Vol. 22, No. 1 Winter 2014

Cal-IPC News

Protecting California's Natural Areas from Wildland Weeds

Newsletter of the California Invasive Plant Council

Conserving Rangelands

Prof. James Bartolome's UC Berkeley rangeland ecology class measures residual dry matter on Mount Burdell in Marin County. See story on top rangeland weeds on page 8 *Photo by Dana Morawitz.*

INSIDE

Cal-IPC

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A California 501(c)3 nonprofit organization

Protecting California's lands and waters from ecologically-damaging invasive plants through science, education, and policy.

Cal-IPC News
Winter 2014 - Vol. 22, No. 1

Editors: Doug Johnson & Elizabeth Brusati

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From the Director's Desk

Progress in the Sierra and beyond

As land managers finish the documentation on one treatment season and prepare for another, it's a good time to take stock of the major progress made in the last year. Here are some of the highlights from Cal-IPC.

The California Wildlife Conservation Board, recognizing the potential for significant conservation benefit at a landscape scale, awarded a grant to Cal-IPC to design top-priority invasive plant management projects with regional partners across the state. If we are successful, some of these projects will garner additional funding for implementation. We're designing projects with partners in the Sierra, on the north coast and in the Bay Area, and will be including more regions in the new year.

Other projects have already secured funding for implementation. Cal-IPC received a grant from the Climate Adaptation Fund of the nonprofit Wildlife Conservation Society to work on invasive plants that threaten Sierra Nevada meadows, sensitive habitat that will only grow more important as our climate changes. We are working with wildlife colleagues to assess key interactions that will help set priorities.

Interaction between wildlife and invasive plants is also being explored through the revision of the state's Wildlife Action Plan. The California Department of Fish & Wildlife has solicited Cal-IPC's partnership in developing information for the plan.

This progress builds on Cal-IPC's CalWeedMapper decision-support tool. Cal-IPC is now releasing WHIPPET Online, a complementary tool for smaller scales (see article in this issue). This growing online toolbox will be enhanced as project partner Calflora builds their Weed Manager module for keeping treatment data in the cloud.

To develop more steady support for such efforts over the long term, Cal-IPC coordinated with agencies to develop a Blueprint for Landscape-Level Invasive Plant Management. The document defines approaches, tools and organizations that are shared within the community, with the goal of consistently funding shared resources and building effective collaborative efforts to address invasive plants together.

Here's to another year of progress in 2014!

Tuolumne County is treating Canada thistle at 7400 feet in the Carson-Iceberg Wilderness. Purple starthistle and diffuse knapweed are the other species being treated in central Sierra counties as part of Cal-IPC's National Fish & Wildlife Foundation grant. Photo courtesy Tuolumne Co. Agricultural Commissioner's office.

Cal-IPC Updates

Symposium dates set! October 8-11 at Chico State University. Details page 11.

National standard for invasive plant listing progresses. Cal-IPC and other partners from the National Association of Exotic Pest Plant Councils will submit their draft standard to the ASTM Sustainability Working Group this spring.

Cal-IPC in the *Vallejo Times-Herald.* Executive Director Doug Johnson was interviewed for an article on invasive plant management in Solano County and the decline in state funding. Andrew Fulks, UC Davis, was quoted on the cost-effectiveness of early eradication. *www.timesheraldonline.com/news/ci_24632429/solano-county-battling-against-spread-invasive-species*

New grants. The Wildlife Conservation Society is funding Cal-IPC to identify and remove invasive plants that threaten Sierra Nevada meadows. The True North Foundation is funding completion of a new manual: *Best Management Practices for Wildland Stewardship: Protecting Wildlife When Using Herbicides for Invasive Plant Management*.

Other Updates

New blog from UC Cooperative Extension. Carl Bell, a Regional Advisor for Invasive Plants with UCCE in Southern California, has started a blog on invasive plants with information on new weeds, management techniques, and more. *ucanr.edu/blogs/socalinvasives/*

Eldorado National Forest completes NEPA for invasive plant management. The forest released a NEPA Decision Notice and Finding of No Significant Impact for the eradication and control of invasive plants on 2,610 acres. The notice also supports treatment of new invasives found in the future. *www.fs.usda.gov/projects/eldorado/landmanagement/projects.*

New NRCS videos. The California office produced short pieces on land management topics, including wildlife on rangelands and access roads on forest lands. *www.youtube.com/user/NRCSCalifornia*

California Naturalist Program. Similar to their popular Master Gardeners program, UC has initiated a program for naturalists, with a first-ever conference this fall. The California Naturalist Handbook provides a fun, science-based introduction to California's natural history with an emphasis on observation, discovery, communication, stewardship and conservation. It also discusses how to create and use a field notebook, natural resource interpretation, citizen science, and collaborative conservation. *http://calnat.ucanr.edu.*

Wildland Weed News

San Francisco plant checklists. The Yerba Buena chapter of the California Native Plant Society has developed a checklist of the plants of San Francisco County. Separate checklists are available for most of the city's 67 natural areas in pdf format. *www.wood-biological.com/san-francisco-plant-checklist/*

Oregon gives itself a B-. On its annual scorecard, the Oregon Invasive Species Council gave the state high marks for prevention work in 2013, but failed to maintain adequate coordination. *www.diggermagazine.com/2014/01/oregon-gets-b-in-invasive-species.html.*

Federal bill on aquatic invasives. The Congressional Invasive Species Caucus, co-chaired by Rep. Mike Thompson from California's north coast, plans to introduce the "Stop Western Aquatic Invasive Species Threats Act of 2013" to address the western spread of aquatic invasive species (particularly dreissenid mussels). *mikethompson.house.gov/news/documents-ingle.aspx?DocumentID=362231*

Rim Fire animation online. Watch the spread of last year's historic fire over a month through an animated map with time lapse display. *apps.opendatacity.de/fire/en*

USFS webinar series on invasives. The Forest Service's Rocky Mountain Research Station is presenting a series of seven webinars on invasive plants, January through May. *www.fs.fed.us/rmrs/webinar-series/invasive-species/*

New USFS Invasive Species Framework. The document prioritizes and guides the prevention, detection, and control of invasive insects, pathogens, plants, wildlife, and fish. *www.fs.fed.us/publications/invasive/invasive-framework-2013.pdf*

Survey on attitudes toward invasives. The European Commission surveyed Europeans on their "attitudes towards biodiversity" including alien species. Most Europeans (78%) think that plants and animals introduced into our ecosystems threaten biodiversity, but consider them less important threats than others such as pollution and deforestation. *ec.europa.eu/public_opinion/archives/flash_arch_390_375_en.htm#379*

WMA funding bill!

