Talk Abstracts

(Poster Abstracts follow in a separate section. List is alphabetical by lead author.)

Land Use Type Influences Project Outcomes and Timelines in Academic and Non-Academic Partnerships. Esther C. Adelsheim, PhD. Land Use and Environmental Planning, Stanford University. ecolea@stanford.edu

Partnerships between academic and non-academic groups can generate mutually beneficial outcomes, but the challenges to executing projects can be formidable due to competing priorities and goals, on the ground logistics, and insufficient time and resources. The complexity of project implementation scales with the number of land use designations layered into a project site and the types of logistical hurdles vary among land use types. On Stanford property, a wide spectrum of land use types support academic activities (campus buildings, agricultural leases, an academic reserve, conservation easements, and recreational areas), however the process for gaining approval for academic projects and the degree to which academic projects lead to productive partnership with mutually beneficial outcomes can vary widely. The administrative unit responsible for stewarding biological resources on Stanford's lands is the Stanford Conservation Program. In service of our primary mission to support and bolster biodiversity, we facilitate academic projects on Stanford lands and learning about the natural world. In recent years we have partnered with Stanford's engineering department, Stanford's biology department, and San Jose State University to implement research and teaching programs and projects on Stanford lands. Across all projects, the primary benefit of our partnerships with academic groups has been to imbed learning within Stanford's lands and to ground academic theory and scholarship.

Weed Alerts and Invasive Plant Updates for 2022. Jutta C. Burger, PhD[1], and Robert Price, PhD[2]. [1]California Invasive Plant Council. [2]California Department of Food and Agriculture. jburger@cal-ipc.org, robert.price@cdfa.ca.gov

New species are regularly introduced into California from other parts of the world and found growing wild. Some of these species spread quickly and impact native habitat, waterways, and agricultural lands. Their early detection, and their identification and removal, could prevent impacts and save on future removal costs. Each year we select a few species that have either been newly discovered in the state or have recently expanded their range as our "Weed Alerts." This year, Cal-IPC and CDFA are again joining together to showcase our selection of new and notable non-native plant species for 2022, chosen from nominations provided by regional land managers and botanists across the state. We will also provide an update on the Cal-IPC inventory and CDFA-listed weeds.

Post-fire EDRR on the Angeles National Forest. Andrew Castro, California Botanic Garden, Claremont, CA. acastro@rsabg.org

In 2020, two large fires, the Bobcat Fire (114,963 acres) and Lake Fire (31,089 acres) burned a combined 146,052 acres on the Angeles National Forest (ANF) in Southern California. As a result, a variety of habitats suffered damage including riparian, chaparral, and conifer habitats. Prior to the fires, the two areas provided essential habitat for wildlife including many species which are considered threatened or endangered. Weed species that are particularly detrimental to watersheds include tree of heaven (*Ailanthus altissima*), tumbleweed (*Salsola tragus*), Spanish broom (*Spartium junceum*), and tamarisk (*Tamarix ramosissima*). The wildfires have vastly increased the density of invasive species due to opportunistic growth, reduced soil quality, and decreased canopy area in the forest, creating gaps for invasive plants to establish. This project combined the skills, labor, and research knowledge from the weed crew at California Botanic Garden (CalBG), working in partnership with ANF and Southern California Edison to improve watershed conditions and habitat restoration in the Bobcat and Lake fire areas. This was accomplished by identifying invasive plant populations, surveying, mapping, and prioritizing and treating these populations.

With limited resources, deciding where work is most needed proved to be challenging. Our team began by surveying the affected burned areas and developing priorities based on factors including: invasive plant species introduced during the fire suppression efforts and existing weed populations at risk of further spread due to the proximity of utility rights-of-way, roads, streams, and heavily used trails or recently burned vulnerable chaparral. We maximized our efficiency by experimenting with novel techniques – For example, we successfully experimented with removing the canopy of *Spartium junceum* with a hedge trimmer, then immediately spraying the exposed base with Roundup. All in all, the CalBG weed crew was able to treat roughly 200 acres throughout the combined ANF burn areas.

Conservation-based approaches for landscape-scale fuels management projects. Allison Erny. Placer County Resource Conservation District, Auburn, CA.
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The Placer County Resource Conservation District (RCD) has completed over 600 acres of shaded fuel breaks in the wildland-urban interface of Placer County since 2020. Treatments are located primarily between 1000 and 2000 feet of elevation, where conifer saplings and sprouting brush present a high fuel hazard. RCD has utilized mechanical treatments (i.e. mastication, chipping), herbicide, targeted grazing, and prescribed fire (pile burning and broadcast burning) to reduce ladder fuels and alter the severity of a potential wildfire. When the use of prescribed fire is precluded, a combination of mechanical treatment and herbicide produce the most effective fuel break. This is especially true in areas with invasive or noxious species, including Himalayan blackberry (*Rubus armeniacus*) and Scotch broom (*Cytisus scoparius*). The added use of prescribed fire allows for ecological maintenance of a fire-resilient ecosystem. Low-intensity prescribed fire aids in restoration of the native plant community, increases soil infiltration rates, and can be used to curb undesirable vegetation. Prescribed fire can also allow for phased burning to reduce residual woody surface fuels left over from mechanical fuels reduction. RCD strives to create landscape and community resiliency through conservation-based management that prioritizes protection of biological, cultural, and natural resources. Multiple management tools can be combined to meet the goal of reduced risk of catastrophic fire through restoration of a fire-adapted ecosystem.

Machine learning and robotics enhances the value of physical weed control. Steven A. Fennimore. University of California Davis, Salinas CA.
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Automated weeders are currently changing the nature of weed management in vegetable crops. The latest machines can differentiate between crops and weeds using deep learning. Increasingly powerful computing technology at the field scale has enabled the development of new weed management tools. Principal technologies required for mechanized weed management are 1) crop/weed identification, 2) control system, 3) methods for killing weeds. These technologies have been evolving for several decades. These machines operating autonomously or towed by a tractor allow selective application of herbicides or physical weed removal by automated robots. The impact of automated weeders has been greatest in conventional and organic vegetable crops which have traditionally been very dependent on hand weeding due to lack of sufficient herbicide coverage. Traditionally direct seeded vegetable crops such as lettuce have been thinned by crews with hoes, but machines that selectively apply carfentrazone to thin lettuce to desired stands and spacing have allowed complete automation of lettuce thinning. Lettuce thinning demonstrated the feasibility of selective plant removal which led to adoption of mechanical weed removal tools. Early camera based machine vision systems were only able to identify crop rows, not individual plants. More recent technologies can differentiate crops from weeds e.g. Stout AgTech and FarmWise. These initial machines employed mechanical knives to uproot weeds, but machines are being developed to burn weeds with lasers, flames, or hot oil. The Stout and FarmWise cultivators were recently tested. Lettuce trials were conducted with the FarmWise Titan, and Stout Smart cultivators equipped with knives that opened and closed around the crop. Auto cultivation was carried out following thinning and was compared with standard cultivation which leaves a 10 to 15 cm - wide non-cultivated band centered on the crop row. Pre and post cultivation weed, and lettuce stand counts

were made in a 15-cm wide band around the crop row to determine the efficacy of cultivation. Hand weeding by commercial crews was timed to determine hours per hectare to weed. The FarmWise Titan removed an average of 71% of the intra-row weeds and reduced hand weeding times 34%. The Stout Smart Cultivator removed an average of 81% of the intra-row weeds and reduced hand weeding times by 49% (Smith and Fennimore, unpublished data). While this technology is being developed in vegetables, the potential is for some of the technology to be applied more broadly, including to restoration plantings on flat terrain. Many features of the new auto weeding technology, such as weed recognition and control mechanisms have potential for use in restoration settings; however, there is need for engineering and research to find the best systems for a particular type of site.

