Vol. 21, No. 3 Fall 2013

Cal-IPC News

Protecting California's Natural Areas from Wildland Weeds

Newsletter of the California Invasive Plant Council. www.cal-ipc.org

Weeds and wildlife

Pipevine swallowtail butterfly and native bee feeding on bull thistle (*Cirsium vulgare*) in Walnut Creek Open Space. Photo by Brian Murphy.

INSIDE

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Cal-IPC News
Fall 2013 - Vol. 21, No. 3

Editors: Elizabeth Brusati and Doug Johnson

From the Director's Desk

A 'cottage industry of criticisms'

By Doug Johnson

As David Richardson and Anthony Ricciardi write in their recent 'field guide" to critiques of invasion science, there seems to be a growing "cottage industry of criticisms" addressing the field (*Diversity and Distributions* 19: 1461-1567). Some of the critiques are more useful than others. In their generally interesting compilation *Invasive and Introduced Plants and Animals: Human Perceptions, Attitudes and Approaches to Management* (2013) editors Ian Rotherham and Robert Lambert, British environmental historians, conclude that "…intervention in conservation practice hides behind a veneer of pseudoscience and certainly challenges democratic processes." As in many recent critiques, this conclusion is based on an element of truth, but it overreaches the actual reality in the field. Though they raise critical issues to address, such critiques understimate the degree to which these issess are already being examined.

This issue of *Cal-IPC News* touches on one of these topics: the complex interactions between native and non-native species. Do naturalized non-native plants support native wildlife? (Sometimes.) Are they an adequate replacement for the native plant species with whom California wildlife evolved? (Rarely.) In the real world, do managers need to evaluate potential wildlife benefits of invasive plants when determining realistic conservation goals? (Of course.) Though the underpinnings of the field provides rich intellectual fodder, critics should make sure they are well versed in the ever-dynamic state of the discipline so that their criticism is ultimately constructive, not simply contrarian.

Managing invasive plants, like all conservation, is part science and part societal values. We pass laws to protect endangered species because we deem it to be the moral and prudent thing to do. Then science helps us figure out how to do it. Unavoidably, communication mixes science and values. The term "invasive" has a scientific meaning, and also carries significant cultural meaning. As Brendon Larson describes in his *Metaphors for Environmental Sustainability: Redefining Our Relationship with Nature* (2011), words take on a life of their own in society's "metaphoric web" and it is difficult, but essential, for conservationists to tend their terms over time.

On the cover...

Natural resource managers continue to explore the complex interactions between native wildlife and non-native plants. Non-native plants listed by Cal-IPC as invasive are assessed to have significant negative ecological impact on native California ecosystems and wildlife. But that does not mean that wildlife have no use for these plants. As Brian Murphy's cover photo shows, some native pollinators do visit some invasive plants. Don Weden caught the ground squirrel at right chowing on yellow starthistle at Rancho San Antonio in Santa Clara County (winning 1st place in our 2013 Photo Contest). Cal-IPC's recent "Climate-Smart Management" workshop asked participants to consider ecological services offered by top weeds of concern. Weighing such information will become increasingly important as land stewards design management approaches to meet long-term conservation goals in an age of great environmental change.

Cal-IPC Updates

2013 Symposium goes on despite federal shutdown. Adaptive management was in full swing as speakers and attendees from federal agencies were not allowed to participate in the 22nd annual Cal-IPC Symposium, held Oct. 2-5 in Lake Arrowhead. See page 6.

Cal-IPC posts new climate adaptation webpage. Following on the "Climate-Smart Land Management" workshop held at the Symposium, Cal-IPC has posted workshop materials and other resources on adapting natural resource management to climate change. *www.cal-ipc.org/ip/climateadaptation*

Tahoe Nature Fund will support regional strategy in the north Sierra. The new grant complements existing funding for regional prioritization in the region stretching from Placer County to Plumas County. Cal-IPC will work with regional partners like the Truckee River Watershed Council.

Military bases to plan with Cal-IPC. The Dept. of Defense Legacy Program will fund Cal-IPC to develop regional invasive plant management plans with resource managers at six installations in California. *www.dodlegacy.org/legacy*

California CESU admits Cal-IPC. The California Cooperative Ecosystem Studies Unit (CESU) brings federal and state agencies together with universities and NGOs for research collaboration. *ucanr.edu/sites/CCESU*

Coalition advocates for wildlife programs. Cal-IPC joined1,600 organizations in signing a letter drafted by the Teaming with Wildlife coalition urging Congress to continue support for natural resources programs such as the North American Wetlands Conservation Fund and the Forest Legacy Program. In July, the House Interior, Environment and Related Agencies Subcommittee eliminated funding for these programs for the federal fiscal year that started October 1. *teaming.com/news/*

Shasta-Trinity National Forest uses CalWeedMapper for management plan. The Shasta-Trinity is the largest national forest in California. Their new management plan focuses on eradication targets and early detection and rapid response for new sightings. *calweedmapper.calflora.org/shf_priorities*

Wildland Weed News

New Board members. The Cal-IPC Board of Directors welcomes Annabelle Kleist (Capitol Impact), Virginia Matzek (Santa Clara University) and Colleen Murphy-Vierra (California Dept. of Food & Agriculture). *www.cal-ipc.org/about/staff.php.*

