

2013



Puget Sound Ecological Fire Program 2013 Summary Report



South Sound Land Managing Partners:

Center for Natural Lands Management
Joint Base Lewis McChord
The Nature Conservancy
WA Department of Fish and Wildlife
WA Department of Natural Resources
Wolf Haven International
Olympic National Forest

Table of Contents

Introduction	2
Background.....	2
Why is Ecological Fire Management Important?	3
Collaborative Approach.....	4
Program Goals	5
South Puget Sound Ecological Fire Program Goals Framework.....	6
2013 Burn Program Accomplishments	7
Overview	7
I. Operational Planning, Implementation, Safety and Adaptive Management	9
Operations - Regional	9
Operations – Joint Base Lewis-McChord	9
Operations – Thurston County - Army Compatible Use Buffer (ACUB) Sites	11
Operations – North Sound	14
II. Information Development and Exchange	15
Research Burns	15
South Sound Fire Effects and Severity Monitoring Program	17
III. Ecological Fire Management Planning	21
IV. Partnership and Burn Program Sustainability	21
V. Ecoregional and Statewide Networking	24
Washington Prescribed Fire Council	24
Northwest Fire Science Consortium	25
International Fire Ecology and Management Annual Congress	25
Appendix 1: Table of all burn projects completed or attempted	26

Introduction

A diverse mosaic of fire dependent prairies once dominated the south Puget Sound region and was scattered throughout the rest of lowland Washington. The prairies were interspersed with coniferous and deciduous woodlands and wetlands. Lack of managed fire during the past 150 years has contributed to significant habitat loss and impact to native species. Regional habitat and rare species management planning has identified integrated use of fire as a corner stone for regional prairie restoration.

Unable to rely solely on local fire suppression agencies to conduct ecological burns at the needed scale, conservation partners involved in the collaborative prairie and oak restoration program in Puget Sound have implemented a partner-driven prescribed ecological burn program with capacity to accomplish burning at the landscape level. 2013 marks our sixth burn season since we scaled-up our burn operations. Prior to 2008, we were only conducting one to two burns annually. Since that time, our partnership has greatly increased burning capacity. In 2013, a year hindered by exceptional weather and other unanticipated constraints, we completed 40 burns totaling 1173 acres on nine different properties in North and South Puget Sound. Based on the number of operational burn shifts (though not total acres), we continue to be the most active burn program in the state. Primary land managing burn partners include Joint Base Lewis-McChord, Washington Departments of Fish and Wildlife and Natural Resources, Wolf Haven, Center for Natural Lands Management and Thurston County as well as Pacific Rim Institute and Whidbey Camano Land Trust in North Puget Sound. This year we welcomed Olympic National Forest as a land managing burn partner with a collaborative attempt to conduct an ecological burn on bear grass savanna habitat.



Spring camas bloom at TA15. This was second burn and shows strong reduction of moss and thatch.

Background

Puget lowland prairies and oak woodlands once mixed extensively with coniferous forest and wetlands to form an ecologically diverse matrix of habitats that ranged throughout the Puget Trough. Prairies and oaks were maintained through frequent anthropogenic fire until around the mid-1800's. As settlement occurred, burning was halted and these habitats were converted

to agriculture, housing and industry, or were invaded by conifer forest. Today, residual native prairies are thought to be restricted to about 3% of their former extent.

A robust and highly active collaborative program has evolved over the past two decades to protect and restore the remaining prairie-oak mosaic habitat and its dependent species. As a result of our past efforts, we are now gaining the capability to effectively restore habitat at the landscape-scale. It is widely agreed that prescribed ecological fire is a critical conservation tool in these systems and can provide benefit not only for the ecosystem as a whole but also to many rare species.

Fire is one of several tools that we utilize in our conservation approach and is not simply an end in itself. Fire is being returned to a fragmented system that has been altered by invasive plants and lack of fire. Rare populations of plants and animals also need special consideration when planning fire, especially when habitat structure has been altered by invasives and fuel build-up. Fires are one part of our comprehensive and evolving science-based restoration strategy that also includes additional weed control measures and establishment of native plants and seeds. On JBLM, burns also target reduction of invasive shrubs for improved military training in low quality grassland and oak woodlands, in an effort to reduce training pressure on higher quality habitats.



Native seed beds producing seed for sowing South Sound prairie sites after burns (Webster Nursery) and fall seeding after fire at South Weir JBLM.

Why is Ecological Fire Management Important?

The unparalleled benefit of fire for the management of native grasslands and hardwood savanna is well documented. In the Puget Sound region, more than a century of fire exclusion has led to the loss of thousands of acres of prairie and oak habitat following the unrestricted invasion of conifer forests. In recent decades, exotic species invasions continue to exacerbate habitat loss and degradation. The list of benefits provided by fire for these habitats is extensive, and has been the subject of much research. The majority of these benefits cannot be effectively replicated by other means. Below are some of the key ecological benefits of fire.

- Fire is the foundational disturbance that shaped and maintained prairie habitat for thousands of years. Prairie plant and animal species evolved in the presence of fire and have developed complex adaptations and dependency on fire. Without fire, the degradation and loss of prairie habitat and associated species continues.
- Frequent low-intensity fires reduce fuel loads and produce less severe fire behavior – a benefit to both public safety and the habitat itself.
- Many of our grasslands have over 100 years of litter, moss and thatch buildup due to fire exclusion. Fires conducted during the dry season reduce accumulations and expose mineral soil to promote native seed establishment, and are the only research tested means to effectively enhance these key aspects of native prairie habitat.
- Noxious and other invasive weed species have become a major threat to grassland habitats. Fire has proven very effective at controlling Scotch broom and other invasives, and prepares sites for more effective control of invasives that are not killed by fire.
- Several studies in Puget Sound and beyond show that many native plant species in these fire-dependent ecosystems experience higher germination success when exposed to smoke and ash.
- Fires release nutrients and contribute to soil building. Charcoal enhances water retention and nutrient storage capacity. Fires help moderate soil pH in favor of native species.
- Multiple fire applications maintain a mosaic of plant communities in varying stages of succession, providing a diverse set of resources and conditions for both plant and animal species.
- Fires reduce the density and distribution of pathogens and parasites.



Test Fire at TA6 JBLM

Collaborative Approach

The core principle behind the Puget Sound ecological burn program is collaboration: together we are more effective and efficient at meeting our shared objectives than we are on our own. Indeed, this approach extends to all our ecological management activities. By pooling resources, each partner's overall commitment of resources can remain relatively low, but when combined the team has remarkable capacity that is more easily sustained over the long-term.

Joint Base Lewis-McChord (JBLM) has the largest prescribed burn program of any of the Puget Sound partners, but currently has insufficient internal capacity to meet its ecological burn objectives. Center for Natural Lands Management (CNLM) inherited its burn program from The Nature Conservancy (TNC), which has a robust international prescribed fire infrastructure, with a 50-year proven track record. CNLM has developed a strong fire management program and continues to be a coordination hub for regional ecological burning. There is an ongoing deficit in locally available burn bosses, and CNLM has been able to bring in outside burn bosses to support training, burn program and planning reviews, and burn implementation. The other land-managing partners have significant limitations in their capacity to burn, either having few resources, or limited availability during the summer burn window.



