Tracking progress in Orange County4Seed banking with California Plant Rescue6Holi in the Parks82019 Cal-IPC Symposium9Mapping in the Santa Ana River<br/>Watershed10

Harvesting invasive species in Africa

20th Anniversary Central Coast Invasive Weed Symposium



12

14

VOLUME 27 NUMBER 2

6

SUMMER 2019



### 1442-A Walnut Street, #462 Berkeley, CA 94709 ph (510) 843-3902 fax (510) 217-3500 cal-ipc.org info@cal-ipc.org

Protecting California's environment and economy from invasive plants

#### STAFF

Doug Johnson, Executive Director Agustín Luna, Director of Finance, Operations & Administration Jutta Burger, Science Program Director Bertha McKinley, Program Assistant Claire F. Meyler, Communications & Marketing Manager Dana Morawitz, Conservation Program Manager Alene Spindel, Training Program Associate

### BOARD OF DIRECTORS

President: Gina Darin, Cal. Dept. of Water Resources Vice President: Doug Gibson, San Elijo Lagoon Conservancy Treasurer: Steve Schoenig, Schoenig Consulting Secretary: Laura Pavliscak (Ventura) Valerie Cook-Fletcher, Cal. Dept. of Fish and Wildlife Jason Giessow, Dendra, Inc. William Hoyer, US Navy Drew Kerr, Invasive Spartina Project Ed King, Placer Co. Ag. Commissioner's Office Marla Knight, Klamath National Forest (retired) Tanya Meyer, Yolo County Resource Conservation District Julia Parish, American Conservation Experience Heather Schneider, Santa Barbara Botanic Garden Baldeo Singh, Sacramento Conservation Corps Lynn Sweet, UC Riverside Palm Desert Center Marcos Trinidad, Audubon Center at Debs Park

### STUDENT LIAISON

Marlee Antill, Cal Poly Pomona Guy Gabriel Hernandez, Cal Poly Pomona Marina LaForgia, UC Davis Noah Teller, UC Riverside

Affiliations for identification purposes only.

### Cal-IPC Dispatch

Summer 2019 – Vol. 27, No. 2 Editor: Doug Johnson Associate Editor: Claire F. Meyler Designed by Melanie Haage Published by the California Invasive Plant Council. Articles may be reprinted with permission. Previous issues are archived at cal-ipc.org. Mention of commercial products does not imply endorsement by Cal-IPC. Submissions are welcome.

We reserve the right to edit content.



### FROM THE DIRECTOR'S DESK

### **Evolving perspectives**

### By Executive Director Doug Johnson

he theme of this year's Symposium is "Evolving management perspectives in a changing world." Along with robust sessions on today's tools, projects, and research, we will feature a plenary session with some of California's top ecologists to explore what tomorrow's work may look like.

One relatively new concept in ecology is that of "novel ecosystems," those places that have been significantly altered by humans and feature new biological assemblages. Some people view the concept with concern because they believe it can be used as a rationale for not restoring degraded places. But virtually everywhere on planet Earth has non-native species as part of their mix you can now read about invasive species in Antarctica. And we need a framework for choosing our most productive course of action.

Natural resource managers know that conservation involves understanding the ecological workings of a place,

### On the cover:

Volunteers pull ripgut brome (Bromus diandrus) at Land's End in San Francisco (cover photo and inset by Alene Spindel). This volunteer weed-pull was part of a recent "Holi in the Parks" event hosted by the Golden Gate National Parks Conservancy. The event combined stewardship work with cultural traditions from India to celebrate the start of spring (see article on page 8). The Conservancy puts particular emphasis on welcoming everyone to the outdoor spaces they manage. Cal-IPC is committed to promoting equity, diversity, and inclusion in the conservation field, and one way of doing that is to highlight organizations that are creatively encouraging California's diverse communities to participate in caring for the environment (read more online at cal-ipc.org/EDIconservation). Volunteerism is one of the best ways to engage our communities, and Cal-IPC

identifying the valued aspects that could be lost, implementing actions designed to protect those valued aspects, and evaluating the impact of our actions. We know that this requires careful study and a willingness to adapt our approaches over time. But we also know how easy it is for volunteers and people new to the field to fall into simplistic perspectives such as, "Any non-native plant growing in the wild is a problem and needs to be removed." Part of our work is reminding each other that it's not that simple.

How do we know which vegetation communities will be most resilient to our shifting climate? When is simply removing an invasive plant species sufficient and when are more intensive restoration efforts needed? What risks and opportunities — do future wildfires bring for conservation? These are the kinds of questions being asked by the ecologists speaking at the Symposium. The answers will guide our work as we move deeper into the Anthropocene.



Jainita Patel shares the tradition of playing with colors for the Holi festival.

is seeking to support that through our Wildland Volunteer Network in the San Francisco Bay Area (read more online at cal-ipc.org/WVN).

### **CAL-IPC UPDATES**

**2019 Cal-IPC Symposium in Riverside** – Online registration ends Oct. 1, discounted room block first come/first served through Sept. 13. Program posted online. See page 9.

**Statewide WMA meeting** – Calling all WMAs, gather at the Symposium on Oct. 15 for training and updates.

**Planning weed management** – Cal-IPC's new guide for land managers is available on our website and a training will be held at the Symposium. cal-ipc. org/BMPplanning

**WMA funding** – More than \$1.7 million in state grants went out this spring for local projects across the state. We continue to advocate for yearly funding in the state budget.

Wildland Volunteer Network – Ten trainings were held in the SF Bay Area this spring, three for Conservation Corps. See our website for a list of volunteer stewardship opportunities in the region. cal-ipc.org/WVN

**Invasive lunch webinars** – We partnered with UC Cooperative Extension on the series for California Invasive Species Action Week.

