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*Protecting California's environment and
economy from invasive plants*

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Cal-IPC Dispatch

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On the cover:

Garrett Dickman mapping bull thistle in the North Mountain Fire area in Yosemite National Park. Cal-IPC's 2016 Symposium is being held at the Tenaya Lodge just outside Yosemite, and will celebrate park stewardship in honor of the National Park Service centennial.

Martin Hutten

FROM THE DIRECTOR'S DESK

SARAH REICHARD, 1957–2016

By Executive Director Doug Johnson

There are many things I could write about: the new “High Risk” category in our Inventory; the increased need for Cal-IPC to publicly support the appropriate use of herbicides in IPM; our new logo and newsletter design. But these topics pale when thinking about the recent loss of Sarah Reichard.

Sarah was the Director of the University of Washington Botanic Garden and a mainstay of the Pacific Northwest Exotic Pest Plant Council. She was known internationally as a leader in working to address the introduction of invasive plants through horticulture. Her research included contributions to improving risk assessment for non-native plants, such as her 1997 article on predicting invasiveness of

it makes sense to invest in developing it as a product. The tool is also allowing Cal-IPC to screen non-natives that grow outside cultivation in California to determine which present the greatest risk of causing environmental problems in the future (the foundation of our new “High Risk” listing).

Sarah has been an active participant in the California Horticultural Invasives Prevention (Cal HIP) partnership since it formed in 2005 (as have I and a few others like John Randall of The Nature Conservancy and nurseryman Nicholas Staddon). She could be counted on to provide healthy skepticism about the safety of “sterile” cultivars sold by nurseries. She was fierce, and she fought hard



for principle and science when necessary. PlantRight will miss her.

Sarah died doing something she loved, leading a botanical tour of South Africa to experience the flora (and wines) of the Cape Region's Fynbos Biome. Those who knew her—as a plant geek, a dedicated conservationist, and a fun-loving colleague—will carry her spirit forward.

Our New Look

For our 25th anniversary, Cal-IPC has adopted a new logo and redesigned our newsletter! (We will be working on our website, too.) Thank you to the Taproot Foundation and our crack team: Rick Fleischman, Valerie Lee, Randy Titchenal, Mike Popalardo and Lauren Dergance.

CAL-IPC UPDATES

Senior Scientist moves on. After more than a decade of working at Cal-IPC, Dr. Elizabeth Brusati accepted a position with the California Dept. of Fish & Wildlife's Invasive Species Program. Her contributions at Cal-IPC touch everything we do. We are fortunate that her new position affords us the opportunity to continue collaborating. Thank you Elizabeth!

Limonium treatment. Cal-IPC contractors treated invasive sea lavender at 13 marsh sites around San Francisco Bay. Densely infested sites on the peninsula were treated with herbicide, while plants in Marin were removed by hand to minimize impacts to Point Reyes bird's beak, a rare native plant. This was the first of two years of control work funded by the National Fish & Wildlife Foundation.

Emerging weeds. Cal-IPC will complete screening for 200 Watchlist species this fall and post the assessments for public review. About one-third of the species are screening as a high risk for becoming invasive in California.

Vinca sales down. PlantRight volunteers surveying retail nurseries across the state this spring found *Vinca major* in only 2% of stores, down from 20% of nurseries in 2012. That's progress!

Forest plan comments. Three national forests—Inyo, Sequoia and Sierra—are updating their long-term forest plans. Cal-IPC submitted comment advocating for invasive plant management measures with meaningful targets, and stressed the need for appropriate herbicide use to be covered under NEPA for all three forests.

Marathoners. Kevin Reindl, Jason Giessow and Taylor Helgestad ran the San Francisco Marathon in July, raising over \$4,000 for Cal-IPC.

Using non-natives. An article by Elise Gornish (Cal-IPC board alumnus), Elizabeth Brusati and Doug Johnson

Wildland Weed News

presents findings of a survey gauging land manager perspectives on using non-native plants for revegetation. [*California Agriculture*]

WCB grants. The California Wildlife Conservation Board (WCB) awarded a grant to the Upper Salinas-Las Tablas RCD for a South Central Coast regional effort to eradicate five incipient weed species, a project initiated by Cal-IPC. WCB also funded the Inyo/Mono Counties Dept. of Agriculture to remove perennial pepperweed in Owens Valley.

OTHER NEWS

Protecting endangered species.

A UC Davis workshop addressed the intersection of endangered species recovery and invasive plant eradication in coastal and aquatic systems. Video available on the website of the Coastal and Marine Sciences Institute.

2016 IUCN World Conservation Congress.

Held in Honolulu this September, the congress approved a standardized classification system for impacts of invasive species, and a moratorium on the use of gene drive technologies for invasive species eradication.

National Plan. The National Invasive Species Council has completed a management plan for 2016-2018, with a long list of actions to be taken to strengthen federal capacity.

Water infrastructure.

AB 2480 (Bloom) passed into law, recognizing watershed health as an integral part of California's water infrastructure and ensuring that conservation activities can compete for funding with other efforts aimed at protecting water supply.

Global pathways.