Assembly Member Joan Buchanan is working with Cal-IPC to author a bill to renew funding for the state's Weed Management Area program. We will need a groundswell of support from groups across the state! We will keep you posted via email. Also, consider attending our

11th Annual Invasive Weeds Awareness Day at the Capitol

on March 12th in Sacramento. See *www.cal-ipc.org* to sign up!

Your membership

In case you missed it in previous issues, we have changed our membership structure a bit. Individual annual memberships start at $50 ($100 professional, $25 student) which includes a discount on Symposium registration. We now send automated email renewal reminders so we can spend more time on our programs. (And you can see your membership status on the newsletter mailing label.) We also have new **organizational memberships** that provide recognition in the newsletter. See page 15 for details. ***Thank you for your support!***

Protection of ecosystem services: A way forward after Weed Management Area cuts

By Jennifer L. Funk, Chapman University, School of Earth and Environmental Sciences, Orange, CA. jlfunk@chapman.edu
Virginia Matzek, Santa Clara University, Department of Environmental Studies and Sciences, Santa Clara, CA
Doug Johnson, California Invasive Plant Council

[Adapted from Funk J.L., V. Matzek, M. Bernhardt, and D. Johnson. 2014. Broadening the case for invasive species management to include impacts on ecosystem services, in BioScience (January 2014) 64 (1): 58-63]

Cal-IPC has estimated that California spends roughly $82 million on invasive species control annually. In 2011, as a result of the state budget crisis, California eliminated all funding for the Weed Management Areas (WMA) program, a loss of roughly $1.5 million annually. These WMAs serve to coordinate invasive plant species removal efforts in agricultural and wildland areas statewide. In a recent study, we questioned the directors of these WMAs to understand the impact of the funding loss on invasive plant control.

Results indicated that the largest budget declines will be felt in what are arguably the most important aspects of invasive species control: on-the-ground removal of plant invaders (63% decline) and early detection of invaders (60% decline). The expected decrease in control effort precipitated by these budget cuts is critical because research shows that temporary lapses in management can set back restoration efforts for years.

Even though funds from the WMA program amounted to a relatively small amount (about $15,000 per county), WMA directors anticipated outsized effects. WMA funds had been used to leverage additional funding and in-kind contributions at a ratio of up to 3 matching dollars to every state dollar funded, in part by hiring personnel to apply for additional funding. Over 3/4 of WMA directors were not confident they could replace lost funding within three years.

The loss of WMA funds amounted to the entire budget for some areas, which represents a potential loss of institutional memory and capacity as staff positions are cut, with some areas not able to participate in region-wide grant proposals because they cannot logistically use the funds.

WMA directors also noted that the ability of managers to travel to symposia or workshops, or to coordinate with other managers, will be compromised. Another recent study found that information on how to successfully address invasive plants is primarily transmitted to managers through informal conversations among managers, and that attending conferences was considered more useful than reading the peer-reviewed literature (Matzek et al. 2013). Thus, the loss of these meetings will likely have strong effects on information transfer.

In order to secure more consistent funding, we suggest that managers broaden the case for invasive species management by considering the impacts of invasive species on ecosystem services (or "nature's benefits" as one communications study suggests calling them), such as carbon sequestration, water delivery, or pollination services. In California, invasive species removal has strong relevance to provision of ecosystem services. For example, yellow starthistle (*Centaurea solstitialis*) costs California ranchers $17 million annually in lost forage and eradication expenses (Eagle et al. 2007). Additionally, starthistle depletes soil moisture in the Sacramento River agricultural region amounting to nearly $75 million annually (Gerlach 2004).

To effectively make the case for funding based on impacts to ecosystem

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Average Loss in WMA Funding. A survey of 21 WMA chairs revealed that many budget categories are affected by the California state budget cuts.

Activity	2011	2012	Decline
On-the-ground treatment	$55,622	$20,333	63%
Early detection/ rapid response	$ 5,719	$ 2,300	60%
Assessment	$ 7,126	$ 3,633	49%
Mapping	$11,851	$ 6,667	44%
Education	$ 5,576	$ 3,833	31%
Regulation	$ 7,501	$ 5,967	20%
Other	$ 1,875	$ 1,333	29%
Total	**$95,269**	**$44,067**	**54%**

Personal Reflection

Working on weeds in the eastern US

By Tanya Meyer, Coordinator, Sinnemahoning Invasive Plant Management Area in Pennsylvania

[Tanya served on the Cal-IPC Board of Directors from 2007 to 2009, during which time she also worked for the Yolo County Resource Conservation District.]

As Cal-IPC members know, invasive plants are a problem everywhere. I have had the opportunity to do weed work on both the west coast and back east, and have observed some interesting differences. I was born and raised in California and did vegetation work in north-central California for 10 years. For the last four years, I have worked in north-central Pennsylvania.

The wildland invasive plant species are different, with the exception of good old tree-of-heaven (*Ailanthus altissima*). Most of the invasive plants came to the east coast from Asia, and have common names like Japanese barberry, Asiatic bittersweet, Japanese stiltgrass, and my favorite, Japanese knotweed. There are a lot of invasive vines, both perennial and annual, which are very challenging to control, since they climb over and entwine with native plants.

