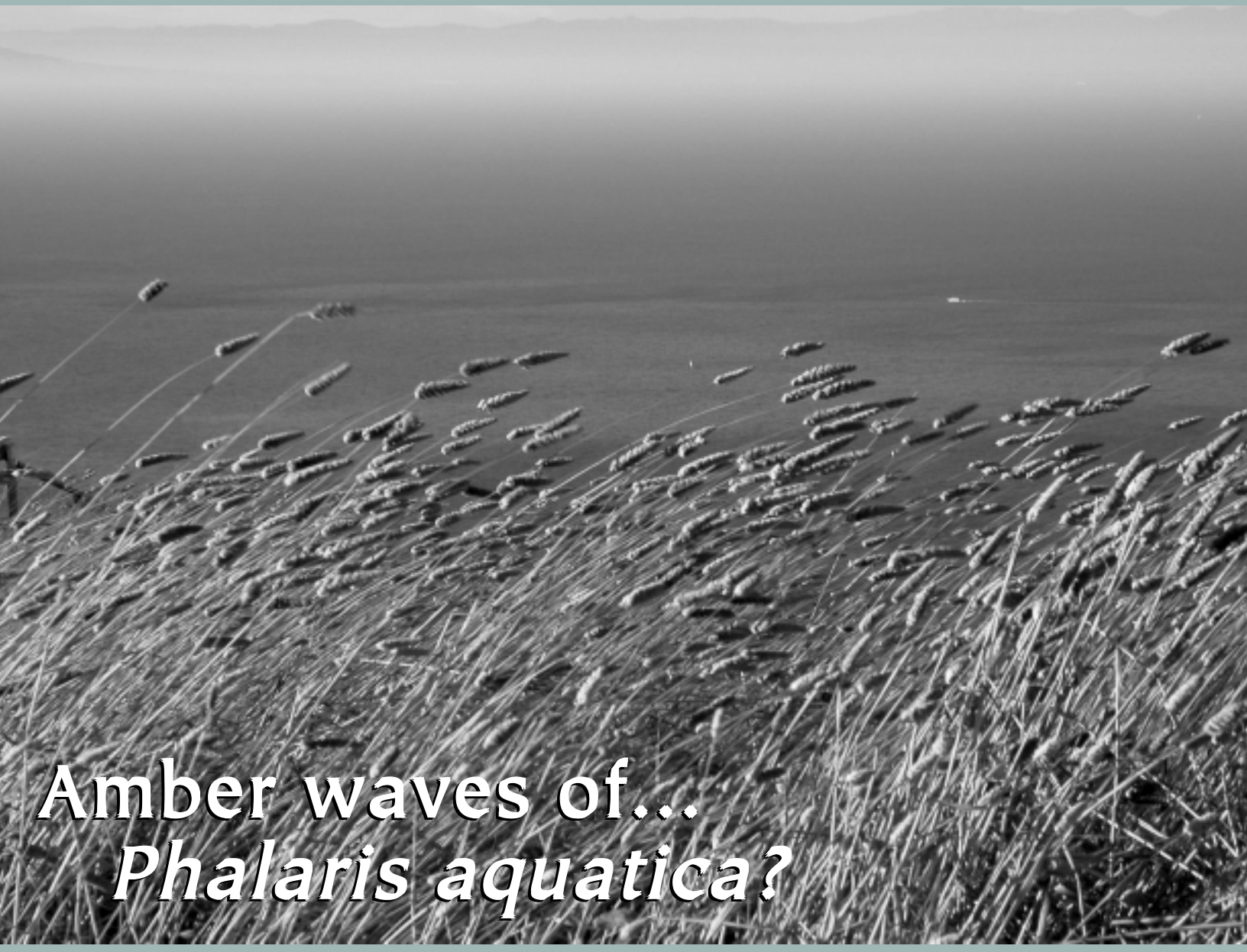
Cal-IPC News

Protecting California's Natural Areas from Wildland Weeds

Vol. 12, Nos. 3/4, Fall/Winter 2004 Newsletter of the California Invasive Plant Council



Amber waves of... *Phalaris aquatica?*

Harding grass is one of sixty-three invasive plant species identified for mapping and control by the Catalina Island Conservancy. Photo by John Knapp of the Conservancy, winner in the "Landscape" catagory of our first photo contest. Other contest winners on pages 10-11.