Other Updates

Invasive species a top threat to birds. Over the last 500 years, invasives are responsible for the extinction of at least 65 bird species, and are a top factor in recent avifauna losses, says a recently released report on the "State of the World's Birds" by BirdLife International. *www.birdlife.org/datazone/sowb/pressure/PRESS2*

California Congressman establishes bipartisan group on invasives. Rep. Mike Thompson from northern California has taken the lead in forming a Congressional Invasive Species Caucus. Their first goal is to pass legislationg adding quagga mussel to the federal invasive species list, a move strongly supported by the governors of western states. *mikethompson.house.gov/news/documentsingle.aspx?DocumentID=342054*

AB763 signed into law. The bill, sponsored by Cal-IPC to strengthen aquatic invasive plant control in the Delta, passed unanimously through the legislature. *www.leginfo.ca.gov*

Plan to control invasive plants in the Delta. The draft Bay Delta Conservation Plan includes a 20-page section on Invasive Aquatic Vegetation Control, in line with the goals of AB-763. *baydeltaconservationplan.com Section 3.4.13.*

Invasive bamboo on the horizon? Researchers determined that five of seven bamboo species tested from East Asian coniferous forests are shade-tolerant enough to spread in shady Pacific Northwest forests. *link.springer.com/article/10.1007%2Fs10530-013-0434-y#page-2*

Online library of invasive plant articles. With hundreds of articles in a searchable database, TechLine Invasive Plant News is designed for "sharing innovative research, success stories and tips with invasive plant managers." *techlinenews.com*

...continued page 14

New Training DVD from Cal-IPC!

"Best Management Practices for Preventing the Spread of Invasive Plants"

This 42-minute training video presents important strategies for preventing the accidental movement of invasive plants, avoiding soil and vegetation disturbance, planning ahead for prevention, and promoting organizational awareness of invasive plants. Suitable for natural resource managers and those managing transprotation and utility corridors.

Available for $10 plus tax and shipping. See trailer and order at *www.cal-ipc.org/shop*.

Controlling mayweed chamomile to help endangered terns

California least tern, a federally endangered species, hovers above invasive mayweed chamomile (*Anthemis cotula*) looking for a nest site. Photo by Juan Benjuama, wildlife volunteer.

By David L. Riensche, Douglas A. Bell and Cliff Rocha, East Bay Regional Park District; Sara A. Lockett, Northern Arizona University; Cody A. Newell, University of Idaho; Rick Miller, Dow AgroSciences LLC; and Bill Nantt, California Department of Transportation

The California least tern (*Sternula antillarum browni*) is a migratory species, nesting from Baja California to the San Francisco Bay. Terns establish nesting colonies on sandy soils with little vegetation along beaches, lagoons, and bays. Nests are shallow depressions lined with shells or other debris. Least terns often have two distinct waves of nesting between mid-April and late September. The California least tern was listed as a federally endangered species in 1970 and as a state endangered species in 1971 due to a population decline resulting from loss of habitat, disturbance of nesting sites, and predation by domestic and wild mammals. Loss of suitable habitat is known to force species to breed in higher densities or in suboptimal areas that may, in turn, increase the risk of predation.

Our study site is known as Island Five within a brackish water marsh of the Hayward Regional Shoreline on San Francisco Bay. Island Five is one of 15 islands created within a man-made marsh system. This island was restored by 4,100 citizen-scientists who have placed filter fabric, moved 175 tons of sand/oyster shells to create nesting substrate, removed vegetation by hand, and monitored terns and their potential predators.

The Hayward Regional Shoreline Marsh system provides habitat for more than twenty nesting waterbird species. The four dominant shorebirds nesting at Island Five with the California least terns are the American avocet (*Recurvirostra americana*), black-necked stilt (*Himantopus mexicanus*), killdeer (*Charadrius vociferous*) and western snowy plover (*Charadrius alexandrinus nivosus*), a federally threatened species. The site is managed by the East Bay Regional Park District (EBRPD), a two-county special district in Alameda and Contra Costa Counties. Since 2001, EBRPD has aimed to enhance and manage a successful California least tern colony at the Hayward Regional Shoreline, while increasing public awareness and involvement for the protection of endangered species.

Invasive plants are a major threat to many wild bird species. The rapid colonization of invasive plants can result in substandard nesting habitat. Due to its nesting preference for open substrate, the California least tern is vulnerable to the spread of vegetation that can quickly colonize its nesting habitat. From 2009-2011, mayweed chamomile

Sara Lockett and Cody Newell conduct California least tern nesting surveys on a weed-free island during summer 2013. Photo by David Riensche.

(*Anthemis cotula*), a common weed from Europe, became the dominant plant cover on Island Five, creating a monoculture and confining terns to subpar nesting sites. The spread of this weed encouraged waterfowl such as gadwall (*Anas strepera)*, mallard (*Anas platyrhynchos*), and cinnamon teal (*Anas cyanoptera*) to nest on the island, which we believe drew red fox (in 2009) and raccoon (in 2011) to swim to the island and attack duck, shorebird and tern nests. The combination of limited nest site availability and increased predation possibly led to the observed reduction in reproductive success for the terns in 2009 and 2011.