The most pronounced difference is the turning of the seasons. California's seasons (in the lower elevations) are subtle: we know the time of year by day length, angle of the sun, and plant activity (or lack thereof). In these gentle seasons we have winter weeds, spring weeds, summer weeds and fall weeds to control. In Pennsylvania, winter is cold, long, and everything is dormant. We may do some basal bark spraying on invasive trees, if there happens to be no snow on the ground, and some pre-emergent treatments to annuals in the early spring, but the bulk of the work happens in the summer (annuals) and early fall (perennials). It is a big push to get all the perennials sprayed before the first hard frost, which could come in early- to mid-October. After that, a Northeastern weed worker can settle into doing billing, grant writing, outreach and reporting for the winter.

Unlike California, the weather does not seem to make a difference to the weed population. While yellow star thistle, for example, will have "good years" and "bad years" because of high or low rainfall, my

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Summer and winter at the Driftwood Pond restoration site.

Weed biological control agents approved for California

By Michael J. Pitcairn, California Department of Food and Agriculture, Pest Detection & Emergency Projects Branch, Sacramento, CA
Lincoln Smith and Patrick Moran, USDA Agricultural Research Service, Exotic and Invasive Weed Research Unit, Albany, CA

Biological control, or biocontrol, is a weed control method where the natural enemies of an invasive exotic weed are intentionally introduced in an effort to reduce its abundance. This is achieved by the introduction of new natural enemies (usually insects that are highly host-specific) from a plant's native range into the area invaded by the weed.

Prior to release of any beneficial exotic organism, several steps are performed: 1) exploration and discovery of potential biological control agents in the weed's area of origin, 2) evaluation of their environmental safety (through host specificity testing) and efficacy, and 3) review of environmental safety and permit approval by USDA-APHIS (Animal and Plant Health Inspection Service). For background on the process of developing biological control agents, see "Biocontrol 101: Classical biological control of weeds" in the Winter 2008 issue of *Cal-IPC News*, available at www.cal-ipc.org.

If a biocontrol agent is approved for release by both APHIS and CDFA, it can be released. Establishment and spread in the invaded range depends on how fast the agent multiplies. The ultimate objective is for the exotic natural enemies to become permanently established and to build up populations that reduce the weed population.

Patrick Moran of USDA examining water hyacinth plants in 2012 as part of the biocontrol release evaluation process for this aquatic weed. Photo by Chris Mehelis, USDA.

In pursuing biological control of a weed, it is understood that the weed will not be eradicated and that both the weed and biological control agents will permanently persist but at densities below economic or ecological threshold levels where the weed is no longer problematic. Because biocontrol agents and their target weeds interact with many environmental factors, the level of control may vary from year to year and site to site.

A total of 65 species of biological control agents have been imported into California and released against 36 species of weeds (see table). Of these, 54 bioagents successfully established in California. However, the impact of these control agents has been variable. Biological control was successfully achieved on musk thistle (*Carduus nutans*) in northern California, diffuse knapweed (*Centaurea diffusa*), squarrose knapweed (*Centaurea squarrosa*), rush skeletonweed, (*Chondrilla juncea*), Klamath weed (*Hypericum perforatum*), and purple loosestrife (*Lythrum salicaria*), as well as tansy ragwort (*Senecio jacobaea*), puncturevine (*Tribulus terrestris*), and to some degree yellow starthistle (*Centaurea solstitialis*) in ungrazed, undisturbed areas.

The table shows the agents released against each target. The agents in bold are the most effective and are therefore recommended for use by land managers. It should be noted that nine bioagents have been released fairly recently and it is too early to judge their efficacy. On the other hand, agents for eight weed species have failed to establish or were extirpated when their host plant was eliminated from release sites by other control methods.

Additional new biocontrol agents are being evaluated for Cape ivy (*Delairea odorata*), Dalmatian toadflax (*Linaria dalmatica*), gorse (*Ulex europaeus*), Russian knapweed (*Acroptilon repens*), Russian thistle (*Salsola tragus*), Scotch broom (*Cytisus scoparius*), French broom (*Genista monspessulana*), Scotch thistle (*Onopordum acanthium*), tamarisk (*Tamarix ramosissima*), water hyacinth (*Eichhornia crassipes*) and yellow starthistle (*Centaurea solstitialis*).

Insect agents that are established in the field may be available for distribution free of cost, for example as weed parts containing insects. Landowners and natural resource managers can contact their County Agricultural Commissioner's office for more information on availability of weed biocontrol agents in their area.

Weeds targeted for classical biological control and associated biological control agents permitted for use in California.

Most effective agents shown in **bold**.