**Tree mortality zone BMPs** – Cal-IPC has published a best practices flyer and slide show on avoiding weed spread when working in Sierra tree mortality zones. Available in the Library section of our website. Supported by US Forest Service State & Private Forestry and the Cal. Dept. of Food & Agriculture. cal-ipc.org/tree\_mortality

**Herbicide policy** – Our website has a new page providing resources, including our policy on the use of herbicides as part of an integrated approach, our policy on the use of glyphosate for invasive plant management, and a flyer on ways to talk with people about these issues. cal-ipc.org/using\_herbicides

### **YOUR MEMBERSHIP**

Thank you for keeping your membership current. Note that your expiration date is shown on the mailing label of this newsletter.

# Wildland Weed News

### **OTHER NEWS**

**Biosecurity report** – The Western Governors' Association has released a "Special Report for the Western Governors' Biosecurity and Invasive Species Initiative."

**Rapid response guidelines** – The State of Montana has posted for review a draft document on state-level rapid response.

**US contribution** – Curious about species from the US that are invasive elsewhere in the world? A June blog post on The Nature Conservancy's website describes impacts of seven animal species abroad: raccoons, largemouth bass, red-eared sliders, mink, American bullfrogs, eastern grey squirrels, and rosy wolfsnails.

**Knotweed biocontrol** – USDA has determined that the Japanese knotweed psyllid is safe for release. The psyllid also damages giant and Bohemian knotweed species.

**Meadows guide** – Point Blue has posted "A guide to climate-smart meadow restoration in the Sierra Nevada and southern Cascades" on the UC Davis meadows website.

**Supporting NISC** – An editorial in an April issue of Frontiers in Ecology and the Environment makes the case against budget cuts for the National Invasive Species Council.

### **New funding for WMAs**

Thanks to your advocacy support, the state's 2019-2020 budget passed with

funding for CDFA's Weed Management Area (WMA) program as part of the state's new Biodiversity Initiative! We anticipate an RFP for new WMA grants this fall. This follows thirty grants awarded to WMAs this spring based on funding secured in last year's budget. In other good news, CNPS was able to secure funding for seed Cats in Australia – Feral cats

cause major damage to native species in Australia and a new campaign is underway to control them.

**Saharan mustard biocontrol** – The Tubb Canyon Desert Conservancy in Borrego Springs is campaigning for USDA to include the species as a target for biocontrol research in its next 5-year plan.

**River restoration** – Utah State has published a design manual on "Low-Tech Process-Based Restoration of Riverscapes."

**Nutria guide** – If you spend time in the Delta, get your pocket guide to invasive nutria from Cal. Delta Stewardship Council.



Jason Mills, Restoration Program Manager at Sonoma Ecology Center, demonstrates tools and techniques for managing weeds and creating fire breaks during a Wildland Volunteer Network training session. Photo: Alene Spindel

banking rare native plants for the California Plant Rescue program (see article page 6).



Photo: Benjamin Dion

llustration by Ryan Jone

# Are we making progress? A bird's-eye view of change in invasive plant cover in central-coastal Orange County

### Jutta C. Burger, Cal-IPC Science Program Director

ffective wildland weed management means not only getting out there and doing the field work, but also strategizing where to go, which species to prioritize, and, critically, how to track and evaluate progress. For many of us, progress is usually — at its best — tracked annually and evaluates how many acres or populations were treated, how many plants were removed, and/or how many hours were spent doing the work. That's

called tracking effort, and it tells us a lot about progress at a local scale.

What we really want to know as land managers, is whether we are making progress at a landscape scale by reducing the number of populations or acreage of high-priority species, eradicating high-risk species that are at low density in an area, or recovering native habitat. Tracking this type of change doesn't just mean monitoring the populations that we've found; it also extends to locating any new populations that have emerged or ones that we have missed.

One would think that this is easy to do, but it is surprisingly difficult. Resources are usually not available to perform comprehensive surveys. Target species are each unique in their degree of difficulty, both to control and to detect. Invasive plant populations do not tend to respect property boundaries, meaning that surveys that end strictly at property lines may miss major source populations just beyond their reach.

Cal-IPC was recently given the opportunity to track landscape-level changes in invasive plant species using data from two helicopter surveys conducted over the same area, five years apart. The area is a portion of the Nature Reserve of Orange County (a Natural Community Conservation Plan/



Helicopter view of coastal sage scrub, oak woodland and grassland habitats in Limestone Canyon, Orange County. Photo: John Gump.

Habitat Conservation Plan – NCCP/HCP — reserve complex) and adjacent Nature Conservancy easement lands, totaling over 30,000 acres of mostly rugged terrain. The first survey was conducted in 2011 by Native Range and the second in 2016/2017 by Wildlands Conservation Science. Surveys were funded in part by a Local Assistance Grant from the California Dept. of Fish & Wildlife, with matching funds from a land manager collaborative comprising the Natural Communities Coalition (NCC), the Irvine Ranch Conservancy (IRC), Orange County Parks (OC Parks), and The Nature Conservancy (TNC). NCC, as the ringleader for tracking reserve-wide change, hired Cal-IPC to compare results from the two surveys.

A lightweight turbine helicopter was used for both surveys, with pilots skilled at maneuvering at low altitudes and across

steep terrain. Botanists on board were able to identify and map plant populations literally on the fly. Each survey covered approximately 31,000 acres, collected 4,253 (2011) and 3,722 data points (2016/2017) and conducted flight surveys in the span of only 12 working days. Flight transects followed the landscape's contours. Invasive plant





populations were mapped as points, lines, or polygons in 2011 and primarily mapped as polygons in 2016/2017. Gross area was estimated by using either patch radius or length x width and net area was derived from percent cover estimates. In all, 24 invasive plant species were recorded consistently by both surveys for comparison.

For each species, we assessed change in gross area, net area, and number of populations. These changes were compared with labor effort spent controlling that species. The survey area was divided into invasive plant management units (IPMUs) to account for spatial variation in species cover and management actions. IPMUs spanned management and land ownership boundaries, but matched hydrological boundaries with the intention of also matching likely movement patterns of invasive plants. The primary land managers involved in the project were IRC and OC Parks, with California State Parks invested in a small portion of the study area.