A recent paper analyzes invasion vectors and response capacity, concluding that one-sixth of lands are highly vulnerable to invasive species, and that the major vectors differ between high-income countries, where the top threat is imports (particularly of plants and pets), and low-income countries, where air travel is the highest threat. [*Nature Communications* 7, Early et al.]

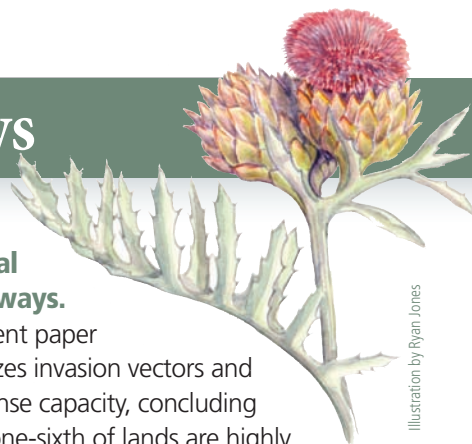


Illustration by Ryan Jones

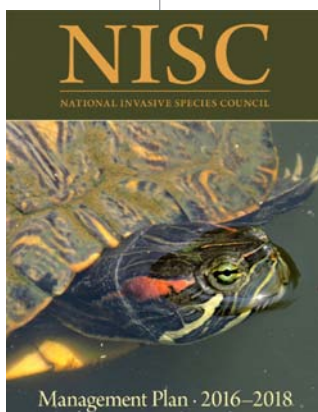


Desert weed guide. The National Park Service's Mojave Desert Inventory and Monitoring Network has produced a downloadable guide for identifying invasive plants in the region.

Collaborative restoration. A two-day national workshop held in Denver focused on the past, present and future of restoration efforts from the local to the large-landscape scale. Presentations and video recordings available on the National Forest Foundation website.

Plant extinctions. An article in the journal *AoB Plants* details six steps toward extinction for plants, proposing that the process is much slower than for animals, and that major damage is done to plant communities by invasive species even if native plants have not gone extinct. [*ScienceDaily*, 9 August 2016]

Invasives and wildlife. The theme of this winter's meeting of the Western Section of the Wildlife Society is "Invasive Species: Globalization and Bad Decisions," with Daniel Simberloff as a keynote. See calendar on back cover.



Protecting San Francisco Bay salt marshes from invasive sea lavender

By Amy Whitcomb

The tidal marshes and mudflats of San Francisco Bay are home to endangered plants and wildlife, and they provide a critical stopover for birds on the Pacific Flyway. The marshes are also a part of the natural infrastructure protecting Bay Area residents from storm surges and sea level rise. Numerous restoration efforts aim to protect these marshes, from reclaiming commercial salt ponds to the major effort by the California Coastal Conservancy to eliminate non-native cordgrass (*Spartina* spp. and hybrids). Recently, the region's residents passed Measure AA to create and fund the San Francisco Bay Restoration Authority.

While invasive cordgrass, an ecosystem engineer that changes sedimentation in mudflats, has been the focus of land manager efforts, over recent years a new invasive plant problem has garnered attention: invasive sea lavenders, *Limonium*



Manual removal of sea lavender at Strawberry Marsh on the Marin County shoreline.

ramosissimum (Algerian sea lavender) and *Limonium duriusculum* (European sea lavender). These species are perennials from the Mediterranean and likely nursery escapees in California (picture the dried statice used in flower arrangements).

Limonium has populations established in numerous Bay Area sites, in addition to several studied and treated populations around Morro Bay and on the southern coast from north of Long Beach to south of San Diego. Seeds float, and are



Treatment on the San Francisco peninsula south of the San Mateo Bridge.



Drew Kerr

Newly colonizing sea lavender on the rare oyster shell beach in Foster City.

thought to remain viable after up to two weeks in salt water.

Invasive sea lavender grows in the high marsh, upland ecotone, and down onto the mid-marsh pickleweed plain, where it is a threat to the rare Point Reyes bird's-beak (*Chloropyron maritimum* ssp. *palustre*), re-introduced California seablight (*Suaeda californica*; federally-endangered), and vegetation that serves as habitat for Ridgway's Rail (*Rallus obsoletus obsoletus*) and Salt Marsh Harvest Mouse (*Reithrodontomys raviventris*), both federally endangered. Additionally, invasive *Limonium* may hybridize with native sea lavender (e.g., *Limonium californicum*).

In 2009, 2010, and 2011, scientists presented their work on these species of concern at Cal-IPC Symposia. Volunteer groups have begun controlling some of the populations around the bay, but most populations have been spreading unimpeded.

MAJOR PROGRESS IN 2016

This year, Cal-IPC received a grant from the National Fish & Wildlife Foundation to begin control efforts on *Limonium*. Cal-IPC formed a project team with representation from Save the Bay, the Don Edwards National Wildlife Refuge, the Invasive Spartina Project, California Department of Fish and Wildlife, and San Francisco State University. During the treatment window in May and June, treatment contractors Drew Kerr and Aquatic

Environments, Inc., completed treatment over six net acres on thirteen high-priority sea lavender sites. They also set up herbicide test plots at two locations, and surveyed sites one-month post treatment to monitor treatment effectiveness.

