplnted Oct 24 2006 |
| Legacy Triodanis perfoliata sown Nov 04 '06 | Legacy Arabis glabra sown Nov 04 2006 germ obsvd Dec 12 |
| Legacy Camassia leichtlinii sown Nov 04 '06 | Legacy Silene antirrhina sown Nov 04 2006 |
| Legacy Plagiobothrys figuratus sown Nov 04, germ early Dec '06 | Legacy Delphinium nuttali sown Nov 2006 |
| Legacy Gaillardia aristata sown Dec 13 '06 w/seed from '05 and '06 | Legacy Lomatium nudicaule sown Nov 2006 oversown Dec 13 |
| Legacy empty as of Dec 13 | Legacy Lupinus lepidus trnsplnt Dec 06 2006 Rod salvaged from Ft |
| Legacy CLAM sown Oct 24 '06 germ Nov 03 '06 | Legacy Perideridea gairdneri sown Dec 13 2006 |
| Legacy PLCO sown Oct 24 '06 germ Nov 06 '06 | Regional VIAD sown Nov 09 '06 |
| Legacy Trifolium tridentatum sown Nov 2006 poss germ Dec 12 oversown Dec 13 | Regional CAHI sown Nov 09 '06 overseeded Dec 13 w/ '05 chaff |
| Legacy Camassia quamash v. azurea sown Nov 2006 oversown Dec 13 | Regional ERLA sown Nov 09 '06 |
| Legacy Brodiea coronaria (?) needs follow-up id confirmation sown Nov 05 2006 | Regional LUAL sown Nov 09 '06 |
| Legacy Lupinus lepidus trnsplnt Dec 08 2006 Rod salvaged from Ft | Regional MILA sown Nov 09 '06 germ early Dec '06 |
| Legacy empty as of Dec 13 | Regional SOSP still to sow |
| Legacy VIAD trnsplnted Oct 26 trnsplt Oct 25 2006 | Regional LOUT sown Nov 09 '06 |
| Legacy Arabis hirsute v. eschscholtziana sown Nov 04 '06 germ Dec 06 | Regional LOTR sown Nov 09 '06 |
| Legacy Trifolium microcephalum sown Nov 04 2006 poss. germ obs Dec 13 | Regional SOMI sown Nov 09 '06 |
| Legacy Zigadenus venenosus v. venenosus sown Nov 04 2006 | Regional DACA trnsplnted Dec 13 '06 sown Dec 13 '06 |
| Legacy Fritillaria affinis (lanceolata) sown Nov 04 2006 | Regional DASP sown Dec 13 '06 |
| Legacy Lupinus lepidus trnsplnt Dec 06 2006 Rod salvaged from Ft | Regional POGR sown Nov 07 '06 |

**Figure 7b: Photograph of newly constructed Legacy seed beds.**

## *Seed Collection*

Seed from about 44 species of prairie plants was collected and cleaned by Fort Lewis and TNC staff and volunteer crews during the late spring and early summer. Much of this seed has already been used for future prairie seed production plots, and will also be used to in plugs for enhancement plantings and for direct seeding. Seed was collected from on and off base sites and funded from multiple sources. Seed is securely stored at Shotwell's nursery facility. See list of species collected in table below.

**TABLE 3: List of seed collected in 2006 and seed requests for each species. Blue cells indicate collections by Fort Lewis staff.**

| Species Name | TNC Request | Collin's Request | Other Project requests | Total collection goal (ml) | Fort Lewis Staff Total Collected(mL) | Total collected (ml) |
|---|---|---|---|---|---|---|
| Achillea millefolium | 0 | 43.4g | | | 0 | 0 |
| Agrostis diegoensis | As Seen | | | | 0 | 0 |
| Anaphalis margaritaceae | | | | | 0.5 | 0.5 |
| Antennaria microphylla | 80 | | | 80 | | 80 |
| Apocynum androsaemifolium | 50 | | | 50 | | 50 |
| Aquilegia formosa | 30 | | | 30 | | 30 |
| Aster curtus | 500 | | | 500 | | 500 |
| Balsamorhiza deltoidea | 300 | 3860 | | 4160 | 200 | 4360 |
| Brodiaea coronaria | | | | 10 | | 10 |
| Brodiaea hyacinthina | 10 | | | 10 | | 10 |
| Calandrina ciliata | | | | | 5 | 5 |
| Camassia quamash | 50 | | | 50 | | 50 |
| Campanula rotundifolia | 30 | | | 30 | | 30 |
| Carex inops | | | | 25 | | 25 |
| Castilleja hispida | 40 | | | 40 | | 40 |
| Clarkie amoena | | | | | | 0 |
| Collomia grandiflora | | | | | 23 | 23 |
| Danthonia californica | 1500 | 5010 | 2000 | 8510 | | 8510 |
| Danthonia spicata | 1000 | 2505 | | 3505 | | 3505 |
| Delphinium nuttallii | 20 | | | 20 | 124 | 144 |
| Dodecatheon hendersonii | | | | 10 | | 10 |
| Erigeron speciosus | 1000 | | 1000 | 2000 | | 2000 |
| Eriophyllum lanatum | 200 | 293 | | 493 | | 493 |
| Festuca roemerii | 10,000 | 4481 | 2000 | 16,481 | | 16,481 |
| Fritillaria lanceolata | | | | 25 | | 25 |
| Gilia capitata | | | | | 6.2 | 6.2 |
| Habenaria greenei | | | | 1 | | 1 |
| Heracleum lanatum | | | | | 550 | 550 |
| Hieracium cynoglossoides | | | | 60 | | 60 |
| Koeleria cristata | | | | As seen | | 0 |
| Lomatium nudicaule | 750 | 2007.5 | | 2757.5 | | 2757.5 |
| Lomatium triternatum | | | | 750 | | 750 |
| Lomatium utriculatum | 150 | 1 | | 1150 | | 1150 |
| Luzula campestris | 35 | | | 35 | | 35 |
| Lupinus albicaulis | 75 | | | 75 | | 75 |
| Lupinus bicolor | | | | 20 | | 20 |
| Lupinus lepidus | | | | 50 | | 50 |
| Marah oreganus | 400 | | | 400 | | 400 |
| Microseris laciniata | 1000 | | | 1000 | 45 | 1045 |
| Panicum occidentale | | | | | | 0 |
| Panicum scribnerianum | | | | | | 0 |
| Plectritis congesta | | | | | | 0 |
| Potentilla gracilis | 50 | | | 50 | 44 | 94 |
| Prunella vulgaris | | | | | 35 | 35 |
| Ranunculus occidentalis | 200 | 626.8 | | 826.8 | | 826.8 |
| Silene scouleri | | | | | | 0 |
| Silene antirrhina | | | | | 1.2 | 1.2 |
| Sisyrinchium angustifolium | | | | | | 0 |
| Solidago canadensis | | | | 500 | | 500 |
| Solidago missouriensis | | | | 500 | | 500 |
| Solidago spathulata | | | | 1000 | | 1000 |
| Viola adunca | | | | 50 | | 50 |

### *Planting Area Management - Invasive Grasses*

As mentioned in the Prairie Pasture Grass Control section above, Colonial bentgrass was controlled with Poast on all past and current planting enhancement sites. 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. See maps at the end of the Pasture Grass Control section for locations of treatment areas.

### *2007 Outlook*

*Planting*. Additional prairie plantings will be conducted during winter 2007 quarter. The remaining plugs to plant are primarily fescue, which will be planted in various enhancement and restoration plots. An additional 2,300 harsh paintbrush that were grown at Shotwell's Nursery will be planted at the triangle by Fort Lewis crew.

*Propagation*. Numerous species will be sown into plug containers during the winter and especially spring. These will be available for enhancement and legacy projects for fall 2006 and winter 2007 plantings.

*Seed Production.* Significant amounts of seed of some species (particularly annuals) should be produced from the legacy seed beds in 2007. Some seed will be used to fill out remaining allocated bed space for species that did not receive enough wild collected seed. Other seed can be used in plug production and direct seed trials.

We are currently evaluating commercially available nursery management software to facilitate organization of the numerous planning details involved with the expanded propagation program. If a suitable software package is discovered, it should be put in place during spring 2007.

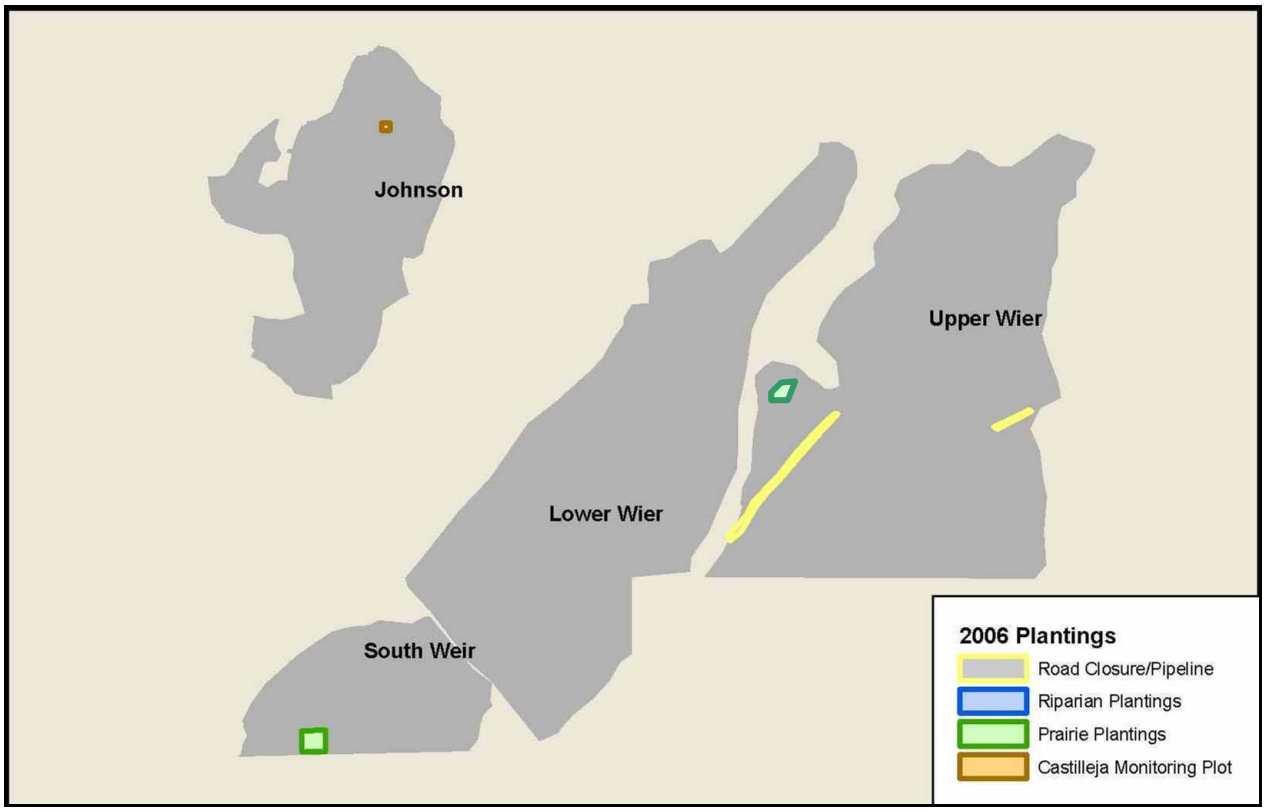



**Figure 8: 2006 prairie planting locations at Fort Lewis Rainier Training Area.**

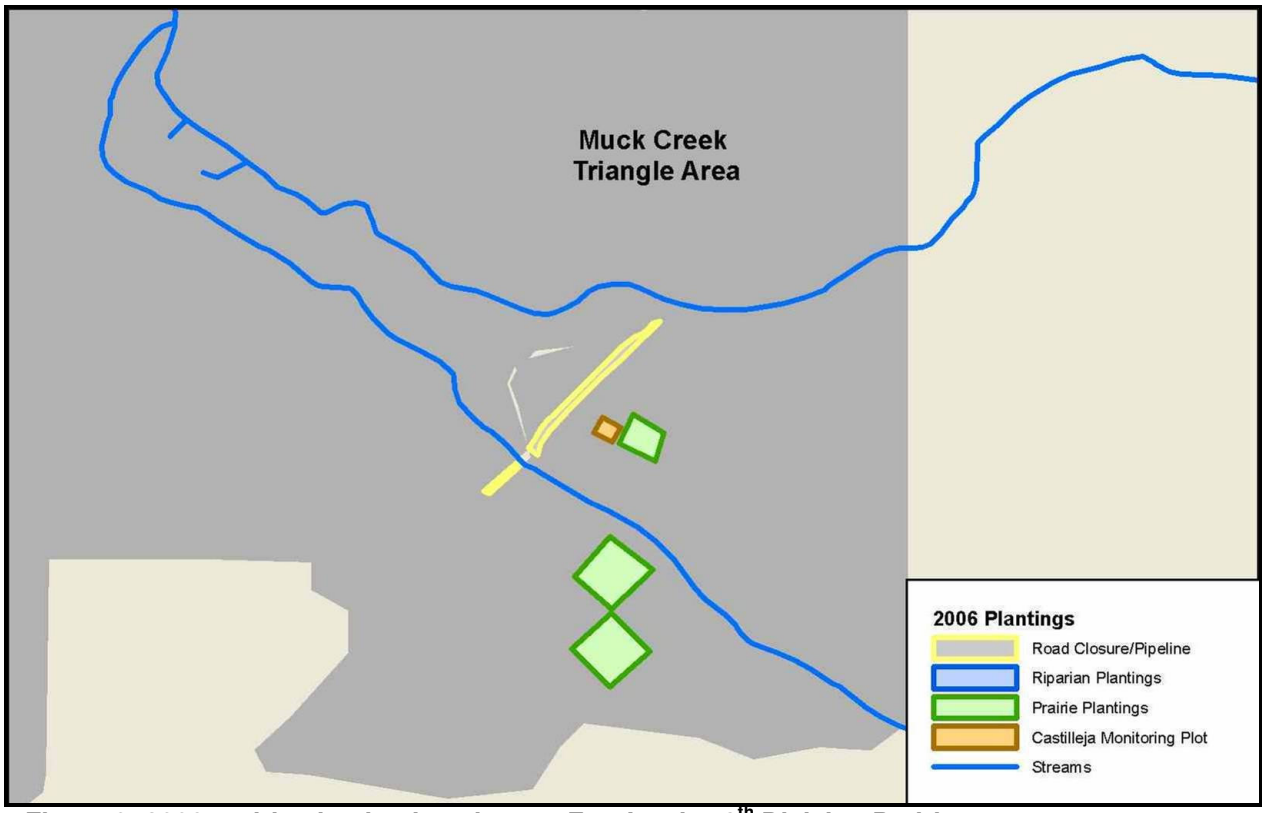



**Figure 9: 2006 prairie planting locations at Fort Lewis 13th Division Prairie.**

## RARE BUTTERFLIES

The Fort Lewis Military Installation is regionally important because it contains the largest remaining prairies in South Puget Sound and provides 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 populations have declined from historic conditions, but 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.

Butterfly habitat enhancement consists of controlling habitat modifying invasive weeds and strategically increasing abundance and diversity of plant species that provide nectar and forage for the various butterfly life stages. While butterfly funding is intended to promote butterfly conservation, butterfly enhancement work simultaneously promotes healthy prairies that support a wide range of native plants and animals.

### *2006 Review*

As usual, habitat enhancement was the main emphasis of this year's butterfly work. Enhancement work is reported under the Scotch broom, pasture grass and planting portions of this report. Castilleja plots that were planted in fall 2004 were assessed to determine survival. Also, a survey for valley silverspot butterflies was conducted.

Zerene Monitoring

**BUTTERFLY SUMMARY TABLE**

**January-March**

- Planted 21,000 forbs to improve butterfly habitat and prairie plant communities. (3861).