Helicopter surveys provided landscapescale distribution data for invasive plant species that allowed for revisions in strategic planning for their control. Significant reductions in several target species were documented. Most notably, cover of five species prioritized for control work declined significantly: artichoke thistle (Cynara cardunculus) cover decreased 93% (from 291,653m<sup>2</sup> to 21,086m<sup>2</sup>), tree-of-heaven (Ailanthus altissima) decreased 88% (from 3063m<sup>2</sup> to 366 m<sup>2</sup>), Spanish broom (Spartium junceum) dropped 98% (from 9831m<sup>2</sup> to 190 m<sup>2</sup>), yellow starthistle (Centaurea solstitialis) dropped from 2080m<sup>2</sup> to 3m<sup>2</sup> (in surveyed areas), and garland chrysanthemum (Glebionis coronaria) decreased from 28m<sup>2</sup> to undetectable levels (Figure 1). All these species, with exception of artichoke thistle (see Figure 2) were relatively localized to begin with and



*Figure 2.* Change in artichoke thistle (Cynara cardunculus) distribution 2011-2016/2017.

therefore could be managed comprehensively within the survey area.

However, news was not all good. We observed the following worrisome increases in invasive plant cover despite local control efforts: fountain grass (Pennisetum setaceum) exploded by nearly ten times its initial area, giant reed (Arundo donax) tripled in area, tamarisk (Tamarix ramosissima) guadrupled in area, and castor bean (Ricinus communis) increased 14%. Increases for all species except fountain grass were localized to specific IPMUs, suggesting that these overall patterns of increase were driven by portions of the study area that were either de-prioritized or not under management. In addition, fine-scale differences in survey outlines inadvertently excluded a lake perimeter in which significant giant reed control work had taken place between 2011 and 2016, making comparisons along the lake untenable. This information can be used to determine whether existing strategies need to be adjusted to address these species.

It is a rare opportunity to have two

"snapshots in time" that can show change in abundance and distribution for the number of species and scale of area surveyed here. The comparison is strengthened by the fact that similar methodologies were employed, which provided invaluable information on population expansions, new infestations, and management progress. Some species (not reviewed here) showed dramatic increases or decreases in cover that, upon further investigation, appeared to be mostly the result in observer-based differences in estimations of percent cover or fine-scale differences in survey effort. Future large-scale surveys would benefit from a written methodology which (1) outlines assumptions made for cover estimates and population delimitation, (2) identifies the criteria for mapping points or polygons, and (3) standardizes survey area, flight transect spacing, and time of year to ensure similar effort and detect-

ability of plants.

Data on treatment effort are essential for deducing likely causes for decreases (or increases) in species cover. In our case, these data could have been collected more consistently. Only one land manager (IRC) was able to provide labor hours invested into each target species across each IPMU. Therefore, our estimates of labor effort are underestimates. Gains in acreage of high priority species could also have been addressed by improved participation and expansion in the invasive plant management collaborative.

Surveys were conducted largely irrespective of property boundaries, but some adjacent populations were undoubtedly missed. For example, though yellow starthistle was significantly reduced within the survey area, known populations persisted on road rights-ofway and adjacent lands just beyond the survey area, and continue to pose a management challenge. Furthermore, no *(Continued on page 11)* 

# Protecting our imperiled flora: Seed banking for the future with California Plant Rescue

### Heather Schneider, Rare Plant Biologist, Santa Barbara Botanic Garden

s home to more than 6,500 different kinds of plants, California is the most botanically diverse state in the nation and a global biodiversity hotspot. Latitudinal and elevational gradients across the state, coupled with diverse and unique soils, contribute to California's status as a botanical wonderland. But, with great diversity comes great responsibility: one-third of California's native flora is considered rare and at risk.

Some of the state's rare plants are intrinsically rare — highly adapted to uncommon soil types or carving out a very particular niche in the landscape. However, many of the 2,000+ imperiled plants in California have suffered from extrinsic pressures such as habitat loss and degradation, exotic species invasions, and climate change. When considering these compounding pressures, one can't help but worry about the future of rare plants. Protecting these rare plants is a primary focus of the California Native Plant Society (CNPS) and institutions both big and small across the state, such as the Center for Plant Conservation and the Santa Barbara Botanic Garden.

Comprehensive conservation of rare plants requires extensive collaboration and investment and it can take decades. While working on comprehensive conservation for the long-term, it is critical in the short-term to establish an insurance policy against extinction. Conservation "seed banking" offers an effective and costefficient means of securing biodiversity by providing a genetic backup in case of catastrophe in the wild.

### An ambitious undertaking

In 2014, a group of conservationists developed a collaboration to secure California's botanical diversity for longterm conservation. They named this partnership California Plant Rescue (CaPR) and set a long-term goal of securing the entire California flora in *ex-situ* conservation collections, including seed banks and living collections in botanic gardens, as a safeguard against extinction.

This endeavor is part of a worldwide conservation effort. The Global Strategy for Plant Conservation has set a target of collecting and storing seeds from 75% of the rarest plants by 2020. As of early 2019, CaPR partners were more than halfway to achieving this goal for California. There are 1,185 plant species in California ranked as "1B" by CNPS, representing the rarest plants in the state. The above-average rains this year bode well for seed production, and CaPR partners will make collections of many additional plant species.

In addition to providing an insurance plan against extinction, these efforts add to the body of knowledge about rare plants, which are often under-studied. The monitoring that CaPR partners perform leading up to seed collecting

### **Seed Bank Overview**



Though the term "seed bank" may conjure images of the Svalbard Global Seed Vault, which sits deep inside a mountain on a remote island halfway between Norway and the North Pole, you don't need an artic mountain to save seeds; you just need determination and a freezer. Photos: Heather Schneider.

