Talk Abstracts

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

Repeated mowing and broadcast seeding increases native plant coverage and swamps year effects in a California grassland. Esther Cole Adelsheim[1], Kathryn Preston[1], Julian Tattoni[2]. [1]Stanford University; [2]UC Davis. ecolea@stanford.edu

Native grassland is one of the most diverse ecosystems in California as well as one of the ecosystems that has been most significantly altered by plant species invasions. We completed a seven-year experiment evaluating the effectiveness of timed mowing coupled with broadcast seeding of native grassland plants in restoring native grasslands. We evaluated the role of year effects in plant community response to restoration treatments initially and after five years of treatment application. Plant community responses were evaluated across different aspects. We found that repeated application of a combined intervention of mowing and seeding increased native plant coverage in an invaded annual grassland. The overall increase in native plant coverage was driven primarily by increases in the coverage of native forbs. The initial treatment year influenced native plant coverage after the first two years of treatment application, but after three years of treatment application, there was no difference in native plant coverage among treatment plots. Aspect also influenced the outcome of mowing and seeding treatments. Seeded grasses had the highest coverage in flat and east facing aspects relative to south facing aspects. Seeded forbs had the highest coverage in flat aspects relative to south facing aspects. Overall, the results of our experiment suggest that native plant restoration in a California grassland is achievable with significant investment if restoration sites and plant seed pallets are chosen carefully.

Herbicide drift: dynamics and management. Kassim Al-Khatib, University of California – Davis. kalkhatib@ucdavis.edu

Drift is a physical movement of herbicide through air, at the time of application or soon thereafter, to any site other than that intended. The three ways herbicides may move to nontarget areas are physical spray-particle drift, vapor drift, and herbicide-contaminated soil. Physical spray-particle drift is the off-target movement of fine droplets generated during herbicide application. Small droplets are produced when herbicides are applied with small nozzle tips at high pressure and low spray volume. The distance that droplets may travel depends on droplet size, with smaller droplets traveling farther than larger droplets. High wind speed, low relative humidity, high temperatures, and height above the ground where the herbicide is released also may increase herbicide drift. Vapor drift, or volatility, refers to the ability of an herbicide to vaporize and mix freely with air. The amount of vapor drift varies depending on herbicide, formulation, and weather and soil conditions. Some herbicides are more volatile than others. Volatile herbicides may produce vapors that can be carried distances from the target area to other crop sites. Vapor drift also may depend on the volatility of formulation. In general, herbicide injury symptoms and damage are more severe and more often from physical spray-particle than from vapor drift. Herbicide also may drift from a treated site by adhering to soil particles and traveling as herbicide-contaminated soil. Herbicide may contaminate soil in several ways: when it is applied directly to the soil, when foliar applications are not intercepted by the foliage, or when herbicide is washed off foliage by rain or overhead irrigation. Subsequent soil disturbance by wind or cultivation may cause soil-adsorbed herbicide to become airborne and to be deposited downwind on plant foliage. However, research shows that herbicides might adsorb tightly to soil particles and not easily release to be absorbed by established plant foliage. The amount of herbicide-

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contaminated soil deposited on plants would have to be extremely large to cause symptoms or injury, so it is unlikely this would occur under field conditions.

Tumbleweeds species and invasion: old, new, and nascent. Debra Ayres[1], Frederick Ryan[2], and Virginia Meyer[1]. [1]El Dorado Chapter CNPS; [2]USDA ARS retired. drayes@ucdavis.edu

Tumbleweeds are ruderal and rangeland pest plants throughout the 48 contiguous states in the US. In California there are three wide spreading species. Russian thistle, *Salsola tragus*, was introduced from Eurasia in the 1800s and was found in 1896 in LA county. *Salsola australis,* native to Australia, was first detected in California and Phoenix in 1997 by DNA analysis by Ryan and Ayres and identified to species in 2010. Over 100 plant specimens in herbaria were reclassified from *S. tragus* to *S. australis*; the first known plant was collected in 1926 in LA county. The third invasive tumbleweed is a new allopolyploid hybrid (2n = 54) between *S. tragus* (2n = 36) and *S. australis* (2n = 18) discovered by Frederick Ryan in 1999 in Coalinga, CA and named *S. ryanii*. During the 25 years since it was first discovered *S. ryanii* has spread hundreds of miles and genetic evidence indicates multiple interspecific hybridizations. Calflora mapping showed few occurrences of tumbleweed in the Sierra foothills in 2019. However, a 2023 survey by the El Dorado CNPS showed 19 nascent occurrences in El Dorado County. Highway 50 is the single main entry to the County from the highly invaded Central Valley and was the main corridor of west-east spread, with north-south spread along secondary roads. Other foothill counties have similar invasion patterns; CNPS chapters can map nascent foothill invasions. Plants escaped herbicide control along and under guardrails, in gores, and along fence lines that exceeded the width of the spray boom.

Growth and response of four *Vallisneria* taxa to aquatic herbicides. Jens Beets[1], Erika Haug[2], Benjamin Sperry[3], and Robert Richardson[4]. [1]USDA-ARS; [2]North Carolina Division of Water Resources; [3]US Army Engineer Research & Development Center; [4]North Carolina State University. jens.beets@usda.gov

Greenhouse mesocosm experiments were conducted in 2023 to investigate herbicide efficacy on two native eelgrass species (*Vallisneria americana* Michx. and *V. neotropicalis* Vict.) and two nonnative taxa (*V. australis* S.W.L. Jacobs & Les and *V. spiralis* × *V. denseserrulata* Makino). Herbicide applications included endothall, diquat, florpyrauxifen-benzyl, flumioxazin, and fluridone, at select combinations of these herbicides. Endothall alone provided 90-100% aboveground biomass reduction at 3000 µg/L with at least 24 hours of continuous or intermittent exposure. Florpyrauxifen-benzyl applied alone resulted in minimal aboveground biomass reduction. Fluridone applied at 10 µg/L with 45 days of exposure resulted in 94.5% biomass reduction on *V. americana* and 7.1 to 47.9% on other tested taxa. The combination of flumioxazin and florpyrauxifen-benzyl resulted in 90-100% aboveground biomass reduction and endothall combined with florpyrauxifen-benzyl resulted in 93-100% aboveground biomass reduction. Reductions in belowground biomass mirrored trends observed in aboveground biomass. No selective treatments were identified between native and invasive *Vallisneria* tax and all treatments were effective on *Hydrilla* bioindicator plants. These insights provide a basis of understanding differences (or lack thereof) between these *Vallisneria* taxa for researchers moving forward with selectively targeting *Hydrilla* in the presence of native *Vallisneria* taxa and two new aquatic invasive *Vallisneria*. Future research should expand treatment and concentration exposure scenarios, increase the study period past six weeks, as well as identify potential integrated plant management strategies for field scenarios.

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Garlic mustard: An update from Trinity County, CA. Jim Belsher, Shasta-Trinity National Forest. james.belsher@usda.gov

Garlic mustard is a well-documented invader of the northern and central U.S. and is increasingly reported from western states. In California it was first reported in 2020 from San Bernardino County. Since the initial northern California discovery in 2022 along Rush Creek in Trinity County, members of the Trinity County Weed Management Area and Shasta-Trinity National Forest staff have initiated efforts to map the extent of the population, conducted initial treatments to limit the spread, and sought funding for more extensive treatments to control or eradicate the populations before it spreads into the Trinity River. This presentation will provide an update on the current status, funding, and treatment methods used.

Weed alerts and inventory updates for 2024. Jutta C. Burger[1], and Ron Vanderhoff[2]. [1]California Invasive Plant Council; [2]California Native Plant Society, Orange County Chapter. jburger@cal-ipc.org

New species are regularly introduced into California from other parts of the world and found growing wild. Some of these 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 is joining together again with Orange County CNPS chapter invasive plant lead, Ron Vanderhoff, to showcase our selection of new and notable non-native plant species for 2024, chosen from nominations provided by regional land managers and botanists across the state and reviewed by CDFA. We will also provide an update on the Cal-IPC inventory and CDFA listing.

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Invasive pigments as a catalyst for environmental engagement. Elissa Callen, Ecological Artist. callenelissa@gmail.com

Many invasive plant species in California have properties that yield extractable pigment for use as natural colorants in textile-dyeing, paint-making, and other creative mediums. Through exposure to artwork and educational workshops focusing on invasive plant pigment extraction and use, community members from non-science backgrounds and with no prior involvement in conservation biology are offered alternative access to environmental stewardship and concepts in ecology and sustainability. Creative, interdisciplinary approaches to participating in conservation can pave wider doorways for fostering increased care for native species and habitats, and more collectively across broader communities.

