Cascadia Prairie-Oak Partnership 2015 Conference

CONSERVATION WITHOUT BORDERS

Working Across Boundaries to Restore Prairie and Oak Communities

October 26-29, 2015 | Tacoma, Washington

CONFERENCE PROCEEDINGS & ABSTRACTS

LINKS TO PRESENTATION & POSTER PDF'S INCLUDED

Cascadia Prairie-Oak Partnership

Visit CPOP online: cascadiaprairieoak.org

Abstracts are arranged in alphabetical order by presenter author's last name.
Oral, keynote, and poster abstracts included, and the title links to a PDF when available.

SESSION PROCEEDINGS

Select sessions have been summarized below, and list the authors that participated in the session. Abstracts can all be found following the proceedings, with links to available presentations.

Oak Habitat Restoration

Numerous conservation organizations and public agencies are actively engaged in oak habitat restoration in the Cascadia Prairie Oak Partnership ecoregion. The session was convened to present a range of oak-related efforts that represented different project goals, scales, and restoration techniques, while also demonstrating commonalities in ecological objectives, monitoring approaches, and economic constraints. The outcome of this session was a suite of detailed project accounts, ranging from novel synergies between oak and riparian habitat projects, to oak savanna and woodland restoration considerations, to post-restoration responses by bird, butterfly, and amphibian populations. Each presentation touched on the complexities of oak restoration projects, as well as a project-by-project evaluation of achieving meaningful success.

The session opened with talks focusing on methods for implementing moderate to large scale oak restoration projects. These projects are reliant on income from timber to achieve ecological goals, and data on oak restoration economics highlighted the narrow conditions within which these projects are economically viable, even with supporting grant funds. Preferred restoration techniques, annual fluctuations in mill pricing, and pre-project site conditions contribute significantly to the economics of the project. The level of conservation-driven constraints on project design and the amount of biomass removed both affected project reach, but were critical to achieving ecological success. In these projects timeframes for planning and implementation spanned at least two years to ensure the availability of low-impact forestry equipment and experienced contractors. Project designs were tailored to benefit target wildlife species and their specific habitat needs, as well as restoring oak plant community structure.

These talks were followed by three case studies, each of which focused on imperiled oak habitats in Washington or British Columbia. Hand-falling and helicopter yarding were the lowest-impact technique discussed, and were recommended for areas with high-quality native cover or rare plants in the herbaceous layer. Topped trees and created snags were an important component in these restoration projects, to benefit cavity-nesters such as Slender-billed nuthatch. In cases where the felled trees were not sold on the market, the extracted timber could be used for in-stream placement for salmon habitat, or chipped and used for mulch on-site. Helicopter projects were low-impact in the restoration areas, but needed ample-sized landings for staging the material before sorting and shipping. Knowledge of historic conditions contributed greatly to oak restoration project design and aerial photo imagery provided a snapshot of conditions over the

last 60-80 years that informed site understanding and restoration prescriptions. In a project in Washington, the Taylor's checkerspot was known to exist at site within the past decade and this knowledge helped guide restoration prescriptions. Furthermore, understanding and incorporating the biology and natural history of oak habitat species, both present and historic, are imperative for oak habitat restoration efforts.

Not infrequently, small-scale oak restoration projects have high ecological value but are bound by significant site constraints. On Turtleback Mountain on Orcas Island, removing cut material was a challenge. Restoration efforts there prioritized actions such as: legacy oak tree release, savanna restoration, invasive species treatment, and understory protection and enhancement. Volunteers removed or girdled trees, piled slash, and burned downed material. Overall, two to three 'entries' were required to fully achieve project objectives. Over approximately 20 acres, legacy oak were released and understory natives, including Garry oak, were seeded or planted. This approach was cost-effective, although implementation was slower and smaller in scale. The final talk in this session highlighted the wildlife responses to oak restoration three years following project completion. Native plants increased modestly over the restoration time-frame, with 38 native species present, but none were present at project goals (25% frequency or higher) suggesting that repeated seeding with natives is required to achieve herbaceous layer diversity goals. Oak associated bird species such as Slender-billed nuthatch were generally increasing, while Pacific Wren, an early-breeding species that uses downed wood and shrubby habitat within forests, decreased with oak habitat restoration. Carefully-timed grass-specific herbicide treatments released the native forb seed bank, and questions around the management of native shrubs such as poison oak and snowberry were raised.

Furthermore, the projects presented in this session demonstrated the varied economic, ecological, and organizational complexities that are associated with conducting oak habitat restoration. While no two oak projects were alike, there are important parallels in the approaches taken and convergences in their effects that can help future project planning and efficiencies. Because of the critical status of this important habitat, it is vital for restoration practitioners to continue to share oak restoration project success stories like these.

Authors: Matthew Gibbons, The Nature Conservancy; Emily Steel, City of Eugene; Carlo Abbruzzese, Washington Department of Natural Resources; David Wilderman, Washington Department of Natural Resources; Eliza Habegger, San Juan County Land Bank; Elaine Stewart, Oregon Metro.

Pollinators

This session addressed multiple questions about how pollinator communities respond to prairie plant communities, non-native plant invasions, and site changes, such as burning and climate changes, and how they influence Camas reproduction and taxon boundaries.

When investigating habitat fragmentation and influence of surrounding habitat, no relationship was detected between bee abundance or bee diversity and habitat fragment size when all bee species were grouped. However, abundance of species in some guilds (cavity nesters, ground nesters) increased with habitat fragment size. Early in the season, the abundance and richness of bees was generally similar among urban matrix-surrounded prairie fragments, urban matrix sites, forest matrix-surrounded prairie fragments, and forest matrix sites. However, later in the season bee richness at urban sites exceeded all others. Overall, fragment landscape context had a much larger impact on bee richness and abundance than fragment size. When exploring the influence of Scotch broom invasion on plant-pollinator interactions, the authors found that assemblages of visiting bees tended to differ between sites with more Camas and honeybees vs. sites with more *Bombus bifarius* and broom. All three bumble bee species showed changes in patterns of visitation that were correlated with changes in densities of the focal plants and the other bees. *C. quamash* set more seeds at sites with more conspecifics, where there were also low visitation rates by *B. bifarius.* It's not clear whether the apparent relationship between reduced *B. bifarius* visitation and increased seed set arose because *B. bifarius* was competitively supplanted by superior *C. quamash* pollinators, or because denser *C. quamash* led to beneficial changes in pollinator foraging patterns independent of pollinator identity. Broom pollination rates increased where both *B. bifarius* and *C. quamash* were more abundant.

Differentially invaded sites differed strongly in both the composition of floral resources they provided to pollinators and the temporal pattern of nectar or pollen provision. Heavy broom invasion at one site resulted in a "food desert" for most pollinator guilds, as broom provides only pollen, provisions only bumble bees, and excludes many other forbs that might otherwise phenologically diversify pollinator resources. The seasonal pattern of pollen and nectar availability to different guilds differed across sites, with seasonal resource gaps at some more-invaded sites. Invasion can create "resource deserts" for pollinators, and although some pollinators can travel to nearby sites, there is a cost to doing so. On the other hand, the plant community's ability to provide adequate pollen and nectar across the whole season should be considered when invasive plants are removed or controlled, as their contribution to filling key phenological gaps can be crucial to local pollinators.

The genus *Camassia* currently has 6 designated species and 15 putative taxa, three of which occur in the northwestern U.S. Pollination may be a mechanism that helps to maintain taxon boundaries. Pollinator assemblages visiting *C. quamash brevifolia* were compared in OR and

CA. Assemblages of pollinators did not differ significantly between the same species in different regions. However, within the same region (OR), pollinator assemblages differed significantly on different *Camassia* species. Pollinator guilds differed with respect to the proportion of visits producing likely pollination events, with *Bombus spp.* most likely to make stigma contact. Among pollinator guilds, *Bombus spp.* tended to visit *C. leichtlinii* about twice as often as *C. quamash* in small plots, while other guilds showed less or no preference. Preferences by solitary bees for *C. leichtlinii* were evident through unispecific and interspecific transects comparison. Overall, generalist pollinator abundances & visitation rates differed with *Camassia* species, habitat, season, and floral traits. It is unlikely that pollination is the major mechanism reinforcing divergence between putative *Camassia* taxa, because insects move between sympatric species, and pollinator assemblages vary with season and habitat, making reproductive isolation unlikely. Vespertine pollination is an interesting phenomenon that may prove useful in disentangling *Camassia* lineages.

Increased restoration actions in South Sound Prairies have led to increased floral resources, so pollinators have access to resource-rich habitats. At nine sites, ~180 morphospecies, and a significant relationship between floral density and bee abundance were found. Comparing burned to unburned sites in the following spring, the number of pollinators differed strongly for some taxa and between sites. With potential major impacts of climate change and habitat fragmentation on pollinator communities, we should consider these factors in management practice. For example, as drought frequency and intensity increase, we should consider prioritizing restoration in moist sites. And using non-traditional prairie plantings, that m include non-native (and non-invasive) species, to improve the lack of native floral resources in late summer. As well as considering opportunities for plantings on off-site partner lands to ameliorate the negative effects of fragmentation.

When evaluating the effects of pollinating bumble bees and introduced beetle seed predators as agents of selective pressure on Scotch broom *(Cytisus scoparius)* along an urban-rural gradient, authors explored whether pollinating bumble bees exert differential selective pressure on flower size, and measured seed predation in urban vs. rural sites. They found strong variation in flower size both within and across sites and evidence suggesting selection by pollinators on flower size was not demonstrated. The lack of relationship was apparent regardless of whether the sites were urban or rural. However, seed predation appeared to vary in response to urban/rural status, with a greater proportion of seeds eaten in urban sites, suggesting that seed predators could act as a stronger selective pressure in urban areas.

Authors: Sandra Gillespie, Simon Fraser University; Susan Waters, Center for Natural Lands Management; Susan Kephart, Willamette University; Robert Bode, St. Martin's University; Cheryl Fimbel

Restoration Partnerships: Voluntary and Shared Conservation to Restore Lands for Dual Benefit (Part A)

This session sought to highlight examples of partnerships through which private landowners could contribute meaningfully to oak and prairie habitat restoration, conservation, and stewardship. By partnering with a watershed council, soil and watershed conservation district, Lomakatsi Restoration Project, the Natural Resource Conservation Service, or other organization, landowners have been able to access financial and technical assistance in planning and carrying out small- and larger-scale oak release and prairie plant community enhancement actions. In addition, through partnering, partner organizations are able to connect restoration actions across property boundaries, including across private, public, and tribal lands to facilitate landscape level ecosystem uplift. Additionally, partner organizations are working hard to increase capacities by sharing resources and expertise, and as a result are forwarding ESA species recovery and native plant material production.

Conservation on working lands was a theme that ran through several presentations in Restoration Partnerships session. The Willamette Partnership is collaborating to create certification standards rewarding vineyard management that protects listed species, Long Tom Watershed Council partners with ranchers and forest owners to protect oak habitats, and Greenbelt Land Trust collaborates with a rancher to use managed grazing as a restoration tool at its flagship public access site. Finding novel ways to make working lands serve conservation needs can reveal new opportunities for partnerships with private landowners.

Authors: Elizabeth Records, Greenbelt Land Trust; Katie MacKendrick, Long Tom Watershed Council; Nicole Maness, Willamette Partnership (Marko Bey was also part of this session, and proceedings for his presentation are included below with the Klamath Siskiyou Oak Network).

Klamath Siskiyou Oak Network

The Klamath Siskiyou Oak Network (KSON) is a collaborative regional partnership composed of active participants from non- governmental organizations, state and federal agencies, private citizens, and watershed-based groups focused on fostering the conservation, restoration and long term health of oak habitats, including both Oregon white oak (*Quercus garryana*) and California black oak (*Q. kelloggii)* woodlands, mixed forest, chaparral, and savanna. The geographic range of the network encompasses the Klamath-Siskiyou Bioregion of southern Oregon and northern California, an area which holds some of the highest terrestrial biodiversity in the Pacific Northwest. Oak habitats within the bioregion are currently threatened with loss and degradation due to fire exclusion, certain agricultural practices, and rural and urban residential development. The primary goals of KSON are to address these threats using an applied science framework, including monitoring and adaptive management, to increase function and connectivity of oak systems landscape-wide and across all ownership types. Recognizing that individual oak trees and oak habitats have intrinsic aesthetic, environmental, wildlife, and economic values shared by a wide cross section of the public, KSON also seeks to provide a forum for community engagement including outreach and education regarding the region's oak resources.

KSON was founded in 2011 to complement and expand upon an existing collaborative partnership effort established in 2007, between agencies and NGO's to restore and conserve oak habitats in southern Oregon and northern California. Since that time, partners have leveraged over $7.5 million to restore oak systems across over 6,000 acres, have conducted scientific research to study the effects of restoration activities on wildlife populations, and have built a strong working partnership. This partnership is an example of work that is turning the conservation tide of generally declining bird population trends and was highlighted as a conservation success story in the *State of the Birds 2014*. The talks below were presented at the Cascadia Prairie-Oak Partnership 2015 Conference, with the goal of informing the broader audience of Pacific Northwest oak conservation practitioners and researchers about KSON's work and initiatives. Davenport and Fairbanks described how KSON was formed, and how the network's steering committee members coalesced their diverse goals and funding mechanisms into an effective model for landscape-scale oak conservation. Bey et al. presented on the use of climate resilience modeling to inform an innovative all-lands restoration project at the culturally and ecologically important Table Rocks in southern Oregon. Finally, Stephens et al. detailed several products that use data from bird and vegetation monitoring to assist private landowners, restoration practitioners, and land managers in ecologically-sound adaptive management of oak and chaparral habitats. Together, these presentations highlighted several of KSON's most prominent accomplishments to date, and demonstrate the power of its collaborative approach to regional oak conservation.

Authors: CalLee Davenport, US Department of Fish and Wildlife; Terry Fairbanks, US Bureau of Land Management; Marko Bey, Lomakatsi Restoration Project; Jaime L. Stephens, Klamath Bird Observatory.

Breakout Session- Oak Restoration: Scoping an Ecoregional Working Group

Breakout session description:

Building on the conversation started in the Oak Habitat Restoration special session, we invite interested colleagues to discuss forming an ecoregional working group. What challenges do we share? How can we learn from each other's work and build on lessons learned? If you could imagine accessing knowledge and experience when you need it, what would that look like? An oak restoration working group could share prescriptions, monitoring methods, weed control techniques, etc. It may be as simple as a more deliberate use of the CPOP listserv and web site, or it could add to those resources. Bring your ideas and share them.

Synopsis:

The session was well-attended and also seemed to have a good geographic representation (WA, southern OR, Willamette Valley, eastern OR), and also representation from conservation groups, agencies, and non-profits. Matt Gibbons provided a bit of background, described the focus of the group (as above in the session description) and then posed the central question to the group about whether there was interest in or need to pursue the formation of a working group. Elaine Stewart also facilitated the session discussion, helping to focus comments on how such a group might fit within the CPOP framework.

The attendees contributed a comments and questions that touched on a variety of different issues related to oak restoration. Overall, these comments revealed interest in accessing resources, avoiding duplication in restoration project implementation, collaboration, and also limited capacity.

Outcome:

It became clear through the discussion that a region-wide working group on oaks and oak habitat would be too large of a scale to meaningfully organize, and that localized groups could be of even greater value to restoration practitioners. CPOP could act as the umbrella organization for these smaller regional groups 'woven together' across landscapes. Groups working locally could address ecological issues and threats specific to their areas, develop working relationships among members, and share resources as appropriate. Several of these groups have already formed or are in the process of doing so. Connecting them requires the support and capacity from CPOP.

Topics raised included restoration economics, cost-sharing to meet common ecological goals, bringing science into restoration practice, available monitoring tools, focus groups for topics such as birds, project specifications, etc., urban oak restoration, and web tools such as webinars.

Session led by: Elaine Stewart, Oregon Metro; and Matt Gibbons, The Nature Conservancy

ABSTRACTS

(with links to presentations when available)

ORAL

OAK FOREST RESTORATION AT WASHOUGAL OAKS NATURAL AREA. **Carlo Abbruzzese** and David Wilderman, Washington Department of Natural Resources, Natural Areas Program, PO Box 47014, Olympia, WA 98504. carlo.abbruzzese@dnr.wa.gov; david.wilderman@dnr.wa.gov

Washougal Oaks Natural Area (NA) was established in 2003 to protect the largest high-quality Oregon white-oak *(Quercus garryana)* woodland remaining in western Washington. Oak woodlands have declined in size and have been significantly degraded by a variety of forces, including land conversion, fire suppression and conifer invasion, grazing, and invasion of non-native plant species. The site protects two distinct rare oak forest types that support habitat for several rare plant and animal species, including three threatened salmonid species and the oak obligate Slender-billed Nuthatch (*Sitta carolinenses aculeata*). Initial restoration work began in 2006 controlling English ivy (Hedera helix), Armenian blackberry (*Rubus armeniacus*) and shiny geranium (*Geranium lucidum*) and establishing small scale oak plantings. In October of 2011, conifer trees that were overtopping oaks in a 90 acre area were removed by helicopter, girdled or topped and left as wildlife snags. Fifty- five full length fir trees were also flown via helicopter and placed in Lawton Creek to provide large woody debris for salmonids. More recent work has included targeted oak release in another 42 acres of forest. In an effort to reduce forest fragmentation, oaks and native shrubs have also been planted in 29 acres of abandoned old fields. Future work will include continued weed control and planting of old fields. While the project has been largely successful, there have also been opportunities to learn from some of the challenges that arose during the project.

POSTER

RESTORING HYDROLOGICAL AND ECOLOGICAL FUNCTIONS OF WETLANDS INVADED WITH REED CANARY GRASS (*PHALARIS ARUNDINACEA)* FOR POTENTIAL OREGON SPOTTED FROG (*RANA PRETIOSA*) OVIPOSITION RECOVERY AT JOINT BASE LEWIS MCCHORD, FORT LEWIS, WA. **Pamela Abreu,** TESC, 5832 Camelot Drive SW, Olympia, WA 98512. pamabreu88@gmail.com

Reed canary grass (*Phalaris arundinacea*) is an invasive aquatic plant capable of changing wetland characteristics and outcompeting native species, causing wetland habitat loss. One of the main causes of amphibian decline is loss of habitat. Currently the Oregon spotted frog (*Rana pretiosa*) is listed as threatened under the federal Endangered Species Act, and wetland managers are working to restore its habitat. The objective of this study was to evaluate four different reed canary grass (RCG) removal treatments, to see which treatment created hydrological and ecological characteristics closest to those found in successful Oregon spotted frog (OSF) oviposition habitat. Hydrologic (water depth, temperature), vegetation (percent live RCG,

percent RCG thatch cover, percent open water, emergent vegetation height, RCG thatch height), and chemical (dissolved oxygen, conductivity) measurements were collected at Joint Base Lewis-McChord (JBLM), where restoration treatments had been applied to wetlands invaded with RCG. Results were compared to West Rocky Prairie (WRP), a successful OSF oviposition site. Treatments applied at JBLM included: Mow/Burn/Herbicide, Mow/Burn, Mow/Herbicide, Burn/Herbicide, and an untreated Control. Conductivity was significantly higher at JBLM compared to West Rocky Prairie, but it did not differ between treatments. Dissolved oxygen did not significantly differ between sites. All hydrologic and vegetation variables differ significantly between sites, and (except for RCG thatch height) they were all affected by the different treatments, although chemical variables were not. The treatment most successful at JBLM for OSF oviposition success was Mow/Herbicide.

ORAL

OREGON VESPER SPARROW REGIONAL INVENTORY: A BIRD ON THE BRINK. **Bob Altman**, American Bird Conservancy, 311 NE Mistletoe, Corvallis, OR 97330. baltman@abcbirds.org

Surveys for Oregon Vesper Sparrow were conducted in 2013-2014 in four ecoregions in western Oregon and Washington at 665 roadside point count stations, 41 off-road point count stations, 12 off-road transects covering approximately 9 miles, and 26 off-road area searches covering approximately 4,500 acres. Oregon Vesper Sparrows were detected at only 13% of the roadside stations, despite targeted placement of point count stations at recent detections and in suitable habitat adjacent to and away from those detections. Compilation of all detections from this and other sources during that period resulted in the documentation of approximately 350 birds. Territory-mapping in 2013-2015 resulted in the delineation of approximately 135 territories at 12 sites in three ecoregions and another 200 birds. These results and other data and extrapolations suggest a small and declining population of approximately 2,000 individuals. There is great concern for its regional persistence including functional extirpation from British Columbia and the North Puget Sound and many other local extirpations, especially in the Puget Lowlands and Willamette Valley ecoregions.

ORAL

NATIVE BULBS AND ECOLOGICAL RESTORATION IN THE PRAIRIE AND OAK HABITATS OF THE WILLAMETTE VALLEY-PUGET TROUGH-GEORGIA BASIN ECOREGION. **Ed Alverson**, 501 Irving Road, Eugene, OR 97404. eralverson@yahoo.com

Native perennial herbs growing from bulbs (or corms) are an ecologically and culturally important component of prairie and oak habitats. Our native species were all formerly placed in the Lily family but phylogenetic analyses of genetic data show that only a subset of our species are related to lilies, with the reminder more closely related to agaves, amaryllis, and daffodils. Thirty taxa of native bulbs, representing 11 genera, have been documented from prairie and oak habitats in the WPG ecoregion. This is only about 4% of the total native herbaceous species

richness of the WPG prairie and oak habitats. Above-ground plant parts are strongly seasonal, with foliage emerging in early spring but disappearing by summer, so their presence is often not evident. Native bulbs are often abundant in prairie remnants, and can be important sources of pollen and nectar for insect pollinators. For example, several bulbs are important nectar sources for endangered butterflies such as the Fender's Blue. Yet, bulbs can be difficult to establish in prairie restoration sites at levels of abundance similar to natural remnants. Competition with other native herbaceous species, particularly at the seedling stage, is likely an issue. Many bulbs seem to benefit from fire, so incorporating controlled burning into the restoration sequence may be useful as well. Greater effort is needed to collect and share results from past restoration projects that have incorporated a bulb component, and a coordinated research program focusing on bulb establishment protocols would be beneficial for guiding future restoration projects.