Replacing non-native grasses with herbaceous native plants to reduce ignition potential of fuel breaks and roadsides. Robert Fitch[1*], Carla D'Antonio[1], and Nicole Molinari[2]. [1]University of California, Santa Barbara. [2]USDA Forest Service. robertfitch@ucsb.edu

Fuel breaks and roadsides are often invaded by non-native annual grasses. Annual grasses grow at high density and cure in spring creating easily ignitable fuel which increases fire spread rates, expands the fire season, and increases fuel continuity. In Southern California national forests, most wildfires start along transportation corridors. Thus, reducing the ignition potential in these areas to increase the resilience of California wildlands to anthropogenic wildfire is critical. Our goal is to eco-engineer fuel breaks and roadsides with native herbaceous species that reduce ignition risk, meet fuel management objectives, and enhance native ecosystem services. We conducted a plot-scale restoration experiment within a fuel break in the Los Padres National Forest, Santa Barbara, California. Plots were restored by either directly seeding a community of annual forbs, or by hand planting a community of bunchgrasses and perennial forbs. Control plots were dominated by non-native annual grasses and forbs. The different plant communities were monitored for three years including: live fuel moisture, fuel load, live: dead biomass, and litter depth; as well as ecological traits—invasion resistance and floral availability. Native communities retained live fuel moisture over summer and created less litter, whereas the non-native community lost all live fuel moisture in spring and generated more litter. Thus, the native communities would be more difficult to ignite and propagate fire, giving credibility to using native species on fuel breaks to meet fuel management goals, while supporting desirable ecosystem services.

Winter Annual Grass Control: Experiences with Indaziflam in the Mountains of Northeastern California. Tom Getts, Weed Ecology and Cropping Systems Advisor (Lassen, Modoc, Sierra, and Plumas Counties), University of California Cooperative Extension. tjgetts@ucanr.edu

Winter annual grasses are problematic throughout California, from red brome in the south to medusahead in the north. In Northeastern California the three main species of concern are cheatgrass, medusahead, and ventenata. These grasses have invaded millions of acres and numerous ecosystems from perennial bunch grasses, to shrublands, and forests. Increasing fire frequency, reducing native biodiversity and reduced forage are just a handful of winter annual grass impacts. Cultural and mechanical means of control are often not feasible or effective in the ecosystems they invade. Historically, chemical methods of control have provided a single season of suppression but have not offered a long-term solution. Over the past decade research from Colorado and throughout the Western United States has investigated a relatively new herbicide indaziflam for control. Trials have found multiyear control of cheatgrass and other annual grass species while safely releasing established perennials from competition. Beginning in 2016, multiple trials were initially implemented in Northeastern California to replicate this work, testing indaziflam against other currently registered herbicides for control of medusahead. Since 2016, numerous additional small plot trials have been implemented and monitoring larger-scale firebreaks has been conducted to investigate the fit of indaziflam for annual grass suppression while releasing desirable perennial plants. Results from these trials and monitoring efforts may help shed light to the effectiveness of indaziflam for annual grass suppression in Northeastern California ecosystems, with potential lessons for other regions.

Land Stewardship in These Changing Times: Hard work, a sense of humor and a dash of humility go a long way towards peace of mind. Michael Gilogly, Pepperwood Preserve.
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Michael is the Preserve Manager of the 3,200-acre Pepperwood Preserve in Northeastern Sonoma County where he has lived and worked for 28 years. Pepperwood experienced the Tubbs fire in 2017 and the Kincade fire in 2019 which brought challenges and opportunities. We utilize an assortment of tools to address invasive plants including targeted grazing, prescribed fire, restorative native plantings as well as hand pulling and herbicide treatments. We take a holistic approach towards landscape health and utilize adaptive management and data collection to inform our actions. Four decades of using cattle to create disturbance in grasslands has had its share of train wrecks but we continue to learn new lessons. A long history of place-based stewardship has encouraged a strong tie to indigenous perspectives, prompted multiple mistakes, and led to years of building mutual understanding and cooperation with our Native American Council.

Case Study Butte Fire: Post fire seeding and mulching treatment effects on plant cover, RDM, erosion control and invasive species recruitment. David Gilpin[1], Bill Agnew[2], and Chris Swann[3]. [1]Pacific Coast Seed, [2]Agnew Environmental Consulting, [3]EBMUD (retired).
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Since 2002, the use of seed in post-fire mitigation projects in California has been confined almost exclusively to state highway and county roads, Federal Emergency Management Agency (FEMA) and other private reseeding efforts. These agencies have found specific situations where seeding and mulching offers appreciable value for the protection of property and reduction of on-site erosion. An often-cited incentive for post fire seeding is invasive species competition and suppression. In this presentation we outline the results of an interdisciplinary effort to reseed and mulch 46 acres of the 2015 Butte Fire. These efforts included native seed and straw mulching, aerial mulching, and manual application coordinated by BLM and EBMUD. During the spring of 2015 Pacific Coast Seed, Inc. retained Agnew Environmental Consulting and other professional team members to help collect and analyze the effects of the seeding treatments. A control site was identified, and the team collected field data for total cover, including native and other plant cover and RDM. Treated slopes were also measured for soil loss using RUSLE2 equations to which estimated first year potential soil loss and the potential loss over 5 years. We found that prompt reseeding and mulching reduces bare ground and thus lowers potential invasive weed establishment in the first and second year after treatment. We have and will use our results to encourage prompt native seed applications on other fire rehabilitation projects.

Making restoration better (Nothing in this presentation is true, but it's exactly how things are). Elise Gornish, University of Arizona.
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Ecological restoration has now been a formalized field of research and application for long enough to be characterized by individuals who call themselves experts. Whether we are researchers or practitioners, many of us have been doing restoration 'for a long time.' But, has our perceived expertise and experience hampered our efforts? Do we think we know what is best? Do we forget to spend time with the projects that fail? Do we hide our failures from others? This talk will be an exploration into how we can make restoration better, by continuing to do what we are doing – but changing everything. With examples largely from my own work, this talk will be the gentle reminder we all need that not only do we not know everything, but we know more than we think.

The Basics of Herbicide-Resistant Weeds. Brad Hanson. University of California, Davis, Dept. of Plant Sciences.
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Herbicides can provide impressive levels of weed control in many crop and non-crop situations; however, not all weedy species are equally controlled due to varying levels of natural tolerance or evolution of herbicide-resistant weed biotypes. Herbicides impose a great degree of "selection pressure" on weed populations and if the same herbicide or herbicides with

the same mode of action are used repeatedly, herbicide-resistant or -tolerant species can build up in the population after several generations.

For more resistance info: http://www.ipm.ucdavis.edu/IPMPROJECT/glyphosateresistance.html

Urban nature, biodiversity, and climate change in cities around the world. Mandy Ikert, C40 Cities Climate Leadership Group. aikert@c40.org

Nature is a natural buffer and regulator of climate change, and cities around the world are increasing and enhancing urban nature to reduce vulnerability to climate impacts towards protecting people, infrastructure, and urban systems. This talk will cover the different ways cities around the world are taking action on urban nature to adapt to climate change. As cities consider the many ways to redesign urban environments to incorporate more nature and nature-based solutions, many are considering the tradeoffs of landscaped, designed, and managed nature or encouraging greater biodiversity and rewilding. At the same time, climate zones and microclimates are being dramatically altered by climate change, resulting in species migration and the evolution of ecosystems arguably up-ending the concepts of indigenous, native, or invasive plants. What is the role of cities in adopting adapted species that will thrive in their future climate while nurturing healthy livable cities and what information can this community provide to help support cities in making good decisions.

