January – December 2008 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.***

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.

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The cooperative program between Fort Lewis and The Nature Conservancy continues to be productive. Our efforts work to balance the need to achieve landscape-level objectives and develop specific knowledge to inform management actions. Fort Lewis Fish and Wildlife and TNC's approach to conservation on Fort Lewis continues to broaden through strategic participation in regional conservation efforts for rare species and habitat management.

In 2008, several programs were initiated on Fort Lewis that benefitted from regional integration. Primary examples of this include: prescribed fire, butterfly habitat enhancement, prairie quality monitoring and tall oatgrass control. We also initiated a study on Fort Lewis to evaluate a streaked horned lark nest predator protection technique that will be scaled-up state wide in 2009 by the Washington Department of Fish and Wildlife.

In summary, 2008 was a productive year on Fort. In spite of the usual set of set-backs such as weather and access restrictions, Fort Lewis and TNC were able to achieve all major shared goals. The summary table below presents highlights of the conservation activities accomplished during the year.

Highlights of 2008 conservation actions on Fort Lewis.

Invasive Plant Control

- Treated approximately 1832 acres of Scotch broom on:
  - 1158 acres of prairie for rare butterfly, streaked horned lark, Mazama pocket gopher and general prairie enhancement.
  - 674 acres of oak and pine to enhance understory structure, remove encroaching Douglas-fir and enhance western gray squirrel habitat.
- Removed and girdled encroaching Douglas-fir from about 711 acres of prairie.
- Controlled 26 acres of reed canarygrass along banks of Muck Creek.
- Mechanically cleared encroaching vegetation on three miles of stream channels for salmon, bald eagle and other species.

Rare Species Management

- Developed and implemented Taylor's Checkerspot butterfly habitat enhancement experiment in three locations in conjunction with regional efforts.
- Conducted butterfly and nectar surveys at Johnson Prairie.
- Initiated regional streaked horned lark predator nest exclosure experiment at Pacemaker.
- Published two papers on western grey squirrel management and presented at Washington Wildlife Society conference.
- Conducted Ft Lewis bat survey and found all nine potential species.

Habitat Enhancement

- Expanded restoration worksite on EcoPark landfill restoration project.
- Installed 77 in-tree nesting cavity structures for birds and mammals.
- Developed process for TNC to assist Ft Lewis on prescribed ecological fires and participated in two prescribed fires.

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 in Western Washington and is therefore the most important conservation area in the Puget Trough region for this habitat type. For more than a decade, Fort Lewis resource managers have provided funding, 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 and aquatic 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.

2008 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-one task orders were active on Fort Lewis during 2007. 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*.

2008 FORT LEWIS ACTIVE TASK ORDERS			
Williams Pipeline Restoration	**3010**	**Howellia 2008**	**4864**
Prairies 2008	**3917**	**Invasive Weeds 08**	**4865**
Cavity Creation FR	**4822**	**Larks 2008**	**4866**
Water Howellia 07	**4825**	**Oaks FR08**	**4867**
Fort Lewis Eagles 07	**4826**	**Watershed 2007**	**4868**
STHL 2007	**4830**	**Watershed 2008**	**4870**
Fort Lewis Butterflies 07	**4831**	**Oak Invasives**	**4871**
Squirrel Oaks	**4832**	**Muck Creek 2008**	**4872**
Gophers 2007	**4833**	**Butterflies 2008**	**4877**
Ft Lewis Muck Creek 07	**4834**	**Bats FR08**	**4878**
Cavity Snag 07	**4835**		

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 will largely be 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 sites: 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 plant communities 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 due to 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 recently 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 quickly and 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 have been 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.

A reliable, well designed strategic prescribed burn plan will be the only feasible way to control Scotch broom at larger scales, while simultaneously providing ecological benefit to these fire dependent communities. This has not been available over the past decade. Fort Lewis Fish and Wildlife and TNC are working to develop capacity to implement a collaborative ecological prescribed burning program. This will hopefully be initiated in summer and fall of 2009.

2008 Review

TNC was able to conduct about 1,158 acres worth of broom controlling activities on prairies in 2008. We mowed broom on 256 acres, hand-cut broom on 526 acres and spray treated 150 acres. In addition, TNC assisted on three burn projects on Fort Lewis that totaled 206 acres. In many of the highest priority prairies, years of integrated broom control is paying off. In these areas, broom densities and seed banks have declined. We have entered a new period of broom control on the high priority prairies, and they require a much reduced level of effort to keep the broom invasion at bay.

Overall acres treated are down this year for two main reasons. After more than a year of planning, we were able to achieve Garrison level approval to allow TNC to boss controlled burns on Fort Lewis. In spite of our high hopes that a significant amount of our control effort could come from fire, the loss of Fort Lewis' burn boss interfered with our ability to implement. In addition, 2008 had a cool and moist summer and many native forbs remained active and vulnerable to broadcast herbicide treatment. For this reason, we did not conduct any boom spraying.

Based on excellent 2006 trial results with Triclopyr amine, we made the decision to stop using Tricolpyr ester in 2007. The ester formulation has a diesel oil base of which has potential impact to invertebrates. 2006 had a notably warm and sunny summer, and the 2006 results with the amine formulation were not repeated during the cool and overcast summer of 2007. Spring 2008 monitoring of 2007 broom spray treatments indicated about a 25% mortality rate (based on estimates made at Johnson and Weir Prairies). Although the mortality rate was disappointing, we did notice a significant reduction in broom seed production: for plants under 2 feet in height, there was an almost 100% abortion of flower-to-seed development. 2007 had an unusually cool and moist summer, and broom spaying results were disappointing.

In 2008, a new formulation of Triclopyr ester was released that used soybean oil as its base. Due to the poor performance of Triclopyr amine in overcast conditions, we switched back to use of the ester formula in 2008.

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 provides locations for 2006 broom treatments.

SCOTCH BROOM SUMMARY TABLE

January-March

Fort Lewis Gophers (TNC# 4833)

- *Upper Weir Prairie*. Mowed 119 acres of broom in the northeastern portion of the prairie. This is follow-up work to previous broom control to restrict summer seed set and maintain prairie structure.

Butterflies (TNC# 4831)

- *13th Division Prairie.* Mowed eight small polygons of Scotch broom to enhance prairie structure and to reveal invasives (and in some cases rare natives)

April-June

Fort Lewis Prairie Restoration (TNC# 3917)

- *Johnson Prairie.* 164 acres of the high and medium priority quality were surveyed and treated. Though many small plants held flowers, the vast majority were not viable.
- *Upper Weir Prairie*. Cut 72 acres of the highest priority prairie in two polygons.
- *South Weir Prairie*. Treated 65 acres of flowering broom. There were very few mature plants in the core portions of the prairie.
- *13th Division Prairie –Triangle*. Surveyed and treated 125 priority acres in three polygons.
- Purchased supplies in preparation for conducting prescription burns on Fort Lewis.

Fort Lewis Larks 2008 (TNC# 4866)

- *13th Division Prairie – Pacemaker.* Surveyed and treated 100 highest priority acres.

July-September

Fort Lewis Larks 2008 (TNC# 4866)

- *Upper Weir- Spot Spray*. During summer, we spot treated about 74 acres of the two highest quality polygons. Work was conducted under the Fort Lewis Larks 2008 task order.

Fort Lewis Prairie Restoration (TNC# 3917)

- *Upper Weir – Prescribed burn*. Assisted Forestry with a 125 acre prescribed burn in Northeast section.
- *South Weir.* South Weir Prairie contains some higher quality native prairie, and has been targeted as a priority broom control site. This summer, we spot treated broom on 72 acres. Overall broom densities have greatly declined, though portions of the perimeter still have relatively high counts of seedlings and re-sprouts.
- *Artillery Impact Area – MP1*. In mid-August, we assisted with an 80-acre prescribed burn

just west of Mortar Point 1. This is an area of medium quality prairie that is just outside the AIA and not subject to stringent access restrictions.
October-December Fort Lewis Prairie Restoration (TNC# 3917) • *Upper Weir Prairie.* Mowed 88 acres of Scotch broom in southeast corner. • *Johnson.* Mowed 7 acres of broom on southern edge. • Purchased 10 fire radios for use with prescription fire program. • Conducted trial fall burn with propane tow behind burner using TNC burn boss.

Tasks

Broom control activities of 2008 are described in the sections below for each of the focal prairie restoration sites. Each section provides a comprehensive look at how the control strategy of mowing, spraying, fire and cutting is working and gives an outlook for upcoming requirements. Unless otherwise stated, all broom spray treatments were made with 2.0% Triclopyr ester 0.25% Nufilm as an adjuvant. Maps of the broom treatment areas are provided at the end of the broom section.

2008 was a problematic year for spray treatment. It remained cool and wet throughout the season, and many native forbs didn't senesce. Because of the high numbers of active native plants, we decided that we would not boom spray. Spot treatments were conducted with an elevated level of precaution for non-target impact.

Scotch Broom Control Trial

Monitoring was done this spring on the scotch broom experimental plots. This experiment was primarily designed to determine if using crop oil alone would be an effective means of controlling scotch broom. Preliminary studies found that such an application could top kill the plant, presumably due to phototoxicity. In order for this to be effective, crop oil needs to be applied when it is warm and sunny out, and the more consecutive days without cloud cover, the better the control is likely to be. During application late last summer, the weather did not meet these criteria. It was cool, overcast, and it rained the following weekend. Visual observation during data collection this spring indicated that control was very modest with this method, however formal analysis of the data is currently underway.

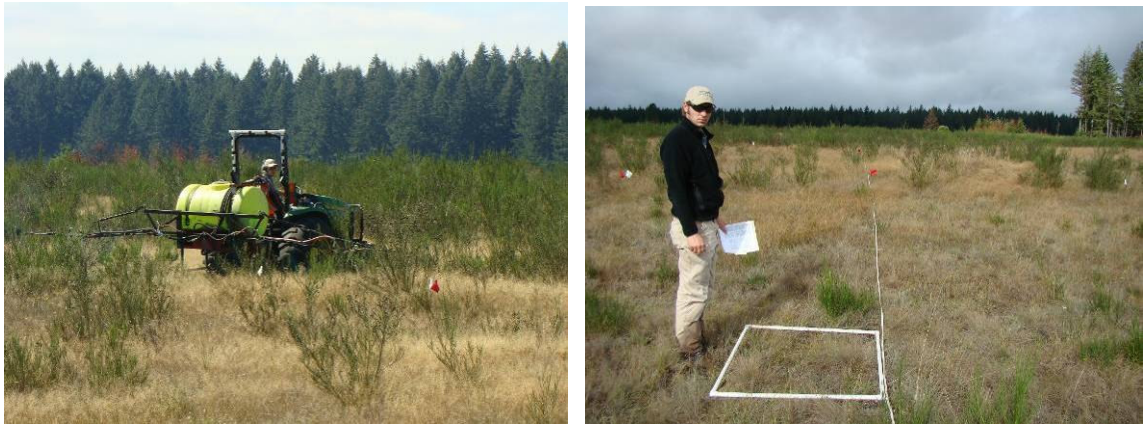

Figure 1: Implementation of the broom control study at Lower Weir Prairie, Fort Lewis.

General Scotch Broom Control

Johnson Prairie. Johnson remains one of the highest priority prairie habitats due to its diverse forb populations and butterflies. We have made tremendous strides at Johnson Prairie in recent years. Broom cutting 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 will be greatly reduced.

Figure 2: Johnson Prairie in spring 2007 showing virtually no mature Scotch broom.

Due to the high level of broom control, very little mowing should be required at Johnson Prairie in the future except around the outside road edges and scattered patches. This year, we mowed about 7 acres on the southern edge and a few dense patches of broom in the west. During spring, an additional 170 acres (the entire core prairie) were brush cut to control the few plants that were flowering and threatened to set seed.

Broom control in 2009 will need to respond to the poor control from the 2007 spray treatment and the lack of prescribed fire. Fire can only be implemented in stages to reduce potential impact to butterflies and other fauna. Mowing may be advisable in patches throughout the western side and the thumb. Continued mowing along the outside road edges will help to push back the broom seed source and open up habitat. A quick evaluation during the spring bloom period will be made to determine if brush cutting is advisable. Areas that are not scheduled to receive summer/fall fire should be surveyed and spot sprayed for Scotch broom.

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 dedication and duration. East of the pipeline the prairie is greatly degraded and heavily infested with broom. Hand cutting was conducted in spring over the whole area to remove plants that were in flower. This was followed-up in August with a spot-treatment.

Looking ahead to 2010, broom densities have been greatly reduced west of the pipeline. This area is difficult to burn because of the smoke risk to the adjacent Rainier Road. It will likely require continual spot treatment and hand-pulling. The area east of the pipeline should be mowed and sprayed/burned in succession to reduce seed source and restore prairie structure

Upper Weir Prairie. Upper Weir has a mixture of quality and treatment history. The highest quality portions are in the southwest and west, with poorer quality prairie in patches along the eastern side. The highest priority portions of this prairie have been managed with a combination of mowing, brush cutting and herbicide and are on-track to reach low-maintenance level for broom control by this year or 2010, depending on the area.

During winter 2008, we mowed 50 acres in the northeast to control seed set. These acres were control burned in August. The higher quality areas in the southwest were surveyed for blooming broom and cut as needed. The remaining 90 acre area of dense taller broom in the southeast was mowed during fall.

Fire needs to play an important role in Scotch broom control on Upper Weir. There are numerous patches of lupine that do not senesce during our spray window, and fire will be the best strategy to control broom without removing the lupine. Otherwise, hand pulling and spraying in the low broom density areas and mowing, burning and spraying in the higher density areas will continue to be our control strategy.

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

Figure 3: Before and after mowing at Upper Weir. Broom growth is up to three feet after one season.

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.

The highest priority sites were mowed at the end of 2007, and we had plans to conduct prescribed burns in 2008. However, the prescribed burn program did not come to fruition and we did not conduct any broom treatment at Lower Weir in 2008.

In 2009, we continue to plan on controlled burns to in the southeast portion of the prairie. We will conduct broom mowing in this area in preparation for the fires to reduce fuels and smoke impact on air quality.

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 strategically managed for broom for more than a decade, and many portions are at a low maintenance condition.

This year we were able to quickly cut flowering broom stems during spring and a wildfire near the power lines occurred on about three acres. There remain scattered patches of broom in the eastern portion that will need continual attention, but most of the site has reached near maintenance condition.

Figure 4: Muck Creek Triangle Area south of South Creek showing low density dead broom.

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.

In spring, we hand cut about 100 acres of flowering broom to control seed set. In spite of our inability implement a controlled burn on this site, about 80 acres of core lark habitat burned in a wildfire this summer. Recent research by WDFW has indicated a strong positive response of lark towards fire, and fire should form a central role in managing the habitat at Pacemaker. In addition, Fort Lewis' LRAM crew has implemented a large-scale mowing effort for all the areas surrounding the core Pacemaker area on 13th Division Prairie.

Looking forward to 2010 and beyond, it is hopeful that we will be able to implement a consistent fire strategy that will maintain broom at minimal levels.

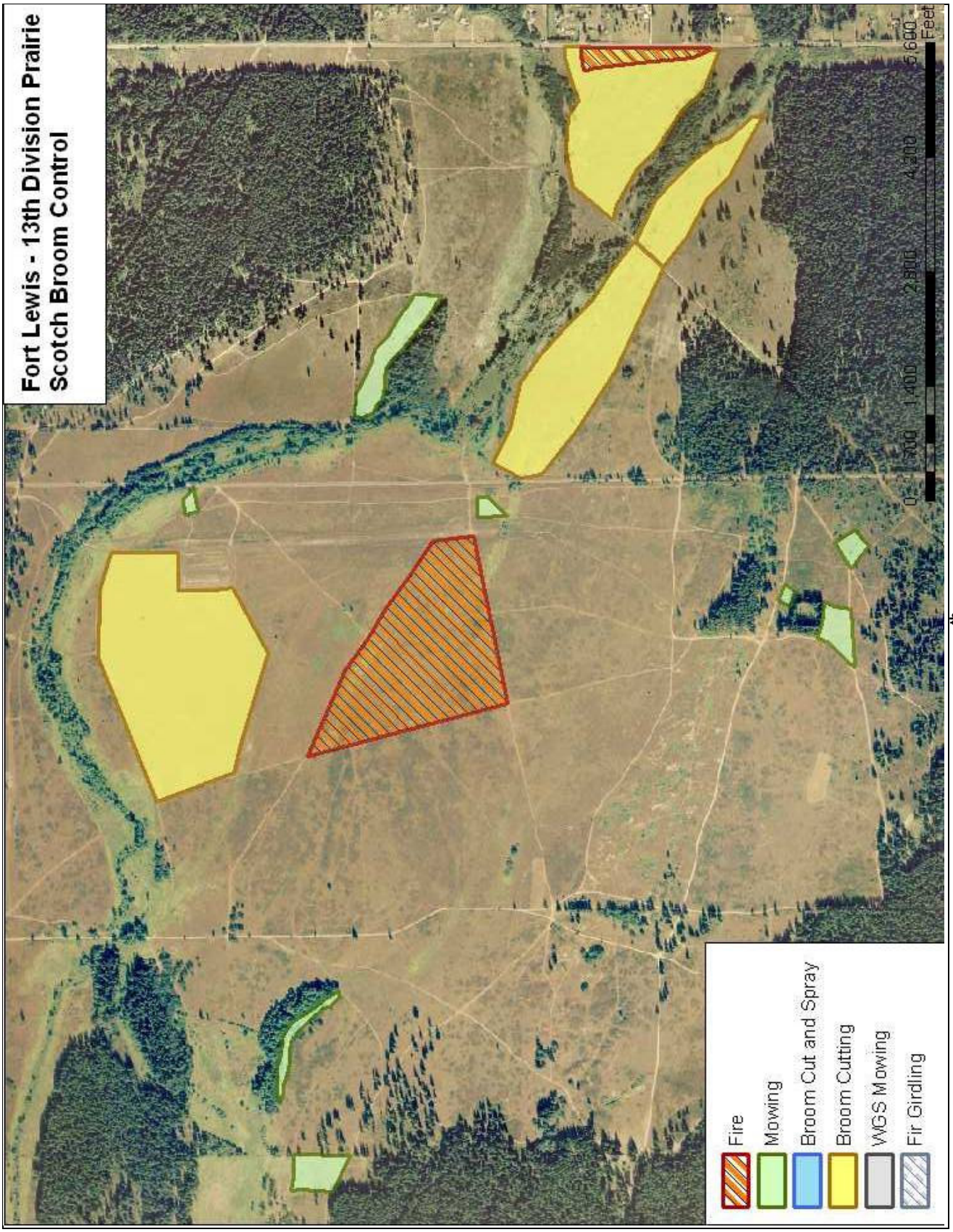

Figure 1:. Map of broom control activities at Fort Lewis 13th Division Prairie

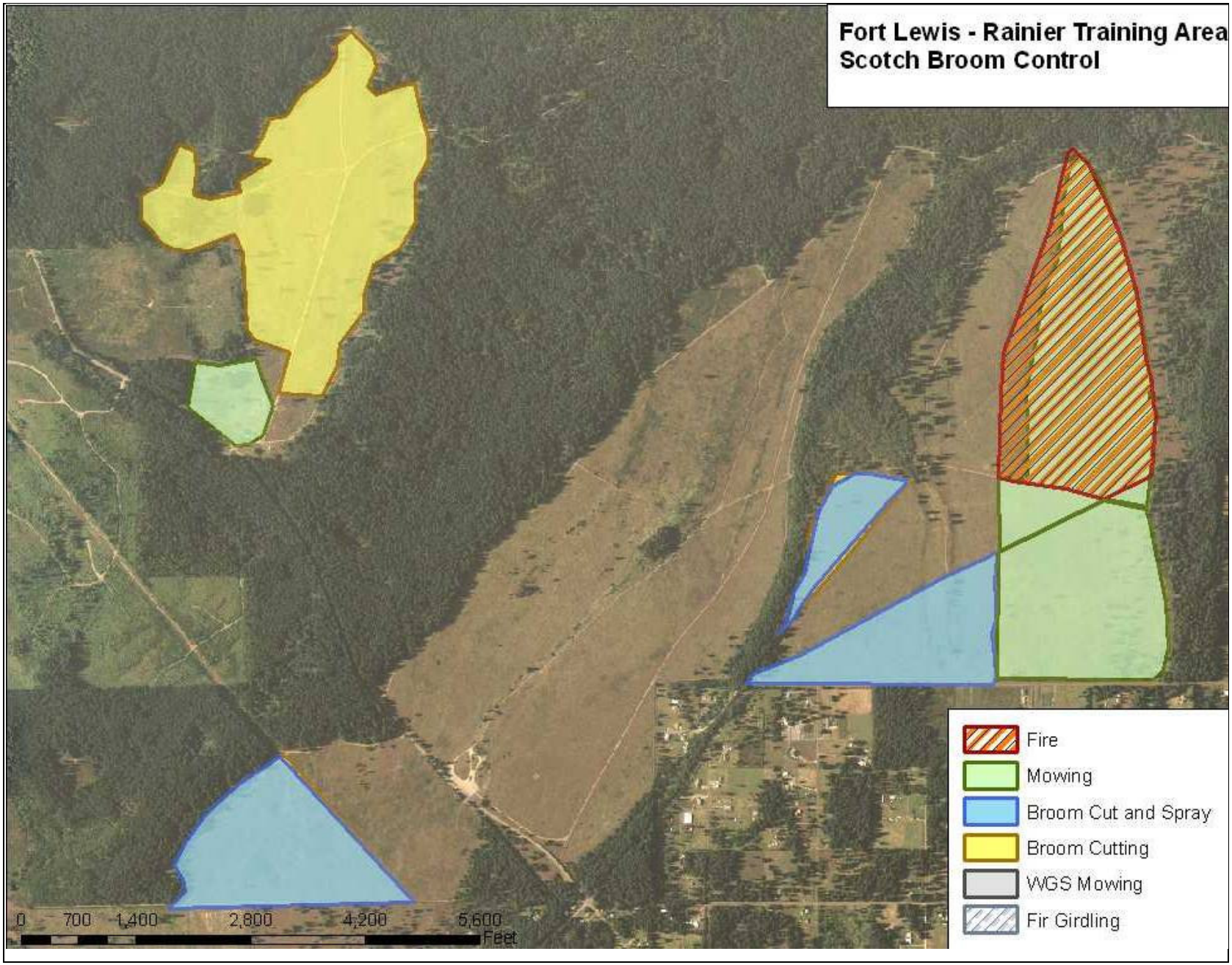

Figure 2:. Map of broom control activities at the Fort Lewis Rainier Training Area.

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.

Since 2004, use of Poast 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 native Roemer's fescue grass.

Colonial bentgrass and tall oatgrass have demonstrated noticable resistance to Poast. Fusillade is another grass specific herbicide that we trialed side-by-side with Poast. Spring 2008 results from the trial indicate that Fusillade is better able to control pasture grasses and still will not impact native fescue. In 2008, we switched to use of Fusillade.

Control of tall oatgrass, a highly invasive pasture grass, is reported in the invasive weed section of this report.

2008 Review

Spring is the primary window for control of pasture grass with herbicide. This year, our efforts were limited by boom access restrictions and poor weather. In total, we sprayed nine acres of prairie to control invasive grasses in spring and five acres in August following a prescribed burn on Upper Weir Prairie.

In spring, we sprayed the large Collins plots with Fusillade located at the Muck Creek Triangle and the other in South Weir Prairie. These plots follow the spray grass, burn, spray glyphosate and seed trajectory developed by the small Collins plot project. A final report for the small Collins plot project will be available in late 2009.

We also conducted a spring Fusillade treatment south of the Muck Creek Triangle on a five-acre plot that has previously been treated twice with Poast in 2005 and 2006. Colonial bentgrass had begun to reestablish after not treating in 2007. We will evaluate the effectiveness of the 2008 treatment this spring as the grasses begin to grow.