ORAL

MANAGING AROUND VULNERABILTIES FOR THE STREAKED HORNED LARK.
Hannah Anderson, Adrian Wolf, and Jerrmaine Treadwell, Center for Natural Lands Management, 120 Union Avenue SE #215, Olympia, WA 98501; Jim Lynch, Joint Base Lewis-McChord, Olympia, WA. handerson@cnlm.org

Throughout their range, streaked horned larks occur almost exclusively on sites whose primary use is for human activity: airports, military training areas, dredged material placement sites, and agricultural fields. The lark is listed as threatened under the federal Endangered Species Act and is a primary conservation target for the Center for Natural Lands Management's (CNLM) South Sound program. CNLM partners with Joint Base Lewis-McChord (JBLM) to track the lark populations on JBLM, maximize productivity, assist in habitat management, and contribute information that can advance recovery range-wide. At JBLM, larks breed on active military training areas, artillery impact areas, and airfields. Because larks build nests on the ground and lark fledglings remain extremely vulnerable just after fledging, military training and site maintenance activities can cause negative effects to larks. To support JBLM in their efforts to maximize lark productivity and minimize negative impacts, CNLM identifies the temporal and spatial extent of lark vulnerability for each known breeding pair and transmits that information in real time to managers of these important breeding sites. We will present the overall conservation strategy for maximizing productivity, the information-sharing process, and recommended buffer distances to avoid impacting larks during vulnerable periods.

ORAL

THE PRAIRIE QUALITY MONITORING PROJECT: MEASURING RESTORATION SUCCESS ON THE SOUTH SOUND PRAIRIES. **Cara Applestein** and Sarah Hamman, Center for Natural Lands Management, 120 Union Avenue SE #215, Olympia, WA 98501. capplestein@cnlm.org

Nearly twenty years into the restoration of South Sound prairies in Washington State, several endangered species have been saved from the brink of extinction, invasive species have been

removed from large areas, and native flora has been returned to many areas where has not existed for several decades. However, it is important to quantify progress of large-scale, multi-faceted restoration efforts in order to enact adaptive management and become more efficient and effective over time. This landscape-scale project focused on monitoring the habitat quality of five prairies (Glacial, Tenalquot, West Rocky, Wolf Haven, Mima Mounds, and Scatter Creek) that have undergone extensive restoration treatments, including prescribed burning, targeted herbicide applications, native planting and seeding, since they were last monitored between 2007 and 2009. Measures of success include increased *Festuca roemeri*, increased total native cover, increased native graminoid cover, decreased *Arrenatherum elatius*, decreased *Cystisus scoparius*, and increased distribution of *Lupinus albicaulis* and *Balsamorhiza deltoidea*. A monitoring crew visually estimated these characteristics in over 2,000 25x25m plots across the five prairies. Additional 1x1m plots were monitored in order to assess which species were present and whether native species richness had increased in the last eight years. Results will indicate which areas of the prairies have the highest quality, how the landscape has changed as a result of various treatment combinations, and what areas need more work or a different approach.

ORAL

LESSONS LEARNED FROM CARBON ADDITION EXPERIMENTS IN THE WILLAMETTE VALLEY. **Matt A. Bahm,** Denise Giles-Johnson, Erin Gray and Thomas N. Kaye, Institute for Applied Ecology, Conservation Research Program, 563 SW Jefferson Avenue, Corvallis, OR 97333. mattab@appliedeco.org

Institute for Applied Ecology has been conducting carbon addition experiments to determine efficacy for invasive plant control and establishment of native prairie species. Carbon addition has the potential to provide managers more flexibility in controlling invasive species. This can help reduce herbicide use, and also has potential to reduce damage to desirable native species; i.e. such as when exotic forbs need to be controlled without eliminating native forbs. We have used carbon addition in direct comparison with other management treatments (i.e. fire, herbicide) and as standalone treatments following previous management. Efficacy of treatments varied by site, previous management, and plant community composition. Carbon addition showed varying impacts to different plant functional groups, but generally decreased overall plant cover. Carbon addition can be a useful tool for short-term control of undesirable vegetation.

POSTER

NATIVE BUNCHGRASS FITNESS AND ENDOPHYTE COMMUNITY COMPOSITION ALONG A PACIFIC NORTHWEST PRAIRIE GRADIENT. **Graham Bailes**, Bitty Roy, Lauren Hendricks, Matt Krna, Scott Bridgham, Laurel Pfeifer-Meister and Bart Johnson, University of Oregon, Eugene, OR 97403; Daniel Doak, University of Colorado Boulder, Boulder, CO 80309; William Morris, Duke University, Durham, NC 27708. bailes.graham@gmail.com

Climate change is expected to have far-reaching impacts on plants species, including altering phenology, and creating range shifts, both through expansion and contraction. With intensification of climate patterns, severe changes to regional diversity are anticipated in coming decades. However, disentangling climate controls from other abiotic and biotic controls has emerged as a critical question for understanding impacts on future plant communities. Using a spatial gradient of 700 km within Willamette Valley-Puget Trough-Georgia Basin (WPG) and Klamath Mountain Ecoregions, natural populations of three native bunchgrasses (*Festuca roemeri, Danthonia californica,* and *Achnatherum lemmonii*, 18 populations total) were monitored to investigate the role of abiotic (climate, parent material, topography, etc.) and biotic factors (herbivores, pathogens, inter- and intraspecific competition, and microbial community composition-through the use of high-throughput sequencing) influencing population dynamics and reproductive fitness. Populations were chosen to maximize environmental variation, along the latitudinal gradient, and ultimately will be used in a regional model that will couple dispersal data with the demographic data to predict long-term survival of these species in the PNW. Preliminary analyses suggest that there are significant differences in plant size, reproductive fitness, and pathogen/herbivore damage among populations. However, these analyses suggest that climate is not the sole predictor; damage profiles from each population may play an important role.

ORAL

GENETIC CHANGES ASSOCIATED WITH EX SITU NATIVE PLANT PROPAGATION AND CONSEQUENCES FOR REINTRODUCTIONS; CASE STUDY IN *CASTILLEJA LEVISECTA.*

Adrienne Basey, Jeremie Fant, PhD, and Andrea Kramer, PhD, Chicago Botanic Garden, 1000 Lake Cook Road, Glencoe, IL 60022. Adrienne.Basey@gmail.com

Successful restoration, reintroduction and plant conservation relies on many interconnected variables. One such example is genetic variability of ecologically appropriate plant material. In the short term, higher diversity can improve plant establishment, affect community structure and productivity. In the long term, populations with more genetic diversity will have a broader range of resources with which to respond to natural selection and climate change. Obtaining genetically diverse plant material is not, however, straightforward. Restoration and reintroduction efforts rely on seed or plant propagules grown and managed ex situ, sometimes for many generations. Are genetic bottlenecks expressed during various stages of plant propagation? To examine this question, we research the reintroduction of golden paintbrush (*Castilleja levisecta*, Orobanchaceae). Once native to the prairies of western Oregon and Washington, currently 11 extant populations remain. Reintroduction began in 2003 and is ongoing. For reintroduction, seed was collected from four extant populations, grown in seed-increase beds and outplanted. Our research investigates changes in genetic variability during these three stages in ex situ production. Using microsatellite markers, we quantified the genetic variation among these groups. We analyzed polymorphism and inbreeding within each population and analyzed genetic structure among populations. Overall, reintroductions show the expected outbreeding from nursery production, nursery populations showed higher inbreeding, and the genetic characterization of reintroduction sites was more reliable when nurseries maintained source-identified propagation plots. Results will inform the larger restoration community by providing a

model for – and emphasizing the importance of – best practices for the production of native plant materials.

ORAL

RESTORING OAK RESILIENCE THROUGH A COLLABORATIVE CROSS BOUNDARY ALL-LANDS INITIATIVE IN SOUTHERN OREGON / NORTHERN CALIFORNIA. **Marko Bey and Lyndia Hammer**, Lomakatsi Restoration Project, Ashland, OR 97520; Terry Fairbanks, Bureau of Land Management, Medford, OR 97501; Jaime Stephens, Klamath Bird Observatory, Ashland, OR 97520; Kerry Metlen and Keith Perchemlides, The Nature Conservancy, Medford, OR 97501; CalLee Davenport, U.S. Fish and Wildlife Service, Portland, OR 97266; Mike Edwards, U.S. Fish and Wildlife Service, Klamath Falls, OR 97601; Dave Johnson, U.S. Fish and Wildlife Service, Yreka CA 96097; Erin Kurtz, Natural Resources Conservation Service, Medford, OR 97501; Jim Patterson, Natural Resources Conservation Service, Yreka CA 96097. marko@lomakatsi.org

The Klamath-Rogue Oak Woodland Health and Habitat Conservation Project (2015 - 2019) will accomplish 3,000 acres of priority oak habitat restoration in biological hotspots in the Klamath Mountains Ecoregion of southern Oregon and northern California with focus on climate adaptation and oak habitat resilience. This multi-state, multi-agency coordinated restoration effort requires active collaboration between federal agencies, tribal governments, non-governmental organizations and private landowners spanning three counties in Oregon and California and is facilitated by Lomakatsi Restoration Project and partners of the Klamath Siskiyou Oak Network. Much of the work will focus on the Table Rocks Natural Area (Jackson County, Oregon), guided by a recent assessment of restoration need conducted by The Nature Conservancy. Recent studies of climate resilient land facets and modeled regional oak distributions under future climate scenarios have elevated the Table Rocks as a high priority area for retaining Oregon white oak under likely future climates. At the Table Rocks, ecologically-based thinning, prescribed burning, invasive species removal, and seeding of native understory species are underway to help develop functional, fire permeable low elevation oak woodland, protect critical habitat features in the short term, improve landscape scale oak habitat connectivity in the long term, and reduce wildfire risk to human communities. This project is a model of emerging climate adaptation science, integrated with innovative oak restoration approaches in a collaborative, all-lands restoration setting.

KEYNOTE

BRINGING BACK THE POLLINATORS: AN INTEGRATED LANDSCAPE APPROACH TO POLLINATOR CONSERVATION. **Scott Hoffman Black**, Xerces Society for Invertebrate Conservation, 628 NE Broadway, Portland OR, 97232. www.xerces.org

Despite the recognized importance of pollinators and the services they provide there is a growing body of evidence that suggests they may be at risk due to loss of habitat, widespread use of pesticides, climate change, and disease and parasites. There are major pollinator conservation

efforts at national, state, and local levels. In May 2015, President Obama released "A National Strategy to Promote the Health of Honey Bees and Other Pollinators." As part of this effort, the U.S. Forest Service developed "Pollinator-Friendly Best Management Practices for Federal Lands," the USDA Natural Resource Conservation Service has ramped up efforts to provide for pollinators on private working lands, and the Federal Highway Administration is developing a variety of tools to help manage highways and roadsides for pollinators. Many agencies in the Northwest are taking action for pollinators, including the Washington Department of Transportation, counties, and cities. An integrated approach is needed to protect this group of keystone animals in the region. A wide range of places offer opportunities for native pollinator conservation, including parks and open spaces, private working lands, road and power line rights-of-way, and state and federal lands in Pacific Northwest prairie and oak ecosystems. Scott will discuss the latest science on pollinators, their importance and decline, and efforts at the federal level and more locally here in the Pacific Northwest. He will conclude with a framework for how we can all work together to ensure pollinators are considered in land management decisions at all levels.

ORAL

PATTERNS OF POLLINATION AND SEED PREDATION LIMIT SCOTCH BROOM.
Robert Bode, Rebecca Tong and Nathan Krueger, Saint Martin's University, 5000 Abbey Way, Lacey, WA 98503. rbode@stmartin.edu

Scotch broom (*Cytisus scoparius*) is an invasive perennial plant in the Pacific Northwest. It reproduces sexually, is not self-compatible, and is limited by pollinator availability. To mediate the spread of this invasive plant, two species of beetle were released in Washington and Oregon. These beetles feed on seeds and thus limit fecundity. Our study aimed to determine if natural selection by pollinators varies between urban and rural areas, as well as measuring if the efficacy of beetles is limited by urban barriers. We measured floral size and pollination rate at 31 sites around the Olympia, WA region, as well as measuring the rate of seed predation by beetles at 30 sites in the same region. Pollination rates were high, suggesting that Scotch broom is not as limited as previous studies have indicated. However, we found that pollinators do not simply pollinate all plants and flowers equally. Rather, they exert selective pressure on Scotch broom, and that the direction of this selective pressure varies between urban and rural sites. In urban areas, plants with larger flowers have a higher pollination rate. We have also found that beetles have a high impact on seed survival rates. We tracked the relative proportions of beetle and weevil predation in urban and rural sites.

POSTER

VASCULAR PLANTS OF THE SOUTH SOUND PRAIRIES.
Frederica Bowcutt, The Evergreen State College, 2700 Evergreen Parkway, NW Lab 2, Olympia, WA 98505; Sarah Hamman, Center for Natural Lands Management, Olympia, WA 98501; Lisa Hintz and Rose Edwards, Evergreen Natural History Museum, The Evergreen State College, Olympia, WA 98505; Joe Bettis, Turnstone Environmental, Portland, OR 97231. bowcuttf@evergreen.edu

A multi-year effort is underway at The Evergreen State College to document the vascular plants of the South Sound prairies and associated oak woodlands. Headed by botanist Frederica Bowcutt, the project has already involved over forty students since 2003, as well as scientists from Centralia College and the Center for Natural Lands Management. We expect to complete the field guide in 2018 with current nomenclature based on the updated Pacific Northwest flora in progress at the University of Washington. In the meantime, a draft is available on a limited basis as a way to solicit feedback from users. It includes illustrations and descriptions of over 140 vascular plants found in the glacial outwash prairies from Tacoma to Rochester, Washington. The final version will include at least another 50 illustrated species. A list of the voucher specimens that are maintained at the Evergreen Herbarium is included in Appendix A and will be updated for the final publication. Images of these specimens are available through the Consortium of Pacific Northwest Herbaria website. In addition to the illustrated taxa, the draft includes sections describing the climate, geology, vegetation, sensitive species, restoration ecology, and cultural history of these endangered ecosystems. This field guide demonstrates the capacity of college students to make significant contributions to their community through citizen science. We hope that the field guide will aid restoration efforts, educate the public, and facilitate greater collaboration in the future with Tribes in the region who have a long history of tending these cultural landscapes.

ORAL

PREDATORS AND PATHOGENS IN NATIVE SEED PRODUCTION: THE CONSEQUENCE OF GROWING A HIGH DIVERSITY BUFFET OF PLANTS AND SEED.

Linda Boyer, Heritage Seedlings, 4194 71st Avenue SE, Salem, OR 97317. lboyer@heritageseedlings.com

High diversity native seed production is desirable from buyers' perspective but challenging for a grower. The demand for local accessions of seed is, relatively, small so growing multiple species in smaller plots is ideal for this niche market. However, native plants and their seed are very attractive to a multitude of native predators: mice, voles, moles, gophers, squirrels, slugs, deer, hares, finches, seed weevils, caterpillars, aphids, and seed bugs (native and non-native). In addition, fields grown on ground cloth or in long-term production have issues with rusts and mildews. I will share some of the successful strategies we have developed while growing over 120 native forb and graminoids over the last 15 years to combat these predators and pathogens.

ORAL

ENGAGING THE COMMUNITY IN OREGON WHITE OAK CONSERVATION IN A CULTURALLY APPROPRIATE WAY.

Sequoia Breck, Savahna Jackson and Judy Bluehorse Skelton, PSU Indigenous Nations Studies Program, 1825 SW Broadway, Portland, OR 97201; Ted Labbe, Kingfisher Ecological Services, Portland, OR 97217. sequoia.breck@gmail.com

In 2014-15 we created OakQuest a citizen science effort to document, learn about, and foster stewardship of imperiled Oregon white oak habitats across the Portland, Oregon metropolitan region. Emerging Native American leaders with the Native American Youth and Family Center and Portland State University Indigenous Nations Studies Program trained and led volunteers in the field and provided important cultural context. Through OakQuest we reached over 100 volunteers, who donated over 1,500 hours. Over 10,000 Oregon white oaks were mapped, creating an important conservation data set and growing a cadre of oak habitat stewards within the region. One important aspect of the project is bringing people back to native white oak and savannah habitats, and reviving the community around them as social environments. Building on the OakQuest success we are launching 'KelipiCamas', which means 'return' or 'return to' camas in Chinook wawa. KelipiCamas teaches landowners naturescaping with oak practices, demonstrates traditional Native land stewardship practices as tools for restoration, and builds relationships among communities of Native American, natural resources managers, and the general public. KelipiCamas emphasizes restoration of native white oak habitats and the human relationships and practices that sustain them as living, social food systems. Both OakQuest and KelipiCamas strengthen the leadership and public appreciation of Native Americans as active habitat stewards of Oregon white oak and savanna habitats, improving long-term conservation prospects. One of the goals of this year and next are re-linking natural resources with the broader native perspective into co-land management and traditional gathering practices.

ORAL

THE PROCESS OF BUILDING PARTNERSHIPS. **Kelli Bush**, Carl Elliott, Carri Leroy and Joslyn Trivett, Sustainability in Prisons Project, The Evergreen State College, 2700 Evergreen Parkway NW, Olympia, WA 98505. bushk@evergreen.edu

Partnerships are crucial to the success of Sustainability in Prisons Project (SPP) programs. Given the proper resources, prisons can be centers for science education and ecological research, models for sustainability, and hubs of collaboration. Thriving partnerships allow participants to leverage resources and increase capacity to benefit all collaborators. With open, flexible, and respectful communication, it is possible to identify common goals among organizations and individuals with seemingly disparate missions. SPP offers four different program areas: science and conservation, education and training, sustainable operations, and community contributions. Conservation and science programs require the greatest number and diversity of partners in and outside the prison. The partnership generally includes corrections staff, incarcerated adults, students, scientists, SPP staff, natural resource agencies, non-profit organizations, and zoos. Each partner contributes value and expertise critical to program operation. Successful conservation programs in prisons require continual evaluation and adjustment to ensure every participant is receiving benefit. Our experience demonstrates that most incarcerated men and women are eager to receive education, training, and to partner in finding solutions to our greatest environmental challenges. SPP conservation programs bridge the divide between people living and working in prisons and the social and ecological communities outside the fences; they create opportunities for interdisciplinary and intercultural learning exchanges. There is vast scientific and conservation potential in collaborations with incarcerated individuals and corrections staff, the possibility of many appropriate, mutually beneficial programs.

ORAL

PORTLAND'S URBAN OAK HABITATS: INVESTIGATING A REGIONAL NEXUS FOR OAK ASSOCIATED AVIAN SPECIES. **Mary Bushman** and David Helzer, City of Portland Bureau of Environmental Services, 1120 SW 5th Room 1000, Portland, OR 97204; Adam Baz, Portland State University, Portland, OR 97201; Joe Liebezeit and Candace Larson, Audubon Society of Portland, Portland, OR 97210. mary.bushman@portlandoregon.gov

The Willamette River and Columbia River in Portland function as vital movement corridors for salmonids and avian species throughout their migration. To understand how these corridors function for oak associated avian species in the urban landscape the City of Portland has initiated a three year study to characterize and monitor bird communities in oak habitats located along the Willamette River in Portland. The project is monitoring bird communities in oak habitats at thirteen point count stations across five sites. Fixed radius point counts are conducted to describe the local bird community using standardized survey methodology modified from Huff et al. (2000). A total of 54 bird species were detected during the 2014 oak habitat point counts. Of the 25 most abundant species, eight (32%) were oak-associates. The one oak-obligate detected was the White-breasted Nuthach (*Sitta carolinesis*). This species was detected 13 times throughout the season, making it the 15th most abundant species overall. The data provides useful information on avian species composition, abundance, and breeding status within the study area. The City of Portland identified a number of high priority areas where oak and prairie has occurred, is underway, or is planned. With this data in hand Oak-associated bird species may be used as indicators of habitat quality and restoration efficacy.

ORAL

SOIL DEGRADATION AND RESTORATION: PERSPECTIVE FROM AGRICULTURE AND HORTICULTURE. **Craig Cogger**, WSU Puyallup Research and Extension Center, 2606 Pioneer Avenue W, Puyallup, WA 98371. cogger@wsu.edu

Row-crop agriculture often degrades soils through disturbance by tillage and compaction. Tillage is effective in preparing seedbeds, incorporating amendments, and managing weeds, but tillage also accelerates the rate of organic matter degradation, and can create a net loss in organic matter over time. Loss of organic matter and compaction damage soil structure and impair soil-water relations. The structure of the microbial ecosystem also changes. Organic soil amendments can improve the plant environment in degraded soils. This presentation briefly summarizes six long-term field research projects in agricultural and horticultural systems: two evaluating soil amendment application in pasture systems, two soil restoration studies with amendments and landscape plants, and two studies in tilled agricultural systems, one focused on amendments, and the other on amendments and tillage. One-time high rates of amendments and repeated agricultural applications of amendments both produced long-term increases in soil organic matter, sequestering carbon and improving soil quality in both tilled and untilled systems. In the landscape studies either surface application or incorporation of amendments improved plant growth, and in one study surface application also improved physical properties of the underlying soil. In the tillage study, tillage decreased bulk density and improved infiltration, but recently

tilled soils had lower microbial biomass and less complex ecosystems than soils with a longer time since tillage.

ORAL

USING LIVESTOCK GRAZING TO MANAGE NATIVE PRAIRIES WEST OF THE CASCADES. **Fred Colvin**, Colvin Ranch, Tenino, WA; **Marty Chaney**, USDA-Natural Resources Conservation Service, 1835 Black Lake Boulevard SW, Suite D, Olympia, WA 98512. marty.chaney@wa.usda.gov

Livestock grazing can be an important tool for management of mixed native prairie and introduced species pastures west of the Cascades. Intensive grazing systems can help maintain a profitable cattle operation, while enhancing the native prairie. The management prescription: First, develop proper infrastructure – fencing and livestock water on all the pastures. Then, manage the fields for the species: Prairie Pastures: Defer grazing or mowing during the critical period for native vegetation (early April until mid-June in the South Puget Sound) by moving livestock to fields managed for introduced forages. If a field containing native vegetation must be used during this period, limit use to 1 in 3 years. On native fields, don't apply fertilizers or compost, since they make introduced grasses and forbs more competitive. Don't till these fields. When supplementing with hay on native fields, move feeding areas often and don't reuse sites. Manage Introduced-Species Pastures by fertilizing and reseeding as necessary to maximize forage production and quality, especially during the spring. Manage all fields with: Prescribed Grazing guidelines for target species grazing heights and periods; manage by plant phenology, not the calendar; and if cattle are wintered on fields, strictly observe minimum stubble heights and use high quality hay that will leave little waste. Adaptive management is critical – keep track of what was done each year, and what happened. Try new things on a small scale and keep improving the system.