- As of 2018, SBBG has 543 CNPS 1B taxa in our on-site seed bank and living collections.
- CaPR partners currently house 8,177 seed bank accessions, representing 2,000+ different taxa.
- CaPR now has capacity for 25,000 accessions, with the ability to expand. Currently, we are using roughly 50% of that capacity.
- Seeds are stored in chest freezers at -18C after being dried down to 25% relative humidity. Drying the seeds and freezing them lowers their metabolic rates and slows aging. Seeds are alive, so they continue to age at a greatly decreased rate in the freezer.
- The National Laboratory of Genetic Resources Preservation has large walk-in freezers where they store seeds, but the CaPR partners uses chest freezers, which is standard for institutions of our scale.
- Longevity varies between species. California's desert annuals are adapted to long periods of drought. If these seeds can survive for many decades in the soil, it stands to reason that they could last at least that long, maybe even a century in the freezer. Some species (like oaks) can't be seed banked at all. Researchers are working on a solution.



Fritillaria ojaiensis is a CNPS 1B.2 plant that was seed banked by the Santa Barbara Botanic Garden. Photo: Santa Barbara Botanic Garden.

improves scientific knowledge about how these plants behave in the wild. Once the seeds are collected, CaPR partners learn about seed structure, germination requirements, and viability of seeds by conducting germination tests. This new information feeds into the long-term *in-situ* conservation of rare plants while also facilitating *ex-situ* preservation.

### **Meeting long-term goals**

Collecting seeds and curating seed collections is painstaking work. (For those species whose seeds cannot be stored successfully using conventional methods



Dudleya nesiotica is a state rare and federally threatened plant that occurs only on Santa Cruz Island. The Santa Barbara Botanic Garden is working with The Nature Conservancy and USFWS to map and seed bank this plant. Photo: Santa Barbara Botanic Garden

of drying and freezing, botanic gardens can add specimens to their living collections.) CaPR partners undertake extensive coordination of land managers, researchers, funding entities and other organizations to facilitate this work. Seed storage requires maintaining facilities with specific technical requirements.



Santa Barbara Botanic Garden volunteer Michael Wittman cleaning and weighing seeds. CaPR partners rely on dedicated volunteers to clean the hundreds of thousands of seeds that are collected each year. Photo: Santa Barbara Botanic Garden.

Some CaPR partners maintain such facilities, and seeds are also shared with the National Laboratory for Genetic Resources Preservation, the US Department of Agriculture's national seed bank in Fort Collins, Colorado.

CaPR's near-term goal is to secure collections for all plants on the CNPS 1B list by 2020. To date, much of the time spent on these efforts has been donated by CaPR partner organizations whose mission is to protect California's natural heritage, but achieving this and future goals will require funding. The state's new Biodiversity Initiative provides an avenue for that funding and this year

### **Rare plants and weeds**

Recovery of rare plants in their habitats requires multifaceted efforts at the landscape scale. To that end, Cal-IPC is partnering with two CaPR organizations (Santa Barbara Botanic Garden and Rancho Santa Ana Botanic Garden) on a funding proposal to the US Fish & Wildlife Service and the California Department of Fish & Wildlife. The project entails risk assessments and habitat enhancement for a set of federally listed plants on California's central coast, with the intention to informing invasive plant management as part of the conservation of rare plants across California.

CNPS worked with Assembly Member Ash Kalra from San Jose to secure \$3.6 million for rare plant seed banking as part of implementing the initiative. (The initiative has also resulted in new state funding for invasive plant management through county Weed Management Areas.)

This infusion of state funding for seed banking will propel CaPR partners toward achieving short-term goals and lay the groundwork for future conservation seed banking efforts. Most importantly, it sets a precedent for prioritizing plant conservation at the state level. To find out more about CaPR, visit www.caplantrescue.org.

### **CaPR Partners:**

- California Department of Fish & Wildlife Natural Diversity Database
- California Native Plant Society
- Center for Plant Conservation
- Rancho Santa Ana Botanic Garden
- San Diego Botanic Garden
- San Diego Zoo Global
- Santa Barbara Botanic Garden
- UC Davis Arboretum & Public Garden
- UC Santa Cruz Arboretum & Botanic Garden
- UCLA Mildred E. Mathias Botanical Garden
- University of California Botanical Garden at Berkeley

# Connecting to stewardship: Why do we gather?

### Alene Spindel, Cal-IPC Training Program Associate

had the privilege to attend the recent "Holi in the Parks" event on March 23. 2019 at Lands End in San Francisco, organized by the Golden Gate National Parks Conservancy (GGNPC). This community stewardship event centered around celebrating the South Asian festival of Holi, a two-day Hindu festival that spans the last night of winter to the first day of spring. Program organizers shared this cultural tradition to help park visitors and volunteers create a personal connection that encourages greater stewardship of our shared natural areas.

Jainita Patel, GGNPC Restoration and Volunteer Management Fellow, shared her experiences of the Holi festival growing up in India:

> On the first night of Holi, the last night of winter, we had a giant bonfire in our backyard to celebrate with the whole family. In the area where my family is from, there were bonfires the size of a city block. Everyone stayed until the fire burnt out, then we slept for a couple hours. The next day, we would celebrate the first day of spring by throwing powdered pigments with bright colors that rejoice in the colors of the natural environment that come with the season. It also spreads good energy, putting good vibes into the atmosphere, and burning away negative energy for the start of the new season.

Lands End is not a suitable space for a giant bonfire. However, GGNPC Community Programs Manager Yakuta Poonawalla decided to bring this special Holi festival to the stewardship community of San



Volunteers pull ripgut brome (Bromus diandrus). Restoration at Lands End is informed by the indigenous knowledge of the native Ohlone Yelamu tribe, that have had ancestral settlements all along this coast.

Francisco to welcome spring and demonstrate the power of gathering community to connect to land, wildlife, and each other. Poonawalla explained, "We wanted to welcome the wildflowers, butterflies, and the colors they brought, as well as the bird season which started on March 1. We wanted to welcome all of that to the Bay Area, and Lands End in particular." The Lands End area on the San Francisco coast has been actively restored by volunteers and GGNPC staff for thirteen years. The transformation of this coastal habitat area is beloved by park visitors, nearby residents, and wildlife.