Inside:

California
Invasive Plant
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A California 501(c)3 nonprofit organization

Our Mission

To protect California's natural areas from wildland weeds through research, restoration, and education.

Cal-IPC News

Fall/Winter 2004 - Volume 12, Numbers 3 & 4

Editor: Doug Johnson, dwjohnson@cal-ipc.org

Cal-IPC News is published quarterly by the California Invasive Plant Council. Articles may be reprinted with permission from the editor. Submissions are welcome. We reserve the right to edit all work.

Transitions

As we move into the rainy season of the new year, we have a new line-up here in the Cal-IPC office. **Brianna Richardson**, after a year of outstanding work as our first Project Manager, is now Project Director at the 609-acre Arastadero Preserve in Palo Alto. Despite all her new duties, Bree continues to contribute to Cal-IPC efforts.

In December, Cal-IPC hired **Elizabeth Brusati** as our new Project Manager. Elizabeth recently received her PhD in Ecology from UC Davis, and her dissertation focused on the impacts of invasive *Spartina* species in San Francisco Bay. Elizabeth's background in weed impacts will be valuable in her primary task of organizing our weed list revision process.

Elizabeth taking samples on San Francisco Bay mudflats.

In addition to these staff transitions, I recently made the transition to fatherhood. Born August 27, **Leo** made last year's Symposium even more adventurous than usual!

Taken together, these transitions put a hitch in our publication schedule, and thus you have in your hands a double issue of *Cal-IPC News*. It's a good issue, with articles ranging from the biogeographical (**John Lambrinos** on *Cortaderia* distribution) and the practical (**Mandy Tu** on the Waipuna hot foam treatment system) to inspirational (**Jim Johnson**'s Symposium address) and the personal (Brianna Richardson on **Bob Connick**'s committed work on broom in the East Bay Hills). Not to mention photos from the Symposium and the first annual photo contest!

Brianna on the Arastadero Preserve in Palo Alto.

Cal-IPC also welcomes four new members to the Board of Directors: **David Chang**, of the Santa Barbara Agricultural Commissioner's office; **Joanna Clines**, of the Sierra National Forest; **Christy Brigham**, of the Santa Monica Mountains National Recreation Area; and **Bob Case** of the California Native Plant Society, recently retired from the Contra Costa County Agricultural Commissioner's office. Thank you to leaving members **Deanne DiPietro**, **Scott Steinmaus**, **Bill Winans**, and **Peter Warner** for your service on the board.

Here's to a great 2005!

Wildland Weed NewsNewsNewsNewsNews

S 144, the Noxious Weed Control Act passed the US House and Senate and has been signed by President Bush. Annual expenditures authorized were reduced to $15 million from the $100 million originally proposed. Nevertheless, those who worked so hard to get this bill passed see this as a great success. The next step is to get funding appropriated,

2005 Membership

Please check the mailing label on your newsletter to make sure that you have renewed your membership for 2005. If you need to renew, please use the form on the back of this newsletter, or give us a call at 510/843-3902. Thanks!

which will be a major focus at this year's **National Invasive Weeds Awareness Week (NIWAW)** in Washington, Feb 28-Mar. 3. *<www.nawma.org>*

Gov. Schwarzenegger signed **AB 2690** August 27, making it legal for restoration projects to utilize volunteers without paying "prevailing wages" (see *Cal-IPC News* Spring 2004). The bill was authored by Assembly Member Loni Hancock, and was unanimously approved by both the House and Senate. *<www.leginfo.ca.gov>*