**July-September**

- Conducted survival assessments for Castilleja *hispida* at plots on 13th Division and Johnson Prairies (3874)

**September-December**

- Conducted Valley Silverspot monitoring (3876)

## *Tasks*

*Castilleja Plots*

We are conducting harsh paintbrush (*Castilleja hispida)* field trials that are designed to be representative of survival and growth in other outplantings. This species is an important larval food resource for Taylor's checkerspot butterflies. Two plots at 13th Division and Johnson Prairies were planted with plugs in November 2004 and assessed for survival and vigor in July 2006. At this time, plugs of harsh paintbrush exhibited survival rates of 38% - similar at both sites. Anecdotally, it seems that survival is largely correlated to initial plug vigor and weed competition. We recommend a repeat evaluation of all transplants in 2007.

A report of this project titled "Castilleja hispida survival in butterfly hostplant outplantings" is available for more detailed information.

*Valley Silverspot Monitoring*

This project was originally intended to determine habitat use but valley silverspot butterflies (*Speyeria zerene bremnerii*) on Johnson Prairie, determine habitat use on other nearby sites, determine population size on Johnson Prairie and evaluate potential translocation sites elsewhere on the Fort. Previous surveys indicate that valley silverspot butterflies are largely restricted to Johnson Prairie and adjacent areas within Fort Lewis. Scattered sightings outside this area have been reported but these are likely individuals dispersing either from undiscovered populations on the Fort or outside the Fort. Unfortunately, the population was extremely low on Johnson Prairie and elsewhere in the butterfly's range in 2006.

Nine surveys between July 22 and September 7 were conducted to determine which areas the butterfly was using. The first three surveys were done using a zig-zag pattern that covered all of Johnson Prairie with approximately equal effort. These transects took between 2.5 and 3 hours each. Only one individual was spotted during this phase and it became clear that either the flight timing was dramatically different than in previous years or that numbers were extremely low.

Because the numbers detected were so low, later surveys attempted to locate high use areas where nectar and host plants would make it more likely that individuals would be located. No additional sightings were made in six 2.5 hour plus visits to this site.

As part of these surveys, nearby areas were also searched, including all areas where valley silverspots were identified in the 2004 survey of the Fort. This included western 13th Division Prairie and a few locations on Weir Prairie. No valley silverspots were identified.

Valley silverspot numbers were down across western Washington and other fritillaries experienced declines as far away as British Columbia and Oregon. Several sites that had high numbers in previous years were nearly or totally devoid of valley silverspots in 2006 (Kelly McAllister, Dave Hays, Barry Bidwell personal communication). Other valley silverspot populations were severely depressed this year: Glacial Heritage, Scatter Creek Wildlife Area, Mima Mounds NAP and nearby Capitol Forest. Norb Kondla (personal communication) indicated that fritillaries populations were lower by 80-90% in southern British Columbia and Alberta in 2005 and 2006. He speculated that climatic factors are playing a role.

Whether or not this population crash is permanent is uncertain. It is not uncommon for butterflies to experience wild population swings but it is much less likely that they will recover in fragmented, degraded habitat, as opposed to populations in high quality, intact habitat.

### *2007 Outlook*

Activities in 2007 will mostly consist of habitat enhancement work as mentioned in sections above. Additional butterfly related tasks are currently being evaluated.

## STREAKED HORNED LARK

The streaked horned lark (STHL) (*Eremophila alpestris strigata*) is a federal candidate species for listing under the Endangered Species Act. 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 large 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 regular 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. Habitat work can sometimes be accomplished for populations of lark in the AIA (Ranges 76 and 51).

### *2006 Review*

This year, most of the lark funding was directed towards STHL habitat enhancement and a habitat enhancement trial. A total of 115 acres of core lark habitat was mowed during the early winter. About 425 acres of broom in core habitat was spot sprayed at 13th Division Prairie and the Artillery Impact Area. These actions have significantly pushed back the broom in critical lark areas and will improved habitat for other prairie plant and animal species well. Scotch broom mowing and spraying activities are reported in the prairie broom section above.

A large prescribed fire was planned for the Pacemaker lark habitat area, but did not come to fruition. Due to its ability to control large areas in an extremely affordable manner, fire is a critical tool for expanding the core lark habitat area. Every effort should be made to re-establish fire as the primary restoration tool in this area.

**STREAKED HORNED LARK SUMMARY TABLE**

**April-June?**

- *Lark Plots* - Conducted vegetation measurements on all experimental lark plots (3877).
- Controlled pasture grass on about 10 acres of the lark enhancement plots (3877).

**July-September**

- *Lark Plots* - Boom sprayed 16 experimental lark habitat plots with triclopyr ester (Tahoe 4e) at Pacemaker and Upper Weir Prairie (3877).
- *WDFW Regional Lark Study* – Contracted continued monitoring of lark populations in collaboration with WDFW (3877).

### *Lark Habitat Enhancement Trial*

In 2006, we initiated a streaked horned lark habitat enhancement trial to determine effective means to develop suitable lark habitat from areas that have become severely degraded. The project was developed with input from Scott Pearson, and designed to dovetail with elements of his habitat assessment work.

In spring, a baseline vegetation evaluation was conducted on a series of plots located east of the Pacemaker landing strip, south of the Pacemaker core lark area, and at Upper Weir Prairie. Results of future treatments will be compared to this initial data.

Subplots at each site were subsequently treated with Triclopyr ester to control broadleaf weeds and with Poast to control pasture grasses.

### *Lark Monitoring.*

TNC cooperated with WDFW and Scott Pearson to conduct regional assessments of streaked horned lark populations. Much of the work was mark-and-recapture of birds that were tagged in previous seasons. The results of this project will be reported by WDFW.

### *2007 Outlook*

The lark habitat enhancement plots will continue to be treated and monitored. Preliminary results from this effort should be available after monitoring work is conducted in spring of 2008. Other lark enhancement work will continue as discussed in the broom control section.

## MAZAMA POCKET GOPHER

For years, pocket gopher recovery actions 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. Based on 2004 and 2006 surveys conducted by ENSR, current populations are thought to be strong on Fort Lewis prairies.

### *2006 Review*

Broom control at the Rainier Training Area and 13th Division Prairie were the gopher habitat enhancement activities for 2006. See the prairie broom section above.

## 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 fir control.

### *2006 Review*

In several areas, fir encroachment onto prairies was managed along with broom mowing. Our mowing decks are capable of cutting Douglas-fir up to about five inches in basal diameter. Most of the invading fir on our priority prairie habitats are much smaller than this. There are areas where fir have become well established and require chainsaws to control. These trees are cut down, or preferably girdled to promote wildlife habitat for rare species, such as the western bluebird and purple martin. Trees are girdled by one of two methods: two horizontal cuts in past the cambium at least six inches apart; or removing at least four inches of cambium in a complete ring around the tree.

**DOUGLAS_FIR CONTROL SUMMARY TABLE**

**April-June**

- Completed mowing and girdling work in Central Impact Area. Girdled a total of 52 acres in winter and spring 2006 (3875)

**October-December**

- Girdled invading Douglas-fir on 335 acres in the Artillery Impact Area (3871)

### *Tasks*

*Central Impact Area.* About 52 acres of fir were girdled or cut in the CIA this spring by Fort Lewis and TNC crew. About one-quarter of this was for oak release, the rest was on encroached prairie. Close to the entire edge of this prairie has had some level of fir control, and over half of the interior prairie firs have been girdled during the past few years. See Figure 10b for map of areas treated in the CIA.

*Artillery Impact Area.* Continuing our effort from past years, TNC and Fish and Wildlife crews were able to get access to control invading fir on the AIA prairie near Range 51. In total, 335 acres of high to low quality prairie had invading fir girdled. Figure 10a below is a map of the area treated.

### *2007 Douglas-Fir Outlook*

Most of the invading fir in the CIA has been girdled in recent years, and the remainder can be managed with less urgency and as opportunity and resources allow. This year's three-day effort with TNC and Fish and Wildlife crews made a substantial dent in the massive fir invasion of the AIA. Although the AIA is over 7500 acres in size, large portions of this have little to no fir invasion. It is conceivable that we could double or triple this year's effort, and cover up to 1000 acres in a given year. In another five years, we may be able to control all the major fir invasions on the AIA.

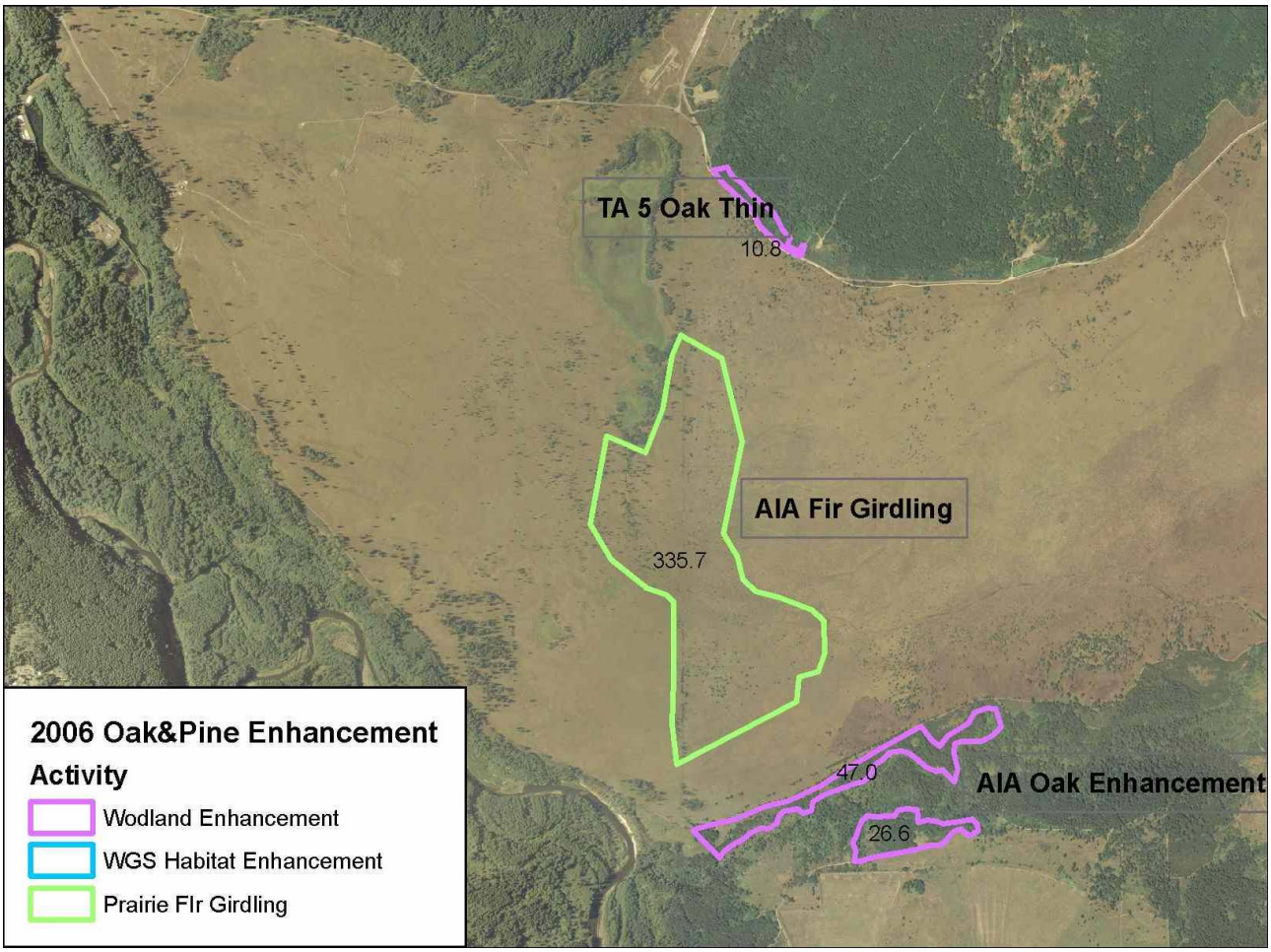



**Figure 10a: Map of Douglas-fir control area in the Artillery Impact Area at Fort Lewis.**

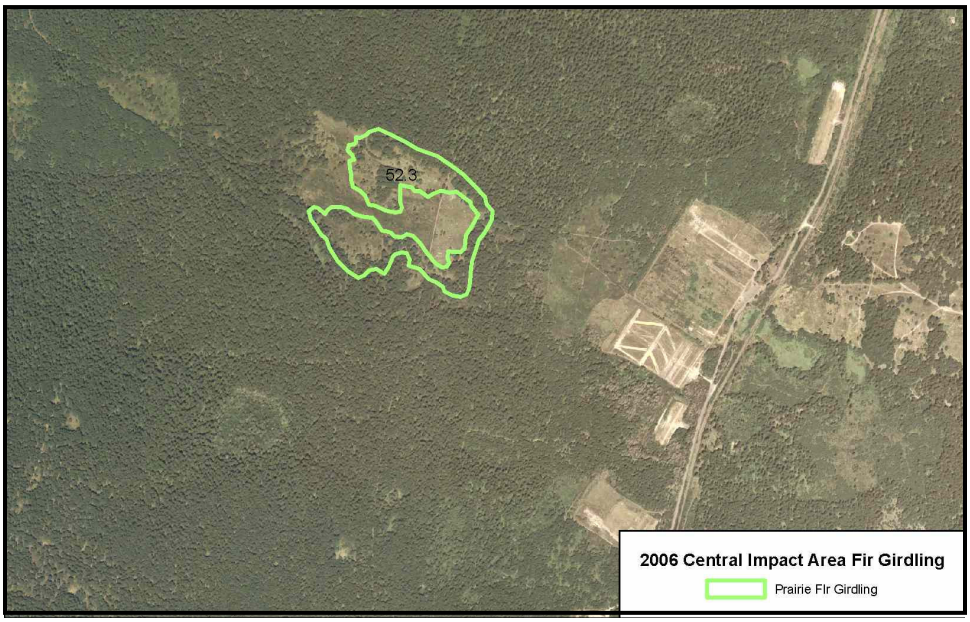



**Figure 10b: Map of Douglas-fir control area in Central Impact Area at Fort Lewis.**

## 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.

### *2006 Review*

**WET PRARIE SUMMARY TABLE**

**April-June**

- Conducted pasture grass and forb control for mesic prairie bioassay project (3874).
- Moisture soil measurements were taken by Fort Lewis crew with TNC guidance (3874).
- Assessed mesic planting bioassay plots (3861).

**July-September**

- Conducted pasture grass and forb control for mesic prairie project (3874).

### *Muck Creek Mesic Prairie*

*Mesic Planting Plots.* Mesic prairie along Muck Creek has significant potential for restoration. This area currently has dense stands of invasive grasses and the bioassay plantings are having a difficult time competing in this environment. As mentioned in the prairie grass control section of this report, the mesic prairie bioassay plots along Muck Creek were treated with Poast in mid-May.

A late spring assessment of the mesic plantings indicated very low survival - too low to warrant conducting a full survey. This project will be discontinued. Although the plantings did not succeed, it is not a failure. We have learned that it is critical to intensively control weed infestations prior to planting in mesic soil conditions. This observation led to the initiation of the mesic prairie site preparation project described below.

*Site Preparation.* A five-acre area north of Muck Creek was treated with Roundup once in spring and again in early summer to prepare the area for larger scale mesic prairie restoration. The area selected had essentially no native species and given the history of the area and the appearance of the soils it had been plowed in the past. We intend to treat the area using tillage and herbicides to reduce the invasive plant seed bank then revegetate the area with native mesic prairie species. Control of the predominant quack grass and other invasive species may take 2-4 years for satisfactory control.

*Landfill.* Soil moisture readings were taken by Fort Lewis staff in a gradient from "upland to wetland edge" at the landfill and at 13th Division Prairie. Measurements were made at intervals from the spring to summer. This data will help us to evaluate the similarity of actual prairie soils to the conditions at the landfill and help assess appropriate plant species to plant along the gradient.