PASTURE GRASS CONTROL SUMMARY TABLE
April-June • South Muck Triangle – Sprayed Fusillade on four acre grass control plot (TNC#3917) • Large Collins Plots – Sprayed Fusillade at two large Collins plots near Muck Creek and South Weir Prairie (TNC#3917).
July-September • Applied grass specific herbicide post-burn on five acres at Upper Weir NE burn unit. (TNC#3917)

Post-burn Fusilade Treatment

As The Nature Conservancy's regional fire program grows, controlled burns will hopefully expand significantly on Fort Lewis. Fire is a superior control method for many invasive species, such as Scotch broom, but there are others that are fire tolerant and will become future targets of chemical control. Some grasses, particularly *Agrostis capellaris* and *Arrhenatherum elatius*, are threatening the prairie ecosystem and are not controlled well by fire. However, these grasses can be controlled quite effectively with Fusilade DX, which does not harm the desirable species of *Festuca roemeri* or *Carex inops*. It is hoped that applying Fusilade to an area a couple weeks after burning will be very successful at controlling these grasses when they are germinating or resprouting following the fire and most vulnerable. With this in mind, 5 acres on the northern portion of Upper Weir was treated with Fusilade DX (at a rate of 24 oz. per acre) to evaluate effectiveness (TNC#3917).

Figure 3. Post-burn Fusilade treatment on Upper Weir (TA 21)

PRESCRIBED FIRE PROGRAM

The South Puget Sound region of Washington was once largely dominated by a diverse mosaic of fire dependent grasslands that were interspersed with conifer and deciduous woodlands and wetlands. Lack of managed fire during the past 150 years has led to significant habitat loss and impact on species. Conservation Action Planning (CAP) for the region has identified the return of fire as a very important if not critical restoration strategy. Fort Lewis is particularly well suited to use of fire due to its large size and contiguous ownership.

While Fort Lewis has had a robust prescribed fire program, changes during the last decade have led to a dramatic reduction in acres burned for habitat enhancement. TNC has worked with Fort Lewis Fish and Wildlife during the past two years to develop the capacity for joint TNC/DoD implemented burns that can be bossed by TNC. This work has occurred in conjunction with regional efforts to step up prescribed prairie burns to benefit habitat and rare species throughout South Puget Sound. Funding from the Army Compatible Use Buffer program has been instrumental in providing staff training and equipment for use off-base. This investment in infrastructure has augmented efforts to build the Ft. Lewis prescribed fire program. A 2008 annual report for the regional fire program is available from TNC on request.

We had a major breakthrough in late spring of this year when we were granted approval by the Garrison Commander for TNC to conduct burns on base. This followed a period of research into examples of other TNC/DoD burn projects and a series of planning meetings. Unfortunately, our efforts to implement plans for the 2008 burn season were thwarted. Our strategy to work directly with the Fort Lewis Forestry Fire Program deteriorated when Forestry was unable to participate in a series of cooperatively bossed transition fires. In spite of high hopes that we would complete as many as twenty different burn projects, in the end we were only able to conduct one minor burn during fall, using a tow behind propane burner.

Figure 5: Fort Lewis Forestry at Upper Weir burn site.

On a positive note, one significant step forward occurred during mid-August. There were only two Forestry bossed prairie burns this year, and on both TNC and Fort Lewis Fish and Wildlife staff joined ranks with Forestry firefighters for the first time. While only a small step, it did provide a valuable inroad for future cooperative actions and completed 180 acres of ecological fire.

PRESCRIBED FIRE SUMMARY TABLE
April-June Fort Lewis Prairie Restoration (TNC# 3917) • Purchased supplies in preparation for conducting prescription burns on Fort Lewis. • Collins Plots - Mowed pathways on small and large Collins plots in preparation for summer burning.
July-September Fort Lewis Prairie Restoration (TNC# 3917) • *Upper Weir – Prescribed burn*. Assisted Forestry with a 125 acre prescribed burn in Northeast section. • *Artillery Impact Area – MP1*. In mid-August, we assisted with an 80-acre prescribed burn just west of Mortar Point 1. This is an area of medium quality prairie that is just outside the AIA and not subject to stringent access restrictions. • *Collins Plots* – Completed burning of large and small Collins plots. • Completed purchases of necessary fire equipment for 2008 burn season in collaboration with ACUB. • Provided training four days of prescribed fire training to four TNC firefighters.
October-December Fort Lewis Prairie Restoration (TNC# 3917) • Purchased 10 fire radios for use with prescription fire program. • Conducted trial fall burn with propane tow behind burner using TNC burn boss.

TNC and Fort Lewis Fish and Wildlife assisted on two broadcast burns and two research burns at Fort Lewis. These burns are also reported and mapped in the Scotch broom section of this report.

Collins Plots This was the fifth and final year of treatment of the small Collins plots. All designated small plots were summer burned and given a follow-up spray treatment of glyphosate. Two large plots (1 ha) were received grass specific herbicide in preparation for a summer burn. Due to limited access and limited burning on fort, only one of the large plots was burned. A final report for the small Collins plot project will be available in late 2009.

Firefighter Training. While there were only limited opportunities to conduct burns on Ft Lewis this year, there were numerous prescribed fires on ACUB prairie sites. These burns provided invaluable training opportunities for firefighters from Fort Lewis, TNC and other partners. As a result, we have a far more experienced crew at the end of the 2008 burn season than we began with. Funding from Fort Lewis operations allowed four TNC firefighters to participate on four days of prescribed fire. Training was funded by Fort Lewis Prairies 2008 (TNC#3917).

Equipment and Supply Infrastructure. A total of $23,000 was spent on fire supplies this past year to augment TNC's limited existing inventory. Approximately $13,000 of this came from ACUB, the remainder came from Fort Lewis operational funding that targets prescribed fire on base. Several cost savings efforts were accomplished while purchasing supplies. Slip-on engine units were custom designed and built by the project, likely saving thousands of dollars. Several other items were purchased used instead of new. The end result is a savings of about $16,000. This quarter, funding came from Larks 2008 and Prairies 2008 (TNC#'s 4866 and 3917).

The following is a list of supplies purchased in preparation for the 2008 burn season:

Table 2. Summary of 2008 equipment purchases.

Four Slip-On Engines		***Saved***
fittings	$2,024	
pumps	$1,734	
tanks	$1,439	
misc	$696	
Total	**$5,893**	*$3,000*
Cost per each	***$1,473***	
Engine Supplies		
fire hose + fittings	$2,754	
75' 3/4" garden hose	$180	
foot valve	$105	
garden hose fittings	$35	
tools	$148	
misc extras	$444	
Total	**$3,666**	
Cost per each	***$917***	
Fire Trailer		
525 gallon fire trailer	**$4,900**	
Shelters		
1 new generation	$188	*$150*
9 shelters	$291	*$2,500*
Total	**$479**	
Misc		
drip torches	**$515**	
ATV	**$3,575**	*$3,000*
2 ATV tanks	**$1,000**	

Communications		***Saved***
10 radios 5 mics 5 chargers	$820	
batteries	$148	
5 antennas	$42	
10 harnesses	$249	
repair kits	$104	
5 belt clips	$53	
10 clamshells	$160	
cloning cable	$56	
Total	**$1,632**	*$6,368*
Personal Protective Equipment		
6 gloves	$93	
7 helmets	$15	
2 duffels	$170	
2 Nomex jumpsuits	$386	
1 Nomex pants	$100	
pack belt	$116	
Nomex - used box	$0	*$700*
7 shrouds	$46	
5 goggles	$120	
Total	**$1,046**	
Grand Total	**$22,706**	***$15,718***

Upcoming Activities:

- Develop a reliable strategy to implement TNC/DoD burns with TNC as burn boss.
- Implement a successful burn season that targets ecological burn priorities.

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 and develop seed production beds, which are strategically used 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.

Direct seeding is expected to become increasingly important as methods of restoring at large-scale are further developed. The recent Collin's restoration experiment has helped to develop a technique to blend fire, herbicide and seeding to restore native diversity and abundance. The DoD Legacy project is facilitating this effort by funding efforts to develop propagation and seed production protocols for most of the local prairie plants.

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.

2008 Review

Most of the planting and seeding work in 2008 is reported in the Butterfly section of this report. In addition, the Dept of Defense Legacy seed project continues to be a major component of our regional seed development effort. The Legacy project is reported separately.

PRAIRIE PROPAGATION AND PLANTING SUMMARY TABLE
April-June • *Pipeline* – Re-sprayed Muck Creek Triangle area pipeline restoration area - 3010. • *Pipeline* – Hand controlled weeds at pipeline restoration site to protect emerging native plants near creeks – 3010. • *Sequalitchew Earthworks* -- Expanded treated area adjacent to initial project site by spraying additional eight acres and monitored seed and planting plots - 4866.
July-September • Collected seed from 40 species of prairie plants -4816. • *Spurgeon Creek Seed Plots* - Sprayed 8 acres as site preparation for fescue seed production - 3917
October-December • *Sequalitchew Earthworks* -- Retreated project site to control summer weed germinants. • *Pipeline* – Re-sprayed Muck Creek Triangle area pipeline restoration area.

Pipeline Restoration

In mid-2006, TNC contracted with Williams Pipeline Company to restore the portion of their gas pipeline project where it crossed 13th Division Prairie at the Muck Creek Triangle. Of the almost one-mile long 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 that resulted from the pipeline work is adjacent to a Fort Lewis road and averages about 70 feet in width.

In spring and fall of this year, we made the regularly scheduled spray treatments to control invasive grasses and forbs. A 2% solution of Aquamaster (Glyphosate) was used in areas that had not been previously planted with fescue. A combination of Fusillade DX and Garlon 3a was used over the fescue planted area.

In fall 2007, 240 yards of topsoil/compost mix were delivered from the Fort Lewis EcoPark and dumped along the north project segment. The topsoil was spread during winter 2008 with a small bulldozer to improve future planting success. This soil was treated throughout the year for weeds and will be planted with Fescue in early 2009.

Spurgeon Creek Seed Plots

Site preparation for 8 acres just off Spurgeon Creek Road near the Rainier Road intersection was conducted this summer using a 2% solution of Round-Up Pro(TNC#3917).

SEQUALITCHEW EARTHWORKS LANDFILL RESTORATION

Sequalitchew Earthworks is located on and managed by Fort Lewis. The site has several landfill mounds that have been capped with sand and gravel and an impermeable poly-liner. Landfills represent a regional opportunity to conduct grassland habitat restoration, which could eventually support conservation target animal and plant species. Due to the size of the landfill site, it is not practical to rely on plug planting to establish native plants. Though some targeted planting will probably be a helpful tool, direct seeding will likely prove more effective at large-scales.

The Earthworks habitat enhancement area was treated and expanded this year to a total of 18 acres. Round-up Pro concentrate was used at maximum label rate in the spring.

Monitoring was done on the research plots that were established late last year. Plug survival was very high, whereas no seed germination was observed.

Plots were seeded again in winter 2008. Seed rates were doubled and sown in November instead of January, which should give the seed more time for establishment and cold stratification. Monitoring for germination will be performed in spring 2009.

Table 3: Fall 2008 plot sowing at Sequalitchew Earthworks enhancement project.

Species	Plug mix (grams per plot)	Cocktail mix (grams per plot)	Fescue (grams per plot)	Total grams sown
Aquilegia formosa	0.000	6.160	0.000	**30.800**
Camassia quamash	9.000	0.000	0.000	**45.000**
Castilleja hispida	0.000	0.480	0.000	**2.400**
Erigeron speciosus	0.750	0.000	0.000	**3.750**
Eriophyllum lanatum	0.000	2.880	0.000	**14.400**
Lomatium utriculatum	3.660	0.000	0.000	**18.300**
Lupinus lepidus	8.147	0.000	0.000	**40.733**
Microseris laciniata	5.176	0.000	0.000	**25.882**
Potentilla gracilis	0.000	1.000	0.000	**5.000**
Ranunculus occidentalis	4.640	0.000	0.000	**23.200**
Danthonia californica	0.000	20.117	0.000	**100.583**
Festuca roemeri	0.000	0.000	10.550	**105.500**

This year, a second round of direct seeding was done in the fall as opposed to the winter in order to give seeds more time for cold stratification. These plots will be monitored again in the spring to determine success.

The below table depicts the survivorship of plugs planted in winter 2007. Ranunculus, Microserous, and Erigeron plugs appear to do quite well after one year. They will be monitored again in 2009 to see if they continue to thrive after two winters.

Table 4: Species planted at Sequalitchew as plugs in winter 2008 with spring 2008 survival. ***(10 of each species planted at each plot)***

	Planting tool	ROAC	LOUT	MILA	LULE	ERSP	CAQU
Plot 1	Dibble	10	6	10	6	10	3
	Shovel	10	5	10	7	10	2
Plot 2	Dibble	10	7	9	3	10	0
	Shovel	10	6	10	7	10	1
Plot 3	Dibble	10	5	10	1	10	0
	Shovel	10	2	10	2	10	0
Plot 4	Dibble	2	0	9	4	10	0
	Shovel	3	0	7	4	9	0
Plot 5	Dibble	10	1	10	4	6	0
	Shovel	6	1	7	6	7	0
Total survival		81	33	92	44	92	6
% survival		81	33	92	44	92	6
Dibble survival		42	19	48	18	46	3
% plug survival		84	38	96	36	92	6
Shovel survival		39	14	44	26	46	3
%Shovel survival		78	28	88	52	92	6

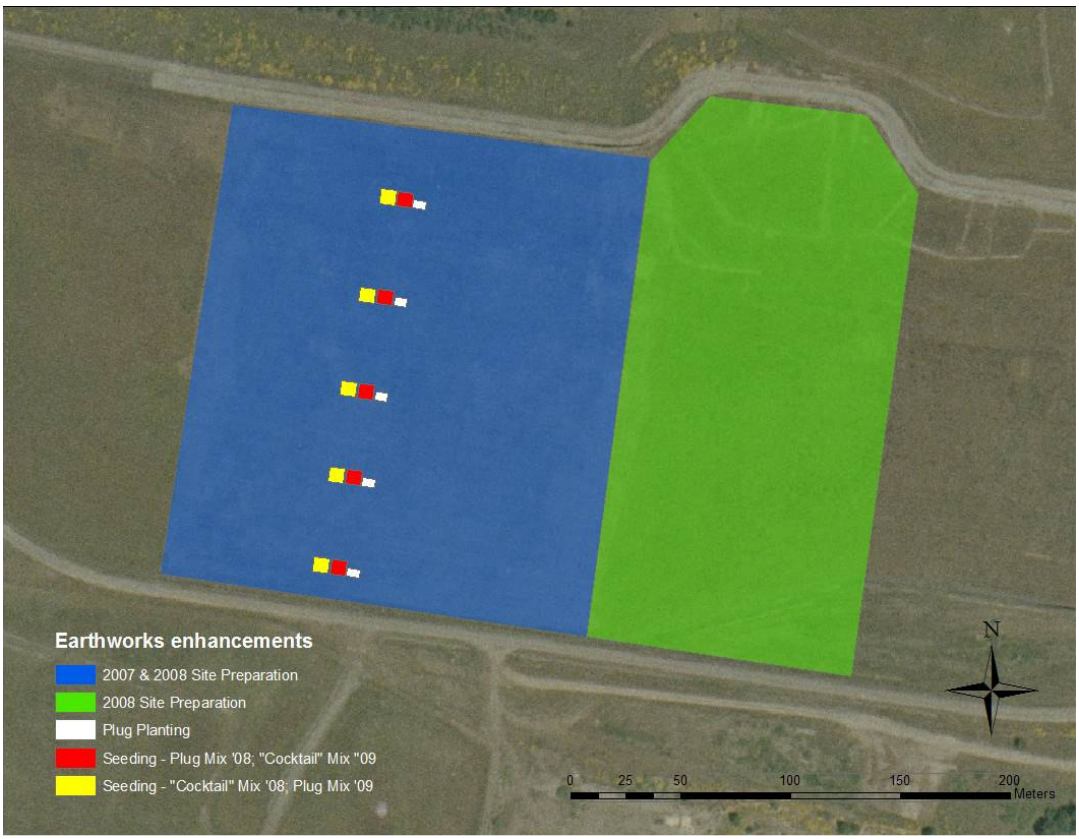

Figure 4: Treatment area and plant establishment plots at Sequalitchew.

SEED COLLECTION

Seed from 40 species of prairie plants was collected and cleaned by Fort Lewis and TNC staff and volunteer crews during the late spring and early summer months. Seed was collected from numerous sites, on and off Ft. Lewis and from Shotwell's Legacy seed beds. Some seed has been and will be used for plug production, direct seed trials, and for large-scale seed production.

TABLE 5: List of seed collected in 2008 by TNC staff and volunteers and Fort Lewis staff.

Spp Code	Total Grams Cleaned	Spp. Standard (in seeds per 1 gram)	Estimated Total Seeds
LICA	0.068		
MIGR	0.176		
CALE	0.307		
HICY	0.35		
CARO	0.75		
PASC	0.8		
DOHE	1.677		
FRLA	2.129		
CAHI	2.455	8333.333	3049.999878
CEAR	3.887	12765.958	24810.63937
ZIVE	4.52		
PLCO	4.857	1000	4857
CAIN	8.388		
LUCA	12.839		
SOCA	29.053	1612.903	57390.31455
PAOC	29.285		
DENU	45.508	1041.667	55127.10097
ARMA	50.259	718.562	18057.10378
KOMA	62.298	5000	204660
SIAN	76.845		
ASCU	79.181	1219.512	96562.17967
LUAL	97.904	51.396	2515.936992
LULE	100	245.499	24549.9
VIAD	101.742	6360.426	57307.43826
ERLA	111.858	8333.332	233037.4627
CAQU	123.769	1666.665	41256.29208
RAOC	144.112	1724.132	54650.24304
ACMI	184.391	9711.503	375597.3609
SOSP	267.303	7185.628	480184.9803
LOUT	292.997	3278.688	160107.6247
ERSP	293.245	20000.004	1954966.829
AQFO	390.802	649.35	126883.6394
POGR	468.283	10000	1142816
DASP	493.003	1351.351	647578.21
ELGL	701.81		
LOTR	709.433	739.524	174880.91
MILA	738.966		
DACA	745.179	745.65	122536.8899
FERO	814.167	7109.005	756255.9519
BADE	848.274	666.668	136975.1073

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 Nature Conservancy conducts prairie restoration actions that aid the butterfly community by controlling invasive weeds, especially Scotch broom and non-native grasses, along with planting native grasses and forbs, on select prairies. In 2004, a butterfly habitat enhancement plan (Fimbel 2004) identified five high priority prairie areas on Fort Lewis and potential strategies for improving habitat for four rare butterfly species. The plan emphasized creating a series of concentrated butterfly resource patches across a variety of habitat structural elements, within a matrix of relatively high quality prairie. During 2004 - 2006, eight - 1 ha. blocks (100 m X 100 m) received management actions including mowing and herbicide applications to control weeds, and plantings of native fescue and forbs, emphasizing butterfly resources.

Recent developments in captive rearing and translocation of Taylor's checkerspot (*Euphydras editha taylori*) butterflies onto Puget prairies necessitates the acceleration of habitat enhancement activities targeting this federal candidate species. To meet this need, 2007 and 2008 butterfly habitat enhancements on Fort Lewis emphasized improvements for Taylor's checkerspot at current and future release sites. The majority of restoration actions are implemented in an experimental fashion to allow comparison of site preparation and planting techniques (plugs of nursery-grown seedlings vs. direct seeding), and first year survivorship data for 2007 enhancement plantings were gathered in May, 2008. This year's forb enhancement plantings to support the Taylor's checkerspot reintroduction program emphasized the 'Pacemaker' site on TA 14 in preparation for a planned releases of checkerspot caterpillars in February, 2009, and the TA 7S prairie site for a planned release in 2010.

To support science-based habitat enhancement, we undertook pilot projects to identify methods suitable for investigating characteristics of habitat used by Taylor's checkerspot butterflies in diapause phase. In 2008, additional efforts were directed toward the Johnson prairie butterfly community, with particular emphasis on the two silverspot butterfly species. Observations of the adult butterfly community, and larval resources for the silverspot butterflies were mapped. Larval host and nectar resources for silverspot butterflies were enhanced with nursery grown seedlings and seeds.

2008 Review

Primary efforts are currently directed atinvasive plant control, while increasing native forb species through direct seeding and planting nursery grown seedlings on select parcels of semi-native prairie in Training Areas 14, 15, and 7S. These enhancements are conducted in support of the Taylor's checkerspot butterfly reintroduction program currently being implemented by Fort Lewis, and also targeting silverspot butterflies in Training Area 22. At the same time, enhancement techniques are being applied in an experimental manner to allow evaluation and improvement of different approaches to butterfly habitat enhancement.

Two pilot projects were also initiated to investigate approaches to characterizing diapause habitat for Taylor's checkerspot caterpillars. Whereas some information was gained, these two pilots led to the development of a third approach to be implemented in the summer of 2009. Although butterfly habitat enhancement activities are designed to provide specific benefits to target butterflies, most prairie fauna, especially pollinators, are expected to benefit from restoration activities that reduce non-native plants while increasing natives, especially forbs, and restoring historical prairie structural components to the vegetative community. We are also participating in the butterfly habitat enhancement working group supported by the ACUB initiative to ensure transfer of information and techniques between Fort Lewis and other Puget prairies. 2008 highlights:

2008 goals were to enhance prairie habitat for butterflies, with particular emphasis on Taylor's checkerspot, and the valley silverspot on Fort Lewis.

Objective 1. Enhance habitat for Taylor's checkerspot in TA 14 (Pacemaker Seibert-staked area), the Seibert-staked area in TA 7S, and TA 15 (Triangle Seibert staked Research Natural Area between Muck Creek and South Creek) incorporating vegetation monitoring to determine success of restoration approach.
Objective 2. Conduct trials to investigate characteristics of habitat used by Taylor's checkerspot butterflies in diapause phase to refine restoration targets.
Objective 3. Map adult butterfly community use and larval resources for silverspot butterflies on Johnson Prairie to guide management planning, along with enhancement plantings of larval and nectar resources in habitat patches.

2008 highlights:

- First year seedling establishment from direct seeding was generally low for most perennial forbs in our trial ($\leq$ 4%), but higher for the one annual Plectritis congesta (~ 20%), with some species yielding very few seedlings. Thus, it may be useful to determine which species establish better by direct seeding vs. planting nursery grown seedlings from cells.
- It appears from our data, and results from the Collins research program, that a key component to site preparation for seedling establishment in moderately degraded prairies includes herbicide spraying to reduce the cover of non-native

vegetation. Thus, investigations into other combinations of herbicide spraying treatments in preparation for direct seeding are warranted.

- Conversely, it appears from first year seedling establishment results that there is little difference among burning, de-thatching, and doing nothing as preparation for direct seeding of some forbs in moderately degraded prairie. Longer-term monitoring is warranted to better understand the influence of site preparation technique on seedling establishment and prairie restoration.
- There were no significant differences in first year survivorship of seedling plugs or seedling establishment rates between de-thatched and control treatments at TA 15.
- First year survivorship results of planted seedlings in plugs yielded a high of 99% survival for *Fragaria Virginia*, followed by *Armeria maritima* at 68 – 75%, and *Castilleja hispida*, *Balsamorhiza deltoidea* and *Lomatium utriculatum* at 46 – 59%.
- First year seedling establishment rates from direct seeding ranged from a high of 20% of seeds for the winter annual *Plectritis congesta*, to 4 – 13% for Lomatium utriculatum, and a low of < 1% for *Castilleja hispida* and *Erigeon speciousus*.
- With the aid of the WCC crew, we planted the following butterfly resources: 387,800 seeds and 9,100 nursery grown forb seedlings ('plugs') into four prairies this fall/winter.
- Four surveys totaling 46.5 survey hours between May and August, 2008 yielded observations of 763 butterflies from fifteen species on Johnson Prairie.
- Observations of two species of silverspot butterflies were considerably lower in 2008 compared to 2003 observation rates on Johnson prairie.