Weed species	Common name	Level of control	Approved biocontrol agents for California
Acroptilon repens	Russian knapweed	Unknown, too early	*Jaapiella ivannikovi* (Russian knapweed galling midge)
Alternanthera philoxeroides	alligatorweed	All extirpated	*Agasicles hygrophila* (alligator weed flea beetle) *Amynothrips andersoni* (alligator weed thrips) *Vogtia malloi* (alligator weed stem borer)
Arundo donax	giant reed	Unknown, too early	*Rhizaspidiotus donacis* (Arundo armored scale) *Tetramesa romana* (Arundo shoot gall wasp)
Carduus nutans	musk thistle	Good control in northern CA	***Rhinocyllus conicus* (thistle seed head weevil)**
Carduus pycnocephalus	Italian thistle	Little control	***Rhinocyllus conicus* (thistle seed head weevil)**
Centaurea diffusa	diffuse knapweed	Good control	***Bangasternus fausti* (broad-nosed seed head weevil)** ***Larinus minutus* (lesser knapweed flower weevil)** *Sphenoptera jugoslavica* (knapweed root-boring beetle) *Urophora affinis* (banded knapweed seed head gall fly) *Urophora quadrifasciata* (four-banded knapweed seed head gall fly)
Centaurea jacea ssp. *pratensis*	meadow knapweed	Uncertain	*Bangasternus fausti* (broad-nosed seed head weevil) ***Cyphocleonus achates* (knapweed root weevil)** ***Larinus minutus* (lesser knapweed flower weevil)** *Larinus obtusus* (blunt knapweed flower weevil) *Urophora affinis* (banded knapweed seed head gall fly)
Centaurea stoebe	spotted knapweed	Uncertain	*Agapeta zoegana* (yellow-winged knapweed root moth) *Cyphocleonus achates (*knapweed root weevil) ***Larinus minutus* (lesser knapweed flower weevil)** *Terellia virens* (green clearwing fly) *Urophora affinis* (banded knapweed seed head gall fly) *Urophora quadrifasciata* (four-banded knapweed seed head gall fly)
Centaurea squarrosa	squarrose knapweed	Good control	***Bangasternus fausti* (broad-nosed seed head weevil)** Cyphocleonus achates (knapweed root weevil) *Larinus minutus* (lesser knapweed flower weevil) *Sphenoptera jugoslavica* (knapweed root-boring beetle) Terellia virens (green clearwing fly) *Urophora affinis* (banded knapweed seed head gall fly) *Urophora quadrifasciata* (four-banded knapweed seed head gall fly)
Centaurea solstitialis[1]	yellow starthistle	Reduction observed in some undisturbed (non-grazed) habitats	*Bangasternus orientalis* (yellow starthistle bud weevil) *Chaetorellia australis* (yellow starthistle peacock fly) ***Eustenopus villosus* (yellow starthistle hairy weevil)** *Larinus curtus* (yellow starthistle flower weevil) *Puccinia jacea* var. *solstitialis* (yellow starthistle rust fungus) *Urophora jacaea* (yellow starthistle gall fly) *Urophora sirunaseva* (yellow starthistle gall fly)

...table continued page 12

Rangeland stakeholders meet on medusahead and goatgrass

By Jeremy James, UC Sierra Foothill Research and Extension Center, jjjames@ucanr.edu

Medusahead and barb (or barbed) goatgrass are two of the most serious invasive species in California rangelands. The ecological impacts of these species are well demonstrated and include negative effects on plant diversity and forage quality, altered soil nutrient, carbon and water cycles, changes in fire frequency and diminished wildlife habitat, among others. Given these serious ecosystem impacts, researchers and practitioners across California have made sustained efforts to better understand the ecology and management of these species.

To synthesize this extensive body of information and transfer this knowledge to a broad stakeholder base, the University of California's Sierra Foothill Research and Extension Center (SFREC) hosted a forum on Nov. 5, 2013, that explored our current understanding of the ecology and management of these species. Over 100 stakeholders attended this forum. Links to handouts and a webcast of this event can be found online at *ucanr.edu/sites/sfrec/*.

The event was structured to maximize information exchange and synthesis among presenters and forum attendees. The forum explored four major thematic areas: the history and spread of these species in California; the fundamental ecology of these species; using ecology to develop practical management tools and strategies; and applying tools and strategies at a management scale. The aim was to link these themes to specific knowledge and experiences of attendees and to use these linked perspectives to identify our most critical knowledge gaps in managing these species.

Over 70% of the attendees listed increasing plant diversity and forage quality as the main reason they are interested in the ecology and management of these species, with less than 20% listing wildlife habitat and fuels management as their top reason. On average, attendees felt they could justifiably spend about $130/acre over a 5 year period to manage these species. Attendees largely viewed different control tools (e.g. herbicide, seeding, fire, grazing) to be similar in effectiveness but were more likely to use targeted grazing over other tools. Over 65% of attendees listed lack of time, high treatment costs, and risk of treatment failure as the main management barriers. Discussions highlighted three main stakeholder information needs: data on treatment efficacy over long time periods; understanding treatment cost relative to market and non-market benefits; and decision-support tools to understand when and where to apply different treatments and strategies.

Dr. Joe DiTomaso compares medusahead and barb goatgrass. Photo by Alison Kent.

This forum represented a first step toward a long-term collaborative statewide effort on advancing understanding and management of these species. Numerous opportunities exist to participate in this effort. Those interested should contact Jeremy James at *jjjames@ucdavis.edu*.

Dispersal dynamics of were discussed by Dr. Erica Spotswood. Photo by Alison Kent.

The ability of *Aegilops triuncialis* (barbed goatgrass) to invade serpentine soil habitats is unusual among invasive plants. Researchers from UC Davis conducted a reciprocal transplant field experiment and determined that both phenotypic plasticity (the ability of a species to adjust to environmental conditions) and genetic variation played a role in its rapid expansion in California. Rice et al. *Biological Invasions,* Nov. 2013, 15(11):2531-254

Goatsrue found in California

By Dean Kelch, California Department of Food and Agriculture, dean.kelch@cdfa.ca.gov

Goatsrue, *Galega officinalis*, a USDA-listed noxious weed, has been found in California. A concerned citizen contacted the Mendocino County Agricultural Department to inform them that she had found an unusual plant growing in ditches along a road east of Ukiah. The plant was confirmed as goatsrue by the California Department of Food and Agriculture's botany lab in July, 2013. This is the first detection of this federal noxious weed occurring spontaneously in California. Further surveys revealed that the plant is also in a small wetland on Bureau of Land Management (BLM) property in western Lake County and that it is spreading down the watershed via a perennial creek. Lake County has been conducting surveys to determine the extent of the infestation and local BLM managers plan on initiating control.

Goatsrue is native to Eurasia, where it is widespread. In the U.S., goatsrue has been found in a dozen states, including Oregon, Washington, Utah, Colorado, and most northeastern states. The largest infestations occur in Cache County, Utah, where it was first introduced to the U.S. in the late 19th century as a potential forage plant. This explains its alternative common name, professorweed. Evidently, the introducers did not realize that the plant contains an alkaloid, galegin, that renders the plant unpalatable to livestock, and toxic if eaten in sufficient quantities.