This pilot phase of the project aims to treat the infestations before seed set at these sites each year for two years. As with any project aiming at eventual eradication, the challenge is to exhaust the seed bank. Based on observations from the Albany Hill site where volunteers have pulled plants since 2011, this year's pilot treatments may result in up to a 50% reduction of invasive *Limonium* at target sites.

Herbicide application was the treatment method employed at most sites, but three sites on the Marin County shoreline were hand-pulled. Kerr reports greater than 90% effectiveness from herbicide treatment at one month post-treatment. The only plants that were definitely alive and flowering appeared to be those that were missed. Most of the invasive *Limonium* was completely brown and shriveled.

Some questions remain about which herbicide formulation is optimal, as Kerr found slightly varying effects across populations and sites. Some test plots showed near-100% efficacy for all three herbicide treatments (imazapyr, glyphosate, or a combination of the two), while other test plots had full efficacy only with the combination. Discrepancies may be

due to a two-week difference in herbicide application or other factors.

The apparent high efficacy from 2016 treatment, and the prevention of additional dispersal and seed bank accumulation, is promising and will hopefully leave only scattered recurrences of *L. ramosissimum* at these thirteen sites in 2017. The pilot treatments utilized 2015 GPS mapping data from Kerstin Kalchmayr, who studied invasive *Limonium* for her M.S. at San Francisco State University. It will be necessary for the project to map remaining sea lavender in each marsh next spring to inform treatment. Experienced marsh botanists from Olofson Environmental, Inc. will be utilized for pre-treatment mapping, relying on their expertise gained from years of treatment implementation for the Invasive *Spartina* Project. This will make the treatment crew more efficient, especially in marshes with dense native vegetation.

WHERE WE'RE HEADED

Cal-IPC is leading another component of this project to develop an invasive plant "vulnerability index" and use it to rank the vulnerability of each marsh around San Francisco Bay. The first round of vulnerability ranking is complete, based on expert knowledge from partners. The next step will be to map invasive plants in a set of ten marshes to provide more detail to their ranking, and to provide baseline data for management. The index integrates an assessment of current extent and impact of invasive plants, anticipated future spread and impact of invasive plants, and the relative value of the marsh habitat at risk. It will also gauge the level of effort needed to address invasive plants at each site.

With funding potentially on the horizon through the new San Francisco Bay Restoration Authority, we are providing prioritization and management specifications for key habitat restoration opportunities in marshes around the bay. We will advocate for invasive plant management to be a core part of the Authority's future restoration work.

Amy Whitcomb writes on the environment.

One Tam unites around Marin's mountain

By Rachel Kesel, Conservation Management Specialist, One Tam

Iconic and beloved Mount Tamalpais towers over Marin County. While most residents and visitors see “the mountain” as a whole, its public lands are managed by four agencies—the Marin Municipal Water District, Marin County Parks and Open Space District, Mount Tamalpais State Park and the National Park Service. When those land owners joined forces with the Golden Gate National Parks Conservancy in 2014 to form the Tamalpais Lands Collaborative (TLC), they had many resource stewardship goals in mind. Among those was a coordinated effort to map and manage incipient infestations of invasive plant

species across the mountain. All four agencies engage in invasive species management and surveying to some degree. While each partner came to the initiative with a different level of capacity for such work, a common understanding of the significance of early detection and weed management was shared equally.

The TLC placed an emphasis on community engagement, hiring staff to work on outreach, youth and volunteer management, as well as community science. While growing these public engagement teams, the partners outlined goals for conservation work on the mountain. Among these were two related to invasive

plants: complete early detection surveys across the mountain in three to five years, and coordinate invasive plant management across boundaries. The initiative created a Conservation Management Team to define data collection and management goals that would serve the needs of agencies and the TLC collectively.

The TLC launched the One Tam community initiative in late 2014 to increase volunteerism, catalyze philanthropic support and build public awareness. Funds raised through One Tam resulted in hiring Conservation Management Team staff. The team created a list of mountain-wide early detection species to target. These



One Tam volunteers participate in a BioBlitz, with lots of French broom.

Lieven Leroy

were divided into “Priority One” species and “Local Detections.” The twenty Priority One species are either limited in the county or across the mountain. These include annual grasses (cheatgrass, barbed goatgrass, medusahead), riparian invaders (rattlebox, hanging sedge, evergreen clematis) and more. These species are mapped regardless of the size of the population.

Our forty Local Detection species are fairly widespread across the mountain, and include species that land managers spend significant time managing, including panic veldt grass, French broom and jubatagrass. For the purposes of early detection, only small populations under 100 square meters are mapped. Presence and absence data however, are taken for all sixty species on all surveys.

As we chose management targets and data to collect, we were faced with challenging decisions about data management and sharing. With five organizations on separate computer servers, our options for data sharing were minimal and cumbersome. To flip this paradigm, the TLC approached the Calflora Database. Working in close collaboration with Calflora, we fine-tuned Calflora’s Weed Manager software and mobile app, Observer Pro, to standardize data collection. We can now readily share our data anywhere we have an internet connection, overcoming many of the hurdles of a traditional GIS system on separate servers.

