California Invasive Plant Council
2014 Symposium Abstracts

WEDNESDAY, OCTOBER 8

PRE-SYMPOSIUM SESSION: DPR LAWS & REGULATIONS

BMPs for protecting special status wildlife when using herbicides for invasive plant management. *Johnson, Doug. Cal-IPC. dwjohnson@cal-ipc.org*

Invasive weed control can assist in the recovery of special status (i.e. threatened or endangered) plant and animal species by removing exotic competitors or improving habitat quality. In some cases, however, invasive weed control efforts can pose risks to protected species via disturbance or contact with herbicide residues. This manual of Best Management Practices focuses on how wildland managers can reduce their impacts to special status wildlife while using herbicides to control invasive plants. This manual has two intended audiences. First are land managers who are already familiar with the applicable laws related to their work but who are interested in additional ways to reduce potential impacts to wildlife. Second are those who would like to learn more about invasive plant management in natural areas. These BMPs are compiled from the collective field experience of longtime wildland managers. They complement legal requirements for applying herbicides and are intended to strengthen general protection for all wildlife and people. They should be used where they do not conflict with legal requirements for particular species or sites. The general BMPs are broadly applicable to all herbicide treatments. These are followed by BMPs for foliar applications and stem treatments. Many of these BMPs are straightforward and can be easily integrated into standard practice. Others may require additional resources. The manual also includes toxicological data and charts for herbicides most commonly used in natural resource management, based on US Forest Service risk analysis. The manual will be available as a free download at www.cal-ipc.org in Fall 2014.

Fix it if it is broken: using data to simplify and improve the new California NPDES aquatic pesticide permit. *Blankinship, Michael. Blankinship & Associates. mike@h2osci.com*

Aquatic weed managers have historically relied on herbicides to solve flow, odor and invasive species problems in drinking water reservoirs, ponds, lakes and streams. The environmental fate and toxicity of these herbicides was questioned when the original aquatic pesticide permit was required in 2003, requiring permittees to generate substantial water quality data during and after herbicide application. Statistical methods and rationale will be presented as some of the tools used to successfully argue the case that resulted in a new, less burdensome 2013 permit.

Assessing sensitivity of Quino checkerspot butterfly larvae to two common herbicides used for habitat management. *Williams, Kathy. San Diego State University, Department of Biology. kathy.williams@sdsu.edu*

In 2005 and 2006, field studies in Marron Valley, CA, showed promising effects of herbicide application for reducing exotic plant growth and improving habitat for food plants of the endangered Quino checkerspot butterfly (*Euphydryas editha quino*). Therefore, this study was designed to evaluate effects of commonly used herbicides (Fusilade II®, Transline®) and application surfactant on Quino checkerspot butterfly larval development, survival, and pupal weights. The study was designed to assess both direct and indirect effects of herbicide exposure, by comparing larval growth, proportions of larvae pupating, and pupal weights. Performance was compared among larvae that had experienced direct contact with herbicides, surfactant, or water, and that were fed food plants that were exposed to herbicides, surfactant, or water. Two groups of post-diapause larvae were obtained from a captive rearing facility.

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PRE-SYMPOSIUM SESSION: DPR LAWS & REGULATIONS (cont.)

Approximately 600 larvae were treated and measured between May and July 2011. Larvae were weighed periodically as they progressed through post-diapause instars towards pupation. Initially larvae grew well and, while there were large differences in weights between the two groups of larvae, there was no significant difference in larval weights among treatments in either group. However, as larvae neared pupation sizes, they stopped feeding and re-entered another diapause instar, which also happens in nature. Although larvae did not pupate, and we could not assess effects of herbicide treatments on pupal weights, results from this experiment suggested that there were no direct or indirect effects on growth of post-diapause Quino checkerspot larvae from exposure to Fusilade or Transline and/or surfactant. That there was no indication of gross toxicity, and that post-diapause larval growth did not appear to be reduced by herbicide exposure is encouraging. Further studies when larvae are available will provide a more complete assessment of potential herbicide effects on this species' developmental and reproductive biology.

US EPA's Worker Protection Standards – 2014 Proposal for Changes. *Bakke, David. USDA Forest Service. dbakke@fs.fed.us.*

On March 19, 2014, US EPA published in the Federal Register a series of proposed changes to the existing Worker Protection Standards (WPS) used to protect pesticide handlers and agricultural workers. The public comment period ended in August of this year. The changes proposed, while extensive, will be familiar to many who use pesticides in California. An overview of the major changes proposed will be presented. An update to the review process will be given.

THURSDAY, OCTOBER 9

SESSION 1: RIPARIAN RESTORATION

Maintaining mitigation sites: the then and now of creating 'self-sustaining' riparian habitat. *Feldheim, Cliff. California Department of Water Resources. cliff.feldheim@water.ca.gov*

The California Department of Water Resources' Delta Levees program began working with Reclamation Districts to establish riparian forest and scrub-shrub mitigation sites in the mid-1990s. Mitigation sites were designed to be "self-sustaining." In 2011, staff evaluated these sites and found the understories dominated by nonnative invasive plants. The California Conservation Corps crews were used at Twitchell Island on two of the worst sites. Crews encountered Himalayan blackberry patches that were over 0.25 acre in size and more than 10 feet tall. The California Department of Water Resources is now working to create habitat mitigation sites that facilitate habitat maintenance and are dominated by native plants.

Region-wide arundo control and restoration in the Delta: an inter-agency collaboration. *Mager, Randall. California Department of Water Resources. rcmager@water.ca.gov*

Arundo, *Arundo donax*, is an invasive species introduced to California two to three centuries ago for a variety of uses. It is becoming increasingly widespread in the Sacramento – San Joaquin Delta and is devastating to riparian habitat. Arundo out-competes native riparian plant species, consumes much more water, does not provide nesting or foraging habitat needed for animal species, weakens levees, increases bank erosion during flood events and increases fire severity. The Delta Conservancy is developing a delta-wide long-term Delta Arundo Control and Restoration Program to treat arundo infestations and restore native vegetation to improve habitat along the Delta waterways. This requires coordination with landowners, local public agencies, funding sources and State regulatory agencies. Before initiating a delta-wide program, a pilot project is currently underway in the Cache Slough Complex to develop expertise in arundo control, effective restoration techniques in the controlled areas, resource requirements, landowner contacts and their cooperation. This pilot project in turn builds upon experience gained, and landowner partnerships developed, during a small-scale arundo control project on Hastings Cut between Lindsey and Cache Sloughs. The successful cooperation between landowners, local Reclamation and Resource Conservation Districts, and State agencies is critical to developing a successful, long-term Delta-wide arundo control program.

A collaborative approach to invasive species management in the Mattole watershed. *Pinnell, Cassie. Mattole Restoration Council. cassie@mattole.org*

The Mattole River drains 300 square miles of northern California's Lost Coast region in Humboldt County. The majority of the Mattole watershed is privately owned, and in response to the rapid decline in watershed health from extensive logging, the Mattole community acted in the early 1980's to form one of the first community-based, watershed restoration efforts in the Pacific Northwest. Today, invasive species management is a large component of the Mattole Restoration Council's restoration priorities, and is included in the majority of our restoration projects. By working with our partner non-profits, agencies, landowners, volunteers, and interns, we have developed a watershed based approach that includes detection, treatment, and monitoring on both public and private lands. Our public lands invasives projects are funded through contracts with agency partners that allow us to manage invasives throughout the coastal prairie, grasslands, and riparian zones in the King Range National Conservation Area, while our private lands projects include a mix of fee for service, volunteer efforts, and foundation funding. We prioritize community education and outreach on invasives, including newsletter articles, pamphlets, fliers, workshops, volunteer days, community meetings, weed pulling field trips and internships for local students. Our Lend-A-Wrench program extends our invasive plant removal efforts throughout the watershed by providing landowners with free and unlimited access to weed wrenches and other tools. We work to deter the establishment of invasives by re-vegetating our restoration sites and private and public lands with native plants cultivated in our native plant nursery (over 40,000 plants grown annually from locally harvested seed) and native grass seed and straw from our ¼ acre native grass farm. By integrating multiple funding sources, agency collaboration, and landowner outreach, we are working to comprehensively target priority invasives on a watershed level.

SESSION 2: INVASIVE PLANT UPDATES

Invasive Plant Progress 2014 *Casanova, Jason. Cal-IPC Board President. cas@watershedhealth.org*

New Weed Alerts! *DiTomaso, Joe. UC Davis. jmditomaso@ucdavis.edu*

Managing invasive plants and bringing back wildlife: the evolution of riparian restoration over 15 years with River Partners. *Griggs, Tom. Senior Restoration Ecologist (Ret.), River Partners. tgriggs@riverpartners.org.*

Riparian restoration along the rivers of the Central Valley started in 1989 when The Nature Conservancy initiated the Sacramento River Project with the goal of restoring wildlife habitat on flood-prone fields adjacent to the river. Trees and shrubs were planted in arrangements and densities that would meet the habitat structure requirements of targeted wildlife. Wildland horticulture is challenging because of limited control over soil depth and heterogeneity, unknown site-specific hydrology, and impacts from invasive weeds. We were successful in establishing the woody plants by aggressively attacking invasives with mechanical and chemical tools. However, once weed maintenance stopped, most invasives returned to dominate the understory. The woody species grew taller than the weeds and could shade them out locally. In the early 1990s several species of native grasses performed well by covering most of a riparian restoration site and replacing invasives as dominant species in the understory. Starting in 2002 River Partners designed and implemented the San Joaquin River NWR riparian restoration project, where the testing of additional understory broadleaf species took place. Experimentation with establishment techniques resulted in rapid establishment of the native herbaceous species to the near total exclusion of invasives. Today at San Joaquin River NWR the native understory is self-sustaining through floods and wildfire. Careful ecological observation and timely horticultural action

will result in the dominance of natives. Management of riparian restoration sites will always require some form of intervention to keep the natives as dominants. As we move into the era of climate change, ecological relationships among species and their physical environment will change – precisely HOW these changes will be manifested is unknown today. Hydrology will be the most influential ecological force affected by climate change. Since the beginning, riparian restorationists have been working within the modified hydrology in the Central Valley, due to dams, diversions, and levees on all rivers. Riparian restorationists have designed successful projects and devised effective land management practices within the currently highly modified hydrology of the Central Valley.

SESSION 3: MANAGEMENT

A means to an end: a systematic approach to eradication target detection and treatment.