Integrating early detection of invasive plant and rare plant management - rare monkeyflowers of Ackerson Meadow, Yosemite National Park, as a case study. David Campbell, Yosemite National Park. David_m_campbell@nps.gov

Yosemite National Park maintains a robust invasive plant management program that includes dedicated early detection and rapid response. A goal of the program is to preserve, protect, and restore biodiversity, including rare and special status plants. The integration of invasive plant and rare plant surveys informs the management of both groups of species. Ackerson Meadow is one of the largest mid-elevation meadows in the Sierra Nevada and is now the largest in Yosemite National Park. The meadow complex was acquired by the park in 2016 through partnerships with several organizations. Heavily grazed for over a century, the meadow had a three mile long, 14' by 100' gully actively eroding and leading to the loss of wetlands and over 100,000 cubic yards of soil. The meadow is transforming through the largest restoration ever attempted by Yosemite, and the largest full fill restoration of an eroded meadow ever attempted in the Sierra Nevada. The first actions taken to manage this area were to survey for rare and invasive plants, and treat high priority invasive plants including medusahead (*Elymus caput-medusae*) and velvet grass (*Holcus*

lanatus). Two CNPS ranked 1B.2 rare monkeyflowers, the slender-stemmed or Hetch Hetchy monkeyflower (*Erythranthe filicaulis*) and the yellow-lip pansy monkeyflower (*Diplacus pulchellus*) occur throughout Ackerson Meadow. The integrated approach to the management of the rare and invasive flora of Ackerson Meadow will be discussed.

Immersed in vegetation: Using high resolution drone imagery to understand the effect of vegetation on fish monitoring in the Yolo Bypass. JT Casby, Nicole Kwan. CA Department of Water Resources. James.Casby@water.ca.gov

Aquatic vegetation can have varied impacts on several fish sampling methods used throughout the Sacramento-San Joaquin Delta. The Yolo Bypass Fish Monitoring Program (YBFMP) sampling has been negatively affected by the increasing presence of aquatic vegetation such as water primrose *(Ludwigia* sp.) and water hyacinth (*Eichhornia crassipes*). It is hypothesized that the increase in vegetation may be affecting water quality, fish communities, and their food resources but the mechanism is not fully understood and hard to quantify. As the YBFMP fulfills monitoring requirements under the 2020 Incidental Take Permit and Wallace Weir and Fremont Weir adult fish passage Biological Opinions, it is imperative to fully understand impacts to sampling and adaptively manage the program. Over the course of a year, we used drones to collect monthly hi-resolution RGB imagery of our affected fish sampling sites to get a better understanding of the changes in total surface area of aquatic vegetation over time. After data were processed, we were able to quantify vegetation impacts at our sites and better understand how those impacts affect fish catch. During this pilot study period, the Yolo Bypass flooded and we were able to document the effect of flooding on aquatic vegetation, furthering our understanding of how flooding can impact aquatic vegetation at our sites. Incorporating this new monitoring technique into current YBFMP long term monitoring could provide a more holistic understanding of the ecology of the Yolo Bypass and the effects of invasive aquatic vegetation on the YBFMP.

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Indigenous cultural practices and modern-day pesticide use. Diania Caudell, Sage Environmental Group. livanov@sageenvironmentalgroup.com

Traditional cultural practices involve gathering of plant, medicinal and food sources in wildlands. Severe health consequences have been documented resulting from physical contact with plants impacted by pesticide use. Basket weaving involves chewing and handling materials in one's mouth, hands, teeth, and lips which results in ingestion of dangerous man-made chemicals. Mouth cancer and other physical reactions can occur after exposure. In areas that have been sprayed, basket makers unknowingly gather juncus, tule, deer grass and willow; medicinal gatherers collect elderberry blossoms, chia, yerba and mansa; and food gatherers collect acorns, berries, and mushrooms that have been exposed. Advocates for safer pesticide use and damaged native plant identification include Native Americans, medical anthropologists, environmental scientists, land managers, and government officials. Dialog with Native Americans offers collaborative opportunities on pesticide policy that affects tribes, promotes a network to share information, and enhances tribal integrated pesticide management (IPM) program development. IPMs offer an ideal avenue for guiding safe field use of pesticides that impact native plants and traditional cultural practices. Goals are to support communication and collaboration between NFS, BLM, State Parks and others regarding native plant habitats; ensure notification of spraying, especially in native plants habitats; coordinate with Native American organizations to address needs and access; and generate educational materials and collaborative events to raise awareness about the dangers of pesticides to native plant users.

Transforming purple nutsedge: Sustainable textile applications from an invasive plant. Cindy Cordoba Arroyo, California State Polytechnic University, Pomona. cindycordoba@cpp.edu

In California's diverse agricultural landscape, the invasive purple nutsedge (*Cyperus rotundus*), a perennial sedge recognized as one of the world's most tenacious weeds, presents significant management challenges due to its aggressive growth and persistence.

Traditional control methods, such as crop rotation and mechanical cultivation, have proven largely ineffective against this weed's season-long persistence, necessitating innovative approaches. Even with the application of herbicides and myco-herbicides, the long-term viability of the tubers remains uncurtailed, necessitating the exploration of alternative management strategies. This research explores the potential of *Cyperus rotundus* as a sustainable source of cellulose for textile applications, addressing both agricultural and environmental concerns. Previous studies have determined that *Cyperus rotundus* comprises 42.58% cellulose, 45.64% hemicellulose, and 9.54% lignin (Bidin, Zakaria, Bujang, & Abdul Aziz, 2015). Preliminary evaluations indicate that cellulose extracted from *Cyperus rotundus* can be utilized to produce biodegradable and renewable textile fibers. This approach provides an eco-friendly alternative to petroleum-based synthetic fibers and aligns with sustainable practices in the textile industry. Through a series of experimental procedures, we have repurposed fibers from *Cyperus rotundus* into various textile applications. By showcasing these textile applications, we aim to reduce the economic burden associated with weed management on farmers and contribute to climate action through the production of sustainable textiles. The integration of *Cyperus rotundus* into the textile industry demonstrates a novel use of invasive plants, transforming them from agricultural menaces into valuable resources for sustainable development.

A case study: creating and using a vegetation map for management of a California Department Wildlife Area.
Allegra Davis, Rachelle Boul, Aaron Johnson. California Department of Fish and Wildlife.
allegra.davis@wildlife.ca.gov

The Vegetation Classification and Mapping Program (VegCAMP) has completed a fine-scale vegetation map, utilizing the Survey of California Vegetation (SCV) standards, of the Slinkard Valley and Little Antelope Valley Wildlife Areas located in Mono County. The map, which depicts the distribution, density, and quality of the vegetation within the wildlife areas based on detailed ground-truthed and remotely sensed data, is being used by CDFW's Inland Deserts Region (Region 6) to inform land management following the 2020 Slink Fire and 2017 Slinkard Fire. Potential uses of the map include assessing the severity of conifer encroachment in stands of Aspen (*Populus tremuloides*), assessing the distribution and composition of rare and sensitive wetland habitats, managing the spread of invasive plants post-fire, and providing a pre-fire inventory to monitor succession. The Region is currently using the map data, in conjunction with mule deer collar GPS location data and burn severity maps, to help prioritize areas for post-fire restoration for seeding Bitterbrush (*Purshia tridentata*), Sagebrush (*Artemisia tridentata*), and a variety of other shrubs, forbs, and grasses. The integration of this map into CDFW's approach to landscape restoration provides an excellent case study of how vegetation data is critical for informing active land management, particularly in light of the increased frequency and size of wildfires in California.

Teamwork makes the dream work in Caulerpa eradication efforts in California.
Cyndi Dawson[1], Leslie Hart[1], Bryant Chesney[2], Jeremy Hass[3], and Terri Reeder[4]. [1]California Department of Fish and Wildlife, [2]NOAA Fisheries, [3]San Diego Regional Water Quality Control Board, [4]Santa Ana Regional Water Quality Control Board. cyndi.dawson@wildlife.ca.gov

The highly diverse genus *Caulerpa* is a marine unicellular green alga with a circum-tropical to warm temperate distribution. There are no *Caulerpa* species native to California. *Caulerpa* species possess unique characteristics that enable them to withstand a broad range of environmental conditions and give them high invasive potential. Non-native Caulerpa invasions have altered native marine aquatic communities while costing millions in control and eradication efforts in several countries. *Caulerpa taxifolia* was discovered in Aqua Hedionda Lagoon and Huntington Harbour in Southern California in 2000. The Southern California Caulerpa Action Team (SCCAT) was created in response and is a volunteer collaborating entity, convened as needed, that seeks to increase effectiveness and efficiency in avoiding, minimizing, and mitigating the impacts of *Caulerpa* on the marine environment. The SCCAT coordinated the resulting eradication effort which spanned nearly 6 years and cost approximately 7

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million dollars (USD). The SCCAT developed the *Caulerpa* Control Protocol (Protocol) during this original infestation. The Protocol specifies the certification, survey, and reporting requirements to detect new Caulerpa findings and avoid the spread of existing *Caulerpa* infestations when conducting ground disturbing activities in nearshore coastal and enclosed bays, estuaries, and harbors from Morro Bay to the U.S./Mexican border. In April 2021, *Caulerpa prolifera* was confirmed in the China Cove area of Newport Bay. In September 2023, another infestation was located in Corando Cays, San Diego Bay. The SCCAT continues to seek funding and coordinate efforts to treat and identify infestations, confirm treatment efficacy, and conduct surveillance surveys to certify eradication.

