Welcome to the 2018 Cal-IPC Symposium!

General Information

Sponsors: Sponsors help offset the cost of the Symposium while providing information and services to Cal-IPC members. Visit them at breaks and during the poster/sponsor session, and see their profiles and contact information in this program.

Meals: Breakfast and lunch is available both Thursday and Friday through the "cash and carry" outlet set up downstairs. (They do take credit cards, not just cash.) Registrants have two coupons worth $5 (blue) and two coupons worth $10 (red) to help offset your expense. The banquet dinner Thursday evening is provided as part of registration (put the yellow card from your name tag at your place setting if you specified a vegetarian or vegan meal). On Saturday box lunches are provided for the full-day field trips.

Photo Contest: Vote for your favorite by Friday lunch! The winner will be announced Friday afternoon.

Sales Table: Check out books, digital resources, boot brushes and Cal-IPC gear!

Membership Table: Come learn about Cal-IPC's work and community and how you can join.

Social Media: Share your experience! @cal_ipc and #CALIPC2018

Raffle and Auction: Join us for a social hour after sessions end after the poster session on Thursday and check out all the donated items for our annual raffle and silent auction fundraiser. Tickets are available at the Sales table during the day and at the social hour itself. Raffle prizes will be distributed after the awards banquet Thursday evening.

Awards Banquet: Join us Thursday evening to honor some of our community's heroes!

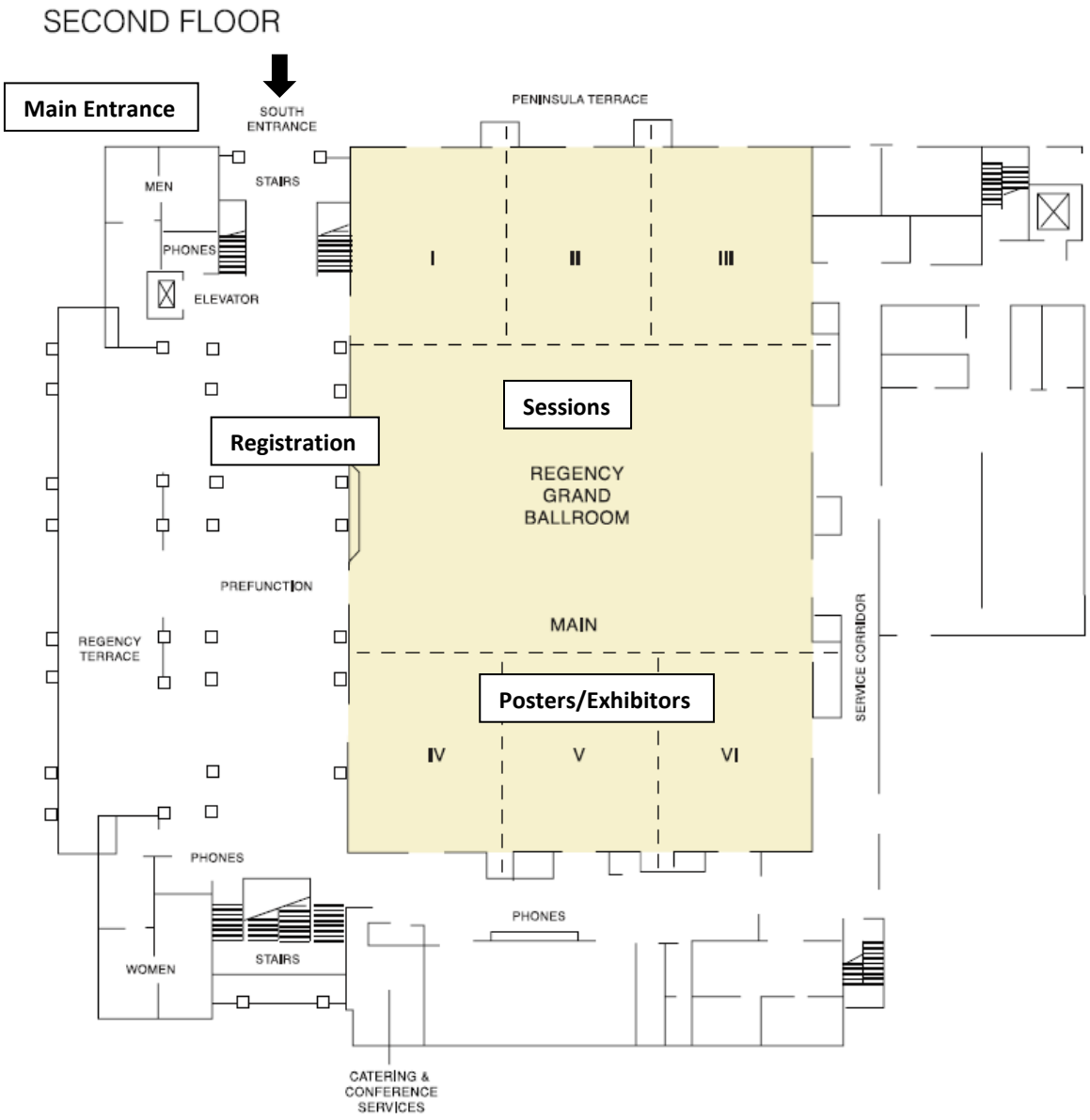
Early Career Networking Lunch: The Cal-IPC Student Section hosts lunch Friday. If you did not register but would like to participate, purchase lunch separately before joining the group.

Field Trips: Meet at the podium after Friday's final session to plan for Saturday morning departure.

Presentation Archive: PowerPoint slides and posters will be posted on the Cal-IPC website.

DPR CEUs: For licensed herbicide applicators, CEUs are available for each day of the Symposium (see below). Check in and out at the DPR table in the foyer to sign attendance sheets and to pick up and return Scantron forms. Please take a Verification of Attendance form for your records each day.

Wednesday (Nov. 7)		
Training 1: Invasive Plant Mgmt 101	M-0995-18	3.0 Other
Training 2: Calflora's Weed Manager	M-0994-18	2.5 Other
Training 3: Best Practices for *Phytophthora*	M-0993-18	2.0 Other
Session: DPR Laws and Regulations	M-1164-18	2.0 Laws
Thursday (Nov. 8) sessions	M-0991-18	4.0 Other
Friday (Nov. 9) session	M-0992-18	4.5 Other
Saturday (Nov. 10)		
Field Trip 1: Fort Ord	M-0990-18	6.0 Other
Field Trip 2: Elkhorn Slough	M-0989-18	6.5 Other
Field Trip 3: Mitteldorf	M-1005-18	2.0 Other


SECOND FLOOR
Main Entrance
SOUTH ENTRANCE
PENINSULA TERRACE
MEN
STAIRS
PHONES
ELEVATOR
I
II
III
Sessions
Registration
REGENCY GRAND BALLROOM
PREFUNCTION
MAIN
REGENCY TERRACE
SERVICE CORRIDOR
Posters/Exhibitors
IV
V
VI
PHONES
PHONES
WOMEN
STAIRS
CATERING & CONFERENCE SERVICES

FIRST FLOOR


WOMEN
STAIRS
BUSINESS CENTER
I
SPYGLASS
II
MARK THOMAS BOARDROOM
I
OAK TREE
II
III
OAK TREE TERRACE
Patio
B'fast/ Lunch
BIG SUR
I
II
III
IV
II
PRESIDO BOARDROOM
Trainings & Discussion Groups
FOYER
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STAIRS
II
CYPRESS
I
II
III
MEN
WINDJAMMER
I
NORTH ENTRANCE
CYPRESS TERRACE

Thank You to our Sponsors!

ACS Habitat Management
Oceanside, CA
www.agrichemical.com
Contact: Tracy Omori at 760-757-1840 or
tracyo@agrichemical.com

ACS Habitat Management is a wildland non-native invasive species control and habitat restoration and enhancement company. We specialize in large-scale invasive weed control and habitat restoration projects. Working with highly qualified staff, versatile labor force and state of the art equipment, ACS Habitat Management provides a full range of professional land management services.

American Conservation Experience
Santa Cruz, CA
www.usaconservation.org
Contact: Julia Parish at 831-427-1091 or
jparish@usaconservation.org

American Conservation Experience (ACE) is a non-profit organization dedicated to providing rewarding environmental service opportunities that harness the idealism and energy of a volunteer labor force to help restore America's public lands. ACE is grounded in the philosophy that cooperative labor on meaningful conservation projects fosters cross-cultural understanding and operates on the belief that challenging volunteer service unites people of all backgrounds in common cause.

Blankinship and Associates
Davis, CA
www.h2osci.com
Contact: Mike Blankinship at 530-757-0941 or
mike@h2osci.com

Our firm specializes in assisting our clients in the assessment, protection and enhancement of natural resources while integrating client goals with regulatory agency requirements. Our expertise lies in understanding and solving problems related to chemicals in the environment.

Bureau of Land Management
Sacramento, CA
www.blm.gov/ca/st/en.html
Contact: Jack Hamby at 916-978-4633 or
jhamby@blm.gov

The Bureau of Land Management (BLM) is an agency within the U.S. Department of the Interior and currently manages approximately 261 million acres across the western United States. Management and control of plants on public lands is done for resource and habitat enhancement.

Burleson Consulting, Inc.
Carmel Valley, CA
www.burlesonconsulting.com
Contact: Thor Anderson at 831-901-9394 or
ta@burlesonconsulting.com

At Burleson we pride ourselves on being your Environmental Puzzle Master. Our multidisciplinary team of engineers, geologists, biologists, environmental scientists, archaeologists, and GIS specialists efficiently solve environmental challenges. Burleson will put the pieces together to meet your goals on every project.

Calflora
Berkeley, CA
www.calflora.org
Contact Cynthia Powell at cpowell@calflora.org

The Calflora website is where you can learn about plants that grow wild in California (both native and non-native). Our suite of Weed Manager applications is designed to support the work of land managers controlling invasive plants. Information on the Calflora website comes from many sources: public agencies, non-profits, scientists, private donors, and you!

California Association of Local Conservation Corps
http://calocalcorps.org
Contact: calocalcorps@gmail.com

CALCC supports collaboration between California's Local Conservation Corps and provides a forum for advancing the Corps movement in California and nationally. The 13 certified Local Conservation Corps that are members of CALCC share a common mission to develop young adults, primarily ages 18-25, through conservation, education and community service.

California Association of Resource Conservation Districts
Sacramento, CA
www.carcd.org
Contact: Karen Buhr at 916-457-7904 or karen-buhr@carcd.org

CARCD represents the state's 99 RCDs, leaders in on-the-ground conservation efforts in their communities. RCDs accomplish thousands of practical, hands-on conservation projects every year while bringing millions of dollars to local communities through grants and private contributions. RCD conservation projects often involve agriculture and private land, but we accomplish much more, from watershed restoration to fire protection, hedgerows to fish passage.

California Conservation Corps
Sacramento, CA
www.ccc.ca.gov
Contact: Melanie Wallace at 916-341-3153 or Melanie.wallace@ccc.ca.gov

The California Conservation Corps (CCC) provides young women and men the opportunity to work hard responding to fires, floods and other disasters, restoring California's environment, and installing clean energy and energy conservation measures at public facilities throughout the state. Through their service, the members of the CCC gain life, work, and academic skills to become strong workers and citizens.

California Department of Food and Agriculture
Sacramento, CA
www.cdfa.ca.gov
Contact: David Kratville at 916-654-0768 or david.kratville@cdfa.ca.gov

CDFA is the lead state department in noxious weed management, tasked with preventing the introduction and spread of noxious weeds. It does this through border enforcement, nursery inspections, weed risk analysis, permit restrictions, public and agency outreach, and (as funds become available) funding of local weed management programs.

California Department of Water Resources
Sacramento, CA
www.water.ca.gov/
Contact: Gina Darin at 916-376-9825 or gina.darin@water.ca.gov

The Department of Water Resources (DWR) is responsible for managing and protecting California's water resources. DWR works with other agencies to benefit the State's people and to protect, restore and enhance the natural and human environments.

California Native Grasslands Association
Davis, CA
www.cnga.org
Contact: Diana Jeffery at 530-902-6009 or admin@cnga.org

Founded in 1991, CNGA promotes, preserves, and restores the diversity of California's native grasses and grassland ecosystems through education, advocacy, research, and stewardship.

California Native Plant Society Chapters
(Dorothy King Young, El Dorado, Los Angeles/Santa Monica Mountains, Marin, Monterey, Mt. Lassen, Napa, Orange County, Riverside-San Bernardino, Sacramento Valley, San Diego, San Gabriel Mountains, Santa Cruz, South Coast and Yerba Buena chapters)
Sacramento, CA
www.cnps.org
Contact: Dan Gluesenkamp at 916-447-2677 or cnps@cnps.org

CNPS is a statewide non-profit organization of nearly 10,000 professional and amateur members that works to protect California's native plant heritage. Working through our 33 local chapters and statewide programs, CNPS seeks to increase understanding of California's native flora and to preserve this rich resource for future generations.

California Society for Ecological Restoration (SERCAL)
Tucson, AZ
www.sercal.org
Contact: Julie St. John at 520-791-9514 or julie.sercal@gmail.com

SERCAL is a non-profit, membership-based organization dedicated to bringing about the recovery of damaged California ecosystems.

California Wildlife Conservation Board
Sacramento, CA
wcb.ca.gov
Contact: Don Crocker at 916-651-7866 or don.crocker@wildlife.ca.gov

The Wildlife Conservation Board protects, restores and enhances California's spectacular natural resources for wildlife and for the public's use and enjoyment in partnership with conservation groups, government agencies and the people of California.

California Wildlife Foundation/California Oaks
Oakland, CA
www.californiawildlifefoundation.org
Contact: Angela Moskow at 510-763-0282 or angelalmoskow@gmail.com

The Bureau of Land Management (BLM) is an agency within the U.S. Department of the Interior and currently manages approximately 261 million acres across the western United States. Management and control of plants on public lands is done for resource and habitat enhancement.

Channel Islands Restoration
Santa Barbara, CA
cirweb.org
Contact: Tanner Yould at 805-448-6203 or tanner@cirweb.org

Channel Islands Restoration is a 501(c)(3) non-profit organization specializing in invasive plant removal, native plant propagation and installation, erosion control, botanical surveys and environmental education throughout the Central Coast and the Channel Islands. We have worked on 91 restoration projects throughout the region for the U.S. Navy, National Park Service, and for many private groups, companies and local government agencies.

Dendra, Inc.
Encinitas, CA
Contact: Jason Giessow at 760-943-6924 or jgiessow@cox.net

We assist a wide range of groups (RCDs, Counties, NGOs, and other consultants) to plan and implement invasive plant control projects. Specializations include: grant writing, permitting, mapping, and program development.

Ecological Concerns, Inc.
Santa Cruz, CA
www.ecologicalconcerns.com
Contact: Joshua Fodor at 831-459-0656 or jtfodor@ecologicalconcerns.com

Ecological Concerns, Inc. (ECI) is a full-service habitat restoration and vegetation management firm. ECI designs and implements invasive plant management, revegetation and erosion control plans for public and private clients throughout the Monterey Bay and San Francisco Bay areas.

Elkhorn Slough Foundation
Moss Landing, CA
www.elkhornslough.org
Contact: Dash Dunkell at 831-320-9212 or dash@elkhornslough.org

The mission of the Elkhorn Slough Foundation is to conserve and restore Elkhorn Slough and its watershed. We see Elkhorn Slough and its watershed protected forever as a working landscape where people, farming, industry and nature thrive together. As one of California's las great coastal wetlands, Elkhorm Slough will remain a wellspring of life for generations to come.

Forester's Co-op/FCO Foresters
Grass Valley, CA
www.forco-op.com
Contact: Tom Amesbury at 530-273-8326 or tom@forco-op.com

Forester's Co-op provides a wide range of environmental consulting services to small private timberland owners, public agencies and utilities, and other diverse clientele throughout the State of California.

Garcia and Associates
San Anselmo, CA
www.garciaandassociates.com
Contact: Eliza Shepard at 415-458-5803 or eshepard@garciaandassociates.com

Garcia and Associates is an environmental consulting firm with more than 140 scientists, planners, and GIS specialists. We assist public and private clients on a broad range of projects throughout the western United States and the Pacific. From planning, design, and permitting to implementation and compliance, we help move projects forward through the complexities of regulatory compliance, budgetary and schedule constraints, and conflicting stakeholder interests.

Go Native, Inc.
Montara, CA
www.gonativeinc.com
Contact: Chuck Kozak at 650-996-8998 or ckozak@gonativeinc.com

Go Native, Inc. is a local small business that specializes in landscape reconstruction for habitat restoration. We began in 1996 as a retail native plant nursery, and quickly grew and diversified into a leading habitat restoration company, meeting the needs of open-space land-managers throughout central California.

Golden Gate National Parks Conservancy
San Francisco, CA
www.parksconservancy.org
Contact: Rachel Kesel at 415-945-1426 or rkesel@onetam.org

The mission of the Parks Conservancy is to preserve the Golden Gate National Parks, enhance the park visitor experience, and build a community dedicated to conserving the parks for the future. We are a community-supported nonprofit organization transforming places—and people—through conservation and improvement of these remarkable national parks.

Irvine Ranch Conservancy
Irvine, CA
www.irconservancy.org
Contact: Mike O'Connell at 714-508-4757 or moconnell@irconservancy.org

Irvine Ranch Conservancy is a non-advocacy, non-profit organization established to ensure the protection, restoration, and enhancement of the natural resources of the Irvine Ranch Natural Landmarks in perpetuity. The Conservancy's programs provide diverse opportunities for compatible public enjoyment by conducting and supporting scientific, recreational, and educational initiatives and programs.

Marin Municipal Water District
Corte Madera, CA
marinwater.org
Contact: Andrea Williams at 415-945-1184 or awilliams@marinwater.org

Marin Municipal Water District stewards 22,000 acres of watershed lands in Marin County, including most of Mt. Tamalpais, and supplies drinking water to 190,000 residents.

National Park Service, California Exotic Plant Management Team
Point Reyes, CA
Contact: Bobbi Simpson at 415-717-0471 or bobbi_simpson@nps.gov

Invasive plant species dominate more than 2.6 million acres of National Park Service lands. In 2000, NPS created the Exotic Plant Management Program that now supports 16 teams working in over 225 park units. The California Exotic Plant Management Program provides invasive species support in 14 national park units. We work with volunteers, contractors, and service organizations to meet the agency's mission: preservation of native habitats for the enjoyment of future generations.

RECON Environmental, Inc. / RECON Native Plants, Inc.
San Diego, CA
www.reconenvironmental.com;
www.reconnativeplants.com
Contact: Peter Tomsovic at 619-308-9333 or ptomsovic@reconenvironmental.com

RECON Environmental, Inc. is an employee-owned environmental consulting firm with offices in San Diego, Goleta and Berkeley, California and Tucson, Arizona. In addition to environmental planning expertise, RECON offers a full line of habitat restoration services including planning, implementation, maintenance and monitoring throughout the Southwest. We also have a wholesale nursery, RECON Native Plants, offering restoration-quality native plants and seed material.

Resource Conservation District of Monterey County
Salinas, CA
www.rcdmonterey.org
Contact: emily Zefferman at 831-975-7761 or emily.zefferman@rcdmonterey.org

RCDMC provides technical assistance for voluntary and collaborative resource management projects throughout Monterey County. Current projects range from small farmer, Spanish language water management assistance to large scale multi-property habitat improvement and vegetation management on the Salinas River with emphasis no noxious wee control.

River Partners
Sacramento, CA
www.riverpartners.org
Contact: Julie Rentner at 209-639-2012 or jrentner@riverpartners.org

River Partners connects a bold vision of bringing life back to rivers with the hard, detailed work of rebuilding wild places, creating homes for wildlife, and improving our landscapes for the benefit of future generations. Since 1998, River Partners has channeled $125 million toward restoration of 11,000 woodland acres throughout California. Every acre we restore yields many times its cost in broad ecological value.

Santa Ana Watershed Association
Riverside, CA
www.sawatershed.org
Contact: James Law at 949-683-0194 or jlaw@sawatershed.org

Since 1997, the Santa Ana Watershed Association has been promoting a healthy watershed for wildlife and people. With a veteran staff of habitat restoration specialists and biologists, it has removed over 4,700 acres of invasive plant species and restored over 1,000 acres natural plant and streambed to promote indigenous plants and wildlife.

Santa Barbara Botanic Garden
Santa Barbara, CA
www.sbbg.org
Contact: Flannery Hill at 805-682-4726 x132 or fhill@sbbg.org

The Santa Barbara Botanic Garden fosters the conservation of California's native plants through our gardens, research, and education, and serves as a role model of sustainable practices.

Santa Lucia Conservancy
Carmel, CA
www.slconservancy.org/
Contact: Jenna Allred at 831-392-5392 or jallred@slconservancy.org

The Santa Lucia Conservancy is a 501(c)(3) non-profit land trust incorporated in 1995 to conserve the ecological integrity of the protected lands within the Santa Lucia Preserve in Carmel, California. We accomplish this through land management, conservation easement, stewardship, ecological research, and environmental education programs.

S&S Seeds
Carpinteria, CA
www.ssseeds.com
Contact: Jody Miller at 805-684-0436 or jodymiller@ssseeds.com

S&S Seeds extensive wildland collections of native seed and our expanding field production allows us to offer seeds of more than 1,000 plant species, including wildflowers, reclamation grasses and shrubs. Our large inventory of source identified seeds can be utilized by planners to identify species from an appropriate location to satisfy the needs of the project.

Student Conservation Association
Oakland, CA
www.theca.org
Contact: Jay Watson at 510-832-1966 x5301 or jwatson@thesca.org

The Student Conservation Association is a national, non-profit organization dedicated to conservation service, youth leadership, and career development in conservation. Founded 60 years ago, SCA has engaged well over 80,000 youth and young adults in service to nature.