### *2007 Wet Prairie Outlook*

For 2007, we will continue treatment of the mesic prairie site preparation plot, and evaluate the moisture readings from the landfill to guide future planting mixes in the wetter soils at the landfill. Additional Poast applications will be made to the mesic plots to try to control invasive grasses and facilitate future successful plantings.

# 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 that 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 of 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.

## 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.

### *2006 Review*

This year, TNC conducted hair snag monitoring for eastern and western gray squirrels throughout the squirrel conservation triangle. In addition, a second annual fall walking survey was conducted to record direct observations of gray squirrels. A monitoring program was developed to track gray squirrel activity in the trap zone of the eastern gray squirrel control experiment. We also continued monitoring of the deBalon oak stand to document the short-term impacts of management actions on gray squirrels. Finally, Cheryl Fimble wrote and revised the first draft of an article for publication titled: *Monitoring western gray squirrels for management in western Washington*.

**WGS MONITORING SUMMARY TABLE**

**January-March**

- Conducted two squirrel monitoring sessions at Lake DeBalon as part of longer-term effort to track squirrel responses to management activities (3866).
- Monitored squirrel hair snag tubes associated with EGS control until February 28, 2006 (4809).
- Monitored squirrel hair snag tubes associated with EGS control after February 28, 2006 (3875).

**April-June**

- Conducted post management squirrel monitoring at Lake DeBalon (3875).
- Continued post EGS control trapping tube monitoring (3875)

**July-September**

- Conducted directed visual surveys for gray squirrels at five Fort Lewis sites (3875).
- Produced first draft of hair snag tube monitoring paper (3875).
- Continued post EGS control trapping tube monitoring (3875)

**October-December**

- Advised WDFW on locations for live trapping WGS for radio telemetry project. Helped establish trapline of 30 traps. (3901)
- Continued post EGS control trapping tube monitoring (3875)

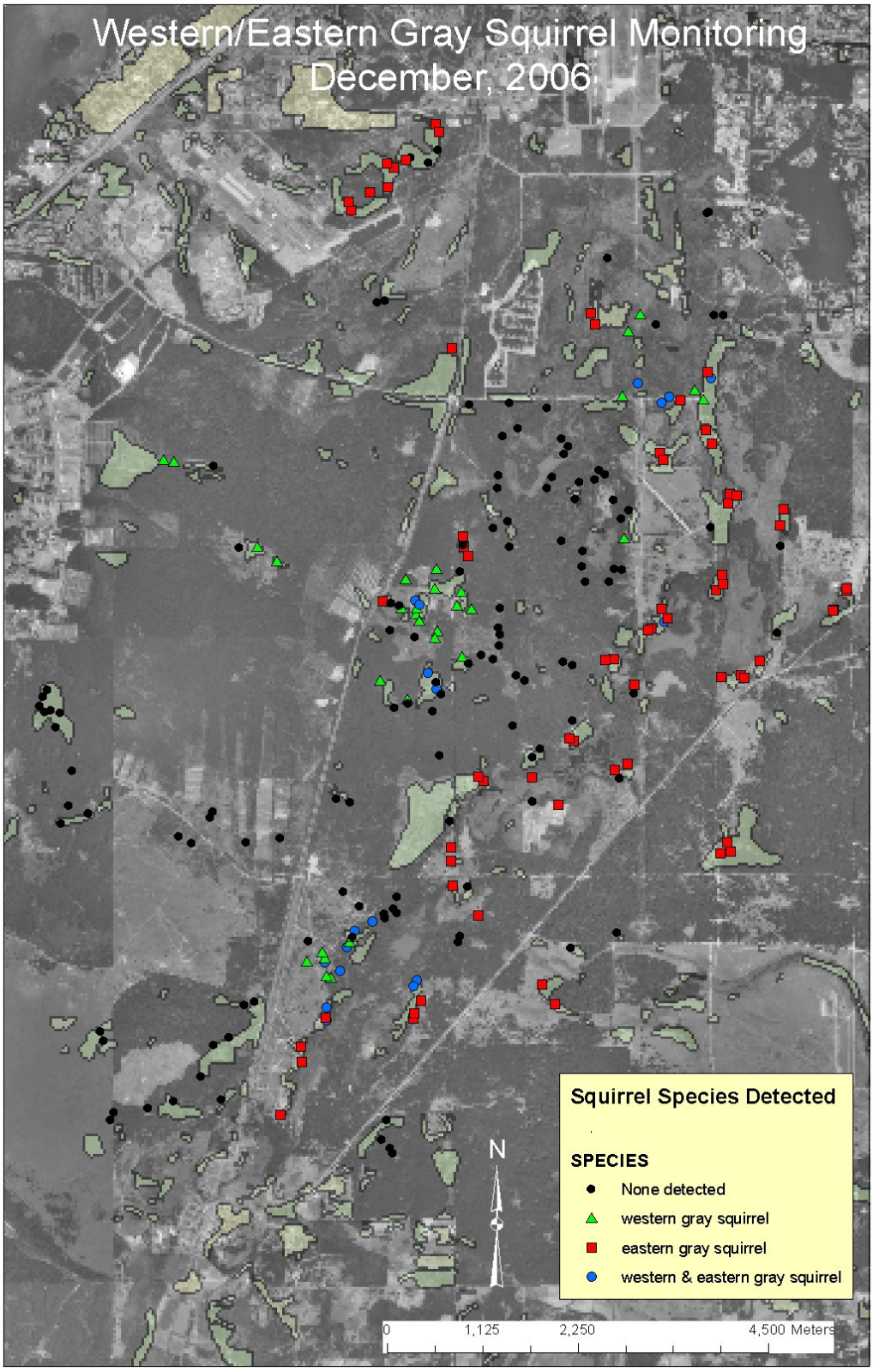
### *General Squirrel Monitoring*

Monitoring for gray squirrel activity using hair snag tubes has been ongoing for nearly three years. To date, a total of 252 tube sites have been established. Most of the sites found to contain western gray squirrel activity were identified within the first year by targeting historical sites with large conifers and oaks and relatively sparse understory vegetation within close proximity to water. Since that time, monitoring sites have been established in a widening network to sample areas outside of the triangle conservation zone, and explore the use of stands adjacent to oak-conifer stands that are more heavily dominated by conifer.

Most often when new squirrel activity occurs at a tube monitoring site, it is the result of eastern gray squirrels. As more data are gathered, a general trend is appearing wherein eastern gray squirrels are more closely associated with riparian stands dominated by hardwoods, and western gray squirrels are more closely associated with mixed stands containing a greater component of conifers. These observations have not been tested quantitatively, but they are consistent with the species' habitat use as described in published literature describing western gray squirrels at Fort Lewis, and eastern gray squirrels elsewhere.

*Visual Surveys.* Directed visual surveys were executed in the fall of 2005 and 2006 to gain a measure of relative abundance among sites and years. Five sites occupied by western gray squirrels were visited on multiple occasions in both years, yielding relatively high observation rates compared with previous research at Fort Lewis (due to the targeting of locales and time where and when western gray squirrels were most likely to be observed). Resulting survey data reveal that this technique can be useful in gaining an index of relative abundance to complement the monitoring data obtained from hair snag tubes. This data set is likely to become more valuable as it grows to provide comparisons among multiple years.

**Figure 11: Results of hair tube monitoring on Fort Lewis 2004 - 2006. Green shading indicates oak-conifer stand.**



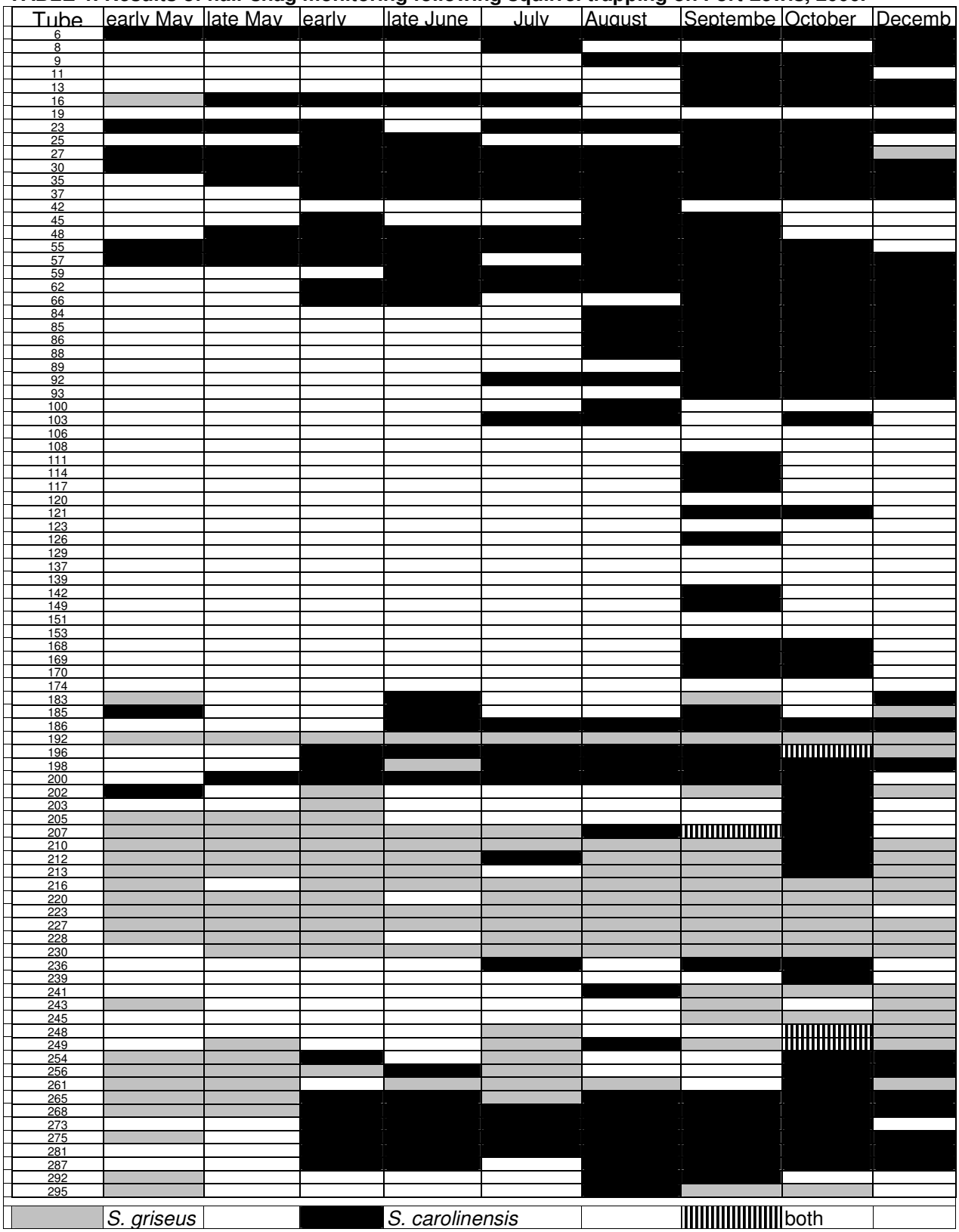
### *Eastern Gray Squirrel Experiment Monitoring*

Results from gray squirrel monitoring in Fort Lewis interior forests revealed an increasing presence of eastern gray squirrel activity. In response, Fort Lewis and partners designed an eastern gray squirrel trap and removal experiment within a priority western gray squirrel conservation zone on Fort Lewis during February - April, 2006. The experiment's purpose was to evaluate the potential for this management action to: reduce the activity of the non-native eastern gray squirrel within a defined range on Fort Lewis, and document the response of native western gray squirrels to eastern gray squirrel removal. The experiment commenced with the trapping and removal of 25 eastern gray squirrels during February - April, 2006, followed by hair-snag monitoring to evaluate the impacts of this action on eastern and western gray squirrel distribution.

Results from the post-trapping monitoring initially (early May 2006) revealed a relatively restricted distribution of eastern gray squirrel activity (8 out of 87 tubes, 0.09%), and a comparatively more widespread distribution of western gray squirrel activity (22 out of 87 tubes, 0.25%). The eastern gray squirrel hairs obtained at this time were likely derived from animals that were known to be present during the trapping operation, but evaded capture despite considerable effort to catch them.

More recent results from December 2006 reveal a wider spread distribution of eastern gray squirrel activity (31 out of 87 tubes, 0.36%), and a slightly reduced level of western gray squirrel activity (19 out of 87 tubes, 0.22%). Table 4 gives a more detailed look at the changes in squirrel activity that occurred in the course of the eight months of post-trapping monitoring. The majority of the increased eastern gray squirrel activity took place along the west side of Spanaway Marsh (north end), the west side of Chambers Lake (south end), and the vicinity of Vietnam marsh (central area).

**TABLE 4: Results of hair snag monitoring following squirrel trapping on Fort Lewis, 2006.**



### *DeBalon Oak Release Monitoring*

Intensive monitoring of gray squirrels in the de Balon oak stand was initiated to document the short-term effects of management actions on resident squirrels. The first management action consisted of an oak release timber cutting operation in early – mid December, 2005, followed by eastern gray squirrel trapping and removal in early March and mid April, 2006. Prior to the timber cutting, western gray squirrel hairs were consistently obtained from hair tubes in the interior of the stand for a period of approximately two years, while no eastern gray squirrel hairs had been observed from tubes within the stand during this time. Walking surveys in the fall of 2005, and hair tube monitoring yielded evidence of eastern gray squirrels in the stands to the west and north of the de Balon stand, but not within the interior of the stand. Hair tubes were checked approximately weekly during and immediately after the cutting operation, and thereafter, approximately every 2 - 3 weeks, most recently by TNC field biologist Mary McCallum. Results are summarized in Table 5.

**TABLE 5: Squirrel species detected by hair snag tubes in the interior of the De Balon stand prior to, during, and after timber cutting and eastern gray squirrel control management activities on Fort Lewis in 2005 and 2006.**

| Sample Period | Management Activity Phase | Species Detected |
|---|---|---|
| 23 Nov. – 9 Dec. 2005 | Just prior to and during cutting | Western gray squirrel |
| 9 Dec. – 17 Dec. 2005 | During timber felling and piling | Western & eastern gray squirrel |
| 17 Dec. 2005 – 22 Feb. 2006 | Post timber felling | Eastern gray squirrel |
| 22 Feb. - 10 April. 2006 | Prior to and during trapping | Western & eastern gray squirrel |
| 10 April – 17 Oct. 2006 | 1 - 6 months post trapping | Western gray squirrel |
| 18 Oct. - 31 Dec. 2006 | 7 - 8 months post trapping | Western & eastern gray squirrel |

Based on these hair snag data, it appears that eastern gray squirrels became more prevalent in the stand during and after the timber cutting than they were prior to the timber activity and the reverse was true for the western gray squirrels. It is likely that one or more western gray squirrels were present in the stand immediately following the timber cutting because there was an observation of a western gray squirrel at that time, but the hair tubes did not reveal their presence.

The trapping and removal of four eastern gray squirrels from the stand and traps just outside the stand during the trapping periods in March and April appears to have 'tipped the balance' once again, resulting in increased evidence of western gray squirrel activity in the stand, and the concomitant absence of eastern gray squirrel evidence within the stand. Monitoring results revealed the presence of eastern gray squirrels in adjacent stands in June, 2006, and by October, 2006, eastern gray squirrel hairs were obtained within the deBalon stand. Intensive trapping in the stands surrounding the deBalon stand resulted in the removal of six eastern gray squirrels in December, 2006. This stand will continue to be the focus of intensive monitoring for a period of at least six months to follow gray squirrel activity patterns.