A partnership between EBRPD, Caltrans, and Dow AgroSciences formed in 2012 to address the rapid vegetation growth and cultivate ideal nesting habitat for the least tern. Dow AgroSciences contributed a combination of Milestone®, Capstone®, Rodeo®, and Dimension® specialty herbicides to inhibit the growth of vegetation at the site. The combination of herbicides was used at the recommendation of local pest control advisors and has been proven to be "practically nontoxic" in dozens of laboratory tests and field studies. The herbicides were carefully applied by Caltrans specialists during the late winter, prior to the terns' arrival in the spring. The treatments resulted in a major decrease in vegetation. Results from a line intercept method showed that vegetation cover in 2007 was 30% (height of 24 cm), but vegetation cover reached 90% (height of 30 cm) in 2011. This three-fold increase in cover was curtailed after the application of herbicides, and in 2012 vegetation cover was less than 10% (height of 23 cm).

In the two breeding seasons since the herbicide treatment was applied, the terns have reacted positively to the decrease in vegetation. During the 2012 breeding season, there were 189 incubated nests at the site, producing a total of 228 chicks. In the 2013 season, the colony experienced an amazing 95% hatching success rate and produced upwards of 118 fledglings. The site is now the second largest California least tern colony north of Ventura County. Thanks to action from this partnership to reduce mayweed chamomile, the Hayward Regional Shoreline is now a prime nesting site for this endangered species.

Contact David Riensche at driensche@ebparks.org.

Progress removing Algerian sea lavender

by Mike Perlmutter

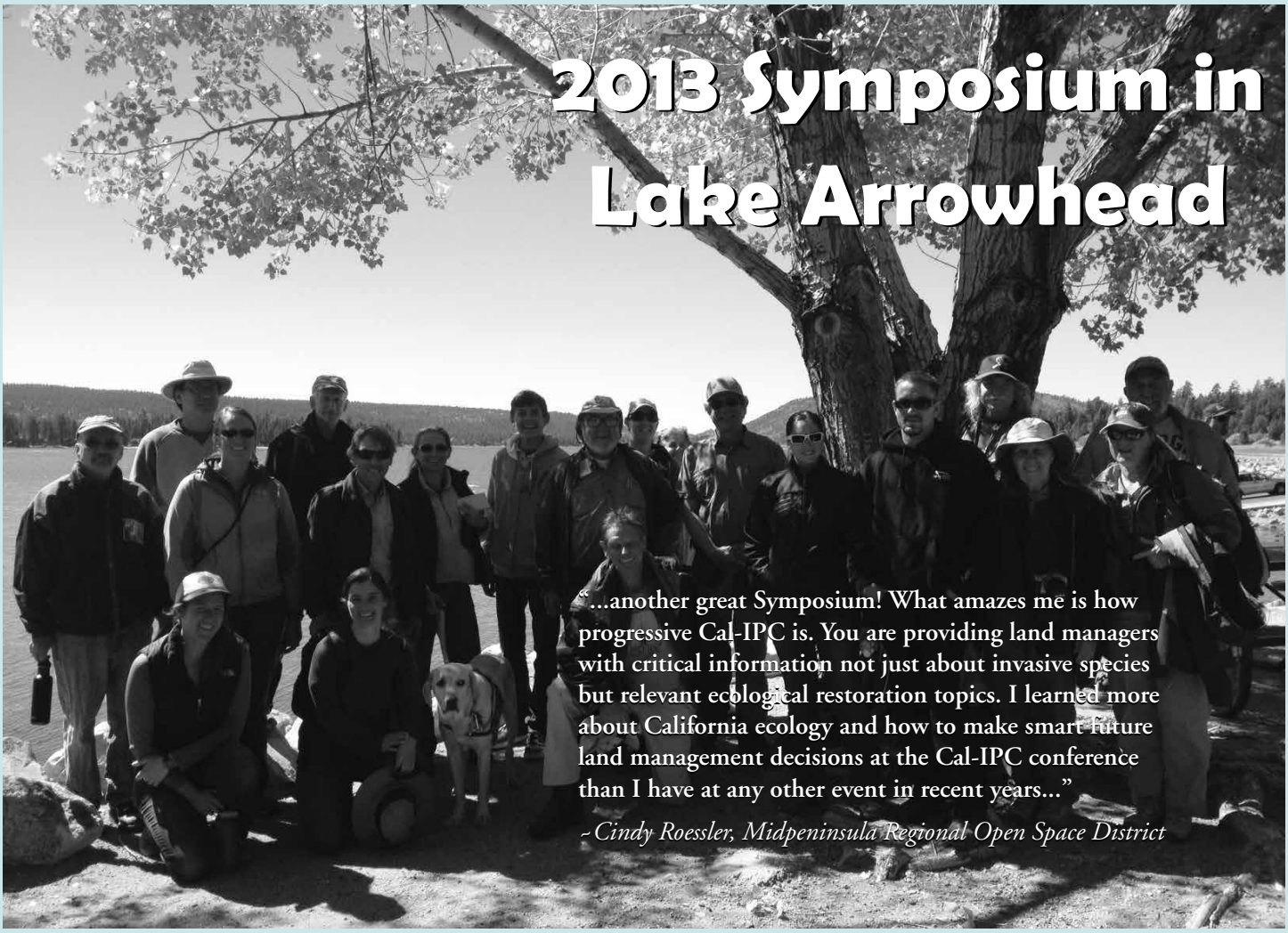
Algerian sea lavender (*Limonium ramosissimum*) is an invasive plant growing in intertidal areas around San Francisco Bay, as well as along the coast from San Luis Obispo to San Diego. The Bay Area Early Detection Network (BAEDN) identified it as a priority target, and with funding from the San Francisco Bay Joint Venture has led work at sites in Albany and Corte Madera to see the efficacy of removal.