Ball, Morgan. Wildlands Conservation Science. morgan@wildlandscs.org

Successful invasive plant eradications are uncommon because it is extremely difficult to meet three key eradication criteria:
(1) detect all individuals,
(2) remove all individuals, and
(3) outpace reproduction.
Land managers primarily focus (on Criterion-2, somewhat on Criterion-3, but rarely on Criterion-1. Although early detection is considered an effective strategy to detect novel invaders; however, once an invader is detected, possibly undetected for several years, how can all eradication criteria be met? Helichrysum petiolare (limelight) was detected on Santa Cruz Island in 2007. In 2011, The Nature Conservancy targeted all known H. petiolare infestations for eradication, and in 2014 a systematic approach to meet all three eradication criteria was developed and presented here. All drainages of known infested watersheds were assigned a unique identification code to ensure a complete survey of the watershed, and then surveyors were then deployed by a small helicopter to the top of each drainage. Surveyors hiked down the drainage to the main stream channel, and once the target was detected, the start and end points of the infested drainage was flagged and recorded. The surveyor would then radio the helicopter for extraction and redeployment to the next drainage, as well as, requesting an applicator to treat the infested drainage. Applicators were stationed in the main stream, where infestations were most abundant, until they were redeployed to infested side drainages. Applicators were then redeployed back to the main channel. A 5.5 person team completely surveyed and treated all plants within approximately 59 km of riparian scrub habitat in 23 discrete watersheds (10 major and 13 minor) over four days. When not transporting field applicators and the 315 gallons of finished product herbicide used on the project, the helicopter pilot, trained in species identification, surveyed open sections of drainages from 3 to 30 m above the ground. This unique perspective enabled the team to meet the first and most important eradication criterion—detection.

Choosing your battles, prioritizing invasive plant management: lessons from the Santa Cruz District of California State Parks.

Hyland, Tim. California Department of Parks and Recreation, Santa Cruz District. tim.hyland@parks.ca.gov

Invasive plant management is critically important in preserving California's biodiversity, but is also chronically underfunded. What funding exists is often relatively short term, or tied to specific projects. Given these realities it is critically important to prioritize invasive plant management because it often requires consistent effort over very long time horizons.
The Santa Cruz District of California State Parks has developed a relatively simple system for prioritizing large numbers of both new and existing weed occurrences representing multiple species in a variety of habitats. This system considers seven factors: Management Goal, Rate/Likelihood of spread, Threat to Sensitive Resources, Logistics, Political Concerns, Potential for Success, and Eradication Dividend. Each factor receives a numeric value (much like the Cal-IPC Inventory) which is used to determine each occurrence's rank.
This talk will expand upon the properties of each of these factors, and the process by which scores are determined. It will also use real world examples of successes and failures from over 15 years of weed work in Santa Cruz and San Mateo counties to illustrate the importance of each factor in the ranking system. It will also address the questions of how frequently prioritization should occur.

Managing California rangelands: effects of weather patterns on plant composition.

Dudney, Joan. UC Berkeley (student paper contest). jdudney@berkekely.edu

Rainfall is a key control on production and composition in California grasslands. While less studied, precipitation may also have a lagged effect, with previous year's rainfall affecting composition the following year. Here, we ask how different functional groups respond to current and lagged effects of precipitation in order to forecast changes due to increased rainfall variability. We monitored grazed grasslands in three sites in northern California: Sunol Regional Wilderness, Pleasanton Ridge Regional Park and Vasco Caves Regional Preserve. At each of the sites, species abundances were measured along four transects in six 500 m2 circular plots. These measurements were repeated for seven years between 2006 and 2012. Using precipitation data collected at each site, we asked whether abundance patterns of major functional groups (based on growth form, life history, origin) were related to the current and previous year's precipitation. Our analyses indicated that some of the functional groups were responsive to annual precipitation and lagged rainfall (previous year's rainfall). For example, exotic grasses increased with higher precipitation, especially with lagged years, while in contrast, exotic annual forb abundance decreased. Our results suggest that native diversity may increase while forage production may decline in grazed grasslands with increased drought years in California.

SESSION 4: SPECIES INTERACTIONS

Ustilago bullata, a potential biocontrol for *Bromus species.*

Hilbig, Bridget. UC Riverside (student paper contest). bhilb001@ucr.edu

The Mediterranean exotic annual grasses *Bromus diandrus* and *Bromus rubens* are invading much of the remaining coastal sage scrub, native grasslands, and native forbland communities throughout California. Changes to soil dynamics and frequency of fire disturbances in invaded areas contribute to Bromus dominance and resistance to restoration attempts. Current control and management of these noxious invasives include prescribed burns, mowing or grazing, and herbicide use, with each method having advantages and disadvantages. Biological control agents that target specific hosts can greatly increase the possibility of restoration. We examined smut disease in Bromus, caused by the fungal pathogen *Ustilago bullata*, as a potential biocontrol organism. *U. bullata* infects seedlings and grows systemically, then sporulates in the host inflorescence eliminating viable seed production. Smutted seeds were observed in 0 to 90% of Bromus populations in desert and coastal sage scrub. We also compared species of Ustilago infecting Bromus in its native range (Spain) to species infecting Bromus in its invaded range (California). Smutted host plants *Bromus diandrus* and *Bromus rubens* were collected from different vegetation types in southern California and Spain, and stored at room temperature. Direct sequencing from teliospores of smutted seed heads was conducted for all populations. Spanish populations revealed three species of Ustilago in *Bromus rubens* including *U. bullata*, *U. hordei*, and *U. avenae*, whereas *U. bullata* was the only species found infecting Bromus species in California populations. Current work to isolate and germinate teliospores for growth chamber inoculation trials is underway. With this information we can determine if *Ustilago bullata* infects native species or important agricultural crops such as wheat, and thus whether it is a viable biocontrol agent candidate.

Edge effects: native and non-native plant distribution along single and multi-use trails in the Santa Monica Mountains.

Irvine, Irina. Santa Monica Mountains National Recreation Area. irina_irvine@nps.gov

Recreational use of trails may result in disturbance of the surrounding biotic communities, with the nature and degree of impact being a function of use type (e.g., hiking, biking, and equestrians) and intensity. Because trails are a consistent source of disturbance, they are vectors for the introduction and spread of non-native, invasive species. Trampling at the trail edge when visitors move aside to avoid conflicts can reduce leaf litter which could aid non-native seed germination. The Santa Monica Mountains have high recreational use (~35 million visitors per year), ~700 miles of trails, and over 4000 documented invasive plant populations. We tested whether trailside vegetation had more non-native species (richness and abundance) than interior vegetation along single-use trails (hiker-only) and multi-use trails in two different vegetation types. Controlling for elevation, slope and time since last fire (≥10 years),

we recorded the species, and percent cover of plants and litter using 60 m long transects placed along the trail edge, and four 10 m transects perpendicular to the trail edge for interior measurements. We sampled at 8 paired sites located in coastal sage scrub (a globally threatened drought deciduous, open canopy shrub community, CSS) and chaparral (a dense perennial shrub community with thick litter layers). Trailside vegetation had ≥80% increase in non-natives compared to interior vegetation, demonstrating an edge effect on both types of trails and in both plant communities. Multi-use trails had a higher proportion of non-natives than single-use, and the interior had 40% more litter regardless of trail type. CSS showed a significantly greater number and penetration of non-natives than chaparral, with more infestation in multi-use trails compared to single-use. More litter in CSS was positively correlated with fewer non-natives. Our results suggest that multi-use trails are more appropriately established in chaparral rather than CSS.

Invasive legume symbioses: do California invasions follow worldwide trends? *La Pierre, Kimberly. UC Berkeley. kimberly.lapierre@berkeley.edu*

Ecologists have a long history of examining the role of biotic interactions in determining invasion success. Currently, new molecular tools are driving a rapid understanding of the importance of feedbacks between plants and their associated microbial communities in determining species invasions. Invasive legumes present a particularly interesting case of plant-microbial feedbacks. A legume may successfully invade by obtaining atmospheric nitrogen to outcompete native plants, however this strategy depends upon being able to associate with compatible rhizobia in the exotic range. An invasive legume can either form novel associations with the resident rhizobia in its exotic range or co-invade with rhizobia from its native range; however, both of these strategies depend upon the specificity between a legume species and its rhizobial associates. Here, we examine legume-rhizobia specificity for three invasive legumes—gorse (*Ulex europaeus*), French broom (*Genista monspessulana*), and Spanish broom (*Spartium junceum*)—and several native legumes in the San Francisco Bay Area through field collections. We further compare the results of this field study to trends of native vs. invasive legume specificity for rhizobial partners identified from a meta-analysis of over 200 studies from around the world. Through this comparison, we can identify whether invasive leguminous shrubs in the Bay Area follow trends similar to those observed around the world, which has important implications for invasive legume management in California.

A river ran through it: restoration on historic gravel bars and weed suppression by native forbs. *Rogner, Michael. River Partners. mrogner@riverpartners.org*

Dams, diversions, and other development projects have severely degraded river processes throughout California. Riparian restoration efforts have often focused on areas where remnant prime soils can support native woody vegetation such as *Populus fremontii*, *Quercus lobata*, and various Salix species. More marginal soil types with high levels of sand, gravel, or cobbles have presented greater challenges, which have often constrained or even prevented restoration efforts. Particularly problematic are areas with poor soils away from river channels which now rarely, if ever, experience larger flood events that could result in significant erosion or deposition. These sites may not contain the appropriate soil characteristics to support native woody species or even perennial grasses. However, they can support a rich diversity of annual and perennial forbs which compete strongly with weeds and provide habitat for wildlife and native pollinators. In 2012 River Partners initiated a trial in Tehama County on a 7-acre historic gravel bar located ~600 meters from the main channel of the Sacramento River, a site that has not flooded since at least 1997. The purpose was to determine a) which species could be collected and germinated at that scale, and b) which could out-compete annual grasses and other weed species which occur in this area. Using local seed sources, we collected eight species (five perennial) that were growing nearby in similar conditions. To prep the site we utilized standard maintenance practices (spraying and mowing) that were also being used on 107 surrounding acres. The site was seeded in December 2012. Monitoring has demonstrated that, in the short term at least, these forb species are capable of establishing on marginal soils without supplemental irrigation or chemical weed control, and that they can be grown densely enough to suppress many weed species.

SESSION 5: RESTORATION

Assessing effectiveness of management actions on recovery of coastal sage scrub plant communities over time. *Dickens, Sara Jo. UC Berkeley. sara.jo.dickens@berkeley.edu*

Highly degraded sites are often the result of long-term disturbance and invasion histories; and, the path of recovery/restoration rarely follows the reverse path of degradation. Novel trajectories and states may occur and direct the type of intervention needed to restore the system. We analyzed data from a 15 year weed program within the Nature Reserve of Orange County, CA. Our objectives were to describe the current vegetation community, tease apart trends due to management efforts versus environmental and land use legacies, identify “stuck” or novel sites and determine thresholds in both native and weed species abundance allowing for further unassisted recovery. In spite of a long-term control program, exotic plant species continue to dominate the reserve as a whole. However, assessment of exotic cover classes and native cover and richness classes over time revealed a substantial reduction in targeted exotics (*Cynara cardunculus* (CYCA) and *Brassica nigra* (BRNI)) and an increase in both native cover and richness. The increase in exotic cover was largely non-targeted exotic annual gasses which doubled in cover between 2008 and 2013. Out of 109 sites 14 lost native cover, 10 are “stuck” and 82 had increased native cover at various rates. Sites that were associated with greater increases in native cover had higher elevation, more recent fire and were larger in size. Land use legacies of grazing were important to exotic species cover. Control of CYCA was an important factor in native recovery as sites that were historically most invaded had the highest recovery rates. Additionally, sites that were treated a greater number of years also had greater native cover. Several trajectories of recovery were observed and resulted from differing environmental conditions, land use histories, invasion histories and weed control intensities. Understanding trajectories and thresholds of recovery resulting from weed control efforts can assist in planning of future management through site prioritization and weed control intensities.