This stewardship event highlighted the importance of sharing rituals, traditions, and cultural gatherings. While preparing for this event that was culturally meaningful to her, Poonawalla became aware of at least five other festivals being celebrated across the world in the same month. To connect to participants' reasons for gathering, all were invited to share stories of festivals, traditions, celebrations, rituals, and nature-worshipping acts close to their hearts.

After learning about Holi traditions, volunteers worked together to remove invasive weeds from the coastal habitats around the park, including ripgut brome grass (Bromus diandrus) and climbing fumitory (Fumaria capreolata). Restoration activities were followed by eating Indian food, sprinkling each other with powdered colors, dancing like monarch butterflies, and sharing stories of connection to spring traditions and nature. In closing, participants shared their visions of a new meaning of stewardship that could be taken into their lives and communities.

I had a chance to pause with Yakuta Poonawalla and Jainita Patel to discuss Holi in the Parks.

## What inspired the Holi in the Parks program?

**YP:** This program was inspired by the question, "What brings community together?" The answer was clear in my mind; traditions, cultures, rituals, birth-days, anniversaries, graduations, memorials... There is so much to celebrate in our human cultures.

I thought, "Hey what do I love?" I love being outside in nature, I love the community that shows up every Saturday, and I thought it was great space to celebrate Holi. I want to give back to this beautiful area that brings so much into our lives. I love hearing about all the reasons that bring people here. Seeing these participants makes me happy and gives me reassurance that spaces like this are needed and times like these are needed.

(Continued on page 13)

# Evolving management perspectives in a changing world

# Cal-IPC Symposium Oct. 15-18, 2019 ~ Riverside

### Join us in Riverside to share the latest in invasive plant biology and management! Missed the early bird deadline on Aug. 1? Register by Oct. 1 for final savings.

### **SYMPOSIUM FEATURES**

Gather with colleagues from across the state to share the latest updates on effective tools, new weeds, relevant research, strategic approaches, and new directions.

### TUES., OCT. 15: WMA MEETING, TRAININGS, & MORE

9 am–12 pm: 2019 Statewide WMA Meeting. Representatives from Weed Management Areas convene to share information on project design, new weeds, control techniques, early detection, mapping, and funding. (no cost)

1–5 pm: Trainings (\$50 Members/\$75 Non-Members)

- Calflora's Weed Manager and Observer Pro Smartphone App
- Soup to Nuts: Planning Your Organization's Invasive Plant Management

5–6:30 pm: Reception (no cost) 6:30–8:30 pm: DPR Laws & Regs (no cost)

### WED. & THURS., OCT. 16–17: MAIN CONFERENCE

Session talks, plenaries, discussion groups, and posters cover a wide range of topics on invasive species biology and management, including:

 Land management – program planning, tools and tactics, mapping, targeted grazing, and lessons learned

- Restoration and recovery fire recovery, grasslands, wetlands, coastal sage scrub, rare plants
- Research and ecological interactions

   plant traits and life cycles, population and community ecology, soil biota, new invasive plants
- Community outreach messaging, volunteer coordination, public engagement
- Inclusivity non-traditional career pathways, broadening the conservation field, reaching diverse audiences
- Invited plenaries on regional history and perspective, invasive plant management on federal wildlife reserves, and evolving perspectives on invasive plants

Plus our annual Photo Contest, Auction/ Raffle Social Hour, and Awards Banquet!

### FRI., OCT. 18: FIELD TRIPS

- Santa Rosa Plateau (Full day, \$50)
- Santa Ana River and Tributaries (Full day, \$50)
- Mill Creek Canyon (Half day, \$30)
- Testing for *Phytophthera* & Land Use Learning Center (Half day, \$20)

### PRICING

Member: \$320 early bird / \$345 regular / \$370 late

Non-Member: \$370 early bird / \$395 regular / \$420 late

**Presenter:** \$295 early bird / \$320 regular / \$345 late (Presenting at 2019 Symposium)

**Student:** \$50 early bird / \$65 regular / \$80 late (in degree program or 1 year post grad)

**Student Presenter:** \$25 early bird / \$40 regular / \$55 late (in degree program or 1 year post grad and presenting at 2019 Symposium)

**Symposium Volunteer:** \$195 (while space lasts, 5 hours work expected. Learn and help lend a hand!)

### OUR VENUE

We are meeting at the Riverside Convention Center, steps away from restaurants and entertainment. Cal-IPC has reserved a limited block of hotel rooms at the historic Mission Inn. See website for details.

Visit cal-ipc.org/symposium to register and find more Symposium information.



Friday field trips explore regional invasive plant management efforts, including Mill Creek. Photo: Aaron Echols.

# Invasive plant species mapping in the Santa Ana River Watershed

### Sloane Seferyn, HANA Resources, Inc. and James Law, Santa Ana Watershed Association

emoving invasive giant cane or giant reed (*Arundo donax*) from the Santa Ana River Watershed has been a goal for many resource conservation and habitat restoration entities for decades. For land managers, its towering size and impenetrable stands make its biomass difficult to quantify, which makes it difficult to estimate removal cost. This article describes an instance where an emerging technology has cracked this case.

In October 2018, the Santa Ana Watershed Association (SAWA) partnered with HANA Resources, Inc. (HANA) to determine the amount of *Arundo* on a 211-acre project site along the Santa Ana River in Norco, California. This consisted of an unmanned aerial vehicle (UAV) flight to obtain high-resolution aerial images and then processing those images through a computer vision algorithm to identify the plant species.

In older methodologies of computer vision through artificial intelligence, an algorithm was hand-defined to quantify a particular aspect of an image such as the image's shape, texture, or color. Given an input image, we would apply our hand-defined algorithm to the pixels



Project map showing Arundo concentration within the 211-acre project site using aerial imagery and HANA's deep learning species recognition software (U.S. Patent No. 9,984,455).

of the image, and in return, we would receive a matrix of values or "features" quantifying the image contents. This matrix of values was what we were truly interested in, as they served as inputs to our machine learning models.