Yosemite's response to disjunct weed populations - an EDRR story. Trevor Denson and David Campbell, National Park Service. trevor_denson@nps.gov

Yosemite National Park has over 78,000 populations mapped in its invasive species geodatabase. With all this robust data, park managers have been able to implement targeted treatments of isolated populations and groups of isolated populations on an individual species level. The term disjunct population refers to these infestations based on Yosemite's localized prioritization level, aggregate distance from other populations of the same species (groupings of 10m, 20m, 40m, and 100m) to account for groups of isolated populations, elevation (above or below 6000 ft.), and location within the park. Yosemite's Early Detection and Rapid Response (EDRR) crew has been an early adopter of the disjunct population model. This model helped identify 291 disjunct populations to help give park staff the upper hand on stopping medium priority, high priority, woody, and EDRR species from spreading through targeted treatments. Using a GIS and data driven approach, Yosemite has been able to meet one of its goals of having a field-ready EDRR, woody, and disjunct population work plan (map series), as well as a targeted treatment plan (Excel document) to guide crews on when, where, and how to treat these infestations.

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The recent appearance and successful eradication of barbed goatgrass (*Aegilops triuncialis*) at a Southern California nature preserve. Sandy DeSimone, Matthew Skarie. Audubon Starr Ranch Sanctuary. sdesimone@audubon.org

Audubon Starr Ranch, a 4,000 acre preserve in Orange County, protects habitat mosaics typical of lower elevations in Southern California: shrublands, woodlands and grasslands. In 2017, we detected the first occurrence of barbed goatgrass (*Aegilops triuncialis*) on Starr Ranch, which also marked the first Orange County record, and hypothesized that it came from visitors from northern California that had inadvertently introduced seeds. The barbed goatgrass control site was mapped as two polygons, extending 0.10 and 0.12 acres, within a 60-acre grassland with 20-30% cover of the native bunchgrass, purple needle grass (*Stipa pulchra*) and several Grasshopper Sparrow territories. We reviewed the literature on goatgrass biology and control to devise our strategy. The effectiveness of mowing (which we simulate with brush cutters) was impressive when timed just as grass awns emerge. In spring 2018, we visited the site starting in March and, once awns emerged, commenced four different unreplicated treatments that covered the invasion extent: brush cut to bare ground, repeat monthly; brush cut to 4-6" to limit purple needle grass impacts, repeat monthly; brush cut and cover several 2 X 2 m areas with black plastic. All treatments were effective and we had no detection of goatgrass after two seasons. We have revisited the site annually and have had no further detections.

The radical land practice of attunement: Invasive plant management on a San Francisco serpentine outcropping as an art practice. Elena Fox, Terremoto. elena@terremoto.la

Starr King Open Space in Potrero Hill, San Francisco is the site of an ongoing experimental test plot that seeks to remove invasive species such as Italian ryegrass (*Lolium multiflorum*), wild oat (*Avena fatua*), wild barley (*Hordeum spantaneum*), rose clover (*Trifolium hirtum*), and wild radish (*Raphanus raphanistrum*) in order to revitalize the native seed bank. Pushing back against the convention of immediate action, we are experimenting

with the process of deliberate observation and minimal intervention for a year before initiating invasive plant management practices. We are attuning to the site through this slow process to deepen our relationship with the place and guide our management strategies for it. Through seed collection, light hand weeding, and weekly visits to log site conditions, our emphasis on restoration is now met with the radical notion of waiting. This process challenges the parameters of invasive plant management, and seeks to uncover insights into the potential for enhanced ecological outcomes through the deeper knowledge that comes from art-making and observation. The culmination of our experiment will manifest in an exhibition at the Palo Alto Arts Center, where we will showcase the process of turning observational land management into an art practice. Our work for the exhibition includes photo and audio documentation, artifacts, and reflections derived from our observation log. This exploration investigates the intersection of art and restoration practices, challenging traditional notions of intervention, and prompting a reevaluation of the transformative power of patience and presence in land stewardship.

Hydrilla eradication and removal efforts in California. Trevor Fox. David Kratville. California Department of Food and Agriculture, Integrated Pest Control Branch. trevor.fox@cdfa.ca.gov

The California Department of Food and Agriculture has housed the *Hydrilla* Eradication Program since 1977. Eradication of *Hydrilla* is a cooperative state effort, sharing resources between several sister agencies including the Department of Water Resources and the Department of Parks and Recreation Division of Boating and Waterways. Since the *Hydrilla* Eradication Program's inception it has achieved some of the Department's greatest successes by keeping California effectively free of this destructive weed. While conducting *Hydrilla* surveys and eradication projects staff regularly encounter and map aquatic weeds. This presentation will focus on the identification, ecology, and biology of *Hydrilla* plants in California and the unique control techniques and permitting surrounding their removal.

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Native grass establishment as a form of weed control - Looking back 25 years later. Sarah Gaffney, Michael Rogner, and Helen Swagerty. River Partners. sgaffney@riverpartners.org

In the fall of 1999, River Partners planted native grass seeds and plugs at the US Fish and Wildlife Service's Ord Bend Unit in Glenn County, California as part of a larger riparian woodland and savanna restoration project. *Elymus triticoides*, *Elymus glaucus*, *Stipa pulchra*, and *Hordeum brachyantherum* were seeded and *Elymus triticoides* and *Carex barbarae* were plug planted. For 6 years between 2001 and 2008, the native grasses and non-native herbaceous species were monitored using a $1m^2$ quadrat to visually assess percent cover in random samples of 25-30% of the planting rows of three fields. In these years native grasses successfully established and weed cover was low. We returned in May 2024 with the same methodology. We aim to determine the continued success of native grass establishment as a method of weed control 25 years after planting. We present the results from the initial 6 years of data post-planting in comparison to year 25 and will also discuss the effects of soil on long-term native and non-native cover.

How California regulates herbicies. Bryan George, Department of Pesticide Regulation. bryan.george@cdpr.ca.gov

Prior to registration and use in California, herbicides undergo a comprehensive and rigorous evaluation process to ensure these products do not pose an unacceptable risk to human health or the environment. Herbicide products are evaluated for such things as product chemistry, environmental fate, human health effects, efficacy, ecotoxicity/phytotoxicity to nontarget flora and fauna, and potential to contaminate surface and ground water and air. This presentation will provide a brief overview of the process for evaluating herbicide products by California Department of Pesticide Regulation scientists.

Herbicide fundamentals. Tom Getts, UC Agriculture and Natural Resources. tjgetts@ucanr.edu

Over the past 80 years, hundreds of chemistries have been developed to control plants in different ways. Physiologically, how a compound kills a plant is considered its "mode of action;" according to the International Herbicide Resistance Action Committee there are 33 herbicide families or "modes of action." Some chemistries work by inhibiting enzymatic pathways, others by mimicking plant hormones or preventing cellular division. Most herbicides are "selective" in that they only kill some types of plants. For instance, some herbicides kill broadleaf plants and do not harm grasses, others kill grasses but not broadleaf plants, and others only kill germinating seeds and do not impact established vegetation. Some herbicides must be applied to the leaves of the target plant, while others are applied to the soil where they can be taken up by roots or prevent seeds from germinating. Some herbicides are "systemic"—they can be absorbed and moved down throughout the plant—and some are "contact" herbicides that only kill the foliage they touch. (Organic herbicides fall into this category.) Herbicides can be applied at different times, in different quantities, and with different application methods to control undesirable vegetation while having minimal impact to desired vegetation. Developing a pesticide is tremendously costly. In 2014 it was estimated that it cost $268 million to conduct all the research needed to gain registration for a product in the United States. A registered herbicide has been highly scrutinized to determine how it might impact the environment. Herbicide labels are reviewed and approved by the EPA, and following label instructions minimizes risk. When utilized with precision and knowledge as part of an integrated pest management approach, herbicides can be a powerful tool for helping managers steward their lands and protect wildlife.