Given our unique partnership environment, we also worked with Calflora to create new features, reports and customizations to serve the TLC. Of particular note is the Survey Area feature, which allows us to upload a tracklog from our surveys. We can buffer or digitize an area around that line to record our survey area. Using our species list, Weed Manager assigns a plant count to each species. For Local Detection species for which we have no individual observations, we can simply add a “1+” to indicate presence. This neatly generates a presence/absence list for a survey area.

With the species list, a pilot protocol and Observer Pro, One Tam staff began surveys in March of 2016 under the



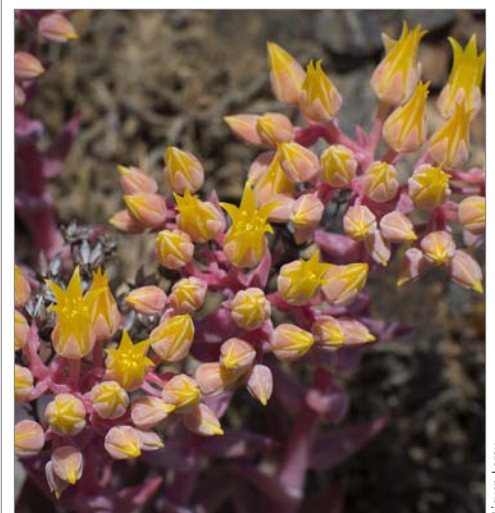
Multiple agencies contribute to the management of Mount Tamalpais. Through One Tam, they are strengthening their coordination.

direction of agency partners. Some sent us far and wide to remote areas; others sent us to visitor use areas with high vector potential. Having a robust EDRR program of its own, the National Park Service determined that riparian surveys would provide the most additive value. Redwood Creek and several gulches off of Bolinas Ridge were identified as priorities for survey.

Marin County Parks and Open Space District had surveyed its intact and most impacted roads and trails in two previous seasons, leaving a mix of moderately impacted lands to cover. The 2016 survey season took us across most of Mount Tam’s iconic habitats, from coastal scrub to redwood forests, riparian areas to barrens, chaparral to grasslands. Including some repeat surveys, we covered fifty miles of roads, trails and riparian corridors. We found and treated Priority One weeds we didn’t know were here (cheatgrass, medusahead). We also found and treated previously unknown patches of Local Detection species (purple star thistle, New Zealand nightshade) where there were expanding tendrils from more heavily infested areas. This extraordinary orientation to the mountain has offered many lessons for the team to carry forward.

As we begin to wrap up a successful

survey season, we’re crunching data in Weed Manager, reviewing protocols and preparing to expand in 2017. Parallel to this work and community engagement, the TLC has been working on a holistic review of the health of Mount Tamalpais. As we strive to protect this ecological treasure, we’re taking stock of the mountain’s resources and documenting what we know, as well as what we don’t. We’re looking forward to sharing this endeavor with the conservation community and the public at a Science Summit on October 28 and 29, 2016. Information is available at www.onetam.org. If you can’t make the Summit, look for an interactive website about the Peak Health project later this year.



Riparian systems threatened by invasive watersnakes

By Amy Whitcomb

Two species of watersnake in the *Nerodia* genus pose a threat to California's waterways and riparian ecosystems. The non-native snakes eat fish, frogs, and other aquatic vertebrates and may outcompete native fauna for prey. They may introduce diseases and parasites. Moreover, they are invading systems already highly compromised by habitat loss and degradation: Today, more than 50% of California's inland fish and amphibians that depend on permanent bodies of fresh water are federally listed or of conservation concern. According to US Geological Survey snake ecologist Robert Reed, it's possible that prolonged draining of water bodies is the only solution to eradicate established *Nerodia* populations. Land managers and researchers are intensifying monitoring and control efforts.

Dark snakes with crossbands, reaching an average of 0.5 to 1 meter in length, *Nerodia fasciata* (including *N. f. pictiventris*; known as southern watersnake) and *Nerodia sipedon* (known as common or northern watersnake) are originally from the Southeastern US and resemble California's native garter snakes

(*Thamnophis* spp.), some of which are endangered. The non-native *Nerodia* spp. are active day and night, across waterways and land, traveling up to a mile to find freshwater habitat to feed. They sun along banks or the low limbs of trees at water's edge and den in banks. The watersnakes reproduce every two years, releasing approximately 20-50 live young. The *Nerodia* spp. are not venomous but will bite. They likely entered California's waters by human transport as pets or possibly stowaways in vehicles or military equipment. In 2008, California Department of Fish and Game (CDFW) gave the species restricted status, making it illegal for people to "import, transport, or possess" *Nerodia* spp. in the state except by CDFW permit.

The invasive *Nerodia* spp. watersnakes are known in California from populations in Los Angeles County as early as 1992,



Ron Smith/USFWS

in Sacramento and Placer counties, and, more recently, along the Colorado River at the California-Arizona border. Dr. Reed of USGS is trapping in the Colorado River basin to determine *Nerodia* spp. density and distribution. In the Sacramento area, Jonathan Rose, PhD candidate, and Dr. Brian Todd from UC Davis are using environmental DNA (eDNA) from multiple water samples to estimate the snake's population and range. eDNA allows the scientists to collect data without having to identify and trap individual snakes, so it is a potentially efficient and powerful tool to track the species and their spread. Other scientists involved in *Nerodia* spp. work in California are Louanne McMartin, a US Fish and Wildlife Service aquatic invasive species biologist based in Lodi, who advises on early detection and eradication, and Valerie Cook-Fletcher, a CDFW Invasive Species Program environmental scientist, who has led monitoring projects since 2015 in Roseville and plans a trapping and removal eradication project in Folsom in 2017.