BAEDN's 2013 work party on the Albany shoreline (northern Alameda County) took much less time than in the past, and the progress was clear. The first effort in 2011 took 40 volunteer hours from the Friends of Five Creeks, a local watershed group, to hand-remove this infestation. The patches were dense, with many seedlings establishing underneath mature flowering plants.

Followup this year took 18 volunteer hours to remove all the plants, totaling 3 large bags. The timing was perfect, as plants were bolting, but not flowering, therefore easy to see and pull without risk of seed spread. Each year there have been fewer plants, and the plants are less mature and require less time to remove. Formerly dense Algerian sea lavender patches are filling back in with native marsh vegetation.

In Corte Madera volunteers from Marin Audubon, Marin County Parks, and San Francisco State have removed plants, but been unable to get 100% of the plants each year. Plant size has been decreasing, though, and additional resources could knock this population out. These pilot efforts show the potential for a comprehensive Bay-wide program to succeed if funding can be secured.

2013 Symposium in Lake Arrowhead



"...another great Symposium! What amazes me is how progressive Cal-IPC is. You are providing land managers with critical information not just about invasive species but relevant ecological restoration topics. I learned more about California ecology and how to make smart future land management decisions at the Cal-IPC conference than I have at any other event in recent years..."

~Cindy Roessler, Midpeninsula Regional Open Space District

Top: Field trippers on the San Bernadino Mountains tour. (Photo by Stacy Gorin. All other photos by Drew Ready.) **Above left:** Discussion at the poster session, which included six entries in our student contest. **Above right:** Sponsor booths lined the hallways with information about their organizations. **Opposite, clockwise from top left:** Sixty entries were submitted to our photo contest, including this shot by Tori Bohlen showing Mills College students pulling French broom seedlings in Tiburon. Naturalist Laura Cunningham gave our keynote address on her book *A State of Change: Forgotten Landscapes of California*. We tried a different format for this year's raffle and auction, and the drawing got wild! Ken Moore runs a tool tailgate sharing lessons learned during his years of experience. Cal-IPC board president John Knapp, on right, presents the 2013 Golden Weed Wrench Award to James Law of the Santa Ana Watershed Association.

Congratulations to: Jason Giessow (Jake Sigg Award for Dedication and Vision); James Law (Golden Weed Wrench Award, see below), Christy Boser, The Nature Conservancy, and Kate Faulkner, National Park Service for the California Islands BioSecurity Program (Policy Award); Josh Volp, Orange County Conservation Corps (Ryan Jones Catalyst Award); Southern California Mountains Foundation (Organization of the Year); Student Papers: Chelsea Carey, UC Merced (1st); Justin Valliere, UC Riverside (2nd); Bridget Hilbig, UC Riverside (3rd); Student Posters: Megan Engel, CSU San Bernardino (1st); Daniela Bruckman, UC Irvine (2nd); Madison Hoffacker, Chapman University (3rd).

Presentations and awards posted at www.cal-ipc.org/symposia

Successful Spanish broom control in San Diego

By Robert A. James, Caltrans, San Diego

Spanish broom (*Spartium junceum*), native to the Mediterranean region and Canary Islands (McClintock 1979), is a well-known invasive shrub throughout much of California. It is rated by the California Department of Food and Agriculture as a Class C pest species and by Cal-IPC as having "high" invasiveness potential. Spanish broom has been a control focus for many years in the state (Bravo 1985). The USDA Forest Service has recently undertaken removal projects in the San Bernardino and Cleveland National Forests with some success in Southern California, particularly using the herbicide triclopyr (L. Criley, USDA Forest Service, pers. comm.).

Leblanc (2001) recommended controlling brooms, including Spanish broom, using an integrated pest management strategy that can include application of glyphosate or triclopyr. Basal bark herbicide application has been attempted, but retreatment has been found to be needed (Neill 2005). Research on effective physical and chemical control was done in Argentina (Sanhueza and Zalba, 2012) with picloram also identified as an effective herbicide, applied to cut stumps. However, picloram does not adhere to soil and has been found in groundwater (EPA 2012).

In mid-2012, an infestation of about 200 plants was identified for control by Caltrans along both sides of State Route 67 (post miles 16.5-19) in rural northern San Diego County, between the City of Poway and the community of Ramona. Plants were first noted about 20 years ago, and have increased in number and extent (M. Connelly, Caltrans, pers. comm.).

State Route 67, Post Mile 17.4, north side, before broom removal (March 2012) and after removal (September 2013).

Methods

An initial cut-stump treatment was done with glyphosate (Roundup®, 50% a.i., water dilution) in May-July 2012. Above-ground biomass was left in place where it did not pose a safety concern for motorists, and was allowed to discompose. Triclopyr (Garlon 4 Ultra®, 15-30% a.i., water dilution) was used for follow-up (and some new) cut-stump control, beginning in fall 2012. Emergent broom plants were hand pulled when possible, or cut near ground level and treated with triclopyr. A second round of follow-up surveys and control efforts was done in July-August 2013, also using triclopyr.

Results

Over 95% of the plants were eliminated one year after initial control. However, noticeably improved results were obtained when the switch to triclopyr was made; there were fewer resprouting stumps requiring subsequent treatment (<10%).