First burn at Fisher Ranch, where fire and grazing are part of an integrated prairie management strategy.

The collaborative strategy has proven very effective. The Puget Sound Ecological Fire Partnership has developed significant capacity, and, during a normal year, is able to meet the majority of the current demand for ecological fire in the Puget Sound. In order to fully meet the demand for ecological fire, additional resources and training will be required, especially qualified local burn bosses and increased ability to conduct multiple simultaneous burn operations. Partners have become adept at prioritizing burn activities from the regional perspective, and supporting operations across ownership boundaries. Our strong collaborative background has also increased our program's competitiveness for local and national funding.

Program Goals

Partners recognize fire as an invaluable tool for restoring our fire dependent ecological communities. The primary goal of our burn program is to responsibly integrate fire as a critical natural resources management tool while holding public and firefighter safety paramount. To that end, we have adopted the current standards for fire management, firefighter training and risk management as established by the National Wildfire Coordinating Group (NWCG) PMS-310.1.

Below is a conceptual framework that outlines the burn program's approach to fire management. The remainder of this report is structured to reflect this framework.

South Puget Sound Ecological Fire Program Goals Framework

I. Operational Planning, Implementation, Safety and Adaptive Management

Partners have sufficient funding, equipment, staff availability and training to safely achieve planned ecological burn objectives. Robust burn planning and permit approval processes are in place that are developed and implemented with the best available information, supporting a long-term sustainable regional burn program.

II. Information Development and Exchange

Fire operations, ecological management and science programs are integrated, and together direct regional efforts to assess and meet information needs.

III. Ecological Fire Management Planning

Prescribed fire and wildfire activities are guided by mid to long-range fire management plans that are regionally integrated with long-range ecological objectives.

IV. Partnership and Burn Program Sustainability

The multi-partner ecological burn program remains cohesive, resilient and responsive to challenges, and able to implement burning at the scale required to meet ecological objectives:

- *The use of fire for ecological benefit is supported by a cooperative infrastructure of local and regional practitioners that have the knowledge, skills and qualifications to successfully and safely implement prescribed ecological burns during constrained burn windows.*
- *Regulatory agencies support ecological burning and have good working relationships with partners.*
- *Local affected communities are aware of ecological fire program and are generally supportive of the goals.*
- *Partners have planned for risks associated with fire management and have sound operational and administrative structures in place to minimize and buffer against risks.*

V. Ecoregional and Statewide Networking

Washington state and the WPG Ecoregion have a network of fire practitioners to facilitate information sharing among partners. The network extends outward to agencies, legislators and the public. As a united body, practitioners are able to address external and internal challenges proactively and with a broad base of support.



Early season burn at Johnson Prairie JBLM showing very mild fire behavior.

2013 Burn Program Accomplishments

Overview

After a mild and, at times, very wet spring season, summer weather got started on June 28 with a dry and warm period. Summer made an early turn towards fall on August 10, when we received our first measureable precipitation. Continual periodic measurable rain events continued through the remainder of the season, with the first heavy rain event on Aug 29. By mid-October, we had received 13" of rain, with more than 11" of those falling between August 28 and October 3. This early and consistent rain pattern allowed early green-up, with many fuels never fully curing. Cloud cover and humidity stayed high during the last half of summer, which limited drying of fine fuels. Rain, steady fuel humidity and early vegetation growth limited burn opportunities and produced mild fire behavior.



Twin smoke columns at TA14 JBLM in August

The first burn of 2013 occurred February 11 at Upper Weir on JBLM. This was the only shoulder season burn we were able to complete in part due to limited availability of an on-site type 2 burn boss that could rapidly respond to the rare weather opportunities. The primary burn season began July 16 and continued through Sept 12 (with two significant regulatory interruptions in between). Burning continued through to Sept 26, but we only met the most minimal ecological objectives during the final days. Burning would have started before the week before the July 16 burn, but CNLM experienced complications renewing fire liability insurance when its previous provider suddenly decided to leave the fire liability market. Shopping for a new policy took time, and resulted in costs almost doubling.

On July 24, two independent risk management decisions curtailed burning at both JBLM and on non-DoD sites. Controlled burns were disallowed at JBLM due to complications that resulted from the 2013 federal congressional budget sequestration and resulted in limited availability of wildfire response staff. This problem was resolved between JBLM Fire Department, Fish and Wildlife and Forestry and CNLM, and burning started again on August 12.

Starting July 25, all DNR burn ban exceptions were cancelled, and no burning was allowed on any DNR jurisdiction land. This was an unexpected and last minute step taken by the DNR that changed a permitting process that had been developed over the previous eight years. As a result, the authority to grant burn ban exceptions was shifted from the region level to the state level. This sudden change created a period of regulatory uncertainty, and it was not until

September 11 that a new interim process was put in place that allowed burning to resume. By this point, the heavy rains had already set in and the prairie green-up was well underway, which significantly limited burning days and dampened fire effects.

Operational Accomplishments: In total, we conducted 40 burns, totaling 1,172 acres during 29 different operational shifts. Of these, 944 acres and 22 units were on JBLM. On ACUB sites, 226 acres and 17 units were completed. One burn project was completed in the North Sound. A total of 10 burns directly supported fire-related research or long-term monitoring and 10 burn projects benefited current populations of species now listed under the Endangered Species Act or sites being prepared for future releases. In total, 32 of the burns conducted directly benefit ESA sensitive species.

Relative to recent years, this was not very productive season for the program, and several priority burns resulted in more mild than desirable fire effects. For ACUB, this setback was compounded by 2012 burning limitations that resulted from drought and other administrative complications.

Season Milestones: There are several notable 2013 actions and accomplishments. At the end of 2012, JBLM prescribed fire management responsibility was turned over to JBLM Fish and Wildlife, and in 2013 Fish and Wildlife implemented new prescribed fire planning and implementation standards. We conducted the first burn at Fisher Property, where fire and grazing are part of an integrated prairie management strategy. Our program supported training exchanges to Eglin Air Force Base and Nebraska, which, among other things, led to RXB2 and ICT4 firefighter qualifications. We hosted the first exchanges from Florida and Georgia with experienced. Faced with complications that unexpectedly limited our burn window, the JBLM and ACUB program managers became better coordinated towards regional ecological priorities. This coordination will be helpful as we strive to maximize our limited burn windows. Finally, the first oak understory burn was completed at Wolf Haven, and we conducted 32 burns to directly benefit occupied or expected release sites of federally significant species.



First oak burn at Wolf Haven prior to DNR burn shut down at the end of July showing low to moderate brush and down fuel reduction.

I. Operational Planning, Implementation, Safety and Adaptive Management

Operations - Regional

Fire Management. In July of 2011, TNC transitioned its South Sound Program (including the fire program) to the Center for Natural Lands Management (CNLM). In 2012, CNLM assumed fire management responsibility and developed its own fire management structure. CNLM continues to play a central coordinating and management roll in Puget Sound burning, and the recently developed CNLM Ecological Fire Management Manual has now been a successful guiding document through two burn seasons. This document is derived from TNC's 50 years of fire management and provides standards for fire planning, risk management and operations.