For more information see Dr. Mike Fuller's "California *Nerodia* Site" <http://biology.unm.edu/mmfuller/WebDocs/HTMLfiles/nerodia.html>

Report sightings to CDFW at www.wildlife.ca.gov/Conservation/Invasives/report or 866-440-9530.

Amy Whitcomb writes on the environment.



Ron Smith/USFWS

California Department of Fish and Wildlife invasive species coordinator Valerie Cook-Fletcher (right), and US Fish and Wildlife Service aquatic invasive species biologist Louanne McMartin, bag a northern watersnake near Roseville this summer.

Shiny geranium: A new weed in California

By Amy Whitcomb

This is a species for which containment is really challenging, if not impossible.” “It was overgrowing cow parsnip! Like ants, it does damage in numbers.” “No other plants really in sight, and there were hundreds of shiny geranium.” Such are the comments from those encountering this new species of concern, shiny geranium (*Geranium lucidum*).

Shiny geranium is spreading through Del Norte and Humboldt counties on California’s north coast, keeping the region’s botanists on their toes. Shiny geranium, *Geranium lucidum*, has up to five generations per growing season and creates monocultures in oak savannahs. It grows under cow parsnip, Himalaya-berry, or fennel, instead of baby blues, tarweeds, and brodeias. It’s found along rights of way and riparian corridors, throughout pastures, and edging forests. When it showed up adjacent to National Park Service headquarters in Crescent City in 2001, biological technician Laura Julian was alarmed and quick to pull.

G. lucidum is a low-growing annual and nursery escapee from Eurasia prone to travel in mulch, mow clippings, equipment, hooves, and hiking shoes. Readily confused with the common dovesfoot geranium in the field at first, shiny geranium has bright red stems in senescence and fewer hairs, nearly none, on the tops of leaves. It blooms in spring, when native annuals are just getting going, and, suppressing them, goes on to bloom again and again.

The USDA’s 2013 weed risk assessment for shiny geranium determined it to be a high-risk for becoming a major invader. The plant is already notorious among land managers and researchers in Washington and Oregon for its multiple generations each summer and prolific seed set (60-730 per plant), seed viability (approximately 100%, for up to two years), and dispersal (seeds are ejected up to twenty feet from a plant, allowing it to spread uphill). Plants even resprout and/or accelerate their life cycles to set seed when damaged or stressed. Its pol-



Laura Julian, Del Norte Redwoods State Park

Shiny geranium germinates quickly after rains, allowing seedlings to outcompete natives.

linators have not been the focus of any study to date and are yet unidentified. By some accounts, shiny geranium was found in northern California wildlands as early as 1998, but the two existing herbarium specimens are dated 2011.

Both mechanical and chemical treatments have been tested and documented for emerging and established invasive populations. A literature review by the Friends of Ridgefield National Wildlife Refuge in Washington, compiles practitioner experiences with different herbicides and different timing (fall treatment with glyphosate appears to be most effective). A multi-method approach of tilling, spraying, and seeding with grass has worked in some areas, and seeding with perennial cover was useful in others. Several factors impact the efficacy and ability to stop an invasion, though. In Del Norte and Humboldt counties, for instance, where shiny geranium marches from the right of way up into the surrounding understory, treatment is impeded by steep road cuts and vegetation that can obscure road crews from oncoming motorists, making for unsafe conditions.

Shiny geranium is currently being assessed for the Cal-IPC inventory. Since 2011, Redwood National Park’s Julian and others have been pulling it (visiting sites once per month over each growing season). Led by Environmental Scientist

(Continued on page 14)



Bruce Newhouse

Shiny geranium carpeting the understory in Oregon white oak riparian woodland near Eugene, OR.

Eradicating knotweeds and other new invaders on California's North Coast

By Amy Eberwein, Redwood Community Action Agency

The Humboldt Weed Management Area (HWMA) is a coalition of organizations and from Humboldt and Del Norte Counties working to reduce the threat of invasive weeds to healthy agricultural and ecological systems on California's North Coast. Members include Humboldt and Del Norte County Agriculture Departments, National and State Parks, the Yurok Tribe, California Conservation Corp, CalTrans, the Mattole Restoration Council and nonprofit organization Redwood Community Action Agency (RCAA).

TAKING AN EARLY-ERADICATION APPROACH

Beginning in 2009, the HWMA used Cal-IPC distribution data from Calflora and CalWeedMapper to identify invasive weeds that were considered new invaders to the North Coast. These were species which had not yet taken hold widely, but had the potential to do so if not

managed swiftly and effectively.

We identified several weed species that are known to have major negative effects on ecosystems, and that are found in low enough numbers within Humboldt and Del Norte counties that they had the potential to be eradicated in a relatively short amount of time.