In a study at Stanford University's Jasper Ridge Preserve that mimicked the natural order of species loss in a grassland ecosystem, researchers found that declining biodiversity greatly reduced **resistance to invasive species** and that the presence of even small numbers of rare species had profound functional effects. *<currents.ucsc.edu/04-05/11-15/biodiversity.asp>*

USDA-APHIS has published its Advance Notice of Proposed Rulemaking for revising its **regulations governing importation** of plants. Comment period ends March 19. *<www.archives.gov/federal_register/public_inspection/public_inspection_list.html>*

Steve Young's final research findings on **natural-based herbicidal alternatives** for CalTrans (see article in *Cal-IPC News* 10(4) Winter 2002) has been published in *Weed Technology* 18:580-587.

Gov. Schwarzenegger vetoed AB 2631, which would have created a **California Invasive Species Council**, saying that it would create "an additional costly layer of bureaucracy, including unfunded mandates, at a time when we are promoting government efficiency." Schwarzenegger has requested from CDFA and the Resources Agency a review of existing invasive species prevention and eradication efforts. *<www.leginfo.ca.gov>*

The USDA-APHIS solicited comments on a proposal aimed at ***Caulerpa taxifolia***, the Mediterranean "killer algae" that was already treated once in Southern California. Cal-IPC joined other organizations in recommending a ban on the entire genus, since the different species are difficult to distinguish. This is seen as the best strategy for eliminating its use in the aquarium trade, the prime pathway for introduction. *<www.aphis.usda.gov/ppq/weeds/caulerpa/>*

The U.S. Coast Guard has published regulations establishing a **national mandatory ballast water management program** for all vessels equiped with ballast water tanks that enter or operate within U.S. waters. These regulations increase the Coast Guard's ability to prevent the introduction of nonindigenous species via ballast water as required by the Nonindigenous Aquatic Nuisance Prevention and Control Act and the National Invasive Species Act. *<www.uscg.mil>*

The **Peace Corps**, working with the National Invasive Species Council (NISC), recently issued guidance to Peace Corps volunteers worldwide on preventing and mitigating the spread of potentially harmful invasive species. *<www.peacecorps.gov>*

Interior Secretary Gale Norton announced **$16 million in grants** to help conserve 150 threatened and endangered wildlife species in 42 states. About $2.4 million will support private efforts to control invasive species that are a threat to ecosystems and wildlife. *<www.doi.gov>*

2nd Annual
Invasive Weed Awareness
Day at the Capitol
March 9, 2005

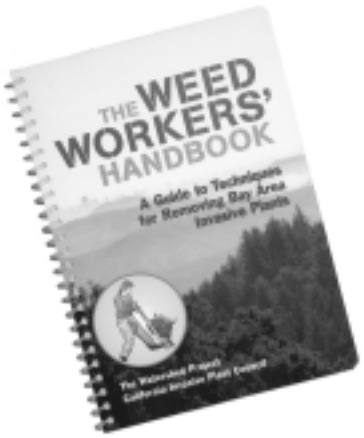
An opportunity for weed workers attend from around the state to discuss their work with agency managers and elected officials. Voice your opinions and help Sacramento make weeds a top priority.

For info, visit link at
< www.cal-ipc.org >

Since the portion of the USDA's Animal and Plant Health Inspection Service responsible for **border inspection** was shifted to the Deparment of Homeland Security (DHS) eighteen months ago, there has been a growing shortage of

continued p.19...

Got It Yet?



The 120-page *Weed Workers' Handbook* is designed for on-the-ground weed workers and those who organize removal projects. Especially valuable for volunteer training.

$13.00 includes S/H. Order from www.cal-ipc.org or call 510.843.3902

Feature

A tale of two invaders

The dynamic history of pampas grass and jubata grass in California

By John G. Lambrinos, Department of Environmental Science and Policy, UC Davis

One of the more vexing aspects of plant invasions is their inconstancy. Our ability to predict important traits like how fast an introduced plant will spread or what kind of impact it will have on native vegetation is complicated by the fact that basic characteristics of invasions can change. Malleable ecological and evolutionary forces continually shape the interaction between an introduced plant and native ecosystems. Far from being static events, plant invasions are convoluted processes with often murky pasts and equally opaque futures.