We used a more efficient approach called "deep learning," specifically Convolutional Neural Networks (CNN). Instead of hand-defining a set of rules and algorithms to extract features from an image, these features were instead automatically "learned" from the training process. (For those interested in the technical details, we applied a series of algorithms — convolution filters, nonlinear activation functions, pooling, backpropagation — and the CNN "learned"

### Arundo Acreages

APN Areas	APN Acreage	Acres of <i>Arundo</i>	% Arundo
130080012	1.27	0.02	1.58%
130080015	7.11	2.12	29.82%
130090002	90.73	19.06	21.01%
130090001	63.34	29.22	46.13%
130080007	48.91	27.61	56.45%
Total	211.36	78.03	36.92%

This table shows the APN versus Arundo acreage values within the project boundary calculated using the algorithm.



HANA Resources' Inspire 1 taking off from a helipad along the Santa Ana River.

filters that were able to detect edges and structures in lowerlevel layers of the network. The network then used the edges and structures as "building blocks," eventually detecting higher-level objects such as faces or plant species. This process of using the lower-level layers to learn to identify higher-level features is the defining aspect of CNNs and was made possible by stacking a specific set of layers in a purposeful manner.)

For this project, HANA utilized a deep learning neural network to recognize, identify, and geographically map the Arundo plant species. The model was trained using the aerial images of Arundo we captured using the UAV. With these images, the model sought to classify images of the invasive plant species that the model had never seen before. (The CNN architecture consisted of convolutional layers, fully connected layers, and a classification layer, and the framework of the model used python code written using Tensorflow and Keras that accepted positive and negative data samples for plant identification.)

The positive samples included a sufficiently large dataset of *Arundo* images collected via UAV by HANA. In order to prevent overfitting, validation data was used by preserving and then utilizing a portion of the training data. Negative samples included an equally large dataset of images of plants and the environment typically found in an *Arundo*-infested area, including willow species. (Since this project's completion, HANA has patented this proprietary



A segmentation layer applied to the detection layer for high-accuracy acreage estimates.



Project map detail showing Arundo concentration within APN 130090001. Notice the tan area just north of the concentration of Arundo. Here, Arundo was removed during another habitat restoration project for the U.S. Army Corps of Engineers.

process: U.S. Patent No. 9,984,455.)

SAWA used the multispectral imagery depicting *Arundo* acreages to make informed decisions about the amount of *Arundo* removal and the costs of implementing the removal. This technology also allows for long-term site monitoring of this site using ultrahigh resolution aerials to compare *Arundo* growth over time and to detect changes in vegetation on a landscape scale. Limitations associated with conventional methodologies have been overcome by rapidly advancing technology. Remote sensing at a much larger scale removes issues associated with point-based monitoring methods, such as quadrats or transects, and is more representative of the area of interest's performance.

All images courtesy HANA Resources, Inc.

### **Tracking progress in Orange County**

### (Continued from page 5)

one survey technique is a silver bullet: helicopter surveys do not detect all populations of target species (Cal-IPC *Dispatch* Spring 2013) and cannot reliably detect several pernicious annuals, such as Saharan mustard or stinknet.

The success of this repeated survey and associated management lies in the strong collaboration of Nature Reserve of Orange County land managers Irvine Ranch Conservancy, OC Parks, and State Parks, and in the leadership and funding brought by NCC. The future success of this program — now complemented with an on-the-ground early detection/ rapid response (EDRR) program — will hinge on tight collaboration, regular communication and coordination, and, as always, vigilance. We are excited to hear about this program's future work, including more in-depth local surveys by NCC and partners to track changes in native vegetation associated with control work.

# Checking the threat and spread of invasive alien species through exploitation in Africa

### Israel Borokini, Program in Ecology, Evolution and Conservation Biology, Department of Biology, University of Nevada, Reno

The establishment of invasive alien species on native terrestrial and aquatic biodiversity. The establishment of invasives in their introduced range is often facilitated by ecological release, niche shifts and human assistance, among other factors. The economic implication of IAS management can add up to billions of dollars annually for controlling invasive species in high risk ecosystems and agricultural landscapes.

Unfortunately, ineffective management of invasive species is particularly common in developing countries, like my home country of Nigeria, that have insufficient financial resources for periodic management and inadequate technical expertise. Adding to this problem, both local scientists and the public may not possess adequate knowledge to distinguish between native biodiversity and naturalized exotics. This may be in part due to the economic and social benefits derived from the introduced species. For example, Theobroma cacao (cocoa), and Manihot esculenta (cassava) were introduced to Nigeria from South America, while Dioscorea esculenta (white yams) came from Asia. However, Nigeria is now the highest global producer of cassava and yams and one of the top five global producers of cocoa. In a recent study, I identified over 1,200 introduced plants in Nigeria, some of which are used for food, construction, ornamental purposes, herbal medicine, and source of income. Of this number, more than 300 species have become invasive.

With international collaboration and funding, many control methods — especially biological control — have been used to combat invasive plant infestations in Africa, with mixed success. For example, five natural enemies of *Eichhornia* 



Harvested water hyacinth rests in a field. It will be dried in bundles before being turned into handcrafts. Photo: Achenyo Idachaba

*crassipes* (water hyacinth) were introduced in various parts of Africa, but only two successfully established and their control



Weavers create purses (pictured) and other handcrafts from dried water hyacinth. The owner of this business, Achenyo Idachaba, won the Carter's Women initiative Laureate Prize in 2014. Photo: Achenyo Idachaba

of water hyacinth was limited, despite the high cost of the projects. Also, none of the biological agents for Chromolaena odorata (Siam weed) successfully established in the wild. Chemical control is also expensive, and some options may have adverse effect on the environment. Mechanical control using heavy machinery is effective but expensive, has negative effect on ecosystems, and can spread propagules. The simultaneous use of two or more control methods (integrated control) appears to be the most effective. Unfortunately, this option is unrealistic in developing countries, due to limited financial resources and technical expertise.