An early detection and rapid response (EDRR) project was developed for six species (see sidebar). The majority of these species, particularly the knotweed species, are spreading south from

Oregon and Washington where eradication is no longer an option due to extensive infestations.

In 2015, RCAA received a five-year grant from the California Wildlife Conservation Board (WCB). The \$450,000 grant funds eradication of these species from Humboldt and Del Norte Counties, halting their southward spread into California.

During the initial phases of the proj-



Treating knotweed along a Eureka roadside.

KNOTWEEDS:

Fallopia japonica (Japanese knotweed):

26 sites

Fallopia sachalinensis (giant knotweed):

34 sites

Persicaria wallichii (Himalayan knotweed):

35 sites

OTHER EARLY-ERADICATION TARGETS:

Arundo donax (giant reed): 9 sites

Chondrilla juncea (rush skeletonweed): 4 sites

Geranium lucidum (shiny geranium):

8 sites

ect, one more species of knotweed was found in Humboldt County and added to the project list: a hybrid of Japanese and giant knotweeds called Bohemian knotweed. This is the first sighting of this species in California.

FIRST-YEAR TREATMENT

Rush skeletonweed, shiny geranium, and giant reed have relatively few populations. (See the article on shiny geranium

(Continued on page 14)



Knotweed taking over an abandoned property in Orick.

BEYOND THE WAR ON INVASIVE SPECIES: A PERMACULTURE APPROACH TO ECOSYSTEM RESTORATION

by Tao Orion, 2015,
Chelsea Green Publishing

Reviewed by Elise Gornish

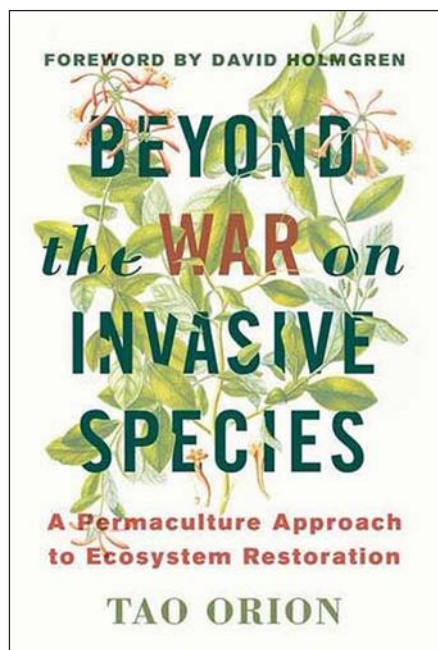
UC Cooperative Extension Specialist
in Restoration Ecology

Tao Orion's recent book, "Beyond the War on Invasive Species." Critiques the field of invasive biology and the practice of invasive species management. In some ways her critique is useful, but unfortunately, in many ways it is not. This is disappointing, because I and many others are interested in learning more about how permaculture might strengthen our work in invasive plant management and ecological stewardship.

The book adopts the tone of an expose, but the ideas explored here have been described at length in the peer-reviewed literature (e.g. Macdougall and Turkington 2005; Didham et al. 2005; Hille Ris Lambers et al. 2010). Discussions of scientific themes in the popular press can serve an important role in communicating important topics to a broader audience. However, the writer has a responsibility for providing balanced, well-researched (and well-supported) information. Orion does not meet this standard.

Too often Orion seems unaware of current practice. For instance, she suggests approaches like prescribed burning and grazing management (rather than herbicides) based on historic vegetation management techniques, not acknowledging that these are already actively used, within the limits of burn permits and grazing leases. Orion concludes the book with a recommendation for where the entire field of invasion ecology should be headed—the very direction that the field has actually been going for at least the past ten years.

Here are three of the many aspects I found troubling.



1. Orion proposes that invasives are just not that bad. She cites "...a lack of evidence for the necessity of spartina eradication..." despite the fact that this invasive grass has been shown to degrade bird habitat, reduce native species biomass, critically alter nutrient cycling and cause significant economic harm (e.g., Daehler and Strong 1996; Levin et al. 2006; Qing et al. 2006).
2. Orion relies heavily on non-peer-reviewed sources in attempting to sound science-based, going so far as to cite an online petition as 'clear evidence' of her beliefs. She cherry picks examples to support her claims, citing single studies that validate her points while ignoring the large number of studies that reinforce opposing arguments.
3. Orion dismisses the enormous efforts of ecologists past and present. She claims that no evidence exists to support species eradication (she is wrong; see for example: Abedrabbo 1994; Zavaleta et al. 2001; Veitch and Clout 2002), and suggests that authors of studies that do highlight successful eradication are all funded by the nefarious hand of Monsanto. (The old claim of Cal-IPC being in the pocket of the pesticide industry even makes an appearance.) Orion casts researchers as grant-hungry and biased, echoing the approach of climate change deniers who attempt to discredit researchers whose findings do not support their world view.

Though some of the concepts presented are important—for instance, that invasive plants are often a symptom of greater ecosystem disturbance—Orion uses them to dismiss invasive species altogether rather than to initiate constructive dialog. And though one does not doubt that Orion sincerely supports sound land stewardship, her book does not use science to develop or support ideas about the ecology and management of invasive species, but instead relies on romantic (and impractical) notions of how plants and animals interact with each other and humans. Hopefully in the future we will gain better insight into the details of how permaculture practices can be implemented on a wider scale to improve invasive plant management and ecological stewardship.