Germinating broom, with their photosynthetic stems, nicely contrasted against dried grasses and other forbs in late summer, making broom hand removal easier and more thorough. The distribution of emergent broom was patchy and limited. No significant erosion was observed. Native species such as buckwheat (*Eriogonum fasciculatum*) and mugwort (*Artemisia douglasiana*) have filled in some of the areas previously covered by broom; this ecological recovery was also noted by Bravo (1985).

Summary and Conclusions

These results demonstrate that substantial control is possible with focused, correctly timed initial efforts, and conscientious follow up. Use of triclopyr allows for effectiveness without the potential for adverse environmental effects to water quality that can occur with picloram.

I recommend application of triclopyr to cut stumps in early summer. Leaving the root system in place has the additional environmental benefit of minimizing soil erosion, especially on slopes or other erodible soils. Follow up control must be completed the next summer on the limited number of stumps that will resprout. At least two follow up visits should be completed in June and September one year after initial treatment to identify stumps that may resprout at different times during the growing season.

Any germinating plants discovered during follow up visits should be pulled by hand, if possible, or chemically treated as described above. Recognizing germinating broom is essential to control success, and reduces needed follow up work, as well as herbicide use. Recovery of native vegetation will lead to increased shading

and ecological resilience, which should also have the benefit of reducing habitat suitability for broom (Moore 2011).

Since related Scotch broom is known to have a seed bank that is mainly persistent for the first two years (in Leblanc 2001), the treatment area should be annually monitored for a total of at least two subsequent summers (i.e., for a total of three years after initial control). This crucial follow up will allow for removal of any germinating Spanish broom when individual plants are small and the recurrence is limited in the area. It is not known for certain how persistent the Spanish broom seed bank is, so a different monitoring period may be warranted based on subsequent observations

In speaking with nearby residents while control efforts were underway, several people were unaware of the hazards of broom, and appreciated the aesthetic benefits the plant offered as part of the semi-arid landscape. Any control program should recognize this cultural perspective and educate stakeholders about the adverse environmental impacts of the species; this will help ensure program support and potentially allow the efforts to be extended to private lands.

By following these straightforward approaches, scaled to available resources and the areas of concern, the challenge of controlling Spanish broom can be won.

Special thanks to Caltrans Maintenance staff, especially Kathlene Manini, Donald Parker, and Daniel Schmidt. Contact the author at robert.a.james@dot.ca.gov

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Staying "on label" in tidal waters

by David Thomson, San Francisco Bay Bird Observatory, Habitats Program

The Fall 2012/Winter 2013 issue of *Cal-IPC News* contained an article entitled "Special concerns near aquatic habitats" by Drill and Trumbo. The article presents a good review of herbicide concerns with most aquatic habitats – except for tidal waters. This is a situation that applies to all of us managing intertidal invasive plants like *Spartina* hybrids and *Limonium ramosissimum*.

In order to stay "on label" with some herbicides you cannot spray "intertidal areas below the mean high water mark." For example, the Telar (XP/XD) labels state: "Do not apply directly to water, or to areas where surface water is present, or to intertidal areas below the mean high-water mark." But what exactly is the mean high-water mark?

According to the US EPA the "mean high-water mark" separates intertidal coastal and estuarine areas that are exposed during low tide but covered during high tide from adjacent terrestrial areas. EPA says the definition varies by state, but in general it's "the line on the shore established by the average of all high tides. It is established by survey based on available tidal data (preferably averaged over a period of 18.6 years because of the variations in tide). In the absence of such data, less precise methods to determine the mean high-water mark are used, such as physical markings, lines of vegetation or comparison of the area in question with an area having similar physical characteristics for which tidal data are readily available." See the diagram below on tidal waters.

Unfortunately, detailed tidal data are usually not available for most sites, and the alternative methods of using physical markings or lines of vegetation can be unclear, even to those of us who have spent years mapping coastal wetlands.

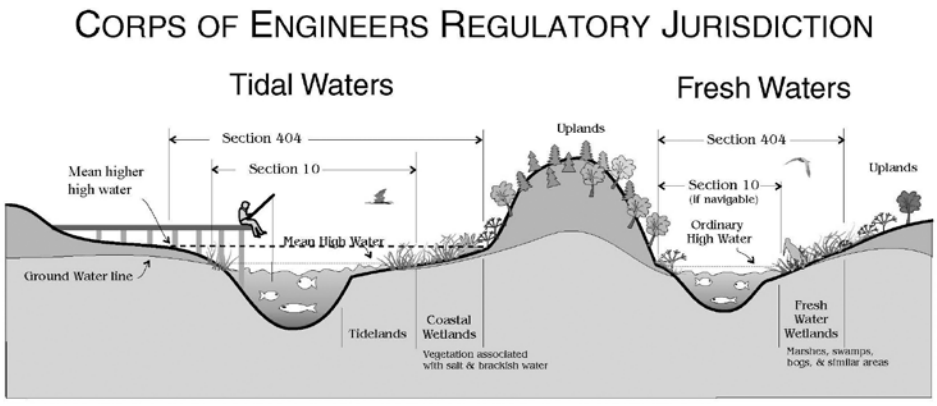
California's State Water Resource Control Board (SWRCB) has a new draft wetland policy that appropriately defines the upper tidal boundary: "For all tidal landscapes, shallow surface water is any portion of the tidal prism that is bounded by the local Mean Lower Low Water (MLLW) datum and the local maximum tide height as adjusted for the current tidal epoch."