Effects of defoliation and habitat type on medusahead demography. *Gornish, Elise. UC Davis. egornish@ucdavis.edu*

The winter annual grass *Taeniatherum caput-medusae (L.) Nevski*, commonly known as medusahead, has invaded over 20 counties in California, significantly decreasing livestock forage production, reducing biodiversity, and promoting increased wildfire frequencies. Targeted control efforts are highly variable, and have not demonstrated long-term success. Contributing to the limited success of controlling medusahead is an absence of fundamental demographic knowledge about this noxious weed, which is essential for predicting the behavior of future invasions. By gaining a better understanding of the life cycle of medusahead, we can assess the susceptibility of life stages to different abiotic factors, and create models to assist with combating future invasions.
We examined the demography of medusahead across its life cycle within oak woodland and open grassland habitat types at different seeding rates (0, 10, 100, 10,000, and 50,000 seeds per m^2), both with and without targeted defoliation, in a randomized design. Survival, growth, and fecundity data were collected to construct periodic matrix models over 1 year. Perturbation analysis was used to determine the sensitivity of each stage to experimental treatments. We found overall population growth rate of medusahead to be lower in oak woodland habitats compared to open grasslands as a result of reduced germination and seedling establishment. We also found that defoliation served to decrease overall medusahead density in both habitats. However, this reduction in density led to an increase in flower production by individuals that escaped the defoliation treatment (due to a late phenology). We expect that this increased flower production will be a positive feedback on population growth for the following year. This work highlights the importance of integrating demographic considerations into invasive weed management efforts. Specifically, our work suggests that effective eradication methods for medusahead require a series of defoliation treatments in order to target both early and late phenology individuals.

The "other" invasive Spartina in San Francisco Bay: progress towards eradication for the lesser-known species. *Kerr, Drew. California Coastal Conservancy's Invasive Spartina Project. drewkerr@comcast.net*

The California State Coastal Conservancy's Invasive Spartina Project (ISP) has led a regionally-coordinated effort since 2000 to eradicate non-native cordgrass from the San Francisco Estuary. The ISP coalition of partnerships has reduced the infestation by 96%, from the peak of 805 net acres down to 32, through the use of integrated landscape-scale monitoring and treatment. The primary targets were hybrids between the introduced *Spartina alterniflora* and native *Spartina foliosa*, but many are unaware of the progress ISP has made towards eradicating several other non-native Spartina species infesting endangered species habitat. While the infestation of *Spartina densiflora* (as well as its hybrid with *S. foliosa*) never reached the scale or geographic scope of *S. alterniflora* × *foliosa*, it was primarily located in a highly-urbanized portion of the Estuary with hundreds of residential and commercial properties involved. Acquiring access to every incidence of *S. densiflora* required years of outreach and education including enormous volunteer contributions from Friends of Corte Madera Creek, as well as threat of noxious weed enforcement action from the Marin County Agricultural Commissioner to obtain permissions from the last holdouts. An adaptive Integrated Vegetation Management strategy was developed to overcome imazapyr's highly-variable efficacy on *S. densiflora*, as well as the persistence of the above-ground biomass that complicated subsequent treatment. Just 64m² of *S. densiflora* remained throughout the Estuary in 2013; the eradication trajectory is now maintained by manual removal to exhaust the seed bank.
Despite the fact that the other two species (*S. patens* and *S. anglica*) were each relegated to a single site, their treatment was confounded by a variety of factors that have delayed attaining the eradication goal. Primary amongst these challenges was the presence of endangered species in these marshes, including the hemi-parasitic plant *Chloropyron molle ssp. molle*, which forced herbicide applications into sub-optimal timing.

Techniques for ecological restoration of *Spartina foliosa* following local eradication of invasive *Spartina alterniflora* hybrids. *Thornton, Whitney. San Francisco State University, (student paper contest). whitney@spartina.org*

In 2011, the San Francisco Estuary Invasive Spartina Project (ISP) initiated a restoration program targeted at providing habitat for the endangered California clapper rail (*Rallus longirostris obsoletus*). A key programmatic goal of this program is to reestablish native Pacific cordgrass (*Spartina foliosa*) in areas in which hybrid Spartina (*S. alterniflora* x *S. foliosa*) control has been successful. Restoration attempts have been complicated by a paucity of *S. foliosa* populations available for transplant, altered marsh characteristics following hybrid invasion and removal, and Canada goose herbivory. Five large scale experiments conducted from 2010-2013 tested how restoration site characteristics, plant caging, and parental source of *S. foliosa* transplants effected establishment rates of native cordgrass. Throughout all experiments, outplanting location (e.g., geographic location, substrate, elevation) and caging were strong predictors of planting success. Establishment rate of native cordgrass was highest on uniform mudflats and wide channel banks (62%) with lower establishment rates occurring in 2nd order channels and bayfront habitat (15%). The influence of caging varied by marsh, but was most predictive of planting success at sites with nesting Canada goose (78% survivorship in caged plots, 7% survivorship in uncaged plots). Parental source was a strong predictor of planting establishment, with eight sources varying significantly in terms of survivorship, flower production, and culm density. Field performance of donor sources was not predictable from geographic region. Successful restoration of native cordgrass requires understanding site specific conditions including marsh hydrology, elevation, substrate, herbivore pressure, and donor source material.

SESSION 6: INVASIVE PLANT ECOLOGY

Nitrogen deposition and invasion: the effects of N availability and plant-soil feedback on the success of three invasive plant species. *Valliere, Justin. UC Riverside, (student paper contest). jvall007@ucr.edu*

Nitrogen deposition is the input of biologically available forms of nitrogen from the atmosphere to the Earth's surface. Industrial, vehicular and agricultural emissions have dramatically increased rates of N deposition worldwide, and this has been identified as a driver of biodiversity loss and invasion in multiple systems. In southern California, high levels of N deposition have been found to increase nonnative biomass, decrease native forb diversity and alter mycorrhizal fungal communities. We studied the effects of experimental N addition on native and nonnative vegetation in the Santa Monica Mountains National Recreation Area, as well as in two controlled greenhouse experiments. Our research questions were: (1) How does N addition influence nonnative performance? (2) How do nonnatives respond to soil microbial communities impacted by N addition? Our study species were *Bromus diandrus, Centaurea melitensis* and *Hirschfeldia incana*. All three of these species are native to the Mediterranean and are successful invaders throughout California. We found that N addition led to higher nonnative cover in the field, to the expense of native species. We also found that both N availability and changes to the soil microbial community influence plant performance. Finally, our results also indicate that increased N availability results in increased reproductive output in all three species. These results highlight the important role N deposition may play in invasion.

Impacts of precipitation change on *Bromus tectorum* and native vegetation in a sagebrush steppe ecosystem. *Wade, Catherine. UC Santa Cruz, (student paper contest). cwade@ucsc.edu*

Sagebrush steppe, one of the most widespread ecosystem types in the western U.S., is highly vulnerable to large-scale ecosystem conversion because of positive feedbacks between the non-native species *Bromus tectorum* (cheatgrass) and fire. Ubiquitous throughout the Intermountain West, *B. tectorum* rapidly colonizes bare ground amid native vegetation, completes an unusually early phenological cycle, and poses a serious fire hazard. Its recent spread to higher elevations is alarming and may be exacerbated by changing climatic conditions. In particular, altered precipitation regimes (amount, type, and timing) may facilitate invasion and alter ecosystem structure and function. This study used a series of experiments over three years to compare potential impacts of precipitation change on *B. tectorum* and native species at 2,175 m elevation. We used snow fences to increase and decrease snowpack, and irrigation to simulate increased frequency and magnitude of spring and summer precipitation. *Bromus tectorum* phenology was advanced in the decreased relative to the increased snowpack treatments in 2013. Snowpack treatments did not significantly affect species richness, percent cover, or *B. tectorum* density within any year, but interannual differences in snowpack depth yielded significant impacts on these variables, including a dramatic reduction in *B. tectorum* density in the driest year. Photosynthetic responses to rainfall simulations were species-specific and varied seasonally and annually; *B. tectorum* responses were more pronounced than those of native species in spring 2013, while the magnitude of responses was more uniform in spring 2014. In summer 2012, some native species significantly responded to watering after *B. tectorum* had senesced, but not in summer 2013. Overall, results indicate that *B. tectorum* may be more sensitive than native vegetation to precipitation change. Uncertainty about future snow and rain climate and the small window of opportunity to manage invasions necessitate close monitoring of high-elevation areas at risk of *B. tectorum* encroachment.

Reestablishing the competitive hierarchy in an invaded California grassland through the process of habitat restoration following the prescribed burn of *Centaurea solstitialis*. *Mills, Jason. MS Interdisciplinary Biogeography C.S.U. Chico. positiveway@hotmail.com*

Land use practices in the past several hundred years have had a dramatic effect on many of California's ecosystems, resulting in large scale ecological consequences. As a result, native grasslands have become one of the state's most threatened ecosystems. Close to 90% of the plants listed on California's Inventory of Rare and Endangered Species occur within grasslands. Native species account for less than 1%

of composition of most California's grasslands today. *Centaurea solstitialis* (yellow star thistle, Asteraceae) was introduced to California in the mid 1800's and has spread widely into exposed grasslands. *Centaurea solstitialis* is highly invasive and is currently the most widely distributed noxious weed in California. Prescribed burns have been demonstrated to be an effective management tool for reducing the density and seed bank of *C. solstitialis* by as much as 99%; however, further research has shown that without continued management, *C. solstitialis* will reestablish in treated areas. I hypothesize that planting native grassland species will suppress the reestablishment of *C. solstitialis* following a burn. Seeds of the perennial bunch grasses, *Stipa pulcra*, *Bromus carinatus*, and *Elymus glaucus*, along with *Grindelia camporum*, and *Madia elegans* were collected within the watershed of Big Chico Creek in the summer of 2012 and propagated in a greenhouse. Two separate fields of *C. solstitialis* along Big Chico Creek were burned in the fall of 2012. Three separate 4m x 7m blocks were established in each of the fields. Each species was planted in separate 1m² plots and replicated 4 times in each of the blocks using systematic randomization. Planting of 1,152 native grass plugs, 216 Grindelia plugs, and 48 1m² direct seed treatments of mixed bunch grasses and *Madia elegans* was completed in the winter of 2012-13. Species composition and growth of each treatment will be monitored once a month for one year. .The use of these species in restoration efforts may be able to shift the competitive advantage back toward native grassland taxa in order to mitigate against future *C. solstitialis infestations*.