ORAL

FROM ACORNS TO LEGACY OAKS, THE GENESIS AND GROWTH OF AN OAK WORKING GROUP, THE KLAMATH-SISKIYOU OAK NETWORK. **CalLee Davenport**, U.S. Fish and Wildlife Service, State Coordinator - Partners for Fish and Wildlife Program, 2600 SE 98th Avenue, Suite #100, Portland, OR 97266. callee_davenport@fws.gov; **Terry Fairbanks**, Bureau of Land Management – Medford District Office, District Silviculturist, 3040 Biddle Road, Medford, OR 97504. tfairban@blm.gov

Development of a functional working group that can effectively and successfully tackle large-scale, cross-boundary natural resource issues can be extremely challenging. Steering committee members of an oak working group in southern Oregon describe the evolution of the recently formed Klamath Siskiyou Oak Network including its history, current projects, and future initiatives. The mission of KSON is to conserve oak habitats on private and public lands in southern Oregon and northern California. Technical aspects of group formation will be presented as a potential model for the creation of other work groups in the natural resources. The current structure of KSON, its funding strategies, identified science and research needs, outreach and networking strategies and future oak conservation initiatives will be discussed.

POSTER

DIVERSIFIED WEED MANAGEMENT FOR NATIVE PLANT SEED PRODUCTION SYSTEM. **Kathryn Donovan,** Center for Natural Lands Management, 120 Union Avenue SE #215, Olympia, WA 98501. kdonovan@cnlm.org

There are significant challenges associated with the production of native plants on an agricultural scale. While there are useful techniques to glean from conventional row crop production, the variation of native plants compared to the relative uniformity of conventional crops presents challenges in directly implementing conventional techniques. Perhaps the most salient example is the use of herbicides in native plant production. While this is a popular and useful weed management technology, plant growth habits paired with the mild climate of the Pacific Northwest requires continuous weed management throughout the winter. This cannot be easily accomplished with herbicide as a primary tool. This poster will highlight that suite of timing, tools, and labor inputs that we have developed at the Violet Prairie Seed Production Farm to appropriately manage weeds and minimize herbicide use.

POSTER

MAZAMA MEADOWS – CONSERVATION BANK FOR GOPHERS AND PRAIRIES. **Patrick Dunn**, Center for Natural Lands Management, 120 Union Avenue SE #215, Olympia, WA 98501. pdunn@cnlm.org

Conservation banks are permanently protected lands that are managed for natural resources, especially imperiled biota. These banks enable landowners to offset negative impacts to specific species and habitats by purchasing credits from the conservation bank to mitigate their impacts. The Center for Natural Lands Management, in cooperation with Thurston County, is in the process of opening the Mazama Meadows Conservation Bank to help mitigate impacts to the Yelm pocket gopher (*Thomomys Mazama yelmensis*) and prairie habitat in southern Thurston County. The pocket gopher is protected through the federal Endangered Species Act as threatened, while prairie habitat is protected through Thurston County's Critical Areas Ordinance. One hundred and forty acres have been purchased to support the Bank, while the agreement process from the U.S. Fish and Wildlife Service and Thurston County is underway and approval expected shortly. The Center for Natural Lands Management will likely own, restore and manage the land and administer the finances, in perpetuity.

ORAL

IS RESTORATION DEAD? THE FUTURE OF PRAIRIE CONSERVATION IN THE PACIFIC NORTHWEST. **Peter W. Dunwiddie**, Center for Natural Lands Management, 120 Union Avenue SE #215, Olympia, WA 98501; Thomas N. Kaye, Institute for Applied Ecology, PO Box 2855, Corvallis, OR 97339; Jonathan D. Bakker, School of Environmental and Forest

Sciences, University of Washington, Box 354115, Seattle, WA 98195.
pdunwidd@u.washington.edu

Lowland prairies and oak woodlands in the Pacific Northwest are highly fragmented, drastically reduced in area, and degraded by invasive exotics and the loss of native species. Projected future changes in climate and land use will continue to introduce new species, generate novel conditions, and further impair ecological functionality in prairie remnants. In such heavily compromised systems, current conservation approaches, such as prescribed fire, will become increasingly untenable at many sites. Rather than restoring and maintaining historically characteristic species assemblages and ecological processes, conservation practitioners must create new paradigms to guide actions in this changing environment. We propose that the most successful and defensible strategies will focus on what we refer to as "lifeboat conservation." The primary goal of this approach is to preserve as many species and genotypes as possible in these imperiled habitats. How this can best be accomplished in an informed, ecologically sound manner is only starting to become clear, but will require the adoption of very different perspectives, strategies, and tools that challenge many currently-accepted norms and practices. At the genetic level, greater species resilience may be achieved by deliberately introducing stock from more distant sites to broaden genetic diversity. Similarly, introducing species deemed likely to be adapted to future environments at a site will be necessary to prevent their extinction elsewhere. Changes like these necessitate redefining communities, including novel assemblages of species. Finally, the appropriateness of management practices must be reconsidered in light of changes in environment, social contexts, and the ecological systems themselves.

ORAL

RESEARCH ON SEED GERMINATION ECOLOGY WITHIN CORRECTIONS CENTERS.

Carl Elliott, Kelli Bush and Carri Leroy, Sustainability in Prisons Project, The Evergreen State College, 2700 Evergreen Parkway NW, Olympia, WA 98505. elliottc@evergreen.edu

The prairies of the South Puget Sound region form the heart of one of the rarest ecosystems in the U.S.: the grasslands and oak woodlands of Cascadia. The prairies host multiple federally listed and candidate species, ranging from plants to invertebrates, birds and mammals. Restoration is a critical conservation strategy for these prairies. Over time, restoration efforts have progressed from invasive species control to the broad reintroduction of native species. The South Puget Sound Conservation Nursery program supports prairie restoration by dramatically increasing the supply of native seed and plants for rapid habitat enhancement. The production goals of the nursery target a suite of species to increase prairie biodiversity and enhance habitat; currently we grow more than 60 perennial plant species. The annual regional demand for native plant plugs has steadily grown, from 22,000 plants of 10 species in 2008, to more than 420,000 of 65 species in 2014. The Conservation Nursery program has responded to demand by researching germination protocols, developing sustainable cultivation techniques, and building trained teams of technicians to carry out the work. The nursery technicians are inmates at three Washington State Corrections centers, supervised by Washington State Department of Corrections staff and trained by staff members from the Sustainability in Prisons Project (SPP). SPP staff develop and test the germination and cultivation protocols with significant input from

and review by the inmate technicians. We have published resulting protocols for more than 50 perennial species through the Native Plant Network and in our Conservation Nursery Manual.

ORAL

BUILDING A CONSERVATION NURSERY EDUCATION PROGRAM THAT BENEFITS THE COMMUNITY. **Conrad Ely**, Carl Elliott, Kelli Bush and Carri Leroy, Sustainability in Prisons Project, The Evergreen State College, 2700 Evergreen Parkway NW, Olympia, WA 98505. elyc@evergreen.edu

SPP's conservation nursery program marries environmental education with novel horticulture practices and plant propagation. As with our other Sustainability in Prisons Project programs, our primary goal is to connect offender technicians back to their communities. In Washington State, the remnant Puget Lowland prairies are extremely threatened and their restoration is a priority for conservationists. Most offender technicians enter the program without knowledge of the ecology of Puget lowland prairie ecosystems. A primary component of the work we do is educating our technicians about the history of the area, how human land use changes and policies have affected the region, and the methodologies professionals are using to restore these ecosystems. Our conservation nurseries serve as effective hands on learning environment where technicians can receive education while taking an active role in restoration. My crew is always reminding me how refreshing it is for incarcerated individuals to get outdoors and how important it is to have a purpose while they are serving their time. Working with plants also provides a special opportunity for technicians to nurture an organism in its infancy, while creating pride in a tangible manifestation of their hard work that grows before their eyes. The contributions of these nurseries back to the community are significant, which is evidenced by the vastness of our partnerships. Since 2009 we have raised over a million plants of 64 different species. Our technicians feel that they have stock in the community through this project and express gratitude for an opportunity to reconnect.

POSTER

PLANT-SOIL FEEDBACK BY AN INVASIVE GRASS, *BRACHYPODIUM SYLVATICUM*, IN DOUGLAS-FIR FORESTS. **Andrew Esterson,** Oregon State University, Department of Botany and Plant Pathology, 2082 Cordley Hall, Corvallis, OR 97331; Tom Kaye, Institute for Applied Ecology, Corvallis, OR 97333. estersoa@science.oregonstate.edu

Brachypodium sylvaticum (false brome), a perennial bunch grass, is listed as a quarantined invasive species in the Pacific Northwest of the United States and is currently in the midst of rapid population growth and range expansion. Such an invasion threatens native plant diversity, endangered species, pollinators, fire regimes, prairie and oak communities, and timber production. Understanding how false brome invades a landscape is critical for the prevention of its expansion and restoration of invaded environments. One possible explanation for false brome's competitive ability is plant soil feedback (PSF). A PSF occurs when plants change biotic and/or abiotic soil properties such that plant growth is increased or decreased, which in turn alters community composition. The objective of this project was to determine the direction

of PSF caused by false brome. We tested the hypotheses that false brome produces positive conspecific and negative heterospecific PSF on native species in a Douglas-fir forest in the Oregon coastal range. To test our hypotheses, false-brome and five common native plants were grown on wild forest soils to condition the soil biotic community to the invader and the native species for six months. Then false brome was grown on soil conditioned by itself and soil conditioned by natives; each of the five native species was grown on soil conditioned by false brome and on their own conditioned soils. Preliminary results indicate that false brome has neutral to negative conspecific PSF and neutral heterospecific PSF, while soils conditioned by native plants have positive PSF on false brome.

ORAL

PRAIRIE POLLINATORS: GOOD NEWS AND A CALL FOR MORE NEWS. **Cheryl Fimbel,** formerly with Center for Natural Lands Management, 120 Union Avenue SE #215, Olympia, WA 98501**.**

There is considerable good news regarding restoration and pollinators on Puget prairies. Restoration actions are increasing the abundance of floral resources on the prairies, and pollinators are using these resource rich habitats. Even smaller fragmented habitats with prairie forbs are used by large numbers of pollinators. Despite this good news, we still need more news. Additional information regarding the relationships between pollinators, plants, and restoration actions is necessary to ensure abundant and diverse assemblages of pollinator communities into the future, especially in the face of climate change. I summarize some of the research on Puget Prairie pollinators and follow with a discussion of ideas for the future. These include unconventional approaches to prairie restoration such as strategic promotion of shrubs and non-native plants, and encouraging neighborhood gardens.

POSTER

SEED PRODUCTION AND VIABILITY OF PUTATIVE *CASTILLEJA LEVISECTA* × *C. HISPIDA* HYBRIDS. **Loretta L. Fisher**, Jonathan D. Bakker and Peter W. Dunwiddie, School of Environmental and Forest Sciences, University of Washington, Box 354115, Seattle, WA 98195-4115. Loretta.Fisher@gmail.com

Castilleja levisecta (CALE) is one of the most vulnerable plants in Puget Sound prairies and is federally listed as a threatened species. *C. hispida* (CAHI) also occurs in some prairies but is not a listed species. CALE and CAHI can be intentionally crossed, but it is unclear how often hybridization can occur in the field. A key unresolved question is whether CALE × CAHI hybrids are sterile or produce viable seed, as sterile hybrids would be of less concern to CALE recovery efforts. We determined the seed production and viability of putative hybrids (plants with morphological traits of both species) observed in the field. Fruiting stems were gathered from 25 putative CALE × CAHI hybrids and from one plant of each species. Seed production and germination were assessed on a per-capsule basis for 4 capsules per plant, two from the top and two from the bottom of the fruiting stem. These data were supplemented by previous experimental data testing effects of host plant identity on CALE seed production. Hybrid plants produced smaller capsules containing half as many seeds as in CALE. Capsules from the bottom

of the stem had lower seed densities than top capsules. On average, 77% of putative hybrid seeds germinated, though this rate ranged from 26 to 95% among maternal plants. Genetic analyses are currently underway to determine the hybridization history of these plants and further elucidate the implications of hybridization for the recovery of CALE.

ORAL

IMPACTS OF PERSISTENT AND PULSE GRAZING ON THE FENDER'S BLUE BUTTERFLY. **Greg Fitzpatrick,** 1328 NW 12th Street, Corvallis, OR 97330. fitzpat@peak.org; Tyler Hicks, PO Box 241, Ridgefield, WA 98642. uplandsandpiper@hotmail.com

Fender's Blue Butterfly (FBB) (*Icaricia icarioides fenderi*) is a federally endangered butterfly endemic to upland prairie habitats in the Willamette Valley of Oregon. FBB requires access to prairie, nectar, and its primary host plant, the threatened Kincaid's Lupine (*Lupinus oreganus*). Although several private lands occupied by FBB are grazed, we have little understanding of the impacts of this grazing on FBB. In this study we investigated persistent grazing with horses and llamas and pulse grazing using sheep. The objectives of grazing in FBB habitat is to reduce invasive cover while minimizing negative impacts to FBB habitat. For the pulse grazing we established three study sites, each site divided into two approximately equal sized paired study plots, with one plot randomly assigned to a grazing treatment and the other to a control. Pre-treatment lupine, vegetation, and FBB egg data were collected in the spring of 2012 and post-treatment data was collected the following spring. Each grazing plot received a grazing treatment of 35-40 sheep over a 4 day period. FBB consistently laid fewer eggs in both persistent and pulse grazing sites even though in persistently grazed areas lupine leaf densities were higher. Cover of invasive grasses and woody species declined in sheep grazed areas. Pulse grazing by sheep appeared to negatively impact lupine cover through trampling and incidental foraging and severely reduced nectar abundance. While some type of grazing may still yet prove to be a valuable habitat management tool it currently appears to be incompatible with FBB conservation goals.

ORAL

ARMY COMPATIBLE USE BUFFER: COOPERATIVE RECOVERY OF ESA-LISTED SPECIES IN THE VICINITY OF A MILITARY INSTALLATION. **Jeffrey R. Foster**, US Army, Environmental Division, Public Works, IMLM-PWE, Box 339500 MS17, Joint Base Lewis-McChord, WA 98433. jeffrey.r.foster.civ@mail.mil.

Three grassland-dependent species (Taylor's checkerspot, streaked horned lark, Mazama pocket gopher) were recently listed under the federal Endangered Species Act. Joint Base Lewis-McChord, an Army/Air Force installation near Tacoma, WA, possesses most of the remaining habitat and populations of these species, and thus has a high burden for their recovery. Listing has also brought significant restrictions on military training. To reduce the burden and eventually lift some of the restrictions, JBLM has an Army Compatible Use Buffer (ACUB) program that promotes cooperative regional conservation of grasslands and improves the status of the three

species. The main conservation actions are land acquisition/easement, habitat restoration, and species reintroduction, plus planning, monitoring, research, and stewardship endowments in support of these actions. Our partners are federal/state/local agencies/governments and NGOs. In 2013, our ACUB was a winner of a special Department of Defense award, and was designated the first Sentinel Landscape (a joint Departments of Defense, Agriculture, and Interior initiative to protect landscapes around military installations), bringing additional funding and expanding the conservation toolkit and partners we work with. To date (2006-2015), 5,968 acres have been acquired/enrolled in the program, habitat restoration conducted on most of these acres, three reintroductions carried out, and research completed to fill key information gaps. Integral to the success of our ACUB is working cooperatively with our partners to pool resources (human, financial), adopt shared goals/objectives, comply with US Fish & Wildlife Service post-listing requirements, and use the same protocols for planning, monitoring, and research.

ORAL

SOURCING NATIVE PLANT MATERIALS THROUGH THE WILLAMETTE VALLEY NATIVE PLANT MATERIALS PARTNERSHIP. **Jenny Getty**, Melanie Gisler, and Tom Kaye, Institute for Applied Ecology, 563 SW Jefferson Avenue, Corvallis, OR 97333.
jenny@appliedeco.org
The Willamette Valley Native Plant Materials Partnership launched in 2012 through a grant from the Oregon Watershed Enhancement Board. The WVNPMP is a diverse partnership of 25 organizations dedicated to increasing availability and affordability of genetically diverse and ecologically appropriate native plant materials for use in the Willamette Valley ecoregion, helping to stabilize and support the local native seed marketplace, and providing a foundation for successful restoration and healthy, thriving native ecosystems. Partners include federal, state, and local agencies as well as non-profits, land trusts, watershed councils, and local plant materials producers. There is already an established native plant materials industry in the Willamette Valley with production of some species sufficient to meet restoration needs. There remains a large number of important restoration species with restricted availability due to high cost, unstable demand, or difficult production. The Partnership has chosen species for contract production that 1) are in high demand for prairie restoration, 2) are not already in widespread production, and/or 3) will improve genetic diversity over what is already available. Later, species for other habitats and those planted for diversity and wildlife will be added. Challenges to choosing species have included differing levels of demand for various species among partners, concern with appropriate seed transfer zones, finding sufficient seed collection sites, and difficult production logistics for some highly desired species. In 2013-14 the first five species were collected and entered into production. Wild collection continues each year, and 3-6 new species will be placed into production in fall 2015.

ORAL

FROM OAKS TO FISH: OAK PROJECT SYNERGIES WITH INSTREAM AND WETLAND RESTORATION NEEDS. **Matthew Gibbons**, Jason Nuckols. The Nature Conservancy, Willamette Valley Field Office, 87200 Rathbone Rd. Eugene OR 97402. mgibbons@tnc.org

From 2013 until 2015, The Nature Conservancy undertook oak habitat restoration on a 645 acre project across four different sites in the Willamette Valley. At two of those sites, the Willamette Confluence Preserve and the Yamhill Oaks Preserve, there were concurrent stream and wetland restoration projects taking place. We took advantage of this timing and utilized materials from the conifer thinning operation for instream, floodplain and wetland placement of woody debris. This included: trees with and without root-wads for constructed logjams and habitat logs, chips for mulch for riparian plantings, and slash for habitat diversity. The synergies between these two restoration efforts allowed material to stay on site, generated efficiencies in contracting, reduced our costs associated with importing wood for floodplain work, reduced our carbon footprint associated with import and export of materials, reduced the carbon emissions associated with traditional slash pile burning, introduced alternate funding sources to pay for oak work, and created an internal market for woody material that had little to no commercial value. In their current state, oak projects in this region tend to be expensive, are bound economically to a volatile log market, and can generate material that has little or negative value in traditional forestry markets. We propose that there are unrealized regional synergies between upland oak restoration and stream restoration projects in the creation of inter-restoration practitioner markets for woody material. The matching of these two restoration puzzle pieces could help push the needle forward on both oak habitat and stream restoration efforts in the region.

POSTER

SURVEY AND MONITORING METHODOLOGY IN CONSERVATION BIOLOGY. **Hannah Gilbert**, Crescent Valley High School, 4444 NW Highland Drive, Corvallis, OR 97330; Matt Bahm, Denise Giles-Johnson, and Erin Gray, Institute for Applied Ecology, 563 SW Jefferson Ave, Corvallis, OR 97333. hannahgilbert27@gmail.com

As part of my high school internship through the Apprenticeships in Science and Engineering Program with the Institute for Applied Ecology, I compared common methodologies used in field research experiments and described their applicability in research conducted on three rare species in Oregon. Surveying, sampling, and monitoring are often used interchangeably however these three terms have very different meanings. According to a report published by the Weed Science Society of America titled *Distinct Roles of Surveys, Inventories, and Monitoring in Adaptive Weed Management*, monitoring "involves the repeated collection and analysis of site-specific data to evaluate progress toward management objective". In contrast, surveys are described as "field searches to determine the location and relative abundance" of the species in question. Sampling is something else entirely: it is the practice of monitoring only part of an entire population, but in such a manner than the rest of the data can be inferred. This summer I utilized all three methods to document rare species in Oregon including Willamette daisy (*Erigeron decumbens*), Cusick's lupine (*Lupinus lepidus* var. *cusickii*), and Kincaid's lupine (*Lupinus oreganus*). I described the experimental design used for each species and the considerations in choosing a particular method for a field research project. When selecting an experimental design, understanding of appropriate methodologies coupled with species biology is essential for gaining accurate information to inform conservation and future management.

POSTER

ADAPTIVE COASTAL PRAIRIE RESTORATION: INITIAL RESULTS FROM AN ONGOING STUDY. **Denise Giles-Johnson**, Matt Bahm, Erin C. Gray, and Thomas N Kaye, Institute for Applied Ecology, 563 SW Jefferson Avenue, Corvallis, OR 97333. Denise@appliedeco.org

Coastal prairies, like their valley counterparts, have experienced significant habitat loss due to agricultural use, urbanization and encroachment of invasive species. The Institute for Applied Ecology in partnership with the North Coast Land Conservancy (NCLC), USFWS and the National Park Service (NPS) have implemented an ongoing study to evaluate adaptive management techniques including soil inversion, soil removal, herbicide treatments (with glyphosate and Imazapic) and controls at five coastal prairie sites in Oregon and Washington. Treatment plots were established in 2013 at five remnant coastal prairie sites and treatments were implemented in 2014/2015. Initial site conditions range from heavily invaded with non-native perennial grasses including *Anthoxanthum odoratum, Schedonorus arundinaceus* and *Agrostis* spp., as well as non-native shrubs (particularly *Cytisus scoparius*) to sites dominated by native forb species, and codominant native/invasive grasses. All sites were seeded with 5 native species in late 2014. These sites could eventually provide habitat for the endangered Oregon silverspot butterfly, and are slated to be outplanted in late 2015/early 2016 with *Viola adunca*. Initial results from the spring of 2015, indicate that soil removal was most effective at removing non-native vegetation, however after treatment, these plots also had the lowest cover of vegetation (both native-and non-native) overall . Establishment of seeded species was also highest in the soil-removal plots with germination of *Lupinus littoralis* over twice that of any other treatment. Herbicide treatments were particularly effective at decreasing cover of *Schedonorus arundinaceus*, however cover of *Anthoxanthum odoratum* was less effected. Results from this ongoing adaptive management study will inform coastal prairie restoration in the Pacific Northwest.

ORAL

LANDSCAPE AND LOCAL EFFECTS ON POLLINATOR BIODIVERSITY AND PLANT-POLLINATOR INTERACTIONS IN PRAIRIE FRAGMENTS IN SOUTHERN VANCOUVER ISLAND. **Sandra Gillespie,** Julie Wray, and Elizabeth Elle, Department of Biological Sciences, Simon Fraser University, 8888 University Drive, Burnaby, BC, Canada, V5A 1S6. sdgillesp@sfu.ca

In British Columbia, the oak-savannah ecosystem is highly fragmented, and habitat fragments are embedded in two main matrix types, forests and urban/suburban (including gardens). Both forest-associated and urban-associated fragments supported high abundance and richness of pollinators and plants, but the pollinator community differed between fragment types. All oak-savannah fragments supported high abundance and diversity of pollinators early in the season when wildflower density was high, but the garden matrix supported higher abundance and diversity of pollinators later in the season. Forests had low abundance and diversity of both plants and pollinators. Our results suggest that we should consider resource availability in areas surrounding oak-savannah habitat when planning for conservation of this ecosystem. Habitat fragmentation and degradation can lead to invasion by non-native plants. We have examined

how the presence of an invasive species (*Cytisus scoparius* – scotch broom) mediates interactions among bumblebee species, and how this may affect pollination of two abundant and pollinator-attractive native plants (*Camassia quamash*, *C. leichtlinii*). Working at multiple sites for 3 years on 3 focal bumblebee species, we have found evidence of competitive interactions between bee species, and that visit rate to native vs. invasive focal plants varies with the abundance of bee species within sites. In addition, we found that bee abundance was related to plant reproduction, suggesting that interactions between competing bumblebee species affect plant pollination. If some bumblebee species increase visits to invasive plants due to competitive exclusion from preferred native plants, pollination of invasive plants may increase, with implications for conservation.