Nearly thirty years ago in *Fremontia* Bruce Cowan (1976) and Martha Costas-Lippmann (1977) alerted us to the invasive threat posed by two species of South American tussock grass in the genus *Cortaderia*. Costas-Lippmann identified the two species as *C. jubata* and *C. selloana*. Both she and Cowan reported that *C. jubata* was highly invasive along the central coast, but that *C. selloana* displayed few weedy characteristics and was only rarely encountered outside of cultivation. In the years immediately following these reports, many management and control activities were based upon the view that only *C. jubata* posed an immediate and serious invasive threat.

I certainly held the same view when I began a study in 1995 comparing the invasive ecology of the two species on Vandenberg Air Force Base, Santa Barbara Co. As part of this study I surveyed *Cortaderia* populations throughout the state. To my surprise, nearly all the invasive populations I found in southern California were of the supposedly non-aggressive *C. selloana*. Now, thanks largely to the educational efforts of Dr. Joe DiTomaso, Alison Stanton, and Cal-IPC, both *C. jubata* and *C. selloana* are more widely recognized as serious threats to native plant communities.

The abrupt change in the perceived invasiveness of the two *Cortaderia* species prompted me to look more closely at their history in California. Was this a change in perception only, or did *C. selloana* actually become more aggressive? If so, why? Could we have acted sooner if we had been more vigilant in our monitoring? As is often the case in the study of human history, this botanical history provides few cut-and-dried answers. However, it does provide important clues about the critical processes shaping the still ongoing invasion by both species. It also highlights the importance of taking into account the inherent dynamism of invasions when developing management plans.

A Muddle of Names

Early botanical accounts of *Cortaderia* in California are confusing. Descriptions in early California floras and herbarium records use at least six separate names. The confusion partly stemmed from a general taxonomic uncertainty over the genus. Since South American specimens were first collected in the 19th century, 17 distinct scientific names have been applied to material of what we would now call *C. jubata* and *C. selloana*. H.E. Connor and Elizabeth Edgar rectified this confused nomenclature in 1974. Working in New Zealand, which has four native species of *Cortaderia* in addition to introductions of both *C. jubata* and *C. selloana*, they produced a standardized list of valid names for all the members of the genus. Yet it was still unclear exactly which of these taxa had become naturalized in California until Costas-Lippmann clearly identified *C. jubata* and *C. selloana* as the culprits.

Even after Costas-Lippmann's work, however, confusion still lingered. The two species are rather difficult to distinguish, particularly when plants are young or when only vegetative parts are available for study. In addition, because of the perception that *C. jubata* was the more aggressive species, invasive populations of *Cortaderia* were often simply assumed to be *C. jubata*. Finally, the single common name "pampas grass" was applied equally to both species, which only

Cortaderia jubata invading *Baccharis* scrub on Vandenberg Air Force Base, Santa Barbara County. Although a severe problem in central and north coast plant communities, *C. jubata* is rare elsewhere in California. *Photograph by the author.*

muddled things further. Dr. DiTomaso and Cal-IPC's *Cortaderia* working group have done much to set matters straight by (1) publishing an informational pamphlet which includes a key to identification (DiTomaso et al. 1999), (2) listing both species on the Cal-IPC list of pest plants of greatest ecological concern, and (3) establishing distinct common names for the two species ("jubata grass" for *C. jubata* and "pampas grass" for *C. selloana*).

A Not-So-Passing Fad

Cortaderia selloana is native to the lowlands of southern Brazil, Uruguay, and Argentina. Despite the image its common name connotes, *C. selloana* is not a major constituent of the formerly vast Pampas grasslands. In its native land it is most commonly found in riparian and other wet habitats such as poorly drained depressions.