Are native and invasive species functionally similar in low-resource ecosystems? A functional trait comparison across five Mediterranean-climate ecosystems. *Funk, Jennifer. Chapman University. jlfunk@chapman.edu*

It is difficult to identify a suite of general traits explaining invasiveness because traits of invaders depend on characteristics of the invaded habitats. Specifically, the mechanisms allowing exotic species to invade low-resource ecosystems are likely to be very different from those allowing species to invade high-resource ecosystems. Invasive species tend to be located on the fast-return end of the leaf economic spectrum (LES), displaying low leaf mass per unit area (LMA), high rates of carbon assimilation, high leaf nitrogen (N) content, and short leaf lifespan while native species occupy the slow-return end of the LES. However, it is unclear if these functional differences exist in low-resource ecosystems where theory suggests plant species should benefit from traits characterized by the slow-return end of the LES.
In this study, we measured functional traits from native and invasive species occurring in eight vegetation communities across the five Mediterranean-climate ecosystems (MCEs), where plant productivity is limited by low water availability in summer. We collected functional trait data from the most common invasive (5-9 species per site) and native (7-47 species per site) species in California (serpentine grassland, coastal sage scrub), Chile (sclerophyll woodland), South Africa (acid-sands fynbos, Renosterveld), Spain (coastal grassland), and Western Australia (banksia woodland, coastal banksia woodland). Traits included leaf N and P content, LMA, photosynthetic capacity, water use efficiency, photosynthetic nutrient use efficiency, root depth, specific root length, nutrient acquisition strategy, height, seed mass, and life form. Traits differed more strongly across the eight sites than between native and invasive species. Despite differences in LMA, root depth, and life form, native and invasive species were similar with respect to rates of carbon assimilation and resource use efficiency. Overall, our data suggest that invasive species are functionally similar to native species in MCEs although there is significant variability across regions and across sites within regions resulting from different environmental pressures and land-use history.

FRIDAY, OCTOBER 10

SESSION 7: CREATIVE SOLUTIONS

High stakes for California rangelands – the battle to stem the tide of invasive plants must be a collaborative effort. *Koopmann, Tim. Koopmann Ranch and California Cattlemen's Association. koopmannranch@gmail.com*

The livestock grazing community is losing the "war on weeds". The number and ground cover acreage of noxious, invasive plant species that reduce grazing value and constitute a fine fuel fire loading hazard are increasing at an alarming rate. Once feared as the bane of the rangeland management community, yellow star thistle (*Centaurea solstitialis*) may now be considered the least problematic of the many toxic weed species impacting California rangelands. The spread of Barbed Goatgrass (*Aegilops triuncialis*), and medusahead (*Taeniatherum caput-medusae*) are but two of the most devastating invaders and the grazing community has limited tools to successfully combat these invasions. The 38 million acres of California classified as rangeland represent a major land use component of the state. Rangelands are home to the majority of terrestrial special status species, provide much coveted view shed and open space for our urban population, play an integral role in the collection, movement, storage, and overall quality of surface water resources and account for significant economic value to the agricultural economy. This valuable land component which provides so much benefit to the state is historically recognized as the frontline battlefield for the continuous invasion of noxious plant species.
Although there are some examples of conservation grazing reducing targeted invasive plants, the development and implementation of an effective rangeland invasive weed management strategy is hampered by a multitude of factors including regulations, apathy, economic constraints, biological ignorance and public resistance. Recent severe drought across the state is greatly affecting rangeland productivity and recent observations indicate a highly variable affect on medusahead and stinkwort populations. Climate models predict shorter, more intense rainfall seasons that will likely lead to less certainty for rangelands and weed control efforts.
The livestock grazing community should assume a leadership role in the development of collaborative tools to reduce the roadblocks to successful rangeland weed management. Collaborative team members in addition to agricultural producers should include regulatory agencies, public land ownership managers, local Resource Conservation Districts, UC Cooperative Extension, and interested public members. One promising collaborative tool which deserves further attention is the ongoing work of the California Rangeland Conservation Coalition (CRCC), which has brought together agencies, NGOs and producer groups to develop projects for the benefit of all interests.

Hot topics in biocontrol. *Pitcairn, Mike. California Department of Agriculture. mike.pitcairn@cdfa.ca.gov*

Several exotic weeds have been the target of weed biological control researchers for several years. A list of weeds with active biocontrol research will be presented. These include tall whitetop (*Lepidium latifolium*), hoary cress (*Lepidium draba*), dyer's woad (*Isatis tinctorius*), Russian knapweed (*Acroptilon repens*), Scotch broom (*Cytisus scoparius*), giant reed (*Arundo donax*), water hyacinth (*Eichhornia crassipes*), Dalmatian toadflax (*Linaria genistifolia*) and rush skeletonweed (*Chondrilla juncea*). Potential biological control agents will be identified and progress on their development for use in the field will be presented.

The power of cross-border collaboration. *Pirosko, Carri. Oregon Department of Agriculture. cpirosko@oda.state.or.us*

The power of cross-border collaboration is being demonstrated in the State of Jefferson. California and Oregon border partners see opportunities in working together despite being separated by a state line, differing state laws, and weed priority lists. With the loss of the California Weed Biological Control Program, cross-border collaboration has become even more crucial on this front. Partners have formed an I-5 Working Group that meets annually to discuss cross-border invasive and noxious weed issues. Representatives attend WMA meetings in both states keeping the communication flowing. Electronic communications, from Facebook to blogs, are shared weekly keeping EDRR timely. Cal-IPC

has been working with Siskiyou and Humboldt WMAs prioritizing weeds worth watching and controlling based on experiences of Oregon partners. Unfortunately, some lessons learned in one state are often hard lessons learned in another. History is bound to repeat itself on several fronts. Arundo could possibly be one such example. Despite some potential set-backs, the power of the committee cannot be understated, for the committee is the engine of collaboration. Weeds know no boundaries; cross-border collaboration should not either.

New Nevada noxious weed prevention and monitoring measures. *Greer, Jamie. Nevada Department of Agriculture. jgreer@agri.nv.gov.*

This presentation will detail new aspects of the Nevada Department of Agriculture (NDA) Noxious Weed Program including the use of EDDMaps for statewide data collection and mapping and new developments in Nevada's Weed Free Certification Program for forage and gravel products. New EDDMaps technology being used in Nevada includes the use of smart phone APPS, customized Nevada EDDMaps online GIS database, and tools for EDRR including expert report verification and email alerts for new reports in areas near you. New developments in Nevada's Weed Free Certification Program include gravel pit and earth material source weed free certifications, new inspection and producer guidelines, and an overall increase in demand for certified weed free products. Overall this presentation will provide the audience with an update on the noxious weed front in Nevada that could also be implemented in California to improve management and prevention of noxious weed spread across state borders.

SESSION 8: DISCUSSION GROUPS

Ask the Experts (and each other)
Panel: Joe DiTomaso, UC Davis, Ken Moore, Wildlands Restoration Team, others to be announced

Bring your questions on management of invasive plants to discuss with our panel of experts and fellow attendees. This will be an open forum to discuss management strategies for particular plants or situations. Learn from other Symposium attendees' expertise.

Careers in invasive plants and restoration
Panelists to be announced.

What are the possible directions a career in invasive plants and restoration can take? What skills do you need to get a job and advance in the field? Our panel of invasive plant managers will describe their experiences working for government agencies, non-profits, consulting firms, and universities. Attendees will be able to ask questions. This panel will be followed by a student lunch with the panelists (free for students).

Prioritization
Leaders: Gina Darin, CADWR, and Giselle Block, USFWS

The discussion group will begin with a short presentation of the major phases of prioritization and a showcase of tools available in California with a live demonstration of Online WHIPPET. (Try it for yourself at whippet.cal-ipc.org and bring your questions to the discussion group. Sign in with a free Calflora account and read the User Guide). From there, we will discuss prioritization issues and challenges.

Working on the wildland/urban interface
Leader: Susan Mason, Friends of Bidwell Park, Chico

Organizations and volunteers working in open spaces that adjoin urban areas have some unique challenges and opportunities. On the down side, it may vastly increase the number of invasive horticultural species in the wildland area and restrict your ability to use the most cost-effective treatments. On the plus side, it could increase the availability of volunteer labor or provide easier access for treatment and debris removal. How does working on the WUI affect your decisions about which weeds to try to control, choices of treatment methods, and timing of work? What works for communicating with dozens to hundreds of adjacent landlord and/or multiple public agencies? In this session, you will be able to discuss your problems and share solutions with others who are working on the wildland/urban interface.

Working with volunteers
Leaders: Susan Schwartz, Friends of Five Creeks, and John Parodi, Point Blue Conservation Science

What can you do to attract volunteers, keep them coming back, and use them effectively in the many roles they can fill? Discuss tips, techiques, and practical problems in a session informed by a pre-session survey and sparked with brief presentations by experienced leaders

Revegetation and competitive planting
Leader: Tim Buonaccorsi, RECON, San Diego.

What are the factors that influence the long term efficacy of competitive planting? What are the benefits of and drawbacks of active vs. passive restoration? In a multi-step approach to native establishment, does the order of events change the outcome? Bring your own problems and solutions and examples of what has worked long-term for your projects.

SESSION 9: MAPPING AND MONITORING

Update - early detection rapid response pilot project in California State Parks. *Robison, Ramona. California Department of Parks and Recreation. Ramona.Robison@parks.ca.gov*

The California State Parks (Parks) Natural Resources Program spends a significant amount of its yearly budget on invasive plant management. Most of the effort goes towards management of known weed infestations. Monitoring is also in place using a modified version of TNC's Weed Information Management System (WIMS), which focuses on 30 species that are already widespread. In order to become more pro-active and identify new infestations before they become widespread, in 2013 Parks implemented a pilot program for early detection and rapid response (EDRR) in the Santa Cruz District's Mountain Sector and Orange Coast District Parks. In 2014 we added some San Diego Coast, North Coast Redwoods and Sierra District Parks to the pilot program. Methods developed included selection of an EDRR target list, preparation of training materials for field staff including: a GPS data collection and management system, maps and GIS layers of EDRR target search areas. We also added cost and budget estimates to extend the protocol to the entire Parks system. The project is in collaboration with the Resource Conservation District of Santa Cruz County (RCD-SCC) and California Invasive Plant Council (Cal-IPC).

Modeling habitat suitability for velvetgrass (*Holcus lanatus*) in Sequoia and Kings Canyon National Parks, California. *Degenstein, Erin. Humboldt State University (student paper contest). erindegenstein@gmail.com*

It is important for land managers to understand where to look and which ecosystems are threatened by invasive species in order to help restore and maintain natural ecosystems. The need for targeted early detection surveys is increased with limited personnel resources and vast areas of rugged terrain. Habitat suitability modeling is a spatial analysis tool that provides managers and researchers alike an understanding of the potential distribution and spread of invasive species. Velvetgrass (*Holcus lanatus*) is a non-native perennial grass that aggressively invades wet meadows in Kings Canyon and Sequoia National Parks in California. This study uses 1,223 recorded presence locations and Maximum entropy (Maxent) modeling to develop habitat suitability maps based on terrain and water features at a 10 meter resolution. Results will be discussed in the context of the model's ability to predict suitable habitat based on quantitative measures (AUC) and model applicability throughout the Sierra Nevada. Uncertainty based on sampling bias, original predictor layer data, GPS accuracy, and modeling methods will also be discussed.