Managing for native biodiversity in San Francisco's urban environment. Isao Kaji, Carolyn Harper, Dylan Hayes, Dani Montijo. San Francisco Recreation and Parks. isao.kaji@sfgov.org

San Francisco's Recreation and Parks Departments (SFRPD) Natural Resources Division (NRD) manages over 1,100 acres of open space in San Francisco's urban environment. The NRD manages small fragments of a unique ecosystem called the Franciscan landscape that hosts an unusual combination of climatic and geologic features that have helped the development of a biologically diverse assemblage of plants and animals. The NRD manages many of the undeveloped portions of iconic parks in San Francisco, including Twin Peaks, Glen Canyon, Mount Davidson and Lake Merced. NRD also manages a small portion of historic oak woodlands in Golden Gate Park (GGP), however it only accounts for 4% of GGP's total acreage. The NRD focuses on protecting the remnant assemblage by managing invasive species common to the California coast with hand and mechanical work when feasible, and with selective herbicide applications when manual removal is not feasible. Some of the species NRD manages include but are not limited to: Italian thistle (*Carduus pycnocephalus*), ice plant (*Carpobrotus chilensis*), cape ivy (*Delairea odorata*), *Ehrharta* (*Ehrharta erecta*), French broom (*Genista monspessulana*), *Oxalis* (*Oxalis pes-caprae*) and Himalayan blackberry (*Rubus armeniacus*). With the absence of fire and grazing animals, the NRD is also responsible for protecting the remnant grasslands in San Francisco from converting into coastal scrub. The NRD program has enjoyed consistent public support for its community-based site stewardship work, and hopes to share some of the lessons gained from over 20 years of biodiversity focused conservation in San Francisco's urban environment.

Mobilizing a rapid response to the threat posed by *Paspalum vaginatum* to tidal marsh conservation in both northern and southern California. Drew Kerr[1], Alys Arenas[2]. [1]Kerr Ecological Solutions (KES). [2]Newport Bay Conservancy. drewkerr@comcast.net, alys.arenas@newportbay.org

Remnant California tidal marshes often occur as patches of wildlands fragmented by urbanization and constrained by human development from their standard landward migration in response to sea level rise. Their position on the WUI exposes them to many stressors including invasive plant degradation. Seashore paspalum (*Paspalum vaginatum*) is proving to be a successful invader of brackish and estuarine marshes in both northern and southern California. This invasive grass, likely a turf industry cultivar escaped from commercial or residential horticultural introduction, was first reported from coastal San Diego County in 2002. It was recently identified in the San Francisco Estuary after being highlighted during the 2020 Cal-IPC Symposium Weed Alerts. Paspalum forms thick, dense

mats that exclude other vegetation once established, expanding into surrounding native vegetation via stolons. In the San Francisco Estuary, *Paspalum* has dominated the mid-elevation pickleweed plain, already smothering several acres of brackish marsh and lining tidal flood control channels for over two miles. While established meadows indicate the longer-term potential of the invader, colonization of recently breached South Bay Salt Pond restoration sites is even more alarming, where *Paspalum* can alter the trajectory of marsh development by colonizing open mud, impeding the establishment of a diverse native plant assemblage. In southern California, records of *Paspalum* in Upper Newport Bay motivated the Newport Bay Conservancy to begin actively surveying for this species in 2021-2022 in the Big Canyon Restoration Project, a 60-acre nature park undergoing its final phase of restoration. Initial management efforts have begun in both areas to delimit the extent of these infestations to inform rapid response treatments.

EDRR Program Jumpstart: Steps for Going from Zero to Pilot Program. Rachel Kesel, One Tam.
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This course will outline the four cornerstones of an Early Detection, Rapid Response program. First, we will consider your survey geography with an emphasis on vector pathways for invasive plants. We will review tools and considerations for selecting target species. Data collection requirements, pitfalls, and opportunities will be discussed at a high level. Because rapid response is the goal of early detection surveys, we will look at strategies for ensuring treatments are built into your pilot program. The instructor will provide a link to training resources for participants and checklists and cheat sheet for later use uploaded to the conference program website. This workshop derives from the One Tam EDRR program in Marin County and the EDRR training program at California State Parks.

Limitations and solutions to sharing knowledge about invasive species research and management between academia and land management. Metha M. Klock, San Jose State University, San Jose, CA.
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Dual interests between invasive species land managers and scientific researchers provide a unique opportunity for collaboration and promotion of one another's goals. However, the active role and insight of land managers, and the scientific advances discovered by researchers, are often not effectively communicated between these groups. This talk will identify several reasons for gaps between invasive species research and land management and highlight ways to more effectively connect knowledge learned by these groups. Significant theoretical and applicable research has been done to inform and improve our understanding of the mechanisms of invasive species colonization and establishment. Research has also been done to improve and refine tools that can be used to manage species invasion. However, this research is often inaccessible to land managers, through limitations such as access to scientific journals. In this talk, I will outline the key barriers that exist to communicating invasive species research findings to land managers and focus on potential solutions to bridging this gap. I will use examples from my research on invasive *Acacia* (*Acacia spp*.) and privet (*Ligustrum sinense*) to highlight ways to connect research with management goals and provide suggestions for improving communication and facilitating sharing of information that will benefit both researchers and land managers. By improving the connection between on-the-ground invasive species management and research on ways to better understand plant invasions, we can streamline and improve our success in combating non-native species invasions.

Optimizing control of invasive parrotfeather in Washington with herbicides and knowledge of environmental constraints. Lauren Kuehne[1], Dr. Julian Olden[2], Amaryllis Adey[2], Madeleine Hicks[3], Bill Wamsley[4], Timothy Wilson[5], Paula Cracknell[5], Mike Murphy[5], and Todd Brownlee[6]. [1]Omfishient Consulting. [2]University of Washington. [3]Oregon State University. [4]Lewis County Noxious Weed Program. [5]Thurston County Noxious Weed Program. [6]Washington State Department of Natural Resources.
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Non-native parrotfeather (*Myriophyllum aquaticum*) is a highly persistent invader that can transform both lotic and lentic habitats, impeding recreational use and

altering quality and abundance of fish habitat. Control is very challenging, requiring many years of consistent treatment with herbicides. Over a ten-year period, we have conducted field-based studies to optimize management of parrotfeather along the Chehalis River and adjacent wetland habitats in Washington State. Two of these studies have evaluated effectiveness of several herbicides – imazapyr, glyphosate, 2,4-D, and triclopyr – to control parrotfeather over 1-2 years, including testing whether timing of herbicide application results in better control. We found that imazapyr offered the best long-term control, followed by triclopyr; however, even the most effective and successful treatments only reduce plant cover in field settings by approximately 25% over a one-year period. Tank mixes are not recommended. We also compared changes in parrotfeather along the Chehalis River over a 20-year period, to determine environmental constraints on distribution and abundance that could inform management action. Our results indicated that establishment and spread of parrotfeather may be limited by floodplain and hydrologic characteristics in upstream and downstream areas but is facilitated in middle reaches. We describe how knowledge of these environmental constraints on distribution is being used to inform management action through prioritizing areas for treatment and considering the implications of a proposed dam that would alter the hydrologic regime.