Demystifying Esri field apps: Tips and tricks for success! Sarah Godfrey. Map the Point Consulting. mapthepoint@gmail.com

Organizations are increasingly using Esri software to integrate data on the Desktop and Online platforms and build field data collection capacity with mobile applications, such as Survey123 and Field Maps. These are easy tools to build within the framework of your existing ArcGIS workflows, and we want to demystify facts about the integration of these tools within your organization and their potential applications for invasive plant management. In this overview presentation, we will discuss the basic features and interfaces of ArcGIS Pro and Online, setting up a Survey123 form, using Field Maps for offline data collection, and other applications that can be used to effectively increase communication or outreach about a project, such as a simple StoryMap. This presentation is an introduction to these applications and tools within a land manager's GIS toolbox that complement data integration with Calflora and can be further supplemented by field trainings and continued discussion and implementation within your own organization.

An assessment of native seed needs and the capacity for their supply: National Academies l Report. Susan Harrison, UC Davis, Department of Environmental Science and Policy. spharrison@ucdavis.edu

A study committee of the National Academies of Sciences, Medicine, and Engineering assessed federal, state, tribal and private sector needs, and capacity for supplying native plant seeds for ecological restoration and other purposes in response to increasing climatic mega-disturbances in synergy with other threats including invasive species. The assessment was requested by BLM and focused mainly on the western United States, with the goal of making recommendations for improving the reliability, predictability, and performance of the nation's native seed supply for emergency soil stabilization, rebuilding natural communities, and prevent invasive plant encroachment in newly burned areas. The report was published in January 2023 at nap.nationalacademies.org/26618. I will summarize the report's findings, conclusions and recommendations, and the steps that have since been taken toward implementation.

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Laws and regulations for pesticide adjuvants. Krista Hoffmann. California Department of Fish and Wildlife. krista.hoffmann@wildlife.ca.gov

This presentation will cover laws and regulations pertaining to pesticide adjuvants. The presenter will cover adjuvant classes and common active ingredients, their registration and reporting requirements in California, and updates relating to adjuvants in the National Pollutant Discharge Elimination System General Permit for aquatic herbicide applications. Use rates, signal words, and other adjuvant label requirements will also be covered and human and environmental risk from adjuvant active ingredients will be reviewed.

Good Fire at Acjachemen "Junco" Meadow. Rosa-lee Jimenez[1], Lauren Quon[2]. [1]Tribal Relations Program Specialist, Region 5 US Forest Service; [2]Forest Botanist, Cleveland National Forest. Rosa-lee.jimenez@usda.gov; Lauren.quon@usda.gov

As a federal land management agency, the Forest Service is responsible for managing and protecting resources on public lands. At Acjachemen "Junco" meadow, a 26-acre dry meadow system located on the easterly side of state route 74, Ortega Highway, on the Trabuco District of the Cleveland National Forest, we collaborated with the Acjachemen to incorporate traditional and ecological knowledge (TEK) to increase native grass cover. It has a long history of local management and use by the Acjachemen, and in more recent years has been an area of great interest for management and use by the local basket weavers group. In 2021, we followed management direction from the Acjachemen to implement a low-intensity broadcast burn to manage and help rejuvenate the native grasses and low shrubs in Junco meadow. Our goals for this project were 1) to remove the dead-standing fuels from forbs, small shrubs, and grasses by broadcast burning, 2) increase native plant cover in the meadow by active restoration, mainly by non-native plant removal and fire, 3) improve quality of native plant materials used in basket weaving, and 4) monitor the effects of fire and non-native plant removal on the native plant community in Junco meadow over the span of 5-7 years. Immediate post-fire observations from 2021 indicated there was no significant difference in native vs non-native plant cover, similar to results observed in a 2015 monitoring report. We plan to monitor Junco meadow in spring 2025, after it was burned in the 2024 Airport Fire, to track changes in native plant cover and determine additional seeding or restoration needs to increase native grass cover over time.

Working together against weeds: Strategies for developing effective best management practices to prevent invasive species spread in California's National Parks. Brent Johnson, National Park Service. brent_johnson@nps.gov

Some of the most significant risks of invasive plant introduction and spread on public lands come from internal management operations and activities. Road and trail maintenance, construction, administrative stock animals, research, fire management, and even invasive plant control and restoration can play a role in invasive plant introductions. Despite relatively low costs and demonstrated effectiveness, there are challenges to put effective Best Management Practices (BMPs) into action. Contractors, outside partners, and internal work groups, each on tight timelines and budgets, and with varying levels of understanding on the ecological and economic impacts of invasive plants can make following through and getting buy-in challenging. Finding workable solutions to these operational hazards requires participation from all sectors of an organization. To address some of these challenges, the National Park Service conducts prevention workshops to develop site-specific and practical best management practices to limit the introduction and spread from their own actions.

Community challenges to the use of herbicide for habitat restoration, fuel modification and targeted invasive control in Laguna Beach, CA. Alan Kaufmann, Laguna Canyon Foundation. alan@lagunacanyon.org

Laguna Canyon Foundation has been engaged in habitat restoration, fuel modification and targeted invasive control projects covering hundreds of acres in and

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around Laguna Beach, CA since 2012. The careful use of synthetic herbicides as part of an integrated pest management program has been an important component of this work. Over the past several years, concern over and resistance to the use of synthetic herbicides, especially glyphosate, has grown steadily. This presentation will discuss the challenges that have arisen, successes and failures we've experienced in attempting to address them, lessons learned and recommendations for other land managers who might face similar challenges.

Riding the invasion curve: Invasive plant management on Santa Catalina Island. Aaron Kreisberg, Catalina Island Conservancy. akreisberg@catalinaconservancy.org

The Catalina Island Conservancy (CIC) owns and manages 88% (42,000+ acres) of Santa Catalina Island (Catalina) off southern California. Catalina also supports the City of Avalon, has a population of 4,000 residents, and receives over a million visitors a year. The presence of a city, infrastructure, and high visitation makes Catalina particularly vulnerable to invasive plants and future introductions, particularly in the context of the California Channel Islands. The biodiversity of Catalina is unique, with existing invasive plant populations and potential introductions of novel taxa major risks to this biodiversity. Through the Catalina Habitat Improvement and Restoration Program (CHIRP), CIC manages invasive species across the extent of the island, including on non-CIC property for particularly problematic invasive plants. Ongoing management challenges include the control of CHIRP's primary control targets: Mediterranean broom (*Genista linifolia*), fennel (*Foeniculum vulgare*), and harding grass (*Phalaris aquatica*). Major successes over the life of the program include presumed eradication of introduced invasive species such as pampas grass (*Cortaderia selloana*) in natural areas and yellow star-thistle (*Centaurea solstitialis*). CIC utilizes a variety of management techniques through an integrated pest management approach, with major employment of physical and chemical methodologies. Management efforts include staff, technicians, contractors, and volunteers. Early detection and rapid response practices continue to be and will remain a critical component to the CHIRP. Partnerships, technology, and community science are all ways CIC plans to continue effective management of invasive plants along the invasion curve.

Lessons learned from an interdisciplinary survey of 37 restored grasslands. Justin Luong[1], Daniel Press[2], Karen Holl[3]. [1]Cal Poly Humboldt; [2]Santa Clara University; [3]UC Santa Cruz. justin.luong@humboldt.edu

Governmental and non-governmental organizations spend considerable funding on restoring ecosystems to counter biodiversity loss and associated domination of non-native weeds, yet outcomes are often not rigorously assessed. Monitoring is done ≤5 years after project-implementation, if at all, and rarely assesses the effects of management practices (primarily weed control) on project success. We combined vegetation surveys and management interviews to compare long-term restoration outcomes of 37 California coastal grassland projects (5–33 y post-implementation) that spanned a 1000-km north-south gradient. We found that coastal grassland restoration is largely successful at reaching project goals (95%) and a standard performance metric (80%) to restore native cover and reduce non-native weed cover, but land managers preferentially use a small number of well-tested, "high success" species, potentially at the expense of regional diversity. Medium and high maintenance intensity (including both herbicides and mechanical methods) resulted in lower non-native weed cover, improved native cover, and increased rarefied native richness. Managers of voluntary (non-statutory) sites were more open to assessing outcomes and spent less per hectare compared to legally mandated (statutory) projects but achieved similar plant cover and even higher rarefied richness. Statutory project managers indicated that regulatory agencies sometimes lowered compliance goals for native cover if the initial targets were not met. Additional funding for greater non-native weed control and other maintenance intensity and incorporating more locally distinctive species (i.e., endemic or range-restricted) may help counteract potential unintended consequences from preferential plant selection, and inter-agency coordination of species selection could reduce biotic homogenization. We recommend

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delegating funds to a third-party monitoring group to ensure legally mandated compliance and consistency in assessment.