In summary, it appears from these hair tube results that timber cutting in a stand occupied by western gray squirrels can cause changes in the activity patterns of resident western gray squirrels, and nearby eastern gray squirrels. A follow up trap-and-removal management action for eastern gray squirrels in the vicinity appeared to allow western gray squirrel activity patterns to return to those in the pre-timber cutting phase. It also appears that as eastern gray squirrel population pressure increases, they will move into habitat occupied by western gray squirrels. A new study underway by the Washington Department of Fish and Wildlife that incorporates the use of radiotelemetry is expected to provide more definitive information for the two species.

### *Monitoring Article for Publication*

The first draft of an article titled: *Monitoring western gray squirrels for management in western Washington,* was completed and distributed internally (within TNC) for comments. The article presents information regarding the utility of hair snagging devices and the application of resulting data for species and habitat management. Helpful comments were received and incorporated into a revised version of the document. The document is temporarily on hold while Sanders Freed develops a related article describing the eastern gray squirrel control experiment so that the two articles may be submitted for publication together as companion articles.

### *2007 Squirrel Monitoring Outlook*

Monitoring work is expected to continue during 2007 as a focused effort designed to inform management decisions. The need and locations for future EGS control sessions will be determined largely by monitoring results. The DeBalon post-treatment monitoring will continue as will the visual surveys.

Additional tube monitoring may be incorporated into the telemetry and WGS augmentation research effort underway. This will be determined as the project design is developed.

## EASTERN GRAY SQUIRREL CONTROL

Introduced eastern gray squirrel (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.

### *2006 Review*

| EGS CONTROL SUMMARY TABLE |
|---|
| **January-March**<br>• Conducted first two sessions of EGS control project trial (4809).<br>• Conducted third sessions of EGS control project trial (3866). |
| **April-June**<br>• Conducted fourth eastern gray squirrel trapping session (3875). |
| **July-September**<br>• Conducted post EGS trapping tube monitoring (3875). |
| **October-December**<br>• Conducted fifth EGS control session for two weeks at the end of December. (3901)<br>• First draft of EGS control write-up is completed and circulated within TNC for review (3901). |

The eastern gray squirrel trapping protocol is described in the EGS Control Plan. The plan called for three trapping sessions, located where EGS threaten WGS habitat according to monitoring results. Each trapping session was preceded by a two-week baiting period, during which the live traps were wired open to build familiarity with the trap and the food source. After each bait period, traps were activated and checked daily and re-baited for eight days. All captured WGS were ear-tagged and released. EGS were euthanized in a manner that is professionally recognized as the most humane.

Two additional targeted trapping sessions were initiated when tube monitoring found EGS had been missed by the first three sessions or recruited from surrounding areas. The first targeted trapping session occurred immediately following the first three and simply reused the previously established trapping points. The second targeted session occurred in December and focused on the Lake DeBalon area, were several EGS had reestablished.

General results are provided in Table 6 and Figure 13 below. In total, 31 EGS were captured and removed. Eleven WGS individuals were captured and tagged. More

specific details of the project are forthcoming in a report by Sanders Freed that is expected to be released and published in 2007.

Monitoring indicates a rapid increase in eastern gray squirrel activity in the trapping zone (see monitoring section above) following trapping. In spite of these discouraging results, it is important to note that the trapping operation was successful in removing 31 eastern gray squirrels, the majority of which were males, suggestive of a colonizing population rather than an established population. Trap and removal of eastern gray squirrels is much more likely to be effective as a management tool if conducted in the early stages of colonization. Delays markedly reduce the chances for successful management of larger established populations, as observed in Europe.

**TABLE 6: 2006 Fort Lewis eastern gray squirrel control results through session 4.**

| | |
|---|---|
| Session 1<br>February 6-13 | 6 EGS captured - all males<br>1 WGS captured - female at northern Spanaway |
| Session 2<br>March 6-13 | 8 EGS captured - 4 females and 4 males<br>2 WGS captured - both females at Debalon |
| Session 3<br>March 27-April 3 | 6 EGS captured- 3 females and 3 males<br>3 WGS captured - 2 females and one male |
| Session 4<br>April 11-14 &<br>18-24 | 5 EGS captured – 2 females and 2 males<br>1 male WGS captured |
| Session 5<br>December 7-23 | 6 EGS captured – 1 female and 5 male<br>4 WGS were captured and tagged<br>1 WGS was recaptured |

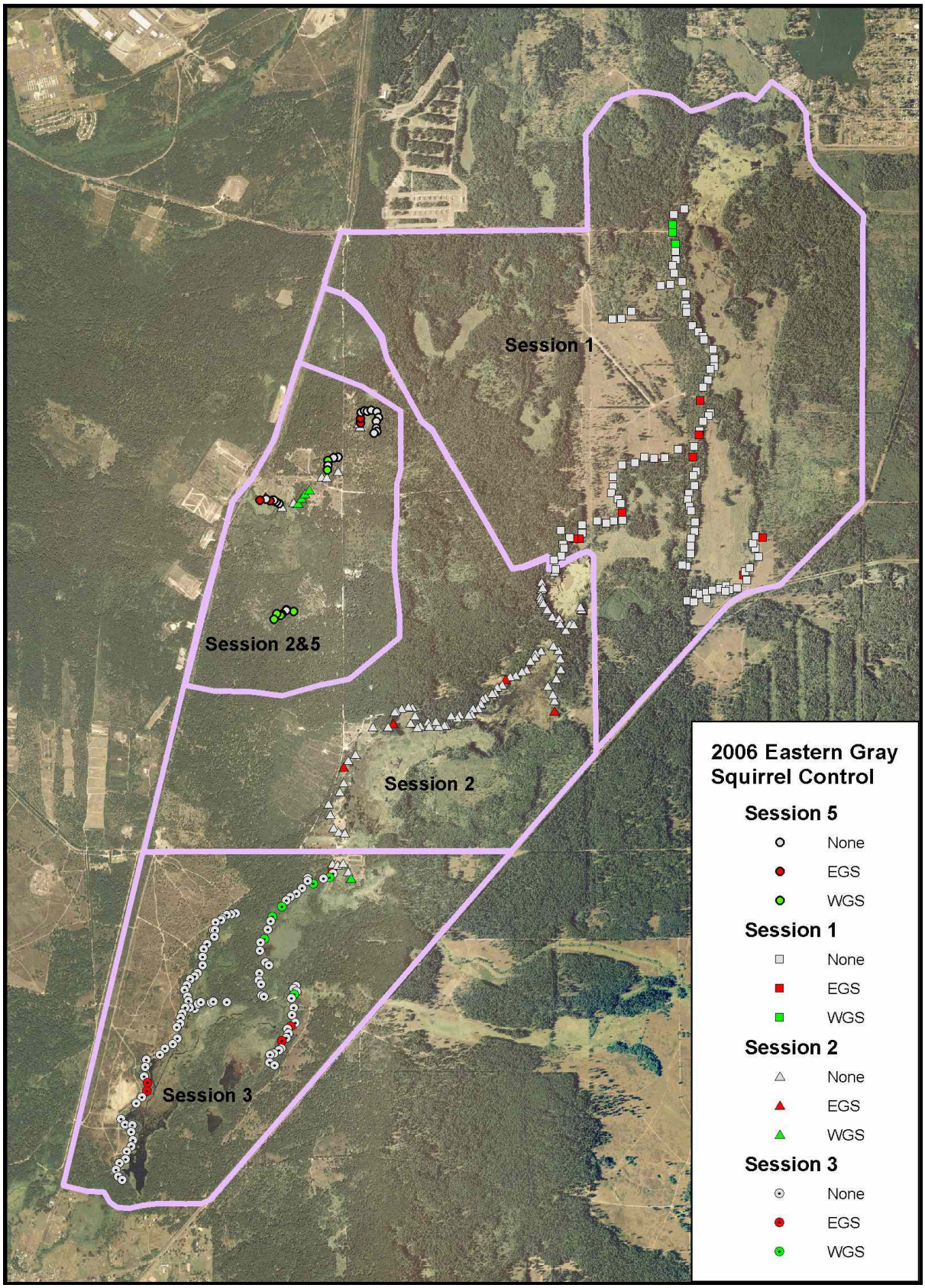



**Figure 13: Map of 2006 eastern gray squirrel control results for each trap set at Fort Lewis.**

## 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 are applied to the wooded habitats.

Woodland related work can be thought of as focusing on two slightly different aspects. Funding that comes from Fort Lewis Fish and Wildlife targets oak and pine enhancement with an emphasis on WGS recovery. Funding that comes from the Forestry Department emphasizes enhancement primarily of the woodlands themselves. Therefore, Fish and wildlife funding tends to focus on areas that are currently occupied by WGS or could be future habitat.

### *2006 Review*

About 380 acres of pine and oak habitat were treated in 2006. Of this, 296 acres were mowed or cut for broom and small invading firs. Another 87 acres were treated by girdling larger firs. Portions of the treated areas were simultaneously treated with mowing and girdling. Another 11 acres had over-dense young oaks that we thinned to a more open prescription. The maps at the end of this section describe the areas that were treated.

**BROOM AND DF CONTROL SUMMARY TABLE**

**January-March**

- Mowed 173 acres of Broom and small Douglas-fir to enhance habitat and reduce fire fuel loading in core WGS habitat (TA's 8, 10 and 12) (3866).
- Mowed about 16 acres of broom in the south Central Impact Area to complete task started at the end of 2005 (3867).

**April-June**

- *Training Area 6.* Mowed 11.9 acres of competitive woody species in Sieber staked area (3867).
- *Training Area 10.* Mowed 4.6 acres of competitive woody species near Holden Woods and completed about one-half of the targeted Douglas-fir girdling. Mowed additional 23 acres in TA 10 near gravel pit (3867).
- *CIA Fir Girdling.* Girdled Douglas-fir around oaks in the central CIA prairie on about 15 acres (3875).

**July-September**

- *TA 8 Enhancement* – Mowed broom and small woody invasives and girdled fir over 5 acres (3867).
- *TA 10 Enhancement* - Mowed broom and small woody invasives and girdled fir over 8 acres (3867).
- *Seibert Staked TA 6* – Mowed and brush cut 12 acres (3867).
- *TA 8 Mowing* – Treated 13 acres to control broom and fir (3875).
- *TA 12 Mowing* – Treated 13 acres to control broom and fir (3875).

**October-December**

- *TA 5.* Thinned 11 acres of young oak and mowed broom (3867)
- *AIA Fir Girdling.* Girdled 47 acres of Douglas-fir that encroached on oak woodlands (3871).
- *South Impact Area Oak Enhancement.* Cut broom and girdled fir on about 27 acres of oak woodlands (3871).

## *Tasks*

*Artillery Impact and South Impact Area*
A total of 74 acres of oak woodland were enhanced in the AIA and SIA on opposite sides of Muck Creek. On the north side of the creek, TNC and Fish and Wildlife crews girdled encroaching firs. This not only opens up growing space for the oaks, but also will create wildlife snags. On the south side of the creek, crews controlled Scotch broom and girdled firs to promote more stable fire conditions.

*Western Gray Squirrel Enhancement Mowing*
Approximately 200 acres of oak and pine woodlands were mowed to enhance understory habitat in TA's 8, 10 and 12. Mowing polygons were all within core WGS habitat as indicated by prior tube monitoring. Scotch broom and small Douglas-fir were primary targets for mowing. Mowing activity ceased prior to March 15 to avoid disturbing western gray squirrel during sensitive breeding and rearing season.

Many of these areas have been repeatedly mowed in the past and are at a point where they require more lethal measures to control the broom. Broom has begun re-sprouting rapidly after mowing, and we can no longer keep up with the areas we have mowed. As with prairies, prescribed fires needs to be better developed as an enhancement tool for oak and pine woodlands. Herbicides are a possible option for lethal broom control, but we will need to conduct trails to determine if there are negative impacts to the oak overstory from the herbicide.

**Figure 14: Training Area 12 before and after mowing broom.**

*Oak and Pine Woodland Enhancement*
We were able to conduct work for the Forestry Department on many of the important pine and oak woodlands during 2006. Tasks ranged from mowing broom and small encroaching fir to enhance stability against prescribed or accidental fires, to girdling encroaching firs, to thinning over-dense young oaks and pines. The projects completed in 2006 include:

- Mowed and released 8.2 acres of Ponderosa pine/Oregon white oak woodland in TA 10 from Douglas-fir competition.
- Ponderosa pine release was conducted on 5 acres just south of the ammo depot in TA 8, completing this project.

**Figure 15: Training Area 8 Douglas-fir girdling around Ponderosa Pine.**

- Mowed and brushcut 12 acres in the Siebert staked portion of TA 6 to control Scotch broom under Ponderosa Pine.

**Figure 16: Training Area 6 after mowing broom under pines.**

- Several site visits were made to the TA 12 oak thinning site to clarify prescriptions and evaluate required effort. A single day was spent thinning on the western edge. The remainder of work is scheduled for mid-October

- Mowed 23 acres of broom and young fir in TA 10 near gravel pit.
- Mowed about 16 acres of broom in the south Central Impact Area to complete task started at the end of 2005.
- Thinned 11 acres of young oak to promote stable growth and fire resistance. Also mowed broom along power line at bottom of unit.

*Central Impact Area Central Prairie Enhancement*

Girdling Douglas-fir and mowing Scotch broom was conducted throughout a large portion of the CIA prairie this year by TNC and Fish and Wildlife crews. About 15 acres of this included girdling fir and mowing around oaks and oak woodlands. This activity is also described under prairie broom and fir control sections earlier in the report.

## *2007 Outlook*

Upcoming projects will be established with Fish and Wildlife in early 2007. A list of prioritized enhancement projects will be developed. 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. The Fort Lewis Fish and Wildlife Program has submitted requests to the wildland fire program manager to begin prescribed burns within selected oak habitat. 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.