Burns during our short and uncertain burn window are made possible by the high degree of cooperation and flexibility from core and external partners and volunteers. The partnership makes concerted efforts to rank burn projects by regional importance and then mutually supports highest priority burns during our limited summer burn windows. This ability to collaborate from a regional perspective will help in future years both JBLM and ACUB projects attempt to work through their burn unit back log that has accrued over the past two years.



Crew briefing at 13th Division Prairie JBLM

Operations – Joint Base Lewis-McChord

2013 was the fifth year that JBLM has implemented its expanded ecological burn program. During August 2012, JBLM transferred responsibility for controlled burning to JBLM Fish and Wildlife. To prepare for this, Fish and Wildlife developed a Prescribed Fire Management Plan, and revamped the burn planning process to better accommodate specific ecological objectives. JBLM's new fire management unit (FMU) plans are standardized with the CNLM burn plan template to facilitate use across projects. The FMU planning that was implemented this year was a successful approach that improved operational flexibility and planning efficiency. Several burns were successful this season that would not have occurred using the previous JBLM burn planning structure - the use of FMU planning allowed crews to move to another block within the FMU to accommodate military training.

JBLM took advantage of a January burn opportunity that developed. There were abundant cured fuels from the previous summer drought, and even though conditions were overcast, a burn team managed to carry fire over 25 acres. While several other burn windows opened up during the winter and spring, the lack of a qualified on site burn boss left us unable to rapidly respond with a burn. We were not able to burn again on JBLM until July 16, when insurance

issues were resolved and our seasonal burn boss was available. Other than a short delay that resulted from complications from the congressional budget sequester, JBLM was able to take advantage of the good summer weather that lasted through to the end of August. The last JBLM burn was on September 12.



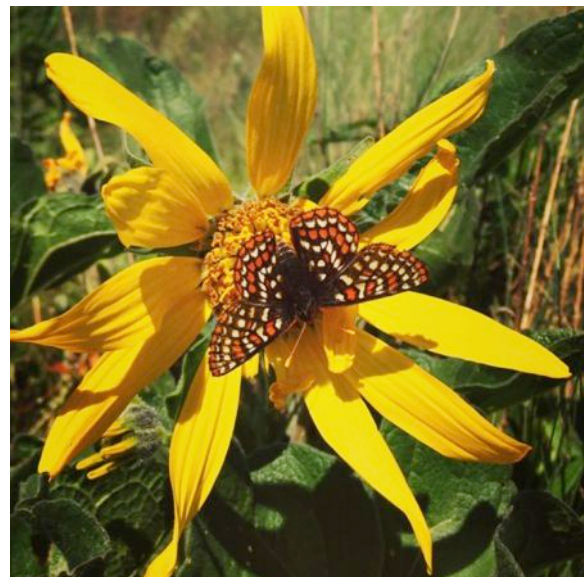
Lighting head fire at JBLM in January at Upper Weir JBLM.

JBLM burn unit sizes were on the smaller size again this year. In the past we have burned up to 200-acre units in prairie sites. However, due to new permitting guidance from the DNR, burns of this size are no longer likely to occur on JBLM. Without confirmed fuel models for our prairies, it is assumed that prairie burns consume .75 tons per acre treated. Using this fuel loading burning on JBLM is restricted to units 133 acres or smaller in order to meet DNR smoke management permitting

requirements. To mitigate for the reduction in unit size, efforts are ongoing to increase the capacity of the Puget Sound Ecological Fire Partnership to allow for multiple units to be burned per day. Thanks to local and national support from visiting firefighters, we were able to successfully implement this strategy several times. Additionally, efforts are ongoing to develop more sophisticated fuel loading and smoke production models that more accurately determine the tonnage of specific fuel types. Smaller burn units also result from days with sub-optimal wind directions, since smaller units produce less smoke.

Crew cohesion, fireline skill and interoperability continue to improve. Given the number of operational shifts, JBLM offers an excellent training ground for core and secondary partners, and this provides the added benefit of increasing overall regional prescribed fire expertise.

Though availability of local RXB2 qualified burn bosses continues to be an issue in the region, CNLM has been able to bring in seasonal burn bosses (RXB1 and RXB2). This not only helps JBLM to accomplish its ecological burn objectives, it also brings in outside skills and techniques from other regions of the country



Taylor's checkerspot butterfly at Range 76 JBLM

that conduct far more controlled burning than the Northwest.

2013 JBLM Operations –Of the 22 ecological burn projects completed at JBLM in 2013, 19 were primarily for grassland objectives and three were for oak woodland/prairie edge enhancement. A total of 945 acres were treated. All burns were conducted in training areas rather than firing ranges.

- *Tenalquot Complex (Weir and Johnson Prairies, Pine Runway and Pipeline)*. Completed 14 burn projects totaling 382 acres. Burns at Johnson typically were conducted during cool conditions to promote lower intensities. Includes burns to promote noxious weed control.
- *13th Division Prairie (Training Areas 13-15)*. Completed two burns totaling 99 acres. Includes burns to benefit federally listed streaked horned lark habitat, Taylor's checkerspot butterfly, and to promote noxious weed control.
- *Training Area 6*. Completed six burns totaling 459 acres in pine woodland and streaked horned lark habitat and to promote noxious weed control.

Operations – Thurston County - Army Compatible Use Buffer (ACUB) Sites

Background - Unlike JBLM, which has fire protection responsibility for its lands, Thurston County burns fall under the regulatory jurisdiction of Washington Department of Natural Resources - Resource Protection - a long-time valued partner in the planning and permitting process. Almost all of the Thurston County burn sites are enrolled in the Army Compatible Use Buffer (ACUB) program, which emphasizes conservation of rare species and habitats to offset regulatory impacts to training on JBLM. ACUB helped to fund the Thurston County burn program starting in 2007.

Washington Wildlife and Recreation Program (WWRP) also supported many of the burns on Thurston County sites. The WWRP project goal is to heighten cooperative actions that restore rare prairie habitats and species. The current WWRP project has the following objectives: develop additional seed resources for restoration; prepare areas for direct native seeding using prescribed burning and weed control; conduct direct seeding; and monitor the success of seeding experiments. It also partners together WADNR, WDFW and CNLM to increase seed production capacity for direct seeding in prairie and oak woodland restoration sites in western Washington. WWRP funds specific work at Scatter Creek and West Rocky Wildlife Areas and Mima Mounds and Rocky Prairie Natural Areas.



After Action Review following a good day of burning at West Rocky Prairie on old rail line.

TNC has coordinated burns at Glacial Heritage since 2001. In 2007, we completed our first fire on TNC's Tenalquot Prairie. These early burns relied heavily on support from DNR's Thurston Fire Management Unit and local fire districts, and were often restricted by summer burn bans. Other ACUB prairie preserves have a similarly limited history of fire. In 2007, the ecological exemption was successfully applied to prairie burns on non-federal property during the summer burn ban. This was a critical step, allowing us to expand our burn window into the preferred period of August through early October.

2013 Thurston County Operations – Thurston County sites had mixed success for the second year in a row due to unexpected regulatory and weather circumstances. On July 25, DNR changed the permitting process, which halted burning until September 11. As a result, we were unable to take advantage of the ideal burn conditions in August. By the time the new permitting process was established, the heavy rains had already brought on significant green-up and fire effects were mild to non-existent.