ORAL

RAISING FROGS AND TURTLES IN PRISON: A METAMORPHOSIS. **Sadie Gilliom**, Sustainability in Prisons Project, The Evergreen State College, 2700 Evergreen Parkway NW, Olympia, WA 98505. gillioms@evergreen.edu

The Sustainability in Prisons Project's works with two endangered species at Cedar Creek Corrections Center, rearing Oregon spotted frogs from egg mass to releasable adults, and caring for western pond turtles as they recover from a shell disease. These initiatives aim to increase the capacity and resiliency of endangered species restoration in southwestern Washington. At the same time, the programs aim to create meaningful work for inmates and staff in a corrections center. To all involved, the work may offer varied knowledge and insight. Both programs have faced challenges and triumphs. This presentation will describe how these endangered species programs became successful through the power of collaborative partnerships. Both programs rely on incarcerated men for daily feeding, monitoring, and record-taking. The turtles require additional, hands-on attention: frequent cleaning, moving to and from dry basking, and checking wounds healing on the ventral shell. These technicians have shown themselves exceptionally capable stewards of the frogs and turtles, but they could not be successful without a host of partners supporting and guiding their work. Access and adherence to best practices and protocols are critical. So is the autonomy to solve emergent problems as they arise. Just as important, a network of responsive and supportive partners ensures that they have the infrastructure, consultation, and services they need. Wildlife biologists, zoo keepers, specialized veterinarians, corrections staff, SPP staff, builders, electricians, funders, and promoters all make critical contributions. The frog and turtle programs had small beginnings, but have morphed into something spectacular and mature.

ORAL

SOIL LEGACIES OF *CYTISUS SCOPARIUS* IMPACT REFORESTATION. **Sara Grove** and Ingrid M. Parker, Ecology and Evolutionary Biology, University of California, Santa Cruz, CA 95064; Karen A. Haubensak, Biological Sciences & Merriam-Powell Center for Environmental Research, Northern Arizona University, Flagstaff, AZ 86011. saragrove@gmail.com

Cytisus scoparius is a nitrogen-fixing invader that imparts soil legacies that inhibit reforestation success. We evaluated the presence and persistence of these legacies such as N-enrichment, as well as their implication(s) for the mycorrhizal community on which the establishment of Douglas-fir depends. In greenhouse experiments we found soils previously invaded by *Cytisus* harbored less ectomycorrhizal fungi (EMF). In the field we assessed two strategies to maximize EMF colonization and improve reforestation success following *Cytisus* removal: planting near forest edges and transplanting local uninvaded forest soil into invaded clearcuts. Edge seedlings had higher survival and more EMF than interior seedlings. Transplanting forest soils did not increase EMF colonization or Douglas-fir success but did increase EMF richness; this suggests inoculation of invaded areas can restore EMF, but not its functionality. Nitrogen-enrichment may be a mechanism by which *Cytisus* affects the Douglas-fir-mycorrhizal mutualism. In a field experiment we measured the persistence of N-enrichment following *Cytisus* removal over two years. One month after removal, there was a large pulse of inorganic N, presumably a result of rapid decomposition of N-rich *Cytisus* biomass. This pulse of N declined by 70% over 10 months and then remained at that level for one year. Douglas-fir seedlings performed worse in plots that had been *Cytisus*-free the longest. This pattern was likely caused by competition from invasive grasses and forbs, whose cover increased with time following *Cytisus* removal. It appears that *Cytisus*-derived N favors the invasion of exotic grasses and forbs that compete with native species.

ORAL

SUPPORTING PRISON CONSERVATION EFFORTS THROUGH DIVERSE PARTNERSHIPS. **Larkin Guenther**, Debbie Rutt, Stacy Moore and Tom Kaye, Institute for Applied Ecology, 563 SW Jefferson, Corvallis, OR 97333. larkin@appliedeco.org

Due primarily to habitat loss and degredation, the Oregon silverspot butterfly (*Speryeria zerene hippolytaI*), native to the coasts of northern California, Oregon, and southern Washington, was listed as threatened in 1980. Oregon silverspot larvae are dependent on one host species, the early blue violet (*Viola adunca*). After pupating, the adult butterflies feed on multiple nectar species native to Pacific coastal prairies. Conservation measures for this species are focused on habitat restoration and an active captive rearing and release program. Female inmates incarcerated at Coffee Creek Correctional Facility in Oregon have been involved in multi-pronged Oregon silverspot conservation efforts for the past two years. The goals of this project are to 1) improve habitat through the production of plant materials, 2) support the Oregon Zoo and the United States Fish and Wildlife Service with the Oregon silverspot captive rearing program, and 3) to provide educational opportunities for incarcerated women to participate in conservation efforts. The success of this program has been dependent upon and enhanced by partnerships with multiple agencies and organizations. Diverse partnerships have improved this project for inmate participants by providing a broad array of educational and service-learning opportunities, as well as providing increased job security. Because inmate participants are involved at multiple levels of silverspot conservation, participating agencies and organizations benefit from these technicians having a more holistic understanding of and greater investment in the project. This project serves as an example of how multiple partnerships can improve the impact and long-term stability of prison conservation efforts.

ORAL

HOST PLANTS OF GOLDEN PAINTBRUSH INFLUENCE ITS SUITABILITY AS A FOOD SOURCE FOR CHECKERSPOT BUTTERFLY LARVAE

Nathan L. Haan, PhD Candidate and Jonathan D. Bakker, Associate Professor, School of Environmental and Forest Sciences, University of Washington, Box 354115, Seattle, WA 98195. nhaan@u.washington.edu

Golden paintbrush (*Castilleja levisecta*) is hemiparasitic, which means in addition to performing photosynthesis, it parasitizes neighboring plants by attaching to their roots and extracting resources. It is a host generalist, parasitizing a wide range of species, although some species are better hosts than others. In South Sound prairies, golden paintbrush is eaten by several herbivores, including Taylor's checkerspot (*Euphydryas editha taylori*) larvae. Paintbrush and its relatives contain iridoid glycosides, bitter secondary chemicals that deter most herbivores but are sequestered by checkerspot larvae which use them as a deterrent against predators. The purpose of this study was to test effects of several host species on golden paintbrush, and to assess whether hosts can indirectly affect checkerspot larvae by changing the quantity or quality of paintbrush available to them as a food source. In a greenhouse, we grew golden paintbrush in pots with six different hosts and a no-host control. We used Colonia checkerspot (*E.e. colonia*, a closely related subspecies of Edith's checkerspot) as a surrogate for Taylor's checkerspot. We placed five larvae on each potted *Castilleja*-host combination, and allowed them to feed until they entered diapause. We found that host identity affected the size and leaf nitrogen content of golden paintbrush, as well as the survival rate, mass, and iridoid glycoside contents of the larvae feeding on golden paintbrush. We conclude that host plants can indirectly affect checkerspot larvae by changing the suitability of golden paintbrush as a food plant.

ORAL

A PHASED APPROACH TO OAK RELEASE ON TURTLEBACK MOUNTAIN, WASHINGTON.

Eliza Habegger, San Juan County Land Bank, 350 Court St. #6, Friday Harbor, WA 98250. eliza@rockisland.com

From 2009 to 2015, the San Juan County Land Bank conducted oak release on 20 acres of Garry oak savannah on Turtleback Mountain Preserve in San Juan County, Washington. Objectives evolved over the course of the project as monitoring increased our awareness of habitat utilization by two of the preserve's rare species, Propertius duskywing and sharp-tailed snake. Actions included conifer removal and girdling, non-native shrub control, burn pile rehabilitation, and caging young oaks to protect them from deer browse. Work was carried out entirely with hand crews using a phased, multi-year approach. Public trails through restoration zones presented both challenges and opportunities. The sequencing, seasonality, and fine details of project implementation were refined over the course of 6 years. We found that the tools and techniques for restoring habitat structure to a Garry oak savannah, while costly, were accessible and effective. However, the goal of increasing native plant abundance and diversity in the understory, which this project did not address, presents a greater challenge. Obstacles to achieving this goal on Turtleback Mountain include heavy deer browse on native forbs and the limited availability of plant materials of local provenance.

ORAL

THE TAYLOR'S CHECKERSPOT BUTTERFLY REARING PROGRAM AT MISSION CREEK CORRECTIONS CENTER FOR WOMEN: BREEDING BUTTERFLIES IN PRISON.

Lindsey Hamilton, Kelli Bush, Joslyn Trivett and Carri LeRoy, Sustainability in Prisons Project, Olympia, WA 98505. LindseyHamilton84@gmail.com

Northwest prairie-oak conservation efforts face significant challenges, with resources often being the limiting factor. Conversely, prisons have a wealth of motivation and talent, but little access to nature and science. The Sustainability in Prisons Project's (SPP) Taylor's checkerspot butterfly (TCB) rearing program at Mission Creek Corrections Center for Women (MCCCW) has found a novel way of pooling resources to contribute to the recovery of this endangered prairie butterfly while simultaneously contributing to a rewarding program for inmate technicians. This program operates through collaborations with multiple partners, each serving distinct missions within unique cultural atmospheres. Accommodating diverse partner needs within the confines of working in a prison environment has proved to be both arduous and synergetic. This presentation will focus on the intricacies of running a captive rearing lab in a corrections center. It will highlight how even though the butterfly husbandry happens in a 10x24 greenhouse, it requires the coordination and support from all facility staff, inmates and outside expertise. It will explain how we have developed a sense of ownership among inmates and Department of Corrections (DOC) staff, in order to increase efficiency, safety and support for the program. It will emphasize how fostering relationships between partners, and empowering inmate technicians has allowed this program to be a significant contributor to meeting TCB recovery targets on South Puget Sound prairies. Lastly, I will speak on the lessons learned, and revelations throughout my personal experience coordinating the program.

ORAL

ESTABLISHING PRAIRIE COMMUNITIES ON ACTIVELY MANAGED GRAZING LANDS IN WESTERN WASHINGTON

. **Sarah Hamman** and Peter Dunwiddie, Center for Natural Lands Management, 120 Union Avenue SE #215, Olympia, WA 98501. shamman@cnlm.org

Working lands have the potential to play an important role in native prairie restoration and endangered species recovery in western Washington. Most ranchlands in this region were established on rich, deep-soil prairies, which are scarcely represented in protected prairie preserves. Although they have been managed to support livestock, many still retain small populations of native prairie plants. However, the capacity of these landscapes to be productive ranchland while simultaneously providing substantial native species habitat is largely unknown. We are evaluating the feasibility of establishing and maintaining a diverse native prairie community on grazing land experiencing different rotational grazing regimes. We seeded a suite of 24 native species into prepared replicate grazed and ungrazed (exclusion) plots at two ranches in Thurston County and evaluated seedling establishment, forage grass cover and bare ground

cover to see if and how grazing is compatible with prairie community establishment. For most seeded annuals and for golden paintbrush (*Castilleja levisecta*), a federally threatened species, there was no significant difference in establishment between grazed and ungrazed sites. There was also no initial difference between grazing treatments in forage species cover. We expect these relationships to change over time as grass and thatch cover increase in ungrazed exclosures, increasing competition and limiting the growth of native species. Understanding how the native plant communities develop in grazed systems will provide guidelines for other landowners that are interested in reintroducing and maintaining natives to their working lands.

ORAL

COVERBOARD ASSESSMENT OF REPTILES AT WEST ROCKY PRAIRIE, THURSTON COUNTY, WASHINGTON. **Marc Hayes and Julie Tyson**, Washington Department of Fish and Wildlife, 600 Capitol Way N, Olympia, WA 98501. Marc.Hayes@dfw.wa.gov

Historically, egg-laying reptiles were restricted to prairie-oak habitats in western Washington State. Those habitats have been reduced 98% from their footprint >100 years ago. This reduction is concordant with few egg-laying reptiles being recorded from prairie-oak habitats over the last 55 years. However, surveys of prairie-oak habitats in western Washington for egg-laying reptiles have been limited, and efficient tools to detect them in these habitats are untested. Coverboards are a passive reptile-detection tool for which the return is higher than alternatives. We tested metal, plywood, and carpet coverboards as tools to detect reptiles in prairie and oak habitats in western Washington at West Rocky Prairie Wildlife Area, a remnant oak and prairie habitat managed by the Washington Department of Fish and Wildlife. All coverboard types were successful in detecting all reptile species (i.e., Northern alligator lizards, *Elgaria coerulea*; and three species of garter snakes [*Thamnophis* spp.]), but reptiles used metal coverboards most frequently, both overall and during seasons with cooler air temperatures (5-20ºC). In contrast, plywood coverboards had greater use during warmer seasons (>20ºC) and detection levels for all species were highest over the spring (April-June) interval. Patterns we observed suggest that use of mixed coverboard types placed early enough to enable sampling during this spring interval will both optimize species detection and maximize species observations.

ORAL

MANAGEMENT STRATEGIES FOR SPECIES OF GREATEST CONSERVATION NEED IN SOUTH PUGET SOUND GRASSLANDS. **David Hays**, Land Conservation and Restoration, Washington Department of Fish and Wildlife. David.hays@dfw.wa.gov

Washington Department of Fish and Wildlife (WDFW) has identified 206 terrestrial Species of Greatest Conservation Need (SGCN) in Washington State in our State Wildlife Action Plan. Of those, 23, or over 10%, are closely or generally associated with the Willamette Valley Upland Prairie Ecological System. Due to the large number of SGCN associated with Willamette Valley Upland Prairie, WDFW has emphasized multi-species management in enhancement and restoration strategies on WDFW lands, and collaborates with partners on multi-species strategies

off WDFW lands. WDFW uses a strategic inter-disciplinary approach to planning enhancement units, and identifies areas with high potential to provide habitat for a number of species. I will discuss strategies that have been successful, species responses to various management actions, and key considerations and techniques used to restore prairies currently occupied by Species of Greatest Conservation Need.

POSTER

CLIMATE CHANGE IMPACTS ON FOUR PERENNIAL FORBS IN PACIFIC NORTHWEST PRAIRIES. **Lauren Hendricks**, Graham Bailes and Bitty Roy, 5289 University of Oregon, Eugene, OR 97403; William Morris, Duke University, Durham, NC 27708; Laurel Pfeifer-Meister, Bart Johnson and Scott Bridgham, 5289 University of Oregon, Eugene, OR 97403. laurenbhendricks@gmail.com

In response to climate change, many species are shifting their geographic ranges. However, the effects of climate change may vary both regionally and by species, and it is difficult to predict how individual populations will respond. The possible effects of climate change on species vary from no effect to range expansion and increased survivorship to extinction locally or globally. Determining how climate change will affect individual species will be important for future management decisions, particularly for the most vulnerable species. To determine how Pacific Northwest prairies could respond to climate change, we are studying the demography (e.g., fitness, plant size) of sixteen natural populations of four perennial forb species native to Pacific Northwest prairies. These populations are distributed along a 700 km latitudinal gradient from Southern Oregon to Whidbey Island, Washington. Our focal species have varying northern range-limits: *Ranunculus austro-oreganus* has its northern limit in southern Oregon, *Sidalcea malviflora* spp. *virgata*, has its northern limit in the Willamette Valley, *Microseris laciniata* is found as far north as Washington, and *Eriophyllum lanatum* is widespread. In addition to climate variables, we also are measuring many abiotic factors (e.g., soil depth, nutrient availability, etc.) to determine the influence of local site factors vs. regional climate. We found significant differences in plant size and fitness between populations for all species. However, preliminary analyses suggest that climate is not a strong predictor; instead, local variation is likely responsible for these differences.

POSTER

LOCAL AND REGIONAL CONTROLS OVER PRAIRIE PLANT RANGE DISTRIBUTIONS UNDER FUTURE CLIMATE CHANGE. Scott Bridgham, Laurel Pfeifer-Meister, Bart Johnson, Bitty Roy, Matt Krna, **Lauren Hendricks and Graham Bailes**, 5289 University of Oregon, Eugene, OR 97403; Mitch Cruzan and Pamela Thompson, Portland State University, PO Box 751, Portland, OR 97207; Daniel Doak 397 University of Colorado Boulder, Boulder, CO 80309; William Morris, Duke University, Durham, NC 27708. bridgham@uoregon.edu

A key challenge in conservation ecology is to understand how climate change will impact biodiversity through changes in species range distributions. Previous modeling studies have

primarily used climatic envelope models to address this question, despite their well-known theoretical limitations. A mechanistic approach that fuses experimentation with demographic models is necessary to provide robust predictions of climatic effects on species range distributions. Moreover, dispersal may limit many species from responding to climate change, especially for many native species that occur in isolated populations in today's highly fragmented landscapes. We are addressing these predictive limitations by (1) using a manipulative climate change experiment at three sites across a 520 km latitudinal climate gradient coupled with 36 natural populations in Pacific Northwest prairies to examine the role of climate versus local factors in controlling the demography of a broad suite of 12 native prairie species that currently reach northern range limits in the Pacific Northwest; (2) determining historical and recent rates of dispersal of a representative group of prairie species using molecular genetics techniques; and (3) synthesizing the first two components in a regional landscape model under three climate change scenarios. To date, warming has decreased recruitment for the 12 species even at the coolest edge of their current ranges, but this effect disappeared when they were moved poleward beyond their current ranges. These results are consistent with predictions that many species will need to expand their ranges poleward to successfully maintain viable populations.

ORAL

MAPPING OAK IN THE PORTLAND AREA USING REMOTE SENSING AND FIELD STUDIES. **Lori Hennings**, Joe Gordon, Justin Houk and Jonathan Soll, Metro Regional Government, 600 NE Grand Avenue, Portland, OR 97232; Ted Labbe, Kingfisher Environmental Services, 6325 N Albina #7, Portland, OR 97217.
lori.hennings@oregonmetro.gov

In 2011 Metro and Kingfisher Environmental Services convened the Intertwine Alliance's Oak Mapping Work Group to create a high quality Oregon white oak (*Quercus garryana*) distribution map for the greater Portland area. In 2013-2014 Metro created a preliminary oak distribution model as follows: we used LIDAR to identify feature heights; summer aerials to create an NDVI vegetation layer; feature heights plus NDVI to identify trees; leaf-off aerials to distinguish conifer from deciduous trees; and within deciduous trees, hand-digitized known oak trees for model training in pilot areas. We created an initial oak distribution model using Feature Analyst software. In 2014 a related field-based project deployed citizen scientists and professionals to map oak and non-oak trees using smart devices and a customizable app. We used these data to conduct an accuracy assessment, the results which are informing the semi-final iteration of the model. For this model iteration, to take advantage of new high quality 2014 LIDAR we will use different software that can employ more structural LIDAR-based variables and under which the objects of interest are automatically drawn tree crown segments rather than hand-digitized oak trees. This summer/fall we will conduct one more citizen science/professional field survey effort, another accuracy assessment, and will produce a final oak model and map in winter 2015-2016. The data will be freely distributed to all interested parties via Data Basin. Oak Mapping Work Group partners will initiate private landowner restoration workshops this fall. Project information is available at: http://www.theintertwine.org/oak-mapping-work-group.

POSTER

TAYLOR'S CHECKERSPOT BUTTERFLY HABITAT ON THE OLYMPIC NATIONAL FOREST. **Karen K. Holtrop**, U.S. Forest Service, 295142 Highway 101, Quilcene, WA 98376; Ann E. Potter and David W. Hays, Washington Department of Fish and Wildlife, 600 Capitol Way N, Olympia, WA 98501; Theodore B. Thomas, U.S. Fish and Wildlife Service, 510 Desmond Drive SE, Suite #102, Lacey, WA 98501. kholtrop@fs.fed.us

We surveyed for Taylor's checkerspot butterflies (*Euphydryas editha taylori*), an endangered species that occurs in lowland prairies, on the northeastern Olympic National Forest 2009-2015. Our objectives were to determine distribution and habitats occupied by Taylor's checkerspots in this region, assess abundance, and determine plant species selected for egg-laying, larval feeding, and nectaring. We surveyed by systematically walking areas with no or little overstory forest vegetation, counting and observing butterflies during the spring - early summer flight period in appropriate weather conditions for butterfly surveys, and searching these sites for larvae during the larvae seasons. We found Taylor's checkerspots in the Dungeness watershed in three types of mid-elevation habitat: (1) early-seral sparsely-regenerating dry Douglas-fir forest, (2) naturally occurring herbaceous balds surrounded by mature dry Douglas-fir forest, and (3) open roadside areas. We observed Taylor's checkerspot egg-laying on two plant species, harsh paintbrush (*Castilleja hispida*) and narrowleaf plantain (*Plantago lanceolata*), and nectaring on numerous plant species. These unique dry sites are faced with a number of threats; and we initiated habitat restoration efforts by removing encroaching vegetation. Monitoring indicates checkerspots utilize newly cleared areas. Regenerating early-seral communities, balds, and roadsides host a diversity of plants and provide valuable habitat for butterflies and other insects, and can be important sites for pollinators.

ORAL

DENDROCHRONOLOGY ACROSS BORDERS: DEVELOPING A NETWORK OF GARRY OAK (*QUERCUS GARRYANA*) TREE-RING CHRONOLOGIES FOR THE PACIFIC NORTHWEST. **David A. Jordan**, Department of Geography and Environment, Trinity Western University, Langley, BC, Canada V2Y1Y1; Gabriel I. Yospin, Institute on Ecosystems, Montana State University, Bozeman, MT 59717; Bart R. Johnson, Department of Landscape Architecture, University of Oregon, Eugene, OR 97403; Doug McCutchen, San Juan County Land Bank, Friday Harbour, WA 98250. davidj@twu.ca

Garry oak (*Quercus garryana* Dougl.), the only native oak species in the Pacific Northwest, has a range extending from central Vancouver Island to northern California. As part of a larger study on the spatiotemporal dynamics of forest succession on current and former oak savanna, we collected increment cores from living trees and cross sections from downed trees in multiple plots at sites ranging in elevation from 10 m – 988 m: from coastal savanna (Beacon Hill), through shallow soil woodland (Saltspring Island and San Juan Islands), valley floor (Finley Nature Reserve), valley buttes (Chip Ross and Mount Pisgah), to the Cascades foothills (Jim's Creek). Where possible, we selected dominant trees for visual and statistical crossdating in order

to enhance common growth signals and reduce the effects of competition and disturbance. We opportunistically sampled cross sections from downed trees, especially those with evidence of fire history. Despite environmental factors impacting growth, we identified marker rings on the majority of cores and fire scars on cross sections indicating a synchronous response by trees to a common radial growth signal. Visual crossdating is confirmed by statistically significant series intercorrelation values at all sites. Chronologies span >400 years from A.D. 1551-2013. Legacy oaks greater than 300 years are common at all sites with individuals older than 400 years identified at four sites. Our results suggest that annually resolved dendroecological data can play a vital role in assessing historical rates and mechanisms of habitat loss and informing future restoration and management needs in Garry oak ecosystems.