Sustainable Conservation/PlantRight
San Francisco, CA
www.PlantRight.org
Contact: Stephanie Falzone at 415-977-0380 x350 or sfalzone@suscon.org

Since 2005 PlantRight has been working to stop the sale of horticultural invasive plants in ways that are good for business and environment. PlantRight unites leaders from California's nursery and landscape industries, conservation groups, academia, and government agencies to find common ground and cost-effective solutions. Check out our list of California-friendly alternatives to today's priority invasive garden plants, at www.PlantRight.org.

USDA Agricultural Research Service, Exotic and Invasive Weeds Research Unit
Albany, CA
www.ars.usda.gov/pacific-west-area/albany-ca/wrrc/eiw/
Contact: Paul D. Pratt at 510-559-6127 or paul.pratt@ars.usda.gov

The mission of the Exotic and Invasive Weeds Research Unit is to develop and transfer integrated, biologically based approaches for the management of invasive species and improvement of pollinator health.

The Watershed Nursery
Richmond, CA
www.watershednursery.com
Contact: Dianna Benner at 510-334-6021 or diana@thewatershednursery.com

A restoration nursery specializing in California native plants for re-vegetation.

PROGRAM

BioDiversity: Expanding Our Vision

Overview

Wed., Nov. 7	1:00 – 5:00pm	Trainings (3)	
	6:00 – 8:00pm	DPR Laws & Regs	
	7:30 – 9:00pm	Student/Professional Mixer	
Thu., Nov. 8	8:00am	Plenary:	Cal-IPC Update
	8:20 – 9:20am	Plenary:	Invasive Plant Management on the Central Coast
	9:40 – 10:40am	Concurrent:	Native Habitat Recovery after Invasive Plant Management Managing Invasive Plants in Coastal Habitats
	11:00 – noon	Concurrent:	Invasive Plant Management and Fire Managing Invasive Plants in Aquatic Habitats
	1:20 – 2:20pm	Concurrent:	Restoration through Invasive Plant Management Managing Invasive Plants using Biocontrols
	2:40 – 3:40pm	Concurrent:	Managing Invasive Species from Other Kingdoms Mapping & Prioritization for Invasive Plant Management
	3:40 – 5:00pm	Poster Session	
	5:00 – 6:30pm	Social Hour, Silent Auction and Raffle	
	6:30 – 8:30pm	Awards Banquet	
Fri., Nov. 9	8:00am	Plenary:	Invasive Plant Management in Washington State
	8:20 – 9:20am	Plenary:	Engaging Diverse Communities in Invasive Plant Management
	9:40 – 10:40am	Concurrent:	Invasive Plant Management Research I Invasive Plant Management Research II
	11:00 – noon	Discussion Groups	
	Noon – 1:00pm	Early Career Networking Lunch, organized by the Cal-IPC Student Section	
	1:00 – 2:00pm	Concurrent:	Outreach & Communications in Invasive Plant Management Planning & Funding Invasive Plant Management Projects
	2:20-3:20pm	Concurrent:	WMAs and the Economic Impact of Weeds Speed Talks
	3:40pm	New Weed Alerts	
	4:00 – 5:00 pm	Plenary:	Restoration in a World of *Phytophthora*
Sat., Nov. 10	8:00am	Field Trips (2 half-day and 2 full-day)	

Wednesday, November 7

12:00 pm Registration

1:00 – 5:00 pm Training 1: Invasive Plant Management 101 (Room: *Cypress*)

Are you new to the field of invasive plant management? Or do you have gaps in your understanding about how everything ties together? Here's your chance to get a solid foundation from a range of experts in the field. We will cover: the ways that land managers identify, map and prioritize weeds; how weed biology affects weed control methods; the range of control tools and techniques at our disposal as part of the Integrated Pest Management toolbox; strategic approaches for program success; communications, funding, permitting, and more. *Instructors: Rachel Kesel, One Tam; Gina Darin, California Dept. of Water Resources; Jason Giessow, Dendra, Inc; Ryan Diller, California State Parks; Steve Schoenig, California Dept. of Fish & Wildlife (retired).*

1:00 – 5:00 pm Training 2: Using Calflora's Weed Manager (Room: *Spyglass*)

Did you know that you can map weeds on your smartphone using a custom interface designed for your organization? Or that you can record details on field efforts each time you work on an invasive plant population? Calflora's Weed Manager suite of tools is designed to do this and more. Calflora staff and current users will show you how it all works. *Instructors: Cynthia Powell and John Malpas, Calflora.*

1:00 – 5:00 pm Training 3: Best Practices for Controlling *Phytophthora* in Restoration (Room: *Windjammer*)

From native plant nursery propagation to trail maintenance to daily worker hygiene, best practices are emerging for land managers looking to address the spread of damaging *Phytophthora* species. This training brings together experts in the field to share best practices, a new diagnostic and sampling guide, and the latest research. Restoration nurseries at the Golden Gate National Parks Conservancy will share practical approaches that nurseries can take to protect their stock from inadvertently spreading pathogens. East Bay Regional Park District land managers will demonstrate techniques they use and discuss how these are integrated into their operations. Many of these methods also reduce the spread of weed seeds and other invasive species. This training will get you up to speed with what you need to know about this rapidly developing topic in the restoration community. *Instructors: Diana Benner, The Watershed Nursery; Suzanne Latham, California Dept. of Food & Agriculture; Tyler Bourret, UC Davis; Ted Swiecki, Phytosphere Research; Janell Hillman, Santa Clara Valley Water District; Alisa Shor, Danny Franco and Jessica Peters, Golden Gate National Parks Conservancy; Pamela Beitz and Michele Hammond, East Bay Regional Park District; Susan Frankel, USDA Forest Service, Pacific SW Research Station.*

5:00 pm Registration

6:00 – 8:00 pm Laws, regulations and safety for herbicide application

Room: *Regency Grand Ballroom.* Chair: *Mike Blankinship, Blankinship & Associates, Inc.*

6:00 Herbicide application at its best: Standards for being an effective and safe herbicide applicator. *Hannah Wallis, Monterey County Agricultural Commissioner's Office*

6:30 Rangeland weed management: Best practices for protecting regulated and sensitive species. *Mike Blankinship, Blankinship & Associates, Inc.*

7:00 Pesticide drift prevention in invasive plant management: Drift definitions, occurrences, impacts, and off-site movement. *Cheryl Wilen, UC Statewide IPM Program*

7:30 Prop. 65 "No Significant Risk Level" for glyphosate: Risk for different applicator scenarios. *Mike Blankinship, Blankinship & Associates, Inc.*

7:30 pm Student/Professional Mixer – *Knuckles Sports Bar at Monterey Hyatt*

Thursday, November 8

7:00-8:00 am Registration and Breakfast

(subsidized "cash and carry" – attendees receive a BLUE coupon for $5.00 toward meal)

8:00 Opening Plenary

2018 Update from Cal-IPC**.** *Doug Johnson, Executive Director, Cal-IPC*

Room: *Regency Grand Ballroom*

8:20 Session 1. Invasive Plant Management on the Central Coast

Chair: *Hannah Wallis, Monterey County Agricultural Commissioner's Office*

8:20 The abiotic mosaic of the Central Coast: Geologic constraints and opportunities for native and non-native biodiversity. *Doug Smith, CSU Monterey Bay*

8:40 Wrinkles in sea-to-summit gradients and the marvelous mosaic of vegetation types in the Monterey Bay region. *Nicole Nedeff, CSU Monterey Bay*

9:00 Dispatching the Monterey Bay region's mosaic of invasive plants. *Hannah Wallis, Monterey County Agricultural Commissioner's Office*

9:20-9:40 am Break

(with coffee/tea)

9:40 Session 2. Native Habitat Recovery after Invasive Plant Management

Room: *Regency Grand Ballroom.* Chair: *Heather Schneider, Santa Barbara Botanic Garden*

9:40 Mapping weeds and rare plants to inform management and conservation in the Zaca and Jesusita Fire scars. *Stephanie Calloway, Santa Barbara Botanic Garden*

10:00 The complexity of restoring complexity: Establishing diverse native forblands in weeds grasslands. *Amelia Ryan, Pinnacles National Park.*

10:20 Restoring a coastal oak woodland on Santa Cruz Island by removing invasive eucalyptus. *Jade Blennau, National Park Service.*

9:40 Session 3. Managing Invasive Plants in Coastal Habitats

Room: *Ballroom I/II/III.* Chair: *Lorraine Parsons, Point Reyes National Seashore*

9:40 Effects of manual and mechanical *Ammophila arenaria* removal on coastal plant communities and dune morphology. *Monique Silva Crossman*, Humboldt State University*

10:00 The effectiveness of applied nucleation, seeding, and mowing in restoring California coastal prairies. *Josie Lesage*, UC Santa Cruz*

10:20 Managing invasive sea lavender at Bothin Marsh using hand removal and flaming. *Tatiana Manzanillo, Marin County Parks*

10:40-11:00 am Break

(with coffee/tea)

11:00 Session 4. Invasive Plants and Fire

Room: *Regency Grand Ballroom.* Chair: *Tim Hyland, California State Parks*

11:00 Lessons learned: Goats, goatgrass, fire, and fuel reduction. *Sarah Minnick, Marin County Parks*

11:20 Targeting bulldozer lines for competitive seeding to suppress postfire invasion in Coastal Sage Scrub. *Noah Teller*, UC Riverside*

10:40 Understory diversity and composition changes in prescribe-burned and passively-managed forests over 20 years. *Svetlana Yegorova, California State Parks*

11:00 Session 5. Managing Invasive Plants in Aquatic Habitats

Room: *Ballroom I/II/III.* Chair: *Drew Kerr, Invasive Spartina Project*

11:00 Pilot project – Ultraviolet light to control invasive aquatic plants in Lake Tahoe. *Nicole Cartwright, Tahoe Resource Conservation District*

11:20 The spread, ecology and challenges to control of the marine invasive seaweed *Sargassum horneri*. *Lindsay Marks*, NOAA*

11:40 Alligatorweed in the Delta: An early detection/rapid response story. *Jon O'Brien, California State Parks, Division of Boating and Waterways*

12:00 - 1:20 pm Lunch
(subsidized "cash and carry" – attendees receive a RED coupon for $10.00 toward meal)

1:20 Session 6. Restoration through Invasive Plant Management

Room: *Regency Grand Ballroom.* Chair: *Heather Schneider, Santa Barbara Botanic Garden*

1:20 Restoring critical coastal dune habitat at Point Reyes for threatened and endangered species by removing invasive plants. *Lorraine Parsons, Point Reyes National Seashore*

1:40 How do invasive grass water-use strategies affect belowground ecosystem services and native shrub re-establishment? *Michala Philips*, UC Riverside*

2:00 Can we condition plants to increase stress tolerance and improve restoration success? *Justin Valliere, UCLA*

1:20 Session 7. Invasive Plant Management using Biocontrols

Room: *Ballroom I/II/III.* Chair: *Lincoln Smith, USDA-ARS*

1:20 The effects of topping and humidity on establishment of the Arundo wasp and scale released to control *Arundo donax*. *Ellyn Bitume, USDA-ARS*

1:40 First release of a shoot-tip galling fly for biological control of Cape-ivy. *Scott Portman, USDA-ARS*

2:00 Recent research on invasive weeds at the European Biological Control Laboratory (EBCL). *Lincoln Smith, USDA-ARS*

2:20 – 2:40 pm Break

2:40 Session 8. Mapping and Prioritization for Invasive Plant Management

Room: *Regency Grand Ballroom.* Chair: *Eric Wrubel, National Park Service*

2:40 Prioritizing invasive species for eradication in the Bay Area National Parks. *Eric Wrubel, National Park Service, SF Bay Area Network I&M Program*

3:00 Mapping and estimating invasive plant chemical traits in the Sacramento-San Joaquin River Delta using hyperspectral UAS imagery. *Erik Bolch*, UC Merced*

3:20 Multi-benefit weed control: The San Joaquin River invasive species management and jobs creation project. *Jason Faridi, River Partners*

2:40 Session 9. Managing Invasive Species from Other Taxonomic Kingdoms

Room: *Ballroom I/II/III.* Chair: *Valerie Cook-Fletcher, California Dept. of Fish and Wildlife*

2:40 Discovery and management of invasive nutria in California's San Joaquin Valley. *Valerie Cook-Fletcher, California Dept. of Fish and Wildlife*

3:00 Eradication efforts for invasive populations of water snakes (*Nerodia* ssp.). *Richard Bireley, California Dept. of Fish and Wildlife*

3:20 IPM building blocks to control invasive shot hole borers–*Fusarium* dieback complex. *Shannon Lynch*, UC Santa Cruz*

3:40 – 5:00 pm Session 10. Poster and Exhibitor Session

Regency Grand Ballroom

5:00 – 6:30 pm Social Hour, Raffle & Silent Auction

Oak Tree and Mark Thomas Foyer (lower level)

6:30 – 8:30 pm Awards Banquet

Regency Grand Ballroom

Wildland Stewardship Organization of the Year Award

National Park Service Weedzilla Award

Ryan Jones Catalyst Award

Golden Weed Wrench Award for Land Manager of the Year

Wildland Stewardship Policy Award

Jake Sigg Award for Vision and Dedicated Service

Friday, November 9

7:00 am Registration and Breakfast

(subsidized "cash and carry" – attendees receive a BLUE coupon for $5.00 toward meal)

7:45 Announcements

8:00 Opening Plenary

Washington State's noxious weed program. *Greg Haubrich, Washington State Dept. of Agriculture*

Room: *Regency Grand Ballroom*

8:20 Session 11. Integrating Equity, Diversity and Inclusion into Conservation

Addressing issues of equity, diversity and inclusion goes beyond ethical considerations—it also improves productivity and innovation in accomplishing our conservation missions. Engaging under-represented communities, hiring diverse staff, and fostering an inclusive work environment engages communities in land stewardship while giving organizations the opportunity to incorporate new perspectives and ideas. Success in conservation requires being responsive to shifting demographics and social networks. Our panel of experts will share approaches that individuals and organizations can use to build a stronger conservation community.

Chair: *Fernando Villalba, Biologist, John Muir National Historic Site*

Panelists: *Marcos A. Trinidad, Director, Audubon Center at Debs Park*

Amanda Rowland, Youth and Volunteer Programs Coordinator, National Park Service, Pacific West Region

Kelli English, Chief of Interpretation, John Muir National Historic Site

9:20 – 9:40 am Break

(with coffee/tea)

9:40 Session 12. Invasive Plant Management Research - I

Room: *Regency Grand Ballroom*. Chair: *Jen Funk, Chapman University*

9:40 How are functional traits related to the invasibility of a restored plant community? *Jen Funk, Chapman University*

10:00 Warm temperatures increase biomass production of seedlings: Implication for management of *Ludwigia hexapetala* and *Ludwigia peploides* subsp. *montevidensis*. *Morgane Gillard, UC Davis*

9:40 Session 13. Invasive Plant Management Research - II

Room: *Ballroom I/II/III*. Chair: *Elizabeth Brusati, California Dept. of Fish and Wildlife*

9:40 Revegetating medusahead (*Taeniatherum caput-medusae*)-invaded rangeland. *Aleta Nafus, Bureau of Land Management*

10:00 Persistence of soil legacy effects and the role of secondary invaders in limiting reforestation success following the removal of *Cytisus scoparius* a widespread nitrogen-fixing invasive shrub. *Sara Grove, UC Santa Cruz*

10:20 Functional trait variation along a climate gradient in invasive wild radish in California. *Shana Welles, Chapman University*

10:20 Temperature-dependent influence of fungi on seed mortality suggests differences in seed bank persistence between invasive Saharan mustard in California and Arizona. *Yue "Max" Li, University of Arizona*

10:40 – 11:00 am Break

(with coffee/tea)

11:00 Session 14: Discussion Groups

1. **Ask the Experts: Control Methods Q&A.** Do you need expert advice on approaches to controlling a particular plant in a particular situation? Come learn from your peers and get your specific control questions answered by our expert panel of seasoned land managers. *Led by a panel of experts with diverse expertise.* (Room: *Spyglass*)
2. **Aquatic Weeds in California.** Water in California is important for humans and wildlife. Aquatic and estuarine environments are among our richest habitats and submerged and emergent invasive plants pose a significant threat. Come discuss the latest invasive plant control methods being used in the Delta, Lake Tahoe, San Francisco Bay and elsewhere. *Led by Drew Kerr, Invasive Spartina Project and Gina Darin, Cal. Dept. of Water Resources.* (Room: *Oak Tree*)
3. ***Arundo donax* Control.** Are you controlling *Arundo* on property you manage? Or planning an *Arundo* control program? Come share your knowledge on *Arundo* control methods (mechanical, chemical, and biological), permitting, funding, monitoring and research, and other topics. *Led by Emily Zefferman, Project Manager for the Resource Conservation District of Monterey County's Arundo Control Program.* (Room: *Big Sur*)
4. **Equity, Diversity and Inclusion.** The Cal-IPC Board of Directors and staff believe that addressing challenges in social equity, diversity and inclusion can increase the success of land managers. Come provide input on the Cal-IPC's draft Statement on Equity, Diversity and Inclusion (EDI) and how we can put it into action. Share ideas, resources and tools to help land management organizations integrate EDI principles and practices into their operations. *Led by: Fernando Villalba, National Park Service, and Marcos Trinidad, Audubon Center at Debs Park.* (Room: *Windjammer*)
5. **Controlling *Phytophthora* in Restoration.** *Phytophthora* soil pathogen species have become a major threat to restoration activities in California. How are native plant nurseries and restoration workers addressing this challenge? Come discuss the pathways for spread of pathogens, best practices for mitigating the risk of contamination, and the future directions of restoration. *Led by: Janell Hillman, Santa Clara Valley Water District; Diana Benner, The Watershed Nursery and Alisa Shor, Golden Gate National Parks Conservancy.* (Room: *Cypress*)

12:00 – 1:00 pm Lunch

(subsidized "cash and carry" – attendees receive a RED coupon for $10.00 toward meal)

Early Career Networking Lunch

Room: *Windjammer* (lunch provided for those who registered)
Organized by the Cal-IPC Student Section.

1:00 Session 15. Outreach and Communications in Invasive Plant Management

Room: *Regency Grand Ballroom*. Chair: *Rachel Kesel, One Tam*

1:00 How to inspire people to pull weeds. *Josie Bennett, Laguna Canyon Foundation*

1:20 What are we trying to say and who's listening? Communication considerations in invasive plant management. *Rachel Kesel, One Tam*

1:40 Communication structures for collaborative invasive plant management: Lessons learned from the Tamalpais Lands Collaborative. *Andrea Williams, Marin Municipal Water District*

1:00 Session 16. Planning and Funding Invasive Plant Management Projects

Room: *Ballroom I/II/III*. Chair: *Bobbi Simpson, National Park Service*

1:00 Regional Conservation Investment Strategies Program – a new tool for regional conservation. *Elizabeth Brusati, California Dept. of Fish and Wildlife*

1:20 Partnerships lifeline: Navigating private and public land projects with competing interests and a diversity of stakeholders. *Bobbi Simpson, National Park Service*

1:40 Evolution of an invasive plant control program, the adoption of early detection and rapid response. *Milan Mitrovich, Natural Communities Coalition*

2:00 – 2:20 pm Break

2:20 Session 17. *WMAs and the Economic Impact of Weeds*

Room: *Regency Grand Ballroom*. Chair: *Steve Schoenig, Independent consultant*

2:20 Brief history and current status of California's Weed Management Areas (WMAs). *Steve Schoenig, California Dept. of Fish & Game (retired)*

2:35 WMA case study: Putting the not in knotweed and other regional early detection/rapid response targets in northwestern California. *Amy Eberwein, Redwood Community Action Agency*

2:50 WMA case study: Placer-Nevada WMA regional invasive plant control in the central Sierra. *Ed King, Placer County Dept. of Agriculture*

3:05 The economic impact of selected invasive species to Washington State. *Greg Haubrich, Washington Dept. of Agriculture*

2:20 Session 18. Speed Talks

Room: *Ballroom I/II/III*. Chair: *Jutta Burger, Cal-IPC*

2:25 New tools for thoroughwort management. *Elliot Gunnison, Golden Gate National Parks Conservancy*

2:30 Integration of propagule pressure and functional traits to promote restoration through native annual forb reestablishment. *Sierra Lauman, Cal Poly Pomona*

2:35 Mapping waterhyacinth (*Eichhornia crassipes*) drift and dispersal in the San Joaquin Delta using GPS drogues. *John Miskella, USDA-ARS*

2:40 Ecological impacts and management of the Argentine ant (*Linepithema humile*, Mayr) in California. *Korie Merrill, Center for Natural Lands Management*

2:45 Native plant recovery in seeded and non-seeded plots following exotic fennel (*Foeniculum vulgare*) control on east Santa Cruz Island – ten years post-treatment. *Clark Cowan, Channel Islands National Park*

2:50 The U.S. Marine Corps versus the Sahara mustard. *Jim Malusa, University of Arizona.*

	2:55 Hand-removal method impacts on labor effort, Sahara mustard and native species: To bag or not to bag? *Lynn Sweet, UC Riverside Center for Conservation Biology* 3:00 The impact of heavy exploitation of invasive alien plant species on their management and control in Nigeria. *Israel Borokini, University of Nevada, Reno* 3:05 Q&A

3:20 – 3:35 pm Break

3:35 Contest Winners announced (Student Paper, Student Poster, and Photo Contests)

3:40 New Weed Alerts

Room: *Regency Grand Ballroom.*

New non-native plants spreading in California's wildlands. *Dean Kelch, California Dept. of Food & Agriculture*

4:00 Session 19. Restoration in a World of *Phytophthora*

Chair: *Susan Frankel, USDA Forest Service, Pacific Southwest Research Station*

4:00 *Phytophthora* threats to native vegetation and land manager response. *Susan Frankel, USDA Forest Service, Pacific Southwest Research Station*

4:20 *Phytophthora* impacts to endangered pallid manzanita in the East Bay Regional Park District. *Michele Hammond, East Bay Regional Parks District*

4:40 Assessment of soilborne *Phytophthora* pathogens at restoration sites in the Midpeninsula Regional Open Space District. *Ebba Peterson, Oregon State University*

5:00 pm Adjourn

(Field Trip participants meet in front of room)

Saturday, November 10

[All field trips meet at Registration area at 8:00 am. Departure at 8:15/8:30 depending on trip. Arrive early if you need DPR CEUs.]