Starting July 19, we started the Thurston County burn season at the new Fisher property. We followed that with one more burn at Wolf Haven before the DNR permitting process changed. We picked up burning again at West Rocky Prairie on September 11, where we experienced decent fire effects. Burning continued through September 26 amidst periods of heavy rainfall and with decreasing fire behavior. By this time, only areas dominated by mature native fescue would carry fire.



Follow-up burning in Taylor's checkerspot expansion area several weeks after a very cool burn at Scatter Creek Wildlife Area South.

Burn Plans and Permits. Burn planning followed the standard process with only minor adjustments. Though the initial permitting process through DNR was seemingly standard, DNR made a last minute decision to shift the authority to grant burn ban exceptions from the local regions to the state level. This change was made before a new process to grant exceptions had been established, which resulted in a long delay before burning was again permitted. We anticipate that future burning under the new exception process should be more seamless, but this remains a point of concern for the 2014 season.



Mid-September burn at West Rocky Prairie.

Restoration Burns. This year the South Sound burn program was able to complete 17 burn units on Thurston County sites, totaling 226 acres. Overall, burn unit sizes are generally smaller on ACUB sites than on JBLM due to: increased adjacency and sensitivity to neighborhoods; working around populations of rare species; and smaller management areas.

- *Glacial Heritage.* Applied fire to all burn units (one unit was only partially burned). Four units were completed, totaling 117 acres. These units targeted habitat enhancement for Taylor's Checkerspot butterfly, weed control, site preparation for native seed reintroduction and maintenance of ongoing research blocks.
- *Wolf Haven.* Both planned units were burned, for a total of 10 acres of prairie and oak edge. Primary objectives included: weed control, tree crown lifting, shrub reduction and preparation for subsequent native seeding.
- *Scatter Creek Wildlife Area.* Completed five units totaling 28 acres. Many of the burns were very mild, with minimal objectives accomplished. Burns supported weed control and butterfly habitat enhancement.
- *Tenalquot Preserve.* Completed one 20-acre burn unit for weed and fir control and likely future Taylor's Checkerspot butterfly release.
- *Mima Mounds NAP.* Completed highest priority 22-acre burn, though under wetter than desired conditions and very mild fire behavior.
- *West Rocky Wildlife Area.* Completed three of the four planned burn units totaling 21 acres. Fire behavior generally met objectives.

Operations – North Sound

North Puget Sound has some of the longest running Puget Sound prairie burn work in recent history. Yellow Island is a TNC preserve that has had regular fire since 1987. The National Park Service has been burning repeatedly at American Camp on San Juan Island for several years. The South Sound burn program has supported prairie burning projects in the North Sound at TNC's Yellow Island and Ebey's Landing preserves, Fort Casey State Park, Pacific Rim Institute and the Naas Preserve owned by Whidbey Camano Land Trust (WCLT). Burns have supported both restoration and research objectives. The South Sound burn program assists with development and reviews burn plans and provides burn bosses and other needed crew and resources.

No burns were planned for Yellow Island in 2013. We had hoped to conduct burns at both Whidbey Camano Island and Pacific Rim Institute, but the DNR permitting process change caused complications. In the end, we were only able to conduct about 1 acre of burning at the WCLT's Naas preserve under very mild conditions.



Aerial view of Naas Preserve on Whidbey Island.

II. Information Development and Exchange

Research Burns

Field verification data for fire behavior and fuel consumption model evaluation. Fire managers are requesting field verification of fire and fuel models to justify their management decisions. In addition, smoke management burn permit fees have tripled in the State of Washington. Since fees are based on predicted fuel consumption, outputs from models such as Consume and FOFEM must be accurate. However, the availability of integrated, quality-assured, fuels, fire, and atmospheric data sets for the evaluation of fire behavior and fuel consumption models is limited. This project focuses on the development and design of a collection protocol to co-measure fuel characteristics, fuel consumption, meteorology, and fire



JFSP burn at Upper Weir Prairie from 80' boom lift.

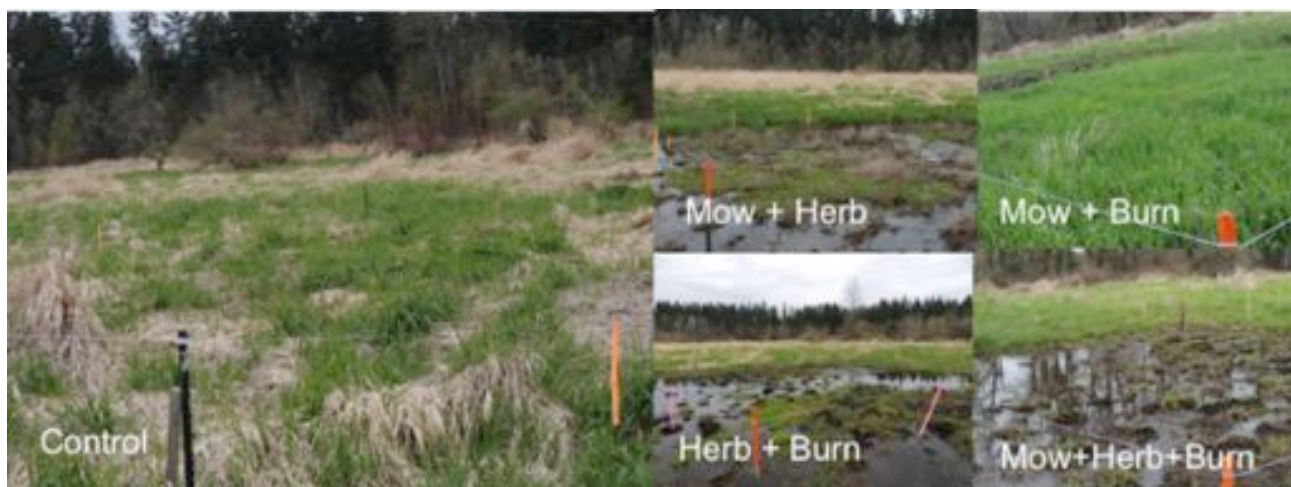
behavior. The methodology will be used to advance fuel discipline research team and initiate development of a fire behavior and fuel consumption validation data set. This study will leverage ongoing research supported by Joint Fire Science Program (JFSP), and is highly likely to lead to further collaborative research with the JFSP, the U.S. Army Corps of Engineers, and Strategic Environmental Research Development Program (SERDP). Our burn program continues to partner with the project leads, and is currently planning the next research burn for 2014.

Plant community and soil responses to experimental fire exclusion – Evergreen State

College. In the summer of 2011, Evergreen State College set up paired research plots randomly across Upper Weir and Johnson Prairies at JBLM. We use a series of paired fire-exclusion treatments within an active managed fire restoration matrix to evaluate the effect of prescribed fire and fire exclusion on prairie plant community and soil biogeochemistry. Prairie plant community composition and abundance were measured alongside soil chemistry measures in 22 paired, 20 m x 50 m Modified Whittaker Plots established randomly across Upper Weir and Johnson Prairies at Joint-Base Lewis-McChord, Washington. Soil samples were collected from both control and burn plots both prior to burn treatments and immediately following burn treatments in September 2011. Prairie plant community composition was measured in all 20 m x 50 m plots and 7 m² sub-plots per plot in May 2012 (a total of 88 1 m² sub-plots and 22, 5 m x 20 m sub-plots). These data are currently being analyzed to determine how prescribed burning influences prairie plant community structure and diversity. Soil samples are currently being segmented, extracted and analyzed for major soil elements and heavy metals (C, N, S, Ca, K, Mg, Fe, Ar, Pb, Mg) and major nutrients (NH₄⁺, NO₃⁻, and PO₄⁻). Early findings show stronger differences between prairie locations in terms of both soil chemistry and plant community structure than between control and burn treatments. Plant community structure and soil chemistry measures will be surveyed at select plots again in May-

June 2014. Data will be collected from plots that are not scheduled to be burned in 2014. In future years data will be collected from plots following burns or every third year.