There are indirect indications that *C. selloana* was available in the exotic nursery markets of San Francisco as early as the 1850's, but by far the single most salient date in the history of *C. selloana* in California is 1872. It was in this year that Joseph Sexton, a pioneering nurseryman in Santa Barbara, received either seeds or a clump of *C. selloana* at his Goleta ranch. Starting with this shipment, Joseph Sexton launched a briefly flourishing commercial industry for pampas grass plumes. He marketed the plumes to east coast and European markets and launched a craze for the dried plumes. For several decades the plumes adorned everything from fashionable ladies' hats to parade floats. Walker Tompkins (1964) reports that at the height of the industry Sexton had nearly 5,000 plants under cultivation and exported nearly 500,000 plumes a year.

Following this brief fanfare, however, *C. selloana* slipped into obscurity. In 1958, Phillip Munz and David Keck reported populations of what they identified as *C. selloana* naturalized from Ventura to Monterey Counties, and ten years later Munz (1968) expanded this range northward to Humboldt County. Based on their description and the geographic distribution, however, it is likely that most of their reported material was in fact *C. jubata*.

Discounting Munz and Keck's probably erroneous report, it is not until 1988 that *C. selloana* is reported again in Mitchel Beauchamp's flora of San Diego County. This lack of documentation probably partly reflects the taxonomic confusion, however, because naturalized populations of *C. selloana* are recorded in herbarium records. The first naturalized record of *C. selloana* was collected in 1929 beside a pond in Mandeville Canyon, Los Angeles. After 1940, the number of herbarium records of naturalized *C. selloana* expanded dramatically. In the past 60 years the spatial expansion of *C. selloana* as estimated by these herbarium records has been twice as fast as that of *C. jubata*.

The majority of this expansion has occurred in southern California, but infestations are common in the San Francisco Bay Area as well. *C. selloana* can be found invading a diverse range of habitats, from riparian corridors and the margins of coastal wetlands to dry hillsides of coastal sage scrub. It has even been documented on serpentine soils. Both coastal and inland populations exist, but only coastal populations appear to be seriously invasive.

Pampas grass plumes adorned nearly everything at the end of the 19th century. This is a First Prize winner in the Flower Carnival parade, Colorado Springs, Colorado sometime during the 1890's. *Photo courtesy of the Western History/Genealogy Department, Denver Public Library.*

Interestingly, the invasiveness of *C. selloana* in California seems to have evolved gradually. The first herbarium records are either clearly ornamentals or plants that have strayed only a few feet from human pampering. Over the past 80 years, however, collections have increasingly been of plants found invading native vegetation or found in large self-sustaining populations. This is in contrast to collections of *C. jubata* that have always been predominately from self-sustaining naturalized populations.

Additionally, populations of *C. selloana* have changed morphologically over this period. During the commercial pampas plume industry, Joseph Sexton purposely selected plants with full, platinum white plumes, which presented a striking appearance when dried. When the plume industry ended, so did Joseph Sexton's intensive selection, and ever since the plumes of naturalized *C. selloana* have gotten darker and less full.

From Darkest Peru

Cortaderia jubata is native to the western slopes of the Andes bisecting Ecuador, Bolivia, and Peru. Here it inhabits an impressive altitudinal range from sea level to nearly 14,000 feet in the shadow of snow-capped volcanic peaks. We have few details of its arrival in California, but it probably was imported sometime in the late 1800's as an ornamental plant. Although there is no direct evidence, it seems likely that at least one importer was Joseph Sexton, who imported a number of *Cortaderia* varieties in an effort to improve his plume industry.