However, this still relies on tidal data that is not generally available for most sites. I encourage the SWRCB and other regulatory agencies to work on providing more specific guidance on how the label term "mean high-water mark" should be determined by herbicide applicators.

Especially with the added complexity of climate-induced sea level rise, those of us working to protect intertidal habitats need even more straightforward and effective methods for assessing where herbicides can and cannot be used on our work sites.

Contact the author at d.x.thomson@gmail.com.

Diagram: US Army Corps of Engineers



Retail nurseries get recognition and training from PlantRight

By Jan Merryweather, Sustainable Conservation

With the launch of its free Retail Nursery Partnership program, PlantRight becomes the go-to resource for California nursery retailers interested in building expertise on ornamental invasive plant issues and opportunities. It's one more way for retailers to demonstrate,'We Care!' when it comes to selling regionally appropriate and environmentally-friendly plants.

Nurseries joining the program agree to not sell plants listed by PlantRight as invasive, and to educate their customers and staff about the problems caused by invasive plants.

PlantRight is a project of the California Horticultural Invasives Partnership (Cal-HIP), a coalition of environmental and horticultural industry groups. The nonprofit group Sustainable Conservation in San Francisco oversees the partnership. Cal-IPC has been a member of the coalition since its inception in 2004.

PlantRight's training materials and science-based educational content are easy-to-access, practical, and available 24/7, so that even the busiest garden center professional can benefit. Nurseries can learn more about this free program by visiting: *www.plantright.org/create-your-plantright-account*.

If you like the sound of this program, and would like to see more PlantRight nursery partners in your area, take a moment to introduce us to your local garden center. Send an email with your local garden center's name and contact information to *PlantRight@suscon.org*.

PLANT RIGHT
KEEP INVASIVE PLANTS IN CHECK

The Garden Company in Santa Cruz proudly displays its PlantRight window decal.

"PlantRight training allows us to make responsible purchasing choices, share our philosophy with customers, and offer reasonable alternatives to popular invasive species. I would encourage all garden center owners and managers to participate in this partnership."

Charlie Keutmann, Owner, The Garden Company (Santa Cruz)

"When PlantRight approached Sloat Garden Center, joining forces was a slam dunk. PlantRight's efforts helped solidify and train our team with a singular, cohesive message that can easily be communicated to our customers through signage, handouts, on-line presence and team member knowledge. Retailers across the country should embrace these types of efforts to educate our customers, helping them make more informed and responsible decisions."

Dave Stoner, President/CEO, Sloat Garden Center, Inc. (Nine locations in the San Francisco Bay Area)

Cal-IPC recently reprinted two of our "Don't Plant a Pest!" brochures featuring invasive ornamental plants to avoid as well as suitable landscaping alternatives. The San Francisco Bay Area brochure and the statewide Trees brochure are available once again. They are great educational resources for plant sales or garden tours. We can provide up to 10 copies for free; request them by emailing info@cal-ipc.org. Larger quantities may be ordered from *www.cal-ipc.org/shop*.

Tracking eradication progress

By Vince Guise, Contra Costa County Agricultural Commissioner

Documenting weed work in a manner that shows progress toward our goals is a challenge that all weed workers face, especially when we are aiming for eradication. Here are some of our practices and experiences from Contra Costa County.

We have 17 noxious/invasive weed species that we deal with as a department. In our program we are trying to eradicate 15 of the 17 species. It takes persistent and dedicated field work to get rid of some of these species. Due to limited resources and other considerations we are trying to manage the other two species, perennial pepperweed and pampas grass, by treating satellite infestations found in new areas and some leading edge areas.

We document the work that we perform on a property-by-property basis and have been doing so for the 34 years of our program. Some properties are small, 5- or 10-acre ranchettes, and others are ranches or regional park open space areas that are well over 1,000 acres. We document each weed species treated, the date of treatment, the treatment type, the name and amount of concentrated product if herbicides are used, the person(s) that performed the application on the property, the gross acres surveyed and the net acres treated. We don't track separately the individual infestations of a species on the same property. We do track separately the different species treated on each property. We treat all of the targeted species each year with a goal of not allowing new seed to set.

Our main indicator of progress on a property is net acres treated over the years. Eventually we will come to eradication of the species on the property, after three years of no detected plants of the targeted species on the entire property. One of the problems with this is that it does not take into consideration the multiples of small infestations that may have been eradicated from the property previous to the overall eradication. This all-or-nothing property-by-property approach does not fully show the progress that we have made in eradicating individual populations, though we generally can show an overall decline in net acres on the property.

One idea that is sometimes used is "eradicating to seed bank," meaning that all plants are treated or removed to where no new seed is produced. This would help to show short-term progress though real eradication can be many years down the road. If eradication to seed bank is accomplished from year to year (as in our program) then it is a matter of persistence until the seed bank is finally depleted and true eradication is achieved.

It is very difficult to get good information on seed bank life in field situations. We have asked the CDFA Seed Botanist to tell us the seed longevity of each. He was not able to find good information. We have also found information in books written by well-respected authors to be different than what we find in the field. The sidebar lists the seed bank longevity that we have observed for the plants we are working on.