Field Trip 1: From Bombs to Biodiversity: Transforming the Fort Ord Military Base to a Park and Monument through Two Decades of Weed Control and Restoration. (Full-day, 8:30 am-5 pm) Visit Fort Ord National Monument to learn about 20 years of invasive weed management, habitat restoration, coastal grassland grazing and maritime chaparral fire ecology. Since receiving land from the former Fort Ord Military Base in the mid-1990's both California State Parks and the Bureau of Land Management (BLM) have put considerable effort into restoration projects including invasive plant control. While learning about these efforts there will be an opportunity to see a variety of habitats including coastal dunes, maritime chaparral and grasslands. The trip will start at Fort Ord State Park for a visit to a current restoration project in the dunes, learning about State Park's work to control iceplant and other invasive plants and the special status species present there. Then we will move to Fort Ord National Monument managed by the BLM and the U.S. Army. The former artillery range is closed to the public because the U.S. Army is still cleaning up ordnance so this is a rare opportunity to visit this beautiful area. We will visit a large-scale jubatagrass control project and have an opportunity to learn about conducting weed control in an area where ordnance removal is ongoing. Following lunch, we will visit the site of a successful hoary cress control project and a grassland site to learn about controlling yellow starthistle and non-native perennial grasses. We will discuss restoring grasslands using sheep and goat grazing and discuss fire ecology at a site that burned in 2017. *Leaders: Amy Palkovic, California State Parks, Susan Hubbard and Bruce Delgado, Bureau of Land Management, Bart Kowalski, U.S. Army.*

Field Trip 2: Salt Water to Fresh Water and Everything in Between: Weed Management in Elkhorn and Watsonville Sloughs. (Full-day, 8:30 am-5 pm) The wetlands and coastal habitat of central Monterey Bay are well known for their rich animal life and birdwatching opportunities. We will begin the day with a two-hour kayak trip up Elkhorn Slough. Guides will discuss various control efforts on iceplant, European beachgrass, perennial pepperweed and yellow starthistle using mechanical removal, herbicide application, and competitive replanting with natives. We will stop to discuss eucalyptus removal/biochar production and a large-scale salt marsh restoration project on the Slough's margin. After the paddle, we'll visit Pajaro Valley farm conversion sites where Watsonville Wetlands Watch has been working on creation of seasonal ponds and wetland and upland restoration efforts using mowing, discing, herbicide application, broadcast seeding and planting. *Leader: Andrea Woolfolk, Stewardship Coordinator, Elkhorn Slough National Estuarine Research Reserve.*

Field Trip 3: From Char to Verdant: Soberanes Wildfire Recovery at Big Sur Land Trust's Mitteldorf Preserve. (Half-day, 8:30am-1 pm) Visit the Mitteldorf Preserve, which was completely burned during the 132,000-acre Soberanes Fire in 2016. Land managers are now in their second year of vegetation monitoring post-fire and working to curtail invasive plant spread. We will address how the fire—and fire suppression activities—affected weed populations, and the process of creating a response plan with weed management priorities based upon site dynamics and invasive species characteristics. We will visit an erect veldtgrass control site in redwood understory, where we will present the results from our Fusilade foliar herbicide application. At the Redtail overlook we will discuss the progression of fire recovery for redwood, grassland, madrone, and chaparral habitats and results from a post-fire vegetation study. *Leader: Patrick Riparetti, Big Sur Land Trust.*

Field Trip 4: Righting the Upside-Down River: Restoring the Salinas through Collaborative "Win-Win" Management Strategies. (Half-day, 8:15 am-1 pm) Visit a cutting-edge partnership between the Resource Conservation District (RCD) of Monterey County, The Nature Conservancy, large agricultural operations, and government agencies to restore the Salinas River and control the state's second largest *Arundo donax* infestation, a bane to both farmers and conservationists alike. This is a rare opportunity to visit private lands and explore the unique ecosystem of the Salinas River. The Salinas is nicknamed the "upside-down river" because it flows south to north and sometimes only underground. It is the longest river in California's Central Coast, stretching 175 miles through San Luis Obispo and Monterey Counties before emptying into Monterey Bay. We will discuss the collaborative programs that are allowing Arundo treatment to happen, as well as the treatment techniques being used. The program is targeting approximately1,500 acres of *Arundo donax* along the Salinas River, along with scattered tamarisk and tree tobacco. Since the program began in 2014, the RCD has mowed over 300 acres of Arundo and is following up with herbicide treatments. As we ride through scenic Steinbeck country you will see the rolling hills of the Sierra de Salinas and Gabilan Range, and vast expanses of some of the most productive farmland in California, the "Salad Bowl of America." *Leader: Emily Zefferman, Resource Conservation District of Monterey County*.

Posters

*Alphabetical by lead author. *indicates Student Contest participant.*

Testing the effects of site selection and artificial shelters on native plant recruitment from seed in a degraded coastal sage scrub restoration. *Marlee Antill*, California State Polytechnic University, Pomona*

The impact of heavy exploitation of invasive alien plant species on their management and control in Nigeria. *Temitope Israel Borokini*, Department of Biology, University of Nevada, Reno*

The invasion of introduced species after forest fires on the southern slope of Mount Merapi, Yogyakarta. *Tjut Sugandawaty Djohan, Laboratory of Ecology and Conservation, Universitas Gadjah Mada, Yogyakarta, Indonesia*

Nitrogen deposition, invasion by *Bromus sp.*, and competition for water in a California grassland. *Robert Fitch, California State Polytechnic University-Pomona, Department of Biological Sciences*

Biochar: turning invasive eucalyptus into a restoration tool. *Martin Genova*, UC Santa Cruz, Ecology and Evolutionary Biology, Parker Lab*

Maximizing the efficiency of invasive plant control with a phenology-based timing approach to management. *Guy Gabriel Hernandez, Don B. Huntley College of Agriculture, California State Polytechnic University, Pomona*

Assessment of native species for the control of gorse (*Ulex europaeus*) by means of allelopathic effect of its leaf litter leachates. *Mika Hozawa*, Laboratory of Tropical Agriculture, Division of Environmental Science and Technology, Graduate School of Agriculture, Kyoto University*

Vetting goat grazing best management practices. *Irina C. Irvine, National Park Service Pacific West Region*

Protecting endangered species from pesticides in California - PRESCRIBE: online database and mobile application for the protection of sensitive-status species from pesticides. *John Gerlach, Department of Pesticide Regulation*

Evaluation of newly registered herbicides for control of waterhyacinth in the Sacramento / San Joaquin Delta. *Guy Kyser, Plant Sciences Department, University of California, Davis*

Can plant functional traits explain impacts of varying water on restoration outcomes? *Justin Luong*, University of California–Santa Cruz*

Restoring degraded chaparral and the impact of exotic species on native shrub establishment. *Stephanie Ma*, University of California, Santa Barbara*

Investigating allelopathy and soil moisture as factors determining community composition of an invaded Southern California black walnut woodland. *Jose Marfori*, Biological Sciences Department – California State Polytechnic University, Pomona*

Using functional traits to build native grassland communities that are resistant to exotic annual grasses. *Madeline Nolan*, University of California, Santa Barbara, Department of Ecology, Evolution and Marine Biology*

Regional Conservation Investment Strategies: a comparison to other conservation planning programs. *Ami Olson, California Department of Fish and Wildlife*

Above- and below-ground effects of four organic herbicides used in invasive plant management in Irvine, California. *Isaac Ostmann, Irvine Ranch Conservancy*

Impacts and best management practices for erect veldtgrass (*Ehrharta erecta*). *Ingrid M. Parker, Department of Ecology and Evolutionary Biology, University of California–Santa Cruz*

Resource availability, propagule supply, and the effect of non-native, ungulate herbivores on *Senecio madagascariensis* invasion. *Erin J. Questad, Biological Sciences Department, California State Polytechnic University, Pomona*

Facilitation and herbivory in Southern California coastal sage scrub. *Lauren H. Quon, California State Polytechnic University Pomona*

Variation in cool temperature performance among weevil (*Neochetina eichhorniae*) populations and implications for the biological control of water hyacinth in a temperate climate. *Angelica M. Reddy, USDA-ARS-WRRC, Invasive Species and Pollinator Research Unit*

Weed Management Areas are fertile ground for fruitful partnerships. *Amelia Ryan, Pinnacles National Park*

Does grazing of compost-amended grasslands impact carbon sequestration and plant diversity? *Mizael Seminatore*, San Francisco State University, Ecology and Evolutionary Biology Department*

Role of soil properties on weed encroachment in serpentine chaparral. *Rebecca Serata*, Department of Environmental Science and Policy, University of California, Davis*

A test of alternatives to glyphosate for the control of invasive plants. *Don Thomas, San Francisco Public Utilities Commission*

Controlling yellow starthistle by lowering soil pH. *Sunie Wood, Chapa-De Indian Health*

Talk Abstracts

(Poster abstracts follow in a separate section; List is alphabetical by lead author)

How to inspire people to pull weeds. Josie Bennett, Laguna Canyon Foundation, Laguna Beach, CA. josie@lagunacanyon.org

Inspiring community stewardship is a critical component to protecting our local open space. To accomplish this, organizations need to create meaningful experiences where people can enjoy themselves while learning about local habitats, biodiversity and the danger of invasive plants. Laguna Canyon Foundation's restoration stewardship volunteer program offers 60 events throughout the year, incorporating opportunities for participants to work in our native plant nursery, attend weekend Keep it Wild restoration events, and engage in mid-week volunteer restoration opportunities. Participants follow the life cycle of a native plant, from collecting and planting seeds, to caring for the young nursery plants, to planting them at our restoration project sites. Once the plants are in the ground, volunteers can continue caring for these plants by watering and removing non-native plants during our monthly restoration events. Joining in these activities establishes a personal connection to the ecosystem and inspires repeated visits, giving each volunteer a unique and personal relationship with the land. Volunteers learn about native plants, habitat restoration, citizen science, and the importance of conserving our wildlands, while contributing in a tangible, hands-on way to our habitat restoration efforts. Each person walks away with a better understanding of the work that needs to be done to protect native habitat. Finding a balance between accomplishing tasks and guaranteeing that participants are having an enjoyable experience can be challenging. Creating a dynamic program that can accommodate people of all ages and abilities is key to bringing this important message to the whole community.

Eradication efforts for invasive populations of water snakes (*Nerodia ssp.*). Richard Bireley* and Valerie Cook-Fletcher, CDFW Invasive Species Program, Sacramento, CA. Richard.Bireley@wildlife.ca.gov

Watersnakes of the genus *Nerodia* are native to the eastern U.S., but through the pet trade and subsequent owner releases have been introduced to and established in environments far beyond their native range. *Nerodia* are highly aquatic, non-venomous snakes that primarily prey upon amphibians and fishes. In 1992, a population of *N. fasciata pictiventris* was discovered within a constructed marsh and adjacent watershed in Folsom (Sacramento County). In 2007, a population of *N. sipedon* was discovered in a freshwater wetland in Roseville (Placer County). A 2014 observation of *N. sipedon* 3.5 km north of the known *N. sipedon* population suggests the progressing drought and diminishing habitat may be driving dispersal of individuals in search of aquatic habitat and resources. The establishment and spread of *Nerodia* in California is of particular concern given their proximity to a number of special status prey species and inherent ecological overlap with the state/federally threatened giant garter snake (*Thamnophis gigas*). For the conservation of native species and their habitats, in 2015 the California Department of Fish and Wildlife, in collaboration with UC-Davis and the Nerodia Working Group, initiated a project to eradicate the *Nerodia sipedon* population from Roseville and in 2016, the ongoing eradication efforts were broadened to include the *N. f. pictiventris* population in Folsom. Additional survey efforts have continued at reported detection sites within the Sacramento-San Joaquin Delta. Up-to-date results and implications will be reported.

The effects of topping and humidity on establishment of the arundo wasp and scale released to control *Arundo donax*. Ellyn Bitume[1] and Patrick Moran, Invasive Species and Pollinator Health Research Unit, USDA-ARS, Albany, CA. Ellyn.Bitume@ars.usda.gov

Arundo (*Arundo donax* L., Poaceae) is a large perennial grass species that is invasive in Texas and California. Besides displacing native vegetation and obstructing flood channels, arundo consumes scare water resources in dry riparian habitats. Mechanical and chemical control are common methods used to eradicate invasive arundo, but these methods prove ineffective or cost-prohibitive against large infestations. Two biological control agents, the arundo wasp (*Tetramesa romana*) and the arundo armored scale (*Rhizaspidiotus donacis*), have been approved for release against arundo. Seven years after initial release in Texas, the arundo wasp decreased live

biomass of arundo shoots by 30-40% and promoted revegetation of native plants. While the wasp is well established in southern Texas, previous trials in northern California have led to unsuccessful establishment. In 2017, our goal was to release the arundo wasp and arundo armored scale at six different sites across central and northern California. To investigate if changes in methodology would facilitate wasp establishment, we conducted a large-scale field experiment to examine the effects of topping (cutting to 1m) the arundo approximately six weeks prior to release on wasp and scale establishment. We expect to find higher wasp and scale presence at topped sites, since topping the arundo promotes the growth of side shoots where the wasp prefers to ovisposit. We also investigated the effects of humidity on wasp oviposition. We found that in a greenhouse, wasps from Texas show higher oviposition in more humid conditions than in less humid conditions. We here present our methodology, results one year post-release from the arundo biocontrol program, and results from the greenhouse humidity experiment.

Restoring a coastal oak woodland on Santa Cruz Island by removing invasive eucalyptus (*Eucalyptus* spp.). Jade Blennau[5]*, Paula Power[1], Clark Cowan[1], Derrek Hartman[2], Joel Wagner[3], Mike Martin[4], and Laura Kirn[1]. [1]Channel Islands National Park, Ventura, CA. [2]Mediterranean Network, Thousand Oaks, CA. [3]NPS Water Resources Division, Lakewood, CO. [4]NPS Water Resources Division, Ft Collins, CO. [5]Student Conservation Association, at Channel Islands State Park. jadeblennau@gmail.com

The Cañada del Puerto is the primary entry point to Santa Cruz Island and is important habitat for Island Scrub Jay (*Aphelocoma insularis*), the only single-island endemic bird in North America. A large portion of the native oak woodland in the watershed was cleared in the 19th century and replaced with non-native eucalyptus (*Eucalyptus* spp.) trees. The fire-prone eucalyptus have since spread and dominate the landscape of the most visited portion of the watershed. In fact, one third of the Central Valley/Cañada del Puerto bottomland was occupied by invasive eucalyptus in 2010 (2.8 km eucalyptus occupy 8.0 km stream channel). In 2011 Channel Islands National Park, The Nature Conservancy, and the NPS Fire Resources partnered to remove invasive eucalyptus trees from 53.41 acres. After completing an EIS and Section 106 compliance fire crews and park staff cut, piled, and burned eucalyptus trees. Logs were bio-utilized wherever possible. 28.51 acres have been cleared to date. Many lessons learned including appropriate personnel, herbicide selection, mapping, and data management helped to successfully treat eucalyptus and obtain additional funds to continue the effort. Restoration of the former groves and burn scar areas involved incipient weed and eucalyptus seedling management and native seed broadcast. Hydrologic monitoring in observation wells and point intercept monitoring revealed hydrologic effects and successional changes among groves. Lessons learned and monitoring data will be presented.

Removing invasive eucalyptus has reduced hazardous fuels, made way for restoration of Southern Coastal Oak Woodland, and improved habitat for Island Scrub Jay and other island wildlife. Removing eucalyptus also demonstrated a successful partnership between NPS Fire Resources, NPS Natural Resources Management divisions and TNC and highlights their commitment to ecological restoration and reduction of fire risk.

Mapping and estimating invasive plant chemical traits in the Sacramento-San Joaquin River Delta using hyperspectral UAS imagery. Erik Bolch* and Erin Hestir. University of California, Merced. ebolch@ucmerced.edu

The spread of invasive species is internationally recognized as one of the most severe threats to biodiversity. Aquatic ecosystems like the Sacramento-San Joaquin River Delta are highly vulnerable to invasion by exotics due to their extensive use for recreational and industrial activities. In the Delta, invasive plants not only have detrimental effects on ecosystem function and sustainability but have significant economic impacts as well. Up-to-date, reliable location and species information on invasive on nonnative plants helps prevent spread and allows land managers to minimize negative economic and ecological impacts. The current method for mapping invasive plants in the Delta involves annual or biannual snapshots taken by hyperspectral imagers mounted on aircraft, which limits temporal resolution. This greatly impedes the monitoring because many species spread rapidly. Unmanned aerial systems (UAS) equipped with hyperspectral imagers offer high spectral and high spatial resolution, with the capability of making repeat measurements with ease, which eliminates this obstacle. Previous studies have been successful in estimating plant biochemical composition using spectral reflectance data in a lab setting. This is a pilot study to evaluate the capability of using a lightweight UAS mountable hyperspectral instrument to

map invasives and estimate their biochemical compositions. The high spatial and high spectral resolution data acquired will help produce more accurate maps and predict patterns of spread, enabling land managers to make informed decisions regarding invasive plants.

The impact of heavy exploitation of invasive alien plant species on their management and control in Nigeria. Temitope Israel Borokini[1,2]* and Folaranmi Dapo Babalola[3]

[1]National Centre for Genetic Resources and Biotechnology, Ibadan, Nigeria, [2]Department of Biology, University of Nevada, Reno, Reno, NV; [3]Department of Forest Resources Management, University of Ilorin, Ilorin, Nigeria. tbisrael@gmail.com

Over 2000 exotic plants have been documented in Nigeria and adjacent West African countries. These exotics were introduced accidentally or deliberately over a long period of time spanning pre-historical, colonial and post-colonial eras. Many of these exotics have become naturalized with or without human mediation, including about 10% which have become invasive. In addition to intrinsic biological features that facilitated their establishment, naturalization and spread, extrinsic factors that support increased species diversity at lower latitudes could have also enhanced their naturalization. These factors include niche diversification, habitat heterogeneity and increased net primary productivity, among others. In addition, anthropogenic-induced landscape disturbance and lack of preventive monitoring measures played huge role in invasion success of many of these exotics. Consequently, most free lands and border regions of protected areas have become novel habitats occupied by a mosaic of early and late seral succession native plants and established invasive species. This presentation discusses success stories where traditional bioprospecting of some of these invasive species led to their heavy exploitation and decimation of their propagules. Similarly, the negative impact of economic exploitation of invasive plants were identified in West Africa. The need for coordinated efforts and pilot studies on the effectiveness of exploitation as a means of controlling invasive species is stressed.

Regional Conservation Investment Strategies Program – a new tool for regional conservation. Elizabeth Brusati* and Ron Unger, California Department of Fish and Wildlife, Sacramento, CA. ron.unger@wildlife.ca.gov

The Regional Conservation Investment Strategies (RCIS) Program (https://www.wildlife.ca.gov/conservation/planning/regional-conservation) is a new tool for regional conservation that may be used to help turn the tide against invasive species invasions to achieve high-quality habitat. On September 22, 2016, the Governor signed Assembly Bill 2087 establishing the California Department of Fish and Wildlife's (CDFW) new RCIS Program. The RCIS Program enables voluntary, non-regulatory regional conservation strategies to guide comprehensive, cohesive, and connected regional conservation through philanthropic investments and advance mitigation. The RCIS Program has three components: regional conservation assessments (RCA), regional conservation investment strategies (RCIS), and mitigation credit agreements (MCA). The RCIS Program works with existing regional conservation plans and can fill in gaps in areas not covered by existing regional conservation plans. The RCIS Program uses a science-based approach to identify and prioritize conservation and habitat enhancement actions to help California's declining and vulnerable species by protecting, restoring, and reconnecting their habitats, and facilitating adaption and resilience to climate change, invasive species and other stressors. These actions may include land protection, habitat restoration, installation of wildlife crossings, removal of fish passage barriers, and other actions on private and public lands, including working lands. MCAs are based on the RCIS actions and provide credits on public and private lands that may be used as compensatory mitigation for impacts under the California Environmental Quality Act, the California Endangered Species Act, Lake and Streambed Alteration Program and potentially for federal mitigation requirements. RCIS may help land managers fund their existing invasive plant priorities by identifying invasive species control actions needed to enhance declining and vulnerable species and their habitats. Those actions can then be funded on public and private lands through grants or MCAs.

Mapping weeds and rare plants to inform management and conservation in the Zaca and Jesusita Fire scars. Stephanie Calloway*, Heather Schneider, Denise Knapp. Santa Barbara Botanic Garden, Santa Barbara, CA. scalloway@sbbg.org

Wildfires can provide unique opportunities to document ecosystem recovery and address invasive plant management. The Santa Barbara Botanic Garden is conducting comprehensive invasive and rare plant surveys throughout the Zaca (2007) and Jesusita (2009) fire scars within the Los Padres National Forest (LPNF) to identify areas in need of recovery projects. Utilizing ESRI's Collector App, iPads, and high accuracy Bad Elf GPS receivers, we are mapping invasive and rare plants along >300 miles of maintained roads, trails and firebreaks. We are focusing on nine invasive plant species listed in the LPNF Business Plan, as well as documenting occurrences of invasive plants listed in the Cal-IPC Inventory. We are also documenting occurrences of any rare plants that we encounter, and submitting inventory information to the California Natural Diversity Database. Other products resulting from this work include GIS maps (including survey data) of invasive and rare plants that will be added to the US Forest Service Natural Resources Information System, herbarium vouchers, photographs, and outreach content. These efforts will also help support the creation of an updated voucher-based checklist for Santa Barbara County. This comprehensive mapping and inventory effort will allow us to work with LPNF to identify priority areas for restoration in remote parts of the forest that would otherwise remain unexplored.