Evaluation of integrated control strategies for reed canary grass. Reed canarygrass (*Phalaris arundinacea*) is a pervasive invader to wetland systems throughout much of the United States. It is a cool season, long-lived perennial grass with extensive rhizomes that, once established, creates a thick mat of litter that prohibits native vegetation from growing. There is anecdotal evidence from previous work in western Washington that a combination of mowing and herbicide is effective at minimizing RCG spread. However, this technique does not remove the thick litter and humic layer that tends to inhibit native growth and recovery. To evaluate effectiveness of control techniques for wet prairies of Joint Base Lewis-McChord (JBLM), we have been testing combinations of three removal strategies (herbicide, fire, mowing), including a control (no treatment), in 100m² plots at three separate invaded sites. The treatment combinations include: 1) Mow + Herbicide, 2) Burn + Herbicide, 3) Mow + Burn, 4) Mow + Burn + Herbicide, and 5) Control (no treatment). Thus far, we have applied all treatments for three years to all sites (with the exception of burning in year 3 due to burning restrictions and water levels. In 2014, we will sow and plant native species into half of each plot to determine how well these treatments prepare sites for native restoration. The propagules for the native species mix will be collected from nearby wetland areas. In spring 2014, we will also monitor eradication effectiveness (% cover RCG, live and dead biomass of RCG, litter and duff depth), habitat metrics for Oregon Spotted Frog (water depth, rate of overland flow) and the composition of the seedbank. This information will enable us to develop recommendations for large-scale control and restoration techniques for reed canarygrass-invaded areas of western Washington.



Experimental treatments applied to control Reed canarygrass at Watkins Marsh, JBLM.

University of Washington Prairie Habitat Restoration for Rare Species

Project. Restoration of highly degraded sites, such as abandoned agricultural fields, presents a great opportunity to address the limited availability of decent quality extant habitat to support many prairie dependent rare plant and animal species. This project breaks new ground by developing techniques for restoring highly degraded sites through an adaptive, iterative approach. This project will significantly increase the breadth of potential sites that can be considered for restoration, and will result in the creation of new habitats that can support viable populations of target prairie species. There are two locations in South Puget Sound associated with this project: West Rocky Prairie and Glacial Heritage. There are also two locations in North Puget Sound: Pacific Rim Institute and Ebey's Landing Preserve. The project concluded its initial experimental phase in 2012 and will be entering a maintenance phase, which will require prescribed fire as an integral tool. In 2013, we completed spring season vegetation sampling at all sites, and conducted maintenance burning at Glacial Heritage.



Native forb-rich research plot at Glacial Heritage 2012.

South Sound Fire Effects and Severity Monitoring Program

To effectively use fire to reach specific ecological objectives, we must first understand how fire affects prairie habitat, both directly through day-of-burn impacts and indirectly through longer-term effects on vegetation. To address these information needs, our 2013 fire effects monitoring involved three primary components: 1) evaluation of fire effects on vegetation communities, 2) evaluation of fire intensity (above and belowground temperatures) and fire severity of 2013 burns, and 3) evaluation of fire effects on bryophytes and lichen. Outcomes from each of these activities are described below.

Evaluation of fire effects on vegetation communities. In early June 2013 we measured post-burn fire effects in the same 50-1m² quadrats as we had monitored in 2011 and 2012. We established and monitored 50 additional pre-burn quadrats in three planned 2013 burn units. We collected the following data within each quadrat: 1) Frequency (i.e. presence/absence) of all species within nested quadrats of 0.1m², 1.0m² and 4m², and 2), % cover of each non-native species, and bare ground. Pre- and post-burn species richness and percent cover data were analyzed using a repeated measures analysis in SAS 9.2. An alpha of 0.05 was used to determine significance between years.

Averaging across sites and burns, we found that fire, along with pre- and post-fire herbicide application, initially (within one year) decreases both native and non-native species richness, but by the 2nd year post-burn, many of those species and several others return, leading to elevated levels of richness over pre-burn conditions (Figure 1). The same pattern exists for non-native cover across sites and years. There is an average of 21% cover of non-native species, largely dominated by non-native grasses, pre-burn. That value drops significantly to 16.7% post-burn but then rises again to over 23% two years post-fire (Figure 2). This pattern can also partially be explained by the shift in species composition that occurs after fire and herbicide treatment. Initially, non-native grasses are replaced by non-native annual forbs and some perennial forbs. By year two, the perennial forbs, which cover considerably more surface area, have filled in.

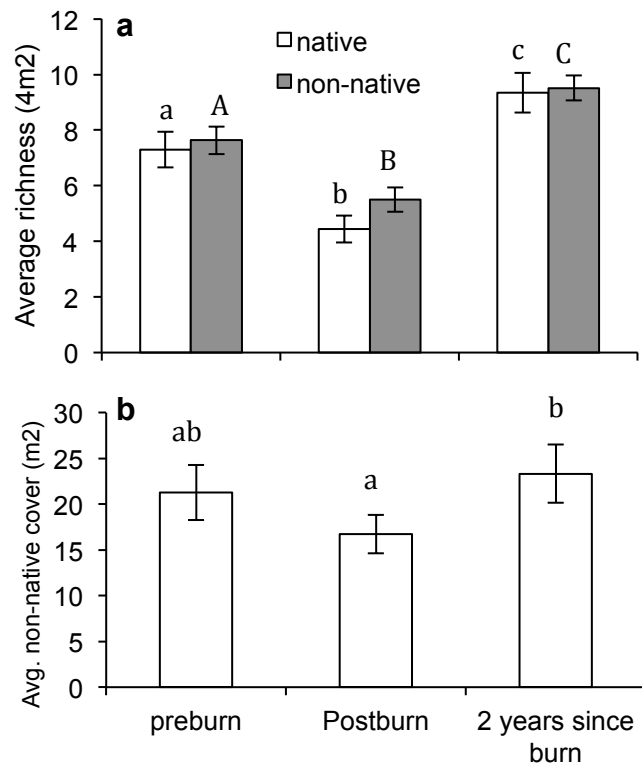


Figure 1. (a) Native and non-native species richness and (b) Non-native cover averaged across all burned sites. Means ± 95% CI are presented. Different letters represent significant differences between years.

Additional analyses with these data will include species- and functional group-specific inquiries to help us identify how our restoration practices influence some of our most troublesome non-native grasses and forbs and, alternatively, how fire and herbicide either assist or hinder the establishment and cover of important butterfly resource species.