CITATIONS

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Updates to California DPR Personal Protective Equipment: Eyewear and Gloves

By Lisa Blecker and Chris McDonald

Wearing the correct personal protective equipment (PPE) is critical to worker safety when applying an herbicide to control invasive plants. According to data provided by California's Pesticide Illness Surveillance Program (PISP), 33% of all pesticide handler illness cases occurred when applicators weren't wearing appropriate PPE. Eye injuries make up over half, 56%, of all pesticide handler injury cases, while skin injuries account for 28% of reported incidents. The data make it clear: wearing the appropriate PPE, and wearing it correctly, greatly reduces the risk of pesticide-related illness for applicators. That is why you need to know about the updates to PPE regulations in California discussed below.

The California Dept. of Pesticide Regulation (DPR, part of the California Environmental Protection Agency), has recently updated its PPE regulations in two important areas: eyewear and gloves (3 C.C.R. §6738.2 and §6738.3, respectively). These updates provide for increased eye protection and for more flexibility when using gloves. If you apply herbicides, it is your responsibility as an applicator to know all the latest regulations and conduct work in a profes-

sional, safe and responsible way. County agricultural commissioners and their staff can inspect pesticide workers to make sure they are following regulations and issue citations if workers are not in compliance.

EYEWEAR

DPR is requiring pesticide workers to use eyewear that meets ANSI Z87.1 – 2010 standards (Z87.1 for short). A standard is a measure designed to ensure the essential performance of a product, like the size of a light bulb socket. In the case of eyewear, the Z87.1 standards provide requirements on very specific items like flammability, minimum coverage area, impact resistance, thickness, ventilation (for goggles), and object penetration.

Z87.1 lenses provide a higher level of protection for applicators since they are designed to resist breaking or shattering upon impact. The Z87.1 standards require that a lens shall not fracture or shatter if exposed to simulated accidents. For example, one Z87.1 standard includes a requirement that the eyewear shall not break when a 1 inch steel ball is dropped from 50 inches high.



Closeup of eyewear showing the raised Z87 marking on the frame and lens.

Cheryl Reynolds UC IPM

When eye protection is required by the pesticide label or by DPR regulations, that eyewear must be labeled "Z87". This is usually done using permanent, raised lettering. This label means that the manufacturer certifies that its eyewear meets the defined baseline of protection. This regulation helps people avoid purchasing poorly constructed eyewear that could increase injuries. The update still requires that eyewear protects the front of your eyes, the brow (with the eyewear conforming to the curvature of the face) and temple (side). If you wear prescription glasses, your glasses must not interfere with the function of the PPE.

Most manufacturers have been following these guidelines for several years, and we have found a large number of Z87.1-labeled products on the market. Double-check your equipment to make sure all your eyewear is labeled Z87.1. Several herbicides used in wild-land invasive plant management have labels that indicate the herbicide can cause eye damage, sometimes irreversible damage; having eyewear that will increase protection is a benefit.

Glove Category Selection Key

Label Code	Material Recommended by CDPH	Material Code
A	1,2,3,4,5,6,7,8	1: Laminate
B	1,2	2: Butyl
C	1,2,3,4,7,8	3: Nitrile
D	1,2	4: Neoprene
E	1,3,4,8	5: Natural
F	1,2,3,8	6: Polyethylene
G	1,8	7: PVC
H	1,8	8: Viton

All but Laminate and Polyethylene must be 14 mils or thicker

DPR glove selection key.

GLOVES

DPR regulations require pesticide handlers to wear chemical-resistant gloves when working with most pesticides, even if the product label does not require gloves. DPR regulations are more strict than some pesticide labels and pesticide workers in the state must follow

California's regulations. DPR has updated its regulations for gloves and now allows for some flexibility under certain working conditions.

Gloves made of most chemical resistant materials need to be 14 mils (1 mil=0.001 inch) or thicker when handling or applying pesticides. The only exemptions are polyethylene and barrier laminate, which can be any thickness. However, a new exemption applies when applicators need to make precise adjustments or need fine motor control with their fingers. An applicator can wear a chemical resistant glove that is less than 14 mils, for up to 15 minutes, "to make fine adjustments to equipment..." (3 C.C.R. § 6738.3 c(2))." This exception could come in handy when fine-tuning adjustable screws or replacing a damaged nozzle, for example. In these and other special cases, a normal 14 mil glove may not fit. The glove still needs to be made of the appropriate material



Disposable glove liners can be worn under a nitrile glove.

as required by the pesticide label. To help you select the proper glove, DPR provides a chart to assist with glove selection.

In addition, we have found suppliers who sell 15 mil disposable nitrile gloves that provide for fine dexterity when making adjustments, but are thick enough that they can be worn for longer than the 15-minute limit.

The second change to the DPR glove regulations is that applicators can wear separable, absorbent glove liners, such as cotton, under their chemical-resistant gloves. Glove liners can be worn only if all three of these conditions are met: (1) the pesticide label does not prohibit the use of a glove liner; (2) the glove liner does not extend beyond the chemical-resistant glove; and (3) the glove liner is disposed of at the end of the day or immediately after it becomes contaminated with pesticide.