ORAL

CONTROLLING INVASIVES WHEN RARE SPECIES ARE PRESENT: THE RESIST DATABASE AND WIKI AS A RESOURCE FOR LAND MANAGERS. **Thomas N. Kaye**, Matt A. Bahm, Erin C. Gray, and Andrea Thorpe, Institute for Applied Ecology, Conservation Research Program, 563 SW Jefferson Avenue, Corvallis, OR 97333. tom@appliedeco.org

Non-native species invasions can negatively impact ecosystem functioning and decrease native species diversity. Land managers need species-specific information regarding potential interactions between rare and invasive plant species. We used literature searches and personal surveys to assess the information available on rare and non-native species interactions, along with methods used to reduce the impacts of invasive plants in rare species habitat. We found that peer-reviewed studies directly addressing interactions between rare and invasive species are uncommon, however those found demonstrated a wide range of interspecific interaction, the majority with negative effects. Grey literature offered a wealth of information regarding more species-specific information. Surveys of land managers and conservationists identified the need for increased communication, particularly involving control methods for invasive species in the presence of a rare species. This study indicates the great need for shared knowledge between scientists and land managers. IAE has worked with funding partners to create a system that allows land managers to access scientific, grey literature, and to store institutional knowledge to increase understanding in habitats where rare and non-native species co-occur.

ORAL

POTENTIAL EFFECTS OF CLIMATE CHANGE ON RARE NATIVE SPECIES IN OREGON: AN ASSESSMENT WITH CLIMATE DRIVEN POPULATION MODELS.
Thomas N. Kaye and Ian Pfingsten, Institute for Applied Ecology, 563 SW Jefferson Avenue, Corvallis, OR 97333. tom@appliedeco.org

The climate in the Pacific Northwest is forecasted by many global circulation models to warm substantially in the next 100 years, with associated seasonal changes in precipitation. This climate change is likely to affect most species in our region over the next 100 years. We correlated demographic data on plant survival, growth, and reproduction from six rare plants and

population growth of a butterfly species, *Icaricia icarioides fenderi* (Fender's blue), with seasonal weather variables. We then used Climate Driven Population Models (CDPMs) to project populations of these rare species over the next century under different climate scenarios from the Intergovernmental Panel on Climate Change (IPCC 2013), including no change in climate, moderate climate action (RCP 4.5), and no climate action (RCP 8.5). The impact from climate change on long-term population growth in CPDM simulations was mixed across the species examined. For example, *Astragalus tyghensis*, *Calochortus greenei*, *Horkelia congesta*, and *Icaricia icarioides fenderi* had projected increases in population growth by 2099 due to climate change, while *Lomatium bradshawii*, *L. cookii*, and *Pyrrocoma radiata* projected decreases (Table 9). *P. radiata* showed the largest decrease, -18% and -20%, for RCP 4.5 and 8.5, respectively, and *A. tyghensis* had the largest increase in the RCP 4.5 and 8.5 scenarios (+7% and +8%, respectively). *H. congesta* had the smallest change in long-term growth due to climate change. Climate change is very likely to affect individual species in differently, and is likely to play out on the landscape in complicated, difficult to predict ways.

ORAL

FLORAL VARIATION, POLLINATOR BEHAVIOR, AND GEOGRAPHY IN RARE AND COMMON SPECIES OF *CAMASSIA*: HOW IMPORTANT ARE PLANT-POLLINATOR INTERACTIONS IN NATURAL COMMUNITIES? **Susan R. Kephart**, Willamette University, 900 State Street, Salem, OR, 97301. skephart@willamette.edu

Emerging global networks on pollinators highlight the necessity of collaboration among researchers, policy-makers, and educators. Maintaining diverse communities and human-managed landscapes, however, depends on understanding the foundational and interacting populations that sustain them. The genus *Camassia* is a potential magnet for pollinator services in spring-flowering prairies, wetlands and oak savannas. We studied spatio-temporal variation in the abundances of 'generalist' pollinators whose role in species divergence and in conserving key functions within these habitats is little-known. We sought to discover if pollinator faunas differ geographically or by species in Northwest populations and whether foraging behavior affects species boundaries in *Camassia* or provides mechanisms for adaptation in changing climates. We focused on the widespread *C. quamash* and *C. leichtlinii* and geographically-restricted *C. howellii*; all provide nectar and pollen for social and solitary bees in diverse microclimates at varied elevations. We tracked phenological variation in insect and plant populations, foraging behavior, and pollinator effectiveness while also manipulating floral density and traits to determine their effect on visitation, constancy, and seed set. Capture data and in-situ observations revealed significant geographic and species-based variation in major pollinators, including vespertine and diurnal bees. Several lines of evidence indicate that *Bombus* is an effective pollinator, and both solitary and social bees showed strong preferences for *C. leichtlinii*, with abundances up to 5x greater than on *C. quamash.* While specialization is efficient for insects and can reduce interspecific pollination, climate change may favor opportunistic 'generalist' foragers when resources vary asynchronously with potential fitness losses among interacting species.

ORAL

SPECIES DIFFERENCES IN WESTERN *CAMASSIA* (AGAVOIDEAE: ASPARAGACEAE): WHAT ARE THE IMPLICATIONS FOR CONSERVING OR RESTORING PRAIRIE AND OAK SAVANNA POPULATIONS?

Susan R. Kephart, Willamette University, 900 State Street, Salem, OR 97301. skephart@willamette.edu

Camassia, "*qém'es*" or camas "lilies," occur in prairies and oak savannas from coastal to montane regions, including spring-fed wetlands that become bone-dry in summer. Molecular, chromosomal, and morphological characters now link camas to soaproot (*Chlorogalum*), rush "lilies" (*Hastingsia*), and other *Agave* relatives. Yet remarkably, despite the value of *Camassia* to indigenous groups and to historical and present-day restoration efforts, we know relatively little about this spring-flowering geophyte. So how do we decipher the puzzling taxonomic variability of this ecologically significant genus? How important are geographic provenance, local adaptation, and habitat differentiation for prairie restoration and reintroduction choices, or collecting seeds for use and long-term storage? Six species comprise *Camassia*; four occur in Oregon alone and two, *C. leichtlinii* (great camas) and *C. quamash* (common camas), together encompass 10 subspecies. In California they are strictly allopatric, yet in Oregon these species more often grow together than apart. Although hybrids occur in the Willamette Valley, the species remain distinct via differences in flowering phenology and post-zygotic reproductive barriers. Rare Howell's camas (*C. howellii)* is also sympatric yet distinct from *C. leichtlinii* in Oregon, but occurs allopatrically in two California counties. This talk highlights easy-to-recognize differences among species, subspecies, and hybrids, covering traits that may be useful in future projects. Preliminary research on seed germination suggests that mechanical shaking of capsules may not be the only seed dispersal mode. Overall, the diverse trait and color variation in *Camassia* has implications for conservation strategies, study design in reintroductions, and how hybridization influences key outcomes.

ORAL

USING A COLLABORATIVE APPROACH TO SUPPORT RECOVERY OF SEVERAL SPECIES OF GREATEST CONSERVATION NEED IN WASHINGTON AND OREGON.

Elspeth Kim, Center for Natural Lands Management, 120 Union Avenue SE #215, Olympia, WA 98501. ekim@cnlm.org

Prairie-oak habitats of the Pacific Northwest are one of the most imperiled habitats in the United States. Washington has seen a >90% loss of native prairie with only 3% of the remainder dominated by native vegetation. Similar rates of habitat degradation and loss have occurred in Oregon. The loss of this important habitat has led to decline of many associated species, including the federally protected streaked horned lark, Taylor's checkerspot butterfly, and Mazama pocket gopher. To address the complex and urgent need for conservation, the Center for Natural Lands Management has partnered with the Washington Department of Fish and Wildlife and ten other conservation entities to restore habitat, increase monitoring, and coordinate landscape scale conservation with funding support from two competitive State Wildlife Grants. The goal of the two-phase project is to substantially improve the population status of 22 rare

and/or declining Species of Greatest Conservation Need and associated native plants that are found in prairie-oak habitats of the Willamette Valley and Puget Trough regions of western OR and WA. This is being accomplished through coordinated conservation actions, including on-the-ground restoration of nearly 1,500 acres across 30 sites, standardized habitat, bird, and butterfly monitoring, ecoregional coordination, and public outreach. This presentation will highlight benefits and lessons learned from this bi-state project and present habitat assessment data that represent on-the-ground gains made to date.

ORAL

USE OF GRAZING AS A MANAGEMENT TOOL ON CONSERVATION LANDS WITH LISTED SPECIES. **Kim Klementowski** and Cathy Little, Center for Natural Lands Management, 27258 Via Industria, Suite B, Temecula, CA 92590. kklementowski@cnlm.org

Grazing is a valuable management tool on conservation lands containing listed species. California has a long history of grazing and rangelands have become an important component of both the ecological and economic landscape. Rangeland science has evolved, and with advocacy from organizations such as the California Rangeland Conservation Coalition, these practices have been adopted by conservation land managers. The goals associated with grazing conservation lands may differ from those of lands geared towards economic production, but land managers and ranchers have come together across California to successfully balance both ecological and economic values. Although the conservation management goals may be clear, a land manager may be uncertain as to the appropriate grazing strategy to accomplish these goals, particularly the choice of grazing animal. Consideration should be given to the logistical variations required for different types of grazing animals as well as the contractual components between the land manager and the rancher. Different grazing animals produce different results across the landscape, including favored plant species for forage, method and impacts of the animal's movement, and timing needed to achieve project goals. Accessibility of the landscape may be critical to install and repair boundary fencing or provide supplemental feed and water. Furthermore, projects where grazing animals are the primary management tool may face uncertainty with unpredictable natural conditions, such as drought, that could impact the ability to achieve project goals or fulfill contractual obligations with the rancher. Knowledge of above components contributes towards a successful partnership with land managers and ranchers.

POSTER

SEEDING TIME TRIALS FOR SELECTED SOUTH PUGET SOUND PRAIRIE SPECIES. **Sarah Krock**, Joint Base Lewis-McChord Fish and Wildlife, 1210 Mann Ave, JBLM, WA 98433. Sarah.l.krock2.ctr@mail.mil

Seeding time trials were performed on 23 native prairie species to determine what time of year broadcast seeding would result in the highest percent establishment in the field. We tested September, October, December, March, a control, and an un-manipulated control on three sites (Upper Weir, Lower Weir, and South Weir prairies) on Joint Base Lewis-McChord, WA. All selected sites were in 2014 burn units, and were prepared by hand raking to mimic the harrowing

usually done by tractors. Seeds were mixed with vermiculite to enable more even distribution through a drop spreader and applied evenly across 25m^2 replicates. Monitoring was done in May and June 2015 to assess percent cover of natives and density of seeded species. Preliminary results indicate that earlier seeding times (September and October) produce higher densities of some species. This research may suggest certain seeding times are better than others for meeting restoration objectives.

ORAL

POST-FIRE DISTRIBUTION OF MAZAMA POCKET GOPHER ON JOINT BASE LEWIS-MCCHORD. **Bill Kronland,** Center for Natural Lands Management, 120 Union Avenue SE #215, Olympia, WA 98501. bkronland@cnlm.org

Prescribed fire is among the most effective tools for restoring and maintaining native grasslands in the South Puget Sound region. Fire prevents expansion of forests on existing prairies, controls invading shrub species, and can create conditions favorable for the germination of native seeds. Many rare and federally-listed species also appear to respond well to fire, including the Mazama pocket gopher. It is believed the removal of shrubs and other woody plant species create grassland conditions preferred by pocket gopher. Still, it is unclear how Mazama pocket gopher respond to prescribed fire in areas occupied by the species. Consumption of surface vegetation may result in a constriction of gopher distribution within burned areas, particularly in dry years when food is in short supply. Alternatively, fire may improve habitat quality that could result in an increase in species distribution. We conducted post-fire mound surveys in 2015 on at least six burn and three control units known to be occupied by pocket gopher on Joint Base Lewis-McChord. Surveys followed a repeat-visit patch occupancy design, and were conducted within 24 hours of prescribed fire. We returned to burn and control units in mid-October to assess changes in patch occupancy, and plan to conduct a third round of surveys in late spring 2016. Moreover, we measured day-of-burn conditions on a sub-sample of units to examine influence of fire condition of gopher distribution within burn units.

ORAL

PRAIRIE HABITAT MONITORING ON JOINT BASE LEWIS-MCCHORD. **Bill Kronland**, Center for Natural Lands Management, 120 Union Avenue SE, Suite #215, Olympia, WA 98501. bkronland@cnlm.org

Understanding habitat condition is essential for any management program, especially those actively involved in restoring habitat for rare and federally-listed species. Monitoring provides feedback to land managers for assessing efficacy of restoration efforts, allows for informed allocation of resources, and can refine understanding of how target species use the landscape. Effective monitoring efforts can also assess management objectives in a manner that is cost effective and repeatable across years and field personnel. We initiated prairie habitat monitoring on Joint Base Lewis-McChord (JBLM) in spring 2015, based on results of pilot efforts conducted in 2014. Our goal was to assess habitat condition and overall native-grassland quality

as defined by specific management objectives concurrently being developed on JBLM. Our efforts focused on Priority Habitat Areas for three federally-listed species (Taylor's checkerspot butterfly, streaked-horned lark, Mazama pocket gopher), using point-intercept methods to quantify vegetation cover and structure on a systematic sample of plots. We also conducted area-search surveys to quantify the number of species present on each plot, because point-intercept tends to under-sample rare or patchily-distributed species. Our efforts in 2015 examined prairie habitat quality on four JBLM Training Areas, and two ranges within the Artillery Impact Area. Results from our efforts will be used to establish baseline habitat conditions in these areas, and guide on-going management strategies on JBLM.

ORAL

DEER HERBIVORY SIGNIFICANTLY REDUCES LARVAL SURVIVORSHIP IN A RARE PIERID, EUCHLOE AUSONIDES INSULANUS (LEPIDOPTERA, PIERIDAE). **Amy M. Lambert,** School of Interdisciplinary Arts and Sciences, University of Washington, 18115 Campus Way NE, Bothell, WA 98011; Julie K. Combs, School of Environmental and Forest Sciences, University of Washington, Seattle, WA 98195; Jerald Weaver, San Juan Island National Historical Park, Friday Harbor, WA 98250; Ann Potter, Washington Department of Fish and Wildlife, Olympia, WA 9850. lambea@uw.edu

Our study links basic ecological research to applied conservation and management of one of the most restricted butterfly endemics in the continental United States, the island marble butterfly, *Euchloe ausonides insulanus* Guppy and Shepard 2001(Pieridae). Here, we quantify and compare larval survival and causes of mortality in all immature stages (egg-instar V) of *E. ausonides insulanus* on patches of a primary host plant, *Brassica rapa*, in deer exclusion versus deer exposed plots. We found that egg to instar I survivorship was significantly higher in deer exclusion plots compared to controls. Death due to deer accounted for a relatively large percentage of total mortality (24%). Predation (by spiders and birds) was the greatest source of mortality in both fenced (55%) and control study sites (47%). Our results indicate that high egg mortality on a primary host plant, *B. rapa*, was mainly attributed to predation and deer herbivory. Mortality factors such as deer herbivory and predation likely contribute to the rarity of *E. ausonides insulanus*. We suggest exclusion of deer on targeted host plant patches will likely lead to the increased survival of *E. ausonides insulanus*. We discuss several key management strategies to support the protection and conservation this rare butterfly.

ORAL

THE TAYLOR'S CHECKERPOT BUTTERFLY REARING PROGRAM AT MISSION CREEK CORRECTIONS CENTER FOR WORMEN: PEER TO PEER TRAINING AND THE INMATE EXPERIENCE. **Carolina Landa**, Lindsey Hamilton, Kelli Bush, Joslyn Trivett and Carri LeRoy, Sustainability in Prisons Project, Olympia, WA 98505. carolinazachariah@yahoo.com

The Sustainability in Prisons Project, Oregon Zoo, Washington Department of Fish and Wildlife and Washington Department of Corrections have implemented a captive rearing lab for the Taylor's checkerspot butterfly (TCB) in a prison, and have put trust in inmate technicians to keep it in motion. Larvae release numbers clearly show our contribution to the recovery of this endangered species. Also, adding a second captive rearing lab makes it possible for back up if needed, which is in itself a positive for the TCB captive rearing effort. Receiving training from the Oregon Zoo is critical for ensuring this success. Continuous training relayed through the student coordinator also makes that person very valuable. However, the peer to peer training is what left me with a lasting memory. I believe the technicians gain a lot from the program. It opens our minds up to a different way of life, in a place where you would not expect to encounter an experience like that. It gives us a feeling of ownership and leadership, at a time in our life where this is crucial. We are giving back to the community and the environment through these butterflies, and they are giving back to us as well. This presentation will focus on what it is like to be an inmate butterfly technician. It will highlight how we work independently and train one another. Lastly, it will explain how this opportunity has helped me to see life through a different lens.

POSTER

BRUSH REMOVAL MONITORING: EVALUATING EFFECTIVENESS OF MOWING AS A METHOD TO REDUCE RE-GROWTH OF SCOT'S BROOM (*CYTISUS SCOPARIUS*).

Christa LeGrande, Integrated Training Area Management Program, Range Support, 4074 Kaufman Avenue, Fort Lewis, WA 98433. Christa.l.legrande.ctr@mail.mil

The Range and Training Land Assessment (RTLA) component of the Integrated Training Area Management (ITAM) program at Joint Base Lewis-McChord (JBLM) began a project in 2011 to evaluate how the seasonal timing of mowing affects the re-growth rate of Scot's Broom (*Cytisus scoparius*). Scot's Broom is a prolific invasive perennial shrub that reduces maneuverability, visibility, and native prairie structure. Brush mowing is a year-round effort, however, if Scot's Broom is most vulnerable to mowing during a certain season, control efforts could be concentrated during that period to maximize effectiveness. Partnering with the Land Rehabilitation and Maintenance (LRAM) component of ITAM, RTLA established 109 50-meter transects in areas mowed by LRAM during different months of the year. Sites varied in Scot's Broom establishment, training area, and location in the prairie-oak landscape. Line intersect data and quadrat data were collected to estimate average percent cover and average height of Scot's Broom for each transect over four years. We hypothesized re-growth would be slowest if mowed in the late summer, when conditions were harsh and after the plant expended most of its energy flowering. In contrast, we found that mowing any time during the fall and winter (September – February) yielded nearly three times the re-growth rate for both cover and height compared to areas mowed in the spring and summer (March – August). This information will assist LRAM in continuing to establish best management practices for Scot's Broom on JBLM, and utilizing the time spent mowing to most effectively control for Scot's Broom.

ORAL

ARE BARE ROOT MATERIALS SUITABLE FOR OAK PRAIRIE RESTORATION? POSSIBILITIES AND IDEAS. Todd Jones, **Dylan Levy-Boyd**; Fourth Corner Nurseries, 5652 Sand Rd, Bellingham, WA 98226. Dylan@fourthcornernurseries.com

The efficiencies of using seed, compared to live plant materials, for large scale restoration of prairie habitats are clear. Still, having more types of native plant material available in the proverbial restoration tool box is handy. In the Pacific Northwest a diverse array of native species are being produced "bare root". Everything from obligate wetland dwellers, to bulbs, to herbaceous perennials, and of course woody stem trees and shrubs can be field grown for restoration projects. Drawing on more than 30 years of experience propagating over 300 species from source identified seed, we will look to answer some basic questions: what are the advantages and disadvantages of bare root, what do these different types of bare root materials look like, what to expect when considering bare root plant materials and how to specify them in plans, and when are they available? To answer these questions we will highlight production techniques and options particular to species of the oak prairies of Cascadia.

ORAL

REACHING ACROSS THE WALL TO SAVE ENDANGERED BUTTERFLIES: OPPORTUNITIES AND CHALLENGES FOR ZOOS PARTNERING WITH PRISONS. **Karen D. Lewis** and Julia Low, Oregon Zoo, 4001 SW Canyon Road, Portland, OR 97221. Karen.Lewis@oregonzoo.org

Taylor's checkerspot butterfly (*Euphydryas editha taylori*) was reduced to one population in the Puget Trough and only scattered populations in the Georgia Basin and Willamette Valley by 2004. Conservation partners joined forces and developed habitat restoration, captive rearing, and reintroduction programs to reduce the likelihood of extirpation from the Puget lowlands. Oregon Zoo began rearing checkerspots in 2004 and the first release occurred in 2006. The program was expanded to include captive breeding in 2008. Habitat recovery efforts led to expanded release opportunities and a corresponding increase in the number of captive reared larvae required. In 2011, under the Sustainability in Prisons Project, a second captive rearing facility was established at Mission Creek Corrections Center for Women. This expansion requires extensive support from Oregon Zoo resulting in a robust partnership among offenders, corrections staff, SPP, WDFW, and zoo staff, volunteers and interns. Opportunities include availability of affordable, year-round, 7-day/week staffing, motivated and dedicated offender technicians, space available for construction of facilities, and expanded audience for zoo conservation messaging. Challenges include distance between rearing facilities, quality and timeliness of communication among partners, program support from corrections staff, recruitment of suitable offender technicians, and limits on offender travel and hourly wage. In 2014, with a different set of partners, a different model, and a different species, OZ began another partnership. This one with OR-DOC and IAE to propagate and harvest violet leaves to feed our Oregon silverspot butterfly (*Speryeria zerene hippolyta*) larvae. This new partnership offers many similar benefits and challenges.