Managing invasive plants for biodiversity in the city: a view from Los Angeles. Travis Longcore, UCLA Institute of the Environment and Sustainability. longcore@ucla.edu

Preconceptions notwithstanding, cities are critically important to California's biodiversity. In fact, over half of the federally listed insects in the state are found in urban or industrial settings. Human connection to biodiversity also depends on integrating indigenous species into urban landscapes. Supported by twenty-five years of work in Los Angeles and beyond, lessons can be shared about managing landscapes for native habitats. First, we still know more about the surface of the Moon than remnant native biodiversity, so discoveries and opportunities abound. Second, appropriate limitations to reduce human risk by requiring herbicide-free techniques pose surmountable challenges, which require more time, labor, and diligence. Third, a thorough understanding of historical ecology and landscape processes can inform actions in even the most urban settings, even as detailed plans depend on present site conditions. Finally, urban stewardship is never over. Restored habitats require periodic ongoing management, presenting opportunities for an engaged public.

Expanding the use of prescribed fire as an ecosystem stewardship tool in fire-adapted landscapes. Hannah Lopez. Fire Forward, Audubon Canyon Ranch, Petaluma, CA. hannah.lopez@egret.org

The North Bay Area of California contains a diversity of ecosystems that span oak woodlands, coastal prairies, and redwood forests. In addition to the wide variety of flora and fauna that cover these landscapes, each community—as a result of millennia of stewardship by indigenous people using cultural fire— has specific adaptations to, and relies upon, fire as a natural disturbance to maintain overall ecosystem health and structure. By understanding these fire adaptations and relationships, land stewards and fire practitioners can implement prescribed burns that meet multiple objectives, including invasive species management, fuels reduction, and improving ecosystem health and vigor. It is the mission of the Fire Forward program of Audubon Canyon Ranch to support the expansion and implementation of prescribed fire as a stewardship tool in the North Bay Area and beyond. Since the launch of the program in 2017, Fire Forward has trained over 400 community members as basic-wildland firefighters capable of participating in the implementation of prescribed burns in the region. These community members are a part of the Good Fire Alliance, an ever-growing prescribed burn association of individuals and communities that understand the ecological and human-health importance of bringing good fire back to our landscapes.

Weeds and Seeds and Fire, Oh my! Weed Management Lessons from Montana. Jane Mangold, Montana State University, Bozeman MT. jane.mangold@montana.edu

Integrated weed management involves controlling the target weed, but even more important is making sure weed control actions lead to healthy plant communities

that meet management objectives. Sometimes integrating seeding, that is revegetation, with weed control is necessary, yet revegetation is prone to failure and can be complicated by site conditions like weed seeds in the seed bank or wildfire. Additionally, many projects do not monitor long enough to determine whether revegetation is successful or not. This presentation will share results from a variety of research projects in Montana including managing the seed bank of the invasive annual grass *Ventenata* (*Ventenata dubia*) with herbicides like indaziflam, imazapic, rimsulfuron, glyphosate, and others; where to prioritize revegetation following wildfire; and the long-term outcomes of revegetation in invasive forb-infested rangeland. Takeaway lessons learned from research in Montana suggest that a single application of indaziflam can deplete the seed bank of *Ventenata*; areas disturbed through fire suppression activities, e.g., fire breaks, should be prioritized for seeding; and revegetation outcomes take many years to be realized.

City of Portland Invasive Species Strategies and Comprehensive Policy Framework; a Synopsis. Dominic Maze, Bureau of Environmental Services, City of Portland, Oregon. dominic.maze@portlandoregon.gov

Building off previous efforts and municipal code modifications, the City of Portland began developing comprehensive invasive species policy and regulatory frameworks in 2008. Since that time, the city has implemented numerous policies with regards to invasive species while continuing with on-the-ground work and community engagement. In 2019, the city passed a new suit of binding policy to bolster previous efforts and address new challenges. Called the "model" for municipalities in the US by the National Invasive Species Advisory Committee, these efforts provide a template for other cities seeking to modify and create policy that addresses invasive species.

Using organic herbicides on roadsides and ROW: Evaluating costs and effectiveness. Chris McDonald. University of California Cooperative Extension. cjmcdonald@ucanr.edu

Land managers regularly use integrated pest management (IPM) to control weeds. One part of the IPM process is to evaluate control methods to improve the effectiveness of weed control and to decrease risk to applicators and the public. In addition, the public is concerned about the use of the herbicide glyphosate by applicators in public spaces. Managers are under pressure to reduce the use of glyphosate or synthetic herbicides in general, and to incorporate organic herbicides into management practices. However, the research on effectiveness and costs of organic herbicides on roadsides is lacking. An experiment was conducted on roadsides and rights of way (ROW) in San Diego County to evaluate the effectiveness and costs of glyphosate, non-glyphosate synthetic herbicides, and organic herbicides at controlling weeds. The study was conducted at three roadside sites across the county in the 2020-2021 growing season. At the beginning of the study, three organic treatments were selected and two non-glyphosate synthetic treatments were compared to glyphosate and untreated controls. This presentation will focus on the effectiveness of organic herbicides and non-glyphosate synthetic herbicides compared with glyphosate and untreated controls. I will also present cost estimates for incorporating organic herbicides into roadside land management and several unintended consequences of switching to organic herbicides for land managers.

What's New from Industry: California Land Management Herbicide Update. Rick Miller, Corteva Agriscience, Pasture & Land Management, Rescue, CA. richard.miller@corteva.com

This presentation will survey the larger herbicide manufacturers, Alligare®, Bayer Environmental Sciences, and Corteva Agriscience for new products or labeling in the Land Management/invasive weed arena in California. Alligare® is launching Ballast™, a non-selective long lasting bare-ground weed control solution. Ballast™ is a dual-action product with 2 modes of action: flumioxazin (Group 14 PPO inhibitor) and imazapyr (Group 2 ALS inhibitor) providing excellent pre-emergent and post-emergent activity. Applying Ballast™ at the labeled use rate of 48 oz/A, will provide long-lasting control of 235 annual, biennial, and perennial weeds, including woody plants and brush. Ballast is anticipated to be available in the US in the Winter/Spring of 2023. Bayer Environmental Sciences is launching Esplanade™ Sure (indaziflam and rimsulfuron), an easy-to-use premix herbicide that manages difficult-to-control weeds in bareground sites,

while lessening off-target risk in sensitive sites. It also provides pre- and post-emergent control in non-crop areas. Rate range is 3.5 to 6 oz/acre with an average rate of 4.5 oz/acre. Packaged in a 90 oz bottle (4 x 90 oz bottle). Corteva Agriscience is awaiting California registration for TerraVue, a combination of aminopyralid and Rinskor®. Both active ingredients feature reduced-risk status from EPA and the combination has labeling for more than 140 broadleaf weeds and brush species. Rinskor active represents the latest member of the arylpicolinate family of chemistry, a unique and new class of synthetic auxin within the HRAC Group O (WSSA Group 4) category. Corteva Agriscience is also expanding the non-crop label for Sapphire, active ingredient penoxsulam, another reduced-risk chemistry. The improved label for Sapphire will have both pre-emergent and post-emergent uses for broadleaf weeds and certain grasses in non-crop including forestry site-prep, right-of-way, and invasive weed uses across a broad range of non-crop use sites.