BUTTERFLY SUMMARY TABLE

April-May

Fort Lewis Butterflies (TNC#4831)

- *13th Division Prairie* - Mowed Scotch broom on eight polygons totaling 31 acres.
- Washington Butterfly Association: Set up agreement for WABA volunteers to survey for butterflies at Johnson Prairie.
- Initiated butterfly detection dog training for detection of Taylor's Checkerspots.
- Purchased one-half of a Drumloc Model DL6 herbicide storage shed to safely contain herbicide (split with TNC#4834)

July-September

Fort Lewis Butterflies 2008 (TNC#4877)

- Facilitated Johnson Prairie butterfly monitoring by Washington Butterfly Association volunteers.
- Mapped *Viola adunca* and *V. praemorsa* at Johnson Prairie.
- Conducted vegetation monitoring of butterfly enhancement plots at 13th Division Prairie.
- Conducted vegetation monitoring in trial site preparation plots on Lower Weir Prairie.
- Treated butterfly enhancement area at Pacemaker (TA 14) to control invasive grasses.

September-December

Fort Lewis Butterflies 2008 (TNC#4877)

- Completed Johnson Prairie butterfly habitat mapping.
- Completed vegetation monitoring on butterfly habitat enhancement plots at Muck Creek Triangle.

- *P*lanted the following butterfly resources at 13th Division and Johnson Prairies: 387,800 seeds and 9,100 nursery grown forb seedlings ('plugs') into four prairies this fall/winter.
- Completed first-year monitoring of Lower Weir Prairie site preparation seeding trials.

Taylors Checkerspot Butterflies

Habitat Enhancements for Taylor's Checkerspot Butterflies

Project Objective: Enhance habitat for Taylor's checkerspot in TA 14 (Pacemaker Seibert-staked area), the Seibert-staked area in TA 7S, and TA 15 (Triangle Seibert staked Research Natural Area between Muck Creek and South Creek) incorporating vegetation monitoring to determine success of restoration approach

In collaboration with Fort Lewis Fish and Wildlife personnel, we identified priority actions for enhancing habitat to support planned reintroductions of Taylor's checkerspot butterflies at three prairie sites, TA 14, 15, and 7S and developed a 2008 workplan. Fort Lewis and The Nature Conservancy weed control specialists applied herbicide to control invasive grasses and forbs at select sites in preparation for fall planting. The workplan called for summer or fall prescribed burns at the three prairie sites, but these burns did not occur. The absence of a burn treatment resulted in sub-optimal planting conditions for 2008. In May we evaluated seedlings and seeds planted in the fall of 2007 for seedling survivorship (from plugs) and seedling establishment from direct seeding in two trials comprising a total of 5 different site preparation treatments.

First Year Results of Habitat Enhancement at TA 15, Muck Creek Triangle

Seedling establishment by direct seeding ranged from a low of 0.3% in harsh paintbrush (*Castilleja hispida)*, to a high of 19.7% in the spring annual *Plectiritis congest*a (Table 6). Site treatment (de-thatch vs. control) did not appear to affect first year seedling establishment in any substantial way, other than for harsh paintbrush. Direct seeding in this trial yielded higher seedling establishment rates compared to the seeding trial conducted at Lower Weir prairie (see table below). Direct seeding is highly dependent upon local microsite conditions, and we do not have corollary site data to explain the different results at the two sites.

Table 6: First year results showing mean number of seedlings / m^2, and approximate seedling establishment rate, by site treatment for four forbs direct seeded at 20 de-thatch and 10 control sites at TA 15, May 2008.

B. deltoidea		*C. hispida*		*L. utriculatum*		*P. congesta*	
de-thatch	control	de-thatch	control	de-thatch	control	de-thatch	control
0.9 / m^2	1 / m^2	0.55 / m^2	0.17 / m^2	8 / m^2	6.4 / m^2	12.4 / m^2	10.8 / m^2
1.4%	1.5%	0.9%	0.3%	12.7%	10.2%	19.7%	17.1%

First year survivorship for seedlings planted as nursery-grown 'plugs' at the triangle site did not differ greatly between de-thatched and control sites (Table 2). Strawberries *(Fragaria virginiana*) yielded the highest survivorship, and generally appeared very

vigorous. Spring gold (*Lomatium utriculatum*) had the lowest survivorship and the plants exhibited relatively low vigor.

Table 7. First year survivorship of forb plugs by site treatment at 20 thatch (de-thatch) and 10 control sites at TA 15, May 2008.

	F. virginiana		*A. maritima*		*B. deltoidea*		*C. hispida*		*L. utriculatum*	
	thatch	control	thatch	control	thatch	control	thatch	control	thatch	control
# planted	360	180	120	60	12	60	960	480	480	240
% survived	96%	99%	68%	72%	59%	53%	55%	46%	49%	49%

First Year Results of Site Preparation Treatments on Lower Weir Prairie
We tested four site preparation techniques: 1) burn, 2) burn + de-thatch, 3) burn + glyphosate spray + de-thatch, and 4) de-thatch, and a control, on the establishment of seedlings from fall direct seeding of seven native forbs in 15 – 1 m^2 test plots (3 replicates of 5 treatments) at Lower Weir Prairie during 2007/2008. First year summary results across all treatments revealed that four species, *Ranunculus occidentalis, Lomatium triternatum, Lomatium utriculatum,* and *Balsamorhiza deltoidea* yielded more seedlings (~ 3 - 4% of seeds) compared to three other species tested, *Solidago* sp., *Castilleja hispida,* and *Erigeron speciousus* (~0.03% of seeds). Site preparation treatments affected seedling establishment (P = 0.02), and percent cover of the non-native forb *Agrostis capillaries* (P = 0.01), and the non-native forb *Hypochaeris radicata* (P = 0.04). The burn + glyphosate spray + de-thatch site preparation treatment yielded the most favorable results, with generally higher rates of seedling establishment, and correspondingly lower percent cover values of non-native plants (Figures 5-7).

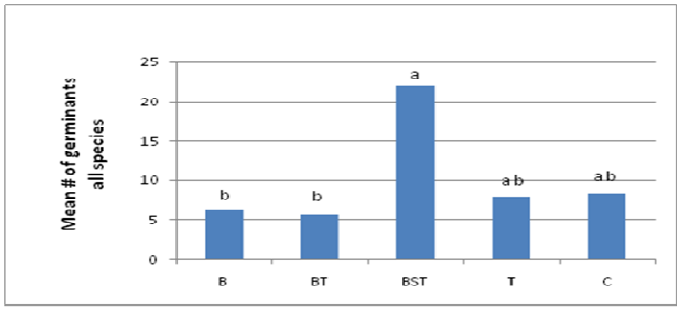

Figure 5. Mean (n=3) number of germinants (seedlings) per m^2 for all species seeded, by site treatment at Lower Weir prairie, 13 June 2008. Means with the same letter are not significantly different at the P < 0.05 level. Treatment codes as follows: B = burn, BT = burn and de-thatch, BST = burn, glyphosate spray and de-thatch, T = de-thatch, C = control.

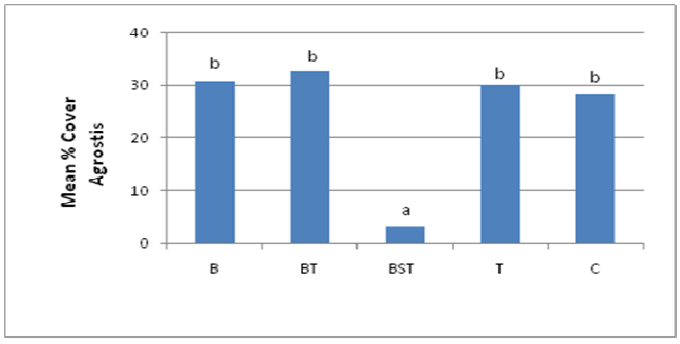

Figure 6. Mean (n=3) percent cover per m^2 of the invasive grass Agrostis capillaris by site treatment at Lower Weir prairie, 13 June 2008. Means with the same letter are not significantly different at the P < 0.05 level. Treatment codes described in Figure 1 above.

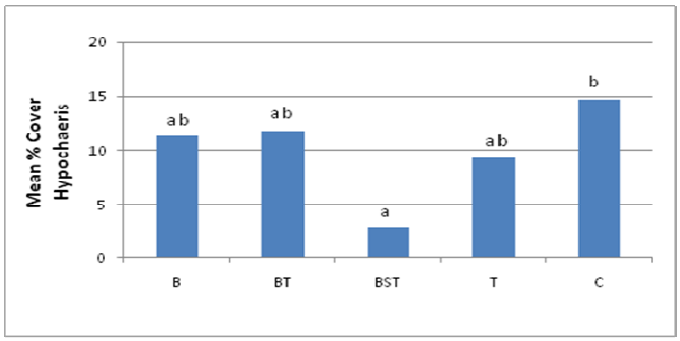

Figure 7. Mean (n=3) percent cover per m^2 of the invasive forb Hypochaeris radicata by site treatment at Lower Weir prairie, 13 June 2008. Means with the same letter are not significantly different at the P < 0.05 level. Treatment codes described in Figure 1 above.

This pilot project raises three main points concerning site preparation and establishing prairie forbs from seed, that could serve as topics for further investigation:

1. First year seedling establishment from direct seeding was generally low for most species (≤ 4%) in this trial, with some species yielding very few seedlings. Thus, it may be useful to determine which species establish better by direct seeding vs. planting nursery grown seedlings from cells.
2. It appears from these data, and results from the Collins research program, that a key component to site preparation for seedling establishment in moderately degraded prairies includes herbicide spraying to reduce the cover of non-native vegetation. Thus, investigations into other combinations of herbicide spraying treatments in preparation for direct seeding are warranted.
3. Conversely, it appears from these first year seedling establishment results that there is little difference among burning, de-thatching, and doing nothing as preparation for direct seeding of some forbs in moderately degraded prairie. Longer-term monitoring is warranted to better understand the influence of site preparation technique on seedling establishment and prairie restoration.

In summary, native prairie forbs used in these trials differed in their transplant survivorship and seedling establishment rates as measured first year post-planting. Survivorship and vigor parameters generated from these trials will become more important following multiple years when plants become more established and can provide a better indication of longer-term potential for providing resources for butterflies and other prairie organisms. Monitoring will continue in subsequent years to provide these comparative data. First year results, however, indicate that tap-rooted plants like *Lomatium utriculatum* and *Balsamorhiza deltoidea* may do relatively well from direct seeding, reducing the need for establishment in nursery cells. In addition, it appears that de-thatching, burning, or a combination of these treatments confer little to no advantage on first year seedling establishment from direct seeding or nursery grown seedlings compared to doing nothing. The addition of an herbicide spray component appears critical to increasing first year success of seedling establishment of direct seeded forbs. Longer-term monitoring may reveal a benefit of site treatments over controls. Future actions will include continuation of the monitoring program, along with additional seed and seedling (plugs) plantings to increase the size of the enhancement area while exploring the use of de-thatching as a substitute for burning.

2008 Habitat Enhancement Plantings Targeting Taylor's Checkerspot

With the aid of the Washington Conservation Crew, we planted a total of 386,000 seeds and 5,800 nursery grown forb seedlings ('plugs') into three prairies (Table 8) to enhance habitat for Taylor's checkerspot butterflies, although these forb species provide resources for a wide variety of prairie fauna.

Table 8. Nursery grown seedling plugs and seeds planted into three prairies on Fort Lewis, WA, November and December 2008.

	bareroot	nursery plugs				direct seed (~ # seeds)							
	LOTR	ARMA	BADE	CAHI	ERLA	PLCO	LOTR	LOUT	ARMA	BADE	CAQU	CAHI	ERLA
TA 14 Pacemaker	500	1,000	300			30,000	50,000	50,000	15,000	3,000	3,000		
TA 15 Triangle		500					50,000	50,000	15,000	3,000		36,000	22,500
TA 7S				3,000	500							36,000	22,500

Diapause Habitat Characteristics for Taylor's Checkerspot Butterflies

Project Objective: Conduct trials to investigate characteristics of habitat used by Taylor's checkerspot butterflies in diapause phase to refine restoration targets to test methods for gaining information on characteristics of habitat used by Taylor's checkerspot caterpillars while in their diapause phase (~ mid-July to mid-February) to better inform habitat restoration to aid species' recovery.

TNC initiated two trials in 2008 to investigate approaches to identifying important habitat characteristics of Taylor's checkerspot butterflies in diapause phase. The first trial included training a conservation detection dog to locate checkerspot larvae, and the second trial focused on the release of captive-reared checkerspot larvae into framed enclosures on native prairie.

Conservation Detection Dog Training to Locate Checkerspot Larvae

To gain a better understanding of habitat needs for relatively unknown, but important life stages of a priority butterfly species, the Taylor's checkerspot, we investigated the potential for training a conservation detection dog to locate checkerspot larvae in native prairie sites (Fig 8).

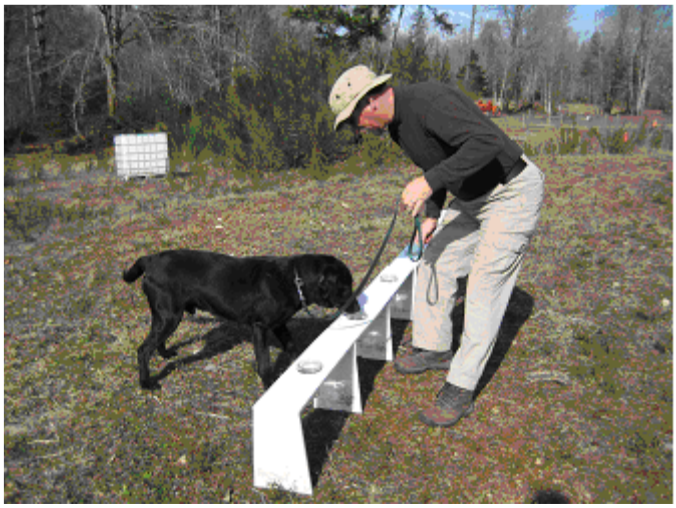

Figure 8: Butterfly detection dog training, Gig Harbor, WA, February, 2008.

The primary objective was to work with Packleader Dog Training in Gig Harbor to train one of their 'conservation detector' dogs to locate checkerspot larvae in prairie habitat. Primary applications for such training are expected to include locating larvae in the field

to better understand characteristics of habitat according to larval stage, especially diapause; conducting searches in habitats in the Puget Sound region where their presence is suspected but not confirmed; and identifying occupied habitat patches to guide on-site implementation of habitat management actions such as fire or herbicide applications. Other potential applications include assisting the reintroduction program to track population dynamics at sites receiving captive-bred larvae.

The initial scent training commenced in February, 2008, with teaching the dog to identify the scent of checkerspot larvae provided by the WDFW / Oregon Zoo captive breeding program. Training then progressed to incorporate field exercises that improved the dog's detection distance under differing wind, temperature, and vegetation conditions, and provide handler training. These training exercises proceeded well, and under ideal conditions, the dog was able to detect captive larvae and piles of frass 'planted' in the prairie from up to 10 – 40 meters. The final stage of training progressed to wild larvae in native habitat on Range 76 at Fort Lewis in March, 2008. In these conditions, the dog displayed more difficulty locating larvae. Despite finding many larvae, there were perhaps an equal number that he missed. Training was put on hold until new colonies of young checkerspot larvae were expected to hatch, in June 2008, to provide a more concentrated source of larvae, and therefore scent. In June, however, Mary Linders, the project lead for the checkerspot reintroduction project, determined that it was imprudent to subject the single known remaining wild population of checkerspot butterflies in the South Sound lowlands to any further research impacts, as they appeared to exhibit low numbers at that time, likely due to extremely cold and wet weather conditions in the spring, 2008. Detection dog efforts, therefore, remain on hold until such time as it appears that conditions would be favorable for larval detection, and the research population of Taylor's checkerspot butterflies appears to be suitably robust to withstand potential impacts from research activities.

Release of Taylor's Checkerspot Caterpillars in Prairie Enclosures

The Butterfly Lab at the Oregon Zoo provided 22 Taylor's checkerspot caterpillars from their captive rearing program on 11 July, 2008 for this diapauses habitat investigation. Larvae were nearing entry into diapause, and were in either their 4th or 5th instar phase. Larvae were placed as groups (10 and 12 individuals) on a *Plantago lanceolata* host plant under two 0.5 m^2 (71 cm x 71 cm) enclosures (Figures 9 and 10) at Glacial Heritage Preserve in Thurston County, WA on 11 July. *P. lanceolata* plants were beginning to show signs of desiccation, but were still generally erect and robust and medium green. No rocks or stones naturally occurred in the plots, so several of these items were added to approximate conditions more typically found on prairies elsewhere in the South Sound.

Figure 9. Example of caterpillar enclosure on Glacial Heritage Preserve, WA, July, 2008.

Vegetation and other cover variables were recorded for each of the two release plots. Enclosures were removed to collect data on caterpillar activity on 13, 15, 18, and 24 July 2008 (Table 9). Caterpillars were initially observed under a rock or at the base of a plant (figure 11), or in a small tunnel in the soil. No webbing was observed in association with the caterpillars at any of the visits. By 24 July, butterflies were no longer locatable within the plots; the were assumed to be buried in the soil, had escaped the enclosure, or died. On 17-19 September, both plots were carefully excavated to a depth of 6", screening all material to search for caterpillars. One live caterpillar was found among thatch debris in the east plot.

Figure 10. One of two plots containing caterpillars with mesh cover removed, at Glacial Heritage Preserve, WA, July 2008.

Figure 11. Single caterpillar resting in depression under rock (left), shown in place in right figure, Glacial Heritage preserve, WA, July 2008.

Table 9. Observations of Taylor's checkerspot caterpillars after release into enclosures at Glacial Heritage Preserve, WA, July 2008.

Date	Plot	Qty. larvae	Behavior	Substrate	Comments
13 July	W	1	moving	vertical P. lanceolata leaf	small amnt evid. of feeding & frass
13 July	W	2	resting	2 together in small hollow at base of release P. lanc.	
13 July	E	1	resting	Under large rock	
13 July	E	1	burrowing	Narrow hole in soil under litter	Larva slowly disappeared into vertical hole in soil. Molted skin next to hole.
13 July	E	2	crawling	Ground surface	Final, diapause (5th?) instar
13 July	E	1	resting	On ground surface under litter at base of Leucanthemum	
15 July	W	1	Resting	Small hollow at base of release P. lanc.	Not in diapause condition (instar prior to), crawled out after disturbance and crawled through plot
15 July	E	1	resting	Small hollow at base of very small P. lanc.	
15 July					No larva under rock in W plot, and no larva at base of Leucanthemum in E plot. Did considerable excavations in areas with small holes to search, but no larvae.
18 July	W	1	resting	Small hollow at base of Balsam/grass clump	Larva in diapause condition
18 July	E	1	resting	On top of leaf of release P. lanc. plant	Fell off plant when disturbed and crawled around plot during investigation.
18 July	W & E				Locations containing larvae during previous visit no longer contain larvae.
24 July	W & E				Locations containing larvae during previous visit no longer contain larvae.

It is likely that searching actions influenced the behavior and movements of the caterpillars and thus the results. Observations by Gordon Pratt on Quino checkerspot caterpillars, however, also revealed that these caterpillars moved between sites several weeks into diapause. Taken together, these observations reveal that the diapause state is not entirely static, but may be somewhat dynamic. In addition, although some caterpillars likely escaped from the enclosures, and I may have missed some individuals during the September plot excavation, it is also possible that some caterpillars died, as this life stage is highly susceptible to mortality. Observations from this trial suggest use of duff layer, especially at the base of plants, and small soil tunnels as diapause habitat for Taylor's checkerpot caterpillars. More research is warranted, and future efforts to document diapause habitat in 2009 will center on creating a more tightly enclosed prairie habitat unit to prevent escape by the caterpillars.

Johnson Prairie

Project Objective: Map adult butterfly community use and larval resources for silverspot butterflies on Johnson Prairie to guide management planning, along with enhancement plantings of larval and nectar resources in habitat patches.

Johnson prairie has historically supported one of the more diverse and abundant butterfly communities on Fort Lewis. Despite weed control efforts, invasive grasses flourish in some areas, and some species of butterflies appear to be declining, especially noteworthy is the state monitor species the valley silverspot (also known as the zerene fritillary). Management activities to control invasive plants and favor native forbs are expected to increase on Johnson prairie in the upcoming years to improve conditions for butterflies. In an effort to inform management planning, and minimize impacts on the butterfly community, we are developing a baseline map of adult butterfly habitat use and *Viola adunca* distribution, the presumed host plant for two resident silverspot butterflies. This approach of mapping adult and larval habitat sites could serve as a model for site-based grassland restoration efforts elsewhere targeting butterflies or other invertebrates with multiple life stages.

Larval Resources

We walked transects in May 2008, noting locations of *Viola adunca* and *V. praemorsa* by patch size and density with the aid of a GPS, in the northeast section of Johnson prairie, an area historically frequented by silverspot fritillaries (Figures 12 and 13).

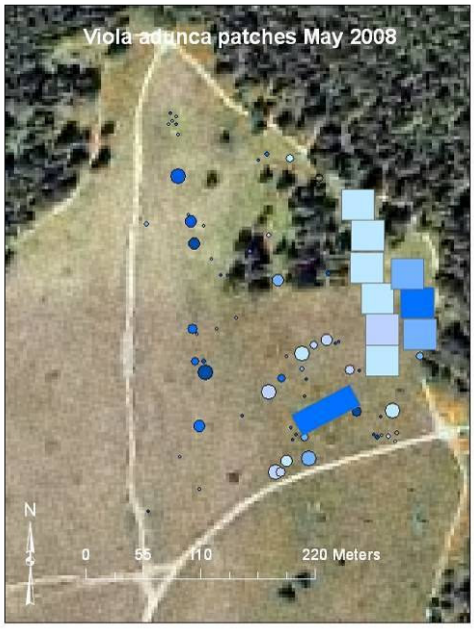

Figure 12. Viola adunca patches in NE corner of Johnson Prairie, May, 2008. Size of circle indicates size of V. adunca patch (< 278m2), and deeper colors equals denser patches (< 8 plants/m2). Squares (900 m2) or rectangle reflect average data results from transects sampling continuous diffuse distributions.

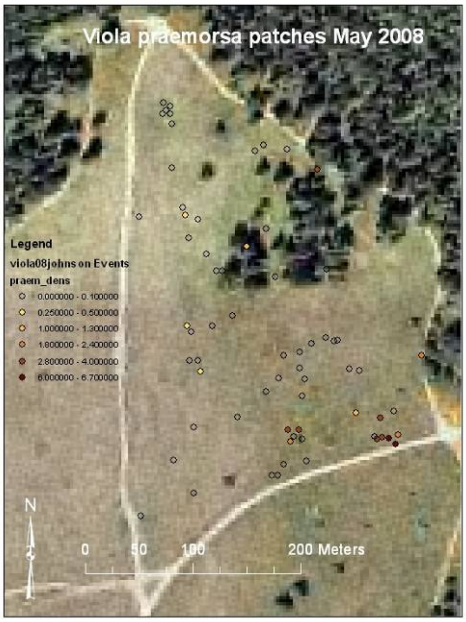

Figure 13. Viola praemorsa patches in NE quadrant of Johnson Prairie, May 2008. Deeper colors represent denser patches (< 6.7 plants/m^2). There were additional V. praemorsa plants in the swale along the eastern edge, but data were less reliable for that region due to multiple observers.