Evaluation of fire intensity and severity of 2013 burns. To assess fire intensity, we measured above-ground fire temperatures using temperature sensitive paints (Ranging from 79°C to 480°C) on copper tags, randomly placed in 10 of the 50 vegetation monitoring quadrats. We measured belowground temperatures (~2cm depth) beneath each set of copper tags using stainless steel temperature data loggers set to measure temperatures in 1 second increments (Dataq Instruments ES-USB-1-PRO). 'Control' data loggers were buried at the same depth in areas of similar vegetation adjacent to the burn unit to provide comparison to those in the burn unit. Finally, to evaluate fire severity, we visually estimated percent cover of each fire severity category (Fire Severity Index (FSI) scale ranks 1-5, based on organic matter consumption and ash presence/color, as developed by National Park Service for grassland burns) in all of the quadrats, within 2 weeks of each burn.

Because all three of the 2013 burn units we'd chosen for monitoring were burned in late September or early October (after intense seasonal rains had begun), the burn intensity and severity was very low. The aboveground temperatures at Tenalquot and West Rocky burns only registered above 79°C in on quadrat in each burn, while the Glacial Heritage burn averaged 232°C (ranged from 135-343°C – data not shown). The belowground temperature data showed correspondingly small 5-10°C jumps in temperature as the fire front passed (see example from Glacial Heritage; Figure 2a). Fire severity was also very low, relative to past years. In 2013, the burns were fairly homogenous, with nearly 100% of the area experiencing only surface scorching or no fire at all (Figure 2b). This means that the fire removed very little to no surface organic material and there was over 2cm of stubble remaining on the vegetation. In comparison, the percent cover of FSI categories represented in past years has had a normal (bell-curve) distribution, reflecting fairly heterogeneous fire severity across the units.

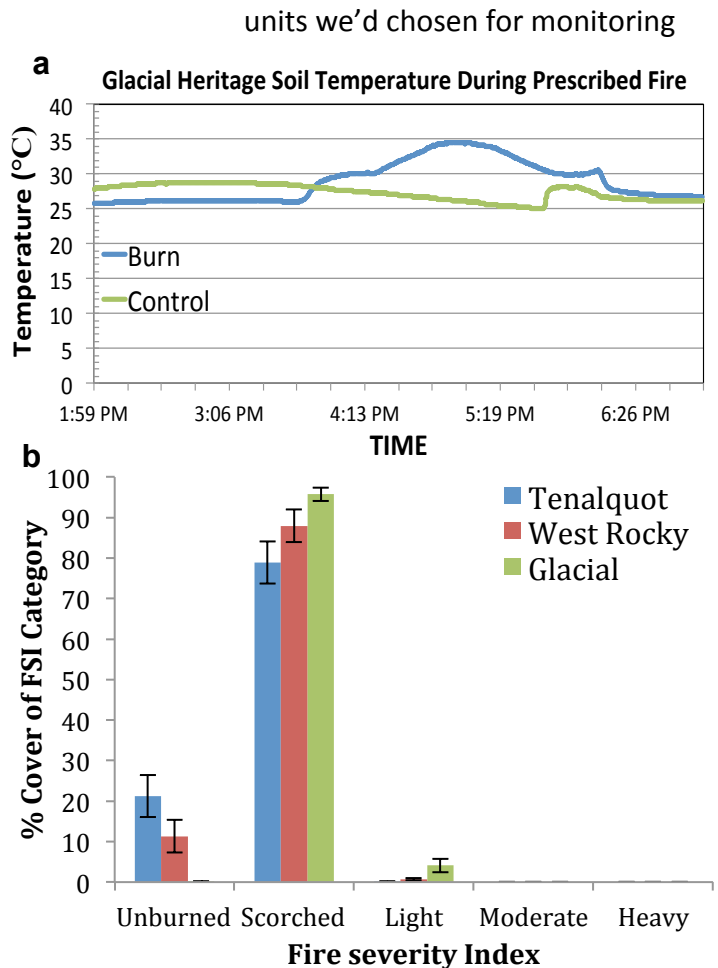


Figure 2. (a) Average soil temperatures (2cm depth) reached in burn and control areas at Glacial Heritage Preserve in 2013 (n=10). Ignition time was 3:45pm and dataloggers were collected between 5:30-6:15pm; (b) percent cover of each Fire Severity Index (FSI) category in each of the three monitored 2013 burn units. Means \pm 1SE are presented.

Evaluation of fire effects on bryophytes and lichen. In June 2013, Sarah Hamman worked with Lalita Calabria (TESC) and several of her students to design a project to evaluate effects of fire on bryophyte and lichen cover, composition and depth. They followed a monitoring protocol developed by the USDA Forest Service – Forest Inventory Monitoring Program that utilizes standardized microplots along transects within larger ocular plots. This protocol was adapted to allow non-experts to accurately and quickly survey the bryophyte and lichen community. This protocol was implemented at five South Sound prairie sites (Glacial Heritage, Mima Mounds, Scatter Creek, West Rocky and JBLM).

Results of this pilot study showed that burning decreased overall species richness (except at JBLM, where there was a slight increase; Figure 3a), decreased bryophyte and lichen cover (Figure 3b) and decreased mat depth (Figure 3c).

Community analyses also suggest that burning shifts the composition of the prairie bryophyte and lichen community (data not shown). There were four species that were found only in burned plots at our five study sites. These species include *Funaria hygrometrica*, *Plagiomnium venustum*, *Pleurozium subulatum* and *Polytrichum piliferum*. Three bryophytes, *Bucklandiella heterosticha*, *Dicranum scoparium*, *Pseudoscleropodium purum* and two lichen genera, *Peltigera* spp., *Reindeer* spp., were recorded only in unburned plots at our five study sites. Several taxa were considered common at our study sites and were recorded growing in at least four out of five plots. The common bryophytes in unburned plots were: *Dicranum scoparium*, *Kinbergia* spp., *Nipotrichum elongatum*, *Rhytidiadelphus triquetrus* and two lichen genera *Peltigera* spp., *Cladonia* spp. Common bryophytes to burned plots were: *Cephaloziella* sp., *Ceratodon purpureus*, *Pleurozium subulatum* and *Polytrichum juniperinum*. No lichen taxa were common to burned plots.

A detailed report on the methodology and the findings of this bryophyte and lichen study will be provided in a report by Lalita Calabria in early 2014. Lalita Calabria and Sarah Hamman will write and submit a manuscript for publication on these findings in 2014.