Glove liners can make wearing gloves

more comfortable. They can absorb some sweat that accumulates in a glove on a hot day. In addition, if a glove accidentally tears in the field the liner could absorb a small amount of pesticide offering some protection (and then both glove and liner must be immediately replaced). Note that gloves with built-in liners, like flocked gloves, cannot be used for pesticide work.

Leather gloves cannot be worn under a chemical-resistant glove, but can be worn over chemical-resistant gloves, if they are needed for specific tasks. After the leather gloves are used in this way they must always be used outside of a chemical-resistant glove or discarded.

It is also important to use the correct type of glove when applying a pesticide. Some herbicides commonly used in wildland vegetation management do not specify the type of glove required. In this case, any chemical-resistant glove on the DPR glove selection chart can be used, if it's the correct thickness. However, some products are specific as to what type of glove is required. In this case the glove type must exactly match the glove specified by the herbicide label.

Learning about changes to DPR regulations will help you select the correct gloves and protective eyewear for the job, which in turn enables you to be safe on the job.

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(Continued from page 10)

Eradicating knotweeds

elsewhere in this issue of *Dispatch*.) Arundo is found primarily on the Eel River in southern Humboldt County and the California Conservation Corp is working to manually dig it out. Shiny geranium and rush skeletonweed are found along highways, making treatment easier.

The largest challenge in this project will be the knotweeds. They're found at nearly 100 sites in the region, and are notoriously difficult to get rid of. Knotweeds are included on lists of the world's worst invasive species. They are capable of taking over waterways and landscapes through their aggressive rhizomatous growth and re-sprouting abilities. Information from many control efforts to date has shown that mechanical methods such as cutting, mowing, and tarping are rarely successful, and usually succeed only in spreading the infestation.

We corresponded with professionals from King County, WA where they have been dealing with knotweeds for decades. Their recommendations corroborated the experiences of local land managers with Redwood National and State Park and the Mattole Restoration Council who have been attempting mechanical control methods such as tarping. Techniques such as burning and steaming were also ineffective on the extensive rhizomes of the knotweeds. The only approach that has consistently worked is herbicide treatment, either by spray or by injection.

To get buy-in up front, we approached local advocates opposed to the use of pesticides. We presented the challenge posed by these weeds, the type and



Knotweed dieback after herbicide treatment.

amount of herbicide that would be used, where it would be used, and how long we expect it to be used. We were successful in securing their go-ahead.

Herbicide treatment consisting of a 1% glyphosate or imazapyr foliar spray was determined to be the most effective and was chosen for treatment by the HWMA. Treatment is done in the fall when the plants are beginning to senesce so the herbicide

can be pulled down into the rhizomes, effectively eliminating its ability to re-sprout. Complete coverage is essential, but knotweeds have the ability to compartmentalize the herbicide in the separate rhizomes.

Research shows that it typically takes 3-5 years of annual herbicide treatment, depending upon the age of the plants and size of the infestation, to completely eradicate knotweed species. However, it is typical to see up to an 80% reduction of infestations after the first year of treatment.

Fall 2016 marked the beginning of herbicide treatment for knotweeds, and hopes are high that the treatments have been effective. We will find out in the spring. This season we were able to treat 80% of the knotweed populations, and 95% of the populations of the other target species. By next year we will be aiming for treatment of every target population, on our way to eventual eradication.

(Continued from page 9)

Shiny Geranium: A New Weed in California

Michelle Forsys, the North Coast Redwoods District of California State Parks is similarly proactive, seeking to complete the required documents for control (e.g., Notice of Exemption for CEQA), with progress likely this fall. It's unclear what efforts the Yurok Tribe, landowner along the Klamath River, might be taking, but CalTrans, under Landscape Specialist Domenic Bongio, is keeping close watch on both plants in the ground and those mown or scraped away during routine maintenance and sent elsewhere for disposal.

Shiny geranium is one of the plants targeted for eradication in the new North Coast Knotweeds project, organized by Cal-IPC and regional partners and funded by the California Wildlife Conservation Board. This comprehensive regional approach for eradication is an example of the land management network working. With an invasive deemed high risk and ideal for early eradication and rapid response, as shiny germanium is, the network's collaboration—and the state's funding—are both crucial for a successful conservation outcome.

Amy Whitcomb writes on the environment.

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ucanr.edu/sites/UC_ANR_Do_No_Harm

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November 16-19, Ontario
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Invasive Species: Globalization and Bad Decisions

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February 6-10, 2017
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<http://twswest.org>

North American Invasive Species

Forum May 9-11, 2017, Savannah, GA
www.invasivespecies2017.org

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"The main reason why there is no clear evidence of extinction that can be exclusively attributed to plant invasions is that invasions have not been around long enough. Our research shows that plant extinction is an agonizingly slow process... There is absolutely no doubt that alien plant invasions are eating away at native plant biodiversity."

—Dave Richardson, Centre for Invasion Biology at Stellenbosch University, South Africa, from ScienceDaily, 9 August 2016, about the paper "The six steps to extinction," AoB Plants, 2016; 8.