Translational Invasion Ecology & Climate Change: Bridging research and practice to address the greatest drivers of global change. Toni Lyn Morelli, United States Geological Survey. tmorelli@usgs.gov

As climate change makes invasive species management even more challenging, research managers and scientists look to combine efforts to improve outcomes. Translational Invasion Ecology (TIE) provides a process to work across disciplines to answer by the question "How can we manage for upcoming biological invasions in the light of climate change?" For the last seven years, the Regional Invasive Species & Climate Change (RISCC) Management network has implemented TIE by identifying stakeholder needs, synthesizing existing research, developing new research and tools, and supporting increased collaboration among scientists and managers. To identify stakeholder needs, we surveyed over 200 national invasive species managers to assess barriers to management in the context of climate change. We have synthesized existing information through summaries of recent literature targeted at a general audience and by crafting two-page 'management challenge' documents that translate the state of the science, which are distributed to a listserv of 350 members. We are developing new research to prioritize range-shifting invasive species based on their impact, and new online tools to create state-level watch lists of range-shifting species. RISCC hosts symposia and workshops to bring together scientists and managers to learn about these combined topics. Moving forward, we will use the information gleaned from these interactions to inform future research translation, implementation, and communication efforts.

The biological deserts fallacy: Cities in their landscapes contribute more than we think to regional biodiversity. Erica Spotswood, Dr. Kelly Iknayan, Lauren Stoneburner, Jennifer Symonds, Joe Burg, Brandon Herman. Second Nature Ecology and Design. erica@secondnatureeco.com

Urban ecosystems are highly altered, containing no-analog communities of species that have not occurred together anywhere else in space or time. Long considered biological deserts, cities have also been left largely out of the conservation movement, allowing ecological communities to assemble with little intervention or intention from people. Left to their own devices, many native species have entered into cities and are doing better than we ever could have expected. At the same time, cities are hubs for human activity, and have been responsible for many exotic and invasive species introductions. Invasive species often arrive first to cities, and cities serve as loci for spread of invasive species into wildland areas. In this talk, I will use biodiversity data from the Bay Area to highlight what we can learn from patterns of native and non-native occurrences in cities, and in adjacent wildland areas. I'll discuss how strong invasive species management inside cities could benefit biodiversity conservation both inside cities and in the wildlands that surround them. I'll discuss specific examples from California of how native species can benefit from invasive species control, as well as specific ecological restoration projects in cities where control has improved urban biodiversity outcomes.

Controlling invasive *Phragmites australis* at a restoration site in Suisun Marsh, CA. Madison Thomas, Gina Darin. California Department of Water Resources. Madison.Thomas@water.ca.gov

The purpose of this study was to characterize the feasibility, efficacy, and environmental impacts of several small-scale *Phragmites* (*Phragmites australis*) control methods to inform site-wide *Phragmites* control within Blacklock, a restoration site in Suisun Marsh.

Effective methods for *Phragmites* control are well established; however, no control method is currently permitted on a site-wide scale in open tidal marshes, as there is concern with off-target negative impacts on sensitive species. Treatments consisting of different combinations of mowing and herbicides (glyphosate and imazapyr) within experimental plots, concluded in fall of 2021 with three years treatments. Treatment efficacy was evaluated several times each year per plot using aerial imagery and subsequent processing of Normalized Difference Vegetation Index (NDVI) value analysis. Environmental impacts were assessed via water quality monitoring before and after treatment events. Efficacy results indicate that all treatments significantly reduced *Phragmites* growth as compared to the untreated control plots, despite variability among seasons and treatment types. In addition, water quality and herbicide detection results indicate off-target impacts were well below threshold levels of concern. Native plant growth in treatment plots is a positive indicator that both passive and active revegetation in the future will be successful. The results of this study indicate that herbicide and mowing treatments of *Phragmites* in open tidal wetlands are feasible, efficacious, and have minimal off-target negative impacts to water quality, food web, and non-target plants. Findings will be used to inform site-wide *Phragmites* control at Blacklock, as well as nearby restoration sites.

Timed mowing of invasive grasslands in Santa Monica Mountains National Recreation Area. Matthew Wells*. Santa Monica Mountains NRA. M.h.wells86@gmail.com

Development at the urban-wildland interface has swelled in recent years due to population growth and urban sprawl. As a result, fuels reduction efforts are on the rise to protect life and property. Traditional fuel safety practices leave buffers of cleared vegetation around housing and include multi-acre fuels reduction zones that are placed in strategic areas to control the travel of wildfire. Although fuels work is necessary to protect life and property, the timing of clearance activities facilitates invasive spread as treatments occur annually during late spring and summer when most weeds have already set seed. This study proposes a digression from late season mowing and instead investigates the efficacy of early season mowing to prevent seed set of flammable invasive vegetation that tend to dominate fuels reduction areas. By managing non-native grasslands through repeated early season mowing, we predict a reduction in the cover of invasive grasses and forbs, and over time a depletion of the non-native seedbank. Preliminary results from this study show that timed mowing reduces cover and litter of invasive grasses and encourages passive recovery of low growing native forbs, which reduces fire risk by lowering relative fuel loads. Although there is an initial labor investment associated with timed mowing activities, the lower fuel load and higher habitat quality resulting from the establishment of native communities will ultimately reduce labor needs, and provide a long-lasting solution to fuels treatment areas, which are otherwise written off as wastelands.

Control of invasive plants within the Scorpion Fire burn area at Santa Cruz Island. Jay Woolsey[1], Mike Parker[1], Katy Carter[1], Annie Little[2], Clark Cowan[2]. [1]California Institute of Environmental Studies. [2]Channel Islands National Park. jaywoolsey313@gmail.com

On Santa Cruz Island a fire ignited on 31 May 2020 burned 1,411 acres from Scorpion Anchorage to Smugglers Cove. The fire and fire suppression response caused areas of exposed and disturbed soil. Such areas are prone to the establishment and/or expansion of invasive plants. Our efforts, post fire suppression, were twofold: 1) prevent invasive plants from establishing or expanding in the burn area, and 2) support and enhance previous invasive plant control conducted prior to the fire. During the 2021 season we targeted fennel (*Foeniculum vulgare*), mustard (*Brassica nigra*), Harding grass (*Phalaris aquatica*), and kikuyu grass (*Pennisetum clandestinum*) over 268 acres within the burn area. For 2022, we additionally targeted olive trees (*Olea europea*), horehound (*Marrubium vulgare*), and Spanish broom (*Spartium junceum*). In 2021, we exclusively used chemical (herbicides) treatments; in 2022, we utilized a combination of chemical and mechanical (hand-pulling) methods. All efforts were mapped in a GIS interface displayed in 25m² cells. This method allowed us to precisely map target infestations and accurately track herbicide usage while estimating plant counts and density providing a realistic assessment of our control efforts. We will evaluate control efforts by comparing findings among two treatment seasons. Preliminary findings indicate a 23.7% reduction in herbicide use when comparing locations previously treated in 2021.