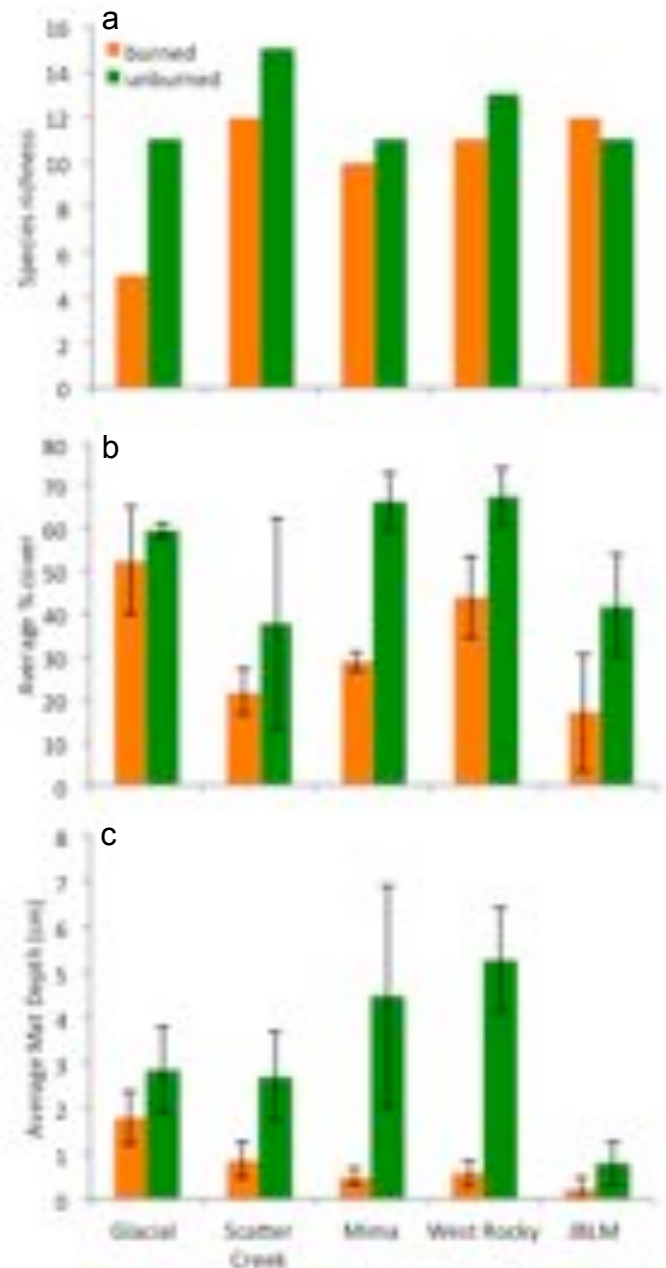


Figure 2. Fire effects on (a) total species richness, (b) average percent cover of moss and lichen and (c) average depth of moss or lichen mat. Means $\pm 1SD$ are shown for percent cover and mat depth.

III. Ecological Fire Management Planning

Prairie and rare species management entails a comprehensive planning effort that balances a site's capacity to provide ecological benefit for multiple species over the short and long term and also considers how a site best fits into regional conservation strategies. All of our sites have specific plans (such as site conservation action plans) and many fall into regional planning for habitat or species management. All sites where we burn include fire as a management objective and often consider prescribed ecological fire to be a cornerstone of their management plans.

IV. Partnership and Burn Program Sustainability

Puget Sound Burn partners recognize the need for a core of fireline leadership and a pool of additional firefighters that is large enough to meet operational needs throughout the burn season. Since we follow the standards of NWCG, leadership qualifications are developed through fireline experience, specific coursework and performance evaluations. Firefighters benefit from exposure to a wide variety of operational, ecological and fuel conditions repeated opportunity to perform in leadership roles. There are many benefits to maintaining a robust leadership pool. More experienced firefighters provide better oversight for those that are newer to controlled burning. Improved leadership increases likelihood that problems will be identified early and effectively handled. It also provides increased flexibility in crew assignments, and a given burn is not dependent on the participation of one or two key participants.



Wolf Haven burn crew, including JBLM, CNLM, DNR, Key Peninsula FD and observers.

In addition to a core group of firefighters that have primary responsibilities to support the burn program, our operations depend on participation from a larger pool of regionally available firefighters. This group includes: land management staff that are only able to participate on a few burns each year; agencies that do not have specific land management objectives, but participate on controlled burns as training opportunities; and organizations and individuals that are seeking fireline experience. Our program's success is attributable to the willingness of these varied groups and individuals to come together.

South Sound burns are also good for partnership building, and we regularly integrate burn crews from outside agencies and fire departments. This type of exchange increases the familiarity of local suppression teams with our South Sound burn program. It also provides these firefighters with fireline training and opportunities to get signed off on NWCG position qualification tasks.

Puget Sound Ecological Prescribed Firefighter Additional Standards

Firefighter safety training and qualifications continue to be cooperatively managed among partners. While all partners use NWCG to establish minimum firefighter qualifications, in 2013, the South Sound burn program partners accepted additional firefighter qualification standards, that are designed to improve programmatic safety and reliability. Titled *Puget Sound Ecological Partnership Voluntary Firefighter Training Standards*, these standards are intended to promote fireline safety and effectiveness. The document addresses gaps between the baseline NWCG standards and the controlled burn environment of our Puget Sound activities. They are a further demonstration of our partnership's commitment to responsible fire management.

Field Training and Training Exchanges

In addition to the routine exchange of firefighters among core South Sound partners, our burn program provided opportunities for outside organizations and individuals to get fireline experience and training. In total, we had 53 firefighter-days worth of DNR, Olympic NP, TNC Oregon and Georgia, Longleaf Alliance and individual volunteers. Visiting crews regularly came equipped with their own engines, and were integrated into the burn team. Of particular note, firefighters from Longleaf Alliance and TNC Georgia and Oregon sent experienced firefighters to assist for one or more weeks during our primary burn season. Their assistance enabled us on several occasions to conduct multiple simultaneous burn operations.



Annual fire safety refresher in Olympia, WA

The South Sound program also helped send partner firefighters to other areas for training and to assist on burns. These exchanges provide valuable training experiences and foster two-way learning and networking. During the winter and spring we supported participation in three out-of-state training opportunities. One firefighter went to Eglin AFB in Florida to get fireline training required to achieve Incident Commander Type 4 (a prerequisite for burn boss qualification). A second went to TNC sponsored training exchange in at the Niobrara Preserve to also work on Incident Commander Type 4. The third attended engine academy in Florida.



Training exchange to Eglin AFB in Florida for wildfire experience towards ICT4 qualification.

NWCG Course Training

The Puget Sound burn program supported several NWCG courses to partner and regional firefighters. This includes: 10 people participated in S-212 Wildland Fire Chainsaws; 15 people participated in S-133 Lookup, Look Down, Look Around; six people participated in S-131 FFT1 Training; and seven people completed S-390 Intermediate Wildland Fire Behavior.

This year, CNLM offered the annual refresher course RT-130 to 36 partner and other regional firefighters. In addition, we supported 10 firefighters to complete S-130/190 through a combination of online and field training and to further qualify as type two wildland firefighters.

Community Outreach

Community outreach for specific prescribed ecological fires consists mostly of neighbor notifications, press releases, Facebook posts and announcements to local radio and news services. Other than some wildfire smoke intrusion that created problems at JBLM, no significant smoke or safety complaints were noted in 2013 from our programs ecological burns.


Outreach also occurs at community events such as Howl-ins at Wolfhaven, Earthday at JBLM and Prairie Appreciation Day. Prairie Appreciation Day is an annual event that regularly draws 1,000 or more people from around Puget Sound to come learn about prairie and oak habitats. The event supports a fire booth which offers information on the role of fire in these habitats and how it is safely managed for ecological benefit.

V. Ecoregional and Statewide Networking

Washington Prescribed Fire Council

The South Sound burn program has assisted in the development of the Washington Prescribed Fire Council (WPFC; www.waprescribedfire.org). The council provides an educated, active body to assist fire practitioners, policymakers, regulators and citizens with issues surrounding public safety, liability, ecological restoration and land management, public education and outreach, and air quality regulation. The goal of the WPFC is to conserve and expand the safe and effective use of prescribed fire on the Washington landscape.