Observed seed bank longevity:

Artichoke thistle: 15-20 years

Purple starthistle: 8-12 years

Red sesbania: 8 program years so far and we expect 30+ year seed life

Barb goatgrass: 3-4 years

Perennial pepperweed: 3-4 years (less if the area is treated with Telar™)

Russian knapweed: 3-5 years

White horsenettle: <5 years, though stolons seem to be difficult

Carderia, whitetop (lens and heart-podded): 3-6 years

Purple loosestrife: 11 program years and counting

Oblong spurge: >12 years

Smooth & woolly distaff thistle: 6-10 years

Kangaroothorn: >8 years

Pampasgrass: 1-2 years

Japanese knotweed: Does not produce seed in our area, but deep rooted stolons take 2-3 years with Imazapyr

Japanese dodder: Also does not produce seed in our area but small remnants that are missed when host plants are removed can keep the infestation going until they are detected. Usually 2-3 years maximum.

Another factor is missed plants. This extends eradication time due to new seed introduced into the soil. And I strongly disagree with any "one acre or less" eradication thought. If you don't get it all, the plant can and likely will come back.

Most of these species seem to have a "breaking point" when net acres fall off significantly. With artichoke thistle, for example, it is 3-5 years. Populations of some species bounce around for a few years before reaching a breaking point. Purple starthistle goes up and down for 6-7 years before dropping off to a low level. However we have noticed in the last two years since we started using Milestone™ on artichoke thistle and purple starthistle that these species crash to lower levels much faster than with materials we used before. It seems that new germinating seed of these species may be sensitive to low residual levels in the soil since this effect seems to carry over from year to year.

Eradication depends on the tools available, the dedication and persistence of individuals, and the structure of the program. One of our success stories s is a 1,060-acre ranch that was first treated near the beginning of our noxious weed program. In 1983, 22 net acres of artichoke thistle were treated by air. Besides dense patches, there were also scattered individual plants throughout this property. Over the years the net acreage on this ranch has diminished to the point that we now count individual plants. We had 42 plants this year and expect there will be zero plants in the next 2-3 years. We have had many properties that followed the same pattern with some reaching total eradication. This goal should be the gold standard for our work, but it requires steady funding and attention, which we have been fortunate to have in our county.

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Prescribed grazing for invasive plant control on rangelands

By Josh Davy, UC Farm Advisor, Tehama, Glenn, Colusa Counties, Kenneth Tate, UC Range Specialist, and Leslie Roche, Post-doctoral Researcher at the UC Davis Rangeland Watershed Lab

Most herbicide weed control methods are good at initial control, but can lack long-term weed management effectiveness if weeds are allowed to re-establish. Grazing is a tool that can offer an opportunity to suppress herbaceous weed populations on rangelands over a longer term. However, grazing should be thought of as a weed "management" tool because grazing does not usually control every plant treated. Instead, grazing can be used to restrain the prolific seed production of annual weeds or root carbohydrate storage of perennial weeds. Depending on the situation, grazing and herbicide weed control methods can be used independently or in cooperation.

There are important factors to keep in mind when approaching a grazing management option for weed control. Unlike herbicides that can make an immediate impact on large weed populations regardless of soil and weather conditions, grazing is more complicated and dependent upon site-specific conditions.

Also, herbicide control entails less physical infrastructure such as fencing and does not require a skilled cowboy to keep livestock fenced on the targeted area.

Finally, livestock are bred primarily to produce food and fiber. Although using livestock for weed control is a double bonus, it means that maintenance of animal nutrition demands while "meating" weed management goals is very important. Factors such as running out of livestock drinking water or a late season reduction in forage quality before optimal defoliation levels are hit can impact weed control success from year to year. It may also require thought about the class of animal used for targeted grazing specific weeds. For example, mature dry cows may serve better for consuming low quality forages than growing yearling cattle or lactating cows.

Fenced cattle in medusahead timed grazing research trial. Photo by Josh S. Davy

Three main strategies exist for weed management on rangeland. These include:

1. Exhaust the root reserves of annual plants through defoliation as soil moisture is being depleted. This inhibits the plants' ability to make seed for subsequent-year germination.
2. Repeated grazing of perennial weeds just prior to the onset of dormancy. Defoliation of plants at this time exhausts root reserves required by plants during the dormant period and entering the next growing season.
3. Remove thatch and open up the canopy to allow desirable plants to establish. This is mostly helpful with weeds that create a monoculture such as medusahead. Published scientific support for this strategy is limited.

The first two strategies are the essential components for reducing weed density in a target area. The key to implementing the first two strategies is timing, timing, and timing of defoliation. Target weeds need to be heavily defoliated as soil moisture is depleted at the end of the growing season. Without moisture to recover, defoliated plants senesce with little or no reproduction and have a reduced chance of surviving dormancy. If adequate moisture is available, the plants are able to recover from grazing.

Clay soils with high water storage potential, or late growing-season rains after grazing ends, can hinder the effectiveness of grazing. Deep-rooted plants are better able to tap soil moisture than shallow rooted plants, usually making a single target grazing more successful on shallower rooted annual plants than biennial or perennial weeds. This can be positive if a manager's goal is to lessen the impact of invasive annual grasses on deep-rooted native perennial grasses.

Examples of successfully managing weed populations exist. The following three examples depict what we have learned from targeted grazing on annual, biannual, and perennial plants. Many more published examples exist.

• Heavy defoliation of medusahead (*Taeniatherum caput-medusae*) in late spring as plants are entering the bolt stage has proven very successful in limiting seed production and subsequent year's plant density (DiTomaso et al. 2008).