ORAL

GRAMINOID-SPECIFIC HERBICIDE IMPACTS ON *CAMASSIA QUAMASH* (COMMON CAMAS) GROWTH, ABUNDANCE AND REPRODUCTION. **Alex Lincoln** and Sarah Hamman, Center for Natural Lands Management, 120 Union Avenue SE #215, Olympia, WA 98501; Rachel Brooks, U.S. Fish and Wildlife Service, Olympia, WA 98501. ael02010@mymail.pomona.edu

As invasive grass removal continues to be a focus of prairie restoration efforts in the South Puget Sound prairies of Washington State, increasing our knowledge of off-target effects of herbicide treatment is paramount. Two graminoid-specific herbicides, flauzifop-p-butyl (Fusilade) and clethodim (Envoy Plus), are frequently used to control invading grasses with little knowledge of how these chemicals impact other native plants. One such plant, *Camassia quamash* (common camas), is a forb characteristic of Washington prairies that is often growing in areas treated with these herbicides. Because *C. quamash* historically held ethnoecological significance to native peoples and is an important resource for native pollinators, land managers should ensure that management methods do not negatively impact this plant. The objective of this study was to understand if and how various seasonal applications of different herbicides may impact *C. quamash*. We implemented a full-factorial design testing the effects of herbicide type (flauzifop-p-butyl, clethodim, control) and application season-frequency (mid-spring, late spring, fall; one, two, or three applications per year). Estimates of growth (biomass, leaf height and width, number of leaves), abundance (percent cover), and reproduction (number of flowers, number of seeds and seedpods produced, seed pod success, and seed viability) were investigated. Our results showed that none of the herbicide treatments had lasting negative impacts on *C. quamash* across all parameters studied, suggesting that repeat applications of either flauzifop-p-butyl or clethodim can be safely used in areas with high concentrations of this iconic prairie species.

ORAL

MANAGING RISK ON OCCUPIED SITES: A GRID-BASED APPROACH TO HABITAT MAINTENANCE AND RESTORATION. **Mary Linders**, Washington Department of Fish and Wildlife, 600 Capitol Way N, Olympia, WA 98501. mary.linders@dfw.wa.gov

According to the IUCN Red list, habitat loss threatens 85% of at-risk species. However habitat management on occupied sites risks unintended consequences where species data and/or coordination are inadequate. This is particularly problematic for invertebrates occupying open grassland. The federally-endangered Taylor's checkerspot butterfly (*Euphydryas editha taylori*) resides in forb-rich grasslands from western Oregon to British Columbia. Human-induced fire is the primary reason this ecosystem exists, for it is at constant risk of invasion by exotic plants and by native trees and shrubs. Restoration and maintenance also requires herbicide, mowing, seeding and planting, all of which can kill or injure checkerspots and their food plants. To co-manage resources and treatment activities, we applied 25 x 25-m grids across 6 occupied sites within which vegetation and species data were spatially housed. Habitat data include 16 variables characterizing checkerspot food resources, vegetation structure, and resilience to invasion; checkerspot data were available for adult and some larval stages. Data were used to assess

habitat suitability and where improvements were needed, burn units were identified to minimize inclusion of checkerspot locations; herbicide and seeding treatments follow burn unit boundaries. Checkerspot concentration areas were also identified, and in one case fenced to reduce recreational impacts; within these areas, restoration technicians employ limited and carefully-timed actions. Another application of the data framework illustrates how military training routes interface with critical habitat features and wildfire to limit checkerspot distribution. Grid-based data management increases the power and extends the application of data for recovery.

ORAL

RAPID HABITAT ASSESSMENT: ASSESSING SITE SUITABILITY AND DETECTING HABITAT CHANGE FOR A FEDERALLY ENDANGERED SPECIES. **Mary Linders**, Washington Department of Fish and Wildlife, 600 Capitol Way N, Olympia, WA 98501. mary.linders@dfw.wa.gov

Habitat loss and degradation is a primary threat responsible for the endangerment of species worldwide. Habitat restoration for the purpose of recovery requires measurable criteria designed to accommodate a species' biological needs for food, shelter, reproduction and safety; ectotherms also require thermoregulatory sites. Tracking abundance and distribution of multiple key resources is challenging but crucial to demonstrating restoration success and its benefit to species recovery. Listed as federally-endangered in 2013, Taylor's checkerspot butterfly (*Euphydryas editha taylori*) has suffered dramatic declines, most recently in 1996-2006, when remaining habitat was insufficient to accommodate population fluctuations at many locales, including six sites in western Washington's Puget lowlands. One extant site serves as a reference for habitat restoration and population source for reintroduction in the region. To assess site suitability for reintroduction, identify outstanding management needs, and monitor habitat condition, we identified and mapped 16 variables characterizing food resources, vegetation structure, and resilience. Invasive exotic vegetation overtops and excludes food resources, alters vegetation structure and limits the availability of open ground needed for thermoregulation and movement. Data collected in 2013-2015 on 12 sites were assessed against a set of thresholds established from 1) data in the scientific literature, 2) local and regional research, 3) existing occupied habitat, and 4) local expertise. Five acre units (sufficient for one year of release and population expansion) were classed as either reintroduction-ready or in need of changes identified in the assessment matrix. Sites will be re-assessed on a 3-year cycle. Fully restored sites will support five 5-acre reintroduction units plus 25 acres of suitable habitat. A standardized approach for assessing measureable targets is improving restoration planning, communication between project partners, and transparency in decision-making and action.

ORAL

TAYLOR'S CHECKERSPOT REINTRODUCTION: A COMMITMENT OF PATIENCE AND PERSISTENCE. **Mary Linders**, Washington Department of Fish and Wildlife, 600 Capitol Way N, Olympia, WA 98501. mary.linders@dfw.wa.gov

Reduced to small, scattered populations by 2006, Taylor's checkerspot butterfly (*Euphydryas editha taylori*) was nearly extirpated from grasslands west of the Cascade Mountains in Oregon to British Columbia. Fluctuations in abundance intersect with habitat loss and degradation to threaten remaining populations. In the Puget lowlands of western Washington, the only extant population (and largest in the species range), occurs on a portion of Joint Base Lewis-McChord where large arms, live-fire military training is the highest priority. To avoid loss of this vital population and its unique genetics, reintroduction trials were initiated at historical sites on and off JBLM in 2006. Since 2008, one to five releases of 340-3,372 captive-reared, postdiapause larvae have been used at each Puget lowland reintroduction site. Larvae feed before pupating and eclosing as adults in the vicinity of release areas, where females in turn, deposit their eggs. Distance sampling is used to monitor the adult population. In 2014, peak daily abundance estimates for five reintroduction sites ranged from 91 on an active release site to 783 on a site whose last release was in 2011. Raw data from 2015 suggest either similar or better numbers than in 2014. We define an established population as one with at least 250 adult butterflies (single day abundance estimate) that are widely distributed across a monitoring area at least 20 ha in size, and whose occupancy is based solely on reproduction each year, for five consecutive years. Checkerspot populations are highly volatile, requiring substantial and consistent investment by a public and private conservation collective to insure reintroduction success.

ORAL

LEARNING HOW TO RESTORE AND STEWARD OAK HABITAT ON WORKING LANDS IN THE LONG TOM WATERSHED, WILLAMETTE VALLEY, OREGON. **Katie MacKendrick**, Long Tom Watershed Council, 751 S Danebo Avenue, Eugene, OR 97402. restoration@longtom.org.

Oak and prairie habitat in the Long Tom Watershed has been described as the anchor for the entire Willamette Valley because of the amount of intact habitat remaining. Less than two percent of oak and prairie habitats remain; they are the rarest habitat types in the Long Tom Watershed. In the Willamette Valley, as much as 98 percent of remaining oak and prairie habitat exists on private land. In the Long Tom Watershed, 90 percent of land is privately owned. Oak and prairie habitat restoration is a top priority for the Long Tom Watershed Council because of the number of listed species these habitats support, the degree to which they have been altered and eliminated, and the limited dispersal ability of rare species. Efforts to restore and steward oak and prairie habitat must include private lands, in particular working farms and forests. Projects that accomplish meaningful restoration in partnership with committed private landowners are vital to ensure the future of rare habitats and species in the Willamette Valley. Yet, to carry out these projects requires building lasting relationships founded on trust, common interests, and balanced objectives. It requires short, middle, and long-term restoration and stewardship approaches that are thoroughly clarified, possible, and affordable. The Long Tom Watershed Council has developed an outreach approach that combines building relationships on working lands with a collaborative landscape perspective and commitment to oak and prairie habitat restoration. Actions on private lands can contribute to landscape-scale restoration as evidenced by the Lower Long Tom Conservation Area and the involvement of multiple Rivers-to-Ridges Partnership organizations.

ORAL

BUTTERFLY-SAFE WINE? ENGAGING PRIVATE LANDOWNERS IN ENDANGERED SPECIES RECOVERY. **Nicole Maness**, Willamette Partnership, 4640 SW Macadam Avenue, Suite #50, Portland, OR 97239. maness@willamettepartnership.org

With the majority of habitat for federally listed species found on private land, engaging landowners in habitat restoration and protection is key for threatened and endangered species recovery. Willamette Partnership's Incentives Trifecta program is working with landowners, scientists, and regulatory agency staff to develop a suite of market-based tools that will allow landowners, actively creating or restoring habitat for imperiled species, to access a suite of conservation incentives. By incorporating species-level science into the performance standards for eco-label certification, ecosystem service credits and regulatory assurances, the Incentives Trifecta links delivery of these incentives through common metrics, accounting systems, and policy templates. This talk will describe the pilot application of Incentives Trifecta program in Oregon's Willamette Valley where vineyard owners and managers are participating in the recovery of the endangered Fender's blue butterfly. Under the pilot, a Programmatic Safe Harbor Agreement will allow landowners who meet Salmon-Safe's management standards for Fender's and use Willamette Partnership's Upland Prairie Credit Calculator to measure benefits to the species, to receive formal assurances from the US Fish and Wildlife Service that their effort to conserve prairie habitat will not lead to additional regulatory burdens under the Endangered Species Act. Anticipated benefits of the Incentives Trifecta approach include greater interest and participation of private landowners in conservation management, and ideally a more rapid recovery and potential down or delisting of an endangered species.

ORAL

ESTABLISHING NEW POPULATIONS OF A RARE SPECIES: LESSONS FROM GOLDEN PAINTBRUSH. **R. Adam Martin** and Peter W. Dunwiddie, Center for Natural Lands Management, 120 Union Avenue SE #215, Olympia, WA 98501. amartin@cnlm.org

Re-establishment of golden paintbrush (*Castilleja levisecta*) is a major restoration objective at many sites in the Pacific Northwest. However, reintroducing species is a time and resource intensive task, and it is imperative restoration is carried out as efficiently as possible. Reintroduction of golden paintbrush in South Puget Sound prairies over the past decade has been carried out in ways that maximize learning opportunities. We have used diverse reintroduction techniques over multiple sites and years to develop a successful restoration framework integrating natural history and management knowledge. In one long-term study, we used >5000 golden paintbrush plugs out-planted in 2007 at six sites to greatly enhance our understanding of site and habitat preferences. We found productive soils, native perennial species richness, ecological similarity to the closest extant population, and a recent burn history were the most important habitat filters at the site and micro-site level. This information has been used to identify the most favorable locations for subsequent, larger scale reintroductions in which golden paintbrush has been established by seeding. This approach has greatly improved seeding success, and facilitated a transition from the costly growing and out-planting of individual plugs to

sowing seed into carefully selected habitats. Current work now focuses on how to enhance the long-term persistence and growth of these reintroduced populations.

ORAL

BURNING FOR BUTTERFLIES. **R. Adam Martin** and Sarah Hamman, Center for Natural Lands Management, 120 Union Avenue SE, Olympia, WA 98501**;** Kathryn C. Hill, School of Environmental and Forest Sciences, University of Washington, Seattle, WA 98195. amartin@cnlm.org

Prescribed fire is a keystone management tool in prairie restoration. Rare and sensitive butterfly species often direct this management, and the restoration and enhancement of their habitat is a primary objective of many prescribed burns. It is important to understand how we can utilize fire to create and maintain butterfly habitat, particularly for the Taylor's checkerspot butterfly, while limiting direct negative impacts to the butterfly itself. Intensive monitoring of vegetation, burn day weather, fire intensity and fire severity has increased our ability to understand how fire impacts butterfly habitat and the belowground conditions where the Taylor's checkerspot butterfly rests in diapause throughout the burn season. In degraded habitat, fire reduced exotic shrub cover and shifted the community from tall exotic perennial grasses to annual and perennial forbs. Key butterfly resource plants responded either neutrally or positively to burning, depending on fire severity and intensity. Average maximum belowground temperatures varied dramatically between and within burns, based on fire severity and intensity. Fire severity and intensity are driven by fuel moisture, air temperature and humidity. Burning during different times of year, burning at different times of the day, and using multiple ignition patterns can influence these factors. As we begin to understand the linkages between burn day weather, fire severity, and fire effects, we can more effectively craft fire prescriptions to enhance habitat benefits and limit direct negative impacts on fire-sensitive butterflies.

ORAL

PRAIRIE AND OAK WOODLAND RESTORATION IN TRAINING AREAS OF CANADIAN FORCES BASE ESQUIMALT. **James Miskelly**, Saanich Native Plants, 741 Haliburton Road, Victoria BC, Canada V8Y1H7. james.miskelly@gmail.com

Rocky Point is the largest property associated with Canadian Forces Base Esquimalt near Victoria, BC. The property hosts a number of military activities and includes approximately 600 ha of prairie and oak woodland. These habitats support populations of 10 federally listed species at risk and at least 25 provincially listed species. Encroachment by conifers, Scotch Broom, and Gorse poses a threat not only to ecological values, but also to military objectives. Until recently, Gorse infestations had effectively closed almost half of the training areas. Since 2009, invasive shrubs and encroaching conifers have been removed over about 75 hectares. Shrubs are being removed with a combination of mechanical methods and herbicide treatments. These actions have greatly improved ecological condition and training capacity. Ongoing challenges include removal of biomass produced by conifer control and the continued dominance of nonnative grasses throughout the site.

ORAL

CONSERVATION OF STREAKED HORNED LARKS IN OREGON'S PRAIRIE(ISH) LANDSCAPE: WHAT WE KNOW, WHAT WE NEED TO KNOW. **Randy Moore**, Oregon State University, Corvallis, OR 97330. Randy.moore@oregonstate.edu

The bulk of the global streaked horned lark (*Eremophila alpestris strigata*) population resides in Oregon, and the great majority of Oregon's SHLA are found in the lower two-thirds of the Willamette Valley. Living in this area's matrix of agricultural and natural prairie-like habitats is both challenging and rewarding for larks. While the disturbance upon which the species depends is very consistent (and is likely responsible for the bird's continued existence here), the timing and nature of the disturbance can present local, and possibly regional, difficulties in successful reproduction and survival. This presentation will focus on what we've learned about natural history and population dynamics of larks in the Willamette Valley, and what we need to know in order to maintain healthy populations in the core of SHLA range.

ORAL

ENGAGING PRISONS IN SAGEBRUSH PROPAGATION. **Stacy Moore**, Larkin Gunther and Tom Kaye, Institute for Applied Ecology, 563 SW Jefferson, Corvallis, OR 97333. stacy@appliedeco.org

The population of incarcerated adults in US prisons represents an opportunity to increase the capacity for habitat conservation in a win-win relationship that benefits inmates as well as wild lands. The purpose of "Engaging Prisons in Sagebrush Propagation," is to improve habitat for Greater sage-grouse by collaborating with state prison systems in production of sagebrush for habitat restoration. Greater sage-grouse is a candidate for listing by the US Fish and Wildlife Service as a threatened or endangered species. Loss of sagebrush habitat is the primary driver of the decline of this species in the western United States. Sagebrush provides crucial food and cover for the birds at multiple stages of their lifecycle. Production of sagebrush within state prison systems represents an opportunity to provide urgently needed plant materials. The Institute for Applied Ecology (IAE) is a nonprofit organization based in Oregon and is working with prisons to propagate sagebrush and milkweed for restoration projects. In 2014, IAE worked with Snake River Correctional Institution, a prison facility in Eastern Oregon, to propagate 20,000 Wyoming big sagebrush plants. IAE staff oversaw plant production at the facility, from seed germination through growth and outplanting. Inmate crews worked alongside BLM and IAE staff to outplant sagebrush plugs on BLM land that was previously burned and is designated for habitat improvement for the Greater sage-grouse near Vale, Oregon. In 2015, IAE started new collaborations with state prisons in Idaho and Washington to further expand sagebrush propagation and outplanting.

POSTER

MILITARY TRAINING LAND REHABILITATION: METHODS USED TO REHABILITATE TRAINING LANDS ON JOINT BASE LEWIS-MCCHORD. **Eric Myers**, Integrated Training Area Management Program, 4074 Kaufman Avenue, Joint Base Lewis-McChord, Washington 98433. eric.r.myers.ctr@mail.mil

The Land Rehabilitation and Maintenance (LRAM) component of the Integrated Training Area Management (ITAM) program on Joint Base Lewis-McChord facilitates the revegetation of military training lands by rehabilitating areas damaged by military activities. ITAM rehabilitates damaged areas by using native Puget Sound prairie specific species that are adapted to the regions environment and will propagate naturally. These actions will achieve the ultimate goal of rehabilitating prairie landscapes so military training can continue into the future. Working in partnership with the Center for Natural Lands Management and JBLM Environmental Division, ITAM has been able to obtain native grass and forb seed to rehabilitate damaged sites. These partnerships have given the ITAM program the flexibility to target efforts at optimal times of the year, primarily in the fall and spring. Also, a consistent amount of seed provided to the ITAM program, gives ITAM the increased flexibility and capacity to target certain species for specific areas in order to maximize plant survivability and rehabilitate more acreage. The primary rehabilitation methods include using live plant plugs, hydroseeding, and broadcast seeding. These methods are selected depending on how many plugs, amount of seed available to plant, the condition of the site, whether the site is conducive to native forbs or grasses, and whether the site is sloped or on flat ground. By working with other components of the ITAM program, we are able to continue finding optimal locations and use scientifically rigorous best management practices to determine the most effective and efficient prairie rehabilitation efforts.

POSTER

CALIFORNIA BLACK OAK RESPROUTING ACROSS RECURRING FIRE SEVERITY GRADIENTS. **Deborah Nemens,** J. Morgan Varner, Kathryn R. Kidd, Department of Forest Resources & Environmental Conservation, Virginia Tech, Blacksburg, VA 24060; Brian Wing, USDA Forest Service Pacific Southwest Research Station, Redding, CA 96002; Jesse K. Kreye, Department of Forestry, Mississippi State University, Miss State, MS 39752; Nicole Vaillant, USDA Forest Service Pacific Northwest Research Station, Western Wildland Environmental Threat Assessment, Bend, OR 97754. dnemens@vt.edu

Oak communities in the western United States have been in decline since the advent of large-scale fire exclusion in the early 20th century. In the absence of fire, woodlands that formerly supported oaks and the wildlife dependent on them are increasingly dominated by shade-tolerant conifers that encroach on remnant oaks, reducing oak vigor. One potential avenue for restoration of California black oak (*Quercus kelloggii*) in mixed-conifer forests is via resprouting following high severity fires. We examined California black oak sprout vigor across a spectrum of fire severities following two mixed-severity wildfires that burned over approximately the same landscape in 2000 (Storrie Fire) and again in 2012 (Chips Fire) in the Lassen National Forest in northern California. Ninety-six plots were established across the landscape burned by both wildfires. Six plots were established in each of 16 Storrie-Chips fire severity combinations,

ranging from unburned to high-severity. Over ninety-five percent of oaks that sprouted following the Storrie fire and were top-killed in the Chips fire resprouted. Sprout vigor was greatest in the moderate and high severity strata and diminished in sites that burned with the lowest severity. Our results will enable managers to prioritize restoration actions after wildfires in mixed conifer-oak communities.

ORAL

WILLAMETTE VALLEY CONSERVATION STUDY. **Kevin O'Hara**, U.S. Fish and Wildlife Service, 911 NE 11th Avenue, Portland, OR 97232. kevin_ohara@fws.gov

The U.S. Fish and Wildlife Service and partners are conducting a study of conservation issues and opportunities in Oregon's Willamette Valley following the Service's Strategic Habitat Conservation planning protocol. Starting with the strategic habitats and species identified by the Oregon Department of Fish and Wildlife's Oregon Conservation Strategy, and following a collaborative partnership approach, we developed measurable conservation objectives (desired population levels) for a suite of species selected to represent the strategic habitats. The study determined that the amount, distribution, and quality of habitat being managed for the valley's native species following a century and a half of conversion, fragmentation, and degradation is not sufficient to support healthy, viable populations of some of Oregon's iconic wildlife species across their historic range in the valley. To address that issue, we translated the population objectives into objectives for a network of habitat patches to be managed principally as breeding areas free from other management conflicts. We also identified specific areas within which to prioritize actions for recovery of the valley's listed species. We used the conservation planning software Marxan to identify an efficient design that blended the network with the T&E recovery sites. Marxan identified 79 specific areas of the valley within which are opportunities to begin establishing the network of breeding areas and to protect important populations of listed species. The Service is currently discussing with its partner agencies and organizations the appropriate roles for implementing the study's recommandations.

ORAL

THE PRAIRIES EDGE: UNUSUAL VEGETATION OF THE SOUTHEAST OLYMPIC PENINSULA. **David Peter**, U.S. Forest Service, Pacific Northwest Research Station, 3625 93rd Avenue SW, Olympia, WA 98512; Andy Bower and Susan Piper, U.S. Forest Service, Olympic National Forest, Olympia, WA 98512. dpeter@fs.fed.us

As the South Puget Sound prairies graded into the forests of the Olympic Peninsula they took on unique floristic and structural characteristics. Oaks gradually disappeared as the conifers became more aggressive in zones of higher precipitation and less frequent fire history but persisted on isolated steep, dry, south facing rocky balds in the Skokomish River watershed. The prairie-to-forest transition graded through approximately16,000 ha of Douglas-fir savannas and woodlands with beargrass understories in which more familiar prairie dominants (Roemer's fescue and common camas) were largely absent. Euro-Americans converted much of this open landscape to

farms and towns and ended regular anthropogenic burning permitting much of the remaining open area to grow into forest. We characterized the pre-contact structure and flora of these woodlands and their succession into forest to inform current and future restorations. In 2003 the Olympic National Forest undertook a restoration of a 12 ha portion of this former woodland that overlapped the National Forest boundary. We evaluate the effects of this restoration treatment which comprised thinning followed by a prescribed burn and subsequent vegetation succession since 2003. The Olympic N.F. plans further restoration with additional prescribed burns followed by reseeding with native species in this and possibly nearby areas, as well as restoring remnant oak balds within the watershed. The oak bald restoration will focus on maintaining gaps and open crown conditions by girdling or removing competing conifers and possibly planting oak seedlings, as natural regeneration is lacking.