Goatsrue is a long-lived, deciduous perennial herb that can reach 2 meters tall when it has ample water. Multiple stems sprout from the crown each spring. The leaves are pale green, alternate, and pinnately compound, with 6-10 pairs of leaflets and a terminal leaflet. The sordid white to pale purple, pea-like blossoms are borne in terminal or axially racemes. The fruit is a straight, smooth legume, with 1 to 9 seeds per pod. A plant may produce more than 15,000 seeds, which are small, yellowish beans. They drop on the ground when mature and may be spread by water, equipment, or animals. Whole pods may be dispersed by water some distance.

Goatsrue infests cropland, fence lines, pastures, roadsides, waterways, and marshy areas. The seeds of goatsrue are typical for legumes; they remain dormant and viable for long periods (potentially decades) until disturbed and scarified.

Goatsrue. By Anneli Salo, via Wikimedia Commons.

Goatsrue prefers continually moist, even wet conditions and can outcompete shorter marsh or stream margin vegtation. Goatsrue could potentially spread rapidly through stream networks in California.

Goatsrue needs full sun to thrive. It can germinate and persist in medium shade, but it produces few or no flowers under these conditions. Where willows and other stream bank vegetation are lacking or have been removed, goatsrue could quickly exploit these opportunities to dominate and exclude other species.

When ingested in small quantities goatsrue may act as a galactogogue, increasing milk production in cattle. In larger quantities it is toxic to livestock. Sheep are particularly susceptible to poisoning from goatsrue. Humans also use goatsrue as a galactogogue and goatsrue seeds are sometimes sold to grow as an herb. Little evidence exists of its efficacy or effects. In one report, the babies of women consuming an herbal tea containing anise, fennel, licorice, and goatsrue suffered symptoms such as vomiting, lethargy, poor suckling, and weak response to painful stimuli. Discontinuation of breast-feeding led to reversal of the symptoms.

Control of goatsrue is difficult, as attested by the persistence and spread of the weed in Utah despite decades of active management. The best way to control goatsrue is to prevent its establishment. Because of its long-lived seeds, early treatment of infestations is crucial in limiting the seed bank. Goatsrue has been controlled by herbicides such as 2,4-D plus Dicamba or glyphosate; retreatment is necessary. Tillage of infested row crop fields can suppress goatsrue, but usually does not lead to eradication. Revegetation with woody vegetation of riparian corridors will likely shade out extant goatsrue plants and prevent (re)establishment of the weed, but any seed bank present is apt to remain intact. Therefore, monitoring of stream corridors will be necessary after disturbances such as flooding.

Resources

Evans, J. O. and M. L. Ashcroft. 1982. Goatsrue. Utah Agricultural Experimental Station Research Report 79. 1-5.

Oldham, M. 2009. Goatsrue: Seed Biology, Control, and Toxicity. All Graduate Theses and Dissertations. Paper 235. digitalcommons.usu.edu/etd/235

Oregon State Weed Risk Assessment of Goatsrue: www.oregon.gov/ODA/PLANT/WEEDS/docs/pdf/ra_goatsrue2013.pdf

Roch N., F. Buronfosse, and D. Grancher. 2007. Cattle poisoning by French honeysuckle (*Galega officinalis* L.). *Revue de Médecine Vétérinaire* 158: 3-6.

Zuppa A. A., P. Sindico, C. Orchi, C. Carducci, V. Cardiello, and C. Romagnoli. 2010. Safety and Efficacy of galactogogues: Substances that induce, maintain, and increase milk production. *Journal of Pharmacy and Pharmaceutical Science* 13: 162-174.

Database of management trials to provide site-specific tools for more effective management

By Valerie Eviner, UC Davis, veviner@ucdavis.edu

Why does one restoration project succeed, while a similar one does not?

Which sites are most (or least) likely to achieve a management goal? What suites of goals are possible at my particular site? (Or will managing for one goal preclude me from managing for another?)

Which suites of invasive species can be managed in a similar way? Which invasive species are likely to become more prevalent when managing for a different invader?

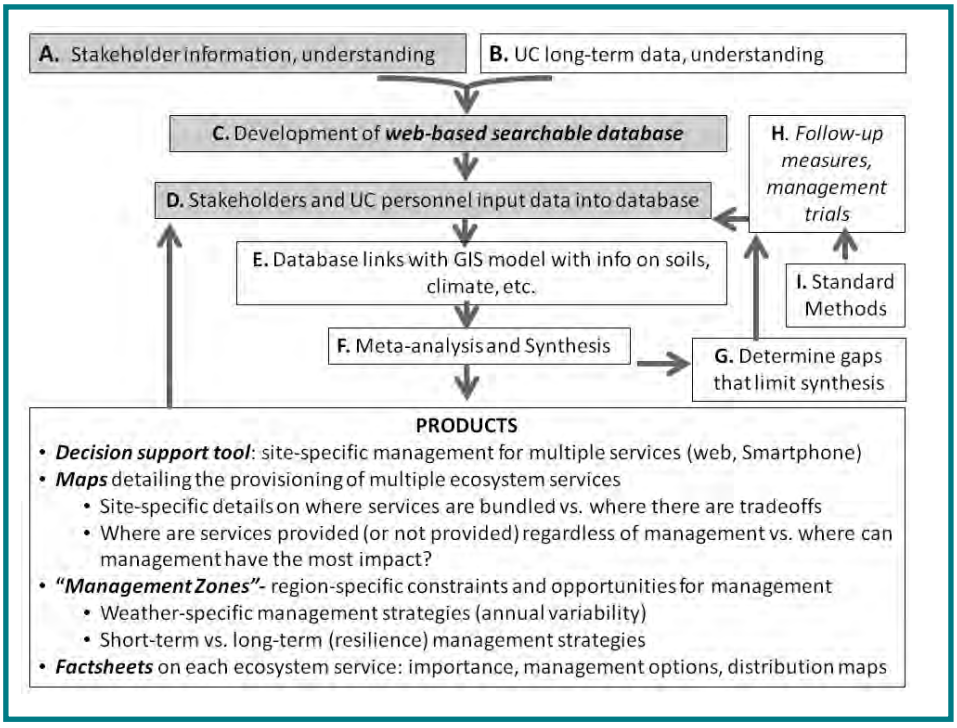
Which management practices will be most effective in achieving my goals at my site? Given the weather this year, how do I alter my management practices to achieve my goals? How do I manage for long-term success of my projects?