Herbicides are applied to sites: What does that even mean? Chris McDonald. UC Cooperative Extension. cjmcdonald@ucanr.edu

Herbicide applications are regulated for a variety of reasons. There are many different levels of regulation for an herbicide application including at federal, state, tribal and local jurisdictions. One area where county agricultural commission inspectors commonly cite herbicide applicators for violations is applying an herbicide to the wrong site. In this presentation we will review this lesser-known aspect of herbicide labels, including regulations about applications made to proper sites (5 minutes). Practitioners may be aware that herbicides are applied to specific sites, and I will review regulations about when a pesticide is applied to a site and how weed species are regulated on labels (5 minutes). I will provide examples of labels which give clear indications of sites that an herbicide can be applied to (5 minutes). For practitioners in wildland areas a site can be called by various names, and I will review common terminology for wildland areas using specific labels (5 minutes). I will also provide examples of where labels are not clear on which specific site they are referring to and helpful guidance on how to better understand different nomenclature for sites that may be colloquially called "wildlands" or "natural areas" (5 minutes). Last, labels may have specific language that may seem to include specific sites but may be listed on multiple parts of the label, and I will help explain those ambiguities (5 minutes). If a practitioner is ever in doubt, the county agricultural commissioner's office regulates pesticide applications at the local level.

Restoration of coastal dunes and salt marsh at the Ocean Ranch Unit of the Eel River Wildlife Area, Humboldt County. Kelsey McDonald, James Ray, and Michael van Hattem. California Department of Fish and Wildlife. kellsey.mcdonald@wildlife.ca.gov

California Department of Fish and Wildlife (CDFW) is restoring over 400 acres of moderately to highly invaded coastal dunes and salt marsh at the Ocean Ranch Unit of the Eel River Wildlife Area, with help from our many partners and funders. The Ocean Ranch Restoration Project includes the restoration of 219 acres of coastal dunes invaded by European beachgrass (*Ammophila arenaria*) and 193 acres of salt marsh invaded by dense-flowered cordgrass (*Spartina densiflora*). Dune restoration also includes Early Detection and Rapid Response for cape weed (*Arctotheca calendula*), a Cal-IPC Alert species. Native dune mat and salt marsh are Sensitive Natural Communities that support many rare plant species. Restoration at the Ocean Ranch Unit uses Integrated Pest Management, including application of the herbicide imazapyr, prescribed fire, mechanical grinding with heavy equipment, hand-held brush cutters, and passive recolonization by native species. Restoration monitoring includes recording vegetation cover and species composition in randomized 1m2 quadrats within treatment areas, untreated controls, and native reference sites. Initial annual monitoring results will be presented showing progress and challenges in meeting restoration objectives, which include reduction in the dominant invasive grasses, increasing native cover, increasing average native species richness, and maintaining or increasing listed and rare plants and Sensitive Natural Communities. All treatments immediately resulted in significant reduction in the dominant invasive species. Monitoring of this ongoing restoration project will be used to inform adaptive management at Ocean Ranch and may inform similar restoration efforts controlling these widespread invasive grasses in coastal dunes and marshes.

Do the right thing! Common mistakes in wildland weed applications and how to correct them. LeeAnne Mila. Eldorado and Alpine County Agricultural Commission. leeanne.mila@edcgov.us

Do you live in fear that you might not be complying with California code when applying herbicides? Fear no more. LeeAnne will show you examples of common pesticide application violations for wildland weed workers and easy steps to correct them. All aspects of the pertinent laws and regulations will be discussed, for both an urban and wildland setting, along with various ways to ensure compliance, including in challenging wildland settings. You'll also get a refresher on worker

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protection issues, container requirements, transportation issues, and more.

The effects of invasive goatgrass control on serpentine wildflowers and pollinators. Rebecca A. Nelson[1*], Sabine Dritz, Fernanda S. Valdovinos[1], Paul A. Aigner[2]. [1]University of California, Davis, Department of Environmental Science & Policy; [2]University of California McLaughlin Natural Reserve. ranelson@ucdavis.edu

Serpentine grasslands are refugia for California's high plant diversity and endemism. Barbed goatgrass (*Aegilops triuncialis*), however, is one of the few invasive plants that can grow on serpentine soils, posing a conservation challenge. We monitored how the control of barbed goatgrass affected serpentine wildflowers and their pollinators. We experimentally removed barbed goatgrass from a serpentine grassland at the University of California McLaughlin Reserve, comparing the efficacy of the following control methods to plots where goatgrass was left in place: spot spraying clethodim (0.73g/L), spot spraying glyphosate (9.83g/L), spot spraying fluazifop-P (1.40g/L), hand-pulling, and mowing. For multiple years following goatgrass control treatments, we monitored goatgrass prevalence, native wildflower community composition, and pollinators. Goatgrass control led to a significant recovery of native wildflower cover and diversity, including for rare and endemic serpentine specialist plants such as Jepson's navarretia (*Navarretia jepsonii*). Moreover, goatgrass control increased pollinator diversity and abundance, having a stabilizing effect on plant-pollinator interaction networks. These increases in plant-pollinator diversity and abundance were consistent across all goatgrass control methods. Thus, both mechanical and chemical goatgrass control methods can effectively eliminate goatgrass and restore rare, endemic serpentine wildflowers and their pollinators. This monitoring informed the subsequent management of barbed goatgrass in serpentine grasslands. Based on these monitoring outcomes, we used a combination of herbicide and mechanical methods for goatgrass control and extended this management approach to additional areas, resulting in restored serpentine meadows with a diverse community of plants and pollinators.

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If you don't know, then know where to go: Sleuthing reveals a new population of desert knapweed (*Volutaria tubuliflora*) in San Diego County. Tracie Nelson, California Department of Fish and Wildlife. tracie.nelson@wildlife.ca.gov

Identifying a novel weed species can be challenging, especially if your botany skills are limited. There are some great tools and information resources located online. In addition, establishing relationships with knowledgeable fellow local weed managers can save you a lot of time and uncertainty if you come across an unfamiliar species. Besides determining what the species name is, there are many factors to consider. What level of threat does the weed species pose to wildland resources and/or other important values? What treatment options have been found effective? This presentation describes a case scenario of identifying and responding to a new desert knapweed (*Volutaria tubuliflora*) population in Rancho Jamul, south San Diego County, with no prior knowledge about the species. It Illustrates the value of some common online weed identification tools, and more importantly, the value of networking with knowledgeable fellow local weed managers, and how to connect with them. Lastly, it describes the methods used to control desert knapweed and their success to date.

Dune Protected Area Network: an approach to recover listed species and protect rare coastal ecosystems. Lindsey Roddick[1], Jonathan Hall[1], Lisa Stratton[2], and Kristie Scarazzo[3]. [1]The Land Conservancy of San Luis Obispo County; [2]University of CA Santa Barbara's Cheadle Center for Biodiversity and Ecological Restoration; [3]U.S. Fish and Wildlife Services, Ventura Office. lindseyr@lcslo.org

Black Lake Ecological Area is owned and managed by The Land Conservancy of San Luis Obispo County and is located within the Guadalupe Nipomo Dunes Complex, a rare coastal sand dune complex in San Luis Obispo County. In collaboration with UCSB's Cheadle Center for Biodiversity and Ecological Restoration and U.S. Fish and Wildlife Service, Nipomo lupine (*Lupinus*

nipomensis) a federally and state endangered species, was outplanted on the site in 2014. Coastal dune habitats are extremely unique and traditional exclusionary invasive species management techniques are not suitable. Creative solutions are necessary to manage invasive species surrounding an endangered species in a unique coastal dune habitat. A Dune Protected Area Network was created for the entire Guadalupe Nipomo Dune Complex to form defensible spaces for long-term management of invasive species threats and preservation of rare coastal dune systems. Both chemical (backpack, truck sprayer, and helicopter) and mechanical invasive species removal methods are used with special attention to seasonality. As high priority invasive species are eliminated, new secondary invaders fill their niche. Long-term management strategies like the Dune Protected Area Network are essential to recovering rare species and preserving unique ecosystems.