ORAL

PHYSICAL AND MECHANICAL ACTIONS TO RESTORE SOIL STRUCTURE. **David Polster**,

Degradation of soil structure can occur as a result of industrial activities, including modern agriculture. Often un-noticed, compaction is one of the most insidious forms of degradation. Where seasonal rainfall remains on the surface over large areas, compaction is probably the cause. Similarly, a lack of soil structure may result from a loss of soil mycorrhizal components that is related to industrial uses and compaction of sites. The inability of plants to reach nutrients or moisture can also be related to poor soil structure. Treatments designed to address the problem of compaction and poor soil structure often only scratch the surface. Creation of rough and loose ground (Polster 2015) can be an effective way to eliminate compaction, although this only works where sites are drastically disturbed and there are no plants that should be retained on the site. Rough and loose ground can be used to restore drastically disturbed sites. Rough and loose ground can be levelled once the compaction is removed if there is a need to have a smooth surface. However, this reduces the erosion control and micro-site provision functions of the rough and loose ground. Where forested ecosystems are destroyed, rough and loose ground can re-create the conditions that occur when trees naturally blow over in the wind, with hummocks and hollows that enhance the diversity of the forest. This paper explores the use of physical and mechanical ways of addressing soil structure limitations encountered in some restoration situations. Examples are drawn from the author's experience.

ORAL

MYCORRHIZAL AND MICROBIAL INOCULATION AFFECT THE GROWTH AND SURVIVAL OF NATIVE PLANTS RAISED FOR RESTORATION. **Sasha R. Porter** and Erin E. Martin, The Evergreen State College, Graduate Program on the Environment, 2700 Evergreen Parkway NW, Olympia, WA 98505; Sarah T. Hamman, Center for Natural Lands Management, Olympia, WA 98501. sashaporter@gmail.com

Production of native seedlings for field outplanting has become a common ecological restoration

technique worldwide. However, field establishment of greenhouse-raised plants is often poor. Mycorrhizal fungi are symbionts that can provide survival benefits to host plants. Within terrestrial ecosystems this plant-fungal relationship is nearly ubiquitous; mycorrhizae are absent only under unusual circumstances, such as in a nursery greenhouse. In this study, nine Northwest prairie species were grown in a sterilized medium with either: 1) an arbuscular mycorrhizal fungi (AMF) inoculant cultured from local native plant roots, 2) a general AMF inoculant of commonly found cosmopolitan species, or 3) no AMF inoculant (control). Microbial inoculants (sans AMF) created from soil collected at two different prairies or unsterilized potting medium (standard practice control) were added via a microbial 'wash' to each AMF treatment in a fully factorial design. Data on emergence, survival, and growth were collected in the greenhouse, and after nine months seedlings were transplanted to field sites. In the greenhouse, AMF significantly enhanced the growth of five species and the survival of four with no detectable difference between the two AMF inoculants. After one field season, AMF-inoculated *Micranthes integrifolia* plants had considerably higher survival rates and reproductive capacity. Microbial addition had mixed results, with inoculation often suppressing seedling emergence, yet improving field survival for two species. Results suggest that AMF can enhance growth and short-term survivorship for some species with no effect on others, while mixed microbial addition has variable effects, depending on species, life-stage and microbial source.

ORAL

BUTTERFLIES OF CONSERVATION CONCERN IN WESTERN WASHINGTON PRAIRIES AND OAK WOODLANDS: UPDATES TO STATUS AND PRELIMINARY FIELD OBSERVATIONS FROM A 2013-2105 STUDY. **Ann Potter**, Washington Department of Fish and Wildlife, 600 Capitol Way N, Olympia, WA 98506; Thor Hanson, Friday Harbor, WA 98250; Loni Beyer, Imperial Beach, CA 91932; Brad Gill, Rainier, WA 98576 ; Mary McCallum, Olympia, WA 98502. ann.potter@dfw.wa.gov

Monitoring of 9 imperiled butterflies that inhabit native grasslands (prairies) and oak woodlands of western Washington was conducted from 2013-2015 as part of a large restoration project focused on these same rare habitats. Focal butterflies were Propertius Duskywing (*Erynnis propertius*), Mardon Skipper (*Polites mardon*), Sonora Skipper (*Polites sonora siris*), Oregon Branded Skipper (*Hesperia colorado* Salish Sea segregate), Hoary Elfin (*Callophrys polios* Puget Trough segregate), Puget (Blackmore's) Blue (*Icaricia icarioides blackmorei*), Great-spangled Fritillary (*Speyeria cybele pugetensis*), Valley Silverspot (*Speyeria zerene bremneri*), and Great Arctic (*Oeneis nevadensis gigas*). Restoration actions included removal of shrub and tree vegetation in oak woodlands and savanna, and in prairies, a suite of actions that included herbicide applications, prescribed fire, and planting/seeding native plants. Monitoring was conducted at sites in San Juan, Clallam, and Thurston counties. The objectives of our study were to determine current status and distribution, assess the effects and effectiveness of restoration, and collect key life history information outstanding for these species. Although quantitative data are being analyzed, updated status and distribution information, results and field observations from butterfly monitoring in restoration units, and a brief discussion of the practical limitations of studying rare butterfly response to prairie restoration are provided. We documented imperiled butterflies' reduction in population numbers and sizes, use of newly restored habitat, and new life history information.

ORAL

RESTORATION INTERPRETION BY STORYMAP AT BALD HILL FARM, A MULTIUSE CONSERVATION AREA. **Elizabeth Records**, Greenbelt Land Trust, PO Box 1721, Corvallis OR 97339. elizabeth@greenbeltlandtrust.org

Bald Hill Farm Conservation Area is a 587-acre site in Corvallis, Oregon, acquired by Greenbelt Land Trust in 2013. Rich with opportunities for oak and prairie restoration, this site features a network of popular County-managed trails connecting to adjacent natural areas, making the property Greenbelt's most public-facing project and placing restoration activities in view of a diverse community. Outreach tools like this award-winning storymap developed by FLO Analytics are a helpful resource for interpreting conservation values and restoration actions to trail visitors. Greenbelt has begun a two-year, 90 acre oak restoration and forest management project and commenced a prairie restoration project spanning nearly 58 acres. As trails closed for these projects are reopened, visitors will view early phases of restoration projects for the first time and the map can be adapted to provide context for the changes that they will observe. Qualitative content highlights the site as a resource for outreach, education and research, encouraging the community to support conservation in the Willamette Valley and beyond.

ORAL

MITIGATION STRATEGIES FOR PRESCRIBED BURNING IN RARE AND ENDANGERED SPECIES HABITAT. **John Richardson**, Joint Base Lewis-McChord Fish and Wildlife, 1210 Mann Avenue, JBLM WA 98433. john.f.richardson1.civ@mail.mil

Due to the complex nature of managing rare and endangered species in fire-dependent ecosystems it is not possible to create a universal management plan for prescribed fire in occupied habitat. Each habitat type and species poses its own set of unique challenges, requiring the development of specific management strategies. The need for multiple species-specific management strategies involving fire requires a complex approach to management, often requiring that multiple mitigation strategies be employed on a single burn. Mitigation strategies are grouped into two categories, pre-burn and implementation. Pre-burn strategies are used during the planning process focusing on unit selection and burn timing. Implementation strategies occur during burns focusing on firing patterns and fine scale unit boundary manipulation, including interior exclusions of important resources or potential refugia for sensitive species. Successful mitigation requires the use of both strategy types. The multi-agency Puget Sound Ecological Fire Partnership has utilized these strategies across several burn units over the past four years to protect sensitive resources during fire operations, while enhancing habitat quality for rare species across the prairie landscape.

ORAL

EXPANDING THE PALETTE: AN EXPERIMENTAL APPROACH TO NATIVE SEED PRODUCTION. **Drew Schneidler,** Center for Natural Lands Management, 120 Union Avenue SE #215, Olympia, WA 98501. dschneidler@cnlm.org

In Washington State, the production of native prairie seed, especially forbs and annuals, is an emerging and still relatively new field of farming. Each species must be brought into cultivation individually, which requires the development of unique techniques, tools and protocols for agricultural production. The goal is to increase seed production to a scale that can support region wide restoration while reducing costs to a level that makes the seeds widely accessible. This is an iterative process requiring continual innovation, evaluation and diligent record keeping. The South Sound Conservation Nursery works with over 100 species of prairie plants and receives requests for additional species every year. We have adopted a trial based approach to seed production to develop techniques for new species and refine protocols for others. This involves planting at varying times, testing transplants against direct seeding, harvesting with a variety of methods, all the while diligently tracking labor and material inputs. This can only be done with a handful of species in any given year, but already surprising results are emerging. These species truly are individual entities and rules of thumb such as "sow annuals in September" are quickly giving way to a much more complex and nuanced approach. We will present on the general strategy of these trials, discuss the techniques tested and the responses measured and provide some of the more interesting preliminary results.

POSTER

WOLF HAVEN'S ROLE IN ENDANGERED SPECIES RECOVERY. **Anne Schuster,** Wolf Haven International, 3111 Offut Lake Road SE, Tenino, WA 98589. anne@wolfhaven.org

Wolf Haven International is a sanctuary for captive born wolves. In addition to wolf conservation, Wolf Haven has 36 acres of rare mounded prairie habitat which we have been working to conserve and restore with many prairie partners since 2001. Wolf Haven's prairie has been a reintroduction site for the threatened Mazama pocket gopher (*Thomomys mazama*) and golden paintbrush (*Castilleja levisecta*) as well as a future reintroduction site for the endangered Taylor's checkerspot butterfly (*Euphydryas editha taylori*). Wolf Haven is a small prairie, but due to its close proximity to larger prairies it is an important stepping stone for endangered species recovery. Beyond prairie species, Wolf Haven also participates in two federally run Species Survival Plans for critically endangered red wolves (*Canis rufus*) and Mexican gray wolves (*Canis lupus baileyi*). Before recovery began there were 14 red wolves and 7 Mexican gray wolves left, now there are about 100 of each in captive breeding programs across the United States and Mexico, and in the wild there are around 50 red wolves living in North Carolina and around 100 Mexican gray wolves living in New Mexico, Arizona, and Mexico. Many of the Mexican gray wolves living in the wild are descendants of individuals who live and have lived at Wolf Haven. Wolf Haven strives to conserve rare and endangered wildlife, both on and off prairies, no matter how controversial some of these species may be.

ORAL

SEPARATING ESTIMATES OF SURVIVAL IN THE STREAKED HORNED LARK BY AGE: POST-FLEDGING, JUVENILE AND ADULT. **Gary Slater**, Hannah Anderson and

Adrian Wolf, Center for Natural Lands Management, 120 Union Avenue SE #215, Olympia, WA 98501. gslater@cnlm.org

Conservation of endangered species requires a full understanding of their population dynamics, including demographic rates and the factors that affect them. The streaked horned lark (*Eremophila alpestris strigata*) was listed as threatened under the Endangered Species Act in 2013. Previous authors (Camfield et al. 2011) identified adult and juvenile survivorship has having the largest influence on Streaked Horned Lark population growth rate. We investigated annual adult and juvenile survival in larks from 2011 to 2015, and further investigated post-fledging survival by estimating 2-week survival rates during the 10-week period after nestlings leave the nest, a time when young may be especially vulnerable. Fieldwork was conducted at the current northern extent of the subspecies breeding range (i.e., Joint Base Lewis-McChord Military Base) in native prairie habitat and on military airfields. From 2011 to 2015, we color-banded 336 nestlings. We conducted standardized surveys to resight banded individuals on nesting territories and occupied sites. Average annual return rates for adults and juveniles were 72% and 17%, respectively. We will report on apparent survival rates, incorporating resight probability, and assess whether other factors (e.g., year, site, or sex) are associated with annual survival using Program Mark. Preliminary results from the post-fledging survival analysis indicated that fledglings have lower survival during their first 2-week period after leaving the nest (0.63; 95% CI = 0.51 – 0.73) than subsequent periods (0.85; 95% CI = 0.76 – 0.91). We will discuss how results from this study will help advance conservation strategies for the lark.

POSTER

AN UPDATE ON WESTERN BLUEBIRD RECOVERY IN THE PACIFIC NORTHWEST.

Gary Slater, Center for Natural Lands Management, 120 Union Avenue SE #215, Olympia, WA 98501; Kelsey Green, Ecostudies Institute, Mount Vernon, WA 98273; Kathleen Foley, San Juan Preservation Trust, Friday Harbor, WA 98250; Jemma Green, Reanna Shelling, Garry Oak Ecosystems Recovery Team, Victoria, BC, Canada V8W 3N2; Jim Lynch, Joint Base Lewis-McChord, Fish and Wildlife Program; Bob Altman, American Bird Conservancy, Corvallis, OR 97330; gslater@cnlm.org

Since 2007, we have been working to restore a regional population of Western bluebirds (*Sialia mexicana*) to their former range in western Washington and southwestern British Columbia through reintroduction. This secondary cavity-nester and migratory species was considered common in oak-prairie habitats of the region during the early 1900's, but populations began disappearing in the mid-1900s due to habitat loss and fragmentation and competition for nesting cavities. We released 134 (99 adults) individuals on San Juan Island from 2007 to 2011 and 92 (46 adults) individuals into the Cowichan Valley on Vancouver Island from 2012 to 2015. On San Juan Island, initial results indicated reintroduction success: population size reached 38 adults in 2011 and demographic rates were similar to other large populations in the region. However, subsequent low demographic rates caused a dramatic decline in population size and emergency translocations were initiated in 2014. On Vancouver Island, reintroduction success has been high and the population size has increased in each year. Major threats to the success of the recovery effort appear to include: high depredation rates from urban predators and house sparrows and

high adult female mortality. Active management to make nest boxes safer, including control of house sparrows may be required for the long-term success of the project. Dispersal events have been recorded between the reintroduced populations and the donor population in south Puget Sound and conservation actions that help expand the size of the South Sound population will also likely improve long-term viability of reintroduced populations.

ORAL

"IF YOU BUILD IT, THEY WILL COME" AND OTHER PARTIAL TRUTHS: MULTI-AGENCY COORDINATION OF ECOREGIONAL SEED PRODUCTION IN WASHINGTON'S NORTH PUGET SOUND. **Sierra Smith,** Center for Natural Lands Management, 120 Union Avenue SE #215, Olympia, WA 98501. ssmith@cnlm.org

Significant opportunities for rare species and prairie habitat conservation exist on the islands of Washington State's North Puget Sound. Golden paintbrush and island marble butterflies are a focus of North Sound prairie restoration and the islands could provide excellent Taylor's checkerspot butterfly habitat as well. Potential partnerships are abundant as prairie land managers range from federal and state agencies to local land trusts and environmental non-profits. The U.S. Fish and Wildlife Service supports many prairie restoration projects in the region and so far each effort has strived to produce their own native seed. Regional coordination of native seed production would allow an economy of scale and avoid the duplication of activities. We will present on the vision and strategy for a new program that will collaborate North Puget Sound nursery efforts with the large scale seed production on-going in the South Puget Sound. By compiling regional seeds needs, pooling wild collection endeavors, utilizing local nurseries and scaling up production at existing seed farms we hope to establish a reliable stream of North Sound provenance native seed. This project will be managed by the Center for Natural Lands Management with initial funding coming from the U.S. Fish and Wildlife Service.

ORAL

WE'RE NOT GROWING VEGETABLES ANYMORE: PRODUCING SEED THAT KEEPS POPULATIONS WILD. **Sierra Smith,** Center for Natural Lands Management, 120 Union Avenue SE #215, Olympia, WA 98501. ssmith@cnlm.org

Region wide habitat restoration requires large quantities of native seed to be successful. Wild collection of this volume of seed is impractical and impactful so this seed must be produced instead on farms. Producing seed that is intended to reestablish or augment wild populations requires a new approach to agriculture that runs counter to generations of established agricultural methods. Generally, farmers like a crop that thrives in cultivated soil, germinates in a single flush, matures consistently and uniformly, and is of a stature that can be mechanically harvested. Homogeneity of the crop is the goal in agriculture. Wild populations, on the other hand, require diversity to thrive and persist in variable and uncertain conditions. Seed dormancy, indeterminate flowering, morphological variability and genetic diversity make for a robust wild population. These traits make agricultural production difficult or are difficult to maintain in agricultural

production. We will discuss the unique farming strategies that are employed by the South Sound Conservation Nursery to produce hundreds of pounds of native seed that maintains its diversity and wild adaptations.

ORAL

APPLICATION OF SPATIAL MODELS TO DESIGN FIRE DISTURBANCE REGIMES IN PRAIRIE SYSTEMS AND MANAGE THREATENED BUTTERFLY POPULATIONS.
Joseph Smokey, Washington State University Vancouver, 14204 NE Salmon Creek Avenue, Vancouver, WA 98686; Norah Warchola, Tufts University, 419 Boston Avenue, Medford, MA 02155; Cheryl Schultz, Washington State University Vancouver, 14204 NE Salmon Creek Avenue, Vancouver, WA 98686; Elizabeth Crone, Tufts University, 419 Boston Avenue, Medford, MA 02155. joey_smokey@wsu.edu

As managers design burn strategies for prairie restoration, use of spatially-explicit models is an important tool to understand the role of metapopulation colonization dynamics of fire-restored habitat. For the endangered Fender's blue butterfly (*Plebejus icarioides fenderi*), previous field studies show that fire kills pre-diapause larvae, but improved habitat quality following a burn results in higher fecundity. Non-spatial models suggest a "best approach" of varying frequency of burn and portion of site burned that balances the tradeoff between very low survival immediately after a burn and higher fecundity in subsequent years. However, these models do not account for connectivity within the larger landscape. We construct a spatially-explicit individual-based model incorporating butterfly demography from a recent four-year fire field study to elucidate the benefits and consequences of various management strategies on a metapopulation in Eugene, Oregon. In our first management strategy, the optimal fire strategy predicted by the non-spatial model, small patches of habitat within a site are sub-divided into sections to burn, allowing for within-site and nearby-site recolonization. In our second management strategy, all habitat within a site is burned at once, eliminating within-site recolonization and relying on recolonization from nearby sites for regional persistence. Using the model's predictions on population viability, residence time, and connectivity indices across various management strategies, we identify a suite of best approaches to using fire as a restoration method in a network of small, well-connected patches of habitat for an endangered butterfly and explore similar approaches for species inhabiting disturbance-maintained systems in fragmented landscapes.

ORAL

OAKS BELOW GROUND: FUNGI AND FRIENDS. **Darlene Southworth**, Department of Biology, Southern Oregon University, Ashland, OR 97520. southworth@sou.edu

Oaks do not live alone. All oak root tips form mycorrhizas, structures formed by an association between roots and fungi. Mycorrhizas are mutualistic: trees provide carbon to fungi, which take up water and nutrients for the oaks. Fungi on oak roots are identified by the sequence of a short piece of DNA. Mycorrhizal communities are diverse including both Ascomycota and

Basidiomycota. Many fungi associated with oak roots are truffles. Over 30 species of truffles occur with Oregon white oaks in southern Oregon. Rodents eat truffles and disperse the spores through fecal pellets. The spores have thick walls that enable them to survive rodent digestive tracts. For purposes of regeneration or restoration, oaks require dual dispersal of both acorns and fungi. Acorns do not contain fungal spores. Seedlings under oaks are likely to be inoculated from fungi of the parent tree. If acorns or seedlings are planted beyond the root zone of mature oaks, they must acquire mycorrhizal fungi. Oregon white oak seedlings germinate in fall and winter and produce a taproot that is not mycorrhizal. In spring and summer, they develop lateral roots that can form mycorrhizas. Thus the time of root germination is disconnected from the need for fungi. Moving seedlings from under oaks is a possible way to get seedlings with mycorrhizas. The mycorrhizal relationship is obligate for both oaks and fungi. Treatments such as brush mastication and prescribed fire do not change mycorrhizal communities, but do reduce truffle abundance.

ORAL

OAK HABITAT RESTORATION PROJECTS IN EUGENE, OREGON: OBJECTIVES, IMPLEMENTATION, AND LESSONS LEARNED. **Emily Steel**, Parks and Open Space Division, City of Eugene, 1820 Roosevelt Blvd, Eugene, OR 97402; emily.c.steel@ci.eugene.or.us

In the Willamette Valley, less than 2% of the historic oak savanna and less than 7% of original oak woodland remain from the 1850s, and much of the remaining oak habitat is found at the valley's southern terminus. Nestled into this region, the City of Eugene's 2,000-acre Ridgeline park system offers the opportunity to restore oak habitat at several sites, improving habitat quality and connectivity on the local landscape. Since 2007 the City's Parks and Open Space Division has pursued this goal, utilizing a variety of techniques including mastication, low-impact timber harvesting, hand felling, and helicopter yarding to achieve ecological restoration objectives for oak savannas and woodlands in areas ranging from 5-125 acres. This presentation will outline the City's ecological goals for plant communities and target wildlife species, and then explore the complexities of implementing oak restoration projects from a practical perspective. Examples from recent projects will be used to highlight three critical project stages: 1) planning and scoping, including stand assessment, selecting a thinning method, and applying conservation principles to project design; 2) implementation, focusing on site considerations, working with forestry consultants and contractors to meet project objectives, and incorporating timber and wood products revenue and costs into project budgets, and 3) post-project stewardship, covering seeding, invasive species control, and woody debris removal. While each project has its challenges, every one presents an opportunity to refine techniques, administration, and ecological outcomes. Strategies for avoiding common pitfalls and achieving project goals will be shared.

ORAL

INFORMING OAK HABITAT RESTORATION WITH AVAILABLE AVIAN SCIENCE AND PROJECT MONITORING. **Jaime L. Stephens**, Katherine E. Halstead and John D.

Alexander, Klamath Bird Observatory, PO Box 758, Ashland, OR 97520; Bob Altman, American Bird Conservancy, 311 NE Mistletoe, Corvallis, OR 97330. jlh@klamathbird.org

Oak habitats once covered a largely contiguous expanse of the Pacific Northwest between the Coast Range and the Cascade Range. There has been dramatic direct loss of oak habitats over the past 150 years, and what currently remains is at risk from fragmentation, degradation or loss due to development, encroachment of coniferous forest, and invasion of exotic species. Because of this, oak restoration is a high priority and is necessary to support birds and other wildlife that depend on these habitats. A series of decision support tools are available to prioritize, guide, and assess oak restoration. Avian Knowledge Northwest, a regional data center, identifies areas of importance for oak bird communities and includes modeled current and projected density under climate change scenarios for individual oak associated species. The *Land Manager's Guide to Bird Habitat and Populations in Oak Ecosystems of the Pacific Northwest* describes bird densities throughout the northwest, habitat conditions favored by each species, and predicted species response to restoration. The landowner guide, *Restoring Oak Habitats in Southern Oregon and Northern California: A Guide for Private Landowners* provides information for landowners and restoration practitioners on setting restoration goals, implementing restoration on-the-ground, and effectiveness monitoring. In combination, these resources can be applied to better understand current and desired future conditions, and existing and projected bird densities. When combined with project level monitoring, these decision support tools can be used to evaluate the success of restoration in meeting goals at both the site and landscape level.

POSTER

GUIDANCE FOR CONSERVING OREGON'S NATIVE TURTLES INCLUDING BEST MANAGEMENT PRACTICES.