Adult Butterflies

Bob Hardwick, research chairman for the Washington Butterfly Association (WABA), an association of amateur and professional butterfly enthusiasts, organized volunteers to conduct five monthly (April – August) butterfly mapping exercises on Johnson Prairie during the spring and summer of 2008. The volunteers, led by Bob, surveyed the prairie a section at a time, recording locations and numbers of butterflies observed on a map of Johnson Prairie. They were generally on site from approximately 9:30 am – 3 pm to allow time to cover the entire prairie during a visit.

Four surveys totaling 46.5 survey hours between May and August, 2008 yielded observations of 763 butterflies from fifteen species (Table 10, Figures 14 and 15). A survey conducted in April did not yield any observations of butterflies because the weather conditions did not promote butterfly flight. Common ringlets were the most abundant butterflies, and were observed throughout the prairie. Puget blue butterflies were the second most abundant, occurring at most sites containing lupine plants. Common woodnymphs were the third most abundant butterfly, flying later in the season, and most commonly observed in the southern half of the prairie. Valley silverspots were not observed during any of these surveys, nor by the Fort Lewis RTLA survey team this year, but one individual was observed by Kelly McAllistair on August 3rd on the northeastern edge of Johnson Prairie.

These 2008 results may be compared to observations gathered during a survey effort organized by Maija Morgenweck and Patrick Dunn in 2003 (Table 11). With the exception of common ringlets and hoary elfins, butterfly observations per survey hour were generally lower for most species in 2008 compared with 2003. The number of species observed was also lower in 2008, perhaps due to less survey time in 2008. Butterfly species observed in 2008 but not in 2003 include: 13 spring azures and 1 cabbage white. Butterfly species observed in 2003 but not in 2008 include: 1 silver-spotted skipper (state monitor species), 28 valley silverspots (state candidate species), 6 western tiger swallowtails, 3 pale tiger swallowtails, 1 clouded sulfur, 1 red admiral, 2 Lorquin's admiral, and 3 gray hairstreaks. The distribution pattern of Puget blue butterflies was similar in 2003 and 2008, the species being widely distributed throughout the prairie in both years. The distribution of silverspot fritillary observations in 2008 was concentrated on the east side of the prairie. This is in contrast to the 2003 silverspot observations which included numerous sightings in the 'thumb' and other forest edges on the west side of Johnson prairie.

For another comparison between years, total butterflies counted by the RTLA survey team at Johnson prairie were approximately 15% lower in 2008 compared with 2003 numbers, and number of species observed was also lower. RTLA data show wide vacillations in butterfly numbers on Johnson prairie in intervening years, so the two years, 2003 and 2008, should not be used to quantify a decreasing trend.

Additional hours were spent searching for valley silverspot butterflies outside of Bob Hardwick's survey effort, though none were found other than the single individual by Kelly McAllistair. Valley. Silverspots have become increasingly difficult to locate on

Johnson and other Puget prairies during the last five years. Barry Bidwell's long-term monitoring effort at Glacial Heritage Preserve in Thurston County has also documented a decline in silverspot fritillaries in recent years. The absence of valley silverspots, and the apparent decline of Puget sound silverspots is cause to direct habitat improvements for these butterflies. Control of invasive grasses and promotion of violets (*V. adunca, V. praemorsa* and *V. glabella*) as larval food plants for both species, and late season nectar resources, especially showy fleabane (*Erigeron speciousus*), are in progress. Habitat improvements currently target resource islands along the eastern side and western thumb areas of Johnson prairie, with expectations of increasing the number of resource islands and clearing forest 'nooks' along the eastern and western edges in upcoming years.

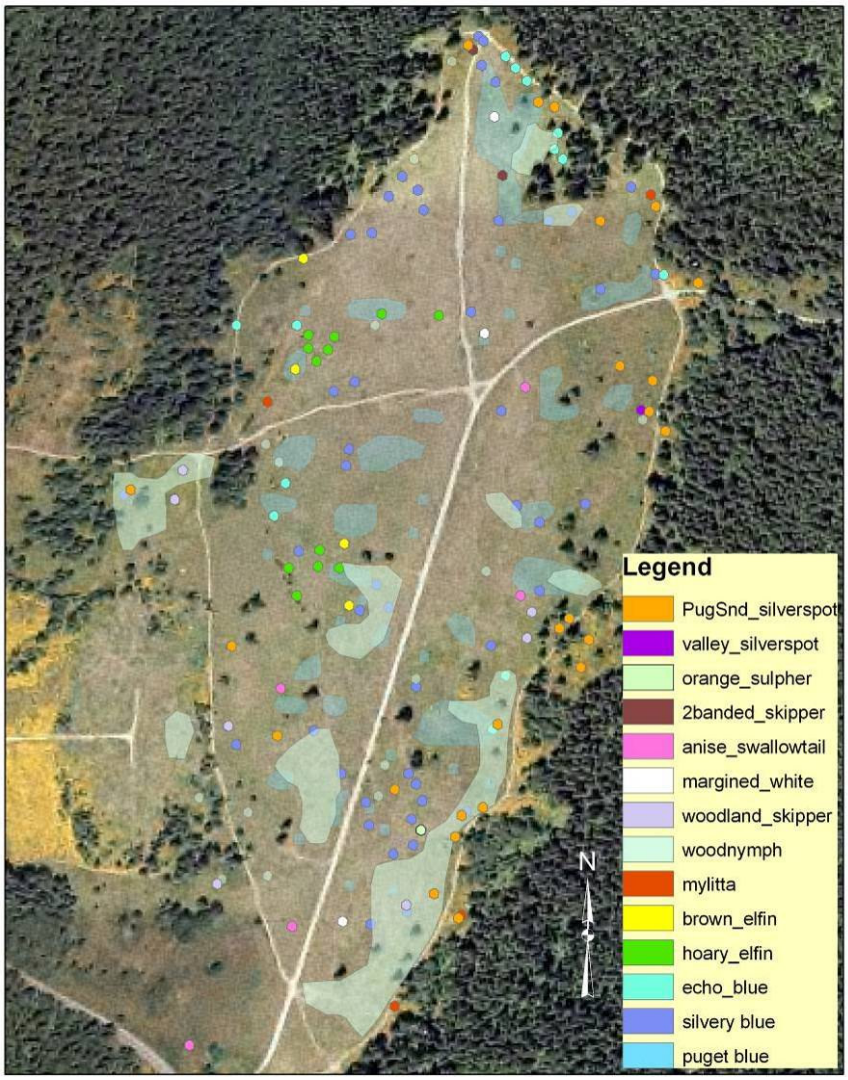

Figure 14. Locations of butterflies, with the exception of ochre ringlets, observed by Bob Hardwick and volunteers on Johnson Prairie, Thurston County, WA, during the course of 4 survey days, May through August, 2008. The single valley silverspot location was provided by Kelly McAllistair.

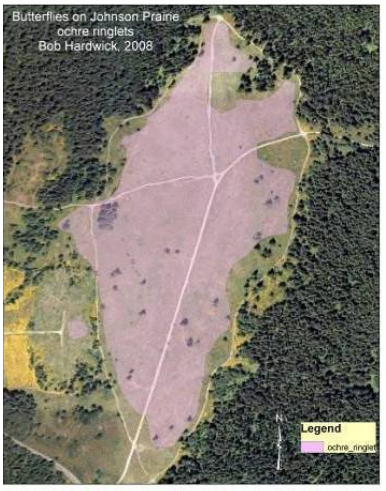

Figure 15. Locations of ochre ringlets observed by Bob Hardwick and volunteers on Johnson Prairie, Thurston Co., WA, 2008

Table 10: Summary of butterfly observations during Bob Hardwick's spring and summer 2008 survey effort at Johnson Prairie, Fort Lewis, WA. Species shaded in gray are state candidate or monitor species according to the WA Department of Fish and Wildlife.

Common Name	Scientific Name	May 16	Jun 26	Jul 16	Aug 28	Totals	#butterflies/ survey hrs*
echo blue or spring azure	*Celestrina echo echo*	13				13	1.4
silvery blue	*Glaucopsyche lygdamus columbia*	33	13			46	2.2
Puget blue	*Plebejus icaroides blackmorei*		122	6		128	6.0
common ringlet	*Coenonympha tullia eunomia*	23	188	127	89	427	9.2
two-banded skipper	*Pyrgus ruralis ruralis*	2				2	0.2
woodland skipper	*Ochlodes sylvanoides sylvanoides*				6	6	0.4
margined white	*Pieris marginalis marginalis*	3				3	0.3
cabbage white	*Pieris rapae*	1				1	0.1
hoary elfin	*Callophrys polios obscura*	12				12	1.3
brown elfin	*Callophrys augustinus iroides*	3				3	0.3
mylitta crescent	*Phyciodes mylitta mylitta*	1				1	0.1
anise swallowtail	*Papilio zelicaon zelicaon*	4		1		5	0.2
common woodnymph	*Cercyonis pegala ariane*			26	69	95	3.7
orange sulphur	*Colias eurytheme*			1		1	0.1
Puget sound silverspot (great spangled fritillary)	*Argynnis (Speyeria) cybele pugetensis*			16	4	20	0.8
	Total Butterflies observed	95	323	177	168	763	
	# person survey hours	9	12	9.5	16	46.5	
	# total butterflies /person survey hour	10.6	26.9	18.6	10.5	16.4	

*These values were calculated as total number of butterflies for that species divided by person survey hours only for surveys during which the butterfly was viewed, considered to be its flight season. The exception was Anise swallowtail, for which total person survey hours included hours from all surveys viewed, along with the survey that occurred between sightings.

Table 11. Comparison between surveys conducted on Johnson Prairie in 2003 (Morgenweck and Dunn 2003) and this survey, 2008.

	2003	2008
Number of butterflies observed	2170	763
Number of species	21	15
Number of survey hours	82.5	46.5
Total butterflies observed / total survey hour	26.3	16.4
Silvery blues / hour	7.19	2.2
Puget blues / hour	8.6	6.0
common ringlets / hour	9.0	9.2
hoary elfins / hour	0.6	1.3
Puget sound silverspots / hr	3.1	0.8
valley silverspots / hr	1.6	0
common woodnymph / hr	16.9	3.7

2008 Habitat Enhancement Plantings Targeting Silverspot Butterflies

With the aid of the Washington Conservation Crew, we planted a total of 1,800 seeds and 3,300 (3,200 *Viola adunca* and 100 *Erigeron speciosus*) nursery grown forb seedlings ('plugs') into nine resource patches to enhance habitat for the valley silverspot butterfly, and potentially the Puget Sound silverspot, although these forb species provide resources for a wide variety of prairie fauna. Experimental plots were incorporated into these enhancement plantings which will allow future evaluations of restoration success. Appendix 2 provides details on locations and quantities of experimental and resource plantings on Johnson prairie.

Summary of 2008 Butterfly Habitat Enhancement Activities

The effectiveness of habitat enhancements for butterflies hinges on our ability to define and address the most relevant habitat conditions that sustain our target populations of butterflies. Fortunately we have some information from local populations and the populations of closely related taxa elsewhere to help define some of the more obvious habitat needs. Despite our existing knowledge base, there are undoubtedly many important habitat characteristics of a more detailed nature that are likely to become relevant during particular life stages and under particular weather conditions. For this reason, we should continue to strive to identify (through observation, discussion, and literature) the various components of the habitat that are likely impact population viability to guide our enhancement efforts. At the same time, the implementation of our butterfly habitat enhancements, especially the seedling and seed plantings, hinges on achieving success in establishing annual and perennial forbs. Recent research has shown that the combination of burning and herbicide applications may offer the greatest potential for seedling establishment. The ability to conduct prescribed burns on Fort Lewis prairies has been hampered in recent years, and the re-establishment of fire as a functional component of the prairie may increase the success of our efforts to restore native forbs to the prairie.

Finally, despite considerable numbers of seedlings and seeds planted to enhance habitat for butterflies, we are limited by a) production of planting stock, and b) labor to plant seedlings, along with established methods to ensure the survival and long-term vigor of planted seedlings. Collaboration with ACUB partners and additional efforts within TNC are underway to address these challenges.

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).

2008 Review

TNC, in cooperation with Fort Lewis and WDFW, initiated a pilot study aimed at reducing streaked horned lark nest failure due to predation. The study is designed as a pilot study to test the use of nest exlosures as a predator deterrent on streaked horned lark nests. This pilot study is being used to develop a region-wide study of the technique to be applied in the Puget Lowlands and the WA Coast

In 2009, TNC will work on 13th Division prairie to locate at least four nests to install with wire-caged nest exclosures. WDFW is complementing this work by initiating similar work on the WA coast population of larks. We will be monitoring nests and nest exclosures from late April through May and possibly into early June. In addition, we will be contributing eggs from the Puget lowland population to range-wide research focusing on the level of contaminants found in streaked horned lark eggs. The egg contaminant work is in cooperation with WDFW and OSU, the analysis will be conducted by USFWS.

Lark habitat enhancement is reported in the Prairies Broom section.

STREAKED HORNED LARK SUMMARY TABLE
January-March
• Initiated nest exclosure pilot project in conjunction with WDFW to evaluate methods for reducing nest predation throughout home range of larks (TNC#4830)
April-June
• Began implementation of lark nest predator exclosure project in conjunction with regional effort. *13th Division Prairie – Pacemaker.* Surveyed and treated 100 highest priority acres. (TNC#4866)

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.

2008 Review

In several areas, fir encroachment onto prairies was controlled while mowing Scotch broom (see Scotch Broom section). 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, however, areas where fir have become well established and require chainsaws to control or mower access is not feasible. These trees are cut down, or preferably girdled to create snags that promote wildlife habitat for rare species, such as the western bluebird and purple martin. Trees are girdled with two horizontal cuts in past the cambium about six inches apart.

DOUGLAS_FIR CONTROL SUMMARY TABLE
April-June
• Girdled 71 acres of encroaching Douglas-fir in AIA as part of oak release project – 4837.
October-December
• Controlled encroaching fir on 711 acres of prairie habitat on the AIA- 3917

Artillery Impact Area Oak Release

During spring Pride Week, we were given access to portions of the AIA to conduct oak and some ponderosa pine release from overly competitive Douglas-fir. We focused on the area around the OP 9 and the old cemetery to the south. In total, 71 acres in two sites were surveyed and treated to reduce competition. (Fort Lewis Cavity Snag 2007 TNC#4835).

Artillery Impact Area Prairie Fir Control

During fall Pride Week, TNC and Fort Lewis Fish and Wildlife staff controlled fir on 711 acres in four different areas throughout the AIA (see map below). Fort Lewis Prairies 2008 TNC#3917)

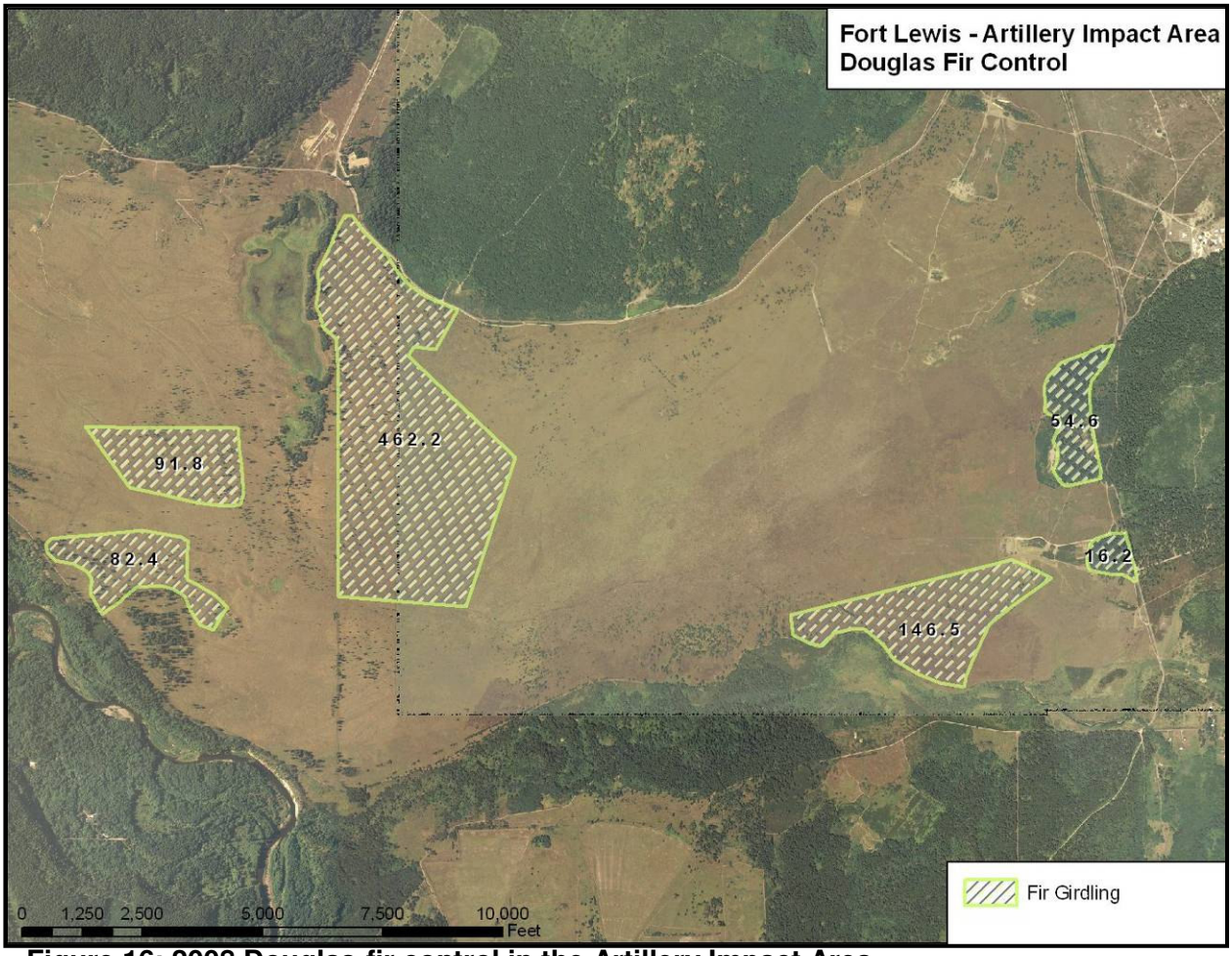

Figure 16: 2008 Douglas-fir control in the Artillery Impact Area.

Figure 17: View of Artillery impact Area from southwest, showing fir invasion.

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.

2008 Review

WET PRARIE SUMMARY TABLE
April-June
• Wet Prairie enhancement plot treated with Aquamaster in May - 3917
October-December
• Wet Prairie enhancement plot treated with Aquamaster in October - 3917

Muck Creek Mesic Prairie

A five-acre area north of Muck Creek has been treated periodically with Glyphosate since spring 2006 to prepare the area for larger scale mesic prairie restoration trial. The area selected had essentially no native species and given the history of the area it has likely been plowed in the past. We have expected it to take 2-4 years to successfully control the weed seed bank. In 2007 we missed our scheduled spring treatment due to unanticipated access restrictions, and the site was quickly overrun with invasive forbs. In October of 2007 we were able to conduct a boom treatment with 2% Aquamaster. We repeated this treatment in the spring and fall of 2008. This site continues to produce resilient broadleaf weeds, including vicia. The herbicide Milestone VM could prove to be an effective control for these plants. Site preparation will continue in 2009 with the hope that continued treatment will exhaust the weed seed bank so that restoration trials may proceed.

WOODLAND 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, and are listed as a 'critical habitat' by the Washington Department of Fish and Wildlife. They provided necessary habitat for numerous species, including the state 'threatened' western gray squirrel. In addition, a unique population of native western Washington ponderosa pine persists on Fort Lewis.

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, releasing oaks from Douglas-fir competition, and improving habitat structure through control of invasive woody species. Past efforts included the reduction of colonizing eastern gray squirrels, a potential competitor for limited resources, and population monitoring utilizing baited hair-snag tubes. Recently, WDFW has implemented a program to research the population and improve genetic viability through a translocation program.

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.

2008 Review

The oak woodlands of Training Areas 8, 9, 10 and 12 have receive consistent and expanded management in recent years. As a result, more acres are in better condition and can be managed with less effort. Scotch broom, Douglas-fir and other woody invasives have been greatly reduced and recent radio telemetry of western gray squirrel activity indicates heavy usage of the managed areas. In 2008, we more than doubled the number of acres treated for oak and squirrel habitat. In total, 490 acres of

treatments were conducted. Of this, 310 were mowed including several sites that had never received treatment. Recently mowed broom is easier to control with herbicide and requires less chemical, and 180 acres of recently mowed habitat was spot sprayed.

WOODLAND AND WGS HABITAT ENHANCEMENT

January-March

- *East Gate Area* - Mowed 28 acres of Scotch broom and encroaching fir – 4832
- Installed new hair snag monitoring tubes at TA's 3V, 4 and 5 – 4832.
- Submitted two papers to Northwest Science: *Monitoring Western Gray Squirrels for Management in Western Washington* and *Invasive Squirrel Control: A Trial on Fort Lewis, Washington.*
- Presented poster *Gray Squirrels in Western Washington, Monitoring and Management* to Washington Wildlife Society conference.

April-June

- Finished mowing east of Chambers Lake TA12MU4 and 9 - 50 acres total – 4832.
- Mowed from Vietnam marsh to west of the landing strip TA8MU5 and 6 - 22 acres - 4832.
- Mowed TA 8 West of Landing Strip - TA8MU4 and 10- 39 acres - 4871
- Mowed Ammo Storage- ASPMU1-5 – 65 acres - 4871
- Mowed Holden Woods- TA10MU2 and 3- 38 acres - 4871
- Brush Cut area NW of deBalon Woods- TA8MU1- 7 acres - 4871

July-September

- Sprayed TA12MU1 - 23 acres - 4871
- Sprayed TA12MU2 - 14 acres - 4871
- Sprayed Holden Woods - TA10MU3 and 2 - 35 acres- 4871
- Sprayed deBalon - TA10MU1; TA8MU2 - 57 acres- 4871
- Sprayed Bill Lake - TA8MU3 - 12 acres - 4871
- Sprayed Vietnam Marsh - TA8MU5 and 6 - 25 acres- 4871
- Sprayed Spanaway pockets - TA9MU2-4 -13 acres- 4871

October- December

- Mowed TA8MU8 - 35 acres – 4867
- Mowed TA10MU1 - 25 acres - 4867

Accomplishments

Restoration

During the 2008 work year, approximately 320 acres of western gray squirrel habitat was treated by mechanical means (mowing and brushcutting), while an additional 170 acres were treated with an herbicide application of 2% Garlon 4 (Figure 18; Table 12). Work focused primarily around oak stands of known significance to WGS, as determined by telemetry efforts by the Washington Department of Fish and Wildlife as part of their western gray squirrel research. Scotch broom, small Douglas-fir and other invasive brush species were mowed and brushcut to create a more open understory that is preferred by the WGS. Efforts in 2009 will focus on expanding mowing efforts outside of the 'squirrel triangle', while continuing control efforts within the triangle with herbicide applications and prescribed fire where appropriate. This work occurred over three quarters and used three task orders: TNC#'s 4832, 4871 and 4867.

Figure 18: Oak treatment areas in Training Areas 8, 9 and 10.

Table 12. 2008 Oak management unit treatments.