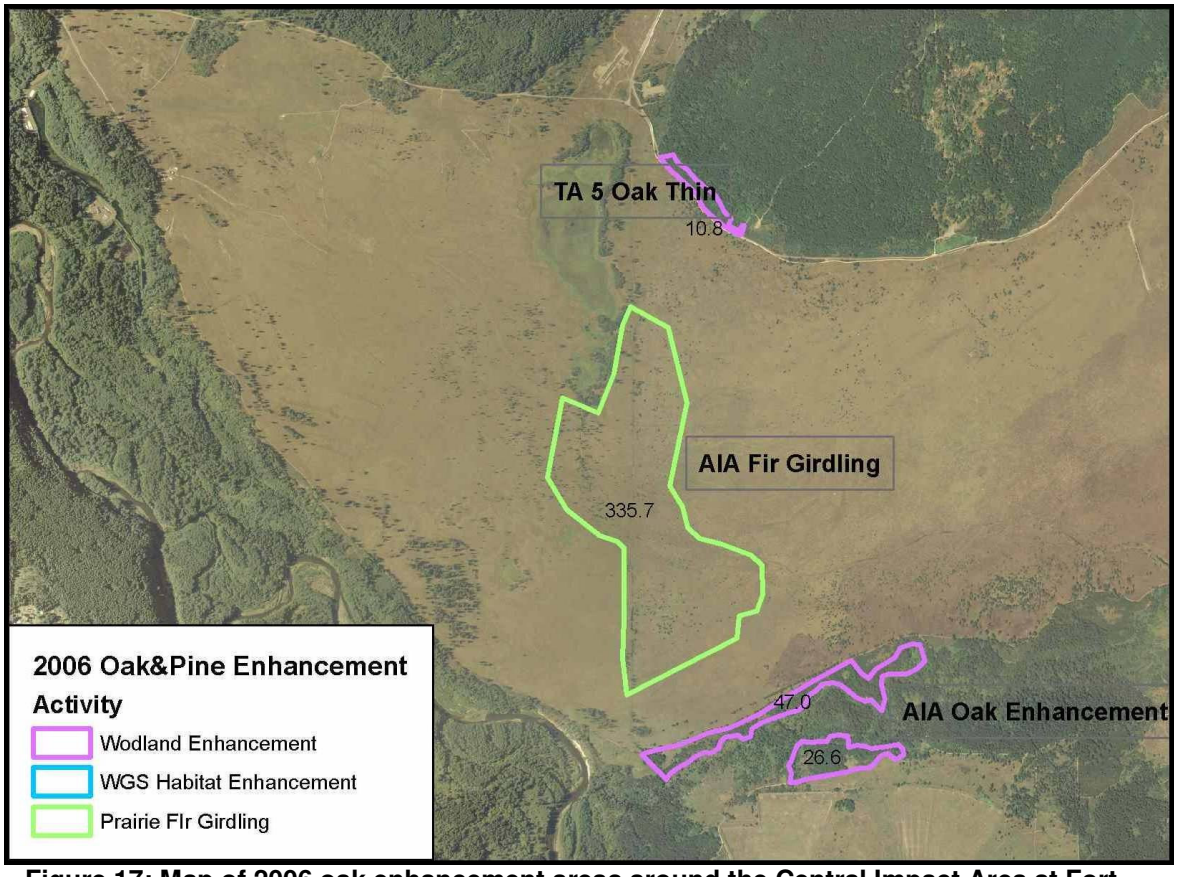



**Figure 17: Map of 2006 oak enhancement areas around the Central Impact Area at Fort Lewis.**

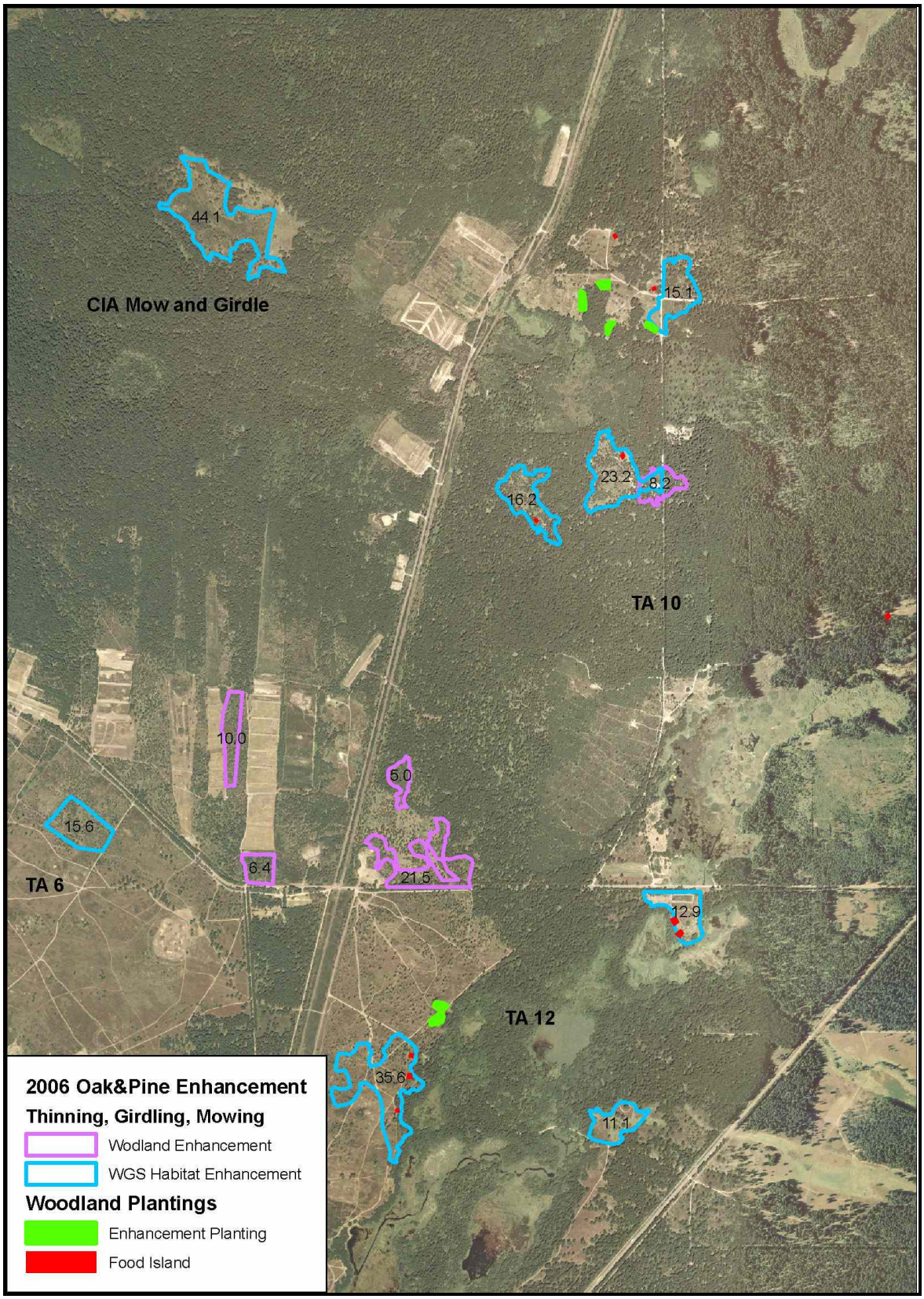



**Figure 18: Map of 2006 oak and pine enhancement areas in Training Areas 6, 10 and 12.**

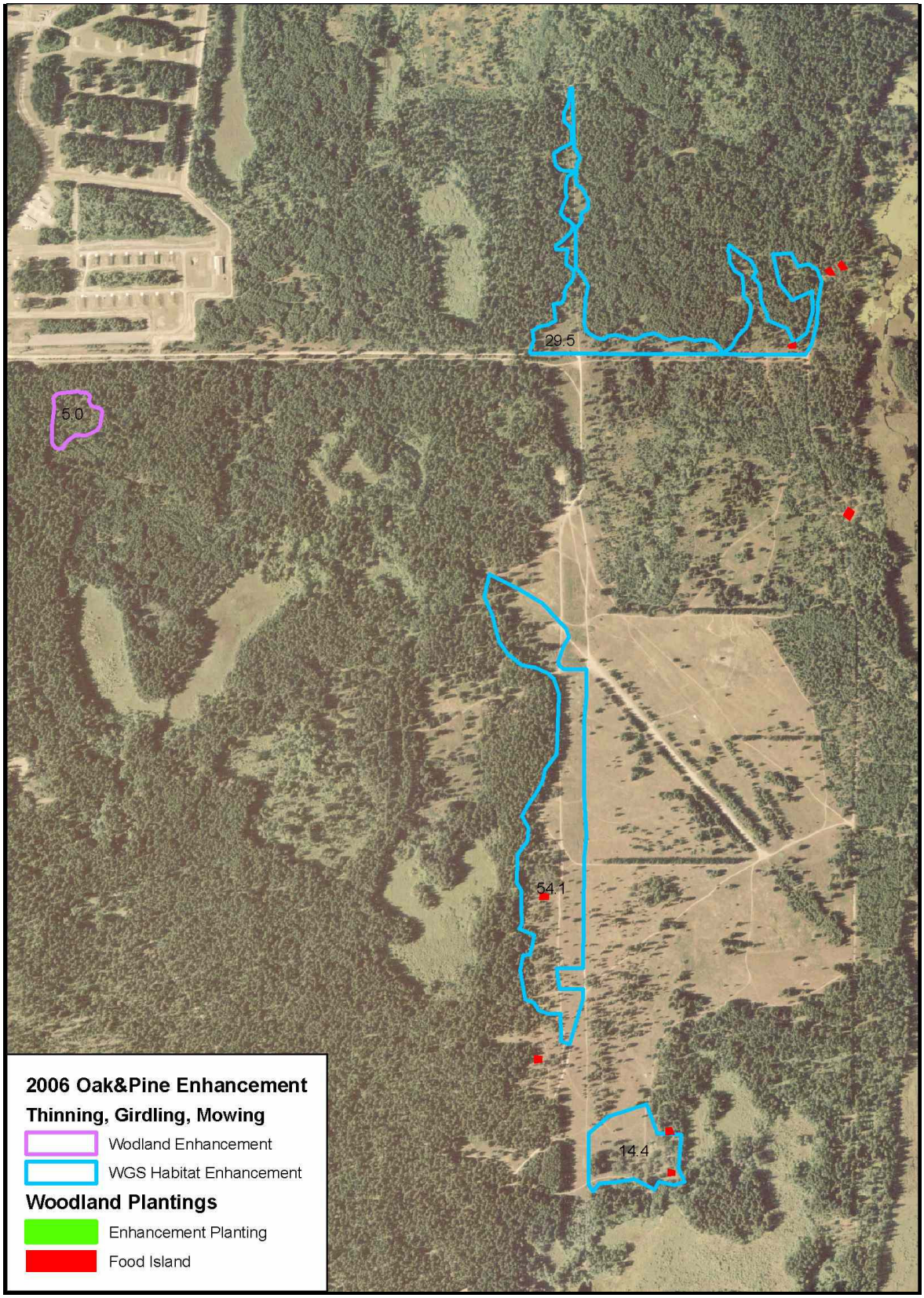



**Figure 19: Map of 2006 oak enhancement areas in Training Area 8 at Fort Lewis.**

## 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.

### *2006 Review*

Approximately 2110 potted shrubs and trees were planted in pockets throughout the "Squirrel Triangle". Maintenance brush control was conducted around all previous years food island plantings and enhancement plantings at Lake DeBalon.

| OAK PLANTING SUMMARY TABLE |
|---|
| **January-March** |
| • Planted 2,110 trees and shrubs to benefit WGS habitat (3866). |
| **April-June** |
| • Pulled and cut brush around all previous years food island plantings and plantings at Lake DeBalon (3866) |

### *Western Gray Squirrel Enhancement Plantings*

Several squirrel habitat enhancement plantings occurred during winter quarter. In total 2,110 trees and shrubs were planted. See map of squirrel plantings in Figures 18 & 19. (All plantings funded by White Oaks - 3866)

- *Lake DeBalon.* This area is central to the efforts to enhance western gray squirrels on Fort Lewis. Tube monitoring has revealed presence and sightings have confirmed several individuals. This planting is adjacent to previous enhancement planting efforts. In all, 650 plants were added to the site. Plantings are aimed at enhancing food opportunities at the site and increasing the size of suitable habitat in the area. The planting consisted of the following species: Oregon White Oak-150; Indian Plum-100; Serviceberry-200; and California Hazelnut-200.
- *Shaver Lake*. As a result of tube monitoring and sightings, Shaver Lake has been identified as a priority WGS restoration site. The site contains all WGS habitat requirements, including proximity to water, large, various foraging sources, and limited understory. In all, 350 plants were planted of the following composition: 50-Oregon white oak; 50-Indian plum; 150-California hazelnut; 100-Serviceberry;
- An additional 550 plants which were surplus from a Fort Lewis Fish and Wildlife project were dispersed throughout the Shaver Lake and DeBalon sites. All of these additional plants are native and many are also food bearing which will add to the

connectivity and foraging opportunities for the western gray squirrel available at each site. In total 550 shrubs and trees were planted: beaked hazelnut-50; bitter cherry-150; choke cherry-50; Oregon white oak-250; Indian plum-25; and service berry-25.

- *Food Islands.* Twenty additional food island plantings were established this winter that are designed to help provide linking habitat for WGS populations at Shaver Lake and Lake DeBalon. Plantings consist of both overstory and understory food producing plants. Each food island contains 28 plants for a total of 560 trees and shrubs. Each food island contains 4 Oregon White Oak, 8 Indian plum, 8 serviceberry, and 8 beaked hazelnut.

### *Planting Maintenance*

WCC crew members visited all previous food island and Lake DeBalon planting sites in late spring 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.

# 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 are similarly 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.

## *2006 Summary*

For better or worse, 2006 was a record year for invasive species/noxious weed control on Fort Lewis. More herbicide was applied in one day of treatment on a newly discovered infestation than during the entire 2005 season. On another day, more new discrete sites for sulfur cinquefoil were found and controlled for that species than during the 2004 and 2005 seasons combined.

The previous years' species "hit list" was expanded to include aggressive pasture grasses such as tall oatgrass and several aquatic weed species that imperil the federally threatened water howellia. This took TNC and Fort Lewis staff out of prairies and into freshwater wetlands more than any time before.

Several changes and improvements were made. A dedicated full-time staff person was added to the TNC project team to manage the invasive species control program. Fort Lewis staff increased their field involvement and planning cooperation, which made for an incredibly successful control season. By changing surfactants, we were able to

spray within 30 minutes of rain and in aquatic/riparian habitats. This enabled us to utilize many of the spring days that would have been called off due to forecasted rain.

**TABLE 7:** List of species, number of infestations and estimated number of plants treated on Fort Lewis in 2006.

| | Species | Spp. Code | Iinfestations | Sum (plants) |
|---|---|---|---|---|
| Colonial bentgrass | *Agrostis capillaris* | agrcap | 1 | 1,000 |
| Tall Oatgrass | *Arrhenatherum elatius* | arrela | 46 | 14,565 |
| Diffuse knapweed | *Centaurea diffusa* | cendiff | 41 | 2,045 |
| Spotted knapweed | *Centaurea maculosa* | cenmac | 2 | 20 |
| Meadow knapweed | *Centaurea pratensis* | cenpra | 6 | 163 |
| Unknown knapweed | *Centaurea spp* | censpp | 6 | 411 |
| Blue Weed | *Echium vulgare* | echvul | 8 | 676 |
| Leafy spurge | *Euphorbia esula* | eupesu | 1 | 6 |
| Stinky bob | *Geranium robertia* | gerrob | 1 | 6,000 |
| Mouse-ear hawkweed | *Hieracium pilosella* | hiepil | 134 | 5,333 |
| Sulfur cinquefoil | *Potentilla recta* | potrec | 166 | 147,095 |
| Tansy ragwort | *Senecio jacobaea* | senjac | 22 | 519 |
| Dalmatian toadflax | *Linaria dalmatica* | lindal | 1 | 1 |
| Yellow toadflax | *Linaria vulgaris* | linvul | 3 | 420 (stems) |
| Yellow flag iris | *Iris pseudacorus* | iripsu | 31 | 13,137(stems) |
| Purple Loosestrife | *Lythrum salicaria* | lytsal | 4 | 700 |
| Japanese knotweed | *Polygonum cuspidatum* | polcus | 3 | 699 (stems) |
| Fragrant waterlilly | *Nymphaea odorata* | nymodo | 35 | 1100 (stems) |
| Reed canary grass | *Phalaris arundinacea* | phaaru | 4 | 11 acres |
| | | | **473** | **193,140** |

## NOXIOUS WEEDS SUMMARY TABLE

### April-June

- *Sulfur cinquefoil*. Surveyed and controlled infestations at Mortar Point 13, Johnson Prairie and 13th Division (3873).
- *Mouse-ear hawkweed.* Surveyed and controlled at Training Area 6 (Leschi Town) and TA 12 (3873).
- *Diffuse knapweed.* Surveyed and controlled populations at Range 74/76 and TA's 13 and 14 (3873).
- *Tall oat grass*. Surveyed and controlled infestations at TA 7S, Johnson, Upper and Lower Weir Prairies, Mortar Point 3 and Range 51 (3873).
- Mortar Point 3. Sprayed Poast around *Plectritis* and under oak savanna (3873).
- Range 51. Sprayed Poast to enhance giant camas population (3873).
- *Other species.* Surveyed and controlled minor infestations of blueweed, tansy ragwort, Himalayan blackberry and leafy spurge (3873).
- *Sulfur cinquefoil*. Surveyed and controlled infestations in riparian habitat at TA's 6 and 13 and Mortar point 13 along Muck Creek riparian corridor (3887).

### July-September

- *Miscellaneous Weed Control* – Treated several small populations of knapweed, a large population of blueweed and one of sulfur cinquefoil (3873).
- *Presentation*- Cliff Chapman presented at regional weed control conference on cinquefoil control (3873).
- *Yellow Flag Iris* – Controlled about 12,000 stems at Shaver Kettle, Shaver Marsh, Halverson Spring, Nixon Spring, American Lake, Muck Creek and along Chamber's Lake (3887).