Oregon Department of Fish and Wildlife, Salem, OR 97302; Oregon Native Turtle Working Group, www.oregonturtles.com; Port of Portland, Portland, OR 97218; **Elaine Stewart**, Metro Parks and Nature, 600 NE Grand Avenue, Portland, Oregon 97232. Elaine.stewart@oregonmetro.gov

Created to facilitate better protection and conservation of native turtles and their habitats, this document includes recommended Best Management Practices (BMPs) for working near western painted turtles (*Chrysemys picta bellii*) and western pond turtles (*Actinemys marmorata*). It is intended primarily for use by natural resource and land managers, land use planners and project managers. Both native turtle species have experienced population declines in many parts of their ranges and remain vulnerable to habitat loss and other anthropogenic impacts. The good news is that each activity known to negatively affect turtles can be made less harmful, or even beneficial, by implementing the recommendations in this document. Chapters address identification of native and exotic turtles, life history and habitat requirements, determining whether turtles inhabit a project area, accommodating turtles in project planning and design, and specific BMPs for project types (e.g., roadwork, vegetation management). The BMPs have been peer-reviewed and are supported by current science. A limited number of hard copies were printed; the entire document is available online at:
http://www.dfw.state.or.us/wildlife/living_with/docs/ODFW_Turtle_BMPs_March_2015.pdf.

ORAL

HOW I LEARNED TO STOP WORRYING AND LOVE BARE GROUND. **Elaine Stewart**, Metro Parks and Nature, 600 NE Grand Avenue, Portland, OR 97232. Elaine.stewart@oregonmetro.gov

When conducting ecological restoration, practitioners must occupy the ground with native plant material to exclude problematic weeds. This axiom is one of the first principles we teach new colleagues in our field. Perhaps it arose from silvicultural practice of densely planted trees to shade out shrubs that might reduce tree growth via competition. Whatever its origins, "occupy the ground" is standard practice. If we unpack the axiom, there are at least three questions to consider. In our rush to occupy the ground with native cover, are we establishing simple plant communities with lower than necessary ecological value? Do the native plants exclude weedy exotics? Is it a good thing to occupy all of the ground with plant material? Over-reliance on this restoration axiom can lead to plant communities that are dominated by a few native grasses, lack structural diversity and provide habitat to a limited suite of wildlife, while "weeds" continue to move in and thrive. Examples from prairie restoration projects in Western Oregon illustrate these points. Restoration practice would be served well by paying less attention to "occupy the ground" and more attention to habitat objectives such as structural diversity, species richness and needs of native plants and wildlife that are appropriate conservation targets for a site. Practitioners need more information on the relative threats posed by exotic species to habitat establishment and what abundance thresholds should trigger treatment of them.

ORAL

REVISITING OAK RELEASE AFTER THREE YEARS: SUCCESSES, LESSONS AND NEXT STEPS. **Elaine Stewart**, Katy Weil, Metro Parks and Nature, 600 NE Grand Avenue, Portland, OR 97232; Elaine.stewart@oregonmetro.gov

In fall 2012, Metro implemented Oregon white oak (*Quercus garryana*) release on 90 acres in Clackamas County, Oregon. Formal surveys of breeding birds and herbaceous vegetation documented pre-treatment conditions as well as post-treatment developments to date. Avian monitoring showed rapid response from some birds associated with oak woodlands. Herbaceous plant monitoring indicated slow improvement of species richness for associated plants. Early maintenance work was dominated by broadleaf weed control, and this will continue for several more years. Rehabilitation of equipment routes was immediately successful and those areas remain healthy. Although the oak release is complete, the project is not. The herbaceous layer's slow progress is due in part to the abundance of perennial exotic grasses, and species richness objectives cannot be achieved in the foreseeable future without additional interventions. Prescribed burns are not feasible at these sites, but experimental treatments with carefully timed broad-spectrum and grass-specific herbicides show promise. A shrub layer dominated by poison oak (Toxicodendron diversiloba) and native and exotic blackberry (Rubus spp.) is developing in areas initially dominated by forbs and graminoids. It is unclear how much threat this shrub layer poses to the herbaceous layer, and choosing when and how to mediate shrub development in the absence of fire remains difficult.

POSTER

TA 13 MANEUVER SPACE DETERMINATION AND VISIBILITY ANALYSIS. **Kerwin Talbot**, SRP GIS Analyst, Integrated Training Area Management Program, Range Support, 4074 Kaufman Avenue, Fort Lewis, WA 98433. kerwin.s.talbot.ctr@mail.mil

Joint Base Lewis-McChord's grasslands provide essential training land resources for military personnel and essential habitat for endangered species. Throughout the installation many areas of grassland have been invaded by Douglas fir thus increasing the conflict between these two primary users into diminishing grassland areas. In order to support both training and endangered species recovery, the Army would like to increase the amount of open maneuver space by clearing out and thinning approximately 1100 acres of heavily forested training land. This project consists of three phases. Phase 1 identified the minimum area required for maneuver training, located and avoided sensitive environmental and cultural sites, and prioritized locations that were afforested that still contained underlying grassland soils. Phase 2 detailed the tree removal area using tree density and basal area estimates developed from LiDAR (Light Detection and Ranging) data. Phase 3 uses LiDAR-based Digital Elevation Models (DEM) to predict the line of sight available for military training operations including viewshed analysis of potential observation posts and firing positions as they will appear after tree removal. The resulting project should enhance military training options, reduce impacts to endangered species, and provide habitat for generalist grassland associated species. All project work is done within ESRI's ArcGIS environment utilizing tools from the 3D Analyst and Spatial Analyst extensions.

POSTER

FACTORS AFFECTING ANT TENDING IN FENDER'S BLUE BUTTERFLY (*PLEBEJUS ICARIOIDES FENDERI*): IMPLICATIONS FOR HABITAT RESTORATION AND SPECIES RECOVERY. **Cameron Thomas and Cheryl Schultz**, Washington State University – School of Biological Sciences, 14204 NE Salmon Creek Avenue, Vancouver, WA 98686. schultzc@wsu.edu; cameron.thomas@wsu.edu

Fender's blue butterfly, *Plebejus icarioides fenderi* (Macy), is a federally endangered species which survives in remnant native prairie habitat in Oregon's Willamette Valley. Less than 1% of historic Fender's habitat remains and much of that has been degraded by invasive grasses and forbs. To date, research involving habitat restoration for Fender's blue has focused primarily on how invasive vegetation affects the adult stage, but recent work suggests ant tending may significantly increase survivorship in Fender's blue larvae, resulting in a higher population growth rate. Fender's blue, like ~45% of all lycaenids, maintains a facultatively mutualistic relationship with ants. Our work indicates that Fender's blue larvae are tended by at least five ant species in as many genera. Here, we systematically document ant tending in post-diapause Fender's blue larvae by its native ant mutualists. We also examine biotic and abiotic factors associated with ant tending in the West Eugene population with a specific focus on the vegetation gradient among nine sites. Our results aim to inform restoration efforts relative to the potential influence of invasive species on vegetation structure during the Fender's blue larval phase, a stage that may be more significant than previously documented.

POSTER

PARTNERING WITH ALTERNITAVE HIGH SCHOOLS TO ACHIEVE EDUCATION AND RESTORATION GOALS ON US ARMY CORPS OF ENGINEERS LANDS IN OREGON.
Rhiannon Thomas, U.S. Army Corps of Engineers, 26275 Clear Lake Road, Junction City, OR 97448. Rhiannon.thomas@usace.army.mil

Due to shortfalls in staffing and/or funding, land management agencies often struggle to maintain natural areas in ideal condition. Similar constraints limit the ability of schools to engage students in experiencing nature. In Eugene, Oregon, several alternative high schools have conservation corps type programs that run both during summer and through the school year. Through my experience working with crews, as well as through feedback from crew members and leaders, I assess 1) how these partnerships benefit the US Army Corps of Engineers (USACE) Environmental Stewardship program and restoration goals, 2) benefits reported by schools and students regarding their experiences working with USACE, and 3) challenges encountered while working in partnership. I find that both quality of the work performed by students and their experiences with the program are improved when agency staff can dedicate time to working with students on projects. Youth crews are particularly effective at seed collection, greenhouse and nursery tasks, planting and seeding at restoration sites, and manual invasive species management.

POSTER

GOLDEN PAINTBRUSH, ON THE ROAD TO RECOVERY: WHAT HAVE WE ACCOMPLISHED, WHAT NEXT?
Theodore B. Thomas, U.S. Fish and Wildlife Service, Olympia, WA 98503; Joseph Arnett, Washington Department of Natural Resources, Olympia, WA 98501; Peter W. Dunwidddie, Center For Natural Lands Management, Olympia, WA 98501; Thomas N. Kaye, Institute for Applied Ecology, Corvallis, OR 97333; Judy Lantor, U.S. Fish and Wildlife Service, Olympia, WA 98503; Scott Pearson, Washington Department of Fish and Wildlife, Olympia, WA 98501. ted_thomas@fws.gov

Recent advances in restoration methods, plant and seed production, and sufficient funding to support management of declining habitat have led to improvements in our range-wide recovery efforts for the federally threatened golden paintbrush (*Castilleja levisecta*). Our recovery objectives include expanding the existing wild populations, establishing and sustaining new populations, and improving the species distribution throughout its historical range in Oregon and Washington. Our recovery criteria directed us to establish 15 populations on protected ownership with a 5 year average population of more than 1,000 flowering plants. We have met many of the recovery goals, and we have added resiliency to the species' persistence by creating nearly 25 new populations range-wide. During the past decade we have made significant progress in how we prepare sites for planting or seeding, and how we manage prairie habitat, which has brought us close to meeting the species recovery objectives. In addition, new research underscores the importance of a diversity of hosts for this hemi-parasitic plant, as well as the potential value of golden paintbrush as a host plant for the endangered Taylor's checkerspot butterfly. We are taking the final steps to bring golden paintbrush to full recovery with the intent of removing the

species from the list of Endangered Species, perhaps as soon as mid-2018. Our success will be the result of a commitment by all conservation partners to sustain long-term management of these populations to conserve golden paintbrush in perpetuity.

ORAL

ENDANGERED SPECIES RECOVERY: NOT FOR THE WEAK AT HEART.
Theodore B. Thomas, U.S. Fish and Wildlife Service, Olympia, WA 98503; Sarah Hamman and Hannah Anderson, Center For Natural Lands Management, Olympia, WA 98501.
ted_thomas@fws.gov

The recovery of an endangered or threatened species listed under the Endangered Species Act (ESA) requires coordinated planning, persistence, adequate funding and the implementation of deliberate management actions to improve a species status and successfully bring it back from the edge of extinction. The task of recovering species is not easy; to be successful it requires a comprehensive, coordinated planning effort from multiple conservation partners. The U.S. Fish and Wildlife Service is tasked with developing recovery plans and working closely with a diverse group of conservation partners to move species to a recovered state. Developing recovery plans that reduce threats and can be directly tied to improving a species population status is our goal for recovery. Given the constraints of ESA implementation, this is not as straight forward as it might seem; there will be bumps on the road to recovery. We will present several examples of conservation efforts to bring listed species to recovery and the challenges we faced, especially when trying to accomplish recovery and management actions in occupied areas. In addition to our primary objective to recover listed species, we should promote early conservation efforts for nonlisted species to preclude the need to list species under the Act. For this presentation we will discuss the nuts and bolts of recovery planning and the nuanced steps required to successfully recover listed species in systems with complex management needs.

POSTER

THROUGH THE SPOTTING SCOPE: STREAKED HORNED LARK OBSERVATIONS AND ANECDOTES.
Jerrmaine Treadwell, Adrian Wolf, Gary Slater, Hannah Anderson, Veronica Reed. Center for Natural Lands Management, 120 Union Avenue SE #215, Olympia, WA 98501.
jtreadwell@cnlm.org

Explore what has shocked, surprised and made Center for Natural Lands Management (CNLM) biologists say, “Wow!” while monitoring the Streaked Horned Lark (SHLA). The lark is a rare, ground-nesting songbird that occurs on short, sparsely vegetated expanses in western Oregon and Washington. For the past several years, CNLM has been monitoring nests, color-banding, tracking juveniles, and observing lark behavior at three active military training sites on Joint Base Lewis-McChord (JBLM). Our primary goal at JBLM is to assist efforts to minimize negative impacts to nests and fledglings and contribute to the body of knowledge that advances key recovery efforts. We have also had the opportunity to conduct surveys at dredged material

islands of the lower Columbia River in support of the Army Corps of Engineers' planning and placement of dredged material, an action that maintains the navigation channel of the river as well as early-successional habitat conditions selected by SHLA. We will share observations we've made of high site fidelity, unusual nest structures and locations, and fun facts about the banded lark population at JBLM. With up to 5 biologists following larks for up to 40 hours a week during the active breeding season, we have gathered a wealth of intriguing behavioral footage. Get a birder's eye view of the lark's world through hands-on video and photo and watch as an excavation transforms into a nest, or a nestling develop from egg to young adult. Discover the daily happenings, struggles, and relationships of the rare and industrious streaked horned lark.

ORAL

INVASION BY EXOTIC PLANT SPECIES ALTERS SEASONAL PATTERNS OF FLORAL RESOURCES FOR POLLINATORS. **Susan Waters**, Center for Natural Lands Management, 120 Union Avenue SE #215, Olympia, WA 98501**;** Janneke Hille Ris Lambers, Department of Biology, University of Washington, Seattle, WA 98105; Wei-Ling Cherry Chen, Yongkang District, Tainan City 710, Taiwan. swaters@cnlm.org

Climate-induced shifts in flowering phenology are known to induce timing mismatches between pollinators and plants, but it is less widely appreciated that invasion may also produce phenological gaps that may affect pollinators. Pollinators require timely availability of floral resources (nectar or pollen) throughout a season. However, patterns of resource availability may be affected by invasion-induced changes in plant community composition, since native and exotic plants may differ in resource provisioning traits. To determine how invasion affects seasonal community floral resource provisioning, we first compared how native vs. exotic prairie floras differ in traits affecting the amount, type (nectar vs. pollen) and timing of resource provision. Next, we combined this floral trait information with floral density and phenology data in five sites differing in management history (and therefore in plant composition and dominant exotic plant species). We found that the exotic flora contained lower proportions of nectar- and pollen-providing species and a lower proportion of species provisioning two pollinator guilds (eusocial bees and Lepidoptera). Native and exotic floras did not systematically differ in the timing of flowering phenologies, but unique assortments of species at sites resulted in distinct temporal patterns of resource provision by site, including one "resource desert" at a highly invaded site and unexpected seasonal resource lows at three other sites. Invasion should be considered with climate-induced phenological shifts as a mechanism for producing "mismatch" between pollinator resource requirements and plant community resource provision.

ORAL

UTILIZING REMOTE SENSING TO MONITOR STREAKED HORNED LARK HABITAT ON DREDGED MATERIALS PLACEMENT SITES IN THE LOWER COLUMBIA RIVER. **Jacob A. Watts and Kristine A. Lightner**, U.S. Army Corps of Engineers, Portland District,

333 SW 1st Avenue, Portland, OR 97204-3440. Jacob.A.Watts@usace.army.mil; Kristine.A.Lightner@usace.army.mil

In 2013, the U.S. Army Corps of Engineers, Portland District (Corps) entered into consultation with the U.S. Fish and Wildlife Service to establish a formal means of strategically managing the placement of dredged materials from the Columbia River's Federal Navigation Channel. The strategic placement of dredged materials benefits habitat succession and the survival of Streaked Horned Larks (*Eremophila alpestris strigata*) (SHLA), a species recently listed as threatened under the Endangered Species Act. The Corps has developed a robust geospatial procedure to evaluate the effects of dredged material placement on SHLA and their habitats. In 2014, the Corps initiated simultaneous monitoring efforts to estimate the local SHLA population and quantify the amount and type of habitat found on the placement sites. In the Columbia River, SHLA habitat has been documented as a mixture of both sand and low-lying grass. Habitat was categorized with regards to suitability for SHLA and identified as Yet-to-be Suitable (90-100% sand), Suitable (50-90% sand), or Not Suitable (0-50% sand). The Corps procedure processes high resolution aerial imagery into high resolution land cover classification data, and in turn classifies the placement areas into the appropriate habitat type (Yet-to-be Suitable, Suitable, Not Suitable) to evaluate the overall quantity and spatial distribution of each type. This information will be used to inform the management of the Corps' dredging program to maximize benefits to SHLA in the Columbia River as habitat transitions from Yet-to-be Suitable, to Suitable, to Not Suitable over time.

ORAL

COMPARING NORTHWEST GARRY OAK PRAIRIES AND DUTCH INLAND DUNES, GRASSLANDS AND HEATHLANDS AND THE EFFECT OF NITROGEN DEPOSITION.

Carleen Y. Weebers, University of Washington Bothell, Interdisciplinary Arts and Sciences, Box 358530, 18115 Campus Way NE, Bothell, WA 98011-8246; Annemieke M. Kooijman, Institute of Biodiversity and Ecosystem Dynamics, University of Amsterdam, Science Park 904, 1098 XH Amsterdam, The Netherlands. cweebers@uw.edu

In both the Pacific Northwest and the Netherlands are small open nature sites formed by prehistoric glaciers with comparable habitats as well as comparable threats to these habitats: the Garry oak prairies of the Northwest and the inland dunes with grasslands, and heathlands of the Netherlands. Both sites have large losses in biodiversity and decline of characteristic gradients in the landscape. In both areas, two major threats are invasive species and forest encroachment. In the Netherlands the increase of invasive species and forest is often found to be higher in regions with high atmospheric nitrogen deposition. Butterfly decline in Northwest Europe may also be due to nitrogen deposition, inducing excess early growth of plants. It is however not clear to which extent nitrogen deposition plays a role in the Garry Oak prairies as Mima Mounds Natural Area Preserve, Glacial Heritage Reserve and Scatter Creek Wildlife Area. This presentation will explain some of the monitoring methods and research results of nitrogen deposition studies in inland dunes, grasslands and heathlands in the Netherlands. These Northwest European studies could be useful for future research of the effect on species by the nitrogen deposition in Garry oak prairies in the northwest of the United States.

ORAL

REVERSING 100 YEARS OF CONIFER ENCROACHMENT IN SENSITIVE GARRY OAK – GRASSLAND BALD HABITATS. **David Wilderman**, Washington Department of Natural Resources, Natural Areas Program, PO Box 47014, Olympia, WA 98504; Deborah Nemens, Virginia Tech University, Blacksburg, VA 24061. david.wilderman@dnr.wa.gov

Bald Hill Natural Area Preserve (NAP), located in Thurston County, Washington encompasses a patchwork of Garry oak (*Quercus garryana*) woodland and savanna, grassland balds, and coniferous forest habitat. The site also supports populations of four rare plant species and four butterflies designated as Species of Greatest Conservation Need in Washington State. A population of the federally-endangered Taylor's checkerspot also occurred on the site as recently as 2006. As part of the Natural Areas Program's restoration efforts to improve the condition of grassland balds and Garry oak habitats, and to enhance habitat for future re-introduction of Taylor's checkerspot, conifers have been removed on approximately 20 acres of the site. This has involved a combination of hand crews to fall and lop small trees, helicopter removal of over 500 larger trees, and girdling of approximately 100 additional trees. Trees targeted for removal were selected based on 1940s aerial imagery, prioritizing Garry oak trees for release, and Taylor's checkerspot habitat enhancement needs. Approximately 90% of the targeted tree removal has been implemented to date in two phases, with the second phase benefiting from the first phase by incorporating lessons learned about contract specifications, project layout, and follow up treatments. Overall, the project has been successful at accomplishing restoration and habitat enhancement objectives, with minimal negative impact to grassland balds and very limited damage to Garry oak trees.

ORAL

STREAKED HORNED LARK NEST SURVIVAL AND PRODUCTIVITY – HOW ARE THEY DOING ON BASE? **Adrian Wolf**, Gary Slater and Hannah Anderson, Center for Natural Lands Management, 120 Union Avenue SE #215, Olympia, WA 98501. awolf@cnlm.org

The current distribution of Streaked Horned Larks (*Eremophila alpestris strigata*) has been reduced to the Willamette Valley, dredged material islands in and along the Columbia River, coastal beaches of Washington, and South Puget Sound grasslands. Joint Base Lewis-McChord (JBLM) contain the vast majority of known lark pairs in the South Sound, an estimated 54-58 breeding pairs on the base. Since 2011, we have conducted intensive nest monitoring at JBLM on one native prairie and two airfields, with the objective to estimate nest survival and productivity (number of young fledged per nest). From 2011 to 2014 we found and monitored 118 lark nests. Using Program MARK, we investigated the effect of year, habitat, and site on variation in nest survival. Preliminary results indicated that the only model in our nest survival analysis that received substantial support was year. Calculating overall nesting success from this model yielded nest success estimates of 71% in 2014, 37% in 2013, 34% in 2012, and 38% in 2011. Preliminary results indicated that the mean (± SE) number of young fledged per nest was

2.5 (+ 0.2). We will present updated analyses, incorporating additional explanatory variables (e.g., nest age, date) and an additional 100 nests monitored in 2015. Results from this study will help identify conservation strategies to best manage a species that occurs on active military training lands.

ORAL

WELCOMING NATIVE PEOPLE TO METRO NATURAL AREAS. **Curt Zonick** and **Marsha Holt Kingsley**, Metro Parks and Nature, 600 NE Grand Avenue, Portland, OR 97232. curt.zonick@oregonmetro.gov

In 2013, the Metro Natural Areas Program made a concerted move to reach out to native peoples in the region. This new welcome focused on meaningfully reconnecting native people to our Natural Area portfolio. Examples included visits to Multnomah Channel Marsh to harvest wapato and discuss salmon habitat restoration and to Quamash Prairie to harvest and plant camas bulbs, harvest native seed, and gather plant material for use in traditional weaving. The partnership has evolved in a very short time on many levels. Beginning 2013, Metro attends monthly meetings of the Native American Community Advisory Council. NACAC is composed of a coalition of representatives from many regional native tribes. The open, non-proprietary aspect of NACAC has reflected a core principle of Metro's new partnership with native peoples. We welcome all and do not associate any lands with any particular tribe. This past spring, the local native American group Wisdom of the Elders established a professional team called the Wisdom Workforce to take advantage of a new on-call Metro habitat restoration contract. Through WW, Metro can now pay native people to help restore Metro parks and natural areas. In August, Metro will hire a new Intertribal Cultural Resource Specialist that will develop a cultural resource inventory at Quamash Prairie and act as a liaison with NACAC, strengthening the foundation of Metro's relationship with tribal people. Near future projects include developing a GIS layer to map First Food species, and testing camas bulbs from Quamash Prairie for herbicide residuals.