Predicting the spread of medusahead in California: importance of climate and dispersal vectors. *Farrer, Emily. UC Berkeley. ecfarrer@berkeley.edu*

Understanding what controls the spread of invasive species is essential to identify areas susceptible to invasion so they can be targeted for early detection surveys and management. Most species distribution models focus only on abiotic factors and ignore dispersal; however, dispersal vectors may be key in promoting or restricting invasive spread. Here we test whether dispersal factors, in addition to abiotic factors, are important in predicting the spread of the noxious rangeland weed medusahead (*Elymus caput-medusae*) in California. We hypothesize that incorporating dispersal will improve model fit and alter predictions of where medusahead is likely to invade. Using logistic regression, we first fit an abiotic model including annual precipitation, annual temperature, soil texture, slope, and aspect. We then fit another model adding two dispersal parameters: road density and cattle density

(medusahead seeds have long barbed awns and can attach to animals including cattle). We compared model fit (AIC) and predictive power (AUC), and extrapolated both models to all of California to compare invasion predictions. In the abiotic model, precipitation, temperature, soil texture, and slope were important for medusahead distribution. Adding dispersal parameters increased model fit; cattle density was positively associated with medusahead presence and road density exhibited a hump-shaped relationship. However, adding dispersal parameters did not increase model predictive power. Both models predicted that wetter, hilly regions in Northern California (the North Coast and Sierra Nevada) are likely to be invaded, whereas invasion is unlikely in hotter, drier regions of Southern California (the Central Valley and desert). The models also highlighted some areas in the Central and South Coast with high habitat suitability. Overall, these results suggest that limiting dispersal vectors may help reduce the spread of this invasive grass. These methods can easily be applied to other invaders and regions to assess invasion risk and aid prevention and management.

The development and refinement of a Plant Risk Evaluation (PRE) tool for assessing the invasive potential of ornamental plants. *Conser, Christiana. UC Davis. cconser@ucdavis.edu*

Weed Risk Assessment (WRA) methods for screening potential new plant introductions have evolved rapidly in the last two decades. To be accepted as a tool for the horticultural industry to evaluate new plant introductions and current plant inventories, it is critical that a pre-screening tool not only accurately predict invasive potential of a species, but also accurately predict non-invasiveness without falsely categorizing them as invasive. In this study, we developed a new abbreviated Plant Risk Evaluation (PRE) tool specific for plants originating from the ornamental industry. The 19 questions in the final PRE tool were narrowed down from 56 original questions based on a combination of other WRAs. For the 56 questions, we evaluated 21 known invasive plants and 14 known non-invasive ornamental species. After statistically comparing the predictability of each question and the frequency the question could be answered for both invasive and non-invasive species, we eliminated questions that provided no predictable power, were irrelevant in our current model, or could not be answered reliably at a high enough percentage. We also combined many similar questions. The final 19 remaining PRE questions were further tested for accuracy using 57 additional known invasive plants and 37 known non-invasive ornamental species. The resulting evaluation demonstrated that when "Evaluate Further" classifications were not included, the accuracy of the model was 100% for both predicting invasiveness and non-invasiveness. When "Evaluate Further" classifications were included as either false positive or false negative, the model was still 93% accurate in predicting invasiveness and 97% accurate in predicting non-invasiveness, with an overall accuracy of 95%. We conclude that the PRE tool should not only provide plant propagators and growers with a method to accurately screen their current stock and potential new introductions, but also increase the probability of the tool being accepted for use by the industry as the basis for a nursery certification program

Session 10: OUTREACH AND MANAGEMENT

Mid Klamath Watershed Council: a collaborative approach to invasive weeds management. *Chapple, Tanya. Mid Klamath Watershed Council. tanya@mkwcorg*

The Mid Klamath Watershed Council (MKWC) has actively been managing high priority invasive weeds in collaboration with federal, state, and Tribal partners and with the support of the local community. MKWC utilizes early detection/rapid response, watershed level planning and collaboration, as well as public involvement and education to effectively manage invasive weeds present in the mid-Klamath. Since 2006, MKWC has coordinated and hosted annual meetings with federal, state, and county agencies, local tribes, and other non-profit groups to coordinate invasive weed activities along the mid-Klamath River. These meetings have resulted in improved coverage, an effective early detection/rapid response approach to treatment of invasive species sites, and improved collaboration and communication between all partners. In addition to extensive work managing priority invasive weeds along the river corridor and in the mid-Klamath communities, MKWC is involved with inventory and management of invasive plants in the nearby wilderness areas. In partnership with the Six Rivers, Klamath, Rogue River-Siskiyou, Shasta-Trinity National Forests and supported by the National Forest Foundation, MKWC has contributed to the inventory of invasive plants in the Siskiyou, Red Buttes, Trinity Alps, Marble Mountain and Castle Crags Wilderness Areas. MKWC has recently been nationally recognized for its exceptional work as a partner with the Forest Service to manage invasive species threatening aquatic and terrestrial areas of national forests throughout the middle section of the Klamath River watershed.

Addressing lessons learned from the NRCS Rangeland CEAP: establishing peer-learning networks for effective, low-cost medusahead control within the ranching community. *Brownsey, Philip. Sierra Foothill Research and Extension Center. pbrownsey@ucanr.edu*

California includes 22 million acres of privately owned rangelands, much of which is predominately used for livestock production. Collaboration with livestock producers is critical for effective management of invasive plants in rangelands at the landscape scale. However, the NRCS Rangeland Conservation Effects Assessment Project found that over 80% of rangeland weed management efforts failed over the long-term for three central reasons including:
(1) lack of simple weed management decision-support systems that address site-specific environmental conditions
(2) lack of low-cost tools for weed management; and
(3) lack of peer-learning networks to promote development and dissemination of on-the-ground knowledge (2011). Over the past several years, efforts have been made to overcome these shortcomings with respect to managing medusahead (*Elymus caput-medusae L.*), an exotic annual grass, on rangelands in California. Medusahead in particular is known to cause serious ecological effects on invaded sites, and also has severe economic impacts on livestock producers who are dependent on these rangelands. Currently, medusahead infests extensive areas of California's annual grasslands and is rapidly expanding both in California and in the intermountain west. The goal of this project is to deploy a holistic education and technology transfer program for sustainable agriculture extension, education and training of agents in California and Oregon that addresses the central ecological, economic and sociological barriers limiting existing medusahead management programs. This program is based on research that identifies effective, low-cost medusahead management methods. In this talk we will briefly discuss the ways that the shortcomings identified in the NRCS CEAP have been addressed and then discuss our progress towards developing peer-learning networks to help disseminate practical knowledge on low-cost medusahead control that can be implemented on private lands to achieve landscape scale effects.

Restoring lower Redwood Creek - collaborative invasive plant management. *Baxter, Tanya. Golden National Recreation Area. tanya_baxter@nps.gov*

Four phases of realignment construction activites to the lower Redwood Creek led to significant changes to the wetland and riparian plant composition. To protect spawning coho salmon and steelhead trout all 30 of the selected target non-native plant species were removed manually, without the use of herbicide by Golden Gate National Parks Conservancy community volunteer program efforts and hired restoration contractors. Both pre-existing non-native populations, such as Cape-ivy (*Delairea odorata*) and panic veldt grass (*Ehrharta erecta*) were removed, as well as new populations continually recruited from upstream sites of early detection species.
Additionally, over 70,000 locally sourced native plant propagules were collected, grown within the watershed nursery and planted during the fall and winter months from 2010-2012. In 2014 the final year of annual vegetation community change monitoring, results are presented on targeted non-native plants that demonstrated absolute changes in frequency of more than 6.5% since 2009. Refinement of the monitoring based on the first five years results will provide guidance for plant species to manage and monitor, for the next 15 years (until 2029), eradication and control of a multitude of invasive species while continuing to face ongoing challenges in a unique landscape. The CHIRP program uses an adaptive three-pronged approach to address threats at different scales: remote backcountry treatment, intensive roadside-based treatment, and education/outreach focused on the urban-wildlife interface. Serving as a retrospective at this ten-year milestone, the talk will discuss the evolution of the program and share the accomplishments and adaptive management decisions required to run a world class invasive plant program.

Multi-benefit weed control: the San Joaquin River invasive species management and jobs creation project. *Meadows, Trever. River Partners. tmeadows@riverpartners.org*

In 2010, River Partners, the San Joaquin River Parkway and Conservation Trust, and The Nature Conservancy received funding from the Bureau of Reclamation to conduct broad-scale, multi-benefit invasive species monitoring and management in the San Joaquin Valley in support of the San Joaquin River Restoration Program. Initial project phases focused on planning, permits, and negotiations with landowners for site access. Mapping of invasive species began in 2011, and >5000 acres of the SJRRP Program Area have been mapped to date including the San Luis and Merced NWRs, Great Valley Grasslands State Park, Hatfield State Recreation Area, Riverbottom Park, Scout Island, Sycamore Island, Spano River West, Van Buren Unit and five private inholdings along the San Joaquin River. Focal invasives have included perennial pepperweed (*Lepidium latifolium*), giant reed (*Arundo donax*), red sesbania (*Sesbania punicea*), edible fig (*Ficus carica*), salt cedar (*Tamarix sp.*), Himalayan blackberry (*Rubus armeniacus*), yellow starthistle (*Centaurea solstitialis*), and tree tobacco (*Nicotiana glauca*). Treatments began in 2013 and will continue through 2014 and beyond. Site prioritization was required due to factors such as contract labor availability, site access, and optimal timing of treatments including biomass removal, herbicide application and retreatment as required. In partnership with university researchers, additional techniques (e.g., solarization) are also being evaluated. To date, over 500 acres of invasives have been treated, including >400 acres of *L. latifolium*, 120 acres of *S. punicea*, 12 acres of *A. donax*, and smaller extents of other species. In addition to funding permanent restoration staff and seasonal interns, the project has provided temporary positions for >50 California Conservation Corpsmembers, >150 Fresno Local Conservation Corpsmembers, and 60 agriculture labor crewmembers, all of whom have received job training related to riparian restoration and invasive species control. In addition, outreach activities have included presentations, publications, newspaper articles, and meetings with landowners and managers.

Session 11. WEEDS AS WATER WASTERS

Water use of native vs non-native trees in wild and urban ecosystems: moving from mythology to a trait-based ecohydrology. *Sack, Lawren. UC Los Angeles. lawrensack@gmail.com.*

Numerous recent studies have shown strong differences among species in water use at leaf and whole-plant scales. These differences can translate into major differences in landscape-scale water use and thus potentially contribute significantly to the water cycle and water budgets of catchments and municipalities. However, a lack of clear concepts and the logistical challenges of current methods have led until recently to a severe paucity of data or clear understanding of the drivers of these differences in water use, how much they can be assessed based on studies of individual or few plants and to what degree we can trust the commonly held beliefs, that alien plants use more water than natives or that drought tolerant plants use less water than drought sensitive plants. These issues and the need for clear understanding become more pressing as water becomes increasingly limited, and to further motivate (and evaluate) the conservation and restoration of native plants in urban and wild ecosystems. Recent work will be reviewed from collaborative projects from our group and others focused on the relative water use of different tree species, emphasizing what is known especially about native trees in natural and urban ecosystems in Los Angeles and Hawaii. Further, I will describe the approaches currently in development for estimating from traits not only leaf and tree-scale water use but also the services provided by trees to weigh against this cost, to provide information toward more sustainable management of species and water in a wide range of ecosystems.