- *Purple Loosestrife* – Controlled over 700 plants at Johnson Marsh and American Lake.
- *Japanese Knotweed* – Controlled four small populations (3887).
- *Fragrant Water Lilly* – Treated numerous plants at Chambers Lake (3887).
- *Reed Canaryrgrass* – mowed and brushcut 10 acres in preparation for fall spraying at Shaver Kettle, Halverson Springs, Nixon Springs and along Muck Creek (3887).

**October-December**

- *Yellow Flag Iris* – followup treatment at Shaver Kettle (3887).
- *Reed Canaryrgrass* – sprayed areas that were mowed and brushcut in previous quarter at Shaver Kettle, Halverson Springs and Nixon Springs (3887).

### *Upland Invasive Species.*

Unless otherwise noted, upland weed control was conducted under the Training Lands task order (3873). See weed control maps at the end of this section.

*Sulfur cinquefoil*. This species received increased attention during the 2006 field season, and alarmingly several large populations were discovered. Due to these discoveries, much more effort was expended to control the cinquefoil than was originally anticipated. Both upland and riparian treatments were conducted (see Aquatic Weed Control section below). Sulfur cinquefoil was controlled with backpack sprayers and a 2.5% solution of Garlon 3A (triclopyr) with 0.25% NuFilm IR adjuvant. Treatments appear to have been largely effective based on preliminary observations. Locations include:

- Mortar Point 13. This is a new population of approximately 80,000 plants treated in and near high quality prairie habitat and along Muck Creek north of the access road. Due to improved access, more discrete populations were found in this one area during one day than during the entire 2005 season for the whole base.

**Figure 20: Sulfur cinquefoil after treatment with Triclopyr amine.**

- Johnson Prairie. New populations of sulfur cinquefoil were found and treated in Johnson Prairie - the first time for the entire Rainer Training Area.
- 13th Division. Previously known populations of cinquefoil were treated in this area. Several new populations were discovered, including one at the Muck Creek Triangle, the first site for this species east of 8th Ave South. One large population of sulfur cinquefoil (700 plants) was discovered in TA 14, but was not treated with herbicide due to training activities. Seed heads were cut and removed.
- Range 74/76. Controlled previously known infestation.
- Training Area 6. Controlled known population north of and along the road closure, but along with Ft. Lewis staff, discovered that this pest continues east all the way to Halverson extension along the closed road.
- Mortar Point 3. Controlled population by Farnsworth Lake for first time.

*Mouse-Ear Hawkweed.* The bulk of the control effort focused on the known population in TA 6 north of Leschi Town. Mouse-ear hawkweed was controlled using a 1.5% solution of Transline (clopyralid) with 0.25% NuFilm IR adjuvant. Treatment areas include:

- TA 6 - Leschi Town. This is the third consecutive year of treatment for the area. Intensive search and treatment effort conducted on approximately 65 acres; large infestations were found east of previously known sites at this location.
- TA 12. A new meta-population was discovered in Ponderosa pine habitat where approximately 1000 plants treated north of Chambers Lake.

*Diffuse Knapweed.* Known infestations were controlled within high quality prairies in the areas listed below. We diverged from pulling as the principle control method as it was felt that most of the plants at Fort Lewis were short lived perennials, rather than the more common biennial form. Various herbicide treatments methods were used and all seemed effective.

- Range 74/76. Knapweed was controlled with 1% solution of Transline.
- Training Area 13 - Pacemaker landing strip. A 2% solution of Round-up or 2.5% solution of Garlon 3A at this site.
- Training Area 14. This site is located south of Pacemaker. A 2.5% solution of Garlon 3A was used.
- Training Area 12. A very large infestation was discovered around the mock prison, and just west of Chambers Lake. A 2% solution of Round-up with 0.2% of Transline was used, but due to the number of plants present and that it was discovered late in the season, Pest Shop sprayed the bulk of this site.
- Motor pool – there are thousands of plants located throughout various parking areas of the motor pool, we treated several when access was available, particularly around wash racks. Maps were provided to Fort Lewis so that Pest Shop could spray areas we did not have access to (such as behind fences/locked gates) or where military activity was high.

- Other small populations of diffuse knapweed in lower priority areas such as TA 7N, TA 5, and disturbed open areas in TA 12. Populations discovered very late in the season were cut and bagged with follow up spraying of rosettes. Otherwise, in lower quality areas, knapweed was controlled with a solution of 2% Round-up with 0.2% Transline.

*Tall Oat Grass*. A relatively new species to make the control list, tall oatgrass threatens several areas of high quality prairie. We used a combination of herbicides, depending on ecological situations. High quality or extensive infestations were treated with Poast, a grass specific herbicide, whereas scattered populations or roadsides were treated with Round-up. Tall oat grass treated with Poast herbicide from tractor boom was at a rate of 1 pint/10 gallons water with equal amount of crop oil, and at 1.5 % solution with 0.25% NuFilm IR adjuvant for spot application. When Round-up was used, it was at a rate of 2%. A number of areas were treated in spring using the task orders indicated below.

- TA 7S Prairie. A large area of oat grass sprayed with tractor boom surrounding high quality prairie. Within high quality prairie, flower heads were removed and plants were spot sprayed with backpacks. This includes areas for future Taylor's Checkerspot reintroduction. (Prairies 2006 – 3861)
- Johnson, Upper and Lower Weir Prairies. The known infestation in the northeast section of Johnson was treated early in the season. Subsequent transects of the Johnson/Weir prairies revealed multiple new infestations – particularly in Johnson and Upper Weir. New infestations were promptly treated with Poast and in some cases seed heads were removed. (Gophers – 3872)
- Mortar Point 3. Sprayed Poast around *Plectritis* and under oak savanna.
- Range 51. Sprayed Poast to enhance giant camas population.

*Blueweed*. TNC cooperated with Fort Lewis staff to treat blueweed on 13$^{th}$ Division Prairie. We also treated blueweed in Range 74/76 (25 plants) and found and treated a large population (600 plants, mostly rosettes) in TA 7S. Blueweed was treated with a 2% solution of Garlon 3A with NuFilm IR.

*Tansy Ragwort*. TNC crew controlled a large infestation at several site within and around Fort Lewis in cooperation with Pierce and Thurston County Noxious Weed Boards. Primary emphasis was along major thoroughfares and Fort Lewis boundaries. Flowering plants were pulled, and some rosettes were sprayed with Garlon 3A while searching for and spraying higher priority species.

*Other Species.* Several other upland invasive species were treated, including:

- Himalayan blackberry – treated at the entrance to Johnson Prairie and some at the north end of Pacemaker airfield using Garlon 3A and Range 76. Further treatment of this species near Pacemaker may benefit streaked horned larks.
- Leafy spurge – treated at Marion Prairie using cut surface application of Tordon RTU.

- Meadow and spotted knapweeds – treated in TA 7N, TA 7S and TA F, and the parking area of Lower Weir…all in low quality settings. Conducted float trip on Nisqually river to monitor and control meadow knapweeds.
- Dalmation toadflax – treated in the motor pool area near wash racks using a cut surface application of Tordon RTU.
- Common toadflax – treated along railroad tracks near Fish & Wildlife offices within Cantonment Area using Garlon 4. Interestingly, this species appeared in the mesic prairie restoration area along Muck Creek in TA 15 after it was treated with Round-up. It was not previously known from this area suggesting it may be more widespread than we currently understand but is being out-competed by non-native pasture grasses.
- Salsify – several hundred sprayed with Garlon 3A while controlling and searching for sulfur cinquefoil at Mortar Point 13. This species is widespread across Fort Lewis prairies, but control in the highest quality prairies could be beneficial.
- Queen Ann's lace – treated northwest of and along Pacemaker airfield. Though not a species of concern for Fort Lewis prairies, this common weed is prolific in this small area and apparently spreading into nearby high quality prairie and may degrade streaked horned lark habitat. Several hundred sprayed with Garlon 3A or Round-up mix while searching for and controlling diffuse knapweed.

*Presentation*. Cliff Chapman presented research and results from sulfur cinquefoil control measures during the 2006 season at an invasive species conference for the Pacific Northwest in Seattle on September 20, 2006.

### *Aquatic Invasive Species.*

The aquatic weed control effort was conducted under the Water Howellia task order (3887). See weed control maps at the end of this section for treatment locations.

*Sulfur cinquefoil*. Sulfur cinquefoil infestations were controlled during spring along aquatic corridors. Though work was conducted in riparian areas, no direct aquatic applications were made. As described above in the Upland Weeds section, we used Garlon 3A – which is labeled for use in aquatic environments.

- TA 6 – both sides of Muck Creek. Approximately 10,000 plants treated in Muck Creek flood plain.
- Mortar Point 13 – Treated large infestations south of the access road. This area has about 65 discrete populations, each ranging from 10 to 2,000 plants.
- TA 13 - Approximately 10,000 plants were treated in the Muck Creek flood plain.
- TA 14 – Several populations were treated in the Muck Creek lowlands, numbering in the thousands.

*Yellow Flag Iris*. Yellow flag iris was controlled at several sites using a drip-less wick system. This system consisted of a rag-covered sponge adapter on a backpack sprayer nozzle that dabbed iris stems after they were cut with hand pruners. A solution of 25% AquaMaster with 0.5% NuFilm IR adjuvant was applied to the cut surfaces. This

method proved slow, but effective and was sufficiently low risk to the high quality wetland systems.

Follow up treatments were needed and done at Shaver Kettle only. Several rhizomes at this site re-sprouted, but not in any recognizable pattern. The selective lack of efficacy from original treatments could be explained by some rhizomes having more starch reserves and simply being too strong, so a higher concentration of Aquamaster may be prudent in future applications. An approximate number of stems treated at each site give an indication of infestation levels:

- Shaver Kettle – 7,000 stems were treated.
- Halverson Spring – 3,000 stems.
- American Lake – 1,000 stems.
- Shaver Marsh – 500 stems.
- Nixon Spring – 20 stems.
- Other infestations – Chambers kettles 20 stems; Muck Creek 100 stems and north Chambers Lake five stems.

**Figure 21: Example of cut and dabbed yellow iris.**

*Purple Loosestrife*. Purple loosestrife was controlled in Johnson Marsh (approximately 500 plants) and American Lake (approximately 200 plants). Purple loosestrife was cut and treated with a 25% AquaMaster/0.5% NuFilm solution applied from small dropper bottles to freshly cut surfaces.

*Fragrant Water-Lily*. Fragrant water-lily was controlled at Chambers Lake. About 20 separate rhizomes were sprayed. Clones varied in size from one square meter to 20 square meters. This represents about 1/5$^{th}$ of the eventual targeted control in this area. Fragrant water-lily was treated with foliar spray of 2% AquaMaster/0.25% NuFilm IR solution.

*Japanese knotweed*. Knotweed was treated at four small, discrete sites in TA 12, TA 15, and the RTA. Japanese knotweed was controlled both by direct injection and foliar spray. Canes of sufficient width were injected with 100% AquaMaster (3mm per cane) and smaller canes were foliar sprayed with a 2% AquaMaster/0.25% NuFilm IR solution.

*Reed Canary Grass*. Reed canary grass was first mowed with brush-cutters in four important wetland areas and then sprayed in October with a 2% AquaMaster/0.25% NuFilm IR solution. Sites included Shaver Kettle (1 acre), Halverson Spring (3 acres), and Nixon Spring (4 acres). An area along Muck Creek in TA 15 (3 acres) was cut, but not sprayed due to access and timing issues.

### *2007 Outlook*

The 2007 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. A survey strategy will be developed to detect infestations in likely or critical areas.

We hope that this year's effort to control sulfur cinquefoil will lead to a much smaller effort required to control the species in 2007. Additional sites are likely to be discovered, though likely not of the size found in 2006. Tall oatgrass will need a significant effort to control in the RTA before it reaches epidemic proportions.

We look forward to discovering the results of the 2006 aquatic species treatments. With an effort similar to this year's, we should be able to get most of the invasive species significantly knocked back. Reed canarygrass has become very pervasive and is very resilient and will require enormous effort to satisfactorily control. The 2006 effort should provide valuable information to guide future and larger-scale control actions.