These questions frustrate both managers and scientists. "It depends" often seems to be the one consistent generalization we can make. However, a new project seeks to answer these questions by compiling the results of thousands of on-the-ground management trials across California's diverse climate, soil, and topographical conditions. This will provide a powerful platform to tease apart the complex interactions between site conditions, management practices, and annual fluctuations in weather; which, in turn, will improve our ability to make site-specific management recommendations.

The project will initially focus on California's grasslands and oak woodlands, as well as the riparian areas found within these systems. It will work with a diverse group of land managers in these systems (e.g., ranchers, conservation groups, agencies, consultants) in order to consider how environmental conditions and management practices impact multiple goals, such as: forage quantity and quality, invasive species control, native species abundance, plant diversity, wildlife habitat, soil erosion control, soil fertility, soil water infiltration and storage, water quality, and soil carbon storage. In addition to assessing effectiveness and riskiness of given practices at specific sites, the project will also collect data on costs of implementing those projects.

The general project plan is presented in the figure below, and the shaded boxes are where you can help get this project started. Over the next year, the database will be designed, large datasets will be entered, and a GIS tool will be refined so that it can identify specific environmental conditions associated with each project entered into the database. We're looking for your guidance to prioritize management practices, goals, and measurements, and will seek these out through stakeholder workgroup meetings (but also feel free to directly contact the project with your opinions). We're also looking for groups with records (formal or informal) of large numbers of management trials, and can work with you to facilitate including them in the database. Once this database is established, it will be available online, and at that point, we'll welcome individual projects to share their results through the database. At that stage, the project team can take measures of multiple goals at your project sites, or you can take the measurements yourself, using a handbook of standardized measures, and a lending library of measurement tools (available from your local Natural Resources/ Rangeland Farm Advisor).

Eventually, this study will result in a diversity of products that can facilitate management planning. For example, the searchable online database will allow you to find management projects based on environmental conditions, goals, and/ or management practices. There will also be a decision-support tool, where you can enter your location and management goals, and it can synthesize information from the database for you—suggesting which goals are most feasible at your site and which management practices are most



...continued page 14

Save the Date! October 8-11, 2014

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Thu./Fri., Oct. 9-10
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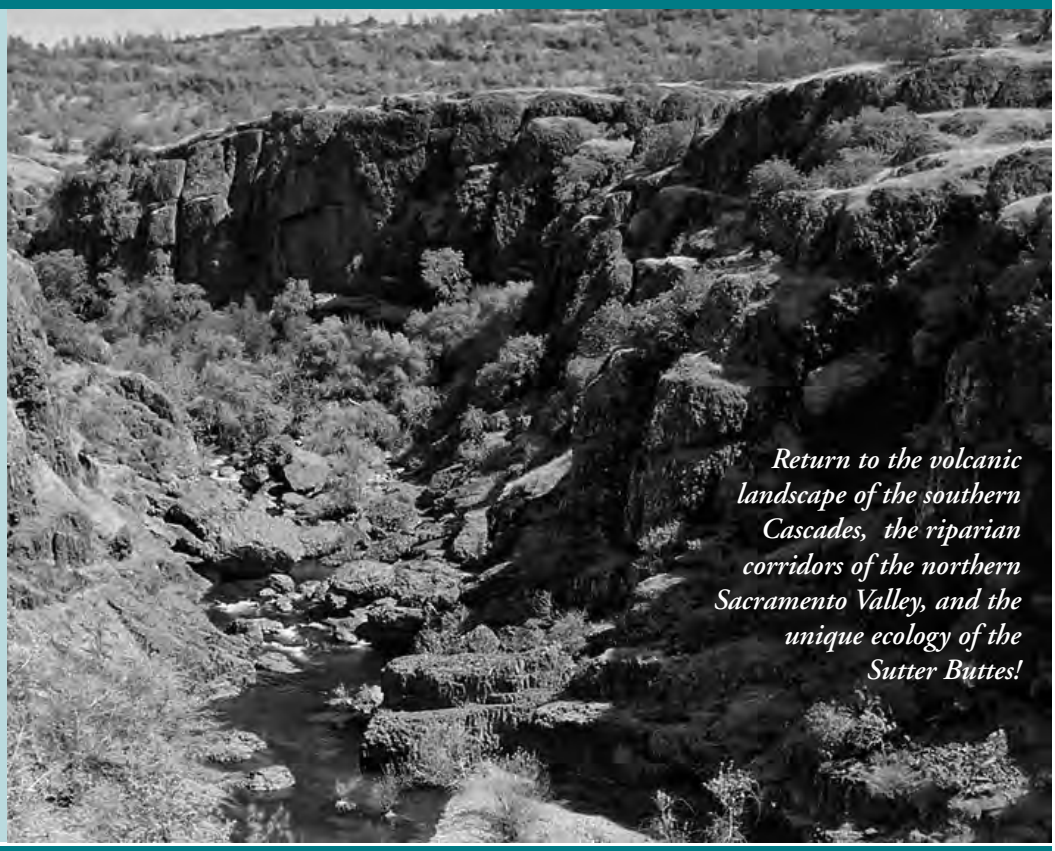

Return to the volcanic landscape of the southern Cascades, the riparian corridors of the northern Sacramento Valley, and the unique ecology of the Sutter Buttes!

www.cal-ipc.org/symposia

Welcome new board members!