Pilot project – Ultraviolet light to control aquatic plants in Lake Tahoe. Nicole Cartwright, Tahoe Resource Conservation District. South Lake Tahoe, CA.[1]*John Paoluccio, Inventive Resources Inc. Salida, CA.[2]* ncartwright@tahoercd.org

A collaboration of public and private partners conducted a non-chemical, ultraviolet light treatment pilot at Lakeside Beach and Marina in Lake Tahoe. Tahoe Resource Conservation District secured funding from the California Tahoe Conservancy and private donations through the Tahoe Fund to conduct the pilot project. Residents and resource managers are hopeful that this new method will prove effective and offer more treatment options to add to our toolbox to help eradicate aquatic invasive weeds throughout Lake Tahoe.

The pilot project consists of two phases; treatment and monitoring. Treatment was completed in summer of 2017, with post monitoring scheduled throughout summer 2018. At the conclusion of the treatment phase it was visibly evident that the densities of the invasive plant populations were reduced. All agencies and partners have been positive thus far with the preliminary results. Prior laboratory results show that after a specific exposure time, all the treated aquatic plants were impacted such that they did not continue to grow. Full project results will be available January 2019.

Discovery of invasive nutria in California's San Joaquin Valley. Valerie Cook Fletcher, Invasive Species Program, California Department of Fish and Wildlife; 1416 Ninth St., 12th floor, Sacramento, CA 95814; Helen.Benson@wildlife.ca.gov

Following their eradication in the 1960s, a reproducing population of invasive nutria (*Myocastor coypus*) has once again been discovered in California's San Joaquin Valley. Nutria are large, semi-aquatic rodents, reaching up to 20 pounds in size and resembling beavers and muskrats. Native to South America, nutria were introduced in the U.S. for the fur-trade in 1899 and later successfully farmed in California during the 1930s-60s. Collapse of the fur market led to nutria releases and feral populations, which were declared eradicated from California by the 1970s. However, in March 2017, a pregnant female nutria was trapped in a private wetland in Merced County. Since that time, over 93 additional nutria have been taken from private and public wetlands, adjacent to the San Joaquin and Merced Rivers, ponds, and irrigational canals, with additional confirmed and potential sightings, damage, and sign in San Joaquin, Stanislaus, Merced, Tuolumne, Mariposa, and Fresno Counties. If allowed to persist, nutria will severely impact California's ecosystems and resources, including the loss of wetlands, severe soil erosion, increased sedimentation, damage to agricultural crops and levees, and reduced stability of banks, dikes, and roadbeds, as they have done in Louisiana, Chesapeake Bay, and the Pacific Northwest. Nutria also degrade water quality and contaminate drinking supplies with parasites and diseases transmissible to humans, livestock, and pets. The California Department of Fish and Wildlife and project partner agencies seek to eradicate nutria from the State for the prevention of significant environmental, agricultural, and economic impacts in the Sacramento-San Joaquin River Delta watershed. CDFW is conducting local outreach, pursuing landowner access permissions, developing an eradication strategy, and has deployed survey and trapping teams to delineate the population and initiate eradication efforts. Up to date needs, progress, and direction of future efforts of the California Nutria Eradication Project will be presented.

Native plant recovery in seeded and non-seeded plots following exotic fennel (*Foeniculum vulgare*) control on east Santa Cruz Island – ten years post-treatment. Clark Cowan[1]*, Paula Power[1], Thomas Stanley[2], James R. Roberts[1]. [1]Channel Islands National Park, [2]USGS. paula_power@nps.gov

In 2007 Channel Islands National Park initiated a program to control fennel using triclopyr on East Santa Cruz Island following the removal of non-native ungulates. Removal of introduced ungulates on the island led to the release of invasive fennel (*Foeniculum vulgare*), which expanded to become the dominant vegetation in some areas. To evaluate the effectiveness of native seed augmentation following fennel removal, we established replicate paired-plots (seeded v. non-seeded) at Scorpion and Smugglers, where notably dense infestations (>10% cover) occurred. Five and ten years after fennel treatment litter, bare ground, native, and non-native cover was recorded. Fire year after fennel control vegetation cover of both native and other (non-fennel) exotic species increased at Scorpion in both seeded and non-seeded plots. At Smugglers, exotic cover decreased significantly ($p=0.0001$) as native cover, comprised of *Eriogonum arborescens* and *Leptosyne gigantea* increased significantly ($p<0.0001$) in seeded plots only. Non-seeded plots at Smugglers were dominated by exotic annual grasses, primarily *Avena barbata*. Follow-up monitoring in 2018 indicate recovery of the native plant community continues and native plant cover is >50%. Data and lessons learned will be presented.

Effects of manual and mechanical *Ammophila arenaria* removal on coastal plant communities and dune morphology. Monique Silva Crossman*[1], David Gwenzi[1], Erik S. Jules[2], and Alison O'Dowd[1]

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The removal of invasive species as part of the restoration process can allow natives organisms to rebound. An ecosystem that incurs damages from invasive species is coastal sand dunes, which are dynamic systems invaded by *Ammophila arenaria*. *Ammophila arenaria* alters and stabilizes foredune morphology. Native populations may suffer when *A. arenaria* invades the foredune. The objectives of my research are to examine the effects that manual and mechanical *A. arenaria* removal techniques have on sand dune morphology and vegetative cover over time. The California State Parks Redwood District manages three sand dune ecosystems where *A. arenaria* removal efforts have been conducted: Little River State Beach, Gold Bluffs Beach in Prairie Creek Redwoods State Park, and Tolowa Dunes State Park. I surveyed the vegetative cover at each of these three locations in each treatment method and in untreated control plots during the summer and early fall of 2017. In order to measure dune morphology at restored and unrestored sites, I used an Unmanned Aerial Vehicle (UAV) that was flown over the mechanical removal and control areas. I then created a Digital Elevation Model (DEM) from photos taken during the UAV flights using Structure for Motion software. Overall, both mechanical and manual treatments lowered *A. arenaria* cover over time. Mechanical removal lowered the foredune elevation compared to control areas (p-value <0.05), and changed the dune morphology in treatment areas into hummocks at Little River. Although mechanical removal was effective at lowering *A. arenaria* cover, it also lowered native plant diversity compared to manual removal. With biodiversity projected to continue to decline over the next few decades, manual removal of *A. arenaria* in coastal sand dunes will afford greater native plant diversity and cover compared to mechanical removal.

Putting the not in knotweed and other regional EDRR targets in the Northwest, Amy Eberwein, Redwood Community Action Agency, Eureka, CA. amy@nrsrcaa.org.

With the support of Cal-IPC and other regional partners, Redwood Community Action Agency developed and implemented the Northwest Regional Eradication Project with the goal of eradicating select early detection, rapid response species in the northwest region. Species were prioritized through a comprehensive assessment using Cal-IPC mapping and prioritization tools that weighed each plant's impact, potential for spread, and feasibility of region-wide eradication. Species selected for this project were known to be highly invasive but were found in low enough numbers within the region as to be considered eradicable in five years. Of the six species chosen for eradication, half were knotweed species. Past research and projects by regional partners had shown eradication of knotweed species to be nearly unachievable despite the low number of infestations. Typical tools used in the region for the treatment of invasive plant species were not viable options for knotweed species. Manual removal proved to be not only laborious, but inefficient and costly. Other methods such as tarping and mowing only resulted in increased spread of infestations. As a result,

annual herbicide treatments were implemented along with extensive monitoring using the Calflora database. In addition to the challenge of combating these invasive plant species themselves, there were other challenges to this project including community contention to herbicide use, the continued discovery of new infestations and extensive landowner access agreement requirements. This project is still currently underway, however, significant progress has been made towards the eradication of knotweed in the northwest region.

Multi-benefit weed control: the San Joaquin River invasive species management and jobs creation project. Jason Faridi* (jfaridi@riverpartners.org), Jeff Holt, Julie Rentner. River Partners, Turlock, CA. Jake Salimbene*, Fresno, CA San Joaquin River Parkway & Conservation Trust, Inc. ridi@riverpartner.org

The San Joaquin River Restoration Program (SJRRP) funded the San Joaquin River Invasive Species Management and Jobs Creation Project in order to manage and monitor invasive species along the 150-mile stretch slated for restoration river flows, and to provide jobs for area residents in a region of chronically high unemployment. River Partners and the San Joaquin River Parkway and Conservation Trust (SJRPCT) partnered to tackle this large-scale project. The project focused on planning, permitting, and negotiations with landowners for site access. Focal invasive species have included giant reed (*Arundo donax*), red sesbania (*Sesbania punicea*), salt cedar (*Tamarix* sp.), perennial pepperweed (*Lepidium latifolium*), Chinese tallow tree (*Triadica sebifera*), edible fig (*Ficus carica*), Himalayan blackberry (*Rubus armeniacus*), yellow starthistle (*Centaurea solstitialis*), and tree tobacco (*Nicotiana glauca*). Mapping began on the project in 2011 and using baseline spatial data collected in that initial year and compiled data from partners, we have balanced multiple factors to prioritize treatment of invasive species. Treatment to control invasive species began in 2012 and continued through 2015. By 2015, over 500 acres of invasive species had been treated; including >400 acres of *L. latifolium*, 160 acres of *S. punicea*, 15 acres of *A. donax*, and to a smaller extent the other species. In 2016 and 2017 mapping and treatment efforts were heavily curtailed by heavy rains and river flows in the San Joaquin Valley. In 2018, mapping and treatment has resumed in full force and assessments are being conducted to document what impact higher flows had on invasive species in the San Joaquin Valley.

***Phytophthora* threats to native vegetation and land manager response.** Susan J. Frankel[1]*, Diana Benner[2], Janell Hillman[3], Alisa Shor[4] and Janice Alexander[5]. [1]USDA Forest Service, Pacific Southwest Research Station, Albany, CA. [2]The Watershed Nursery, Richmond, CA. [3]Santa Clara Valley Water District, San Jose, CA. [4]Golden Gate National Parks Conservancy, San Francisco, CA. [5]University of California, Cooperative Extension, Marin County, Novato, CA. sfrankel@fs.fed.us.

In 2013, Bay Area vegetation ecologists first recognized the inadvertent introduction of *Phytophthora* pathogens on outplanted native plant container stock in restoration sites. Over the past several years, Phytophthoras have been found to be common on California native plant nursery stock, with more than 40 *Phytophthora* species recovered from plants in 22 different host families, and the pathogen detected from 75% of the nurseries that voluntarily provided samples. Coming nearly two decades after the outbreak of the sudden oak death pathogen (*P. ramorum*), these detections heighten concerns that the nursery to wildland invasive species pathway may once again, unintentionally, initiate an uncontrollable, wildland plant disease epidemic. To address these recent introduced soilborne *Phytophthora* detections, land managers have suspended some plantings, cancelled nursery stock orders or solarized sites to clean-up contaminated areas, but have achieved only partial eradication. However, discontinuing planting, or switching to direct seeding, is not an ideal long-term approach to *Phytophthora* prevention since many of the benefits of restoration may become more challenging to achieve or be significantly delayed without the use of nursery stock. Determined to protect native plant habitats, including areas that support threatened and endangered species, the Phytophthoras in Native Habitats Work Group, www.calphytos.org, formed to provide technical assistance, develop strategies and techniques to support adaptive integrated pest management and assist the restoration industry. An interdisciplinary, collaborative group process is being used to formulate and implement best management practices for restoration nursery production, planting, site maintenance and field worker sanitation. Additionally, a restoration nursery accreditation pilot program is underway to ensure the health of restoration nursery stock. We invite you to join this effort to address the complex issue of *Phytophthora* species in California native plant nurseries and restoration sites.

How are functional traits related to the invasibility of a restored plant community? Jennifer Funk[1]*, Sarah Kimball[2], Travis Huxman[2], Megan Lulow[2], Gregory Vose[2]. [1]Chapman University. [2]University of California, Irvine. jlfunk@chapman.edu.

Trait-based ecology has emerged as an effective method for predicting population dynamics, outcomes of competitive interactions, and response to global change, using a few simple measurements that are available in online databases. Yet trait values scaled to the community level have failed to reveal universal patterns regarding community persistence. This is particularly important in restoration ecology, where a common goal is to establish a native community that is resilient to invasive species. Here, we use existing large-scale ecological restoration efforts in southern California, combined with metrics of subsequent invasibility and trait values of natives to identify trait values that most strongly influence invasibility. We established plots in two different ecosystems: coastal sage scrub and grassland. We used seven unique seed mixes, including four in the coastal sage scrub community (grasses, forbs, shrubs, and all combined), and three in the grassland community (grasses, forbs, and both combined). We measured the number of seedlings and adults, and several performance metrics for *Brassica nigra* (the most abundant non-native species at our study site). We collected seed, leaf, and root trait data on adult plants near the restoration site. Species mix influenced invasion resistance, but this was more strongly tied to life history (e.g., shrub, forb) than functional traits. Overall, native grasses provided the weakest resistance to invasion. Functional dispersion and community weighted mean trait values showed few correlations with *B. nigra* performance. Plots with high carbon assimilation traits resulted in high invader performance. Plots with low specific leaf area, thick roots, and big root systems (e.g., shrubs) resulted in high invader density and low individual invader biomass. It is possible that the more stress-tolerant native shrubs were most resistant to invasion because they are best able to survive despite resource extraction by invaders.

Warm temperatures increase biomass production of seedlings: implication for management of *Ludwigia hexapetala* and *Ludwigia peploides* subsp. *montevidensis*. Morgane Gillard[1,2]*, Brenda J. Grewell[1], Caryn J. Futrell[1], Carole Deleu[3] and Gabrielle Thiébaut[2]. [1]USDA-ARS Invasive Species and Pollinator Health Research Unit, Department of Plant Sciences, University of California, Davis, CA. [2]ECOBIO, UMR 6553 CNRS, Université de Rennes 1, Rennes, France. [3]IGEPP, UMR 1349 INRA, Université de Rennes 1, Le Rheu, France. mgillard@ucdavis.edu.

Perennial Uruguayan primrose-willow (*Ludwigia hexapetala*) and creeping water primrose (*L. peploides* subsp. *montevidensis*) are invasive in both the US and Europe. These two macrophyte species spread mainly through clonal fragments, but also invest a lot of energy towards sexual reproduction. Moreover, they have been shown to exhibit greater recruitment from seedlings in disturbed habitats. Thus, seed germination and early seedling growth represent key components of the ecology of invasive *Ludwigia* spp.. In this study, we compared the emergence, survivorship and growth of seedlings grown in two outdoor experimental gardens: one under Oceanic climate in France, and one under Mediterranean climate in California. The seeds had been collected from populations in both of these two contrasted climates. The experiment lasted 6 weeks from May through June 2016, during which the average air temperature recorded was 5.6°C greater in the Mediterranean garden. Our results showed that these warmer conditions increased or maintained germination percentages and velocity, decreased survivorship of germinants, but increased their production of biomass in the seedling life stage by 6.7 times. These results highlight that under current climate, in California water primroses can grow easily and fast from the seeds they produce. With continued climate warming, greater hydrologic drawdown along lakes and rivers is predicted. With this disturbance we expect an increase in moist soil habitat that will promote greater germination, emergence and growth of *Ludwigia* spp. from seed banks. Results suggest sustainable management of these species must consider their capacity for sexual reproduction that can be enhanced under warming conditions. For effective management, *Ludwigia* spp. biomass should be removed or suppressed before late flowering stage to prevent annual seed production and seed bank augmentation, and managers must plan for long term management response to seed bank emergence.

Persistence of soil legacy effects and the role of secondary invaders in limiting reforestation success following the removal of Cytisus scoparius a widespread nitrogen-fixing invasive shrub, Sara Grove[1], Karen Haubensak[2], and Ingrid Parker[1], [1]University of California, Santa Cruz, CA., [2]Northern Arizona University, Flagstaff, AZ. sgrove@ucsc.edu

It is typically assumed that once an invasive species is successfully removed, the impact of that species on the community is also eliminated. However, invasive species may change the environment in ways that persist, as legacy effects, long after the species itself is gone. To evaluate the persistence of soil legacy effects following the removal of *Cytisus scoparius*, an invasive N-fixer, we implemented a randomized blocked field experiment. We killed *Cytisus* using herbicide in one randomly selected plot per block, so that by the end of 5.5 years of removal treatments *Cytisus* had been absent from plots for 64, 43, 17, 15, 12, 10 and 7 months. We also had a treatment where *Cytisus* was left unmanipulated. After the final *Cytisus* removal treatment, we planted Douglas-fir seedlings into all plots, measured available nitrogen and phosphorus and implemented a competitor removal treatment to determine if the competitive effects of secondary invaders change over time following *Cytisus* removal.

Douglas-fir seedlings planted into sites where *Cytisus* had been removed longer ago had lower survival. The negative effect of time following *Cytisus* removal on seedling survival was small when the secondary invaders were removed. However, where the secondary invaders we left intact the negative effect of time following *Cytisus* removal is greatly exacerbated. Overall seedling survival was 26% higher in the absence of secondary invaders. Soil nitrogen availability decreased with time following *Cytisus* removal, and was likely used by the fast growing secondary invaders, whose abundance increased with time following *Cytisus* removal. Rather than providing a lasting positive fertilization effect on native vegetation, our results suggest that N enrichment associated with *Cytisus* instead favors the invasion of fast-growing, nitrophyllic exotic grasses and forbs and that these species can limit reforestation success in areas invaded by *Cytisus scoparius*.

New Tools for Thoroughwort Management. Elliot Gunnison[3]*, Alison Forrestal[1], Tom Reyes[2], Danny Franco[3], Bree Hardcastle[4], Joe DiTomaso[5], Guy Kyser[6] . [1]Golden Gate National Recreation Area, Sausalito, CA. [2]MidPeninsula Regional Open Space District, Los Altos, CA. [3]Golden Gate National Parks Conservancy, San Francisco, CA. [4]California State Parks, Bay Area District, Petaluma, CA. [5]Retired. [6]University of California Cooperative Extension, Davis, CA. Alison_forrestel@nps.gov.

Thoroughwort (*Ageratina adenophora*) is an invasive perennial shrub with the ability to invade a variety of habitats including coastal scrub and riparian areas. Golden Gate National Recreation Area has been managing thoroughwort in Marin County since the late 1990s primarily using a combination of foliar treatments with glyphosate and hand pulling. Due to the high costs of follow-up and inconsistent results with these approaches, the National Park Service, California State Parks and the Golden Gate National Parks Conservancy partnered with UC Cooperative Extension to study the efficacy of different herbicide formulations on thoroughwort in coastal scrub. The study compared 13 different treatments over two seasons. Two herbicide formulations showed both effective control of mature plants and suppression of seedling germination: 0.3% aminocyclopyrachlor (Method), and 2% glyphosate (Roundup) + 0.25% aminopyralid (Milestone). These formulations are now being used for thoroughwort treatment on NPS and California State Parks lands in Marin County, CA.

***Phytophthora* impacts to endangered pallid manzanita in the East Bay Regional Park District.** Michele Hammond, East Bay Regional Park District, Oakland, CA. mhammond@ebparks.org

The East Bay Regional Park District (EBRPD) manages maritime chaparral with a state endangered plant, pallid manzanita (*Arctostaphylos pallida*), within a context of wildland-urban interface and fuels management. In 2017, pallid manzanita populations were surveyed for overall population health and plant pathogens. Results show impacts to pallid manzanita populations from multiple *Phytophthora* species as well as invasive plants, drought, and conversion to oak woodland. Mortality of pallid manzanita and other chaparral species, including chinquapin (*Chrysolepis chrysophylla var. minor*) and huckleberry (*Vaccinium ovatum*), was documented. Fuels management potentially can be used to assist the recovery of this plant community.

The economic impact of selected invasive species to Washington State. Greg Haubrich, Washington State Department of Agriculture, Yakima, WA. ghaubrich@agr.wa.gov

Invasive species are non-native organisms that cause economic or environmental harm and are capable of spreading to new areas of the state. Invasive species harm Washington State's landscapes, ecosystems, agriculture, commerce, recreation, and sometimes human health. The damages from invasive species can translate into economic losses for communities and businesses. Often the environmental harm caused by these species is well known and documented, however the economic impacts in general are less understood and often difficult to define.

In 2016, the Washington State Department of Agriculture, Washington State Noxious Weed Control Board and the Washington Invasive Species Council worked with Community Attributes Incorporated (CAI) to analyze how invasive species economically affect Washington State. Additional funding for the work was provided by other state agencies.

While there are more than 200 known invasive species found within or near Washington State, the economic analysis highlights the damages and potential impacts that could result if 23 of these plant and animal species were allowed to spread in Washington in a single year. The study looked specifically at fifteen noxious weeds, four insects, two mussels and two mammals. Without prevention and control, the selected invasive species could have a total impact of $1.3 billion dollars annually.

An addendum to the economic analysis was undertaken in 2017 to evaluate the economic impacts of invasive knotweeds at a county level. The findings are helping county and other local stakeholders and policymakers understand the potential costs of invasive knotweed and assist them with county level planning. Additional species may be analyzed at this level in the future.