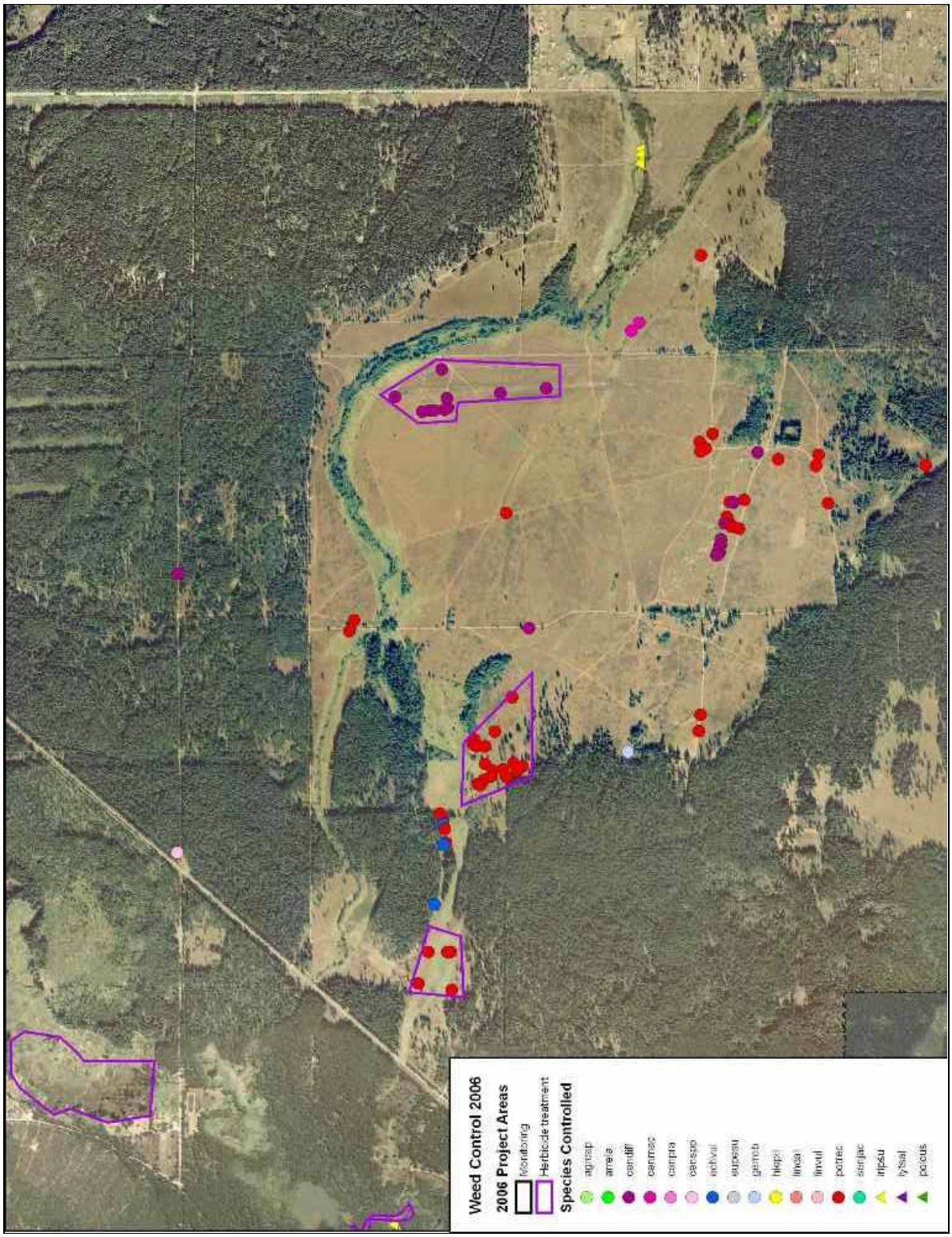



**Figure 22: Map of 2006 weed control locations around 13th Division Prairie at Fort Lewis.**

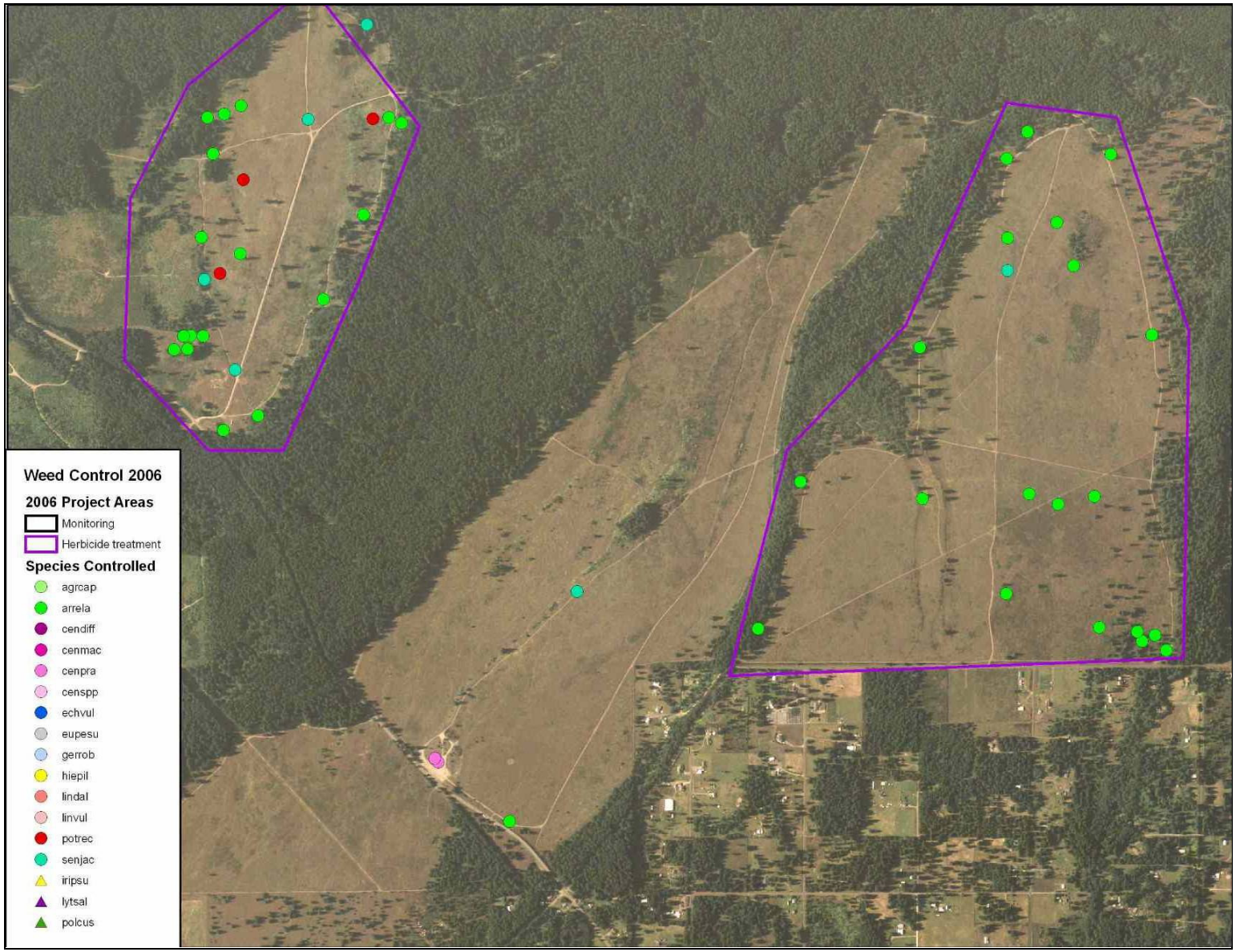



**Figure 23: Map of 2006 weed control locations in the Rainier Training Area at Fort Lewis.**

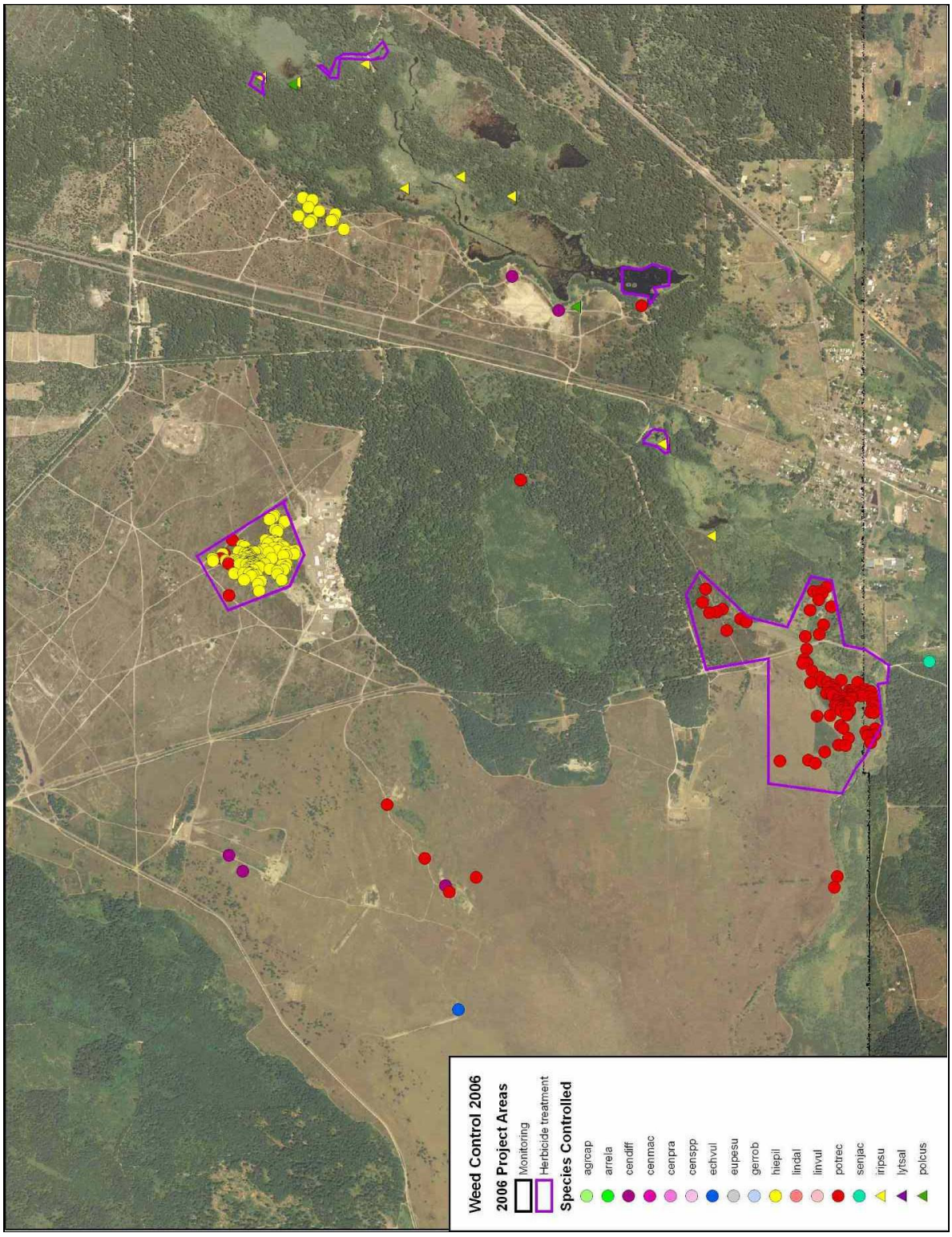



**Figure 24: Map of 2006 weed control locations around the east end of the Central Impact Area at Fort Lewis.**

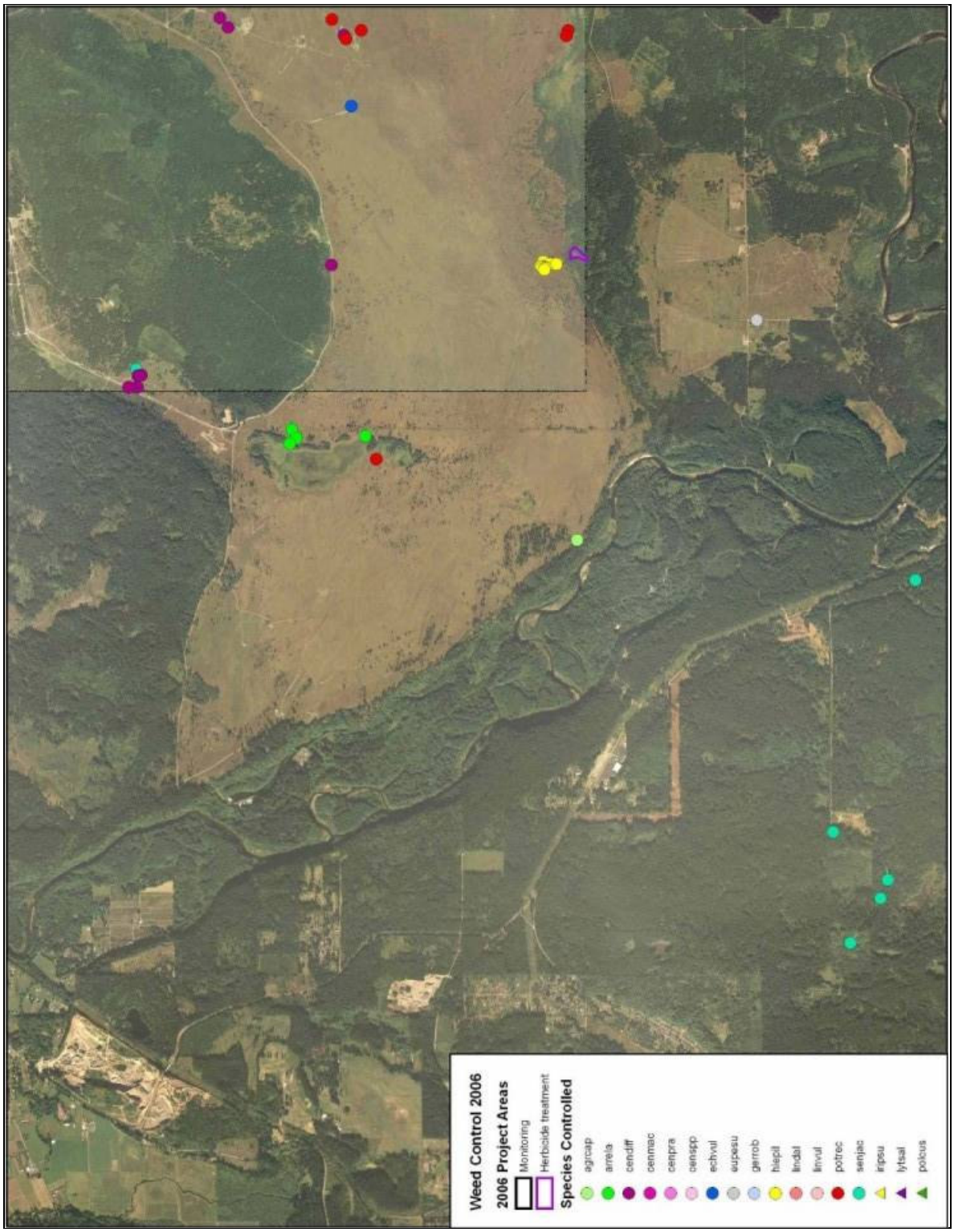



**Figure 25: Map of 2006 weed control locations around the west end of the Central Impact Area at Fort Lewis**

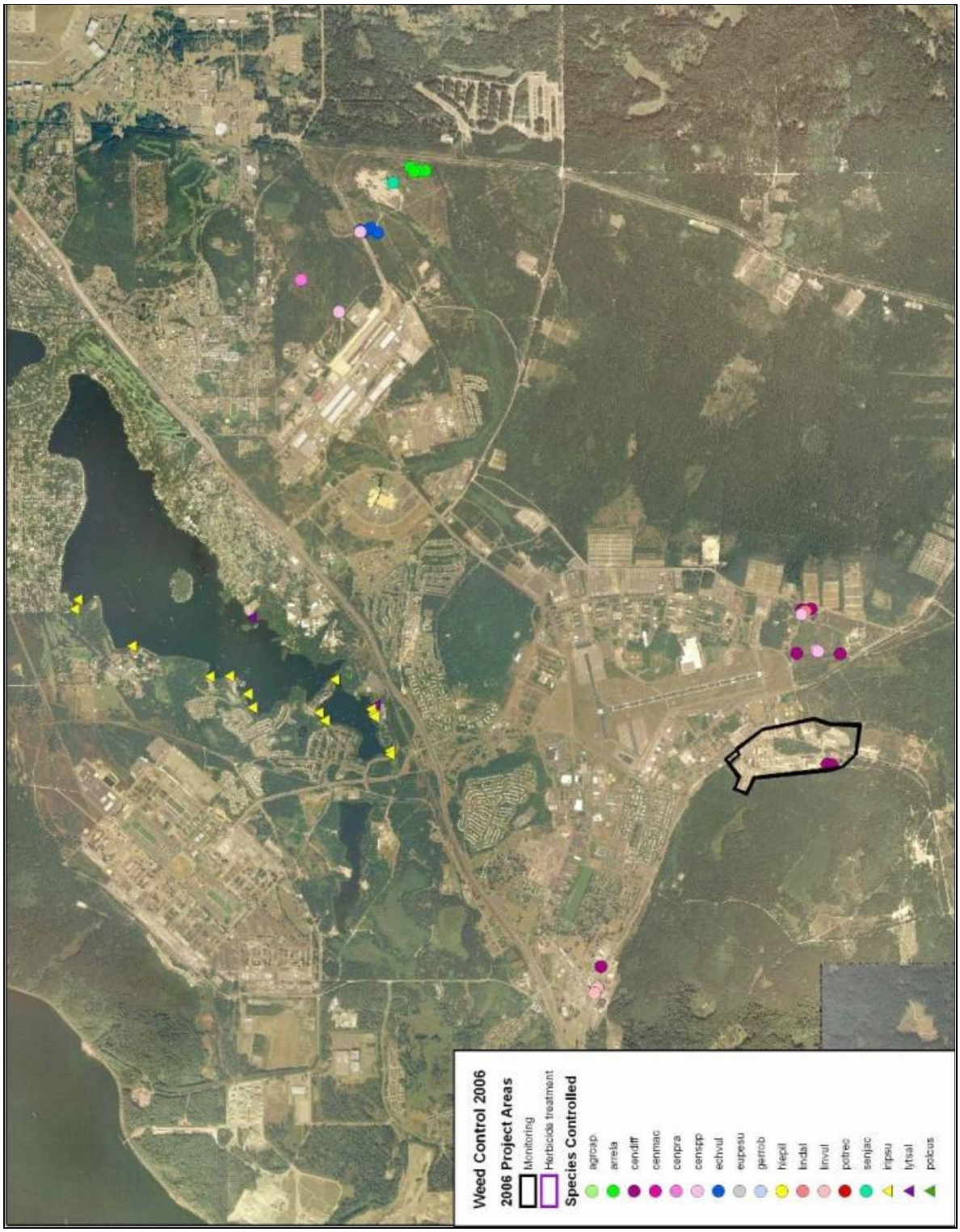



**Figure 26: Map of 2006 weed control locations around American Lake at Fort Lewis**

# RIPARIAN AND STREAM 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.

### *2006 Review*

Compared with previous years, a fairly small amount of riparian enhancement was conducted. Most of this year's effort went to two in-stream tasks in Muck Creek to improve salmon habitat. See map at end of section for locations of aquatic projects.