Traditional bioprospecting of some of these invasives have led to their exploitation to meet basic needs and generate additional incomes for local producers. For instance, many ethnobiological studies have documented the use of some invasive plants as alternative source of traditional medicine across Africa. Exploitation of Typha australis (typha grass) for charcoal production for domestic energy and sales for additional income is common in Mali, Senegal, the Gambia, and northern Nigeria. The potentials for organic farming with compost from E. crassipes (water hyacinth) foliage and biogas production from Tithonia diversifolia (Mexican sunflower) and C. odorata have been noted. Many parts of Prosopis juliflora (mesquite) are being harvested in many African countries in the Sahara and Sahelian ecoregions and in the Indian subcontinent for use in traditional medicine, baking, construction, charcoal production and for fodder. Additionally, several local products are being derived from Nypa fruticans (nipa palm), which threaten the mangrove systems in southern Nigeria.

Empirical evidence and many case studies have shown that economic

exploitation can help eradicate or manage invasive species, provide additional income sources, and reduce human dependence on already-threatened native biodiversity. Furthermore, most harvesting of invasives occur at the community level, which can bolster community-based natural resources management. In India and Ethiopia, successful reclamation of land invaded by *P. juliflora* was achieved through exploitation.

This method of control is not limited to developing countries. The management of invasive weeds using goats in the United States and Australia can be considered an economic exploitation (and biological control). Also, commercial harvesting of invasive crayfish in Lake Tahoe is now permitted as the only means of controlling their populations. A similar approach was adopted by the U.S. Government for managing nutria and Burmese pythons.

This approach is not without concerns. The local communities engaged in this exploitation should be educated to understand the end goal, which is to control invasive species. Therefore, cultivation of species solely for economic gains should not be allowed. Further-



The work of rural Nigerian weavers displayed at a gallery show in Berlin, Germany. Much of the craftwork is made from water hyacinth. Photo: Gert Baumbach

more, local exploitation of invasive plants needs to be done at a scale that covers their entire geographical extent, to avoid re-invasion from unexploited neighboring areas. Context-dependent frameworks

should be developed to evaluate economic implications, establish best practices for local harvesting to reduce accidental propagule spread, and for sustainable land use after reclamation from invasive plants.

### Connecting to stewardship

(Continued from page 8)

How can we shift the ways in which we talk about stewardship to make it a more inclusive space and encourage a broader range of people to take care of our public lands?

**YP:** I ask myself, "How do you make this work relatable and relevant? How do you make it accessible? How do you break down barriers?" We have to breakdown technical jargons that are removed from lived experience of participants. Give people more metaphors and examples of how people can see themselves in nature through celebrations, cultural

festivals, rituals, and meaningful traditions. We can only protect something that we understand, so making stewardship relatable to people's lived experience is crucial to grow this community. I will care for it once I have an experience I can relate to.

I started this program because I felt that everyone should have access to experience Holi, and the more we learn of each other's cultures, the more we start breaking down barriers. By celebrating outside, we create more moments of connection and provide a strong example of the power of gathering.

Some people don't have a sense of community or special cultural festivals, and for them this type of program



Participants share traditions of the Holi festival, including dancing with colorful scarves.

becomes a way to connect. Some people join every single cultural program we have. One volunteer told me that this program has become her tradition, that she has learned so much about south Asian culture. Before meeting me, she had never met another Indian woman in conservation work.

It is vital that we have leaders from the community like Jainita Patel to represent and create space for themselves and the community. So many of the little things that make this work more inclusive need to be hit from all angles before it starts making sense.

What does this program mean to you? JP: I started my year-long internship in October. When I first moved out here

> from the East Coast, I didn't think I would be able to celebrate my culture through this work. The fact that everyone is out here today celebrating Holi makes me so happy because I didn't think I would get to celebrate this year. The fact that we are out here playing with colors, eating Indian food, and enjoying the outdoors together is a really wonderful experience for me.

**YP:** I am so thankful for our participants, and for their shared stories. I hope we can continue seeing our national park as spaces where we can bring our whole selves, where we can bring a little bit of what is important to us. Once we do that, I feel like magic can happen. Let's continue to show up for community, for parks, for nature, and for ourselves and our own wellbeing.

All photos by Alene Spindel

## 20th Anniversary Central Coast Invasive Weed Symposium

### Bruce Delgado, Bureau of Land Management, Fort Ord National Monument

n November 14, 2019, Carmel Valley will host the 20<sup>th</sup> anniversary of the Central Coast Invasive Weed Symposium (CCIWS) and it seems timely to celebrate and reflect upon how such collaborated efforts succeed.

In many ways, CCIWS is a proud mini version of Cal-IPC. The annual symposium focuses on the nuts and bolts of removing invasive weeds and current weed research. We also discuss how policies regarding prescribed burning, habitat restoration, climate change, integrated pest management, and Dept. of Pesticide Regulations help dictate the ethics, requirements, and opportunities for successful wildland weed abatement. The symposium cost is under \$70 and includes a morning of speakers, a healthy and hearty breakfast and lunch, post-lunch laws and regulation speakers for those

interested in Continuing Education Credits, and afternoon field trips for everyone.

Twenty-six years ago, a few bright-eyed university and government agency representatives decided it would be a



Attendees of the CCIWS Symposium enjoy a field trip led by Sue Hubbard, Bureau of Land Management, Fort Ord. Photo courtesy CCIWS.

good idea to organize a Weed Management Area on Fort Ord and to hold a weed symposium. Entering the new millennium, the Fort Ord Weed Management Area was folded into the newly established Monterey County Weed Management Area, and its various participants, with critical leadership of the Monterey County Agricultural Commissioner, assumed the organization of the annual War on Weeds Symposium which would later be renamed

the Central Coast Invasive Weed Symposium.

In 2010, it became clear that more is better in collaboration of invasive weed abatement efforts. Thus, it was decided that the symposium would alternate years between Santa Cruz and Monterey County venues, with leadership being shared between representatives of both counties' non-profits and agencies.

We thank participants from throughout California who have attended our 20 symposia and the many partners who have supported them. Hope to see you all November 14 in Carmel Valley! Find out more at cciws.org.