It is difficult to be certain, however, because for a considerable time, *C. jubata* was nearly invisible in the California landscape. Compared to *C. selloana*, its use as an ornamental plant was minimal. In 1924 L.H. Bailey described *C. selloana* as widely planted in California, while *C. jubata* was only sometimes cultivated in California. Following Bailey's description, there are no other published accounts of the presence of *C. jubata* in California (either as an ornamental or as a naturalized species) until Munz and Keck's probable report in the late 1950's. The first herbarium record documenting a naturalized population is not encountered

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Tools

Waipuna™ not? Hot foam good for more than lattes

Review by Mandy Tu

Reprinted with permission from The Nature Conservancy's Wildland Invasive Species Team website, www.tncweeds.org.

Out of a New Zealand company named Waipuna comes this hot foam system for steam-killing vegetation. This system employs hot foam to deliver and trap superheated steam onto foliage to kill weeds. Waipuna states that the surfactant foam is a biodegradable mixture of corn and coconut sugar extracts, and that the foam is an "organic," naturally-occurring compound. As such, it is not regulated (or labeled) as a herbicide product by the U.S. EPA.

The Device and How it Works

The Waipuna™ Hot Foam system is comprised primarily of a diesel-powered boiler and foam generator, which deliver hot water with a foam surfactant to target weeds via a supply hose and a treatment wand. The superheated hot foam is applied to the targeted vegetation at a precise temperature (93 degrees C, 200 degrees F) and pressure; the foam traps the steam, giving it time to "cook" the vegetation. This causes a cellular collapse of the aboveground vegetation. Waipuna claims that the hot foam can kill both annual and perennial weeds by starving their root systems (for some perennials, repeat treatments may be necessary).

In addition to the boiler/burner-foam generator system, applicator hose and wand, the Waipuna system also includes an internal computer that monitors the flow and pressure of all functions. To make the system fully operational, however, you will have to provide the following additional equipment:

1. A truck to transport the system (a 2-ton flatbed truck works well)
2. A large water tank - a 1,140 liter (300-gallon) baffled tank is recommended
3. Foam concentrate solution - purchased by the barrel (100 liter/55 gal) from Waipun
4. Insulated hoses - 60 meters (200 ft) in length

A nozzle is used to spread hot foam generated by the truck-based burner system.

There are two types of foam systems currently available: a single- and a double-burner version. Both are designed mostly for municipal use. The single-burner model is for use by a sole operator (comes with one applicator wand), and can be mounted on the back of a trailer or truck. The double-burner model is to be operated by two people (comes with two applicator wands), and requires a minivan or large truck to transport. Waipuna states that the double-burner model is the most cost-effective method. A mechanical boom can also be used with the double-burner model. Waipuna plans to have smaller garden-use machines available soon.

Field Demonstration

To see how well the Waipuna system works in the field, I tested a double-burner model on the perennial rhizomatous grass, *Brachypodium sylvaticum* (false brome). After all tanks were filled and the hoses unrolled, the Waipuna system was turned on and heated up. The foam was ready to be deployed!

The system is noisy (about as loud as a deep-toned snowmobile), but was very easy to use once everything had been set-up. To release the hot foam, you depress a small trigger on the application wand. This releases a constant stream of hot foam/steam (which came out much faster than I expected!). You simply draw the nozzle over any target vegetation to achieve good coverage of foliage with the foam. The hot foam achieves full kill on annuals immediately after contact. Some perennials can also be killed after only one treatment, but perennials with extensive root and rhizome systems may need to be treated several times for full kill.

Genista monspessulana (French broom) seedlings before (above) and after (below) treatment with Waipuna.

Costs to Use the System

As of this writing (March 2004), the Waipuna system is not available for individual purchase. To obtain a system, you must lease it from the company for about $700 per month (minimum lease period is 2 years).

Chuck Fairchild (BLM-Oregon) notes that the foam concentrate costs about the same as RoundUp® herbicide. A 100-liter (55-gallon) drum of the foam concentrate costs about $900. Because of the equipment lease and cost of foam, Chuck estimates that the overall cost of using the Waipuna system is approximately three times that of using herbicide. He judges that treatments of open areas can take 20 to 25% longer than treating the same area using herbicide because of application equipment differences and equipment maintenance (filling water tanks, etc.). Although using this system is more expensive, Chuck adds that a big advantage of the hot foam over herbicide is that the foam can be applied in variable weather conditions. Hot sunny weather is ideal for treatment, but windy, cool, moist (light rain) weather will

also work. Further, depending on state pesticide regulations, an application permit is likely not needed when using this system.