Virginia Matzek, left, is an Assistant Professor in the Department of Environmental Studies and Sciences at Santa Clara University. She completed her Ph.D. at Stanford University and her research examines the ecosystem service benefits to humans that may accrue from restoring natural ecosystems. **Annabelle Kleist,** center, is a Program Associate at Capitol Impact in Sacramento, where she works on education policy. She completed a Ph.D. at UC Davis examining the genetics of French and sweet brooms. She served on the board previously as a Student Liaison on the Cal-IPC board. **Tim Buonaccorsi,** far right, is a Restoration Ecologist at RECON Environmental, Inc., in San Diego. Learn more about your Cal-IPC board at *www.cal-ipc.org/about/staff.php*.

...Biocontrol table continued from page 12

Weed species	Common name	Level of control	Approved biocontrol agents for California
Centaurea calcitrapa	purple starthistle	All failed to establish	*Bangasternus fausti* (broad-nosed seed head weevil) *Larinus minutus* (lesser knapweed flower weevil) *Terellia virens* (green clearwing fly)
Centaurea iberica	Iberian starthistle	Failed to establish	*Bangasternus fausti* (broad-nosed seed head weevil)
Chondrilla juncea	rush skeletonweed	Good control	*Aceria chondrillae* (rush skeletonweed gall mite) *Cystiphora schmidti* (rush skeletonweed gall midge) *Puccinia chondrillina* (rush skeletonweed rust fungus)
Cirsium arvense	Canada thistle	? - Too early	*Altica carduorum* (Canada thistle flea beetle) ***Ceutorhynchus litura* (Canada thistle stem weevil)** *Urophora cardui* (Canada thistle gall fly)
Cirsium vulgare	bull thistle	Level of control uncertain	***Urophora stylata* (bull thistle seed head gall fly)**
Cytisus scoparius	Scotch broom	Little control	***Exapion fuscirostre* (Scotch broom seed weevil)** *Leucoptera spartifoliella* (Scotch broom twigminer)
Eichhornia crassipes	water hyacinth	Little control	*Megamelus scutellaris* (water hyacinth plant hopper) *Neochetina bruchi* (water hyacinth weevil) *Neochetina eichhorniae* (water hyacinth weevil) *Niphograpta albiguttalis* (water hyacinth moth)
Euphorbia esula	leafy spurge	? - Too early	***Aphthona lacertosa* (brown-legged leafy spurge flea beetle)** ***Aphthona nigriscutis* (black dot leafy spurge flea beetle)** *Oberea erythrocephala* (red-headed leafy spurge stem borer)
Euphorbia oblongata	oblong spurge	All failed to establish	*Hyles euphorbiae* (leafy spurge hawk moth) *Aphthona lacertosa* (brown-legged leafy spurge flea beetle)
Euphorbia terracina	carnation spurge	Failed to establish	*Aphthona lacertosa* (brown-legged leafy spurge flea beetle)
Halogeton glomeratus	halogeton	Failed to establish	*Coleophora parthenica* (Russian thistle stem-mining moth)
Hydrilla verticillata	hydrilla	All extirpated	*Bagous affinis* (Indian hydrilla tuber weevil) *Hydrellia pakistanae* (Indian hydrilla leaf-mining fly)
Hypericum canariensis	Canary Island hypericum	? - Too early	*Aplocera plagiata* (St. Johnswort inchworm)
Hypericum perforatum	St. Johnswort (klamathweed)	Good control	***Agrilus hyperici* (St. Johnswort root borer)** *Aplocera plagiata* (St. Johnswort inchworm) ***Chrysolina hyperici* (klamathweed beetle)** ***Chrysolina quadrigemina* (klamathweed beetle)** *Zeuxidiplosis giardi*
Linaria dalmatica[2]	Dalmatian toadflax	? - Too early	***Mecinus janthiniformis* (Dalmatian toadflax stem weevil)**
Lythrum salicaria	purple loosestrife	Good control north of Sacramento	***Galerucella calmariensis* (black-margined loosestrife beetle)** ***Galerucella pusilla* (golden loosestrife beetle)** *Hylobius transversovittatus* (loosestrife root weevil) *Nanophyes marmoratus* (loosestrife weed weevil)
Onopordum acanthium	Scotch thistle	Failed to establish	*Rhinocyllus conicus* (thistle seed head weevil)

Weed species	Common name	Level of control	Approved biocontrol agents for California
Salsola tragus	Russian thistle	Little control	*Coleophora klimeschiella* (Russian thistle casebearer) *Coleophora parthenica (*Russian thistle stem-mining moth)
Salvia aethiopis	Mediterranean sage	Good control	***Phrydiuchus tau*** **(Mediterranean sage root weevil)**
Salvinia molesta	giant salvinia	Good control	***Cyrtobagous salviniae*** **(salvinia weevil)**
Senecio jacobaea	tansy ragwort	Good control	***Longitarsus jacobaeae*** **(tansy ragwort flea beetle)** *Botanophila seneciella* (ragwort seed head fly) *Tyria jacobaeae* (cinnabar moth)
Silybum marianum	milk thistle	Little control	*Rhinocyllus conicus* (thistle seed head weevil)
Tamarix parviflora[3] *Tamarix ramosissima*[3]	saltcedar	Level of control uncertain	***Diorhabda carinulata*** **(northern tamarisk beetle)** ***Diorhabda elongata*** **(Mediterranean tamarisk beetle)**
Tribulus terrestris	puncturevine	Good control	***Microlarinus lareynii*** **(puncturevine seed weevil)** ***Microlarinus lypriformis*** **(puncturevine stem weevil)**
Ulex europaeus	gorse	Little control	***Exapion ulicis*** **(gorse seed weevil)** *Tetranychus lintearius* (gorse spider mite)

[1]Note that the accidentally introduced species *Chaetorellia succinea* is more common than *C. australis*.

[2] Biocontrol agents for *L. dalmatica* are permitted only in Kern, Los Angeles, and Ventura counties.

[3] Biocontrol agents for *Tamarix* spp. are permitted only in central and northern California. Contact your local county agricultural commissioner's office to find out if you are in the area where these agents are permitted.

The Arundo wasp, *Tetramesa romana,* is approximately 6 mm long. Photo by USDA-ARS.