Oak Woodlands Priority List		
Oak Management Unit	Acreage Sprayed	Acreage Mowed
TA12MU1	16.5	28
TA12MU2	13.5	0
TA12MU4	0	13
TA12MU9	0	28.5
TA10MU3	10.7	12
TA10MU2	23.75	24
TA10MU1	23.2	25
TA8MU1	0	7
TA8MU2	33.25	0
TA8MU3	11.5	0
TA8MU8	0	35
TA8MU5	19.5	25
TA8MU6	5.75	20
TA8MU4	0	25
TA8MU10	0	13
TA9MU2	4.5	0
TA9MU3	3	0
TA9MU4	5	0
ASPMU1	0	12
ASPMU2	0	20
ASPMU3	0	9
ASPMU4	0	12
ASPMU5	0	12
Totals	170.15	320.5

Squirrel Monitoring and Eastern Grey Squirrel Control Publications

Cheryl Fimble and Sanders Freed co-authored and submitted for publication two final draft papers on squirrel monitoring and invasive squirrel control. Both papers were reviewed by Fort Lewis and TNC prior to submittal. Cheryl is primary author for Monitoring Western Gray Squirrels for Management in Western Washington. Sanders is primary author of Invasive Squirrel Control: A Trial on Fort Lewis, Washington. Both papers have been submitted as companion papers to the journal Northwest Science. These are both available upon request. (Fort Lewis Squirrel Oaks TNC#4832).

Squirrel Poster Presentation

Cheryl Fimble prepared and presented a poster Gray Squirrels in Western Washington, Monitoring and Management (co-authored by Sanders Freed and Todd Zuchowski) at the Washington Wildlife Society conference in Spokane, WA March 19 – 21, 2008. The information presented was of particular interest to WDFW land managers interested in learning more about western gray squirrels on their properties in eastern Washington, as well as a representative from the non-profit organization Conservation Northwest interested in data relating to the cross-base highway initiative. An electronic copy of this poster is available upon request. (Fort Lewis Squirrel Oaks TNC#4832).

Hair Snare Monitoring Tubes

Much of the effort related to monitoring with hair-snares, and collection of old hair-snare tubes has been transferred to WDFW personnel: Aaron Johnson and Gene Orth. These individuals requested use of the older tubes that were being collected from the field because they have new uses for the hair-snares in their work related to trapping and radio-collaring western and eastern gray squirrels, namely that of prospecting for new locales to install traps. TNC continues to install hair snare tubes and monitor sites in training areas 3N, 4 and 5 because this area has not yet been investigated, and is not a high priority interest for WDFW at this time. (Fort Lewis Squirrel Oaks TNC#4832).

CAVITY CREATION

Cavity creation tasks were aimed at improving habitat for numerous species that require cavities for nesting, roosting, or shelter. The decay class for these types of cavities, where heart wood is rotten, is a component often lost in typical managed landscapes. Snags, dying, and decadent trees are often removed from stands to make room for economically more valuable trees. Thus, species that rely on cavities for some aspect of their life cycle are often quickly lost from intensively managed forests. The history of management on Fort Lewis tended toward this type of intensive management. In 1995, a new management guideline was established which favored retaining more of the natural features common in forests, including snags and decadent trees. Although there is now an existing mandate for this type of habitat tree retention, little remains. The task order was designed to introduce cavities at sites favorable to certain cavity using species- such as the wood duck (*Aix sponsa*), and increase the number of standing dead trees for primary and secondary cavity nesters- such as purple martins (*Progne subis*). Western gray squirrels (*Sciurus griseus*) and blue birds (*Sialia mexicana*) were also included as a target given the treatments and habitats were similar. Another unique species to the area, the Vaux's swift (*Chaetura vauxi*), was included in habitat enhancements. In addition, in combination with our summer 2008 bat survey, a bat box experiment was conducted to determine what design is most useful in western Washington. There are nine species of bats present in the region, while 4 have federal or state conservation listings.

In Washington, cavity-nesting ducks nest primarily in late successional forests and riparian areas adjacent to low gradient rivers, sloughs, lakes, and beaver ponds. Wood ducks, a Washington State 'priority species', nest almost exclusively in tree cavities, which offer protection from weather and predators. They are secondary cavity nesters, using cavities created by large woodpeckers or by decay or damage to the tree. Destruction of cavity trees can eliminate this species from an area. An adequate supply of nest cavities is the key to supporting populations of cavity-nesting ducks in Washington. A nest box program on Fort Lewis has been in operation since the 1990's, and has successfully maintained breeding populations of this species, although the long term goal of the program is to maintain breeding populations until enough natural cavities are available to replace artificial cavities.

Purple martins, a Washington State 'candidate' species, are insectivorous, colonial nesting swallows that nest in cavities. In Washington, most martins have been reported nesting in artificial structures near cities and towns in the lowlands of western Washington. Historically, they probably bred in old woodpecker cavities in large dead trees, but only a few such nests are known to exist in Washington today. The nest site preferences of the purple martin have been studied at Fort Lewis in Pierce County. Martins nested in a variety of artificial nesting structures, including wood duck boxes. No purple martin nesting activity was detected in artificial nesting structures on land; all artificial cavities were over freshwater wetlands, ponds or saltwater. Several sites on Fort Lewis are known to currently contain nesting cavities in snags, such as Lower Weir prairie. The decline of the purple martin is attributed to the lack of snags containing

nest cavities as well as competition for nesting cavities with more aggressive European starlings (*Sturnus vulgaris*) and house sparrows (*Passer domesticus*).

Fort Lewis and McChord Air Force Base contain the only known population of western gray squirrels (*Sciurus griseus*) west of the Cascades. Several studies have documented significant declines of the population on Fort Lewis, resulting in current efforts on Fort Lewis to study and augment the population. Efforts have been directed toward the enhancement of western gray squirrel habitat, including the removal of invasive plants and the release of oaks. Western gray squirrels use cavities for parturition and rearing of young. Given the history of forest management on Fort Lewis, few trees are large enough to provide cavity opportunities for larger mammals. Eleven cavities, similar to wood duck cavities, were created to be monitored for use this reproductive season.

The western bluebird (*Sailia mexicana*) is rare in western Washington, but fairly common on Fort Lewis. A secondary cavity nester, the western bluebird has persisted on Fort Lewis with an extensive box program, and numerous, small diameter snags in prime bluebird habitat. Bluebird cavities were placed in Douglas-fir trees located on the periphery of prairie habitat to increase nesting opportunities. These cavities will provide immediate nesting opportunities for bluebirds and other cavity nesting species, while also contributing to the long term creation of standing dead and decaying trees, improving habitat for numerous species. In total, 50 cavities have been created throughout Fort Lewis.

The Vaux's swift (*Chaetura vauxi*) is a colony nesting neo-tropical migrant species. Swifts nest in several varieties of man-made towers, including chimneys, bell towers, and other upright open towers. Due to the removal of chimneys from modern architecture and the reduction of large diameter snags in forests, swift populations have been declining. Two swift towers were constructed, one at Sequalitchew ecopark, and one on Upper Weir prairie. Future monitoring of the structures will be conducted to assess use.

In combination with our summer bat survey, an experiment was conducted to determine the best of three designs for bat use in the region. Our three designs were the mammoth box, the dual chambered rocket box, and a design created by our contracted bat expert- Greg Falxa, of Cascadia Research Collective. All bat species use cavities for night and day roosts, and several of our boxes received use in the first season. Our two most successful designs included the dual chambered rocket box, and the Falxa model. Future efforts will be directed towards monitoring for future use and to species.

CAVITY CREATION SUMMARY TABLE

January-March

- Purchased supplies for cavity projects- 4822.
- *Sequalichew Ecopark* – Constructed and installed one swift tower- 4822.

- *Spanaway Marsh* – created 4 wood duck cavities- 4822
- *TA 8 Landing Strip* – Created 2 WGS cavities- 4822
- *Upper Weir* – Created 20 blue bird cavities- 4822
- *Lower Weir* – Created 14 blue bird cavities- 4822
- Presented poster on cavity creation to Washington Wildlife Society Conference - 4822

April-June

- Upper Weir swift tower on topped-tree- 4835
- Five purple martin boxes on Upper Weir- 4835
- Built and placed 30 bat boxes at 10 sites- 4835
- Artillery Impact Area snag creation- 71 acres- 4835
- Initiated Ft Lewis bat survey project – 4878

July-September

- Completed bat survey, confirming the presence of all 9 species of bats found in the Puget Sound – 4878.
- Radio-tagged two Townsend's big-eared bats and gathered foraging and roosting data – 4878.

October- December

- Monitored cavities for use– 4867

Accomplishments

Blue Bird Cavities-

Thirty four (34) bluebird cavities were created on Lower and Upper Weir, bringing the total created to 50 (Figure 19). Experiments with bluebird cavities are being conducted on other TNC sites to evaluate the rate of use on created cavities.

Swift Towers-

Two swift towers were completed during 2008, one at Sequalitchew Ecopark and one on Upper Weir (Figure 20). No use was detected this season, future monitoring will be conducted to identify use and determine rate of colonization. The Upper Weir swift tower was of special note, given the method of placement. With the aid of a lift truck, this swift tower was placed on a topped tree, approximately 35 feet high. In addition to the swift tower, 5 purple martin boxes were placed on the topped tree bole.

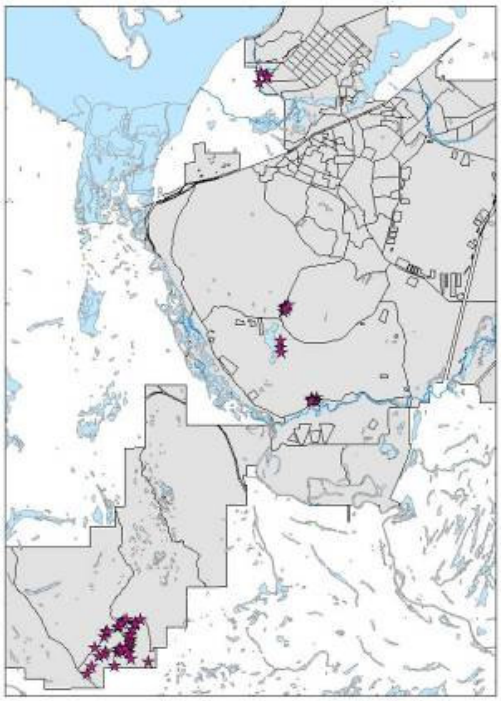

Figure 19. Bluebird cavities on Fort Lewis at Sequalitchew Ecopark, Scouts Out Prairie, AIA, and Weir Prairies.


Figure 20. Swift towers at Sequalitchew Ecopark and Upper Weir.

Wood Duck and Western Gray Squirrel Cavities

Four (21) wood duck cavities were created on Spanaway Marsh, bringing the total to 39 wood duck cavities on Fort Lewis, while two western gray squirrel cavities were created in TA8, bringing the total to 11. In addition, monitoring of all 50 cavities was conducted, finding high rates of use. Of cavities created in 2007, rates of use exceeded 90%, while cavities created in 2008, had 50% use (13 of 26). These high rates of use suggest a dearth of cavities for wildlife in the woodlands of Fort Lewis. Although the western gray squirrel cavities showed no definitive use by western gray squirrels, several wood duck cavities had confirmed use by eastern gray squirrels. In addition to our target species, numerous other species were found to use the cavities, including other species of birds, several mammals including bats, and honey bees.

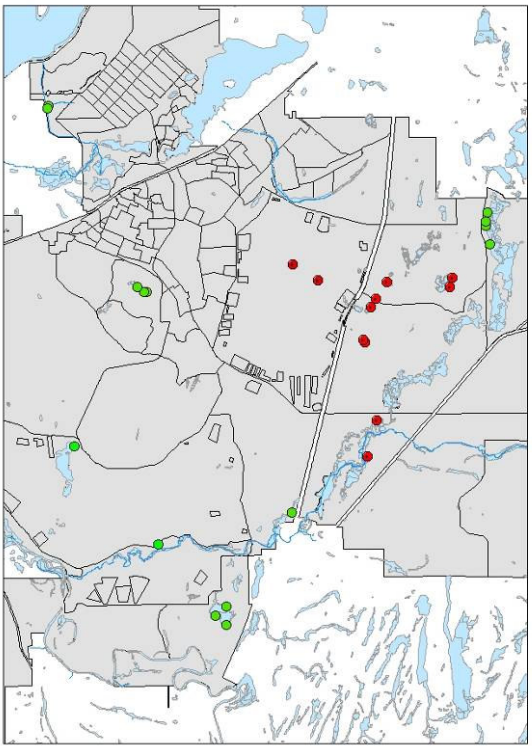

Figure 21. Wood duck cavities (green) and western gray squirrel cavities (red) created on Fort Lewis.

Artillery Impact Area Oak Release

During Pride Week, we were given access to portions of the AIA to conduct oak and some ponderosa pine release from overly competitive Douglas-fir. We focused on the area around the OP 9 and the old cemetery to the south. In total, 71 acres in two sites were surveyed and treated to reduce competition (Figure 22).

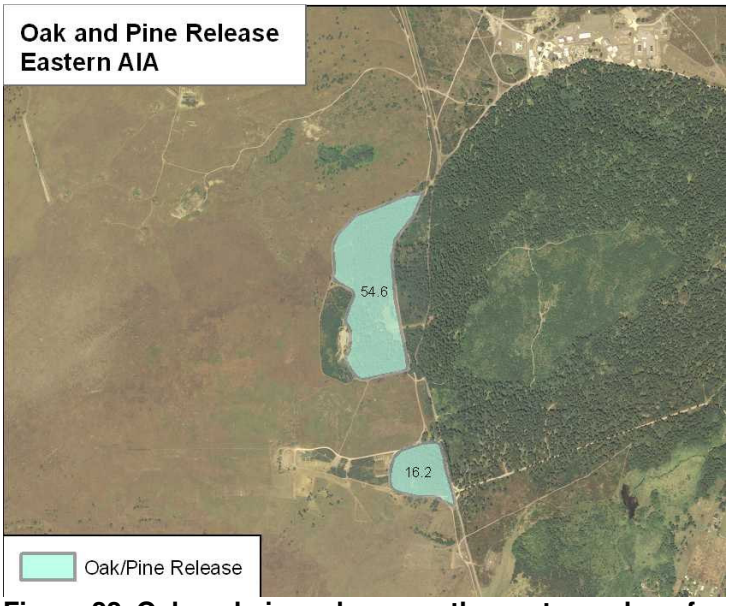

Figure 22. Oak and pine release on the eastern edge of the Artillery Impact Area.

Bat Box Experiment

During June, we contracted work with Greg Falxa of Cascadia Research Collective to assist with a bat box experiment intended to evaluate effectiveness of manufactured bat roosts. During this project, we build 30 bat boxes of three different designs (Figure 23). The 30 boxes were installed at 10 sites on Fort Lewis (Figure 24). Guano traps were installed on each box to help with monitoring. Initial results showed use in the dual chambered rocket box, and the Falxa design. With future funding, monitoring for rates of use and species will be available.

Figure 23. Bat box designs (Falxa, Dual-chambered Rocket, Mammoth).

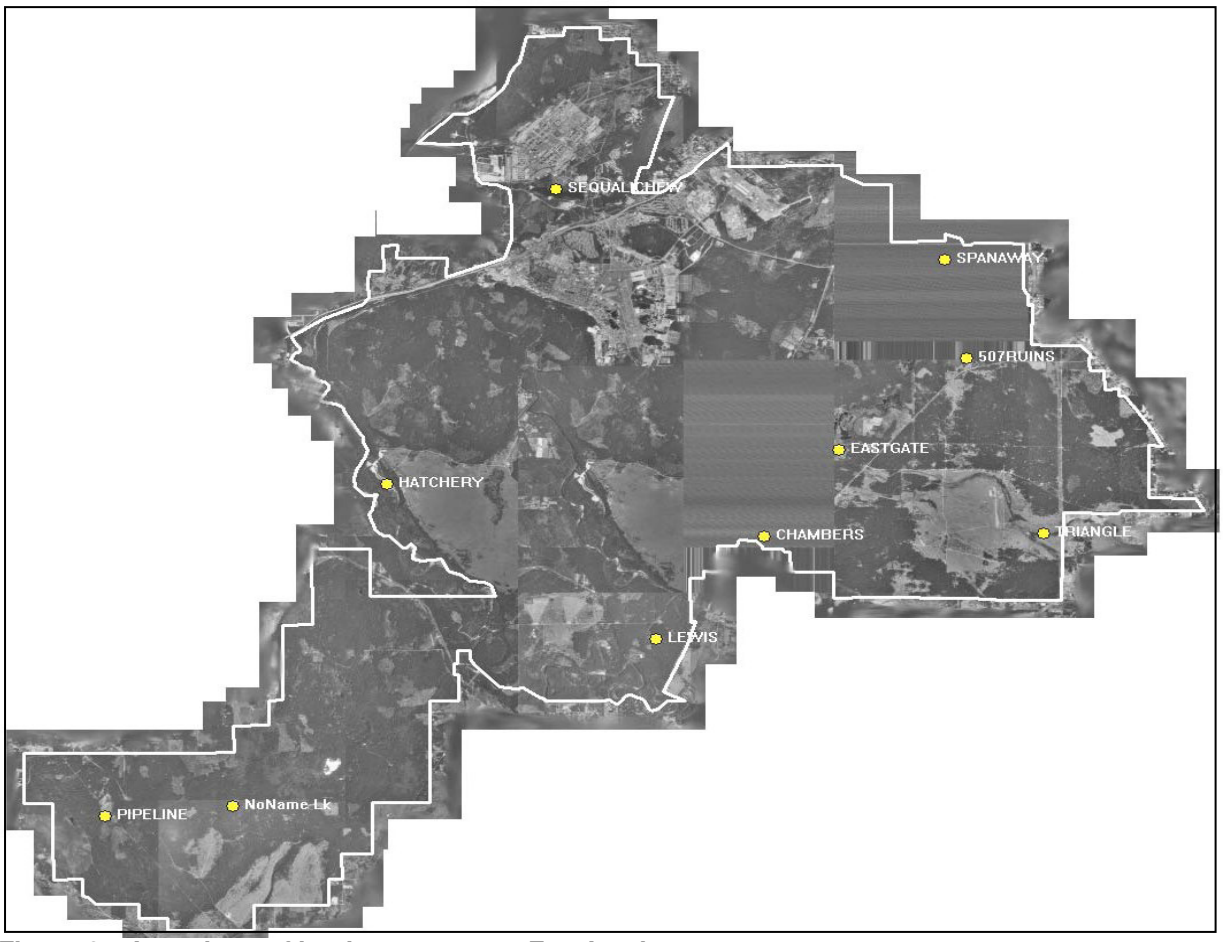

Figure 24: Locations of bat box arrays on Fort Lewis.

BAT SURVEY

During the summer months of 2008, Cascadia Research and TNC personnel performed surveys for bats in the undeveloped areas of Fort Lewis. The primary objectives were to assess bat species present on the Fort, to gather information on their distribution, and assess habitat associations. Using both traditional 'mist-net' capture methods, and state-of-the-art 'acoustic sampling' of bat echolocation calls, 59 sites were sampled between 1 and 6 times. We completed 86 acoustic and 20 net-capture survey events between May 2 and September 30, 2008. Buildings, bridges, and other structures were sampled for indications of bat use.

Figure 25. Townsend's big-eared bat captured at Range 26.

All species of bats known to occur in the South Puget Sound region (Table 2) were documented as summer residents on Fort Lewis, including a species considered rare, the Townsend's big-eared bat (Figure 25). This bat is listed on both the federal and state 'species of concern' lists, and is difficult to document using traditional and newer acoustic methods. By far the least encountered species during this effort, Townsend's big-eared bat may warrant a targeted investigation to achieve greater understanding of its relationship to the habitats found at Fort Lewis. Three bats on the federal 'species of concern' lists were documented, though in lower numbers or more limited areas than most of the 'unlisted' species.

Recommendations from the survey include more targeted research on Townsend's big-eared bat and Keen's Myotis, creation, maintenance, and preservation of snags, the development and protection of additional bat roosts/boxes, and the maintenance enhancement of natural resources on base including invasive species removal and maintaining open water features. The final report is completed and is available at Fort Lewis Fish and Wildlife or The Nature Conservancy.

Table 13. Bat species documented on Fort Lewis summer, 2008.

Scientific Name	Common Name	Federal Status	State Status	Natureserv
Corynorhinus townsendii	Townsend's Big-eared Bat	Species of Concern	Species of Concern	S3
Lasionycteris noctivagans	Silver-haired Bat	-	-	S3S4
Lasiurus cinereus	Hoary Bat	-	-	S4
Eptesicus fuscus	Big Brown Bat	-	-	S5
Myotis californicus	California Myotis	-	-	S5
Myotis evotis	Long-eared Myotis	Species of Concern	-	S4
Myotis lucifugus	Little Brown Myotis	-	-	S5
Myotis volans	Long-legged Myotis	Species of Concern	-	S3S4
Myotis yumanensis	Yuma Myotis	Species of Concern	-	S5

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. Tall oatgrass is an invasive grass that displaces native vegetation, degrades habitat and has become a priority for control across the region.

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. This year, data was collected and entered in WIMS (Weed Information Management System), a MS Access based database. Each year, all infestations are scheduled for survey 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.

2008 Summary

2008 was another important weed control year at Fort Lewis. Significant work was performed on tall oatgrass, sulfur cinquefoil, mouse-ear hawkweed, knapweeds, tansy ragwort, and reed canary grass. Common toadflax, leafy spurge, blueweed, and knotweed were not widespread but received treatement.

Monitoring information continues to help hone our control strategies, as we continually strive to develop integrated approaches that minimize risk to people and the environment while improving effectiveness. In particular, trials conducted in 2007 and 2008 proved that Fusilade DX offers superior control of tall oatgrass. Thus, we switched from Poast, which had been the herbicide of choice. Additionally, this information was shared with regional partners who also decided to make the switch. Other monitoring suggests that our strategies for controlling yellow flag iris, canarygrass, toadflax, mouse-eared hawkweed and others have been very effective.

NOXIOUS WEEDS SUMMARY TABLE

January-March

- Purchased Argo, an all-terrain vehicle for aquatic weed control work on Ft. Lewis – 4825.
- Purchased two Drumloc DL6 herbicide storage sheds to safely contain herbicide for Ft Lewis weed control projects – 4826 and 4831

April-June

- Tall Oat Grass control - TA 7S, Rainier Training Area, Pacemaker (TA14) Muck Creek Triangle (TA 15), Mortar Point 13 and Range 76 (4865,3917)
- Sulfur Cinquefoil control - TA 6, TA 13, TA 15, MP13 (4865,4872)
- Common toadflax control - TA 6 (4865)
- Knapweed control - TA 7S, TA 14, North Fort Lewis (4865)
- Mouse-ear Hawkweed control - TA 6, TA 12 and Lower Weir (4865)
- Blueweed control - TA 7N (4865)
- Leafy Spurge control - near MP 13 (4865)
- Treated 2 100x100 meter Collins plots at TA 15 and South Weir prairie (3917)
- Treated butterfly enhancement area at Pacemaker (TA 14) (4877)
- Treated and expanded Earthworks preparation area (4866)
- Treated wet prairie restoration area in TA 15 (3917)
- Treated pipeline restoration area in TA 15 (3010)
- Treated area surrounding seed plots in TA 13 (3917)
- Monitored Earthworks experimental plots (4866)
- Monitored Scotch broom experiment plots (3917)
- Monitored sulfur cinquefoil control plots (4865, 4872)
- Monitored reed canarygrass control plots (4872)

July-September

- Knapweed control – TA 7S and TA 6 (4865)
- Mouse-ear hawkweed control – TA 6 (4865)
- Sulfur cinquefoil control – TA 6 and MP 13 (4865, 4872)
- Blueweed control – near Fort Lewis main gate(4865)
- Knotweed control – TA 10 and TA 21 (4865)
- Tansy ragwort control – TA 21 and roadsides (4865)
- White water lily control – Chambers Lake (TA 12) (4865)
- Reed canary grass control on Muck Creek – TA 6, TA 10, TA 12, TA 15 and MP 13 (4872)
- Site preparation for Spurgeon Creek seed plots (3917)
- Post-burn Fusilade application at Upper Weir (TA 21) (3917)

October-December

- *Reed Canary Grass* – Treated areas mowed in the summer in TA 6, TA 12, TA 13, TA 15 and MP 13 (4872)
- *Yellow Flag Iris* control – TA 12 (4864)
- Treated Earthworks preparation area and seeded experimental plots (4866)
- Treated wet prairie restoration area in TA 15 (3917)
- Treated pipeline restoration area in TA 15 (3010)

UPLAND INVASIVE SPECIES TASKS COMPLETED

Unless otherwise noted, upland weed control was conducted under the Training Lands task order (4865). See weed control maps at the end of this section.