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- Waipuna machine lease (Waipuna machine, foam generator, wands) - $700/month
- Foam concentrate - $900 per 100 liter (55 gallon) barrel. If you were to use a 1,140 liter (300 gallon) water tank, you would add 4 liters of foam concentrate. A barrel of concentrate should last through one year of near-continuous use.
- 1,140 liter (300 gallon) water tank - allows two applicators to run the machine for about one hour before it must be refilled with water (it goes through water fast!). A 1,140 liter tank can cover about 0.4 mile long swath on each side of road (about 5 to 10 ft deep), with solid weed infestations. If the roadside infestation is patchy, you may be able to cover about 4 miles of road per day.
- Diesel gas for Waipuna machine - 5 gallon tank (can last three days of treatment).
- Gas for generator.
- Gas for transportation.

Caution

Protective clothing and gloves are recommended when using the Waipuna system. The foam can cause eye irritation. The foam should also not be applied to surface water, as concentrations of foam at 3 mg/liter can be toxic to fish. When applied to soil, the foam is generally applied at concentrations of 0.0004 mg/liter and it is degraded by soil microorganisms within 28 days, so the foam is likely to be benign to soil organisms. The California Department of Pesticide Regulation has determined that the Waipuna hot foam surfactant is not a pesticide, so it does not require registration as a pesticide product.

Advantages of the Waipuna Hot Foam system

- No chemically-produced herbicides are used, so depending upon your location there may be no need for permits.
- It can be used in windy or moist/light rain conditions (heavy rain may breakdown foam quickly and lower temperatures).
- It can be very specific—as long as the target plants are spatially separated from the surrounding vegetation, the system can be applied to a single plant or to a small population of plants, with little to no disturbance to the surrounding vegetation.
- Seedlings or annual herbs are instantaneously killed. Some perennials may be killed after one application.
- Results are instantaneous - the user can see wilted, cooked vegetation and the areas where the foam was applied.

Disadvantages of the Waipuna Hot Foam System

- The system has a large start-up cost: Machinery lease, foam solution, 2-ton truck, water tank, hoses, gas for diesel generator, gas for transport, etc. Depending on how often it is used, it can be expensive to operate.
- It may not thoroughly kill deep-rooted plants or those with extensive rhizomes with one application; perennial plants with deep roots may require several treatments for full kill.
- Depending on how intermixed the weeds are with desirable vegetation, it may be difficult or impossible to provide target-specific control.
- The system uses water very quickly - a water source must be nearby for continual use.
- Because of the 60 m (200 foot) hose, it can only be used in sites easily accessible and navigable by truck.
- It is relatively noisy, may not be applicable in areas with sensitive animal populations.
- The effects of the "organic" foam on the environment, while probably benign, have not been extensively studied.

More Information:

For information on leasing and advantages of the Waipuna™ Hot Foam system, see their website: www.waipuna.com. For personal accounts on using the Waipuna system in natural areas, contact Chuck Fairchild, Bureau of Land Management, Eugene, Oregon 541-683-6207, chuck_fairchild@or.blm.gov, or Janet Klein, Marin Municipal Water District, California 415-945-1192, jklein@marinwater.org.

Taxonomy Notes

Rubus armeniacus

by Brianna Richardson

A blackberry by any other name will still ruin a good pair of jeans. Nevertheless, the true name for Himalayan blackberry is ***Rubus armeniacus***. For many years, this weed has been known in California as *Rubus discolor* or *Rubus procerus*. The *Rubus* genus is so complicated that another Latin phrase has also been applied to it: *Rubus crux botanicorum*, or "*Rubus* is the botanists' cross." In fact, botanists who study the *Rubus* genus have earned their own special name: batologists (bramble botanists).