The WPFC held its second annual conference March 11-12, 2013 at the Quality Inn in Ellensburg, WA, which attracted 65 attendees from over 35 different organizations around the state. Guest speakers presented on smoke research, public perceptions of smoke, health issues surrounding air quality and permitting issues surrounding Rx fire implementation. Attendees divided out into five mini-workshops to develop action plans for the top five Priority Action Areas for the Council. The 3-year Strategic Action Plan has since been developed based on the directives and ideas developed at the conference. Planning is underway for the 3rd annual statewide conference, to be held March 4-5 in Olympia, WA.



Priority Action Areas for the WPFC:

- Training, Certification and Expertise Exchange
- Policy Influence and Issues Resolution
- Public Understanding, Outreach and Education
- Partnering and Collaboration
- Council Operations, Funding & Communications

Other 2013 WPFC Accomplishments:

- **Fiscal Sponsorship** – Obtained fiscal sponsorship from South Central Washington Resource Conservation and Development Council.
- **Senate Hearing** – WPFC representative presented information on prescribed fire to the Senate Committee on Natural Resources.
- **Strategic Plan** – Developed Strategic Plan to guide Council actions for the next three years.
- **Funding** – Received funding from the Fire Learning Network and Joint Fire Sciences Program.
- **Good Press** – Multiple newspaper articles from several different regions published in the past year mentioning the WPFC.
- **Part-time Coordinator** – Through generous funding from JBLM, the WPFC now has a part-time Coordinator, Kara Karboski, to help facilitate and mobilize the Strategic Plan.



Attendees at the 2012 WPFC Annual Conference

Northwest Fire Science Consortium

The South Sound program has continued to work with other fire organizations from across Oregon and Washington to manage and expand the work of the NW Fire Science Consortium (NWFSC), which was funded by the Joint Fire Science Program as part of a national effort to improve information exchange between fire science and management.



The NWFSC website (www.nwfirescience.org) and listserv continue to provide up-to-date information on regional and national fire research, conferences, webinars, workshops, and news for a broad audience.

International Fire Ecology and Management Annual Congress

Three people from the South Sound presented at the Association for Fire Ecology's annual conference in Portland in December 2012. Presentations were titled: "Burning for butterflies" can prescribed fire be used to restore habitat for fire-sensitive species?", "Mobilizing ecological burners – building a grassroots burn program in Puget Sound" and "Fire application technique alters fire intensity, severity and post-fire prairie plant communities."

Appendix 1: Table of burn projects completed or attempted in South Sound and North Sound

Unit ID	Shift	Date	Unit	Acres	Location	Boss
JB-RX13-01	1	02/11/13	UW Winter	24	JBLM	McKinley
JB-RX13-02	2	07/16/13	Broom Blob N	5	JBLM	Dunwiddie
JB-RX13-03	3	07/17/13	Broom Blob S	7	JBLM	Dunwiddie
FI-RX13-04	4	07/19/13	Fisher Unit 1	8	Fisher Ranch	Dunwiddie
JB-RX13-05	5	07/22/13	Johnson Thumb	4	JBLM	Wilken
JB-RX13-06	6	07/25/13	Johnson Oak	1.5	JBLM	Wilken
WH-RX13-07	7	07/24/13	Wolf Haven Unit 1	4	Wolf Haven	Wilken
WH-RX13-08	7	07/24/13	Wolf Haven Unit 2	6	Wolf Haven	Wilken
JB-RX13-09	8	08/07/13	Johnson Prairie NE	13	JBLM	Wilken
JB-RX13-10	9	08/12/13	TA 6 SW	53	JBLM	Wilken
JB-RX13-11	10	08/13/13	TA 14 SW	90	JBLM	Wilken
JB-RX13-12	11	08/14/13	Upper Weir SE fir	91	JBLM	Wilken
JB-RX13-13	11	08/14/13	Upper Weir Oak	7	JBLM	Wilken
JB-RX13-14	12	08/19/13	Upper Weir NW	60	JBLM	Wilken
JB-RX13-15	13	08/20/13	TA 13 East	48	JBLM	Wilken
JB-RX13-16	14	08/21/13	South Weir Triangle	69	JBLM	Wilken
JB-RX13-17	15	08/27/13	Johnson Prairie North	24	JBLM	Wilken
JB-RX13-18	16	08/28/13	TA 06 SE	46	JBLM	Wilken
JB-RX13-19	17	09/04/13	13th Div Lark North	133	JBLM	Wilken
JB-RX13-20	18	09/09/13	13th Div Lark North	65	JBLM	Wilken
JB-RX13-21	18	09/09/13	13th Div West	67	JBLM	Justin Jones (TNC)
JB-RX13-22	19	09/10/13	Johnson Thumb	6	JBLM	Justin Jones (TNC)
JB-RX13-23	19	09/10/13	Johnson Edge	9	JBLM	Dunwiddie
WR-RX13-24	20	09/11/13	West Rocky Unit 1	12	West Rocky	Wilken
WR-RX13-25	20	09/11/13	West Rocky Unit 2	4	West Rocky	Wilken
WR-RX13-26	20	09/11/13	West Rocky 2012 Unit 3	5	West Rocky	Wilken
GH-RX13-27	21	09/12/13	Glacial Heritage Unit 1	20	Glacial Heritage	Justin Jones (TNC)
GH-RX13-28	21	09/12/13	Glacial Heritage Unit 2	85	Glacial Heritage	Justin Jones (TNC)
JB-RX13-29	22	09/12/13	TA 15 South Creek	66	JBLM	Wilken
-	23	09/13/13	Scatter Creek	-	Scatter Creek	Wilken
-	-	09/14/13	Skokomish Prairie	-	Olympic NF	Myca Johnson (ONF)
-	24	09/17/13	Lower Weir - aborted	-	JBLM.	Wilken
JB-RX13-30	25	09/18/13	Lower Weir	56	JBLM	Wilken
TQ-RX13-31	25	09/18/13	Tenalquot Unit 1	20	Tenalquot	McKinley (T)
SC-RX13-32	26	09/19/13	Scatter Creek 2013 Unit 1	4	Scatter Creek	Wilken
SC-RX13-33	26	09/19/13	Scatter Creek 2013 Unit 2	9	Scatter Creek	Wilken
SC-RX13-34	26	09/19/13	Scatter Creek 2013 Unit 6	2	Scatter Creek	Wilken
SC-RX13-35	26	09/19/13	Scatter Creek 2012 Unit I	5	Scatter Creek	Wilken
SC-RX13-36	26	09/19/13	Scatter Creek 2012 Unit 3	8	Scatter Creek	Wilken
NS-RX13-37	27	09/19/13	Naas Units A and B	1	Naas Preserve	Dunwiddie
GH-RX13-38	28	09/20/13	Glacial UW Plots	2	Glacial	Dunwiddie
GH-RX13-39	28	09/20/13	Glacial Unit 3 (Castileja)	10	Glacial	Dunwiddie
MM_RX13-40	29	09/26/13	Mima Unit 1	22	Mima Mounds	Wilken

	Acres	Count
COMBINED TOTAL	1150	40
JBLM	945	22
Thurston County	226	17
North Sound	1	1

multiple burns on same day by same burn team.