Stewardship Circle	\$1000
Champion	\$ 500
Partner	\$ 250
Professional	\$ 100
Friend	\$ 50
Student/Early Career	\$ 25
Members receive Dispa	<b>tch</b> and discount

on Symposium registration!

Benefactor	\$2000	Pro membership for 8	Qu
Patron	\$1000	Pro membership for 6	Eig
Sustainer	\$ 500	Pro membership for 4	Log
Supporter	\$ 250	Pro membership for 3	Nar

Quarter-page in newsletter Eighth-page in newsletter Logo in newsletter Name in newsletter

Organizations receive Professional membership for their staff and newsletter recognition for 12 months!

See cal-ipc.org for full membership details

# **Thank You for Supporting Our Work**



Blankinship and Associates, Inc Bolsa Chica Land Trust Burleson Consulting Inc. Calflora California Assoc. of Local Conservation Corps California Association of Resource **Conservation Districts** California Dept. of Food & Agriculture California Native Grasslands Association California Wildlife Foundation/California Oaks Catalina Island Conservancy Channel Islands Restoration Chambers Group CNPS – Dorothy King Young Chapter CNPS – East Bay Chapter CNPS – El Dorado Chapter CNPS – Los Angeles/Santa Monica Mountains Chapter CNPS – Marin Chapter CNPS – Monterey Bay Chapter CNPS – Mt. Lassen Chapter CNPS - Napa Chapter CNPS – North Coast Chapter CNPS – Orange County Chapter CNPS – Riverside-San Bernardino Chapter CNPS – Sacramento Valley Chapter CNPS – San Diego Chapter CNPS – San Gabriel Mountains Chapter CNPS - Santa Clara Valley Chapter CNPS – Santa Cruz Chapter CNPS – South Coast Chapter CNPS – Yerba Buena Chapter Cummings Anesthesia, Inc. Dendra, Inc. East Bay Regional Park District Elkhorn Slough Foundation

Forester's Co-op/FCO Foresters Garcia and Associates Go Native, Inc Golden Gate National Parks Conservancy Gulf South Research Corporation H. T. Harvey & Associates Hedgerow Farms The Huntington Library Irvine Ranch Water District Jesse Mack Company Marin Agricultural Land Trust Marin Municipal Water District Nakae & Associates, Inc. Nomad Ecology, LLC Palos Verdes Peninsula Land Conservancy Placer County Dept of Agriculture **RECON Environmental**, Inc. **RCD Monterey County** RCD Riverside-Corona **River Partners** S&S Seeds Inc Sage Environmental Group San Mateo County Parks Department Santa Ana Watershed Association Santa Barbara Botanic Garden Santa Barbara County Ag Commissioner Santa Clara County Parks & Recreation Santa Lucia Conservancy Sempervirens Fund SERĊAL SoCal Biology Student Conservation Association Sustainable Conservation/PlantRight **Triangle Properties** Tule River Indian Tribe The Watershed Nursery WRA, Inc.

### **Individual Supporters**

(New and renewing)

Gifts received from March 27, 2019 to July 3, 2019

**Stewardship Circle** Edith Allen, Riverside Anonymous Gina Darin, West Sacramento Joe DiTomaso, Woodland Doug Gibson, Encinitas Rick Hoskins & Lynne Frame, Mill Valley Ed King, Auburn Marla Knight, Fort Jones Julia Parish, Dulzura Laura Pavliscak, Ventura Peter Schuyler, Santa Barbara Heather Schneider, Santa Barbara Baldeo Singh, Sacramento Marcos Trinidad, Los Angeles

### Champion

Anonymous Mark Bowler, Trabuco Canyon Gigi Hurst, Escondido Bob Huttar, Santa Ana Robert LaForgia, Naples, FL Tanya Meyer, Woodland Barbara Pavliscak, Palos Verdes Patrick Reynolds, Winters Lynn Sweet, Palm Desert Meredith Williams, San Francisco

### Partner

Anonymous (2) Michael Blankinship, Davis Lance Dohman, Benicia James Ellsworth, Fairfax Jennifer Funk, Santa Ana Susan Harrison, Davis Doug Johnson, Berkeley Marcia Kolb, Oakland Jill Pavliscak, Half Moon Bay Susan Thomas, Fremont Kathy Welch, Truckee David Wilson, Aliso Viejo Paul Ziemann, Boulder, CO

A special thank you to all the generous donors to our 2019 Spring Campaign! Your generosity helps us continue our hard work.



1442-A Walnut Street, #462 Berkeley, CA 94709

ADDRESS SERVICE REQUESTED

Non-Profit Org. U.S. Postage PAID Berkeley, CA Permit No. 1435

### WILDLAND WEED CALENDAR

**Conference on Ecology and Management of Alien Plant invasions** September 9-13, Prague, Czech Republic emapi2019.org

Society for Ecological Restoration World Conference September 24-28, Cape Town, South Africa ser.org/page/SER2019

North American Invasive Species Management Association Annual Conference September 30 – October 3, Sarasota Springs, NY naisma.org/annual-conference

Student Conference on Conservation Science October 2-4, New York, NY amnh.org/sccsny Southern California Botanists Symposium October 5, Claremont, CA socalbot.org/symposia.php

**Cal-IPC Symposium** October 15-18, Riverside, CA cal-ipc.org/symposium

California Association of Resource Conservation Districts November 12-15, Redding, CA carcd.org/conferences/2019-annualconference/

**Central Coast Invasive Weed Symposium** November 14, Carmel, CA cciws.org

### Innovations in Invasive Species Management

December 10-12, Coeur d'Alene, ID invasiveplantcontrol.com/conference19/ "Although restoring ecosystems and maximizing biodiversity will always and should be a goal in some instances, there are many more cases in which society wants nature to provide a variety of functions that may require we give the past as a model, and embrace novel ecosystems (especially with climate change or major alterations of hydrological systems prohibiting the viability of past ecological assemblages)."

— From Brian Silliman and Stephanie Wear's chapter "Conservation bias: What have we learned?" in the book "Effective Conservation Science: Data Not Dogma (Oxford University Press, 2018)