Invasive species control for the restoration of coastal endangered and threatened bird and butterfly species habitat. Cris Sarabia, Johnny Perez, Olivia Jenkins, and Adrienne Mohan. Palos Verdes Peninsula Land Conservancy. csarabia@pvplc.org

The Los Angeles area is sometimes referred to as a concrete jungle due to the high-density urbanization. Even though most of the area is denuded of native habitat, species resiliency still persists in small outlier pockets throughout the region. The Palos Verdes Peninsula Land Conservancy manages habitat for various endangered and threatened species on the Palos Verdes Peninsula. While some of the typical invasives such as mustard and non-native grasses threaten our native species, other perennial woody shrubs like Coastal Wattle (*Acacia cyclops*) have quickly begun to take over and are becoming a threat to local biodiversity. Using a variety of methods including grazing, mowing and volunteer involvement, we have been able to restore these invasive species footprints achieving quick habitat restoration results. As endangered and threatened species begin to reinhabit their historical locations, we will share our approach to restoring these habitats and the successes we have seen.

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A sustainable future for pest management. Sapna Thottathil, Department of Pesticide Regulation. Sapna.Thottathil@cdpr.ca.gov

Pest management plays an integral role in the stability of California's healthy food supply, the health of our communities and environment, and the maintenance of our infrastructure. Attend this session to hear about the recommendations in the Sustainable Pest Management (SPM) Roadmap released in Jan. 2023, how the DPR is building on the objectives to accelerate a transition to sustainable pest management and next steps.

Assessing invasive plant risk and climate vulnerability to sensitive habitats in the California Central Coast region. Nicole Valentine, Jutta C. Burger. California Invasive Plant Council. nvalentine@cal-ipc.org

Invasive plant risk and climate vulnerability scores were determined for the sensitive habitats in the California Central Coast region. These scores were calculated for 2.5 square mile hexagons and will allow land managers to prioritize sensitive habitats most at risk with a changing climate. Geospatial data was compiled for 171 sensitive habitats based on the California Department of Vegetation's "Significant Terrestrial Habitats." These sensitive habitats were crosswalked to habitats and component plant alliances listed by the Manual of California Vegetation. Vulnerability to climate was based on future predicted exposure to solar and heat load, fire, and aridity, combined with estimated intrinsic habitat sensitivity to stressors, based on Manual of California Vegetation (MCV) descriptions. Invasive plant species risk was based on eight factors, including current co-occurring invasive species, occurrence of rare plant species vulnerable to invasive plants, regional level of invasion, reference to intrinsic vulnerability from the MCV, and location-based exposure to risk factors such as high nitrogen and proximity to roads. Invasive Plant Risk Scores were compiled for hexagons based on averaged risk ratings across habitats and added to Climate Vulnerability Scores. Two riparian *Salix laevigata*-dominated sensitive habitats scored highest for combined invasive plant and climate vulnerability risk. Habitats along the central coastline as well as the extreme north and south of the Central Coast region scored as especially high current and

future risk from invasive plants. Woody habitats and mountainous areas scored as high climate vulnerability, though only a subset also had high invasive plant risk.

Leveraging monitoring data to inform weed management in the world's largest urban national park. Justin Valliere[1], Olivia Parra[1], Joseph Algiers[2]. [1]University of California Davis; [2]Santa Monica Mountains National Recreation Area. jmvalliere@ucdavis.edu

Invasive plants pose a growing threat to native species and ecosystems, including in protected areas. For example, at Santa Monica Mountains National Recreation Area – the world's largest urban national park – weed invasion has been implicated in the decline of the park's iconic wildflowers and increase in wildfires. Weed control is therefore a critical component of efforts to protect the park's flora, fauna, and natural and cultural resources. However, weed management is challenging, and monitoring data is essential for evaluating control success and identifying factors that facilitate or inhibit such success. To this end, we compiled nearly twenty years of monitoring and treatment data from 280 infestations within the park. We also resurveyed each of these infestations in 2023 to evaluate long-term management outcomes. We used multiple statistical approaches to identify management inputs and site characteristics that are predictors of eradication, invasive plant cover, and native species recovery. We found that the greater the initial size or percent cover of an infestation, the lower the probability of eradication. We also found that weed infestations on steeper slopes and in areas that have burned more frequently are less likely to be eradicated. Promisingly, our results also showed that greater reductions in invasive plant cover benefitted native diversity. These analyses also highlighted that persistence is key; more frequent treatment (both chemical and nonchemical) and greater investment of labor resulted in larger reductions in invasive plant cover. The results of this project will be used to develop best practices for weed management and monitoring.

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Comprehensive pest prevention program analysis. Claudia Vazquez, California Department of Food and Agriculture, Plant Health and Pest Prevention Services Division. Claudia.vazquez@cdfa.ca.gov

Due to advancements in technology and increases in international travel and commerce, there has been a dramatic increase in invasive species detections in California. The California Department of Food and Agriculture has requested analyses be performed by university researchers to evaluate the effectiveness of the current pest prevention systems. The study will use the information provided by this team of scientists to help identify the strategies and tools needed to support a modern pest prevention system, as well as quantification of the necessary funding to support an efficacious and dynamic program. CDFA is currently working with researchers from the University of California and California State University systems on a statewide study. This study will help facilitate improvements and modifications to the existing pest prevention system, strengthening our regulatory framework to address plant pests and diseases. Part of the analysis will include evaluating current and new pest pathways in recent decades. These pathways include e-commerce, nurseries, parcel facilities, new crops, specialty markets, community gardens, mechanization of farm equipment, organic production systems and changes in management practices due to climate change and availability of resources (e.g. land, water and labor).

Evaluating the early detection, rapid response framework for aquatic species in the Delta. Christine Whitcraft, Anita Arenas. CSU Long Beach. Christine.whitcraft@csulb.edu

Aquatic invasive species and their impacts have been ecological and management challenges in the Sacramento-San Joaquin Delta (Delta) since the 1970s. Despite these impacts, the Delta still provides a suite of ecosystem services. To continue to protect this watershed, an efficient early detection and rapid response (EDRR) framework must be implemented with the goal to find, report, and eradicate invasive species before they spread and cause harm. Effective EDRR frameworks require coordination as well as early action,

but frequently the implementation of effective EDRR is limited by lack of information or coordination. To address this need, we conducted an evaluation of the existing draft EDRR framework developed by the Delta Interagency Invasive Species Coordination (DIISC) Team by conducting a series of stakeholder interviews. Through qualitative review of these interviews, we identified potential barriers and areas for increased coordination at each stage in the EDRR process. In addition, we researched the invasive submerged aquatic species, ribbon weed (*Vallisneria australis*), as a case study to understand challenges with the EDRR process. Finally, we collected data on ribbon weed plant traits to directly inform the response and treatment step of the EDRR process. Our findings can inform our understanding of how invasive species management response can be improved for aquatic plants and will hopefully increase our abilities to get ahead of the invasion curve.

Lightning Talk Abstracts

How medusahead, thatch, native, and bare ground cover changes soil and ground-level conditions.
Katherine Brafford*, UC Davis. kebrafford@ucdavis.edu

Invasive thatch-producing annual grasses, such as medusahead (*Elymus caput-medusae*), are problematic in western grasslands, oak woodlands and chaparral. They are known for reducing plant diversity by suppressing the germination and seedling survival of other plants; increasing fire risk and severity; and providing decreased ecosystem services. However, exactly how these thatch-producing grasses change the soil and ground-level microhabitats was only measured in artificial conditions for a brief period in the springtime over fifty years ago (Evans & Young, 1970). We are building off of their long-cited findings by measuring soil moisture, soil temperature, air temperature, humidity, and light measurements in medusahead, medusahead thatch, bare ground, and native plant plots for two years. Here we present a few of those findings and compare them to the results published by Evans & Young, 1970.

Adaptive management of invasive aquatic vegetation in the Delta: Successes and challenges.
Elizabeth Brusati[1], Jeffrey Caudill[2], Dylan Chapple[1], Gina Darin[3], Edward Hard[2], and Louise Conrad[3]. [1]Delta Stewardship Council; [2]California Department of Parks and Recreation, Division of Boating and Waterways; [3]California Department of Water Resources. elizabeth.brusati@deltacouncil.ca.gov

The Sacramento-San Joaquin Delta provides water to 27 million Californians, is a major agricultural area, and is home to over 750 plant and animal species. Tidal wetlands restoration projects are in progress to create over 8,800 acres of habitat for mitigation and other purposes, and invasive aquatic vegetation is one of the biggest threats to project success. Adaptive management is a structured decision-making process where actions are adjusted as the project is implemented to achieve desired objectives and is required by the 2013 Delta Plan for restoration and water management projects. In 2020, an interagency white paper made recommendations for adaptive management related to controlling aquatic weeds. This talk describes successes and challenges since that white paper for the Aquatic Invasive Plant Control Program State Parks' Division of Boating and Waterways. Successes include a streamlined risk assessment process for plants, increased flexibility and authorization for new tools, and the use of Demonstration Investigation Zones (DIZ). Continuing challenges include the complex process to acquire required permits, challenges in scaling up DIZ's to restoration projects, and the need for

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effectiveness monitoring and early detection of new invaders.