Tall oatgrass

2008 was not an ideal year for controlling tall oatgrass, as the cold and rainy weather made for a difficult spray season. Still, all of last year's treatment sites were revisited. This year we used the herbicide Fusilade DX instead of Poast to control tall oatgrass. As described below, Fusilade has proven to be more effective at controlling tall oatgrass, does not harm fescue species, has a lower toxicity rating than Poast and is applied at half the concentration. Tall oatgrass was treated this year with a 0.75% solution of Fusilade DX plus 0.25% Nufilm IR.

Figure 26: Spraying tall oatgrass at TA 7S in spring.

Approximately 23 acres were treated at TA 7S, while avoiding the butterfly release sites (see maps). Progress has been made here, but it will require more effort in the years to come. Controlled burning should help keep tall oatgrass from expanding, and following a burn with an application of Fusilade could prove to be a very effective control method.

Tall oatgrass has increased significantly near Mortar Point 13, where a fire from last year appears to have stimulated seed germination. About 3.2 acres of tall oatgrass was treated here with Fusilade. Due to access restrictions, the entire area was not treated this spring. Canvassing this area next year should be a top priority.

A 6.5 acre section of the Muck Creek triangle (TA 15) was surveyed and treated again this year. More tall oatgrass was found in this area, but the population appears to still be contained within this section.

All of Upper Weir prairie was surveyed this year and there was a notable reduction in tall oatgrass populations. Johnson Prairie similarly showed good signs of tall oatgrass control. This year tall oatgrass was also controlled on Lower Weir along Rainier Road. It is recommended that Lower Weir be completely surveyed for tall oatgrass next year.

Figure 27: Fusillade/Poast trial plot at TA 7S.

Fusillade/Poast Comparison Trial

Monitoring at Training Area 7S indicates that Fusilade is more effective than Poast at controlling tall oatgrass. Analysis of Poast treatments show that while there was a noticeable reduction of the percent of tall oatgrass cover, the median cover class remained 6-25% before and after Poast treatment. Fusilade treatments showed significant reduction, with the median cover

class falling from 26-50% to <1%. Control plots showed a slight increase in percent cover. Treatments were repeated this spring and will be monitored this fall and again next spring to assess control after two years of treatment. After data is collected next spring it is recommended that the experimental plots be treated immediately with Fusilade so that the control plots, which are located in a high quality habitat, are not allowed to grow and drop seed again. It is also recommended that future Fusilade experiements be performed to observe the effectiveness of treating colonial bentgrass.

Sulfur Cinquefoil

Sulfur cinquefoil is proving to do be a very difficult pest to control. While monitoring has shown that spraying with a 2.5% Garlon 3A and 0.25% Nufilm solution has proven to be very effective at controlling cinquefoil, treated areas continue to produce large populations. This is partially due to the fact that the plant can be very difficult to see in the thick vegetation where it is often found, and also because its seeds are very viable. What little research has been done on seed viability suggests that they can persist for more than 4 years. So, even if every plant is eliminated this year, there will continue to be new germinates for many years to come. There is also speculation that there is an upstream seed source that has yet to be identified. The source could be an unknown population on Fort Lewis, or it could be further upstream on private property. It is recommended that a thorough survey be done along the Muck Creek corridor, and to coordination a possible evaluation upstream with Pierce County Noxious Weed Board.

Figure 28: Sulfur cinquefoil germinants.

A prolific amount of sulfur cinquefoil has emerged following a fire last year at MP 13. It is common for fire stimulates seed germination for many species, so this flush of cinquefoil is not unexpected and could effectively exhaust much of the seed bank. With this hope in mind, 139 acres at MP 13 and the adjacent TA 6 have been swept and sprayed numerous times in 2008.

Approximately 12 acres of TA 13 along the Muck Creek overflow was treated for cinquefoil as well. The section of Muck Creek in this area is most likely to have undiscovered populations, which means that a thorough survey should be done.

The infestation that was found last year near the Muck Creek triangle (TA 15) has been repeatedly visited and sprayed. Results look very positive here, control is very successful and this population may be eradicated in the next year. This is promising evidence that early detection and treatment with Garlon 3A is extremely effective.

Other smaller populations of sulfur cinquefoil have been treated by Fort Lewis and The Nature Conservancy staff throughout the base, including TAs 6, 12, 13 and 22.

Milestone VM, a herbicide from the same chemical family as Transline, has demonstrated great control of cinquefoil on McChord AFB. It is reported to be more environmentally friendly than Transline and can be used in aquatic environments. Although Garlon 3A has also shown good control, a significant amount of cinquefoil persists in infested areas. Milestone is supposed to have a more soil activity than Garlon 3A and could therefore have better control. Trials are being planned for 2009.

Mouse-ear Hawkweed

It was a challenging year for mouse-ear hawkweed control as a new population was found at Lower Weir prairie and another was discovered by Fort Lewis staff on TA 6.

The worst known infestation on Fort Lewis is on TA 6 near Leschi Town. This year the population seems to have grown despite successful treatment in prior years. The timing of treatment was delayed slightly this year so that the plant was flowering when we were looking for it. Considering the small rosettes of mouse-ear hawkweed, this technique makes it much easier to find populations and may be why we found more than in previous years. The downside to this technique is that chemical control is not quite as effective. This was evident when the site was revisited and mouse-ear hawkweed was unfortunately found going to seed. Upon this discovery, all known populations were visited again and any flower or seed heads were collected and the plants were retreated with Transline. 57 acres were surveyed and controlled in TA 6 this year.

Figure 29: Mouse-ear hawkweed in flower and in seed.

23 acres of TA 12 were surveyed and treated. Populations that were treated in prior seasons appear to be effectively controlled, but new populations were discovered this year suggesting that some plants were missed and able to release seed in prior years.

The population that was discovered at Lower Weir occupied less than 0.5 acres. The nearby area was surveyed and no other infestations were found. It would be advised that the rest of Lower Weir be searched, particularly north of this population were the predominant wind would have likely dispersed seed last year.

Range control reported a new site at TA 6. This site was located, however the plants had already gone to seed. Remaining seed heads were collected (and sent to the University of Montana for research), and then the plants were sprayed with a solution of

0.75% Transline and 0.25% Nufilm IR. This and the surrounding area will require a detailed survey next year.

Milestone VM should control hawkweed as well or better than Transline and trials will be done to determine which provides the most effective control.

Miscellaneous Upland Weeds

Knapweed complex

Control continued for this tenacious plant, and likely will for the foreseeable future. All know populations were surveyed and treated again this year. Most sites had knapweed growing again this year, and several more populations were found in TA 7S and on North Fort Lewis. The new infestation on North Fort Lewis that was discovered is just inside the northern gate; Pest shop was notified of this and indicated they would control it. TA 6 near Leschi Town also had knapweed that required control. All plants were treated with a 0.75% solution of Transline with 0.25% Nufilm IR.

Figure 29: Knapweed in bloom.

Milestone VM is also supposed to control knapweed very well. Trials will be done in 2009 to see if it is more effective than Transline.

Blueweed

Known blueweed populations appear to be controlled very well with a solution of 2.5% Garlon 3A with 0.25% Nufilm. All know populations, for a total of less than 20 individuals, were controlled in TA 7S. The small infestation near the main gate of Fort Lewis was also treated and it was encouraging to see that only a few plants flowered this year.

Leafy Spurge

It would appear that last years control of leafy spurge was very successful. The stems that were treated near Marion Prairie with Tordon RTU did not reemerge this year, and the larger population near MP 13 was significantly, but not totally, reduced as well. Of particular significance is that treatment with Garlon 3A appears to have been effective when it was expected to provide poor control. Regardless of this apparent success, these sites will be diligently monitored and treated as necessary in the future.

Tansy Ragwort Control

Tansy ragwort (Senecio jacobaea) control continues on Fort Lewis. Infestations were found mostly along major roads, but a significant population has emerged at the northeastern section of Johnson Prairie (TA 22). Some populations were hand pulled and bagged, and a solution of 2.5% Garlon 3A and 0.25% Nufilm IR was used on

others. Also worth reporting is that the Cinnabar moth (Tyria jacobaeae) was found on many of these plants; it is very encouraging to see this biocontrol establishing itself.

Figure 30: Caterpillar of the Cinnabar moth (Photo: Jens Buugaard Nielson)

Common Toadflax

TA 6 near MP 13 (as shown in the MP 13 tall oatgrass map) was the only known area of Fort Lewis where this plant was found until TNC staff discovered another population in TA 13 along Muck Creek. The large population, which is on the northern side of Muck Creek, was diminished by last year's treatments. A larger area (nearly 1 acre) was searched this year, but there were less stems to control. A 2% solution of Razor Pro (glyphosate) was used. Several more years of treatment are expected to bring this infestation under control. The infestation on TA 13, located in the Muck Creek flood zone near highway 507 was treated with Aquamaster. A thorough survey of the area should be done in 2009.

Figure 31: Tall oatgrass control area at Training Area 7S.

Figure 32: Tall oatgrass control area at Muck Creek Triangle – Training Area 15.

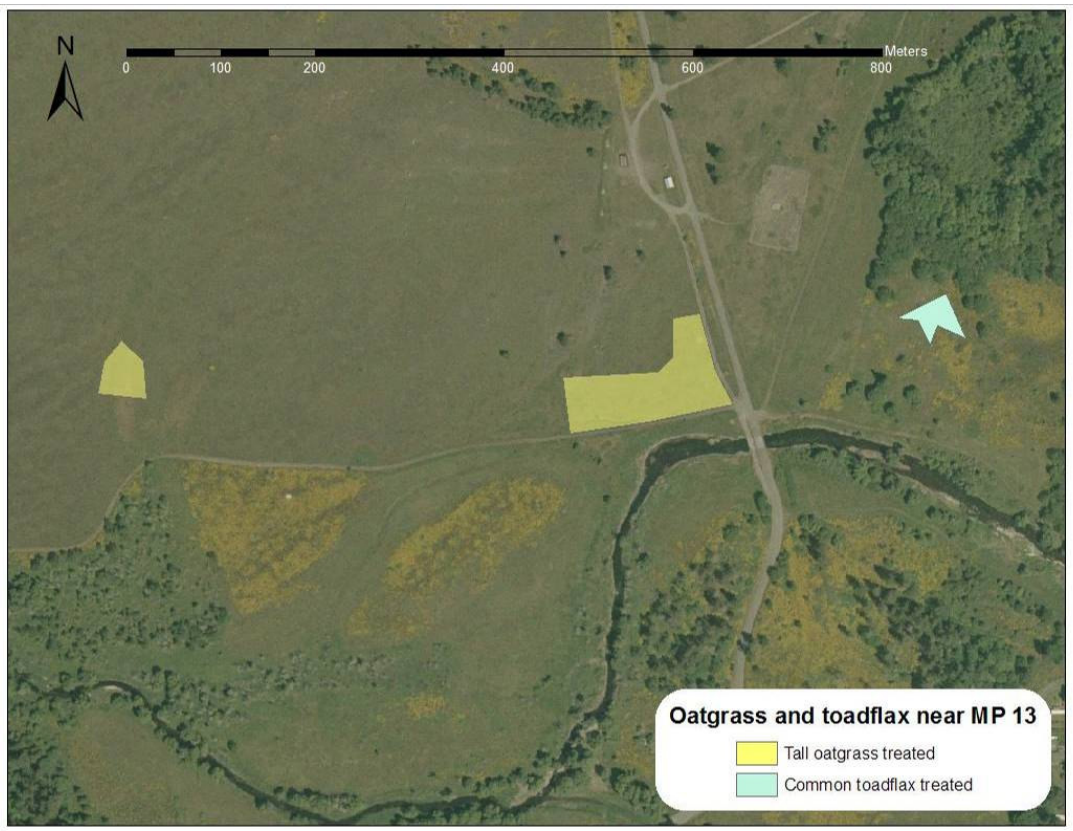

Figure 33: Tall oatgrass and toadflax control area at near Mortar Point 13.

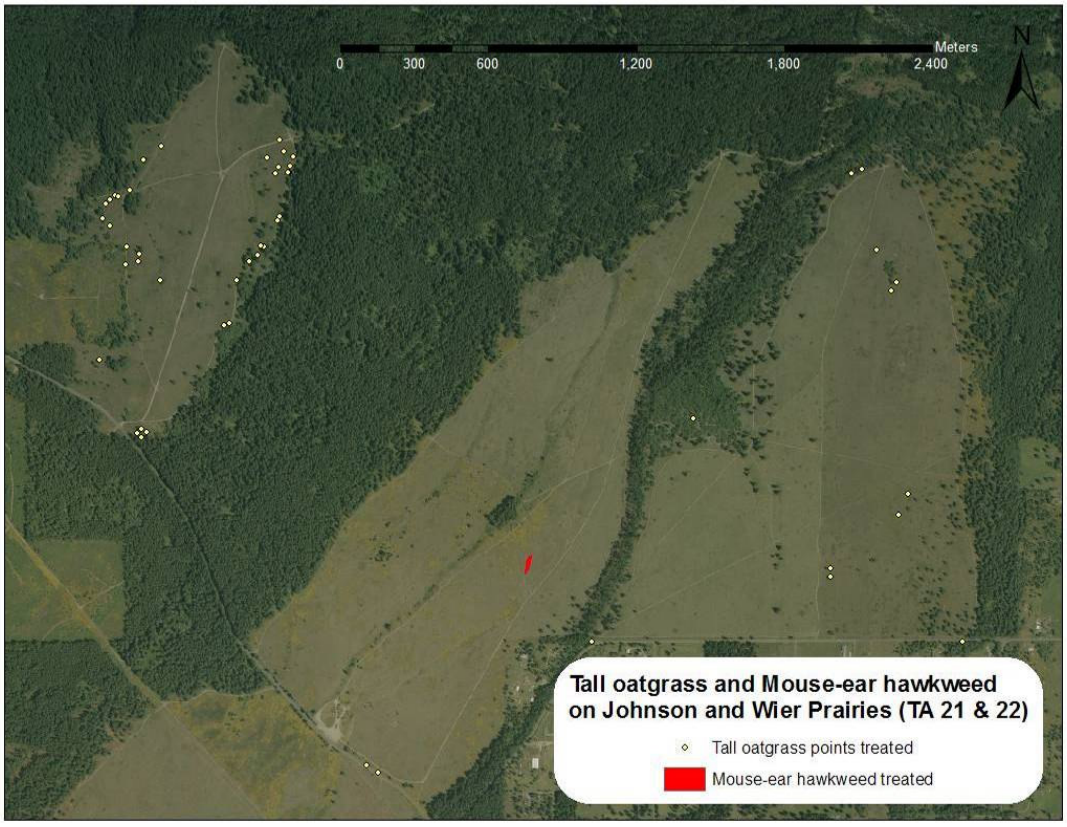

Figure 34: Tall oatgrass and mouse-eared hawkweed at Johnson and Weir Prairies.

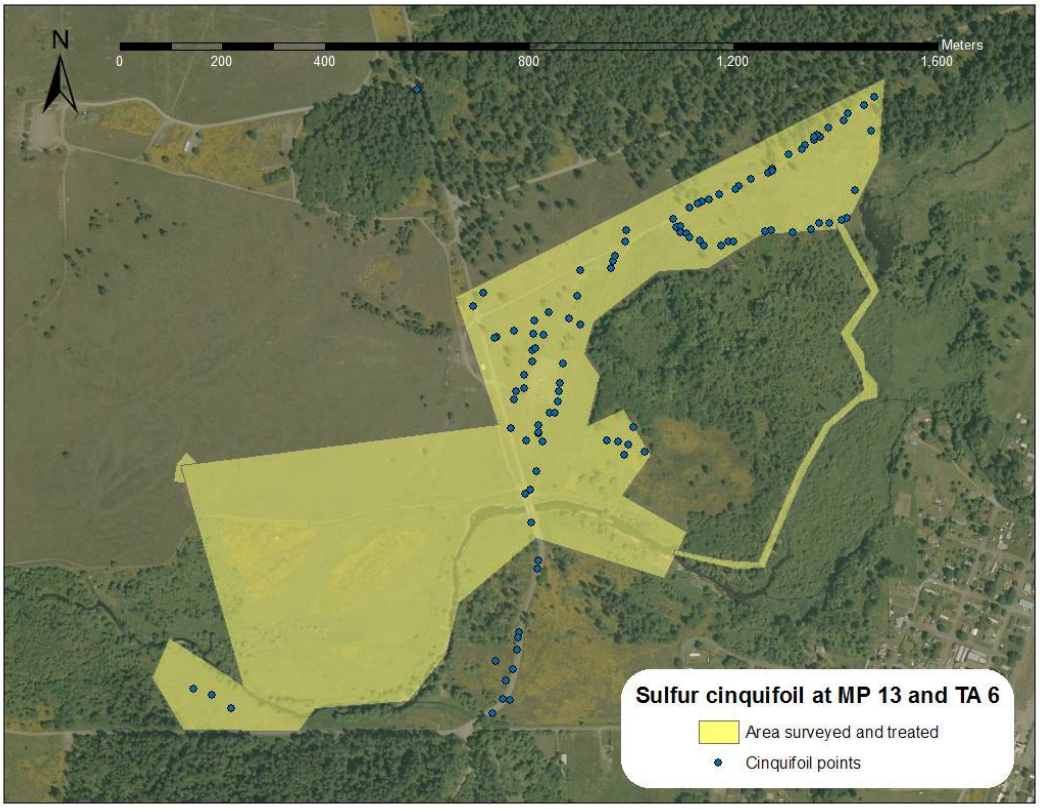

Figure 35: Tall oatgrass and mouse-eared hawkweed control at Johnson and Weir Prairies.

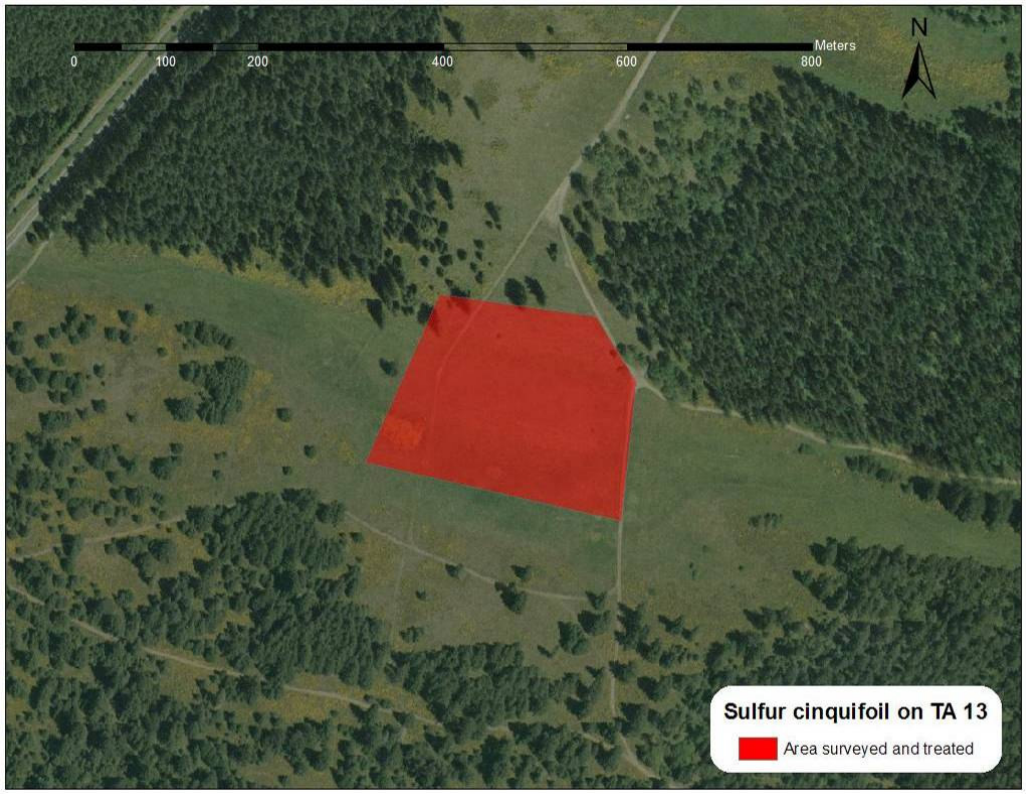

Figure 36: Sulfur cinquefoil control at Training Area 13.

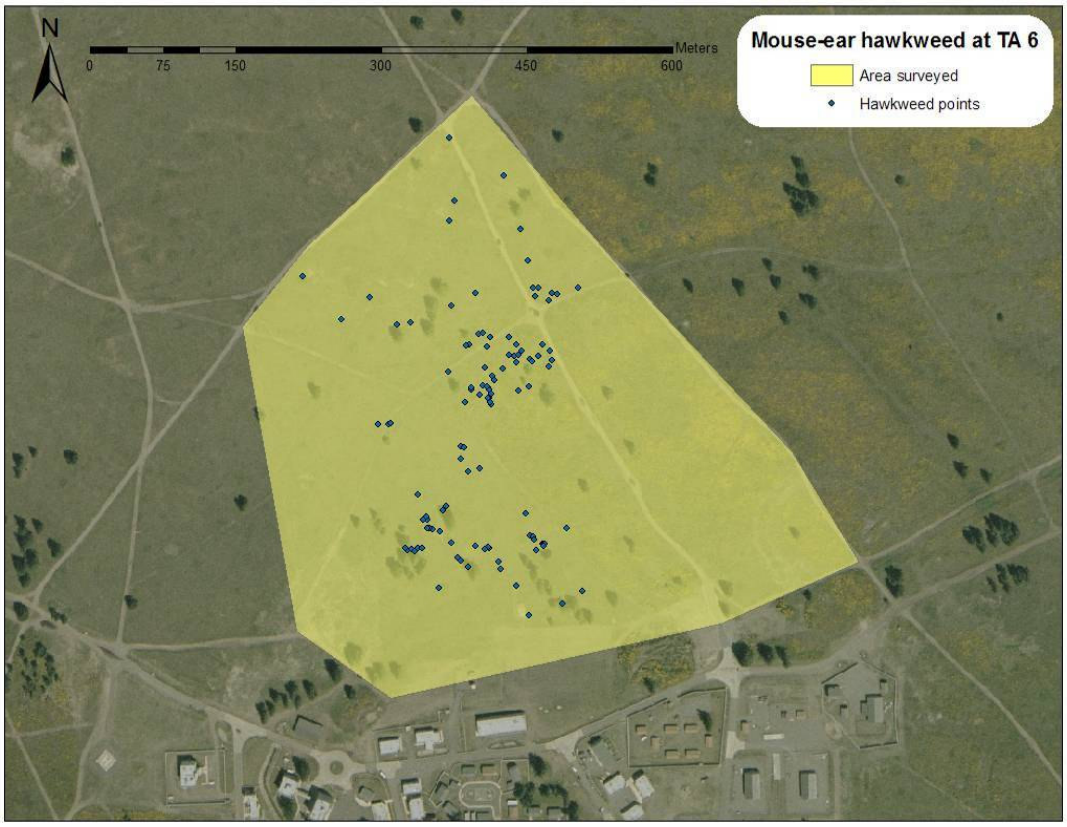

Figure 37: Mouse-eared hawkweed control at Training Area 6.