Additional species will be added (as funding for this work is identified) using the same or similar analysis tools with flowering rush (*Butomus umbellatus*) due in late 2018 or early 2019.

Washington State noxious weed program. Greg Haubrich, Washington State Department of Agriculture, Yakima, WA. ghaubrich@agr.wa.gov

Protecting the agriculture, environment, and economy of Washington State from the deleterious impacts of noxious weeds are integral to the mission of Washington's noxious weed program. It takes a coordinated and extensive network of federal, state, local, tribal and private partnerships to control noxious weeds and we are working together to achieve great things to preserve and protect our land, resources, businesses, and natural areas.

Washington State has been a national leader in its creation of noxious weed laws and a statewide infrastructure to implement these laws. Washington's first weed law was enacted in 1881, when it was still a territory, to fight the spread of "Chinese and Canada Thistles" accidentally introduced by early settlers. The Washington State Department of Agriculture (WSDA) was formed in 1913 and formed the first weed districts in 1921 primarily to begin to address Scotch Broom and frankly that hasn't gone so well. In the late 1960's, the state legislature established the Washington State Noxious Weed Control Board (WSNWCB) and authorized counties to establish County Weed Boards and Districts. Thirty-eight of Washington's 39 counties now have such boards.

The state utilizes a tiered weed classification system (as does California) that is currently comprised of 153 different noxious weed species. This list is annually reviewed, and revised if needed, by the WSNWCB. The board also oversees a monitor list that includes species of concern that are being monitored for potential inclusion on the state noxious weed list. WSDA administers a quarantine list that makes it illegal to buy, sell or transport any plant or plant parts of 88 distinct weed species.

This talk will briefly explain and review Washington's noxious weed program and highlight a few of our more successful and innovative projects including one of the largest and most successful weed eradication efforts in the United States and a cooperative inventory and mapping project that is allowing our program and our cooperators to make better management decisions.

What are we trying to say and who's listening? Communication considerations in invasive plant management. Rachel Kesel [1]. One Tam, San Rafael, CA. rkesel@onetam.org

In an era of distraction and information overload, land managers must compete for the attention of policy makers, funders, and the public. The demand to communicate science in sound bites raises the stakes for practitioners and advocates. Given this complicated

social environment, effective messaging is critical to conservation success.

Messaging that emphasizes natural resource protection, utility provisioning, fuels reduction, or visitor access gives the audience a reason to care about invasive plant management. Rather than focusing solely on the negative impacts of weeds, turning attention to the value of a resource puts stakeholders on common ground with agencies and advocates. This framework of placing invasive plant management into a larger context of land management and resource protection also allows managers to demonstrate their depth of knowledge and stewardship to the public and policy makers. Building respect and trust in these arenas pays off when sticky situations arise.

The language of invasive plant management is evolving as the discipline matures both in science and in public discourse. Inclusive language and thoughtful metaphors open doors to new audiences, and ensure that messaging does not unintentionally shut out stakeholders. Reaching a broad cross section of Californians is key to conserving wildlands. Framing invasive plants in terms of their impacts to systems, rather than their nativity or point of origin, clarifies resource protection goals and minimizes misunderstandings about the need to manage invasive plants. Several effective outreach campaigns offer helpful models to organizations crafting a fresh message.

Training staff is critical to ensuring consistent messaging across organizations and partnerships. Field staff and environmental educators make indelible impressions on the public. Staff in leadership positions craft and share the vision of organizations. Key messaging elements should resonate from the bottom to the top.

WMA case study: Nevada-Placer and Lake Tahoe Basin regional invasive plant control in the Sierras. Ed King, Placer County Agriculture, Weights & Measures. eking@placer.ca.gov

The Nevada-Placer Weed Management Area and the Lake Tahoe Basin Weed Coordinating Group have remained active and even thrived in recent years despite lack of support, coordination and leadership from a statewide weed management area (WMA) program. Since 2011, when the California Department of Food and Agriculture (CDFA) disbanded its WMA program due to forced budget cuts, both groups have persevered by securing funding from diverse sources, promoting interagency cooperation, sharing resources, facilitating joint prioritization efforts and refusing to relinquish on-the-ground successes achieved in the early 2000s when the state WMA program prospered. Local WMA efforts have continued to prevent yellow starthistle from invading the Lake Tahoe Basin, Scotch thistle from encroaching into mountain meadows, spotted knapweed from moving westward on the I-80 corridor, and Dyer's woad from infesting burned forest lands. The California Invasive Plant Council has advocated for restoration of CDFAs WMA program to promote similar strategic efforts throughout the state. In 2018, Cal-IPC with a supporting coalition of over 80 organizations, lobbied the state legislature to renew WMA funding and reestablish a coordinated statewide approach to invasive plant management. This endeavor is poised to be the first step in rebuilding California's well-proven WMA network.

Integration of propagule pressure and functional traits to promote restoration through native annual forb reestablishment. Sierra Lauman[1]* and Erin J. Questad[1]. [1]California State Polytechnic University, Pomona, CA. stlauman@cpp.edu.

The success of invasion by non-native species is mediated by numerous ecological factors, both abiotic and biotic, which together constitute the ecological resistance of an ecosystem. The supply of invader propagules, or propagule pressure, has consistently shown to be related to levels of community invasibility and serves as a strong predictor of invasion success, as increased levels of propagule pressure may overcome high invasion resistance. The role of propagule pressure in invasion success is known to be affected by the traits of the arriving species, the traits of the resident species, and the abiotic conditions of the novel environment. Few studies have investigated the interactions of these factors. Further, whether the principle of propagule pressure can be applied in the context of restoring invaded habitats has been studied minimally. Using a multispecies sowing experiment, I will evaluate whether the relationship between propagule pressure and invasion success applies to native species, allowing them to overcome competition with invasive species to restore invaded habitats. I will also investigate how the functional composition of the invasive community will affect the success of native reestablishment at varying propagule pressures. Integrative studies of the mechanisms determining invasion success may increase the understanding of how these processes may affect the restoration of invaded communities through the re-invasion of native species.

The effectiveness of applied nucleation, seeding, and mowing in restoring California coastal prairies. Josephine Lesage[1]*, and Karen Holl[1]. [1]Enviornmental Studies Department, University of California, Santa Cruz, CA. jclesage@ucsc.edu

Restoration efforts in California's grasslands attempt to increase native species richness and cover in a matrix of dominant, highly invasive exotic annual species. Directly planting greenhouse grown plants is costlier than seeding, but seeding can be ineffective, and land managers must balance resource budgets with likely outcomes. This study examines the long-term establishment and growth of restored native species in an invaded prairie, using three restoration planting techniques along a resource gradient (full planting, 'island'-style planting, and seeding) and two management treatments (with and without mowing), eight years after initial planting. We found that native grass cover was greater in the mowing treatment plots, and marginally greater in the full-planting plots than in the island-planting plots, but accounted for only 5-10% of the cover in most of the plots where grasses were planted. For native forbs, island-plating and full-planting plots had similar levels of cover after seven years, and there was no effect of mowing, accounting for 30-35% of the cover in most plots where it forbs were planted. We recommend the use of island-plantings for natives forbs, especially those that grow rhizomatously or spread aggressively, such as *Achillea millefolium* and *Symphyotrichum chilense*. Neither full-planting nor island-planting resulted in high levels of native grass cover, through mowing appears to benefit the native species.

Temperature dependent influence of fungi on seed mortality suggests differences in seed bank persistence between Sahara mustard in California and Arizona. Yue M. Li[1,2]*, Justin P. Shaffer[3,4], Brenna Hall[2],Hongseok Ko[2], A. Elizabeth Arnold[2,3]. 1. School of Natural Resources and the Environment, University of Arizona, Tucson, AZ. 2. Department of Ecology and Evolutionary Biology, University of Arizona, Tucson, AZ. 3. School of Plant Sciences, University of Arizona, Tucson. 4. Division of Biological Sciences, University of California, San Diego, La Jolla, CA. max.liyue@gmail.com.

Field studies in southwestern Arizona and in Australia show high germination rates and low survival rates of seeds of Sahara mustard (*Brassica tournefortii*), suggesting weak seed banks of this invasive winter annual species. Nevertheless, Sahara mustard populations persist in California after multiple dry winters, suggesting stronger seed banks that may be attributed to climatic differences. We isolated fungi that naturally colonize seeds of Sahara mustard in soils in Tucson, Arizona, and evaluated their impact on seeds of Sahara mustard and a native winter annual (*Plantago ovata*) under simulated summer and winter temperatures. Several fungal strains induced higher seed losses of Sahara mustard than the native *P. ovata in vitro*. Moreover, these fungi induced seed losses only in the summer temperature regime, despite that they were active in both summer and winter temperatures. This finding suggests that fungal activities during summer rains may play an important role in increasing seed mortality of Sahara mustard. With less summer rain in California, Sahara mustard seed banks can be more persistent than those in Arizona. Controlling Sahara mustard in regions of little summer rainfall must rely on persistent treatment of its germinated individuals.

IPM building blocks to control invasive shot hole borers – Fusarium dieback. Shannon C. Lynch[1]*, Richard Stouthamer[2], Akif Eskalen[3], Gregory S. Gilbert[1]. [1]University of California Santa Cruz, Department of Environmental Studies, Santa Cruz, CA. [2]University of California Riverside, Department of Entomology, Riverside, CA. [3]University of California Davis, Department Plant Pathology, Davis, CA. sclynch@ucsc.edu.

The viability of oak and riparian communities in southern California is threatened by an emergent pest-disease complex involving two invasive shot hole borers (ISHB, *Euwallacea* n. *fornicatus*), each associated with specific fungal pathogens (*Fusarium euwallaceae* and *F. kuroshium*) that cause Fusarium dieback (FD) on 64 tree species. As part of a multi-campus and multi-agency collaborative effort, we are developing essential building blocks for integrative pest management (IPM) in native vegetation, urban forests, and avocado growing regions of California. The fundamental IPM components include 1) rapid early detection and identification tools; 2) identifying which habitats are most vulnerable to ISHB – FD and most important in its spread; 3) evaluating preventive and curative control options appropriate for different habitat types; 4) training users to identify ISHB symptoms and implement appropriate control measures; 5) evaluating and improving IPM strategies with managers in an iterative process. In July – November 2017, we established a network of 260 0.25-ha monitoring plots throughout infested and non-infested urban-wildland forests and avocado groves to determine which factors control the landscape spread of ISHB – FD.

We are measuring vegetation and landscape characteristics, microclimate, and resident beneficial microorganisms across sites. Our preliminary data suggest that xylem-limited bacterial endophytes collected from healthy trees in diseased sites inhibit growth of the fusaria pathogens. Given that the beetles survive by feeding on their fungal symbionts exclusively, microbes interfering with fungal growth thus protect individual plants, potentially reduce disease spread, and present biocontrol opportunities. By combining these survey data with what we know about host range into a risk model, we will interpolate likely areas of spread into an interactive map tool to aid managers with decision-making. This adaptive model, continuously improved with new survey data and field testing, will help prioritize management efforts to specific sites and avoid unfruitful efforts in low priority sites.

The U.S. Marine Corps versus the Sahara mustard. Jim Malusa* and Max Li. School of Natural Resources and the Environment, University of Arizona, Tucson, Arizona, 85721. malusa@email.arizona.edu

Up-to-date spatial data is key to controlling any invasive, particularly if your method of control is seek-and-destroy. In the case of the invasive Sahara mustard on the Barry M. Goldwater Range in southwestern Arizona, the problem was in coordinating the seekers and the destroyers. The solution was a simple phone app. Previous control efforts by the range managers, the United States Marine Corps, have been thwarted by logistics: the people most likely to encounter the mustard – the range wardens – were not certified to spray glyphosate, the most effective control method. In contrast, the National Park Service (NPS) Exotic Plant Management Team based in Boulder City, Nevada, gladly takes on the task of spraying – if they know where to go. A cloud-based mapping app called GISCloud, which works on Android or Apple phones, allows the user to customize the data collection form. We opted for the simplest possible: it takes about one minute to collect a datum, which includes a geo-referenced photo, and optional audio recording of observations. The phone stores the data locally until within range of a cell tower or wireless network, then uploads the data to a base map. The map is thus updated on-the-fly by the wardens, who are in the field daily. Quality control is the responsibility of the project manager. Everyone else, from the wardens to the NPS weed killers, need only to visit the webpage at https://editor.giscloud.com/ and type 'Goldwater' in the field called Search Maps. No password required. To limit costs, the GISCloud subscription can be deactivated during the dry season. Total costs of this survey method, including GISCloud subscription and service for 4 phones, but not including purchase of phones, is $1500/year, based on six months of active use during the wet seasons. A full year's service would be $2000.

Managing invasive sea lavender at Bothin Marsh using hand removal and flaming. Tatiana Manzanillo, Pete Frye. Marin County Parks, San Rafael, CA. tlmanzanillo@gmail.com

Bothin Marsh is an open space preserve in Marin County that provides a unique salt marsh habitat for a variety of native species and recreational opportunities to locals and visitors alike. Marin County Parks staff manage for a few invasive sea lavender species (*Limonium ramosissimum, Limonium duriusculum, Limonium binervosum*) at this preserve as part of a San Francisco Bay Area wide eradication effort. For the last few years, staff have only utilized hand removal for these species in areas that did not have a high density of individuals. Recently, with the addition of taking on a new area to manage, staff have begun to use propane torches as a viable method of treating higher density patches. The results for flaming invasive sea lavender at a higher intensity than a lower intensity for one season yields a -99% change and -40% change in number of individuals respectively, with hand pulling at a -50% change. The use of propane torches has also been shown to reduce the amount of staff time spent on restoration while also increasing the number of acres treated.

The spread, ecology and challenges to control of the marine invasive seaweed *Sargassum horneri*. Lindsay Marks, National Oceanic and Atmospheric Administration Channel Islands National Marine Sanctuary, Santa Barbara, CA. lindsay.marks@noaa.gov

Sargassum horneri is a seaweed native to eastern Asia that was discovered in the Port of Long Beach in 2003. It has since spread aggressively throughout southern California, USA, and Baja California, Mexico, causing concern over its potential ecological impacts and generating interest from resource managers in controlling its spread. In this talk, I will describe the spatial and temporal invasion of *S. horneri* and discuss factors that promote its spread and persistence. I will also share some challenges associated with controlling marine invasive seaweeds, strategies used with other seaweed invasions, and results from an experiment testing the efficacy and feasibility of controlling *S. horneri* through removal.

Ecological impacts and management of the Argentine ant (*Linepithema humile*, Mayr) in California. Korie C. Merrill[1]. [1]Center for Natural Lands Management, Temecula CA. kmerrill@cnlm.org

The Argentine ant (*Linepithema humile* Mayr) can be a destructive species. Originally from South America, this species has been directly and indirectly affecting ecosystems it has been introduced to globally. In particular, research in California has shown the negative impacts to native insect-plant symbiosis, arthropod communities and vertebrate species caused by the Argentine ant. As land managers, restoration ecologists and weed scientists the Argentine ant is something we need to be conscious of, not only for successful conservation and restoration but in preventing the spread of this invasive species to ecologically sensitive areas. I will discuss the ecological impacts of the Argentine ant as well as the current methodologies for controlling the species in natural landscapes; which are being conducted by pest control specialist and researchers around the world.

Lessons learned: Goats, goatgrass, fire, and fuel reduction. Sarah Minnick[1]* and Pete Frye[1]. [1]Marin County Parks, San Rafael, CA. sminnick@marincounty.org.

For 14 years Marin County Parks has been working to control the county's largest known population of barbed goatgrass (*Aegilops triuncialis*). In 2018, as part of a regional fuel-reduction partnership with adjacent landowners, goat grazing was introduced for the purposes of fuel reduction and weed control. Grazing is now one of a variety of techniques being used on goatgrass as part of an Integrated Pest Management (IPM) program. Other methods incorporated into treatment include string trimming, hand pulling, controlled burns, propane flaming, and herbicide application. Techniques are used in succession to accomplish a variety of initial and follow-up treatments within each treatment year. Challenges include lack of sufficient biomass when burning in serpentine grasslands, logistical hurdles of staffing and carrying out controlled burns, difficulty detecting a few grass plants in a sea of grasses, and lots of labor needed to accomplish initial and follow-up treatments within the same season. Based on initial observations, grazing is effective at reducing goatgrass and in making the target species easier to detect during subsequent follow-up treatments. Overall, successive years of controlled burning is considered the best treatment; even a single year burn can be very effective at reducing density. Timing is critical for all treatments, and we found that grazing intensity also plays an important role. The addition of grazing to the treatment plan brought new challenges, like meeting phenological deadlines to prevent seed-set and managing interactions between preserve visitors and the herding operation. Also, during implementation of such a large project with objectives for both weed control and fuel reduction, one objective sometimes suffered at the expense of the other. However, the addition of grazing was well-received by the public and was effective at enhancing our ability to detect and control goatgrass, making it worth adapting for use in future treatment years.

Mapping waterhyacinth (*Eichhornia crassipes*) drift and dispersal in the San Joaquin Delta using GPS drogues. John Miskella* and John D. Madsen. USDA-ARS Aquatic Weed Lab, Davis, CA. jmiskella@ucdavis.edu.

Waterhyacinth (*Eichhornia crassipes* (Mart.) Solms)) is a perennial free-floating aquatic plant species native to South America that has become invasive in the Sacramento-San Joaquin Delta in California. From June 2016 to Feb 2018, the effect of wind, tidal movement, and mass flow on the dispersal of waterhyacinth mats in the Delta was studied. Drogues were deployed to track the movement of waterhyacinth mats. Each drogue was comprised of a 2000mL Nalgene bottle containing a radio collar and a GPS-based recording device. Drogue location and movement was recorded at 15-second intervals during a 2 to 4 hour run on a Trackstick GPS device and downloaded into Trackstick Manager 3.1.1 (Telespatial Systems, 2011). The data were tested to determine whether the size (m^2) of a plant mat had a significant effect on the distance traveled (miles), using ANOVA to detect differences ($P \leq 0.05$), with significant effects evaluated with Tukey's HSD test ($P \leq 0.05$). There was no significant difference in distance between plant mats of different sizes ($F = 1.88$, $p = .0867$). The water discharge, in ft^3/s, was obtained from USGS stream gages located throughout the Delta. The movement of each drogue was compared to the wind and water movement during the period the drogue was deployed. The plant mat direction, recorded as a compass heading, was compared to the direction of the water movement using simple linear regression (SAS 9.4, 2012). The direction of water movement explained a significant proportion of the variance in direction ($R^2 = 0.8218$, $F(1, 77) = 355.07$, $p < .0001$). The plant mat direction was also compared to the heading of the wind movement using simple linear regression. The direction of wind movement failed to explain a significant proportion of the variance in direction ($R^2 = .0163$, $F(1,77) = 1.28$, $p < .2617$).

Evolution of an invasive plant control program, the adoption of early detection and rapid response. Milan Mitrovich. Natural Communities Coalition, Irvine, CA. mitrovich@occonservation.org.

Implementation of the invasive plant control program for the Natural Communities Coalition (NCC) requires multi-agency coordination and collaboration. Since the formal program was initiated in 2000, close to $3.5M in funds have been spent on implementation, resulting in spot application of herbicide to thousands of individual plants and reduction of target invasive species from thousands to hundreds of acres across the 38,000-acre habitat reserve of the County of Orange Central and Coastal Subregion NCCP/HCP. With the creation of a Core Management Team in 2016, consisting of representatives from State Parks, OC Parks, and the Irvine Ranch Conservancy, coupled with advanced planning conducted under the guidance of the California Invasive Plant Council, the program is evolving, with expansion of the list of priority species and creation of a new firewall to prevent the presence and establishment of problematic emergent species. The resulting, comprehensive-nature of the early detection and rapid response (EDRR) program is a first for the region. The first expression of the program occurred in 2017 following the hiring of a biologist to conduct botanical surveys to detect and confirm new and existing populations of emergent invasive species within the coastal portion of the Subregion. Fieldwork resulted in approximately 250 miles of trails being surveyed on foot. A total of 44 priority emergent weed species were detected accounting for close to 1,700 new records. All information associated with the finds were uploaded to Calflora's Weed Manager for sharing with the respective land manager and communication to the rapid response contractor on-call, and under contract with NCC. Throughout the 2017 season, the emergent invasive plant control contractor treated new discoveries (and performed wider surveys of the immediate surroundings) of high-priority species found during early detection surveys ensuring a rapid response and providing the greatest likelihood of successful containment of otherwise problematic invasive plant populations. Lessons learned from 2017 are being applied to the 2018 field season as the EDRR program enters its second year and is expanded to include the inland portion of the Subregion.

Revegetating medusahead (*Taeniatherum caput medusae*)-invaded rangeland. Aleta Nafus[1]* and Kirk Davies[2]. [1]Bureau of Land Management, Las Vegas, NV. [2]USDA-Agricultural Research Service, Burns, Oregon. anafus@blm.gov

Successful establishment of perennial vegetation, particularly bunchgrasses, can promote long-term (> 5 year) community resistance to medusahead re-establishment following successful herbicide treatments. On medusahead-invaded sites where perennial bunchgrasses are not successfully established in sufficient densities, medusahead can more quickly recover to become the dominant vegetation. Coating the seeds of native perennial bunchgrasses with activated charcoal may allow for seeding of desirable vegetation species simultaneously with pre-emergent herbicide treatments, thereby allowing for earlier and more successful establishment and longer-term treatment effectiveness. Regardless of successful perennial vegetation establishment, a single treatment is unlikely to provide complete rehabilitation and subsequent treatments may be necessary. However, successful establishment of perennial bunchgrasses can increase the interval between re-treatments and decrease the amount of area where re-treatment is necessary.