Aquatic weeds: water waste or water wise? *Madsen, John. US Davis. jmadsen@ucdavis.edu*

Native aquatic plant communities provide useful ecosystem services, structure the aquatic habitat for fish and macroinvertebrates, produce food for waterfowl and other wildlife, and contribute to ecosystem functions and processes. An overabundance of aquatic plants, however, can have deleterious effects on water resources and the ability of society to utilize them. Most commonly, this is due to the unrestricted growth of invasive aquatic plant species. Abundant growth of some species, for instance, greatly increases loss of water through evapotranspiration relative to a standing pool. Dense growths of aquatic plants reduce the ability of ditches and channels to carry water through displacement, reduced flow rates, and increased hydraulic roughness. Dense plant growth will increase the probability, amplitude, and duration of flood events, resulting in water loss. When plant mats drift due to senescence or become unrooted, the mat may block water intakes, pump stations, and power generation turbines, resulting in reduced water transportation. While moderate growth of aquatic plants can contribute to conservation of water resources, the excessive growth caused by invasive plants may lead to water loss or waste. Fortunately, management of aquatic weed growths may restore the functionality of the water resource, reduce water losses, and restore a desirable native plant community.

Weeds and water: the interacting effects of phenology, competition, climate, geology, and soils on soil moisture, surface flows, and ground water recharge. *Gerlach, John. State Water Resources Control Board. John.Gerlach@waterboards.ca.gov*

All plants lose water as a byproduct of photosynthesis – when they open small pores in their leaves to let CO^2 in, water molecules gush uncontrollability out of the pores in a process that is called transpiration. The lost water is immediately replaced molecule by molecule with water that the plant literally pulls out of the soil. Over time and across large areas the process of transpiration moves enormous quantities of water from the soil to the atmosphere.

There are many plant characteristics that control the amount of water that is transpired. Short-lived annual species use less water than long-lived annual or perennial species. Some species use water extravagantly while others are water misers. Deeply rooted plants have access to a greater volume of soil and hence more water. Soil properties and geologic formations determine the volume of water that plant roots can access. Climate determines the timing and rates of both the precipitation that recharges soil moisture as well as losses due to transpiration. Together, all of these factors affect surface flows and ground water recharge through their effect on soil moisture.

I will use the context described above to show how the invasion of annual grassland and blue oak woodland by yellow starthistle imposes a permanent drought in the invaded areas – essentially stopping ground water recharge and sub-surface flows to streams. I'll also provide a rough estimate of the amount and value of the water lost annually from the Sacramento Valley.

POSTER ABSTRACTS

STUDENT POSTERS

Invasive weeds of the Voorhis Ecological Reserve. *Berbeo, Eileen. California State Polytechnic University. aeberbeo@csupomona.edu*

The Voorhis Ecological Reserve (VER) on the campus of California State Polytechnic University, Pomona (Cal Poly Pomona) is a portion of the San Jose Hills consisting of coastal sage scrub, coast live oak and walnut woodland, riparian habitat, as well as disturbed annual grassland. Use of the San Jose Hills for agriculture is recorded from as early as the 1700s to as late as the present day. Historically the portion of the San Jose Hills that encompasses the Voorhis Ecological Reserve was part of the San Gabriel Mission, then later part of Rancho La Puente, and the lands were used for growing grains and grazing cattle. When a portion of the lands became part of Cal Poly Pomona, the land was used for grazing until the 1970s. Grazing ended on the land when the VER was established in 1983; the VER is currently included as part of the Buzzard Peak Significant Ecological Area. Disturbance of the Reserve includes wildfires in 1981 and 1989, subsequent bulldozing, and development of nearby lower slopes of the San Jose Hills. Invasive species have been recorded in the hills from as early as the 1930s, with vouchered specimens housed in several herbaria including those at Cal Poly Pomona, Rancho Santa Ana Botanic Garden, Santa Barbara Botanic Garden, and the California Academy of Sciences. Based on herbarium records, there are more than 100 known invasive weedy species that have been vouchered from the VER, which is roughly 36% of the known species that occur in this area. Known invasive genera include A*vena, Brassica, Bromus, Carduus, Centaurea, Hirschfeldia, Hordeum, Nicotiana, Ricinus, Salsola,* and *Vinca.* Species of the disturbed areas of the Reserve continue to be catalogued for invasive cover using traditional species identification at the ground-level as well as GIS.

Precipitation and nitrogen manipulations alter post-fire recovery of coastal sage scrub. *Parker, Scot. UC Irvine. sparker@uci.edu*

Climate models project increased aridity and precipitation variability in southern California over the next century, which may accelerate invasion by exotic Eurasian grasses into coastal sage scrub ecosystems. Urban areas have expanded into regions historically populated by coastal sage scrub, increasing nearby nitrogen deposition. To test the effects of increased nitrogen, aridity, and precipitation variability on post-fire recovery of coastal sage in a region invaded by European grasses, we established a precipitation and nitrogen experiment in adjacent grassland and coastal sage scrub communities in Orange County, CA. The entire experimental site burned in the Santiago Wildfire in September, 2007. We began the treatments during the following rainy season. We analyzed the response of three shrub species (*Acmispon glaber, Artemisia californica,* and *Salvia mellifera*) to five years of these treatment effects. We tracked changes in community composition and individual shrub productivity for these species throughout the experiment using several techniques. We quantified treatment efficacy by routinely measuring surface and depth profiles of soil moisture. For all three species we found a dramatic reduction in biomass in the restricted precipitation treatments. *A.glaber* dominated plot primary production in 2010 and 2011 in the control and increased precipitation plots, and was more productive in the ambient nitrogen plots over the added nitrogen plots. *A. glaber* productivity diminished substantially after 2011 possibly due to drought and natural succession following fire. We did not observe a significant nitrogen treatment effect for *A. californica* or *S. mellifera.* Our results indicate that urbanization threatens to alter fire succession patterns by displacing nitrogen fixers such as *A. glaber*, and that prolonged drought threatens coastal sage scrub. Both factors individually favor invasive grasses, and in combination their future effect could be dramatic.

GENERAL POSTERS

Sunrise Powerlink Adaptive Weed Control Strategy: yellow star-thistle eradication at Eichenlaub Ranch. *Atik, Raquel. Recon Environmental. ratik@reconenvironmental.com*

San Diego Gas & Electric (SDG&E), in consultation with RECON Environmental (RECON) developed an Adaptive Weed Control Strategy (AWCS) for the Sunrise Powerlink Energy Project that takes a holistic watershed approach by focusing on enhancement of large, biologically significant parcels of land. The AWCS targets the limits of entire populations of weed species within large contiguous parcels. One of the target areas is Eichenlaub Ranch, a 195-acre parcel in eastern San Diego County.
At the time of initial weed mapping for the Project, Eichenlaub Ranch had the largest population of yellow star-thistle (*Centaurea solstitalis*) within San Diego County. However, as of the fall of 2014, yellow star-thistle, a Cal-IPC high ranked species, has been completely eradicated from this site.
This poster presents the steps that were taken to eradicate this species, including initial mapping of the species, the application of pre-emergent herbicide, and follow-up maintenance visits where spot-spraying of herbicide occurred. This poster also includes maps showing the yearly reduction in population size of the species.

Invasive aquatic weeds: implications for mosquito and vector management activities. *Blair, Charles. Mosquito and Vector Management District of Santa Barbara County. blairce@verizon.net*

Healthy natural wetlands ARE FAR LESS LIKELY to be breeding areas for disease-carrying mosquitoes than degraded ones. Degradation of these bodies of water by invasive aquatic weeds and other influences can result in their being potential habitat for mosquitoes that can carry the West Nile Virus, encephalitis, and other diseases. Control of these invasive plants can be an important part of the Integrated Weed/Pest Management efforts of both Weed Management Areas and Mosquito and Vector Control Agencies. This poster focuses on continuing problems with control of Water Evening-primrose, *Ludwigia spp*. Successes in on-going control of Smooth Cordgrass, *Spartina spp.*, *S. densiflora x foliosa*, in the San Francisco Estuary will be shown. Presentations on the importance of Smooth Cordgrass in San Francisco Bay have been made at recent statewide Cal-IPC and Mosquito and Vector Control Conferences. Demonstration of these relationships can enhance both agency and public awareness of their importance.

Small-scale grass control experiment in the Woolly-Star Preserve Area (WSPA), San Bernardino, CA
Brown, Lauren. Leidos, Inc. brownla@leidos.com

Non-native grasses are associated with reduced habitat suitability for federally-listed slender-horned spineflower (*Dodecahema leptoceras*), Santa Ana River woolly-star (*Eriastrum densifolium ssp. sanctorum*), and San Bernardino kangaroo rat (*Dipodomys merriami parvus*) in the Santa Ana River Woolly Star Preserve Area (WSPA), San Bernardino, California. Small-scale experiments were developed to identify the most effective herbicide and pre-application treatment for reducing non-native grasses, particularly dominant species such as cheat grass (*Bromus tectorum*) and rattail fescue (*Festuca myuros*), in mature Riversidean Alluvial Fan Sage Scrub (RAFSS) habitat within the preserve.
Replicate grids of small plots (2 square meters), which each included several treatments and a control, were established at six locations between 2009 and 2011. The herbicide treatments included use of post-emergent, non-selective RoundUp® and AquaMaster® (active ingredient Glyphosate), and grass-specific Envoy® (Clethodim), Fusilade® (Fluazifop_P-butyl), and Grass Getter® (Sethoxydim). Different pre-application approaches (early-season watering, and raking for thatch removal and soil scarification) also were tested. The effects of the treatments on non-native grass species and forbs were monitored before and for one to four years after treatment depending on the herbicide. As expected, the non-selective herbicides killed all plants, but forbs reestablished quicker after treatment with AquaMaster® than RoundUp®. The grass-specific herbicides were effective at not reducing forbs, but differed in their control of the dominant grasses. Envoy® was more effective at control of both cheat grass and rattail fescue than Grass Getter®. Fusilade® was effective at control of cheat grass but not rattail fescue. Removing thatch, soil scarification, and early season watering had only minor effects. It was noted that annual forb cover and diversity appeared to be greater when natural precipitation occurred earlier in the rainy season.

Prioritizing invasive plants on military bases.
Brusati, Elizabeth. Cal-IPC. edbrusati@cal-ipc.org

Cal-IPC is working with six military installations to make their invasive plant management more strategic and effective. The military manages a large amount of land and its natural resource management must support the military mission while maintaining habitat for sensitive species. This is a one-year pilot project, funded by the Department of Defense's Legacy Program, to develop a process that can be applied to additional installations in the future. The project includes analyzing invasive plant management on the bases as well as connecting the bases to regional partners for the purpose of developing projects on lands near the bases. The six installations cover all four branches of the military: Camp Pendleton (Marines), Fort Hunter Liggett (Army Reserve), Beale Air Force Base, Vandenberg Air Force Base, Fallbrook Naval Weapons Station, and Remote Training Site Warner Springs (Navy).
These installations vary widely in size, habitat, and current invasive plant management. Some have extensive programs already while others have limited programs and little connection to regional partners. Each base contains habitat for endangered or threatened species as well as rare plants. We reviewed their current invasive plant management plans, met with each base individually, and then convened a meeting with regional partners for each base. We used CalWeedMapper to examine invasive plants around each base and develop an initial list of eradication, surveillance, and control targets. We will also develop surveillance guides with photos to help early detection efforts on and around the bases. This poster will present results on the priority species identified for each base.