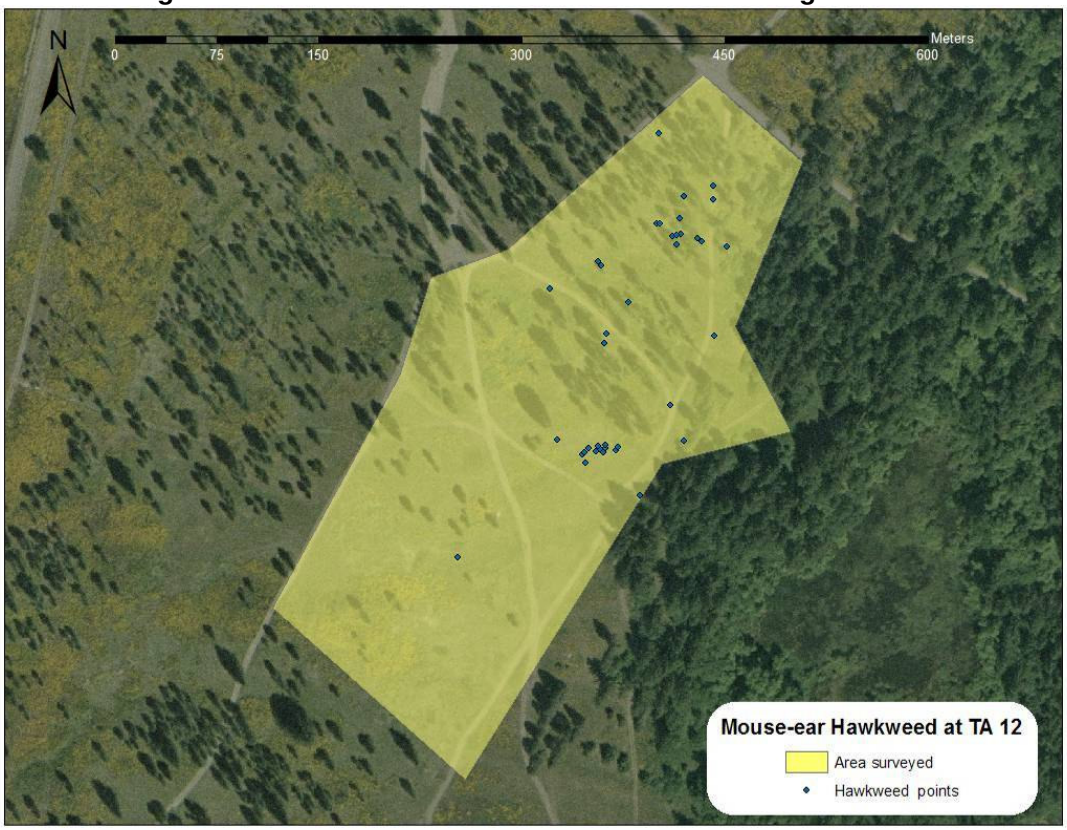

Figure 38: Mouse-eared hawkweed control at Training Area 12.

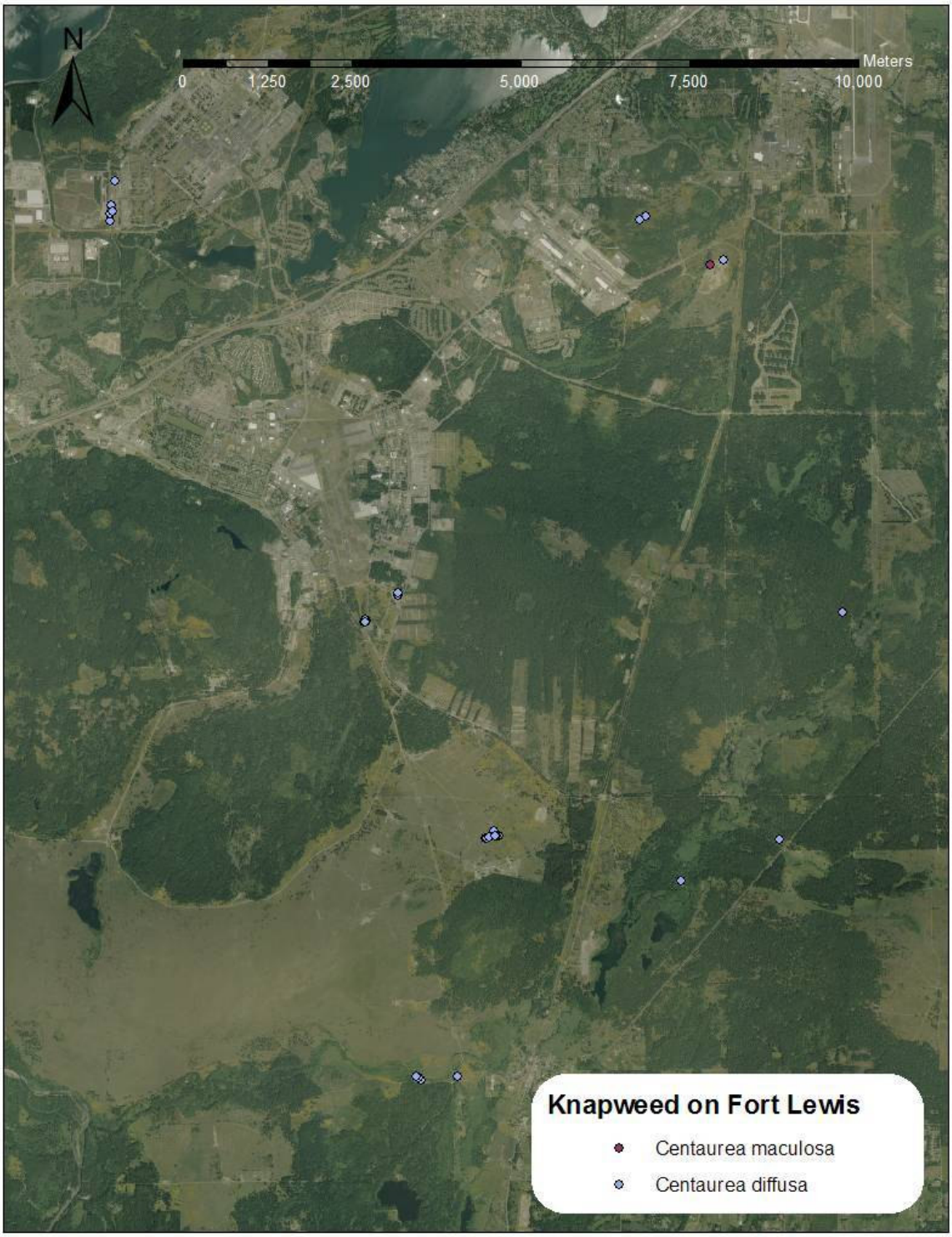

Figure 39: Knapweed control at Fort Lewis.

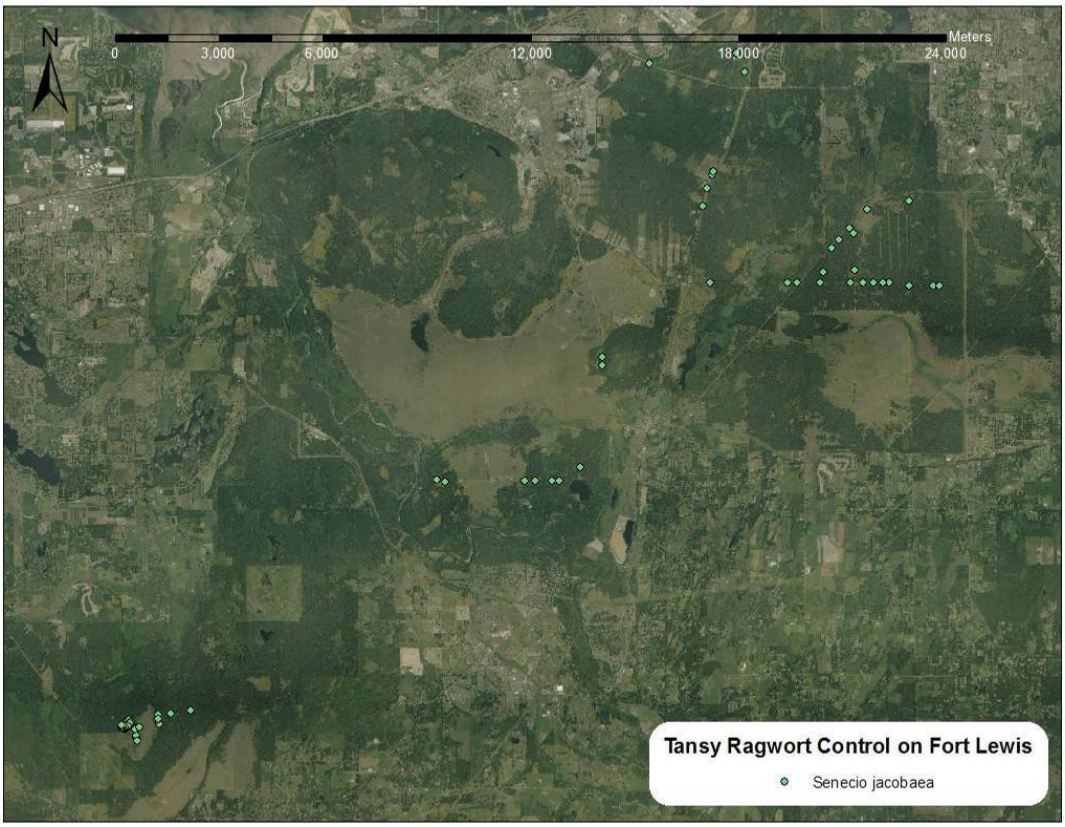

Figure 40: Tansy ragwort control at Fort Lewis.

AQUATIC INVASIVE SPECIES.

Reed Canary Grass

Reed canarygrass work was completed under Ft Lewis Muck Creek 2008 TNC#4872 unless otherwise indicated.

Site	Area (acres)	Stream length (miles)
TA 15	6.22	1.80
TA 13	1.05	0.25
TA 12	14.16	1.90
TA 10	0.53	0.10
TA 6	1.95	0.28
Mortar Point 13	1.95	0.45
Total	**25.86**	**4.78**

Exeter spring was again treated during Pride Week this year with a solution of 2% Aquamaster and 0.25% Nufilm IR. Restoration here is progressing quite well, as the reed canary grass is being reduced and some natives are starting to return. Another section of reed canary grass was treated along the spawning channel of Muck Creek. A significant amount of reed canary grass is growing here and could require more attention.

Figure 41: Nixon Spring during winter 2008 after fall treatment (left) and following spring 2008.

Monitoring was done at Nixon Spring this spring to determine control effectiveness. Results demonstrated significant control of reed canary grass with last year's method. Average and mean cover classes moved significantly from 51-75% cover to 0% cover. Most impressive is the fact that out of 30 plots, 24 had no living reed canary grass growing, and it was less than 1% cover in the 6 that did have grass.

Figure 42: TNC staff working with contactors at Shaver Marsh (TA 12)

As can be seen in the above winter and spring pictures, reed canary grass was significantly reduced allowing the area to

flood. While our methods were effective on the living reed canary grass, new germinates emerged in the month of June. These early plants can be controlled very effectively with an early treatment of Aquamaster.

The unique Muck Creek ecosystem continues to be a top priority for Fort Lewis and The Nature Conservancy. Reed canary grass is currently the most established and dominant invasive plant of this waterway and has restricted passage of salmon to historic spawning grounds. Thus a significant portion of Muck Creek was managed this year with control of reed canary grass in mind. The table on the right demonstrates the amount of work done on various training areas by acres and miles of stream.

Last year The Nature Conservancy hired the Tacoma Urban League to assist with brush cutting and treating reed canary grass. This year we committed more TNC staff to brush cutting and hired subcontractors for one week. The results were very positive as the quality of work improved and more areas were treated.

While controlling reed canary grass is going to require many years of management and the primary reason for doing so is for spawning salmon, the work has also resulted in releasing habitat for native plants to emerge where they could not compete with reed canary grass in the past. Below are a few of the native plants that have responded.


Figure 43*: Navarretia intertexta* (left) and *Plagiobothrys scouleri* (right) two native annuals

Miscellaneous Upland Weeds

Knotweed Control (4864)

All known knotweed (*Polygonum spp.*) sites were again treated this year with a 2% solution of Aquamaster with 0.25% Nufilm IR. While the infestations are being reduced, some plants persist. Other knotweed programs have demonstrated that Habitat (imazapyr) is more effective and it is recommended that Fort Lewis populations should be treated with it next year.

White Water Lily Control (4872)

Last year the southern half of Chambers Lake was treated for white water lily (*Nymphaea odorata*). This year the northern half was controlled using the Argo and a

solution of 2% Aquamaster with 0.25% Nufilm IR. This pattern should reduce the population so that the entire lake can be treated next year.

Yellow Flag Iris (4864)

Known populations of yellow flag iris were treated with a cut and squirt method using 50% aquamaster. The density of these plants, particularly at Shaver Kettle, are being reduced, but control efforts will be necessary for many more years.

2008 Outlook

The 2008 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. Several trials will be performed this year using Milestone VM. This herbicide is very environmentally friendly and is less dangerous to handle. Trials will investigate how well Milestone controls mouse-ear hawkweed and sulfur cinquefoil, and will determine if we should revise our control strategies.

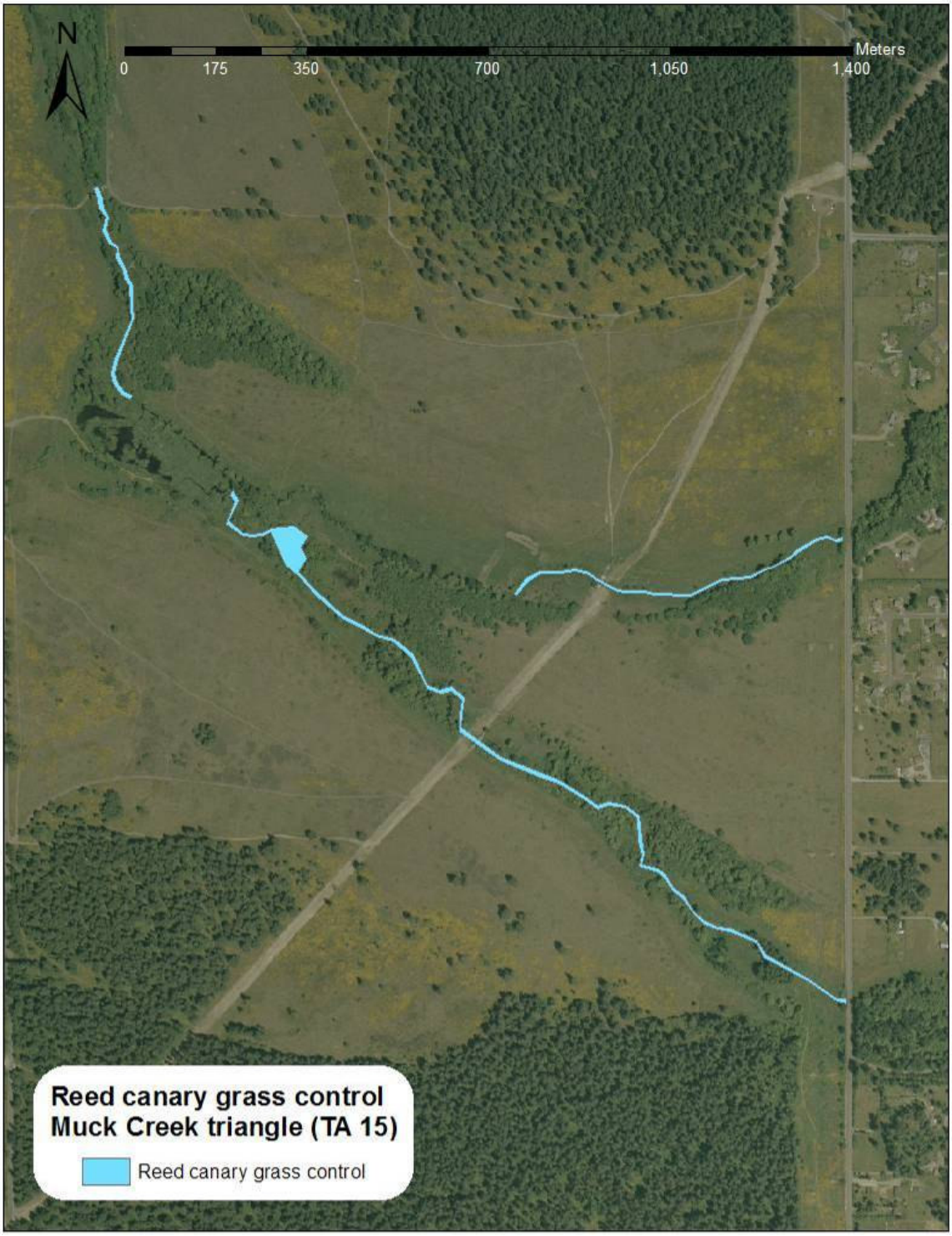

Figure 44: Reed canarygrass control at Muck Creek triangle – Training Area 15.

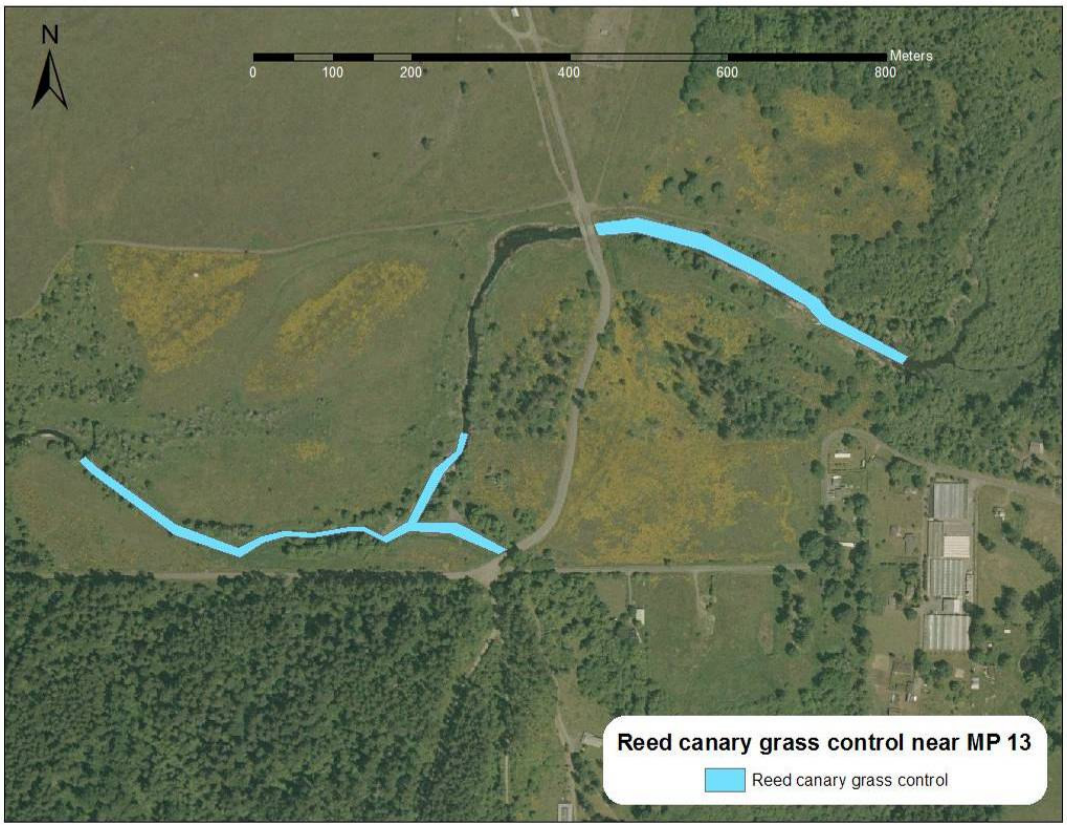

Figure 45: Reed canarygrass control near Mortar Point 13.

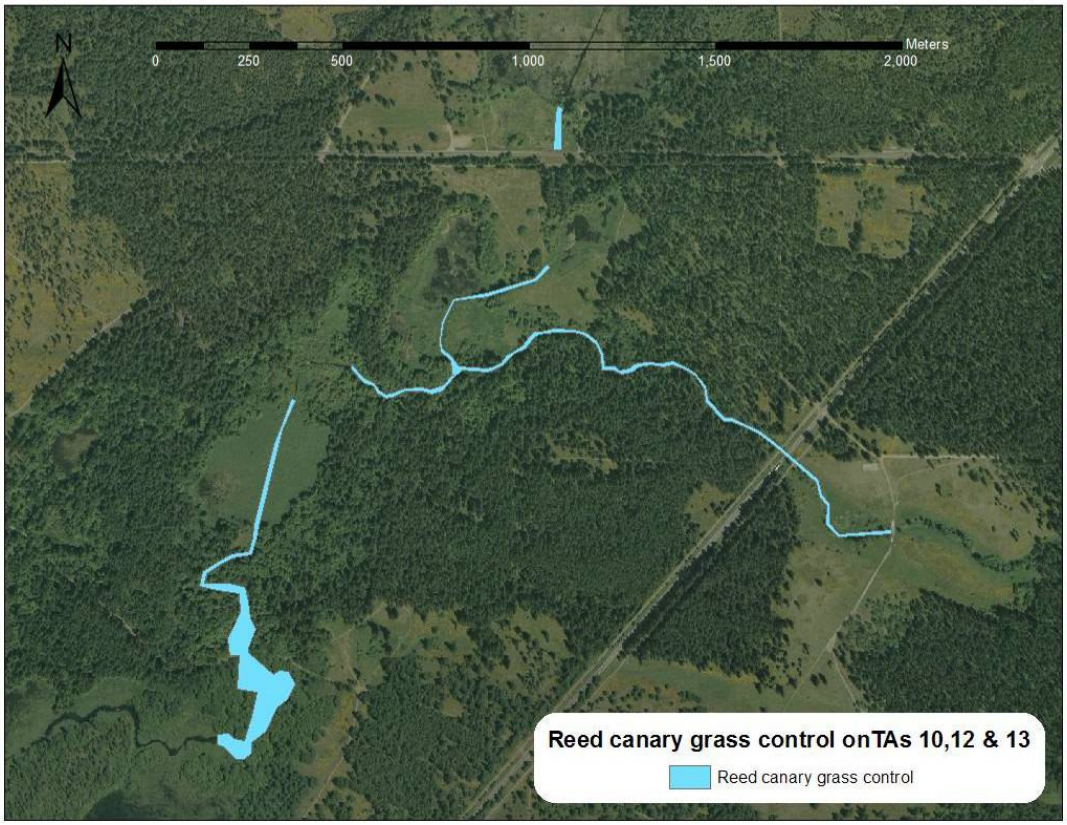

Figure 46: Reed canarygrass control at Training Areas 10,12 and 13.