Wrinkles in Sea to Summit Gradients and the Marvelous Mosaic of Vegetation Types in the Monterey Bay Region. Nicole Nedeff, California State University Monterey Bay, School of Natural Sciences. Marina, CA. nikki@ventanaview.net.

The Central Coast's unique geography and geologic history create a heterogeneous environment that supports a remarkable diversity of species, habitats and natural communities. Local topography, geology, soils and climate, combined with episodic catalysts of ecological change, have created complex physical patterns in the regional landscape and an interrelated mosaic of diverse vegetation types. From the dunes in Marina and Elkhorn Slough estuarine habitats that fringe Monterey Bay, to the stands of sugar pine and bristlecone fir forests on peaks in the neighboring Santa Lucia Range, there are endemic plants and associations found nowhere else in the world except in California's Central Coast region. The high degree of plant richness and rarity reflects our exquisitely complicated landscape, including along the ecological staircase where Monterey cypress, Gowen cypress, Monterey and Bishop pine grow with endemic manzanitas in Maritime Chaparral, as well as with wetland indicators on ancient geomorphic surfaces.

Notable native plant invasion on marine terraces is occurring in places where Torrey pine is recruiting into Maritime Chaparral and changing the character of one of the most unique vegetation types in the region.

Alligatorweed in the Delta, an early detection/rapid response story. Jon O'Brien, Senior Environmental Scientist, CA State Parks, Division of Boating and Waterways, Sacramento, CA. Jon.OBrien@parks.ca.gov

Aquatic plant management in the California Sacramento-San Joaquin Delta (Delta), and its tributaries, and Suisun Marsh have been conducted since 1982 by the California Parks and Recreation Division of Boating and Waterways (DBW). The aquatic plant management program utilizes chemical, physical and biological control methods as a part of Integrated Pest Management (IPM) in the Delta, which is approximately 68,000 acres plus 31,000 acres in Suisun Marsh. DBW targets eight invasive aquatic plant species including waterhyacinth (*Eichhornia crassipes)* and Brazillian waterweed (*Egeria densa)*. In September 2017, a new aquatic invasive species, alligatorweed (*Alternanthera philoxeroides*), was identified in the Suisun Marsh area of the Delta. Alligatorweed is a highly invasive floating aquatic plant from South America. DBW has worked with multiple agencies to obtain the necessary permits and permissions to treat the new weed. In November 2017, alligatorweed was officially designated an invasive species of concern in the Delta by the CA Department of Fish and Wildlife. In February 2018, DBW was given federal permission to control the plant. In the spring of 2018, DBW began treating alligatorweed in an effort to eradicate the known populations from the Delta. DBW is conducting ongoing monitoring to identify other populations of the invasive species in the Delta for treatment. The goal is to utilize early detection/rapid response techniques to keep alligatorweed from becoming another floating waterhyacinth in the California Delta.

Restoring critical coastal dune habitat at Point Reyes for threatened and endangered species. Lorraine Parsons[1*] and Cody Ender[2]. [1]Point Reyes National Seashore, Point Reyes Station, CA. [2]Point Reyes National Seashore Association. Point Reyes Station, CA. Lorraine_Parsons@nps.gov.

Point Reyes National Seashore preserves some of the highest quality coastal dune habitat remaining. However, dunes are threatened by continued encroachment of two invasive, non-native plant species, European beachgrass (*Ammophila arenaria*) and iceplant (*Carpobrotus* sp.). By 2004, more than 60% (1,400 acres) of the park's coastal dune, bluff, and scrub were dominated by these species. Several federally listed species occur in the dunes, including Western snowy plover, Myrtle's silverspot butterfly, California red-legged frog, and three plants. At least one of plant species (Tidestrom's lupine; *Lupinus tidestromii*) has a number of populations that are threatened with extirpation due in large part to heavy seed predation by native deer mice that live in higher-than-normal densities in European beachgrass. In efforts to help in recovery of listed species, the Seashore has conducted dune restoration since 2000. Dune restoration efforts are complicated by the deep and/or extensive root systems of invasives, as well as their propensity for rapid expansion sexual and asexual reproduction. The Seashore has experimented with a number of removal methods, including manual and mechanical removal and herbicide treatment. The ecological results – and associated impacts -- of these different approaches have varied tremendously. In addition to continued re-treatment of primary invaders, the park has also had to contend with a wave of secondary invasion as restoration creates open areas ripe for establishment by "new" invasives such as European searocket (*Cakile maritima*) and New Zealand spinach (*Tetragonia tetragonioides*). Unfortunately, secondary invaders are also appearing in native dune areas where invasives were formerly uncommon because of frequent disturbance from shifting sands originating from restored dune areas. Ultimately, the Seashore must balance the need to improve natural dune processes and functions – particularly given threats from climate change -- against the need of minimizing impact to other resources in and adjacent to the dunes, including ranching.

Assessment of soilborne *Phytophthora* pathogens at restoration sites in the Midpeninsula Regional Open Space District. Ebba Peterson[1]*, Amanda Mills[2], Cindy Roessler[2], and Jennifer Parke[1,3]. [1]Oregon State University Dept. of Botany and Plant Pathology, Corvallis, OR. [2]Midpeninsula Regional Open Space District, Los Altos, CA. [3]Oregon State University Dept. of Crop and Soil Science, Corvallis, OR. peterbb@science.oregonstate.edu

Since the introduction of *Phytophthora ramorum*, causal agent of sudden oak death, to the Bay Area, new interest has developed to assess overall *Phytophthora* diversity in native plant communities. Of major concern is the inadvertent movement of *Phytophthora* spp. from native plant nurseries into vulnerable habitats during

restoration outplantings. Root-infecting *Phytophthora* spp. are abundant within plant nurseries; their introduction can result in failed plantings, reduced natural regeneration, and further spread of *Phytophthora* into surrounding habitat. To assess this risk we performed surveys within Midpeninsula Regional Open Space District (MROSD) restoration sites with the goal of determining the presence and distribution of *Phytophthora* pathogens. Soil was collected from the base of symptomatic plants at 27 restoration plantings and 18 adjacent non-planted areas in December 2017. Soil samples were then baited for *Phytophthora*. Plant samples collected in the field and lesions from the soil baits yielded pathogenic *Phytophthora* species from 11 restoration sites and 9 non-planted sites. Species of concern include *P. ramorum*, *P. cinnamomi*, *P. cambivora* and *P. cactorum*, all of which are associated with plant decline in native plant communities. We additionally extracted DNA from a subsample of each soil sample, which was submitted to Illumina Miseq high-throughput sequencing for identification of all species present. Analysis is in progress. Given the widespread distribution of pathogenic *Phytophthora* species and the complex history of disturbance at restoration sites we cannot conclusively determine which *Phytophthora* spp. were introduced with nursery-grown plants. Nevertheless, future management of MROSD reserves and restoration projects should utilize best management practices to limit the spread of *Phytophthora* in surrounding environs.

How do invasive grass water-use strategies affect belowground ecosystem services and native shrub re-establishment? Michala Phillips*[1], and Edith Allen[1]. [1]University of California, Riverside. Michala.phillips@gmail.com

Global change contributes to shifts in vegetation composition and one important example is terrestrial plant invasion. Invasion often leads to vegetation community type conversion, such as shifts from native shrubland to invasive grassland. Chaparral was previously thought to be resilient to disturbance yet has recently undergone invasion in some areas. Invasive species often have life history traits with flexible resource acquisition strategies. Flexible responses to precipitation could make invasive species stronger competitors in a changing climate when compared to natives. In addition, invasive grasses may rapidly deplete soil moisture disrupting deep water percolation that natives depend on. We hypothesized that invasive grass density would affect restoration success through the depletion of soil moisture. We set up twenty 1m^2 restoration plots in an area of chaparral that has been type converted to exotic annual grass. In these plots, we created three levels of invasive density (0%, 50%, and 100%) by hand weeding and planted an *A. fasciculatum* seedling in each plot. We deployed soil moisture sensors at two depths in each plot to track differences in soil water percolation. In the first growing season, increased invasive density decreased native seedling survival: 100% weeded plots had 0% mortality, 50% weeded had x % and 0% weeded had 80% mortality. Also, we observed a decrease in soil moisture at 35 cm when competition occurred between invasive grasses and native shrubs. The results of this research show great potential to inform decision making in weed management and restoration efforts with increasing presence of invasive annual grasses.

First release of a shoot-tip galling fly for biological control of Cape-ivy. Scott L. Portman* and Patrick, J. Moran, USDA-ARS, scott.portman@ars.usda.gov

Cape-ivy (*Delairea odorata*, Asteraceae) is a vine-like perennial that has established in riparian and coastal scrub habitats along the entire length of the California coastline. It is now considered one of the worst plant invaders in the State because it grows and spreads rapidly, smothering native plants, shrubs, and small trees, causing significant declines in biodiversity and integrity of natural habitats. A host-specific shoot tip galling fly (*Parafreutreta regalis*, Diptera: Tephritidae), the first biocontrol agent in the world targeting Cape-ivy, has been released at ten locations on the California coast. Greenhouse studies determined that the fly is able to make galls on different accessions of Cape-ivy from California to a degree equal to, or greater than on South African native range accessions. Field releases have resulted in field galls at every site, and galls indicative of overwintering and second generation field reproduction have been found at one or more locations. Release sites continue to be monitored to determine biocontrol agent establishment.

The complexity of restoring complexity: establishing diverse native forblands in weedy grasslands. Amelia Ryan* and Brent Johnson. Pinnacles National Park, Paicines, CA. Amelia_Ryan@nps.gov

While the craggy uplands surrounding the peaks for which Pinnacles National Park was named remain remarkably pristine, recently incorporated former agricultural lands near the park's eastern entrance have

been converted to non-native annual species typical of California's interior grasslands. As with much of the state, 150 years of European-style farming, grazing, and other activities left these new lands (Pinnacles Bottomlands) with little native diversity and very high cover of yellow star thistle. Using a combination of burning and herbicide, the park has been remarkably successful at reducing cover of yellow star thistle in the Pinnacles Bottomlands, but cover of native species is low. Instead, other weedy species – particularly non-native grasses- remain behind. Historic accounts of California are redolent with references to annual wildflowers covering the valleys in huge swaths of color. These historic "forblands" (dubbed the "bee gardens" by John Muir, and providing seed that were staples in California Indian diets) were an important component of the ecosystem, but are almost completely gone, replaced by non-native annual grasslands. In the next phase of restoration, Pinnacles NP seeks to restore some part of these missing native forblands. To this end, Pinnacles NP, in partnership with UCSC and the Amah Mutsun tribal band, has conducted an experiment to determine the most effective way to establish persistent wildflower populations. Plots were subjected to either spring herbicide, spring and fall herbicide, or spring herbicide followed by fall scraping. After two years, wildflowers persisted in high numbers in all plots, but those that were scraped had significantly higher abundance of native wildflowers than other plot types. Pinnacles NP hopes to use the results of these experiments to provide guidance on how to manage these lands that would include the establishment of annual wildflowers on a larger scale.

History and background of Weed Management Areas in California 1996-2018. Steve Schoenig, California Invasive Plant Council Board Member, Davis, CA. seschoenig@gmail.com

A Weed Management Area (WMA) is a local organization that brings together landowners, land managers (private, city, county, state, and federal), special districts, and the public in a geographical area for the purpose of coordinating and combining their action and expertise to deal with their common invasive weeds. Every county in California formed or joined a WMA between 1997-2000. The state of California created a fund that dispensed up to $2 million a year to these groups for cost-share programs. For each dollar provided by the state, WMAs contributed 3 dollars in cost-share and in-kind labor. Despite wide-spread success in eradicating and controlling over a thousand populations of pioneering highly invasive weeds, the state funding was eliminated during the height of the Great Recession in 2011. A survey completed in 2017 shows that many WMAs still meet at least once a year, however the lack of funding and cessation of coordination by the California Department of Food and Agriculture (CDFA) have greatly decreased coordinated weed control projects in California.

Partnerships lifeline: Navigating private and public land projects with competing interests and a diversity of stakeholders. Bobbi Simpson. National Park Service, Point Reyes Station, CA. Bobbi_Simpson@nps.gov

Japanese knotweed (*Fallopia japonica)*, the tenth most invasive plant in the world, was first discovered in Marin County along Lagunitas Creek in 2011. This presentation will touch on the complex nature of controlling such a species on the edge of a highly valued salmonid bearing stream. This case study involves a series of elements that ramp up the complexity and navigation of management options. Lagunitas Creek is at the southern end of the endangered Coho Salmon range. Federal, state and county fish biologists have been involved in planning for several years implement restoration of this species winter habitat. Two-thousand seventeen was the first year of effective knotweed treatment and it coincided with first phase of fish habitat improvement projects. Side channels were created within known pockets of knotweed. Mitigation measures were applied, however time will tell if they were enough. Complexity is compounded by the fact that the Japanese knotweed occurs across multiple land jurisdictional boundaries. A group of invasive plant managers began meeting in 2016 and expressed concerns about the management bandwidth needed to coordinate and secure necessary permissions. Coordinating with the necessary compliance agencies and securing the support for surveys of, and treatment to over 30 private homeowner populations have challenged our ability to provide a "rapid response." Although encouraging milestones have been passed, this 3-legged table is a process based upon determination and optimism that all the parts will come together. Actions that worked or didn't work to foster collaboration will be discussed. This talk will focus on the evolution of this partnership that has recently experienced what is hopefully the threshold of support required to achieve eradication.

Recent research on invasive weeds at the European Biological Control Laboratory (EBCL). Lincoln Smith[1]*, Marie-Claude Bon[1], Gaylord Desurmont[1], Javid Kashefi[1], René Sforza[1], Mélanie Tannières[1], Massimo Cristofaro[2], Francesca Marini[2], John Goolsby[3], Brian Rector[4], Biljana Vidovic[5], Daniel E. Winkler[6], Patrick Moran[7] and Paul Pratt[7]. [1] USDA-ARS European Biological Control Laboratory, Montferrier-sur-Lez, France. [2]Biotechnology and Biological Control Agency, Rome, Italy. [3]USDA- ARS, Edinburg, TX. [4]USDA- ARS, Reno, NV. [5]University of Belgrade, Belgrade-Zemun, Serbia. [6]USGS Southwest Biological Science Center, Moab, Utah. [7]USDA-ARS, Albany, CA. link.smith@ars.usda.gov.

EBCL scientists and cooperators conduct foreign exploration to discover and help evaluate prospective biological control agents of invasive weeds. The agents we find must undergo extensive evaluation for host specificity and formal review by USDA-APHIS, USWFS and CDFA before they can be permitted for release in California. For giant reed, we have shipped scales (*Rhizaspidiotus donacis*) and the Arundo wasp (*Tetramesa romana*) for release in California and Texas, are working to develop a nematode-free colony of the leaf midge (*Lasioptera donacis*, which is permitted for release), and are studying the taxonomy and field biology of the shoot tip fly (*Cryptonevra* sp.). We have conducted biological and preliminary host specificity studies on the French broom seed-pod weevil (*Lepidapion argentatum*), and shipped them to Albany, CA for evaluation in quarantine. A field experiment to measure the interaction of a gall weevil (*Ceutorhynchus assimilis*) and a soil fungus (*Rhizoctonia* sp.) on hoary cress showed a small additional effect of the fungus. An eriophyid mite (*Aculodes altamurgiensis*) and a gall-forming wasp (eulophid) have been collected on medusahead, and the mite has been sent to Albany, CA for evaluation. The seed-feeding caterpillar (*Gymnancyla canella*) that attacks Russian thistle is being colonized to conduct further host specificity testing. We collected Sahara mustard from various countries and conducted molecular genetic analysis to determine that the population that is invading the southwestern USA probably originated from Morocco or Jordan. A seed head weevil (*Larinus filiformis*) that attacks yellow starthistle is being multiplied in quarantine to conduct further host specificity testing.

The Abiotic Mosaic of the Central Coast: Geologic Constraints and Opportunities for Native and Non-native Biodiversity Doug Smith, California State University Monterey Bay, School of Natural Sciences and Watershed Institute. Marina, CA. dosmith@csumb.edu.

The existence and aerial distribution of both native plant communities and invasive species are controlled in large part by abiotic factors. Elevation, slope, aspect, fog, precipitation patterns, geology and both natural and human disturbance are all important factors. On the central coast, the abiotic factors are exceptionally diverse in space, and have changed markedly on the scale of millions of years. A complex geologic history has resulted in a wonderful tapestry of rocks, topography, micro climates, and attendant diverse plant communities. Further plant diversity occurs where foggy coastal microclimates are driven by upwelling along the enormous Monterey submarine canyon just offshore. The Carmel watershed is an excellent local example of rapid lateral variability in abiotic conditions. Rainfall varies from 70 inches per year to 13 inches per year over several kilometers. Active faulting results in high slopes and steep elevational gradients. The geology changes on the scale of 100's of meters with numerous faults separating slivers of granite, shale, and schist. Frequent landslides, fire, and drought/flood cycles give broad opportunities for pioneer and disturbance-loving species.

Hand-Removal Method Impacts on Labor Effort, Sahara Mustard and Native Species: to Bag or Not to Bag. Lynn Sweet[1]*, Jennifer Prado[2] and Cameron Barrows[1], [1]Center for Conservation Biology, UC Riverside, Riverside, CA, and [2]Friends of the Desert Mountains, Palm Desert, CA. lynn.sweet@ucr.edu

Some of the largest-scale and most consistent efforts to control Sahara mustard (*Brassica tournefortii*) in the Coachella Valley have been hand pulling, by paid and volunteer staff. Challenges to this approach include the additional labor involved in bagging plants (per common protocol) and disposal of biomass. In the spring of 2016, we set up an experiment in the Edom Hill Conservation Area within the Coachella Valley to test the efficacy of pulling plants without bagging them, in partnership with Friends of the Desert Mountains. The goal of this experiment was to determine whether it is necessary to bag Sahara mustard after pulling it in order to achieve sufficient control. Mustard onsite was previously established in low-moderate density. Three comparison plots each were established, in 3 repetitions. Treatments within each repeated plot included: A) pull and leave mustard plants in place; B) pull and bag; C) the comparison control (no treatment). During treatments, each of 6 volunteers contributed a total of 4.5 hours of

labor to work on the 25 x 5m plots, covering a total of 750 m^2. Non-bagged plots took an average of 0.013 person hours/m^2, and bagged plots took more than twice the time, at 0.028 person hours/m^2. The following year, there was sparse annual growth on the site, and we found a significant decline in Sahara mustard percent cover on all plots, including the no-treatment plot. The highest decline was in the bagged plots, at 12%, compared with 6% in the non-bagged plots, and 4% in the no-treatment plots, although these differences between treatments were non-significant. This may be because the treatments were initiated after the seed heads had begun to fill. There were no significant differences in native species cover between treatments; however, there was a significant decline in native annual species richness in the bagged treatment as compared to the no-treatment control (2 vs. 3.4 species per m^2 respectively, $p < 0.01$). These results show that hand-pulling mustard is a viable way to reduce cover to some extent. From these single-year results, it is suspected that bagging plants could cause declines in native species richness, because seeds of native species may be negatively impacted by the ground disturbance involved, or because they are removed along with the mustard biomass. This finding is preliminary and warrants further investigation, and certainly to eliminate mustard, multiple treatments over years is necessary, as the species' seed bank is known to persist several years. Whether bagging the biomass is necessary to reduce or eliminate Sahara mustard cover remains to be determined, because these treatments were initiated after seed set, and there was high variation between repetitions and years. If it is not necessary, and even detrimental, not bagging the mustard biomass would reduce labor and other costs.

Targeting bulldozer lines for competitive seeding to suppress postfire invasion in Coastal Sage Scrub.
Noah Teller[1]*, Elise Gornish[2], Travis Bean[1], and Loralee Larios[1]. [1]University of California, Riverside; [2]Univeristy of Arizona, Tucson. noah.teller@email.ucr.edu

As wildfires in the West become more frequent and severe, firefighting activity may provide opportunities for invasive species to establish and spread. Improved postfire rehabilitation strategies are needed to address this challenge. Postfire competitive seeding has been historically difficult and inconsistent, but by carefully designing the composition of species mixes used for competitive seeding in fire breaks, managers may be able to reduce the risk of postfire invasion. At Chino Hills State Park, fire breaks left by bulldozers during the Canyon fires of 2017 may have spread Mediterranean grasses and invasive forbs into Coastal Sage Scrub. Reestablishing native vegetation by seeding native species in these fire breaks may provide invasion resistance and help prevent type conversion of CSS to annual grassland. A greenhouse experiment at UC Riverside has characterized key competitive traits of twenty native and five invasive species from Coal Canyon across multiple individuals and life stages. Using these data we have created one seed mix with similar traits to invaders, and the other with maximum functional diversity in competitive traits across the local native species pool. We hypothesize that the trait-matched community will reduce relative abundance and dispersal of invasive species in the first year after seeding due to intense resource competition, but that the high functional diversity community will have better native plant establishment in the second year due to improved stress tolerance of slower-growing species. We will use our findings to provide better tools for land managers tasked with rehabilitating burned areas.

Can we condition plants to increase stress tolerance and improve restoration success?
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A common method in ecological restoration is the outplanting of nursery-grown seedlings to restoration sites, and with proper resources this technique is often highly successful. However, multiple plant stressors, such as drought or herbivory, may negatively impact restoration success. Furthermore, increasing environmental variability and other drivers of global change may hamper the ability of practitioners to restore native vegetation. A growing body of research that suggests exposure of plants to a stressor may improve tolerance to subsequent stress events later in life. We sought to understand if such a phenomena could be exploited in order to improve plant stress-tolerance and contribute to restoration of native plant species in southern California. In the first set of experiments, we exposed seedlings of native perennials to episodic drought, and then we compared the response of these plants to a second drought event to that of well-watered controls. We also transplanted replicates of both treatments to a restoration site to test if exposure to drought as a seedling could improve plant performance in the field. In the second set of experiments, we explored

if clipping native bunchgrasses prior to outplanting would improve tolerance of subsequent grazing. In both experiments we observed a high level of variability across species, with species exhibiting the full range of positive, neutral, and negative responses to temporal variability in plant stressors. For example, previously drought-stressed seedlings of the shrub species *Encelia* and *Salvia* showed increased growth in the field relative to controls, while the herbaceous perennial *Grindelia* showed the opposite effect. This suggests that simple applications of stress treatments could improve plant growth and stress tolerance, but the success of this method is likely very species-specific. Restoration practitioners should consider conducting pilot studies with target plant species to better understand if these practices could assist in achieving restoration goals.