The Pepperwood Conservation Grazing Pilot Project: managing for complexity in our coastal California grasslands. *Gillogly, Michael. Pepperwood Preserve. mgillogly@pepperwoodpreserve.org*

The fact that Coastal California's grasslands are composed of a diverse mosaic of annual and perennial grass species presents a range of management

challenges. At Pepperwood Preserve (Sonoma County, CA) we have historically used open range grazing practices to manage invasive non-native grass species such as Harding grass (*Phalaris aquatica*) and Medusa head (*Elymus caput-medusae*) across 900 acres of grasslands. Starting in 2013, we initiated a Conservation Grazing Pilot Project to test the value of high-intensity short-duration rotational grazing to support our management objectives of improving soil health and favoring native plant species.

An advantage of the "conservation grazing" approach is that it can be modified to accommodate the diversity of our complex landscape. We utilize mobile electric fencing and watering systems to concentrate grazers at a high density, ranging from 10,000 to 300,000 lbs/acre, and the herd is typically moved every 12 to 96 hours. Rotational grazing allows for longer rangeland rest periods, reduces impacts from occurring during the same phenological phase or season every year, and introduces flexibility for targeting non-native vegetation during optimum treatment windows.

Through our adaptive management and grassland monitoring program we are documenting how our grasslands are responding to our best management practices on an annual basis. This practice allows us to review and modify our management methods so that we may attain our objectives of:

(1) preventing the spread of Harding grass, Medusa head, and other established non-native invasive grass species;

(2) preventing the conversion of grassland to shrubland or forest communities; and

(3) increasing native species diversity and abundance relative to exotic species.

Ultimately, we seek to contribute to the creation of healthy, vibrant working landscapes in California by demonstrating an economically feasible alternative to open range grazing that can target problematic areas of invasion and address issues of timing.

Collaborative Weed Control along the Truckee River. *Halderman, Jeannette. Truckee River Watershed Council Weed Warriors. jhalderman@truckeeriverwc.org*

During the summer 2014, the Truckee River Watershed Council Weed Warriors worked collaboratively with Nevada County, California Department of Fish and Game, US Forest Service, private and public landowners, to treat non-native invasive plant species (NNIPs), along a section of the Middle Truckee River. Approximately 30,000 NNIPs individuals were treated as part of this effort. Through coordination and combined funding and staff, we treated several NNIPs on approximately 260 acres. NNIPs within the 260 acres were treated during two to three passes between June and July 2014. NNIPs treated include State Listed A & B species musk thistle, perennial pepperweed, hoary cress, spotted knapweed, Russian knapweed; State Listed C rated species bull thistle, Klamath weed; and locally targeted invasive species including teasel and white sweet clover. Mechanical and chemical treatments were used depending on known effectiveness by species. As a result of the collaborative effort, we were able to treat all the floodplain on both sides of the Middle Truckee River corridor from Highway 267 bipass to Hirschdale (approximately 6 miles), and three select areas within the watershed feeding into the Truckee River via the Little Truckee River, one area East of Hirschdale, and another area near Martis Creek. We believe this collaborative effort has enabled us to make a substantial impact on the numbers of NNIPs and seed dispersal in this area of the Middle Truckee River. Funds have been secured to continue this effort in 2015.

Cabbage tree (Cordyline australis) distribution, management and control in California State Parks *Heintzelman, Chris. California Department of Parks and Recreation, Russian River District. chris.heintzelman@parks.ca.gov*

Cabbage tree (Cordyline australis) has begun to invade the understory of the bishop pine forest and riparian zones found within Salt Point State Park, Sonoma County, CA. It appears to be radiating out from historical plantings although much of its distribution appears to be random (i.e. isolated drainages). This distribution has led State Parks staff to conclude that birds are, at least in part, responsible for the spread of this plant. Since this plant has a limited distribution on our lands at the moment, Parks staff have prioritized its removal. Removal began in 2013 and to date three chemical treatments have been tried with varying degrees of success. Foliar application has been used on small plants (< 2 feet tall) while cut stump and the EZ-Ject lance has been used on mature plants. Foliar spraying was met with modest success as the leaves shed moisture very effectively. Cut stump treatments were effective on the base of the plant but the stalks were able to re-sprout vigorously. One stalk which was approximately 8 feet long re-sprouted into 6 individuals. Treatment with the EZ-Ject lance appears to be most effective. It delivers a precise dose of herbicide into the trunk of the plant, and no re-sprouting has occurred. Treatment with the EZ-Ject lance began in December 2013 and will continue into the fall to help determine the most effective timing of this treatment. We are interested in more information on the distribution of this plant in natural areas throughout California since it is widely available in the horticultural trade.

Inferring the complex origins of horticultural invasives: French broom in California. *Kleist, Annabelle. UC Davis. ackleist@ucdavis.edu*

Investigating the origins of invasive populations provides insight into the evolutionary and anthropogenic factors underlying invasions, and can also provide important information for management decisions. Invasive species introduced for horticultural purposes often have complex origins typified by multiple introductions of species, cultivars, and genotypes, and interspecific and intraspecific hybridizations in introduced ranges. We inferred the origins of the invasive French broom complex in California by characterizing the genetic diversity and population structure of invasive and horticultural brooms and of *Genista monspessulana* from its native Mediterranean range using 12 nuclear microsatellite markers. Overall, no significant differences in allelic richness, inbreeding, or genetic structure were observed between the invaded and native ranges, but there were differences between populations within ranges. Bayesian analyses revealed three genetic clusters in the French broom complex. Nearly all native *G. monspessulana* assigned highly to a single cluster. Some invasives assigned to a group containing *G. canariensis*, *G. stenopetala*, an ornamental sweet broom, and the remaining invasives assigned to a group containing *G. monspessulana* from Sardinia and Corsica. Admixture between the two groups containing invasives was detected. An Approximate Bayesian Computation analysis supported the hypothesis that some invasive French broom is derived from an unsampled population branching from ornamental sweet broom. A combination of factors, including multiple introductions, escapes from cultivation, and inter-taxon hybridizations, likely contribute to the invasive success of French broom in California and have important implications for management, particularly biological control.

Eradication strategy of russian wheatgrass (*Elymus farctus)* populations found in the Guadalupe-Nipomo Dunes, San Luis Obispo County. *La Grille, Nancy. California State Parks and Recreation. nlagrille@parks.ca.gov*

California State Park and Recreation (CDPR) first documented the presence of Russian wheatgrass (*Elymus farctus*) in the Guadalupe-Nipomo Dunes in 2003. In 2010 an eradication strategy was initiated based on the formulated success of treating European beachgrass (*Ammophila arenaria*). The spray formula is an herbicide mixture of glyphosate (2%) and imazpry (1%). Several treatments are required to be fully successful. Maps on the poser show the extent of the infestation and the extent of treatment efforts to date.

New tools for biological control of arundo and water hyacinth in the Sacramento Delta and elsewhere in Northern California. *Moran, Patrick. USDA-Agricultural Research Service. Patrick.Moran@ars.usda.gov*

Terrestrial riparian arundo (*Arundo donax*) and floating aquatic water hyacinth (*Eichhornia crassipes*) are widespread invasive weeds in the Sacramento-San Joaquin Delta and associated river systems. Both of these weeds consume water, obstruct access to water, alter water quality, and displace native species. Three biological control agents are being released in northern California to develop biological control strategies for these two weeds. The arundo wasp *Tetramesa romana* and the arundo armored scale *Rhizaspidiotus donacis* were released by ARS in 2013-2014 in Glenn County in the Sacramento River watershed, and early evidence suggests that both insects are established. The water hyacinth planthopper *Megamelus scutellaris* was released by CDFA and ARS in 2011-2013 at two sites in the Delta and one site in the American River watershed, and is established at the latter site. A new integrated management program for arundo, water hyacinth, and other weeds in the Delta is being coordinated by the USDA-ARS with university, state agency, and county cooperators. This program includes a focus on the interaction of weed biocontrol with herbicides,

mosquito vector control, and other pest and natural resource management projects in the Delta.

Setting and implementing regional strategies for landscape-scale invasive plant management.
Morawitz, Dana. Cal-IPC. dfmorawitz@cal-ipc.org

Detecting and responding to invasive plant populations before they spread is the most effective way of limiting their impact, but prioritizing invasive plant populations at the landscape scale is challenging. Working with public and private land managers, Cal-IPC developed a transparent process to set regional priorities for invasive plant management. Our approach uses spatial distribution data from CalWeedMapper (calweedmapper.cal-ipc.org). The process is being used by seven multi-county regions in California (comprising 30 of the state's 58 counties) to set priorities. To date, two regions have secured funding for on-the-ground management projects based on their prioritization, and others are developing funding proposals.
Seven multi-county regions have selected priority species for eradication and surveillance. Of these regions, five have completed eradication work plans with budgets, and four have completed training materials to aid plant identification and reporting.
Two regions have secured funding to implement on-the-ground projects based on their work plans, and two other regions are currently developing funding proposals. More than 40 organizations are significantly involved in collaborative regional planning through this process.
The two-county Northwest California region, comprising two counties that span from the Cascade mountains to the Pacific Ocean, is one of those currently developing a proposal. This project will focus on region-wide eradication of knotweed (*Fallopia spp*.), oblong spurge (*Euphorbia oblongata*), rush skeletonweed (*Chondrilla juncea*) and a new detection from Oregon, shiny geranium (*Geranium lucidum*). The 5-year project budget will be in the $1M range, a scale that is only possible because this mapping and prioritization approach provides funding agencies (such as California's Wildlife Conservation Board) with a strong transparent rationale for eradicating these populations before they spread and have much greater ecological impact.

Attempts at medusahead eradication
Niederer, Christal. Creekside Center for Earth Observation. christal@creeksidescience.com

In 2007, a 5.5-acre population of medusahead (E*lymus caput-medusae*) was targeted for eradication at Edgewood Natural Preserve in Redwood City, CA. Eradication was selected as a goal due to the presence of sensitive species within the preserve grasslands, the relatively small infestation, and the lack of an obvious adjacent seed source. Initial monitoring showed live medusahead cover at 22.3% (±2.1 SE), and medusahead thatch cover at another 16.9% (±1.7 SE). Experiments testing tarping, flaming, and mowing with and without thatch removal identified a single mow without thatch removal as an effective and pragmatic means of reducing cover. After two years of mowing with hand followup, medusahead was down to 1.5% cover. The monitoring protocol switched to line intercept frequency in order to detect further decreases. Initial frequency ranged from 3 to 47 hits. After another four years of mowing, no medusahead was found on or even near the monitoring transects. Approximately 12 plants have been found throughout the preserve this year. This success is likely based on well-timed mowing, which includes frequent and widespread checks of seed maturation. I will discuss how to check seed development and identify the soft dough stage in the field. The next steps toward eradication bring up additional issues. With density of this cryptic plant so low, the costs of aiming for eradication may seem high. Is it worth spending the money to find the last few plants, and is eradication even possible?