**RIPARIAN ENHANCEMENT SUMMARY**

**April-June**

- Planted approximately 2000 woody plant species along the Muck Creek road closure (3879).

**October-December**

- *Chambers Lake.* Installed nine in-stream structures over about 1000' of the Chambers spillway for salmon habitat (3879)
- *Halverson Springs.* Enhanced salmon spawning sites at Halverson Springs (3879)

### *Muck Creek Road Closure*

At the beginning of spring quarter, we planted 2000 potted woody plant species along Muck Creek in holes that were augured by Fort Lewis and TNC staff. This task was part

of the ongoing road closure project and will help with weed control and riparian habitat restoration.

### *Halverson Springs*

Historical accounts indicate that Halverson Springs was once a very productive spawning site. Multitudes of oxygenated springs percolate up through well washed gravel and provide excellent locations for redds. Over the years, the area has become invaded by reed canarygrass, which has grown into spawning areas and created thick muck layers. This project brought in heavy equipment to remove muck, canarygrass and yellow flag iris, deepen springs areas to inhibit weed re-colonization and import clean salmon-sized spawning gravel. Three discrete portions of Halverson Springs were improved and showed almost immediate results. At least 60 chum salmon have now been seen in the enhanced area at one time. This comes in a year when the chum run is fairly low. Work was conducted by Aquatic Consulting LLC.

**Figure 27: Western spawning enhancement area at Halverson Springs, Fort Lewis.**

**Figure 28: Central spawning enhancement area at Halverson Springs with salmon.**

**Figure 29: East spawning enhancement area at Halverson Springs, Fort Lewis.**

### *Chambers Spillway*

The stretch of creek below the Chamber's Lake was very simplified. Very little woody debris or rocks were present to enhance structural complexity. High waters moved quickly through the stretch with few resting sites for migrating salmon. This project installed eight rootwad/rock structures below the armored ford and two rock structures above the ford. Imported rootwads were dug into the substraight and anchored with rebar and large on-site rocks and logs. Some cable was also used to secure less stable structures together.

**Figure 30: Chamber Spillway salmon habitat enhancement area at Fort Lewis.**

## *2007 Outlook*

Funding for additional riparian and in-stream work is likely to be provided to conduct bald eagle and salmon habitat enhancement. Specific tasks have yet to be developed, but will likely include reed canarygrass channel clearing, and other in-stream and riparian projects.

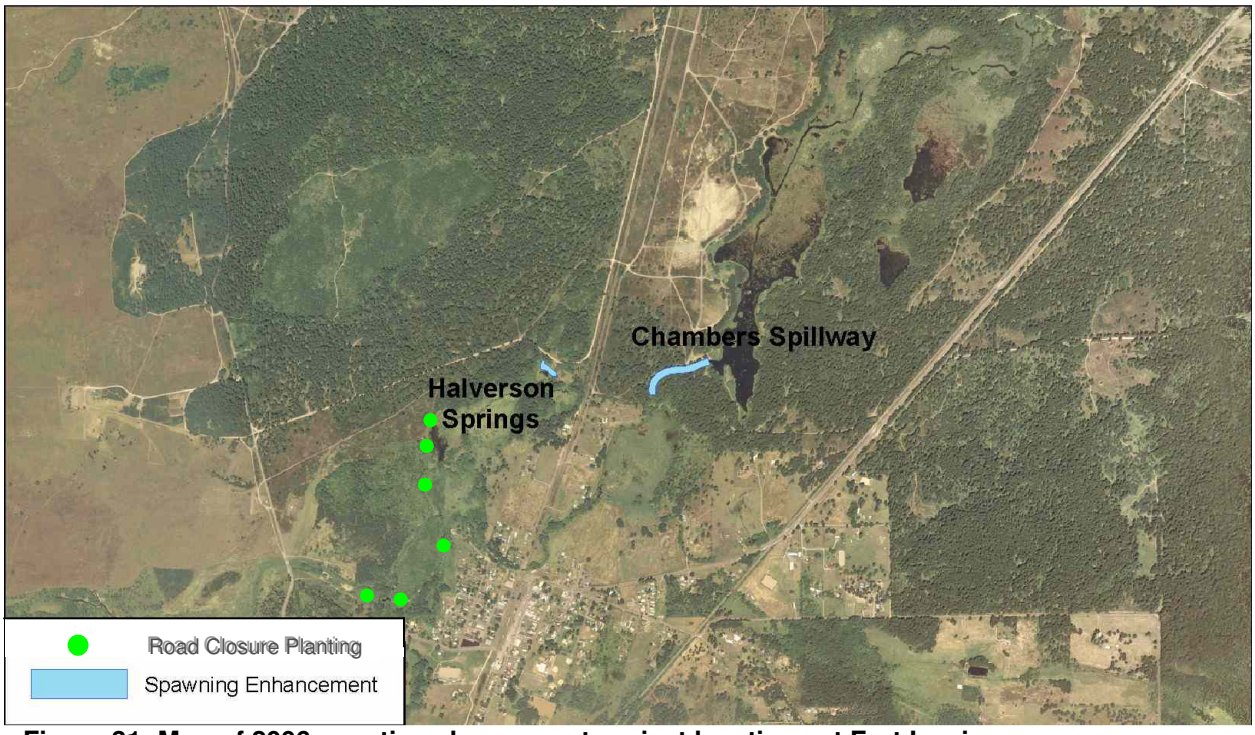



**Figure 31: Map of 2006 aquatic enhancement project locations at Fort Lewis.**

# APPENDIX – Summary of all 2006 Activities for Each Task Order

**TABLE 8: Summary of all tasks completed in 2005 arranged by Fort Lewis task order (with TNC grant numbers).**

## STHL FY 05 (3849)

- Improved Streaked horned lark habitat on 13th Division Prairie by mowing 115 acres of Scotch broom in core and surrounding habitat.

## Prairie Enhancement (3861)

- *Muck Creek Triangle Mowing.* Mowed Scotch broom on three polygons of prairie totaling 116 acres.
- *Johnson Mowing.* Mowed Scotch broom on three polygons of prairie totaling 70 acres.
- *Upper Weir Mowing*. Mowed Scotch broom on two polygons of prairie totaling 152 acres.
- *Lower Weir Mowing*. Mowed Scotch broom on two polygons of prairie totaling 55 acres.
- Propagated 11,500 plugs for fall 2006 and Winter 2007
- Planted 21,400 plugs of prairie plants in three planting location at 13th Division, South Weir and Upper Weir Prairies.
- Transplanted plugs into 260 square feet of beds for rare plant seed production.
- Maintained 60,000 plugs for planting in fall 2006 and winter 2007.
- Assessed mesic planting plots (3874).

## Oak Enhancement (3866)

- Conducted two squirrel monitoring sessions at Lake DeBalon as part of longer-term effort to track squirrel responses to management activities.
- Pulled and cut brush around all previous years food island plantings and plantings at Lake DeBalon
- Mowed 173 acres of Broom and small Douglas-fir to enhance habitat and reduce fire fuel loading in core WGS habitat (TA's 8, 10 and 12)
- Planted 2,110 trees and shrubs to benefit WGS habitat

## Oak and Pine (3867)

- Mowed about 16 acres of broom in the south Central Impact Area to complete task started at the end of 2005.
- *Training Area 6.* Mowed 11.9 acres of competitive woody species in Sieber staked area.
- *Training Area 10.* Mowed 4.6 acres of competitive woody species near Holden Woods and completed about one-half of the targeted Douglas-fir girdling. Mowed additional 23 acres in TA 10 near gravel pit.
- *TA 8 Enhancement* – Mowed broom and small woody invasives and girdled fir over 5 acres.
- *TA 10 Enhancement* - Mowed broom and small woody invasives and girdled fir over 8 acres.
- *Seibert Staked TA 6* – Mowed and brush cut 12 acres.
- *TA 5.* Thinned 11 acres of young oak and mowed broom.

## Cavity Creation (3871)

- Girdled invading Douglas-fir on 335 acres in the Artillery Impact Area
- *AIA Fir Girdling.* Girdled 47 acres of Douglas-fir that encroached on oak woodlands.
- *South Impact Area Oak Enhancement.* Cut broom and girdled fir on about 27 acres of oak woodlands.

## Williams Pipeline

- Planted 35,000 native fescue plugs for pipeline restoration (Pipeline)
- Sprayed weeds along restoration area

## Gophers 2006 (3872)

- Conducted follow-up brush cutting to remove any Scotch broom which survived previous year's spray treatment and threatened to produce seed:
  - 13th Division Prairie Muck Creek Triangle – total of 60 acres.
  - Johnson Prairie – total of 55 acres.
  - South Weir – total of 60 acres.
- *Johnson Prairie*. Brush cut low density Scotch broom in a 27-acre high quality prairie polygon.
- *Upper Weir*. Brush cut low density Scotch broom that threatened to set seed in a 19-acre high quality prairie polygon and 50 acres of quality broom that had been recently been mowed.
- *Johnson Prairie Mowing.* Mowed about 14 acres of lower quality prairie and the entire outside perimeter of the prairie was mowed back about 10 feet along the road edge.
- *Upper Weir Mowing.* Mowed 21 acres on western edge under the oaks and a small 3 acre patch in the middle.

## Training Lands (3873)

- *13th Division Broom Mowing.* Mowed two polygons of broom totaling 9 acres to enhance prairie habitat and facilitate future control of *P. recta*.
- *Sulfur cinquefoil*. Surveyed and controlled infestations at Mortar Point 13, Johnson Prairie and 13th Division.
- *Mouse-ear hawkweed.* Surveyed and controlled at Training Area 6 (Leschi Town) and TA 12.
- *Diffuse knapweed.* Surveyed and controlled populations at Range 74/76 and TA's 13 and 14.
- *Tall oat grass*. Surveyed and controlled infestations at TA 7S, Johnson, Upper and Lower Weir Prairies, Mortar Point 3 and Range 51.
- Mortar Point 3. Sprayed Poast around *Plectritis* and under oak savanna.
- Range 51. Sprayed Poast to enhance giant camas population.
- *Other species.* Surveyed and controlled minor infestations of blueweed, tansy ragwort, Himalayan blackberry and leafy spurge.
- *Miscellaneous Weed Control* – Treated several small populations of knapweed, a large population of blueweed and one of sulfur cinquefoil.
- *Presentation*- Cliff Chapman presented at regional weed control conference on cinquefoil control.

## Prairies FY 06 (3874)

- *Muck Creek Triangle Area Broom Spraying* - Treated about 125 acres in core and buffer areas.
- *Johnson Prairie Broom Spraying* – Treated 132 acres throughout the prairie.
- *Upper Weir Prairie Broom Spraying* – Sprayed 59 acres in the southern portion of the prairie.
- *South Weir Broom Spraying* – Treated 10 acres on northeast side of pipeline.
- *Broom Spray Test Plots* – treated 10 100$m^2$ plots to test treatment rates and products.
- *South Weir Broom Spraying.* Treated about 9 acres of broom as a trial of late season effectiveness.
- Conducted Poast treatments for large-scale Collins plots on about 4 acres total.
- Sprayed Poast to small area around the rare plant *Plagiobothrys* to control invading grasses
- Conducted spring and summer pasture grass and forb control for mesic prairie project.
- Seed collection. Collected seed from 44 species of prairie plants.
- Sowed 12,000 plugs of *Viola adunca* and *Castilleja hispida* for fall 2007 outplanting.
- Planted 2520 plugs at the Muck Creek Triangle enhancement plot.

## Oaks for Squirrels (3875)

- Completed mowing and girdling work in Central Impact Area. Mowed at total of 43 acres and girdled a total of 25 acres in winter and spring 2006.
- Conducted post management squirrel monitoring at Lake DeBalon.
- Conducted directed visual surveys for gray squirrels at five Fort Lewis sites.
- Produced first draft of hair snag tube monitoring paper.
- Monitored squirrel hair snag tubes associated with EGS control after February 28, 2006.
- Conducted fourth eastern gray squirrel trapping session.
- *CIA Fir Girdling*. Girdled Douglas-fir around oaks in the central CIA prairie on about 15 acres.
- *TA 8 Mowing* – Treated 13 acres to control broom and fir.
- *TA 12 Mowing* – Treated 13 acres to control broom and fir.

## Butterflies (3876)

- Applied Poast on pasture grasses on 8 plots totaling about 20 acres for butterfly and prairie habitat enhancement project.
- Conducted survival assessments for Castilleja *hispida* at plots on 13th Division and Johnson Prairies.
- Conducted Valley Silverspot monitoring.
- *13th Division Broom Mowing*. Mowed 10 acres of broom in high quality portion of prairie in Muck Creek Triangle Area.

## Larks FY 06 (3877)

- *Range 74/76 Broom Spraying* – Sprayed about 221 acres in streaked horned lark use area.
- *Pacemaker Area Broom Spraying* – Sprayed about 203 acres of broom in core lark habitat.
- *Lark Plots* - Conducted vegetation measurements on all experimental lark plots.
- Controlled pasture grass on about 10 acres of the lark enhancement plots.
- *Lark Plots* - Boom sprayed 16 experimental lark habitat plots with triclopyr ester (Tahoe 4e) at Pacemaker and Upper Weir Prairie.
- *WDFW Regional Lark Study* – Contracted continued monitoring of lark populations in collaboration with WDFW.

## Muck Creek (3879)

- Planted approximately 2000 woody plant species along the Muck Creek road closure (3879).
- *Chambers Lake.* Installed nine in-stream structures over about 1000' of the Chambers spillway for salmon habitat (3879)
- *Halverson Springs*. Enhanced salmon spawning sites at Halverson Springs (3879)

## Howellia (3887)

- *13th Division Broom Mowing.* Mowed two polygons of broom totaling 41 acres to enhance prairie habitat and facilitate future control of *P. recta* along Muck Creek.
- *Sulfur cinquefoil*. Surveyed and controlled infestations in riparian habitat at TA's 6 and 13 and Mortar point 13 along Muck Creek riparian corridor.
- *Yellow Flag Iris* – Controlled about 12,000 stems at Shaver Kettle, Shaver Marsh, Halverson Spring, Nixon Spring, American Lake, Muck Creek and along Chamber's Lake.
- *Purple Loosestrife* – Controlled over 700 plants at Johnson Marsh and American Lake.
- *Japanese Knotweed* – Controlled four small populations.
- *Fragrant Water Lilly* – Treated numerous plants at Chambers Lake.
- *Reed Canaryrgrass* – mowed and brushcut 10 acres in preparation for fall spraying at Shaver Kettle, Halverson Springs, Nixon Springs and along Muck Creek.
- *Yellow Flag Iris* – followup treatment at Shaver Kettle.
- *Reed Canaryrgrass* – sprayed areas that were mowed and brushcut in previous quarter at Shaver Kettle, Halverson Springs and Nixon Springs.

### Squirrel Habitat (3901)

- Advised WDFW on locations for live trapping WGS for radio telemetry project. Helped establish trapline of 30 traps.
- Conducted fifth EGS control session for two weeks at the end of December.
- First draft of EGS control write-up is completed and circulated within TNC for review

### Road Closure (4808)

- Propagated 11,500 plugs for fall 2006 and Winter 2007
- Established 480 square feet of seed production beds for prairie plant species. This augments the 2400 square feet established for the Collins project .
- Germinated 8 out of 27 targeted locally rare Fort Lewis prairie plant species for seed production and enhancement planting.

### WGS FY 05 (4809)

- Conducted first two sessions of EGS control project trial.
- Monitored squirrel hair snag tubes associated with EGS control until February 28, 2006.

### Legacy Seed Production

- Built 50 propagation tables and installed irrigation for legacy propagation
- Planted 10,900 prairie forbs into Fort Lewis seed plots
- Completed construction and sowing of 40 legacy prairie seed beds with irrigation

### Pipeline

- Planted 35,000 native fescue plugs for pipeline restoration following spray treatment with Roundup to control weeds