Dispatching the Monterey Bay Area's Mosaic of Invasive Plants. Hannah Wallis, Agricultural Programs Biologist, Monterey County Agricultural Commissioner's Office, Salinas, CA. WALLISHA@co.monterey.ca.us

Santa Cruz County and Monterey County flank the Monterey Bay with more than 4,000 square miles of land and terrestrial water bodies that harbor approximately 200 Cal-IPC rated Invasive Species. With abundant agricultural lands, pristine beaches, expansive forests, coursing rivers and vibrant urban communities, there's a lot of potential for non-native introduction and establishment- and there's a lot to protect. The region has two active Weed Management Areas with 85 members collectively, which have collaborated annually for 20 years to address invasive species issues at the Central California Invasive Weed Symposium. These member organizations guard the region's precious natural resources by tackling the Sisyphean task of extirpating its invasive species. Conservation organizations boast large scale stream maintenance and timber harvesting projects to eradicate Arundo and Eucalyptus from critical habitat. Communities bind together to suppress naturalized usual suspects like Yellow Star Thistle and French Broom in Oak Savannah and Woodland. Government agencies steward sweeping territories through comprehensive programs that intercept early invaders, immobilize spreading populations and steadily crush colonizing exotics with each emergence.

Functional trait variation along a climate gradient in California wild radish. Shana R. Welles* and Jennifer Funk. Chapman University, Orange, CA. welles@chapman.edu.

Documenting how functional traits vary along climate gradients allows us to comment on the extent and nature of adaptation to climate in invasive species. In this study, we examine how a suite of functional traits of California wild radish vary across a latitudinal gradient in California (Eureka to San Diego CA) and in response to differing water availability. California wild radish is hybrid between *Raphanus sativus* (jointed charlock), an introduced species, and *Raphanus raphanistrum* (crop radish). California wild radish has a broad distribution throughout California, including populations along the coast throughout the state and in the northern Central Valley. We conducted a potted plant experiment and measured a suite of functional traits associated with drought tolerance (growth rate, root:shoot ratio, specific leaf area, photosynthetic rate, water use efficiency) in 6 populations under conditions of low and high water availability. We predict that across this latitudinal gradient from north to south root:shoot ratio and water use efficiency will increase and specific leaf area and growth rate will decrease associated decreasing water availability based on previous studies demonstrating the importance of this suite of functional traits in adaptation to drought.

Communication structures for collaborative invasive plant management. Andrea Williams[3]*, Rachel Kesel [1], Pete Frye[2], Eric Wrubel[4]. [1]One Tam, San Rafael, CA. [2] Marin County Parks and Open Space, San Rafael, CA. [3]Marin Municipal Water District, Corte Madera, CA. [4]National Park Service, Sausalito, CA. rkesel@onetam.org.

Collaboration among land managers elevates the effective management of invasive plants by addressing populations at larger scales. Collaborative weed management requires efficient and productive communication to ensure that all parties share common goals and expectations. The Tamalpais Lands Collaborative (TLC) has developed several communication structures to facilitate communication across four agencies and their non-profit support partner. These tools and techniques, which are applied to invasive plants as well as other collaborative endeavors, serve as models for other partnerships.

Through a suite of committees and subcommittees, the TLC empowers staff to share data, co-develop management targets, and prioritize across jurisdictions. Several techniques, including realistic scheduling,

capable facilitation, and comprehensive meeting notes, enable participants to stay current as members track their individual and collaborative workloads.

Collaborative training programs for seasonal staff on topics such as early detection, rapid response and public communication reduce redundancies and assure consistent delivery in the field. These training programs are underpinned by robust documentation of protocols, workflows, cheat sheets, and best practices. In turn, these documents become resource guides during staff transitions, effectively serving as succession planning for key positions in weed management.

Partnership requires transparency and robust communication without information overload. The TLC employs a variety of communication and data sharing tools, including Trello, Google products, sharepoints, and Calflora's Weed Manager, to facilitate effective invasive plant management. Some tools offer excellent tracking for long-term projects while others facilitate rapid response in the height of the field season. By balancing the utility of these tools with recurring opportunities for communication and constant fine tuning, the TLC is improving invasive plant management across 39,000 acres of publicly-owned open space.

Prioritizing invasive species for eradication in the Bay Area National Parks. Wrubel, Eric*. National Park Service, San Francisco Bay Area Network Inventory and Monitoring Program (SFAN I&M). eric_wrubel@nps.gov

Early detection and rapid response (EDRR) is a proven method for eradicating invasive species from a given area before they spread beyond control. The San Francisco Bay Area National Parks Network (SFAN) has conducted over ten years of EDRR surveillance and mapping, discovering numerous new infestations of high priority invasive species. However, prioritizing eradication efforts has proven challenging without complete risk analyses on the ecology, impacts, and invasiveness of nonindigenous species. In 2017 Cal-IPC assessed the risk of future invasiveness posed by over 200 newly naturalized species in California, using the Plant Risk Evaluation tool (PRE). We used the PRE results to assign risk factors to SFAN target early detection species of unknown invasiveness, and crosswalked to species already on the Cal-IPC Inventory. We calculated the gross area for each target species at several scales (regional, park, watershed), and divided the species' risk factor by the gross area. The highest eradication priority went to species that posed the highest risk, and occupied the smallest area. Species' scores at the local scale were weighted by the regional score, allowing managers to prioritize eradications by site, while keeping the regional scale in context.

Understory diversity and composition changes in prescribe burned and passively managed forests over 20 years. Svetlana Yegorova*, Daniel Shaw. California State Parks, Sierra District, Tahoma, CA. svetlana.yegorova@parks.ca.gov

Prescribed fire is a tool used to reduce fuels in the forests in the Sierra Nevada and mimic the low and moderate severity wildfires that burned before the onset of fire suppression. A manager's hope is that prescribed fire will create the disturbance necessary to stimulate the development of species rich understory communities, and increase species richness, compared to unburned forests, which are often viewed as species depauperate. We report on understory richness and composition change over 20 years in forests managed with prescribed fire and passively managed forests. Species richness was highly variable within burned and passively managed areas but was not statistically different. Passively managed areas did not appear to be depauperate in understory species diversity compared to areas managed with prescribed fire. Species richness increased in burned areas and remained relatively unchanged in control areas over time. Species composition (as measured by frequency) was different in burned and control areas 20 years after treatment. Both burned and unmanaged areas contributed to the overall species diversity of the forest. Protecting forest from disturbance and introducing fire, resulted in the overall increased species richness in the forest, and lower tree density in both types of management. Fire did not appear to reduce or enhance species richness numbers in burned areas, as compared to passively managed areas, and appeared to provide a species richness benefit beyond that mediated by reduced tree densities and fine fuels decrease, as evidenced by the different species composition of treated areas compared to control areas.

Poster Abstracts

Testing the effects of site selection and artificial shelters on native plant recruitment from seed in a degraded coastal sage scrub restoration. Marlee Antill[1]*, [1]California State Polytechnic University, Pomona. marleebaron@gmail.com

Slope and aspect are important factors in determining where plant species occur in dry climates and yet are underutilized in locating sites for restoration of native plant communities in semiarid ecosystems. Habitat Suitability Modeling with Remote Sensing has the potential to identify high priority sites over large areas where abiotic conditions are more favorable for native plant recruitment. Though high suitability sites have been associated with higher native plant survival during restoration, possibly due to decreased moisture stress and seed movement, these sites may not be accessible in all restoration projects. In regions of southern California where site selection is narrowed due to urban development and inaccessible terrain, the use of artificial shelters may improve abiotic conditions for native plant restoration in low suitability sites by mimicking the effects of high suitability sites.

In this project, a habitat suitability model was created to identify high and low suitability plots based upon topography in a sample of degraded Coastal Sage Scrub (CSS) habitat in the Voorhis Ecological Reserve at Cal Poly Pomona. A two-year seedling survival experiment was established to test for differences in native plant recruitment in high vs low suitability sites, and in and out of artificial shelters. Seeds of four common CSS species were sown directly in the field in the Winter of 2018, and survival and growth data was collected weekly along with abiotic data for solar radiation, soil moisture, and leaf wetness. Year 1 data shows a preference for high suitability and in-shelter treatments for three of four species. In addition to higher seeding success rates for native species in the field, protecting reintroduced plants within shelters could allow for the chemical and/or mechanical treatment of invasives to occur simultaneously to native species addition, reducing the timing of restoration projects and helping practitioners meet funding schedules.

The invasion of introduced species after forest fires on the southern slope of Mount Merapi, Yogyakarta. Tjut Sugandawaty Djohan*[1], Krisni Suhesthiningsih[2], and Perdana Kusuma WIjaya Jati Putra[2]. [1]Laboratory of Ecology and Conservation, Faculty of Biology Universitas Gadjah Mada, Yogyakarta 55281 Indonesia; [2]Alumni of Faculty of Biology Universitas Gadjah Mada. tjutdjohan@ugm.ac.id

The forest fires post-eruption and the pyroclastic flows of Mount Merapi in the 1994 and the fire from human activities in 2002 on the southern slope created open "gap" areas as well as areas where gaps were created in the tree canopy. Both types of areas were invaded by the introduced plant species *Eupatorium odoratum*, *Lantana camara*, *Piper aduncum, and Imperata cylindrica*. These invasive species threaten the recovery of fire-tolerant native plant species that use both r and K strategies. This study was designed to measure the abundance of these invasive species after forest fires. We carried out this study at four sites in the west Turgo area on the southern slope of Mount Merapi, and at one site in the Kaliurang forest. At each site we used quadrat plots of 20m x 20m with two replicates. We measured both the number of species and the number of individuals of the invasive species, as well as tree-canopy gap, canopy area, and height of all the growth forms. The composites of five soil samples were collected at 0-10 cm depth. We measured nutrients, pH, soil moisture, temperature, and light intensity. Results revealed that both the gap areas and the areas with gaps in tree canopy were invaded by *E. odoratum*, *L. camara*, *P. aduncum,* and *I. cylindrica*. The areas where forest fires had been severe were highly invaded with these invasive species. These invasions were due to the gap area of 44-78%. The gap areas and the post-fire nutrients in the soil accelerated the growing of these invasive species. However, the harvesting of grass by the people next to the forest reduced the amount of invasive grass that was able to develop. Therefore, to support recovery at the Mount Merapi post-forest fire, the gap areas should be planted with seedlings of native-tree species as soon as possible.

Nitrogen deposition, invasion by *Bromus sp.,* and competition for water in a California grassland. Fitch, Robert*[1], Erin Questad[1], and Katharine Suding[2], [1]California State Polytechnic University-Pomona Department of Biological Sciences, Pomona, CA., [2]University of California-Berkeley Department of Environmental Science, Policy, Management, Berkeley, CA. rlfitch@cpp.edu

Anthropogenic nitrogen (N) deposition can alter invasion rates and competitive interactions among species. We hypothesized that N deposition will accelerate invasion by non-native annual grasses into California grasslands through increased competitive dominance by annual species under high N conditions. We experimentally examined how N inputs affect competitive interactions between species by applying N fertilizer treatments to plots containing the invasive annual grass, *Bromus hordeaceus*, and native perennial grass, *Stipa pulchra*, planted in a checkerboard pattern. We measured percent cover, growth, and indicators of water use for each species. We also recorded the impact of an unmanipulated invasion by *Bromus diandrus* into the experiment. The experiment was conducted from 2012 to 2014.

The abundance of *B. hordeaceus* stayed relatively consistent from 2012 to 2014, while the abundance of *S. pulchra* decreased each subsequent year. In contrast, *B. diandrus* which was absent from the study in 2012, increased in abundance from 2013 to 2014. N addition increased the growth of *B. diandrus* but decreased the growth of *S. pulchra,* and did not have a strong effect on *B. hordeaceus*. The growth of *B. diandrus* was positively associated with the abundance of *B. hordeaceus* from the prior year whereas the growth of *B. hordeaceus* was negatively associated with the abundance of *B. diandrus* from the same year. These results suggest that invasion of *B. diandrus* can be initially facilitated by the presence of other invasive species and then potentially outcompete them. The growth of *S. pulchra* was negatively associated with the total abundance of invasive species present in the same year. In 2013, the abundance of the invasive species had a stronger negative effect on *S. pulchra* growth in N added plots than in control plots. Soil moisture was lower in *B. hordeaceus* patches, compared to *S. pulchra*. N addition significantly lowered soil moisture during periods of plant uptake that followed rain events. These results suggest that competition for water was a significant driver of invasion in this grassland, and that N deposition could intensify competitive interactions.

Biochar: turning invasive eucalyptus into a restoration tool. Martin Genova*, Karen Tanner[1], Ingrid Parker[1], Andrea Woolfolk[2], Bree Candiloro[2], and Kerstin Wasson[2]. [1]UC Santa Cruz, Ecology and Evolutionary Biology, Parker Lab. [2]Elkhorn Slough National Estuarine Research Reserve (ESNERR), Watsonville, CA. mgenova@ucsc.edu

Eucalyptus is a common invader of California coastal ecosystems, where it can form dense groves that displace native species. Eucalyptus removal is often required for habitat restoration, but decomposition of the resulting biomass can release free carbon to the atmosphere, where it contributes to climate change – an outcome most restoration practitioners are anxious to avoid. One potential solution is the conversion of waste eucalyptus biomass into biochar, a durable carbonaceous soil amendment that can lock carbon underground for years. In agricultural systems, biochar has also been shown to improve crop performance in dry, saline soils, where it can bind excess salts and increase plant water availability. Biochar therefore has great potential to increase carbon storage and enhance plant performance at salt marsh restoration sites, where tides create salinity and moisture gradients that can affect transplant success. Here, we test the effect of biochar addition on the performance of five native salt marsh plant species at Elkhorn Slough National Estuarine Research Reserve (Monterey County, California). We transplanted each species (*Distichlis spicata*, *Extriplex californica*, *Frankenia salina*, *Jaumea carnosa*, and *Spergularia macrotheca*) in the high marsh, filling holes with plain sand or biochar mix (treatments of 5% or 25% biochar by volume). We conducted monthly survival surveys and bi-monthly growth surveys (maximum shoot length, stem number, and plant diameter) to assess response, comparing performance across treatments. This experiment will demonstrate the effects of eucalyptus biochar on native salt marsh plant performance, and suggest whether eucalyptus biochar addition could improve restoration outcomes in other salt marsh systems.

Maximizing the efficiency of invasive plant control with a phenology-based timing approach to management. Guy Gabriel Hernandez* and Erin J. Questad, Don B. Huntley College of Agriculture, California State Polytechnic University, Pomona, CA. gghernandez@cpp.edu

The control of invasive plants has been the primary concern in ecological and agricultural systems alike for many years. Factors such as increased human population, increased management cost, and herbicide resistant plants have all contributed to invasive species wide spread success. There is a need for integrated weed management

(IWM), which integrates multiple control methods to develop the most efficient management program that can be economically and environmentally sound. Plant phenology, the timing of events in the plant life cycle, is an important concept that may help explain the opportunistic and competitive nature of invasive species, which can in turn provide insight to potential management strategies and practices. I aim to investigate which stage of growth and development is best to implement mechanical control of *Brassica nigra*, *Bromus diandrus*, and *Centaurea melitensis*. I predict that applying a treatment shortly after flowering, once a plant has used most of its resources, will have a significant effect on the growth and seed production of *B. nigra*, *C. melitensis*, and *B. diandrus*. A field experiment is underway in three locations on the campus of California State Polytechnic University, Pomona, California. Sixteen plots per plant species were marked and randomly assigned one of four treatments. The treatments include an uncut control and three cutting treatments at three stages of development: Early, flowering, and late. For each plant I will measure maximum height and dry weight before and after each treatment. I will also estimate the number of seeds per test plant during senescence. This research can be useful to the restoration and agriculture community alike in order to obtain optimum control efficiency of *Brassica nigra*, *Bromus diandrus*, and *Centaurea melitensis*.

Assessment of native species for the control of gorse (*Ulex europaeus*) by means of allelopathic effect of its leaf litter leachates. Mika Hozawa[1]* and Eiji Nawata[1].
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Gorse (*Ulex europaeus,* Fabaceae) is considered to be originated in Western Europe and a well-known invasive weed worldwide not only in California. As invasive plants often exude allelochemicals as one of their propagation strategies to the new environments, the experiment on the leaf samples from Hawaii Island (USA) was conducted to investigate if gorse leaf litter leachates have allelopathy. The sandwich method (Fujii et al. 2004) was adopted: 50mg of air-dried leaves were sandwiched by 5ml of agar (0.5%) layers and length of radicles and hypocotyls of lettuce (Great Lakes) seeds set on top of the agar after incubation at 25℃ for 72 hours in complete darkness were measured. As a strong negative allelopathy on the germination of lettuce seeds was observed, the same tests were conducted on the gorse leaves from nine populations of different habitats in California (one population), Maui Island (one population), Oregon (three populations) (USA) and New Zealand (four populations), and the magnitude of the allelopathy of 10 different populations including Hawaii Island (one population) was compared. All the leaf leachates showed the negative allelopathic effects on the seed germination of lettuce. The magnitude of allelopathy was the strongest in New Zealand north island site 2 and the weakest in Coos Bay (Oregon). It was inferred that the leaves grown with some other species showed the strong alleolopathy, whereas those grown with few other species showed the weak allelopathy. By investigating the vegetation of the sampling sites of the leaves that showed the strong allelopathy, some competitive native species for the managerial control method of gorse were identified; *Kunzea ericoides* (Myrtaceae, kanuka in common) and *Leptospermum scoparium* (Myrtaceae, manuka in common) in New Zealand, and *Gaultheria shallon* (Ericaceae, salal in common) in Oregon were inferred to limit the growth of gorse by competing the niche.

Evaluation of newly registered herbicides for control of waterhyacinth in the Sacramento / San Joaquin Delta. Guy Kyser[1]*, John Miskella[2], and John Madsen[2]. [1]Plant Sciences Department, University of California, Davis, CA. [2]USDA-ARS Invasive Species and Pollinator Health Research Unit, Davis, CA. gbkyser@ucdavis.edu

Waterhyacinth is a worldwide aquatic weed that has become a significant nuisance in the Sacramento/San Joaquin River Delta. Glyphosate and 2,4-D have been the predominant herbicides used for management. While these chemicals have been effective for control, additional herbicides need to be evaluated to address concerns over herbicide resistance management, environmental restrictions, and reduction in total active ingredient applied. We performed three trials in floating quadrats in the Delta. Treatments were applied in four replications using a 3-nozzle boom, with a standard spray volume of 935 L ha^{-1} and *Agridex* surfactant (3.5 L ha^{-1}). In the first (2016), we applied two rates each of 2,4-D (1065 and 2130 g ae ha^{-1}), glyphosate (1681 and 3363 g ae ha^{-1}), imazamox (560 and 1121 g ae ha^{-1}), and penoxsulam (53 and 88 g ai ha^{-1}). The highest rates of all four herbicides provided satisfactory control (2,4-D, 82%; glyphosate, 87%; imazamox, 93%; and penoxsulam, 94%). In the second trial (2016), we compared the lower rate of glyphosate (1681 g ae ha^{-1}) to four rates each of imazamox (187 to 1494 g ae ha^{-1}) and penoxsulam (12 to 98 g ai ha^{-1}). The highest rates of imazamox and penoxsulam provided excellent control (96% and 95%, respectively). In the third trial (2017), we applied other low-rate chemicals, carfentrazone and flumioxazin, alone and in tank mixes with imazamox or glyphosate. We also applied glyphosate (1681 g ae ha^{-1}) in

three spray volumes (234 L ha^{-1}, 468 L ha^{-1}, and the standard volume of 935 L ha^{-1}). Flumioxazin + imazamox (316 + 280 g ai/ae ha^{-1}) and glyphosate (468 L ha^{-1}) each produced better than 95% control. Imazamox and penoxsulam appear to be effective alternatives to 2,4-D and glyphosate for controlling waterhyacinth with reduced rates of active ingredient. Their availability also will facilitate management for herbicide resistance.

Protecting endangered species from pesticides in California - PRESCRIBE: online database and mobile application for the protection of sensitive-status species from pesticides. Rich Marovich[1], Polo Moreno-Matiella[2], Catherine Bilheimer[2], John Gerlach[*2], Nino Yanga[2], and Joe Damiano[2]. [1]Solano County Water Agency, Vacaville, CA. [2]California Department of Pesticide Regulation, Sacramento, CA. john.gerlach@cdpr.ca.gov

The California Department of Pesticide Regulation (DPR) has worked with stakeholders to develop an endangered species protection Web-based program that includes all federal- and state-listed and state special-status species and all pesticides registered for use in California. The program and a free mobile application allow users to identify local habitat for listed and sensitive status species and provide advice on required pesticide use limitations. PRESCRIBE (http://cdpr.ca.gov/docd/es/prescint.htm), contains location records for over 1,000 endangered, threatened, and other special-status species, encompassing almost 80,000 unique land sections. It also can search for 30,000 pesticides by brand name. During a PRESCRIBE query the user selects the county-township-range-section(s) where he/she intends to apply pesticides and also the pesticide intended for use. PRESCRIBE looks up the species that have been reported to occur in the selected section(s) and the active ingredients in the selected pesticides that may affect those species and generates a report of what species are known to occur in the area and what use limitations may apply to the selected pesticides for protection of those species. These use limitations were derived from biological opinions developed by the U.S. Fish and Wildlife Service (USFWS) in consultation with the U.S. Environmental Protection Agency (USEPA) and have been reviewed by the USFWS. The endangered species habitat index was derived from the Department of Fish and Wildlife (DFW) Natural Diversity Database, as well as maps obtained from USFWS and National Marine Fisheries Service. The use limitations are voluntary unless required by pesticide labeling or pesticide use permits. PRESCRIBE Mobile, a new mobile application (https://mobile.cdpr.ca.gov/prescribe) also yields protective measures and adds a feature that uses a smart phone's geographic locator function to identify a user's current location and proximity to listed species' habitat.