Fumbling towards successful strategies to increase forest diversity under *Acacia koa* stands in Hawai'i. Stephanie Yelenik[1], Carla D'Antonio[2], Jonah Kuwahara-Hu[3], Eben Paxton[4], Evan Rehm[5], Eli Rose[4], Jeff Stallman[3], and Corie Yanger[3]. [1]US Forest Service. [2]UC Santa Barbara. [3]Hawaii Cooperative Studies Unit. [4]USGS. [5]Austin Peay State University.
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Restoration with the native nitrogen-fixing tree *Koa* (*Acacia koa*), is common in Hawai'i. *Koa* is easy to propagate, has faster growth rates, and higher survival than other native trees. This talk synthesizes multiple studies that explore the benefits and drawbacks of using *Koa* in restoration, including experiments we have conducted to increase forest diversity under planted *Koa*. Koa increases available nitrogen in degraded soils and can act as a nurse plant that protects native outplants from stressful conditions. When established as in monospecific stands, however, it can stall secondary succession of native diverse, healthy forests, particularly in previously pastured ecosystems. There, invasive grasses are facilitated by high available nitrogen in soils, inhibiting natural regeneration, even when native seed is present. At Hakalau Forest National Wildlife Refuge, over the course of eight years, we tried various strategies to lower grass biomass and facilitate native species regeneration. These experiments included testing various herbicides, adding seed at various rates, carbon amendments to mimic high densities of other tree species, and dense plantings of native woody species. Carbon amendments did not lower high soil nitrogen and/or suppress grasses. Seed addition in the absence of grass removal, did not lead to native seedling recruitment, even at high rates. Herbicides, while effective at killing grasses, led to secondary invasions by sawtooth blackberry (*Rubus argutus*). Finally, dense plantings of native woody species decreased invasive grass biomass while simultaneously leading to natural recruitment of desired native species.

Lightning Talk Abstracts

Case study: managing yellow starthistle in grazed and ungrazed areas in the California Central Coast. Jackson Brooke, Jenna Allred, and Dr. Rodrigo Sierra Corona. Santa Lucia Conservancy. jbrooke@slconservancy.org

The Santa Lucia Conservancy (SLC) manages 20,000 acres of conservation land, either owned (10,000 acres) or through easements (8,000 acres) with a variety of partners within the Santa Lucia Preserve (SLP) in the Central Coast of California. We control a variety of species including yellow starthistle (*Centaurea solstitialis*) which is only found in 3 areas totaling 150 acres within the SLP. Beginning in 2019, multiple treatment methods such as grazing, spot herbicide applications with Milestone, and hand removal have been used to control yellow starthistle in grasslands. After four years of management and comparing areas that have been grazed to ungrazed areas, there are differing levels of success. After herbicide treatment in 2019 in ungrazed areas, hand removal has been sufficient for treatments in subsequent years and percent cover has dropped from 50% to 5%. In grazed areas, herbicide and hand removal have been required annually and percent cover has remained around 25%. Based on this case study, managing yellow starthistle in ungrazed areas is more successful than management in grazed areas. Going forward, coordination with the grazing program will be crucial for keeping cattle out of areas with yellow starthistle until treatments are completed.

South American Spongeplant (*Limnobium laevigatum*) found in the Feather River. Robin M. Carter-Ervin. California Department of Water Resources, Oroville Field Division. Robin.Carter@water.ca.gov

In 2021, South American Spongeplant (*Limnobium laevigatum*) was found for the first time in Butte County, within the upper reaches of the Feather River. *Limnobium laevigatum* appears to be a distinct species from *L. spongia*, which is found more broadly across California, though there is still debate about its taxonomy. This species spreads rapidly: in 8 months the known number of locations in the county have more than doubled in size. The Feather River is a popular fishing destination, which suggests that fishing may be spreading spongeplant to other water bodies. Currently

there are no control plans in place for this species. What should be done to combat the spread of this plant and other invasive plants rapidly spreading in the river systems that feed the Delta?

Habitat Restoration at Hidden Valley Wildlife Area Utilizing Drone Technology. Christiana Conser[1], Sloane Seferyn[1], AJ Fox[1], Varren Anacleto[1], Kelsey Warkentin[1], Taylor Paez[1], Dustin McLain[2]. [1]HANA Resources, Inc. [2]Riverside County Regional Park & Open-Space District. christianac@hanaresources.com

Riverside County Regional Park & Open-Space District (Parks) and HANA Resources (HANA) plan to restore 608 acres of native habitat on 1,170 acres at the Hidden Valley Wildlife Area following long-term giant reed (*Arundo donax*) management. The project goals are to reduce giant reed cover, increase native riparian and upland habitat, decrease cowbird parasitism, and increase community stewardship. HANA secured grant-funding and led the development of the project in collaboration with Parks and project partners San Bernardino Valley Municipal Water District and Santa Ana Watershed Association. Project progress is being measured using annual unmanned aerial vehicles (UAV) and HANA's patented technology, Plant Species Recognition Assessments, which maps and determines giant reed density utilizing machine learning. The project will be executed in five phases. Phase 1, funded by the Wildlife Conservation Board, will be completed in the 2022. Phase 1 tasks include environmental compliance and development of a habitat restoration plan. Project implementation will occur in Phases 2–5. Phase 2 will restore 207 acres of Mulefat Scrub. Phase 3 will restore 126 acres of Willow Riparian and Southern Cottonwood/Willow Forest. Phase 4 will restore 157 acres of Riparian Scrub and Riverside Alluvial Fan Sage Scrub. Phase 5 will restore 120 acres of Coastal Sage Scrub/Cactus. Giant reed control will occur during all phases. Targeted management of high-priority invasive plants will be performed in the restoration areas within each phase.

Jubata Grass in the Wake of the Woodward Fire. Rachel Hendrickson, Point Reyes National Seashore, National Park Service. rachel_hendrickson@nps.gov

The Woodward Fire was ignited by lightning in August 2020. It burned approximately 5,000 acres just west of the Bear Valley headquarters in the Point Reyes National Seashore. As part of the Burned Area Rehabilitation Plan, staff developed a strategy to locate new introductions and previously undocumented populations of invasive plant species and treated priority patches of invasive species using a modified EDRR approach. In 2021, 3,745 acres were surveyed covering roads, trails, and areas of operational impact from fire suppression and repair efforts and high burn severity units. Jubata grass (*Cortaderia jubata*) is one of the highest priority invasive plant species found at Point Reyes. Its spread quickly and poses a risk to several CNPS-listed rare plant species at risk as well as larval host plants and nectar sources for the federally endangered Myrtles Silverspot Butterfly. Increased distributions also decrease habitat for the federally threatened California red-legged frog. After the Vision Fire in 1995 burned 12,000 acres, jubata grass' wind-dispersed propagules invaded newly opened canopy. Primary objectives of the post-Woodward Fire invasive management plan are to continue to detect all new infestations, return to historic infestations and treat completely all jubata grass populations in the Woodward Fire area in order to prevent a similar spread. The Woodward burned primarily in designated wilderness, mainly in coastal scrub, chaparral, and forest communities. This presentation will cover lessons learned and treatment strategies from the first year of monitoring and treatment of jubata grass in a post-fire landscape.