• Yellow starthistle (*Centaurea solstitialis*) required multiple heavy grazing sessions late in the season to reduce seed production due to the plant's deep roots (Thompsen et al. 1993).

• McKell et al. (1966) found repeated defoliation of hardinggrass (*Phalaris aquatica*) during spring prior to dormancy could cause plant death. Fundamentally showing deep-rooted perennial plant control is possible using repeated defoliation as a strategy.

Exciting new research at the Sierra Foothill Research and Extension Center led by the California Rangeland Watershed Laboratory is examining the long-term effects of four grazing treatments. The lab has completed the first year of implementing treatments of seven-month continuous grazing, four-month fall and spring grazing, four-month fall and spring targeted grazing, and winter-only grazing. The lab has implemented the project at a ranch scale (over 1200 acres, using over 360 cattle) and is monitoring multiple parameters including yearling cattle production, invasive and native plant responses, and other ecosystem responses.

Medusahead at the proper phenological stage to begin a targeted grazing treatment. Photo by Josh S. Davy

It is important to note that the "target style" grazing strategies for weed control described above are not the only way that grazing can affect weed management. Any defoliation of weed plants has an impact on their subsequent seed production or the amount of thatch accumulated. Grazing can also have a positive effect on the reduction of fire fuel loads. A grazing strategy with a moderate continuous stocking rate does reduce weeds such as medusahead and starthistle when compared to non-grazed areas. With this grazing scheme it may be that effects are not seen on high rainfall years or years with significant late growing season rainfall, but effects may be seen during drought years or years with an early end to rainfall.

As stated earlier, grazing treatments rarely control the entire weed population. Rainfall's influence on a grazing treatment's "perfect" timing can cause success to vary from moderate to high between years. Because of this, grazing should be implemented only as a long-term weed management strategy. Such moderate single-season success in weed management can compound over years into drastically lower weed populations.

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Impacts of native vs. exotic grassland vegetation

By Valerie Eviner, Joanne Heraty, Jill Baty, Carolyn Malmstrom, and Kevin Rice, UC Davis Dept. of Plant Sciences

[Abstract from poster presented at the 2013 Cal-IPC Symposium]

California's grasslands have been dominated by annual exotic grasses for the past 200-300 years. More recently, newer invasive grasses have become prevalent, such as medusahead and barbed goatgrass. Control of these newer invasive grasses, or restoration of natives is not possible in all impacted areas, due to the broad extent of these invasions. Ecosystem services are a potential criteria to prioritize areas for restoration and weed control.

We planted plots consisting of three community types: naturalized exotic species (that have dominated California's grasslands for 200-300 years), invasive weeds (goatgrass and medusahead), and native species (common mix of species used for restoration in California's Central Valley). After 3 years,we assessed the impacts of these vegetation types on multiple ecosystem services. When comparing natives to naturalized species, natives increased soil nitrogen availability, and were much better at suppressing invasive weeds. However, the naturalized species plots provided better erosion control, mitigation of soil compaction, water qual-

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ity, and soil water storage. This suggests that restoration of natives will be most beneficial in areas with high invasive weed pressure, but could be detrimental in areas where erosion, compaction, and water quality are of concern. Invasion of noxious rangeland weeds into the naturalized community did not enhance any ecosystem services, and greatly decreased palatable spring forage quantity. However, there is a tradeoff between invasive weeds and native species. Invasion of noxious weeds into native communities decreased spring forage availability and decreased soil nitrogen availability, but enhanced soil water storage, compaction alleviation and water quality. This suggests that sites that are less vulnerable to soil degradation would be best to prioritize for invasive weed control.

While the impacts of invasive grasses on California's flora are an important criterion for restoration and weed control, it is not possible to manage all invaded areas. Thus, prioritization of sites for management should consider that some of these invasive grasses are improving soil conditions and water quality.

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Wildland Weed News, cont'd...

Undergraduates help National Wildlife refuges. Eight universities including UC Santa Barbara participated in a combined seminar which compiled data on invasive plants in nearby refuges, including habitat richness and evenness, elevational range, native species diversity, refuge size, and the regional pool of invasive species. Results were combined for a continental-scale analysis. They found that patterns are highly variable among regions, suggesting that management strategies for invasive species are best formulated at the regional level. *Santa Barbara Independent*, August 22.

Does it matter whether a plant is native? Dr. Mark Davis of Macalester College and Dr. Daniel Simberloff of the University of Tennessee-Knoxville debated when, if, and how conservation biologists and managers should deal with non-native species. A recording of "Native and non-native species: How much attention should managers be paying to origins?" is available at *distancelearning.fws.gov/players/con_sci.html*.

Eucalyptus: friend or foe? The online science blog for KQED public radio in San Francisco describes the controversies surrounding removal of eucalyptus stands in the East Bay. *blogs.kqed.org/science/2013/06/12/eucalyptus-california-icon-fire-hazard-and-invasive-species/*

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High-school student Connor describes weed projects at the National Children's Forest during the San Bernardino Mountains field trip at the Symposium.

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www.regonline.com/2014nripc

Western Society of Weed Science
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www.wsweedscience.org

Invasive Weeds Awareness Day at the Capitol
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"If we really want to change people's minds about invasive plants, I think we need to re-name them... Himalayan blackberry could probably be called "ravening monsterthorn" without anybody who is familiar with it complaining."

- Ursula Vernon, "A Matter of Names",
nativeplantwildlifegarden.com/a-matter-of-names/