A case study on San Francisco's most expensive weed, covering lessons, goals, and new methods to control it. Josiah Clark, Ray Mullin. Habitat Potential. Josiah.clark621@gmail.com

Googling Algerian ivy (*Hedera canariensis*), most of what you would find touts its attributes as a ground cover, or as a way to ornament your yard. However, in terms of both dollars and native habitat, it is the most expensive plant in the San Francisco Bay Area. Algerian ivy is found everywhere in SF, including many high-value natural areas from the highest hilltops to the riparian habitats to the wooded parks. It is destructive to Franciscan native plant communities, to local fauna, and to built infrastructure, and it serves as key habitat for the invasive Norway rat (*Rattus norvegicus*) and Black rat (*Rattus rattus*). While many large-scale ivy efforts have taken place and been effective on a local level over the years, there has yet to be a cohesive citywide or regionwide strategy for controlling this fastmoving foe. Its management and control is expensive and labor-intensive. Not dealing with this plant, however, has proven to be far more expensive and at its current trajectory will continue to get even more expensive. Based on decades of experience, the goal of our presentation is to illustrate important facts about the life cycle, distribution, and ultimately the control of Algerian ivy. We will discuss treatment techniques, including the most effective tools and methods, and strategies that will make great strides in the widespread management of this most costly invasive plant.

Complexity in the city: studying the effects of urban environmental heterogeneity on the life history traits of the annual, invasive forb *Centaurea melitensis* across California. Anthony Dant*, University of Arizona. adant@arizona.edu

As the number of organisms interacting with urban spaces increases, it is increasingly recognized that biology must include an understanding of how the ecology and life history of these organisms change in response to urbanization. A central unanswered question is how specific environmental cues within urban areas are responsible for changes in life history traits. To better understand how urban environmental heterogeneity affects eco-evolutionary variation in traits, I explored the life history traits of the invasive, annual self-pollinating forb *Centaurea melitensis* across the state of California. Specifically, I tested whether the plant economic spectrum, which predicts differences in life history strategies in response to varying environmental conditions, could be applied to *C. melitensis* in urban systems. To test this, I collected seeds from populations of *C. melitensis* across California in locations which varied in environmental conditions including land cover, pollution, and socioeconomics. Seeds were then grown in greenhouse conditions, self-pollinated, and grown for a second generation where a variety of 19 traits, such as specific leaf area and root diameter, were measured. Results showed significant associations of traits with multiple urban environmental variables including land cover, urban heat island, and socioeconomics. These results highlight eco-evolutionary change in response to urbanization and particularly the importance of including a wide spectrum of urban environmental heterogeneity in future urban studies. As urbanization continues to increase across the world, determining which environmental cues lead to eco-evolutionary change will be instrumental in understanding, conserving, and managing species in urban environments.

Post-fire recovery of plant community assembly in Joshua tree woodlands. Yanina Aldao Galvan[1,2*], Darrel G. Jenerette[1], Michael Vamstad[2], Melanie Davis[3]. [1]University of California Riverside; [2]Mojave Desert Land Trust; [3]USGS; [4]Center for Conservation Biology; [5]Joshua Tree National Park; [6]Mojave National Preserve. ecolove1980@gmail.com

Wildfires in the Mojave Desert have historically been rare, yet in the last 40 years, wildfires have been recorded as one of the most damaging factors impacting Joshua tree (*Yucca brevifolia*) woodlands. Exotic grasses such as *Bromus tectorum* can increase the size and frequency of fires, while invasive mustards increase the height of the flames. Desert ecosystems

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contain high endemism levels, and understanding trends in ecosystem response to fire is critical for land management agencies. Preliminary data and a thorough review of the fire ecology history of the studied sites led to the hypothesis that fires in the desert may contribute to a more diverse ecosystem and can potentially be used as a management tool for invasive species control. To test this hypothesis, we selected sites in the Mojave Desert across a chronosequence of Years Since Fire (YSF) <1, <5, <20, <30, <40, and <85 years post-burn in which to sample vegetation and biocrust. Plots were sampled using frequency frames and California Native Plant Society (CNPS) rapid assessment methods. These data were analyzed using Jaccard similarity (Sj) and Shannon Diversity Index (SDI). A comparative analysis revealed annual forbs, perennial species, and Eastern Joshua trees (*Yucca jaegeriana*) sprouted readily when a wet year followed a fire. Sites with burn scars older than fifty years exposed a more extensive percent cover of exotic grasses. The need to test different methods to protect biodiversity in Joshua tree woodlands is becoming apparent as we deal with increased invasions in previously pristine ecosystems.

Monarch recovery initiative: Gearing up to establish 15 million milkweed by 2030. Halie Goeman, Holly Ferrara, Michael Rogner, and Emm Havstad. River Partners. hferrara@riverpartners.org

River Partners implemented large-scale restoration of over 600 acres of habitat across 8 sites in California in 2020 to increase habitat availability for rapidly declining monarch butterflies and other pollinator populations. Multiple establishment methods were attempted. Monarch monitoring was conducted, searching for eggs and larvae between 2020 and 2022. In 2022, restoration successfully created monarch breeding habitat - milkweed was found at 6 of the 8 sites, and monarchs were observed at 4 sites. One of the biggest challenges to milkweed establishment was weed maintenance. Lessons learned from this pilot project are guiding future restoration projects to continually improve habitat for the monarch and aim to reduce herbicide applications. River Partners new Monarch recovery initiative aims to establish 15-million milkweed across the state of California by the year 2030.

*Student Contest entrant

Evaluating the long-term success of roadside grassland restorations. Kees Hood, Katie Michaels, and Justin Luong. California State Polytechnic University, Humboldt. keeswhood@gmail.com

Long-term monitoring of restoration projects that replace non-native weed-dominated sites is important for understanding their efficacy. We resurveyed 6 roadside native grass plantings in Yolo County, established between 1993-2001, in the spring of 2023 to track their success. Two 50m transects were delineated along the length of each roadside planting. Every 10m, we established three 0.5m quadrats parallel to our transect spanning 3 separate topographical positions – roadside, swale, and back. We interviewed individuals involved in these restoration efforts and their partnering landowners to gain information about goals, costs, initial restoration planning, and longer-term weed management. Overall, we found two initially planted species persisting across multiple sites - *Stipa pulchra* and *Elymus triticoides*. Stipa *pulchra* was found at all sites and in 38.6% (average cover 8%). *Elymus triticoides* was found at 5/6th of the sites and in 34% of plots (average cover 10%). The most common nonnative plants were Avena *fatua* (average cover 4%), *Festuca perennis* (3.36%), and *Erodium moschatum* (3.52%). Sixty species were detected, 14 native and 46 non-native, but 30 species were detected in less than 3% of plots. Native cover was site dependent ($p = 0.014$), and *S. pulchra* cover was higher in areas that were mowed (a weed control technique that also promotes perennial grass regrowth; $p = <0.001$). Our results highlight that native grass species can persist in these restoration projects at a cover comparable to remnant native grasslands but that their long-term success may depend on continued management, which differed by site.

Pesticide application and its effects on soil decomposition and microbial communities. Tessa Hospod[1*], Jason Henderson[1], and Mia Maltz[1,2]. [1]University of Connecticut, Storrs; [2]University of California, Riverside. tessa.hospod@uconn.edu

Pesticides and their impact have become a focused area of concern regarding their accumulation and persistence in the surrounding environment post application. Herbicides, in particular, are highly used, but limited information is known about their lasting persistence. Effects of pesticides may vary due to different chemical compositions and their interactions with non-target organisms and the surrounding environment. Therefore, it is challenging to predict how pesticides impact the environment, as every chemical has different mechanisms or residual effects. Pesticides may alter soil microbial activity which may affect soil decomposition rates. We examined pinoxaden, a highly selective, systemic herbicide used to control grassy weeds, applied to research plots at four times the labeled rate. The herbicide was used to control perennial ryegrass (*Lolium perenne*) in a native species, the eastern star sedge (*Carex radiata*). Eighteen weeks post application, we conducted a decomposition experiment in a sandy loam soil at this site, comparing treated to untreated controlled treatments. After six weeks, decomposition was hindered in plots that received pinoxaden applications. We detected shifts in fungal – but not bacterial – community composition in herbicide treated plots. Additionally, we conducted molecular analyses on a site at the same property on fungal and bacterial communities to monitor effects of repeated pesticide treatments on microorganisms. This study investigated the effects of pesticide applications on controlled grass research plots, with implications for agricultural crop and soil management and elucidates the nuanced influence of pesticide effects on soil microbial processes, human health and safety, and the environment.