Invasive grasses interact with rainfall variability to shift taxonomy and function in native rhizosphere microbiomes. Dr. Marina LaForgia[1], Dr. Cassie Ettinger[2]. [1]Department of Evolution and Ecology, UC Davis. [2]Department of Microbiology and Plant Pathology, UC Riverside. marina.laforgia@gmail.com

The soil microbial community is a critical component of a healthy ecosystem. Invasive plants can disrupt these healthy communities by changing their taxonomic and functional makeup, which may have detrimental effects on natives' abilities to compete with invaders. At the same time, climate change is amplifying rainfall variability, leading to more frequent extreme wet and extreme dry events. Invasive management in these systems thus requires not only understanding how plant invaders affect the taxonomic and functional microbiome of native species, but also how these invaders interact with a changing climate to shift this community. Here we pair a greenhouse study with a manipulative field experiment on a set of 6 native

annual forbs and 3 invasive annual grasses to test how competition with invaders alters both identity and function in the native rhizosphere microbiome, and whether competition interacts with rainfall to amplify or ameliorate these microbial shifts. We found that competition with invaders shifted the rhizosphere composition of native annual forbs and these shifts were linked to grass dominance. Further, while drought alone had little effect on microbial composition, drought combined with grass competition led to significant shifts in function in the microbial community. This suggests grass-driven shifts in the microbial community may be weakening natives' ability to cope with climate change. Restoring a healthy microbial community is thus a critical component of mitigating the negative effects of invasions and climate change on our local communities.

Update on recent biological control releases against invasive plants by the USDA-ARS in California. Patrick J. Moran, Paul D. Pratt, Lincoln Smith. U.S. Department of Agriculture-Agricultural Research Service (ARS), Invasive Species and Pollinator Health Research Unit, Albany, CA. Patrick.Moran@usda.gov

The USDA-ARS Invasive Species and Pollinator Health Research Unit has released two new biological control agents since 2019 and has monitored dispersal of other agents. The yellow starthistle rosette weevil (*Ceratapion basicorne*) is the first new agent against this weed in California in almost 20 years and the first that feeds on the taproot of immature plants. It has been released at three sites in California since 2020. The gorse thrips (*Sericothrips staphylinus*), which feeds on leaves and stems, is the first new agent in over 25 years. It was obtained from collaborators in Oregon and released at six sites in California in 2020. Preliminary evidence of establishment has been obtained for both agents. The *Arundo* shoot tip-galling wasp (*Tetramesa romana*), first released in northern California in 2017, is established at one site each in the Sacramento and San Joaquin Valleys and at several sites in the Delta, and has dispersed 6 km from one site. The Cape-ivy shoot tip-galling fly (*Parafreutreta regalis*), first released in 2016, is established at six or more sites along the coast and has dispersed 1 km. Biological control holds promise to contribute to integrated management of these invasive weeds in California.

The effect of *Vicia villosa* invasion on plant-pollinator networks and native plant fitness. Rebecca A. Nelson*, Dr. Fernanda Valdovinos, Dr. Susan Harrison. University of California, Davis. ranelson@ucdavis.edu

Plant-pollinator mutualisms contribute to California's biodiversity. Invasive species decreased plant diversity in California annual grassland ecosystems. The invasive hairy vetch (*Vicia villosa*) is prevalent in California grasslands. The extent to which *V. villosa* shares pollinators with native California plants remains a knowledge gap. To address this knowledge gap, we investigated whether the degree of *V. villosa* invasion influenced plant-pollinator networks and native plant fitness in a northern California grassland. At the University of California McLaughlin Reserve, we conducted floral visitor observations via transect surveys and measured native plant seed set for six meadows spanning a *V. villosa* invasion gradient. *Vicia villosa* and native plants differed strongly in floral visitors. *V. villosa* shared pollinators with a functionally similar native plant, *Trifolium fucatum*, particularly honeybees and bumblebees. The relative abundance of *V. villosa* to *T. fucatum* influenced pollinator diversity, abundance, and plant-pollinator interaction structure. These findings may have consequences for native plant fitness. The presence of *V. villosa* in California grasslands as an invasive species may affect the restoration of native legumes such as *T. fucatum*.

Distilling Data with Calflora. Cynthia Powell, Calflora. cpowell@calflora.org

Calflora is a unique and comprehensive data source of California's wild plants that provides analytical tools and an ability to display geographical plant occurrences. Use Calflora to document invasive plants on the land you manage. For instance, you may opt to document how your invasive plant tracking team spends its time, how many acres of which species exist in which region, how the gross area of an infestation has changed over time, how many staff / volunteer labor hours have been spent and / or bags collected, how many funds have been used, etc. Customize your reports for any field(s) on your group's data collection form. These reports may be generated for your board, supervisor(s), and / or to plan your strategies for the future.

Assessing the impacts of herbicide management options on the soil seedbank. Clarissa Rodriguez*, Loralee Larios. Botany and Plant Sciences, University of California, Riverside. crodr087@ucr.edu

Stinknet (*Oncosiphon pilulifer*) is a winter annual forb native to South Africa that is an invader of concern in California. In our previous research, we replicated herbicide field trials at three grassland sites within Riverside County in 2018 and 2019 to assess and compare the efficacy of reducing initial stinknet establishment with herbicides applied in the fall (aminopyralid, indaziflam, isoxaben + dithiopyr) vs reducing stinknet seed production with herbicides applied in the spring (glyphosate, clopyralid, triclopyr). We found that herbicides applied in the fall were more effective at reducing stinknet cover but also altered community composition one year after treatment. The extent to which these changes in composition reflect changes in the seedbank is unknown. Stinknet produces many seeds that may saturate the soil seedbank; therefore, it is critical to understand how herbicide management may impact the soil seedbank. To assess the impacts of herbicide management on the soil seed bank, we collected soil cores across our previously treated sites and conducted a seedling emergence study aimed at 1) evaluating the effectiveness of herbicides on reducing stinknet density in the soil seed bank, and 2) assessing herbicide impacts on seed bank composition and diversity of nontarget species. We found that fall-applied herbicides reduced stinknet density in the soil seedbank compared to spring-applied herbicides and control plots by 55%. Additionally, we found that herbicides did not alter species diversity or community composition of the seed bank. Our results suggest that fall-applied herbicides are viable options for reducing stinknet density in the soil seed bank, while limiting impacts of non-target species.

Incomplete burning during prescribed fire may form stinknet (*Oncosiphon piluliferum*) refugia. Stuart T. Schwab*, G. Darrel Jenerette, Loralee Larios. University of California Riverside, Botany and Plant Sciences Department. sschw005@ucr.edu

Prescribed fires are a common practice to reduce built up litter and seedbanks of non-native annual grasses; however, the response of non-native forbs is less clear. Forbs such as stinknet (*Oncosiphon piluliferum*) have secondary compounds and woodier stems that are not as readily burned, and these differences in fuel type can lead to incomplete consumption of both seed and litter which may result in the benefits of prescribed fires not being actualized. To elucidate post-fire recruitment dynamics, we executed a factorial experiment in a 200-acre prescribed burn performed at Lake Perris State Park, California, in June 2019. We paired plots inside singed stands or in surrounding areas of complete burn and manipulated litter to have either litter present or no litter present. To investigate the differences in seedbank, we collected soils in our experimental plots and conducted a five-month grow-out study to evaluate seed density. We measured plant composition during peak biomass over two years (2020 and 2021). We found 23% greater stinknet cover in singed stands and more than double the amount of viable stinknet seeds present in these stands (124+15 vs 47+9) regardless of year or litter treatment. Our litter treatments had 6% greater stinknet cover and more viable stinknet seeds present (102+78 vs 68+15) regardless of burn completion or year. Our study suggests that in the post-fire landscape, stinknet and other invasive forbs, which do not completely burn, may form refugia through increased seed retention and favorable microclimates from which they may spread.