Restoring degraded chaparral and the impact of exotic species on native shrub establishment. Stephanie Ma[1]*, Michala Phillips[2], Katherine Nigro[1], Sameer Saroa[2], Shane Dewees[1], Edith Allen[2], and Carla D'Antonio[1]. [1]University of California, Santa Barbara. [2]University of California, Riverside. stephanie.ma@lifesci.ucsb.edu.

Chaparral is one of the dominant vegetation types in southern California. It is characterized by evergreen, sclerophyllous shrubs adapted to a Mediterranean climate and has long been considered highly resilient to wildfire disturbances and tolerant of climate stressors (e.g., drought). However, these ecosystems can be degraded or lost due to anthropogenic stressors such as an expanding wildland-urban interface, invasive species, and an increase in fire frequency. As these communities become degraded, the need for restoration arises. In this study, we aimed to determine the role of competition from exotic species on the establishment of native shrubs. Our study focused on establishing *Salvia leucophylla, Salvia apiana, Hesperoyucca whipplei, Eriodictyon crassifolium,* and *Malacothamnus fasciculatus* in degraded chaparral sites in Piru, California. Our treatments included: planting 3-4 month old seedlings, sowing seeds, and scarifying the topsoil 5 cm to stimulate the existing seed bank before sowing seeds. Competition with exotic annuals, including *Avena fatua*, *Bromus rubens*, and *Erodium cicutarium*, was controlled within each treatment at: no removal, half removal or full removal. We observed the greatest seedling establishment with outplanting into plots with full exotic removal. There was almost no shrub establishment from seed regardless of the level of exotic species removal. *Salvia apiana* seeds and seedlings had the highest rate of establishment. Scarifying the topsoil did not result in greater native cover compared with un-scarified treatments. Current work includes planting 3-12 month old seedlings, scarifying the topsoil 12 cm before sowing seeds and removing exotic species at full, half, or no removal.

Investigating allelopathy and soil moisture as factors determining community composition of an invaded Southern California black walnut woodland. Jose Marfori* and Dr. Erin Questad.

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Soil moisture and allelopathy can affect plant germination and establishment. Understanding their interaction can help explain the distribution of native and invasive species and provide methods for cultural control of invasive plants. *Juglans californica*, a Southern California endemic tree, produces juglone. Juglone's allelopathic effects have been studied in agricultural systems but not in the context of invasive and native species occurring under the canopy of *Juglans californica*. *Brassica nigra* is an invasive forb that produces allelopathic glucosinolates and is also a dominant member of walnut woodland communities in California. Since these allelochemicals are abundant during times of high soil moisture, it is expected both species' allelopathic potentials are most influential in winter than in summer. Invasive dominance in the walnut woodland may be due to invasive species' higher tolerance of allelopathy than native species. Our ongoing greenhouse experiment tests the tolerance of invasive and native species to allelochemicals from *J. californica* and *B. nigra* under dry and wet soil conditions. Three native and three invasive species are being treated with the following treatments: *J. californica* mulch, *B. nigra* mulch, coconut mulch, allyl isothiocyanate, juglone, or DI water. To examine how soil moisture and allelopathy interact, each plant is also given a moisture regime: dry or wet. Each treatment combination is replicated four times. The chemical treatments reduced the biomass of *Silybum marianum, Brassica nigra,* and *Sambucus nigra* but the mulch treatments did not. This suggests that inhibitory concentrations of allelochemicals are not found in leaf mulch. *B. nigra* also flowered despite being treated with concentrated juglone. Since juglone levels in the field are lower than used in the greenhouse, juglone in the woodland is not inhibitive to *B. nigra* reproduction and could be a reason for its continued success as an invader.

Using functional traits to build native grassland communities that are resistant to exotic annual grasses. Madeline Nolan. University of California, Santa Barbara, Department of Ecology, Evolution and Marine Biology. m_nolan@ucsb.edu

Historically grasslands in California's coast ranges were dominated by a diverse mixture of native bunchgrasses and forbs, but today they are dominated by exotic annual grasses and forbs particularly where past agricultural activities disrupted the root systems of perennial plants. Without human intervention, these former agricultural sites remain dominated by exotic species with little to no natural succession back to native species assemblages over many decades. Throughout California, restoration activities in these habitats have focused on the reestablishment of a small number of species particularly the perennial bunchgrass *Stipa pulchra*. However, the plant richness in CA grasslands arises from forb and not grass diversity in California, so the failure of grassland restoration could be due, in part, to a lack of forbs in restored communities. Apart from being lower in species richness, restored communities that do not have native forbs could be missing important functional traits that could help restored grasslands resist reinvasion by exotic annual grasses. My research proposes to quantify the diversity of functional traits across native grassland species and the common exotic annual grass *Avena fatua*. This information can then be used to create theoretical assemblages of native grassland species that functionally overlap with *Avena fatua* and resist the establishment of this noxious exotic species. This research could provide valuable insight into the mechanisms controlling the continued dominance of *Avena fatua* and other exotic annual grasses in California grasslands.

Regional Conservation Investment Strategies: a comparison to other conservation planning programs. Ami Olson*, Shannon Lucas, and Ron Unger. California Department of Fish and Wildlife, Sacramento, CA. ami.olson@wildlife.ca.gov.

The Regional Conservation Investment Strategies (RCIS) Program is a new conservation planning tool that uses a science-based approach to identify and prioritize conservation and habitat enhancement actions within a given region. These actions may include control of invasive species for the benefit of vulnerable species, habitats, and other natural resources. Similar conservation tools include Natural Community Conservation Plans, Federal Habitat Conservation Plans, and conservation and mitigation banks. Each of these tools has their distinct benefits. Some examples of the benefits of the RCIS Program are: 1) invasive species removal may be used to create mitigation credits for compensation of project impacts and 2) it provides a voluntary conservation planning tool that may be applied even in portions of California where implementation of other conservation tools is difficult or not possible. This poster will provide a summary of the RCIS Program, its benefits and uses, and how it compares to some of the other conservation tools.

Above- and below-ground effects of four organic herbicides used in invasive plant management in Irvine, California. Isaac Ostmann*[1], Amanda Swanson[2], Mia Maltz[2], Jutta Burger[1]. [1]Irvine Ranch Conservancy, Irvine, CA. [2]Center for Conservation Biology, University of California, Riverside, CA. iostmann@irconservnancy.org

Herbicides are often used in restorations to control invasive plants with systemic synthetic herbicides generally preferred because of their high efficacy. Organic herbicides are however increasingly being recommended and prescribed in response to concerns about potential health risks of glyphosate. For example, Irvine, CA has restricted the use of all systemic synthetic herbicides since April 2016. We designed an experiment at Bommer Canyon, Irvine to compare the effectiveness of four contact organic herbicides to mowing and untreated controls. The herbicides tested were: Suppress® and FinalSanO® (strong acids), Fiesta® (chelated iron product), and Avenger® (orange oil-based). We photo-documented plots and collected soils pre and post treatment to assess changes in plant cover and microbial communities. Herbicide plots were treated in February, March, and early May while mowed plots were treated in April. Within a month of the first application, invasive grasses resprouted in all of the herbicide and mowed plots with percent cover comparable to controls. All plots contained resprouts of invasive grasses by the end of the season despite receiving three herbicide and/or mowing treatments. Mowing was most effective at reducing total invasive cover and number of viable seed heads. The microbial community shifted with herbicide treatment, which may influence native plant recruitment. This suggests that acid-based organic herbicides are somewhat effective but timing and weed context are critical. Below-ground effects are more complex and mowing may still be a preferable management tool for controlling invasive plants when synthetic herbicide use is restricted.

Impacts and best management practices for erect veldtgrass (*Ehrharta erecta*). Ingrid M. Parker*, Courtenay A. Ray, Joel J. Sherman, Anna L. Godinho, Nikki Hanson. Department of Ecology and Evolutionary Biology, University of California–Santa Cruz, Santa Cruz, CA. imparker@ucsc.edu.

Erect veldtgrass [*Ehrharta erecta* (Lam).] is an invasive grass actively spreading in California that is capable of invading multiple habitats. Our objective is to contribute to a better understanding of the ecology, impacts, and potential for control of *E. erecta* in order to guide management practices. In a mixed-evergreen forest in Santa Cruz County, we measured impacts of *E. erecta* on native plant species richness and abundance in an observational comparison across 11 sites. Strikingly, we measured nearly four times greater total vegetation cover in plots invaded by *E. erecta*. However, native plants were not significantly less abundant in invaded plots than in reference plots, and native cover was not significantly predicted by *E. erecta* cover within invaded plots. We did, however, find evidence of change in community composition in response to *E. erecta* abundance. Our findings demonstrate that native species can persist in the presence of *E. erecta*, although the long-term impacts on populations of the perennial plants that dominate this forest understory are still unknown.

We also compared the effectiveness of mechanical (hand pulling with volunteers) and chemical (glyphosate) management methods. Twenty-two months following management treatments, we found substantial reductions in *E. erecta* using both mechanical and herbicide treatments, but herbicide also produced greater reductions in native species cover and species richness. Transplanting native yerba buena [*Clinopodium douglasii* (Benth.) Kuntze] into management plots following treatment did not slow regrowth of *E. erecta*. It did, however, increase total native plant percent cover in herbicide and pull treatments, although largely by increasing *C. douglasii* itself. Effective management is possible using either manual or chemical removal methods; the optimal method may depend on the availability of manual labor and the sensitivity of the habitat to non-target effects on native plants.

Resource availability, propagule supply, and the effect of non-native, ungulate herbivores on *Senecio madagascariensis* invasion[1]

Erin J. Questad*[1], Amanda Uowolo[2], Sam Brooks[2], Robert Fitch[1], and Susan Cordell[2]

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Non-native, invasive herbivores can create complex biotic interactions by differentially feeding on native and non-native, invasive plant species. The herbivores may act as enemies of non-native plants and prevent them from becoming invasive, or they may facilitate invasion by having a greater negative impact on native plants, compared to non-native plants. It is also possible that within the same ecosystem non-native herbivores could

either facilitate or inhibit invasion under different abiotic or biotic conditions. We experimentally investigated how abiotic (soil nutrients) and biotic (propagule density) conditions influenced the effect of invasive, generalist herbivores on *Senecio madagascariensis*, an invasive plant species in Hawaiian dry forest plant communities. We used fenced exclosures to manipulate the presence or absence of invasive ungulates (feral goats and sheep), and we used seed addition to manipulate the propagule supply of *S. madagascariensis*. The experiment was replicated in a recently burned and an unburned site in order to examine how a resource pulse following fire may alter plant-herbivore interactions. There were very few seeds of *S. madagascariensis* in the seed rain of both sites, and recruitment was four times higher when seeds were experimentally added, suggesting that *S. madagascariensis* is dispersal limited in this area. Recruitment of *S. madagascariensis* was five times higher in the burned, compared to the unburned site, suggesting that increased resources promote recruitment. Recruitment was three times higher when herbivores were present, compared to when they were excluded, but plants were much smaller when herbivores were present. We conclude that herbivores can alter *S. madagascariensis* recruitment, even during dry conditions, and that propagule availability influences where *S. madagascariensis* can become established. When removing feral ungulates for restoration, care should be taken to plan removals in areas with low propagule supply of invasive plants or prepare an invasive plant management plan following the removal.

Facilitation and herbivory in Southern California coastal sage scrub. Lauren H. Quon[1]*and Dr. Erin J. Questad[1]. [1]California State Polytechnic University Pomona. Pomona, CA. Laurenquon@gmail.com.

Prolonged drought, urban development, and invasion by non-native plants have created a mix of dead shrubs and bare areas in southern California coastal sage scrub (CSS) habitat. After invasive plant removal in degraded CSS habitats, established native shrubs may be important in facilitation, where neighboring seedlings benefit from shared resources and protection from abiotic stresses. Though living plants strongly influence plant community structure and interactions, there is little information about the influence of dead shrubs on seedling growth in semi-arid Mediterranean environments. Biotic pressures such as herbivory on native recruitment in these plant communities are also not well understood. We conducted an experiment in a degraded CSS plant community to investigate whether seedling establishment, growth, and survival depends on abiotic factors (microclimate conditions under shrubs), or biotic factors (herbivory). Two native woody shrubs (*Artemisia californica* and *Salvia mellifera*) were planted and four annual native species (*Amsinckia intermedia, Deinandra fasciculata, Phacelia distans,* and *Pseudognaphalium californicum*) were sown in five blocks with three microsite treatments (live shrub, dead shrub, and exposed areas), and a caged and uncaged treatment within each microsite treatment. Removal of invasive mustards and annual grasses was also implemented at the site to eliminate competition with native seedlings. Environmental sensors and trail cameras were installed to measure abiotic factors and track herbivore visits. Seedling growth and size were analyzed to determine abiotic and biotic effects on growth and survivorship under microsite and cage treatments. Cages increased the number native annual seedlings across all microsite treatments and *A. californica* seedling height under dead shrubs and in exposed areas. Overall, there was little evidence of facilitation of all species tested, perhaps because CSS is a mild, semi-arid environment compared to harsh, arid habitats where facilitative interactions are stronger. In this study, herbivory was a great barrier to native recruitment and growth of unprotected seedlings in restoration of disturbed CSS.

Variation in cool temperature performance among weevil (*Neochetina eichhorniae*) populations and implications for the biological control of water hyacinth in a temperate climate. Angelica M. Reddy [1,*], Paul D. Pratt[1], Julie V. Hopper[2], Ximena Cibils-Stewart[3], Guillermo Cabrera Walsh[4], Fernando Mc Kay[4].

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Biological control of water hyacinth (*Eichhornia crassipes*) has resulted in variable outcomes in temperate regions where cool climates are thought to limit population growth and performance of the biological control agents. The weevil (*Neochetina eichhorniae*), originating from Argentina, was introduced into northern California in 1982. The realized distribution and abundance of this weevil is limited, and water hyacinth remains a problem. In this study, we tested populations of *N. eichhorniae* from northern California, Australia, South Africa, and Uruguay to examine the effects of low temperature on life-history

performance to determine if cold hardiness differs among populations. We measured the development time, fecundity, survivorship, and thermal tolerance (chill coma: CT_{min} and supercooling point: SCP) of the four *N. eichhorniae* populations under two temperature treatments simulating fall and winter seasons of northern California. Results suggest that immature stages of all populations tested failed to survive and females did not reproduce in the winter treatment. In the fall treatment, all populations showed similar performance in most of the measured traits. Interestingly, the Australian population had the highest intrinsic rate of increase, net reproductive rate and doubling time, due to its longer oviposition period, and higher daily fecundity (2.08 ± 0.22 eggs per day), twice that of the California population (0.95 ± 0.15 eggs per day). Thus, the introduction of *N. eichhorniae* from Australia into northern California may increase weevil densities, distribution, and improve biological control of water hyacinth.

Does grazing of compost-amended grasslands impact carbon sequestration and plant diversity? Mizael Seminatore[1]*, Thomas Parker[2], Michael Vasey[3], Jared Lewis[4], and Pelayo Alvarez[5]. [1,2,3] San Francisco State University, Ecology and Evolutionary Biology Department, [4]Solano Land Trust and [5]Carbon Cycle Institute. mprezaza@mail.sfsu.edu

Compost application to grasslands is a novel approach aimed at mitigating greenhouse gases by increasing carbon sequestration without affecting ecological diversity. However, a significant portion of grasslands is utilized for grazing by agriculture, and the impacts of grazing on compost-amended grasslands are mostly unknown. My research objective is to evaluate the feasibility of compost application to grazed grasslands as a method to increase soil carbon sequestration. My specific questions ask which combinations of compost application and grazing: 1) increase soil organic carbon (SOC) and below-ground biomass, and, 2) increase or decrease species richness.

To assess the effect of compost and grazing on both carbon sequestration and species composition and abundance, I will mark 20 ~0.4-hectare plot in a valley grassland and apply a layer of compost. I will collect soil cores, assess plant biomass and measure plant biodiversity. While we expect grazing to reduce SOC and below-ground biomass, these effects should be lessened by compost application. Conversely, while we anticipate grazing to increase biodiversity in grasslands, this effect should be further increased by compost application. Grazing of composted grasslands has the potential to allow us to mitigate the impacts of climate change.

Role of soil properties on weed encroachment in serpentine chaparral. Rebecca Serata[1]*, Chhaya Werner[2], Susan P. Harrison[1], and Hugh D. Safford[1], [1] Department of Environmental Science and Policy, University of California, Davis, CA. [2] Graduate Group in Population Biology and Department of Plant Sciences, University of California, Davis CA. rpserata@ucdavis.edu.

Historically, chaparral plant communities on serpentinite soils have been protected from the continuous spread of invasive species into California's ecosystems due to its unique soil chemistry. However, within serpentine soils there are variations in the elemental composition and texture of soils, which may lead to differentiation in weed establishment. Serpentine grasslands also tend to be more easily invaded than chaparral, most likely due to finer soils and moister conditions. Increasing fire frequency in combination with more severe weather patterns could threaten formerly uninvaded landscapes. We conducted a three-year study of plant community composition on serpentine soils following a fire which burned in 2015. We measured percent cover of native and exotic species on burned and unburned plots on serpentinite soils and collected corresponding soil fertility and soil texture data. In order to estimate this ecosystem's potential for weed establishment, we need to fully understand how these unique soil features have hindered invasions.

In 2016 we found an average of 2.76 invasive species including *Taeniatherum caput*-medusae and *Bromus madritensis ssp. rubens* per plot. Richness of exotic species was highly dependent on magnesium concentrations ($p=0.002$) and calcium concentrations ($p=0.009$). Serpentine plots with no exotics had an average magnesium to calcium ratio of 4.97 and plots with 5 or more species of exotics had an average ratio of 2.67. Concentration of potassium in the soil was marginally significant in determining exotic richness between plots in 2016 ($p=0.075$). We hypothesize that plots with finer soils will also contain more invasives because of less water stress and because after the precipitation in 2016, some soils would have held water long enough to allow for establishment. This information can help land managers preserve this system's endemic species and more efficiently combat invasive grasses that have changed fire regimes throughout California.

A test of alternatives to glyphosate for the control of invasive plants. Don Thomas, IPM Specialist, San Francisco Public Utilities Commission. don_e_thomas@yahoo.com

As part of an integrated pest management approach to invasive plant management, the use of herbicides has been an indispensable tool, along with biological, cultural, mechanical and physical control measures. One of the most useful herbicides is glyphosate because of its broad spectrum of weed control and lack of residual soil activity. However, there are now growing concerns about over-reliance on glyphosate for weed management. First, a growing number of weeds are being selected for genetic resistance to glyphosate, including marestail (*Conyza bonariensis*) and Italian ryegrass (*Festuca perennis*). Second, the recent finding of probable carcinogenicity by the International Agency for Research on Cancer (IARC) and the addition of glyphosate to the Proposition 65 list of carcinogens by the California Office of Environmental Health & Hazard Assessment (OEHHA) have led many agencies to greatly restrict or suspend its use. This study is a test of two herbicides, glufosinate and imazamox, as alternatives to glyphosate for the management of invasive plants. The preliminary results indicate that glufosinate may be an effective substitute for many of the foliar spray, cut-stump and other applications of glyphosate for control of plants, such as brooms (*Genista monspessulana and Cytisus scoparius)*, eucalyptus (*Eucalyptus globulus*), acacia (*Acacia melanoxylon*) and Bermuda buttercup oxalis (*Oxalis pes-caprae*). Imazamox also shows promise as an alternative for some of the uses for glyphosate, such as cut-stump applications.

Controlling yellow star thistle by lowering soil PH. Sunie Wood, Chapa-De Indian Health, Grass Valley, CA. swood@chapa-de.org

A field test indicates that a slight lowering of soil PH may have discouraged the germination of yellow star thistle seeds (*Centaurea solstitialis*). A 6400 square-foot area actively growing yellow starthistle was first soil-tested on in October 2017, with results showing PH=7.5, nitrogen and phosphorus deficient, potassium sufficient. The yellow starthistle was removed by hand (although seeds had already dropped) then the area was mowed to a height of 4-6 inches. No pre-emergents or herbicides were applied. Then the area was treated with: 20 lbs. granulated sulfur, 18 lbs. Master Nursery Formula 49 fertilizer, 2 lbs. perennial rye seed, and 2 lbs. annual rye seed, 8 lbs. inoculated crimson clover seed. Spring 2018 results showed no yellow starthistle growing in the treated area, while adjacent non-treated areas were actively growing yellow starthistle. The treated area has a healthy growth of mixed grasses and clover. Soil testing from May 2018 show PH=6.25, nitrogen & phosphorus deficient, potassium sufficient. The only change in basic soil fertility was the decrease in the soil PH to a slightly acid level. I conclude that slightly acid to acid soil PH levels may prevent the germination and growth of yellow starthistle seeds without the use of chemical controls. This may prove beneficial to homeowners, land owners, and public entities wanting to eliminate this invasive weed.