Catalpa speciosa control using herbicide application methods
Oats, Meghan. California State Parks. msoats@gmail.com

There are two species of non-native catalpa trees found in California, *Catalpa speciosa* and *Catalpa bignonioides*. These trees are generally used as large ornamental shade trees that are planted in urban areas as a street and lawn tree. Both species have been observed in Sacramento/San Joaquin Valley riparian corridors.
We found *Catalpa speciosa* in our treatment areas, which were along Big Chico Creek in lower Bidwell Park in Chico and along the mouth of Big Chico Creek at the Sacramento River. There is a noticed increase over the past several years of Catalpa trees along the waterways in Chico, which will ultimately lead to a change in composition of riparian areas. Four herbicides were tested using two stem application techniques for control of both single trunks and shoots of Catalpa trees. Aquatic glyphosate and aquatic imazapyr were applied using a stem injection application. Imazapyr and triclopyr were applied as a basal bark application. Treatments were compared against untreated controls. The untreated trees had no reduced canopy. Stem injection of aquatic glyphosate (50% in water, applied at a rate of 1 ml/3 inch circumference) resulted in more than 90% reduction in vigor of canopy, as well as resprouts. Furthermore, stem injection of aquatic imazapyr (66% in water, applied at a rate of 1 ml/3 inch circumference) resulted in over 95% canopy reduction and resprouts. Basal bark applications provided slightly less control as shown by the application of triclopyr (25% in oil), which resulted in 88% reduction in canopy and resprouts. Similarly, the basal bark application of imazapyr (9% in oil) resulted in an 84% reduction in canopy and resprouts. Overall, these results provide a few effective options in treating and controlling the further spread of catalpa trees along riparian corridors.

The effects of invasive forbs and abundance on fine fuel loads in a degraded coastal sage scrub habitat.
Paolini, James. California State Polytechnic University. jjpaolini@csupomona.edu

Exotic forbs and grasses can reduce the fitness of native plant species via resource competition, allelopathy, and the ability to take advantage of high disturbance rates. Their life histories may also cause alterations in the fire regime that native species have adapted to over evolutionary time. This is extremely evident in southern California, where coastal sage scrub has become fragmented and degraded due to human factors and the influx of exotic species. Because type conversion of native plant communities is so prolific, our study sought to investigate the impact on fine fuels that invasive forbs have in a degraded coastal sage scrub (CSS) plant community located in the San Jose Hills on the campus of California State Polytechnic University, Pomona, in the Voorhis Ecological Reserve (VER). We were also interested in how species abundance in the community influenced fine fuels. In order to estimate the fine fuel load contribution per individual, two methods were used. For perennial shrubs, fallen litter was measured under the shrub canopy in a 100 cm^2 quadrat. For the invasive forbs *Centaurea melitensis* and *Hirschfeldia incana*, whole dead individuals were collected, dried and weighed. To estimate the total abundance of these species, 72 quadrats were sampled throughout the landscape and percent cover was measured. There was a significant correlation between abundance and fuel. However, two of the seven species did not conform to the linear relationship. *Salvia mellifera* and *C. melitensis* contributed significantly more fuel than would be expected based on their abundance, while H. incana did not. Despite their similarities in life history strategy and functional traits, this data suggests that *C. melitensis* may influence fuel loads to a greater degree. This information should be important for restoration efforts with limited time and resources.

Effects of native establishment in late summer.
Paternoster, Joseph. DriWater. joe@driwater.com

When is the best time to plant for optimum survival rates and minimal water use? Can time-release water gel (TRWG) provide enough moisture to establish plants, reduce costs and lower maintenance over hand watering? Is there substantial difference in the growth of a plant (both root mass and upper body growth) when established using time-release water gel with the micronutrient zinc and glacial acetic acid (IAA), over hand watered plants. When plants feed, or photosynthesize, they grow and increase their carbohydrate storage (energy). Plants given adequate time and moisture to grow and develop roots prior to the dormant season are assumed to have more capacity to increase carbohydrate storage. Having "food" available when spring comes, the plants have a head start. They are better able to uptake spring moisture and nutrients making plants stronger for the coming season. With today's unstable climates spring may be the only time plants have to develop and strengthen before summer drought. The extra push plants received from carbohydrate reserves better prepare them to handle dryer climatic conditions. Findings showed late summer planting allows sufficient photosynthesis resulting in ample carbohydrate storage for spring plant growth. The addition of zinc and IAA contributes to the production of essential growth over potable water with no nutrients.

Using TRWG-Z significantly lowers water use while efficiently establishing plants. The study shows August plants with a 139% average increase in root mass, and a 68% increase in upper plant growth for plants established with TRWG-Z over hand-watered plants.

Calflora's Weed Manager system. *Powell, Cynthia. Calflora. cpowell@calflora.org*

Weed Manager (WM) is a new system designed by Calflora and partners to track changes in invasive plant populations. WM is based on current Calflora weed tracking applications and the desktop Geoweed system and is sometimes referred to as "Geoweed in the Cloud." Used by organizations engaged in land management, WM tracks invasive plant infestations changes over time and the treatments applied to those infestations.
Weed Manager is intended to be used by various organizations engaged in land management. The primary purpose of the system is to track weed infestations over time, how they change (percent cover, polygon size, phenology, etc.) and the treatments applied to those infestations. Each subscribing organization or agency may choose which fields and reporting mechanisms are relevant and implement those. Each agency will use a private copy of the system, but will have the option of sharing their data with other subscribing organizations within the system, other Calflora users, and with other systems such as CalWeedMapper.
Each organization which subscribes to Weed Manager can configure certain aspects of how they want to use the system -- for instance, by choosing which fields are required, or which extra fields they want to collect for an assessment. The core data fields and the core methodologies remain standard across all organization subscribers however, thus enabling data exchange and integration. WM development will be complete March 2015, but users may request early access now.

Taro root (*Colocasia esculenta*) reported naturalizing in California *Robison, Ramona. California Department of Parks and Recreation. Ramona.robison@parks.ca.gov*

In late 2013 resource managers at Delta Meadows State Park, located near Walnut Grove, CA, reported a large-leaved plant growing along the slough banks in several locations. Plants were collected in 2014 and confirmed by CDFA botanists to be taro root (*Colocasia esculenta*). This plant had not been previously collected in the wild in California, however it is a specialty crop and is grown in the Central Valley. For example, in Fresno County in 2000 there were 20 acres in production on 3 farms. A weed alert was prepared and sent out to determine if the species is more widespread in the San Joaquin Delta or elsewhere in California. The final poster will include a map of reported locations of naturalized populations as well as locations of farms, and some of the uses of the plant.

Impact of field border management on rodents in walnut orchards
Sellers, Laurel. UC Davis. Laurel.Sellers@gmail.com

Growers in California's Sacramento Valley rate rodents as a major concern related to hedgerow field plantings according to a recent survey by R. Long. Our one-year study documented vertebrate population dynamics in relation to field border and orchard floor vegetation management in walnuts, a high value crop grown on 245,000 acres in California that is valued at $1.3 billion annually. To better understand their abundance and distribution, deer mice (*Peromyscus maniculatis*), house mice (*Mus musculus*), California voles (*Microtus californicus*),and western harvest mice (*Reithrodontomys megalotis*) were live trapped in 4 sites at 0, 10, 75, 175-meter transects away from conventionally managed field edges (mowed or sprayed for weeds) and hedgerows of California native shrubs and perennial grasses. Remote-triggered cameras documented the association of rabbits, predators, and other animals of interest to management practice. Transects to survey pocket gophers (*Thomomys bottae*) were also located at each distance with active mounds serving as an indicator of seasonal population fluctuation. Unique rodent capture data from live traps showed two peaks in activity: 1) in the middle of the orchard regardless of field border type, and 2) in the middle of the hedgerow across all seasons with winter being the most active overall. Few captures were recorded in the conventional field border, likely because they were often devoid of vegetative structure. California voles were found in hedgerows and rarely in adjacent crops. Pocket gopher were concentrated towards both edge types, although very few were recorded inside the hedgerow.

A test of the application of grass-specific herbicides for the enhancement of native forbs in serpentine grassland. *Thomas, Don. San Francisco Public Utilities Commission. dethomas@sfwater.org*

The invasion of non-native annual grasses has transformed California's grasslands, previously dominated by perennial bunchgrasses and annual forbs. These invasive grasses have replaced most of the native annual wildflowers and, to a lesser extent, the perennial bunchgrasses. California's serpentine grasslands, formerly thought to be relatively resistant to invasion by exotic invasive plants, are now also increasingly being invaded by non-native annual grasses, such as Italian ryegrass. Selective grass-specific herbicides have been suggested as a tool for the management of these invasive grasses.
This study is a test of the efficacy of three grass-specific herbicides (sethoxydim, fluazifop and clethodim) in enhancing the abundance of native annual forbs in serpentine grassland on the San Francisco Peninsula. A preliminary test performed in 2013 indicated that the application of fluazifop and clethodim may increase forb frequency, while sethoxydim may have had phytotoxic effects. A follow-up test conducted in 2014 failed to show this effect, but this result may have been due to the failure of early winter rains, which caused sparse germination of annual grasses and reduced competition with forbs. Grass-specific herbicides appear to show promise as a tool for enhancing and restoring the native forb plant community.

Getting swept away by broom: 2013 re-mapping on Mt. Tam reveals faster-than-predicted spread
Williams, Andrea. Marin Municipal Water District. awilliams@marinwater.org

Weed maps are out of date before they are finished. At Marin Municipal Water District (MMWD), the first Geographic Information Systems (GIS)-based mapping effort for broom species (primarily French broom, but also Scotch and Spanish broom) began in the mid-1990's, with a more concerted effort made from 2003-2006 to make a single comprehensive coverage of broom populations on watershed lands. The result was a map and file representing 917 acres of broom with notes on control. With the start of the process to update the 1995 Vegetation Management Plan, the 2006 information was revisited in 2009 and new populations and information on percent cover were added. The 2012 Wildfire Protection and Habitat Improvement Plan shows this updated layer and its 1,138 acres of mapped broom. The information contained in the plan may have changed, as managed broom decreases and unmanaged broom spreads. A professional mapping team was hired for just over a month in 2013 to finish mapping begun by interns in 2011. Using GPS cameras to record populations and search areas, they recorded 1,414 acres of broom. Under the predicted-spread model of three feet per year, we expected 30 additional acres per year of broom; the mapped rate is nearly 70 acres per year, even though MMWD, its volunteers and contractors spend between 3,000 and 5,000 person-hours per year pulling broom.

A phenological detectability index for invasive plants of Golden Gate National Recreation Area.
Wrubel, Eric. National Park Service. eric_wrubel@nps.gov

We present a phenological detectability index for plant taxa monitored by the SFAN I&M Invasive Species Early Detection Program (ISED). The ISED program conducts protocol surveys to map newly introduced invasive species in network parks. For each species encountered during surveys, detectability was ranked on a scale of 1 – 4, and phenophase was characterized for the majority of individuals observed. Occurrence data was used to rank detectability by month for each species, normalizing by the highest and lowest detectability scores that each species received over a six-year period. Most species had the highest detectability at peak flowering, as is typically assumed. However, some species and life forms were more detectable in fruit, or were equally detectable in senescence. The phenological detectability index will inform the training of field staff, and the timing of early detection surveys. This index can also be used to determine optimal timeframes for control efforts, when species are both detectable and at an appropriate phenological stage for treatment.

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