Take the long view: encouraging native revegetation after jubata grass (*Cortaderia jubata*) removal. Leah Lord, Marin Water. leahelord@gmail.com

Once an invasive plant is controlled, the site it occupied is often left to recover alone. However, to fully achieve reintegration of a site into the broader landscape, an approach that threads the needle between passive and active restoration may be more appropriate. At a serpentine-influenced wetland on Mt. Tamalpais, Marin County, California the invasion of jubata grass (*Cortaderia jubata*) and its subsequent removal greatly reduced native cover, leaving the site vulnerable to a secondary invasion and unlikely to fully support native fauna. The initial mechanical removal of the jubata grass was very successful, with a dramatic decrease in control effort needed after the first two years. In phase two of the project, methods to encourage and speed-up native regeneration are being added. These include direct seeding, protecting native resprouts with natural materials, and moving invasive biomass that is suppressing native species. Takeaway lessons learned include considering the native plant community in the initial invasive treatment and adapting to successes at a site instead of forcing initial ideas of success. This project shows the value of complementing weed treatment with methods to encourage native plant reestablishment in order to ensure the site returns to one that is ecologically functional and save time and money in the long run.

Scaling up, studying, and financing eucalyptus tree removal: Strategies and techniques for processing massive amounts of woody material and site restoration. Mary Paul[1], Kevin Contreras[2], Dash Dunkell[2], and Arun Jani[3]. [1]Elkhorn Slough Reserve, [2]Elkhorn Slough Foundation, [3]CSU Monterey Bay. mary@elkhornslough.org

The Elkhorn Slough Reserve and the Elkhorn Slough Foundation (ESF) have been working to remove select stands of eucalyptus (*Eucalyptus globulus*) in northern Monterey County to restore native habitats and help reduce wildfire risk. The Reserve removed 13 acres from 2015 to 2023 and facing challenges with the amount of woody material generated by the removal of over 1,200 trees, initiated small-scale biochar production to sequester carbon and test its utility as a soil amendment in restoration projects. We learned that larger-scale production is needed to efficiently process the woody material generated. Biomass removal constitutes a large part of the costs of tree removal and

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can be an obstacle in completing projects. An alternative is to pyrolyze it into biochar for sale as a farmland soil amendment. In 2021, ESF removed 7 acres of eucalyptus and pyrolyzed 8,000 tons of dried logs into 200 tons of biochar and plans to remove another 40 acres to convert to biochar. ESF partnered with CSUMB to start a long-term study of eucalyptus sourced biochar benefits in farm fields. Biochar has agricultural applications and may improve soil moisture retention and fertility while sequestering carbon. These benefits largely depend on the source material and local environmental conditions. We will investigate agricultural uses of eucalyptus biochar in the region. As many agencies and organizations address the challenges of removing select stands of eucalyptus, biochar production may be a viable approach to manage the woody material generated by such projects.

Climate and competition interactions on above and below-ground traits of California grassland species.
Karen Situ[1]*, Jennifer Funk[1], Justin Luong[2]. [1]UC Davis; [2]Cal Poly Humboldt. ksitu@ucdavis.edu

With increased drought frequency and severity in California, understanding the adaptive above and below-ground responses of invasive and native species has become vital for invasive plant management. Plant trait research primarily focuses on readily available above-ground traits, but root traits may be the missing component in uncovering why seemingly similar plants have different drought and productivity responses. To study the impact of drought and competition on productivity, we compared the above and below-ground traits of several grasses commonly found in California grasslands. We planted two invasive grass species—*Holcus lanatus* and *Briza maxima*—in pots alongside three native grass species—*Elymus condensatus*, *Bromus sitchensis*, and *Festuca microstachys*—and three native forb species—*Achyrachaena mollis*, *Clarkia ungiculata*, and *Nemophila maculata*—as part of a larger experiment to simulate different environments where invasive grasses could hinder restoration efforts. The pots were split into high or low competition, with high competition pots containing larger amounts of its invasive grass species. Half of the replicates were kept well-watered and the other half experienced episodic drought. Overall, the most significant indicator was above and below-ground biomass. Controlling for different treatments, we found that other important indicators include root length per volume and root diameter, pointing to the importance of below-ground traits as research indicators. This suggests that using below-ground traits as a measure of productivity may provide more insight into how plants respond to challenging conditions and provide a possible avenue for studying methods of invasive plant management.

Evaluating intraspecific variation to restore climate-resilient populations.
Joanna Tang*, Carla D'Antonio and Scott Cooper. University of California, Santa Barbara, Department of Ecology, Evolution & Marine Biology. joannatang@ucsb.edu

Climate change is predicted to alter California's precipitation patterns. In Santa Barbara, the annual wet season is predicted to be shorter and comprised of larger but fewer storm events, resulting in prolonged summer/fall drought and episodic dry periods during the winter. These drought conditions may favor invasive species such as exotic annual grasses, especially if local native populations are not resilient to projected drought. Restoring resilient native populations that can withstand both drought and competition from annual grasses may allow us to "get ahead of the curve" to prevent future invasion. Intraspecific variation among native populations may result in populations that have higher drought tolerance and competitive ability than others. We hypothesized that populations that evolved with historical severe drought conditions would exhibit greater drought tolerance. To test this hypothesis, we set up a common garden greenhouse of toad rush (*Juncus bufonius*) populations. We collected seed from San Diego (which historically experiences more severe drought conditions) and Santa Barbara populations and subjected them to different drought regimes and competition with Italian ryegrass (*Festuca perennis*). We found intraspecific differences in total aboveground biomass, but none of the populations were able to produce seed under the severe drought regime. Intraspecific variation may affect a population's resilience to climate change and invasive species, which

*Student Contest entrant

suggests that specifically restoring populations with adaptations to future climate conditions may maximize the establishment and resilience of restored populations.

Test Plot: Community stewardship, experimental restoration design, land-based research. Jennifer Wai-Kwun Toy[1], Jenny Jones[2], Max Kanter[3], Alex Robinson[4]. University of Berkeley[1]; Terremoto[2]; Saturate[3]; University of Southern California Department of Landscape Architecture and Urbanism[4]. jen@testplot.info

Founded in 2019, Test Plot builds experimental restoration gardens throughout California that are responsive to site, community, and resources. They are open to the public and managed by volunteers from initial planting through establishment. The Test Plot ethos centers experimentation, asking questions, and design through ongoing maintenance. As a movement, we explore the routines, rituals and practices embedded in the dynamic relationships between people and plants. While the disciplines of conservation and restoration have typically focused on areas outside our cities heralded for their conservation value, most people now live in cities in urban nature. Ecologists call these landscapes "novel ecosystems": human-built landscapes characterized by non-native species, altered processes, new interactions and human influence. There is little scientific consensus on how to manage these lands and many ecological, economic, and social questions are still to be answered. Test Plot thus acts as a living laboratory, embracing this gray area and seeking to creatively connect communities – both plants and humans – on the margins. We currently have 15 plots across Los Angeles and the Bay Area. They are mostly located in urban parks where land managers need help and the ecology is highly disturbed. Across these plots we do not use herbicides and try many strategies to decrease the aggressiveness of invasive species from grow/kill cycles, solarization, sheet mulching and the "Bradley method." While these approaches may not work "at scale" they are replicable and serve as important demonstration projects for what is possible when people start taking care of the land again.

Today's technology for today's environment: Constructing a CNN to enhance invasive plant identification and removal. Sophie Zeng*, Grace Yao*. Project ARISE. sophie.zeng2@gmail.com

Invasive species' negative effects on both ecosystems and cities—especially removal and control expenditures that cost the US billions of tax dollars yearly—are exacerbated due to a lack of initiative and knowledge among regular citizens. The average person does not know what hundreds of different invasive plants look like or the proper procedure to remove them. Aiming to break down this knowledge barrier, we developed an AI algorithm that identifies the most invasive plant species in San Diego County as a tool for volunteers, homeowners, and other individuals without specific botanical education to remove invasive plants in their daily lives. Our algorithm is a convolutional neural network (CNN), trained using several thousand expert-confirmed invasive plant images collected from the Calflora and Bugwood Image databases. Through dozens of tests and detailed tuning, it accumulated a top-2 and top-3 accuracy of >80-90%. We utilized data analyzation and visualization methods such as confusion matrices to gauge the model's performance and adjust accordingly. Invasive species control experts from the San Diego River Park Foundation, California-IPC, and San Diego Park and Recreation confirmed that AI tools such as the one developed in this experiment has the potential to revolutionize and greatly streamline invasive plant removal. Implemented into a mobile app, this algorithm will equip volunteers, homeowners, and other people without botanical education with an accessible tool that allows for greater efficiency and scalability in removing invasive plants.

*Student Contest entrant