CDFA staff releasing the arundo wasp in Glenn County in 2010. (CDFA's weed biocontrol program has since been eliminated because of state budget cuts. Cal-IPC is sponsoring a bill to renew funding to the program, along with funding for Weed Management Areas. See page 3.) USDA is continuing arundo work at this site. Photo by Mike Pitcairn, CDFA.

...Ecosystem services from page 4

services, important information gaps need to be addressed. Most importantly, we need better information on the impacts of invasive species, both ecological and economic. Assigning dollar figures to invasive species impacts has only been done for a relatively small number species. Although some ecosystem processes, such as timber production or streamflow, can be measured directly, many others, such as carbon storage and flood control, are difficult to quantify (Eviner et al. 2012).

We need to know which stakeholders can be considered beneficiaries when particular invasive species are controlled and ecosystem services protected. Such beneficiaries are the most likely candidates for paying for that control work. However, it is more common than not that impacts cannot be isolated to a particular group of stakeholders. Often invasive species impact ecosystem services that affect a wider segment of society.

Invasive plant programs can look to the growing number of frameworks tying the users of ecosystem services to their protection. For instance, "forests to faucets" plans, such as that governing the Mokelumne River watershed in California, engage public water users in paying for upstream ecosystem preservation and restoration, and have included invasive plant management in their project goals.

California also has a market system for compensating landowners for carbon sequestration through reforestation and improved forest management that could create incentives for restoring native vegetation and removing invaders that spread fire.

Likewise, California's 2006 Safe Drinking Water Act, funded by bonds, provides for weed management as a means of ensuring water supplies.

Without steady funding, invasive species management can lose ground, increasing the ultimate restoration costs and damages to native biodiversity and ecosystems. Tying invasive plant management to the protection of ecosystem services may be the best way to secure consistent funding for invasive species management and ecosystem restoration.

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...Restoration database from page 10

promising, based on your goals.

Updated information on the project, as it develops, will be found at *www.plantsciences.ucdavis.edu/plantsciences_faculty/eviner/main/current_research.htm*

Project contact: Valerie Eviner veviner@ucdavis.edu 530-752-8538

Project Funders: UC Agriculture and Natural Resources (through the Kearney endowment) and Western Sustainable Agriculture Research Education Program (for on-ranch work)

Project PIs: Valerie Eviner, Mel George, Andrew Latimer, David Lewis, Toby O'Geen, Kevin Rice, Ken Tate, Truman Young

Project Collaborations: UC Cooperative Extension Farm Advisors (Sheila Barry, Theresa Becchetti, Josh Davy, Morgan Doran, Julie Finzel, John Harper, Roger Ingram, Royce Larsen, Stephanie Larson, David Lile, Missy Merrill-Davies, Glenn Nader), Audubon's Bobcat Ranch, California Climate & Agriculture Network, California Farm Bureau, California Invasive Plant Council, California Native Grasslands Association, California Rangeland Conservation Coalition, Center for Natural Lands Management, Hedgerow Farms, Putah Creek Riparian Reserve, Solano Resource Conservation District, US Forest Service, and we're always looking for more!!

...Eastern weed work from page5

Japanese knotweed patches are not affected by differences in rainfall, or a hard, late spring frost. While they might wilt and look miserable for a while, by spray season in late summer they are fine. The same goes for annuals—a hard frost might slow their growth, but they get back on track and seem to produce as many seeds as they would in a more mild spring.

Another difference: rainfall. In the Northeast, it rains in the summer. People in PA are amazed when I tell them that it doesn't rain in CA for 4-5 months of the year (except during the current drought condition). Rain can really disrupt your spraying schedule, but is also means that you don't have to set up irrigation systems for restoration projects. In fact, many of my treated sites restore themselves, filling in with perennials such as goldenrod, aster and tree seedlings.

California's dramatic landscape creates a diversity of plant communities. A weed worker in Yosemite will have a completely different set of weeds to control than someone in San Diego. Back east, the topography is more subtle and gentle, and a weed worker in New York State may have to control the same weeds as someone in West Virginia. I joined the Mid-Atlantic Invasive Plant Council and have attended some meetings, and noticed that there is less experimentation and more clarity about how to control the suite of invasive plants in the east. People have been doing weed work here for a long time and are very good at it. One important similarity: on both coasts the weed workers are committed, hard-working, knowledgeable people who love their native ecosystems and landscapes and are dedicated to protecting them from invasive plants. Thank you for all you do!

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Weed wrench grabbing Scotch broom from our annual Photo Contest. Photo by William Welsch.

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The Wildland Weed Calendar

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January 23-25, Sacramento
www.cwss.org

Tamarisk Coalition
February 18-20, Grand Junction, CO
tamariskcoalition.org/programs/conferences/2014

California Native Grasslands Association Annual Field Day
March 14, Winters
www.cnga.org

SERCAL Conference
May 13-15, Santa Rosa
www.sercal.org/sercal-2014.html

North American Congress for Conservation Biology
July 13-16, Missoula, MT
www.xcdsystem.com/scbna

Ecological Society of America
August 10-15, Sacramento
www.esa.org/am

Cal-IPC Symposium
October 8-11, Chico
www.cal-ipc.org/symposia

Natural Areas Association Conference
October 15-17, Dayton, OH
naturalareas.org/conference

California Naturalist Conference
October 17-19, Pacific Grove
calnat.ucanr.edu/2014conference

California Association of RCDs Conference
November, Ventura
www.carcd.org/annual_conference0.aspx

CNPS Conservation Conference
January 13-17, 2015, San Jose
www.cnps.org

*"**All of these ways of defining weeds include a human connection...** To me this is the important value of the term Weed; it reminds us that we are responsible for weeds and make decisions regarding what to do about them, even if it means doing nothing, which is too often the case."*

~ "Why I like the word Weed" by Carl Bell, from his "Invasive Plants in Southern California" blog (*ucanr.edu/blogs/socalinvasives*)