Updates on Horticultural Invasives Prevention. Alex Simmons. PlantRight. info@plantright.org

PlantRight is a collaborative, science-based, and voluntary program that serves to promote the use of non-invasive plants in California gardens and landscapes. Through partnerships with stakeholders in the nursery industry, conservation, government, and academia, PlantRight has effectively prioritized and tracked the sale of invasive plants of horticultural origins in California retail nurseries over the past decade. While there was not a survey this year, PlantRight continued to present its 2021 findings to gardening and conservation groups as well as raise awareness about invasive plants across various media. Additionally, PlantRight has been partnering with Cal-IPC to further develop the use our Plant Risk Evaluator (PRE) tool which is designed to predict the invasive risk of newly introduced ornamental plants and plants that have yet to be classified as invasive. The Plant Risk Evaluator (PRE) tool is an online assessment tool designed by researchers at UC Davis and University of Washington in collaboration with PlantRight. A primary focus of the tool has been on ornamental plants since horticulture has been a top pathway for introduction of non-native plants that later become invasive. Funded

for a second year by a grant from the Western Integrated Pest Management Center (WIPM), we have formed a multi-state work group aimed at expanding use of the PRE tool. The work group includes partners in California, Arizona, Nevada, Oregon, Washington, and the Yurok Tribe. By broadening adoption of the tool, we can promote better collaboration in invasive plant listing and ensure the ongoing maintenance of this valuable web tool.

Assessing woody plant encroachment in Marin County, California, 1952-2018. Charlotte Startin*. University of Southern California. charlotte.startin@gmail.com

To maintain healthy ecosystems, land managers and ecologists must understand an area's historical ecological context to inform restoration decisions. Ecological restoration often involves reestablishing habitat to a previous condition or mitigating changes in ecosystem functioning. In Marin County, the study area for this thesis, woody plant encroachment caused by fire suppression is an ecological concern. Where indigenous people once managed the land with frequent burning, fire suppression throughout the past two centuries has caused ecological changes. Transitions from grassland to shrubland and from shrubland to woodland are a result of woody plant encroachment and can lead to decreased biodiversity. This thesis classified and compared changing vegetation communities in aerial imagery from 1952 and 2018. The mosaiced landscape of 1952 is now more homogenous. Ultimately, it was found that herbaceous plant communities and shrubland have shrunk by 62% and 51%, respectively, while woodland has increased by 307%. 44% of total woody plant encroachment consisted of woodland replacing shrubland, while 39% consisted of woodland replacing grassland, and 17% consisted of shrubland replacing grassland. The most common shrub species replacing grassland was coyote brush (*Baccharis pilularis*). The most common woodland species replacing grassland and shrubland was Douglas fir (*Pseudotsuga menziesii*). While the majority of encroachments were by native species, non-native species including Monterey pine (*Pinus radiata*) and Eucalyptus (*Eucalyptus globulus*) also contributed to woody plant encroachment. These results point to specific targeting of coyote brush and Douglas fir establishment in areas of known encroachment.

Who's managing what, and for whom? Joanna Tang[1*], Brooke Wainwright[2]. [1]University of California, Santa Barbara. [2]University of California, Davis. joannatang@ucsb.edu

"You obviously need help, let me fix you." "I only have time to help you start, but you'll be able to figure it out from there." Are those auspicious expressions you would want to hear from your manager or boss? I don't think so. Then why do we bring these perspectives to ecosystem management? While Western perspectives of ecosystem management view humans as separate from the land, and view restoration actions as short-term interventions, traditional indigenous perspectives view humans as part of the ecosystem, intertwined in relationships with other ecosystem components. Indigenous land management was removed during Western colonization, and this broken relationship has caused ecosystem degradation and species invasions. It is this relationship that needs restoration and better management. Once we view restoration as an ongoing, long-term relationship, we can better develop and plan for effective strategies for managing ecosystems. We highlight case studies of long-term management through UC programs that not only increase native biodiversity, but also increase the diversity of people involved in management and bridge the gap across cities and wildlands. For example, UC Davis's Hands on the Land cultivates a sense of place by engaging students in hands-on ecosystem management, ultimately striving to reconnect all people with the land, restore ecosystems, and honor the first indigenous stewards of the land and the land itself. Removing barriers to connecting to the natural world and creating space for people to come together, Hands on the Land harnesses the power of local people to restore local ecosystems.

Poster Abstracts

Managing invasive species from cities to wildlands for wildlife, plants, and habitat. Elizabeth Brusati[1], Krista Hoffmann[2]. [1]California Department of Fish and Wildlife (CDFW) Invasive Species Program. [2]CDFW Lands Program. elizabeth.brusati@wildlife.ca.gov

The California Department of Fish and Wildlife's (CDFW) work on invasive species spans from cities to wildlands to manage fish, wildlife, plants, and their habitats. Activities encompass prevention, monitoring, control, and public outreach. CDFW scientists prevent the spread of quagga (*Dreissena rostriformis bugensis*) and zebra mussels (*Dreissena polymorpha*) by monitoring reservoirs, training local agency staff, and reviewing Control and Prevention Plans. Other major projects include eradicating nutria (*Myocastor coypus*) in the Central Valley and invasive watersnakes (*Nerodia spp*.) near Sacramento and surveying watersheds for New Zealand mudsnails (*Potamopyrgus antipodarum*). We perform Weed Risk Assessments for Delta invasive plants to assist the Division of Boating and Waterways control program. On state Wildlife Areas and Ecological Reserves, CDFW manages our lands for the benefit of species and ecosystems, for public use and enjoyment, and to enhance wildland resilience to wildfire. We prevent, monitor, and treat invasive plant species on our lands using an Integrated Pest Management (IPM) approach, which includes grazing, mowing, hand removal, chemical control, burning, and biological control. Most often a combination of methods is used to enhance efficacy, minimize non-target impacts, and reduce the likelihood of resistance from the overuse of one method alone. Our major outreach event is California Invasive Species Action Week each June and we respond to hundreds of inquiries annually to our Invasive Species Hotline.

Succession of Soil Microbial Communities in a Managed Conifer-Encroached Grassland. Ka Ki Law[1]*, Metha Klock[1], Katerina Estera-Molina[2], Rachel O'Malley[1]. [1]San Jose State University. [2]University of California, Berkeley. kaki.law@sjsu.edu

Woody species encroachment on grasslands is a widespread phenomenon around the world due to the increasing loss in grassland species diversity and ecosystem functions. Management of invasive trees on encroached grasslands often overlooks the impact that land conversion may have on below ground soil microbial communities. These microbial communities play a critical role in plant root associations and global nutrient cycling. In this project, I will analyze soil microbial communities of grasslands encroached by Monterey pine (*Pinus radiata*) and Monterey cypress (*Hesperocyparis macrocarpa*). Both Monterey pine and Monterey cypress are usually considered to be invasive when found outside of their native region: the central coast of California. This project will be conducted at the coastal grassland in Rancho Corral de Tierra, adjacent to Montara, California, where the trees were introduced to the study region for wind breaks and timber but have been displacing the grassland habitat for many native plant species. I will compare soil microbial communities in conifer-encroached areas and areas where conifer removal has occurred. Seven plots of each treatment type, totaling 21 plots, will be established at this site where soil will be collected at three random locations 1 meter from the center of each plot and mixed well to be one homogenized sample. I will compare the soil microbial community composition and relative abundance between each treatment type to clarify the effect of invasive tree encroachment and subsequent tree removal on the soil microbial community in a coastal grassland. This study will analyze the impacts of invasive tree management practices on the grassland soil microbial community that can be incorporated into future management plans to accompany above ground restoration efforts.