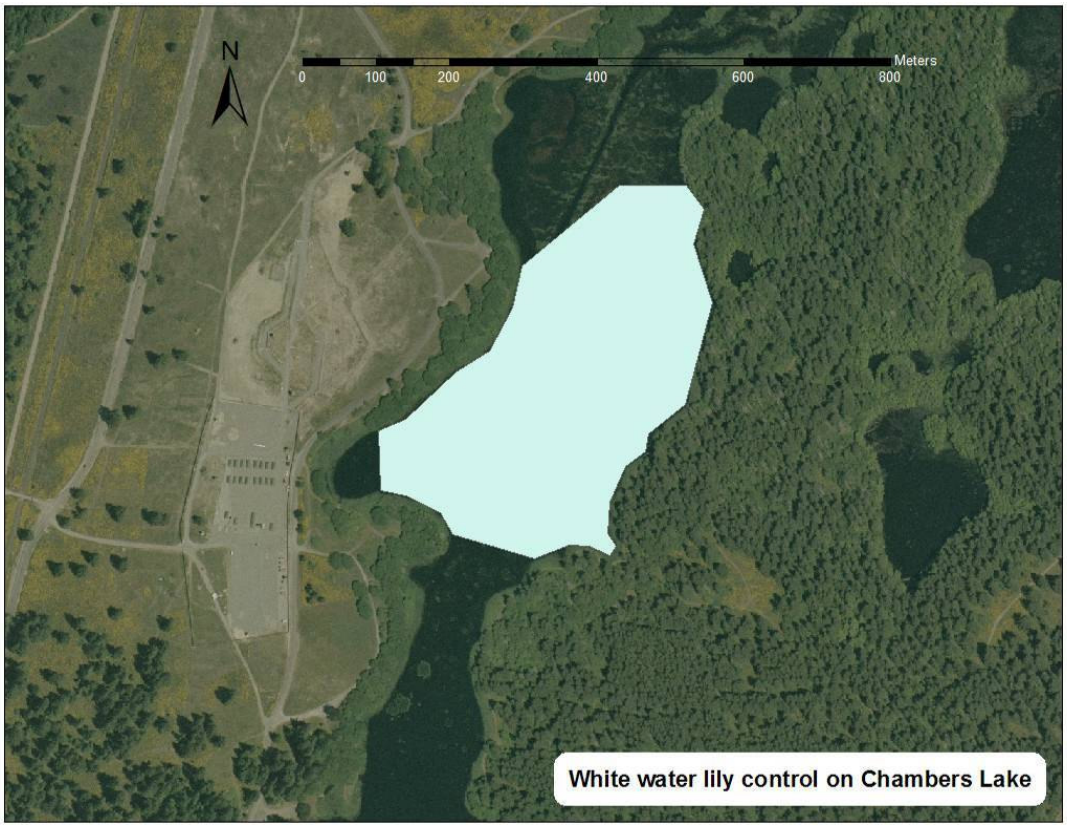

Figure 47: White water lily control at Chambers lake.

RIPARIAN AND STREAM ENHANCEMENT.

Riparian zones are an important component 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.

2008 Review

RIPARIAN ENHANCEMENT SUMMARY

January-March

- Purchased and planted 5000 Oregon ash and 500 western red cedar along stretches of Muck Creek that have been treated for reed canarygrass - 4834.
- Purchased one-half of a Drumloc Model DL6 herbicide storage shed to safely contain herbicide (TNC#4831 and 4834)

April-June

- Initiated stream and wetland vegetation removal with Aquamog – 4868 and 4870
- Completed road closure project at Nisqually access on Mounts Road - 4868

July-September

- Completed stream and wetland vegetation removal Aquamog contract at Muck Creek above Halverson, Spanaway Marsh and Upper Chambers Lake- 4868 and 4870.

Muck Creek Tree Planting

TNC and Fort Lewis staff planted 5000 Oregon ash and 500 Western redcedar along Muck Creek in areas that have been treated to control reed canarygrass (TNC#4834)

Instream and Wetland Channel Clearing - Aquamog

In early summer, we completed a major channel clearing project in Muck Creek, Upper Chambers Lake and Spanaway Marsh. The project entailed removing reed canarygrass and common cattail and their associated root masses in these priority areas where it is restricting flows, impeding fish migration to upstream habitat and decreasing the overall open water habitat. At Halverson channel, about 2250 linear feet of stream channel was cleared. Almost one mile of channel was cleared in the upper portion of Chambers Lake and one-and-a-half miles of channel was converted to open water at Spanaway Marsh. In total, three linear miles of channel was cleared.

The work was contracted with Aquatic Environments, Inc. The contractor primarily used an Aquamog (a mechanized barge with a variety of attachment options). Work progressed quickly, and we were able to complete all three priority projects. Work was completed under Fort Lewis Watershed 2007 and 2008 task orders (TNC#s 4868 and 4870).

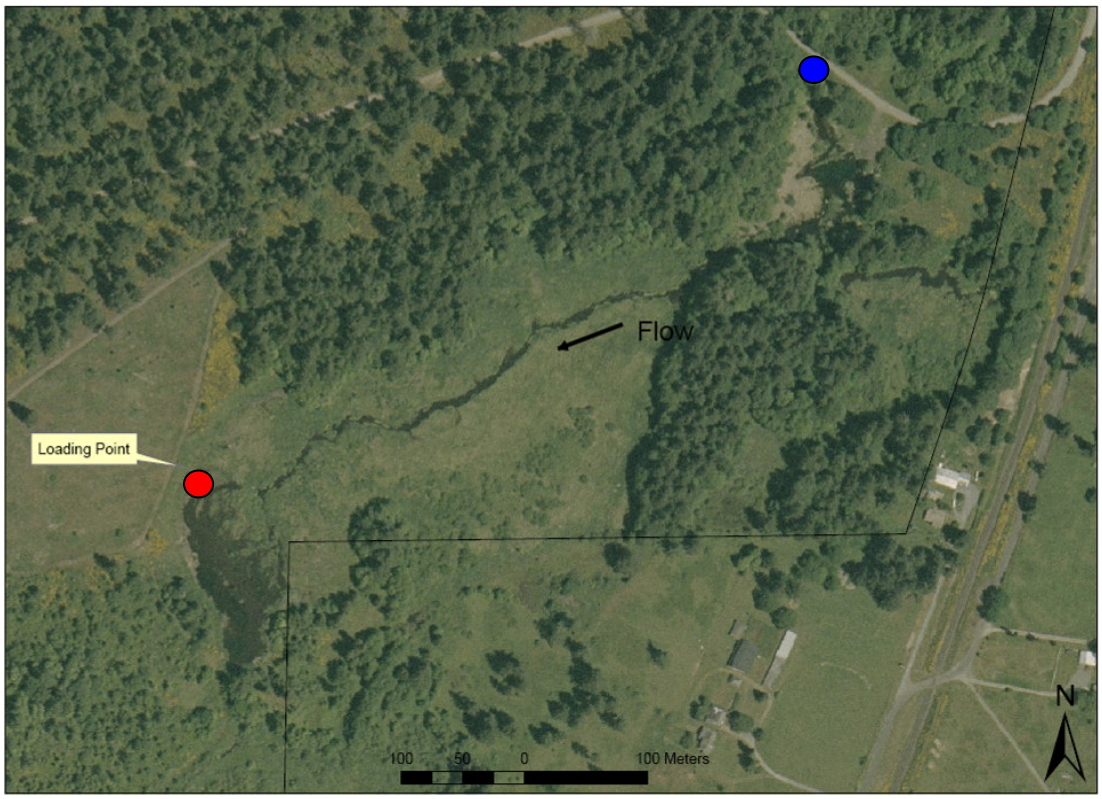

Figure 48: Halverson Channel project area with start (red) and end (blue) points.

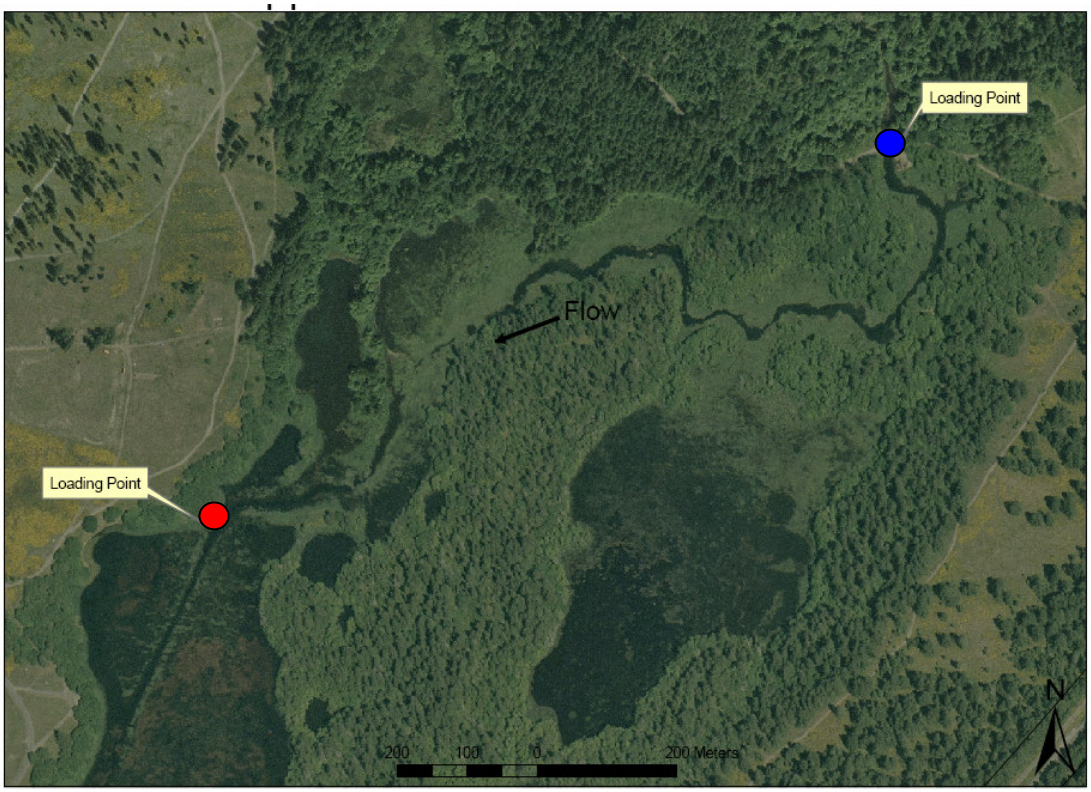

Figure 49: Upper Chambers Lake project area with start (red) and end (blue) points.

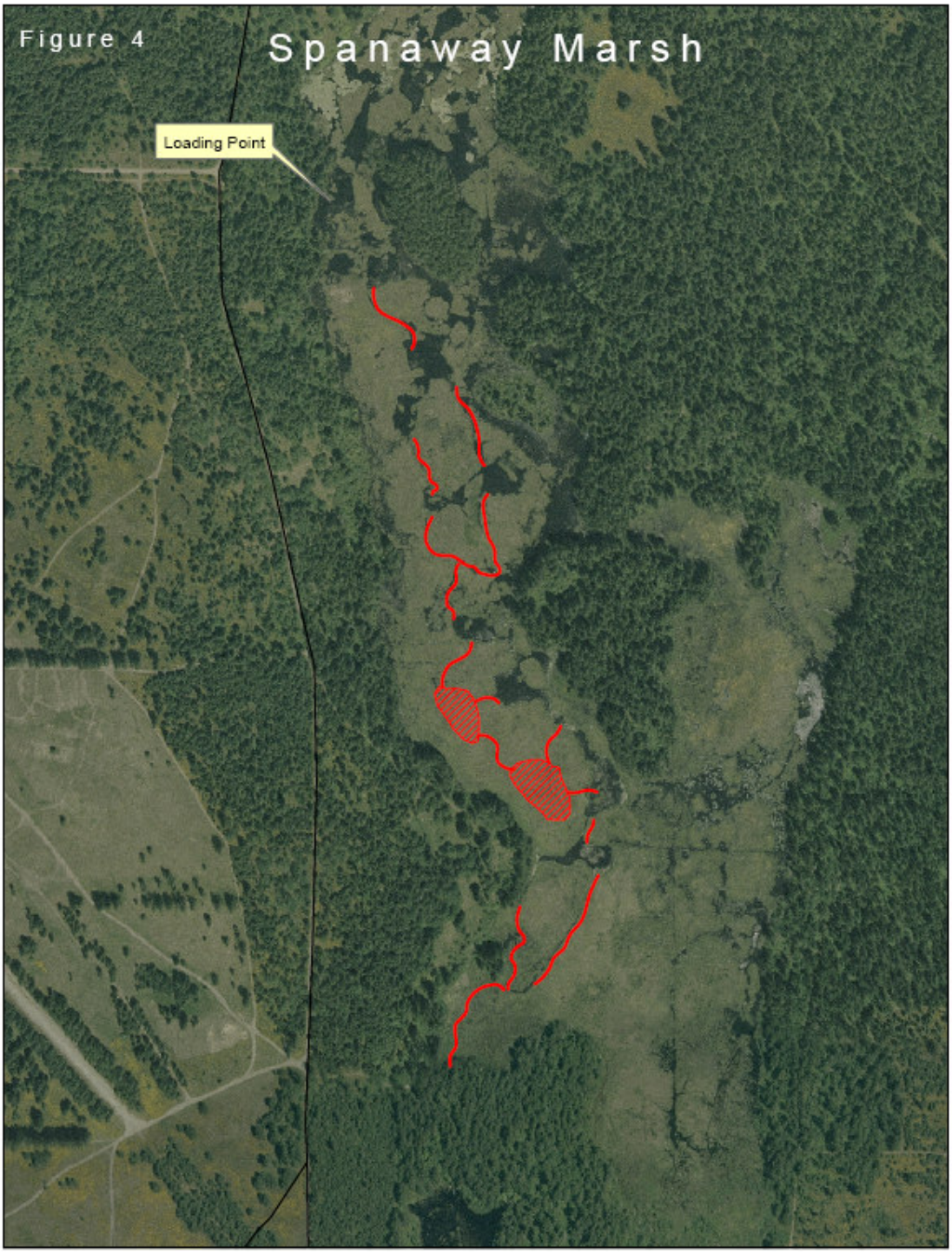

Figure 50: Spanaway Marsh project area with removal areas indicated in red.

APPENDIX – Summary of all 2008 Activities for Each Task Order

TABLE 14: Summary of all tasks completed in 2005 arranged by Fort Lewis task order (with TNC grant numbers).

Williams Pipeline Restoration (TNC#3010)

- *Pipeline* – Hand controlled weeds at pipeline restoration site to protect emerging native plants near creeks.
- *Pipeline* – Boom sprayed pipeline area to control invading weeds in spring and early fall.

Prairies 2008 (TNC#3917)

- *Johnson Prairie.* 164 acres of the high and medium priority quality were surveyed and treated for broom. Though many small plants held flowers, the vast majority were not viable.
- *Upper Weir Prairie*. Cut 72 acres of the highest priority prairie in two polygons.
- *South Weir Prairie*. Treated 65 acres of flowering broom. There were very few mature plants in the core portions of the prairie.
- *13th Division Prairie –Triangle*. Surveyed and treated 125 priority acres in three polygons.
- *Upper Weir – Prescribed burn*. Assisted Forestry with a 125 acre prescribed burn in Northeast section.
- *South Weir.* South Weir Prairie contains some higher quality native prairie, and has been targeted as a priority broom control site. This summer, we spot treated broom on 72 acres. Overall broom densities have greatly declined, though portions of the perimeter still have relatively high counts of seedlings and re-sprouts.
- *Artillery Impact Area – MP1*. In mid-August, we assisted with an 80-acre prescribed burn just west of Mortar Point 1. This is an area of medium quality prairie that is just outside the AIA and not subject to stringent access restrictions.
- *Upper Weir Prairie.* Mowed 88 acres of Scotch broom in southeast corner.
- *Johnson.* Mowed 7 acres of broom on southern edge.
- Conducted trial fall burn with propane tow behind burner using TNC burn boss.
- South Muck Triangle – Sprayed Fusillade on four acre grass control plot.
- *Large Collins Plots* – Sprayed Fusillade at two large Collins plots near Muck Creek and South Weir Prairie
- Applied grass specific herbicide post-burn on five acres at Upper Weir NE burn unit.
- *Upper Weir* - Post-burn Fusilade application (TA 21)
- Provided training four days of prescribed fire training to four TNC firefighters.
- Purchased 10 fire radios for use with prescription fire program.
- Completed purchases of necessary fire equipment for 2008 burn season in

collaboration with ACUB.
- Conducted trial fall burn with propane tow behind burner using TNC burn boss.
- *Collins Plots* – Completed burning of large and small Collins plots.
- *Collins Plots* - Mowed pathways on small and large Collins plots in preparation for summer burning.
- *Collins Plots* - Treated 2 100x100 meter Collins plots at TA 15 and South Weir prairie for invasive plants following burn.
- *Sequalitchew Earthworks* – Expanded landfill enhancement area in spring and followed up with summer re-treatment.
- *Spurgeon Creek Seed Plots* - Sprayed 8 acres as site preparation for fescue seed production.
- *AIA* - Controlled encroaching fir on 711 acres of prairie habitat.
- Wet Prairie enhancement plot treated with Aquamaster in Spring and October
- Completed tall oatgrass control at Rainier Training Area.
- *Cultural Site* - Treated area surrounding seed plots in TA 13.
- Monitored Scotch broom experimental control plots at Lower Weir.

Cavity Creation (TNC# 4822)
- Purchased supplies for cavity projects.
- *Sequalichew Ecopark* – Constructed and installed one swift tower.
- *Spanaway Marsh* – created 4 wood duck cavities.
- *TA 8 Landing Strip* – Created 2 WGS cavities.
- *Upper Weir* – Created 20 blue bird cavities.
- *Lower Weir* – Created 14 blue bird cavities.
- Presented poster on cavity creation to Washington Wildlife Society Conference.

Water Howellia Aquatic Weeds (TNC# 4825)
- Purchased Argo, an all-terrain vehicle for aquatic weed control work on Ft. Lewis.

Fort Lewis Eagles (TNC#4826)
- Purchased one Drumloc DL6 herbicide storage shed to safely contain herbicide for Ft Lewis weed control projects.
- Conducted two spring bald eagle surveys of Nisqually River and Muck Creek.

STHL 2007 (TNC#4830)

- Initiated nest exclosure pilot project in conjunction with WDFW to evaluate methods for reducing nest predation throughout home range of larks

Fort Lewis Butterflies (TNC#4831)

- *13th Division Prairie.* Mowed eight small polygons of Scotch broom to enhance prairie structure and to reveal invasives (and in some cases rare natives)
- *13th Division Prairie* - Mowed Scotch broom on eight polygons totaling 31 acres.
- Washington Butterfly Association: Set up agreement for WABA volunteers to survey for butterflies at Johnson Prairie.
- Initiated butterfly detection dog training for detection of Taylor's Checkerspots.
- Purchased one-half of a Drumloc Model DL6 herbicide storage shed to safely contain herbicide (split with TNC#4834)

Squirrel Oaks (TNC#4832)

- *East Gate Area* – Mowed 28 acres of Scotch broom and encroaching fir.
- Installed new hair snag monitoring tubes at TA's 3V, 4 and 5.
- Submitted two papers to Northwest Science: *Monitoring Western Gray Squirrels for Management in Western Washington* and *Invasive Squirrel Control: A Trial on Fort Lewis, Washington.*
- Presented poster *Gray Squirrels in Western Washington, Monitoring and Management* to Washington Wildlife Society conference.
- Finished mowing east of Chambers Lake TA12MU4 and 9- 50 acres total.
- Mowed from Vietnam marsh to west of the landing strip TA8MU5 and 6- 22 acres.

Gophers 2007 (TNC#4833)

- *Upper Weir Prairie*. Mowed 119 acres of broom in the northeastern portion of the prairie. This is follow-up work to previous broom control to restrict summer seed set and maintain prairie structure

Ft Lewis Muck Creek (TNC#4834)

- Purchased one-half of a Drumloc Model DL6 herbicide storage shed to safely contain herbicide (split with TNC#4831)
- Purchased and planted 5000 Oregon ash and 500 western red cedar along stretches of Muck Creek that have been treated for reed canarygrass.

Cavity Snag(TNC#4835)

- Build swift tower on topped-tree at Upper Weir.
- Built five purple martin boxes on Upper Weir.
- Built and placed 30 bat boxes at 10 sites around Ft Lewis.
- Artillery Impact Area snag creation - 71 acres.

Howellia (TNC#4864)

- *Yellow Flag Iris* control – TA 12

Invasive Weeds 08 (TNC# 4865)

- Tall Oat Grass control - TA 7S, Pacemaker (TA14) Muck Creek Triangle (TA 15), Mortar Point 13 and Range 76.
- Sulfur Cinquefoil control - TA 6, TA 13, TA 15, MP13
- Common toadflax control - TA 6.
- Knapweed control - TA 7S, TA 6, TA 14, North Fort Lewis.
- Mouse-ear Hawkweed control - TA 6, TA 12 and Lower Weir.
- Blueweed control - TA 7N and near Ft Lewis main gate.
- Leafy Spurge control - near MP 13.
- Monitored Sulfur Cinquefoil control plots.
- Knotweed control – TA 10 and TA 21.
- Tansy ragwort control – TA 21 and sides of main roads.
- White water lily control – Chambers Lake (TA 12)

Larks 2008 (TNC# 4866)

- *13th Division Prairie – Pacemaker.* Surveyed and treated 100 highest priority acres.
- *Upper Weir* - spot treated about 74 acres of the two highest quality polygons.
- *Sequalitchew Earthworks* -- Expanded treated area adjacent to initial project site by spraying additional eight acres and monitored seed and planting plots
- Began implementation of lark nest predator exclosure project in conjunction with regional effort.*13th Division Prairie – Pacemaker.* Surveyed and treated 100 highest priority acres.
- Expanded Earthworks preparation area and retreated.
- Monitored Earthworks experimental planting and seeding plots.

Oaks FR08 (TNC#4867)

- Mowed competing brush under oak at TA8MU8-35 acres.
- Mowed competing brush under oak at TA10MU1-25 acres.
- Monitored created cavities for wildlife use in fall.

Watershed 2007 (TNC#4868)

- Completed stream and wetland vegetation removal Aquamog contract at Muck Creek above Halverson, Spanaway Marsh and Upper Chambers Lake- 4868 and 4870.
- Completed road closure at Nisqually access on Mounts Road.

Watershed 2008 (TNC#4870)

- Completed stream and wetland vegetation removal Aquamog contract at Muck Creek above Halverson, Spanaway Marsh and Upper Chambers Lake- 4868 and 4870.

Oak Invasives (TNC#4871)

- Mowed TA 8 West of Landing Strip- TA8MU4 and 10- 38.5 acres.
- Mowed Ammo Storage- ASPMU1-5 – 64.5 acres.
- Mowed Holden Woods- TA10MU2 and 3- 38 acres.
- Brush Cut area NW of deBalon Woods- TA8MU1- 7 acres.
- Sprayed TA12MU1-23 acres.
- Sprayed TA12MU2-13.5 acres.
- Sprayed Holden Woods- TA10MU3 and 2- 34.5 acres.
- Sprayed deBalon- TA10MU1; TA8MU2- 57 acres.
- Sprayed Bill Lake- TA8MU3- 11.5 acres.
- Sprayed Vietnam Marsh- TA8MU5 and 6- 25.25 acres.
- Sprayed Spanaway pockets- TA9MU2-4 -12.5 acres.

Muck Creek (TNC#4872)

- Sulfur Cinquefoil control - TA 6, TA 13, TA 15, MP13.
- Monitored Reed Canary Grass control plots.
- Reed canary grass control on Muck Creek – TA 6, TA 10, TA 12, TA 13, TA 15 and MP 13.

Butterflies 2008 (TNC#4877)

- Facilitated Johnson Prairie butterfly monitoring by Washington Butterfly Association volunteers.
- Mapped *Viola adunca* and *V. praemorsa* at Johnson Prairie.
- Conducted vegetation monitoring of butterfly enhancement plots at 13th Division Prairie.
- Conducted vegetation monitoring in trial site preparation plots on Lower Weir Prairie.
- Treated butterfly enhancement area at Pacemaker (TA 14) to control invasive grasses
- Completed Johnson Prairie butterfly habitat mapping.
- Completed vegetation monitoring on butterfly habitat enhancement plots at Muck Creek Triangle.
- *P*lanted the following butterfly resources at 13th Division and Johnson Prairies: 387,800 seeds and 9,100 nursery grown forb seedlings ('plugs') into four prairies this fall/winter.
- Completed first-year monitoring of Lower Weir Prairie site preparation seeding trials
- Spray treated butterfly enhancement area at Pacemaker at site preparation.

Bats FR08 (TNC#4878)

- Completed bat survey, confirming the presence of all 9 species of bats found in the Puget Sound.
- Radio-tagged two Townsend's big-eared bats and gathered foraging and roosting data.