Rubus procerus is not a legitamate name for Himalayan blackberry, since it is a taxonomic synonym for *R. praecox*, which is not a weedy species. *Rubus discolor*, similarly, is a synonym for *R. ulmifolius*. So even though calling Himalayan blackberry *Rubus armeniacus* won't make it any easier to get rid of, it's still the right thing to do. Now we just need the taxonomists to figure out why a blackberry from Armenia is called Himalayan.

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Taxonomic explanation from Ceska, Adolf. 1999. "Rubus armeniacus-A correct name for Himalayan blackberries." Botanical Electronic News. No.230. <www.ou.edu>

2004 Symposium, Ventura

A record 320 attendees participated in a full agenda featuring 44 presentations and 14 working groups, plus posters and exhibitors.

Thursday night's mixer/poster session/auction at the Masonic Temple.

Working group session Ventura-style (Dunes WG, of course).

Joe DiTomaso and Carri Pirsoko auction off a pair of handmade quilts donated by Dianne Nygaard. Other hot items included vintage wine, a weekend cabin, a weedy wall clock, and a Jepson Herbarium course.

2004 Award winners, from left: **Ken Moore** of the Wildlands Restoration Team in Santa Cruz, won the Golden Weed Wrench Award for Weed Manager of the Year (pictured with Doug Johnson, Cal-IPC); **Wendy West** of the El Dorado County Agriculture Department won the Catalyst Award for coordinating the first annual Invasive Weeds Awareness Day at the Capitol (pictured with Steve Schoenig, Cal-IPC Board President, and Bobbi Simpson of the National Park Service with the Weed Godzilla Award for NPS Resource Manager of the Year, which went to **Christy Brigham** of the Santa Monica Mountains NRA); **Mike Kelly** of Friends of Los Penasquitos Reserve in San Diego and a founder of Cal-IPC, won the Jake Sigg Award for Service and Vision; and **Nicholas Staddon** of Monrovia Nursery won the Progressive Policy Award for collaboration on development of landscaping alternatives.

Super-volunteer Gina Skurka and Board Member Mark Newhouser show just how crazy a raffle can get.

On top of the world on the Santa Cruz Island field trip.

Who needs a fork? Board Secretary/Auction Diva Carri Pirosko.

See you in Chico for the 2005 Symposium, October 6-8!

So who saw *The Perfect Storm*? 120 participants head to Santa Cruz Island for the day.

Marching into *Arundo* on the Santa Clara & Ventura Rivers field trip.

Field trippers discuss the complexities the Park Service faces on Santa Cruz Island, with rare endemics, challenging access, and historic features.

Jo Kitz of the Mountains Restoration Trust describes work on a bluffs restoration site along the coast.

1st Annual Cal-IPC Photo Contest

Weed Warriors

1st Place
Dune restoration volunteers
Aquatic Adventures, San Diego

2nd Place
Tiny with iceplant
Aquatic Adventures, San Diego

3rd Place
Four-legged spray rigs
Kristin Cooper-Carter, Chico

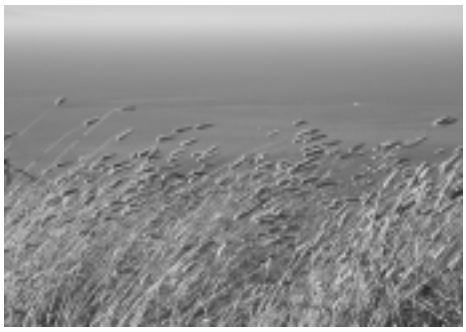
Specimen Weed

1st Place
Cirsium vulgare in seed
John Knapp, Catalina Island Conservancy

2nd Place
Cirsium vulgare
Douglas Burgess, Martinez

3rd Place
Cirsium vulgare seed snow
John Knapp, Catalina Island Conservancy

Landscapes



1st Place
Phalaris aquatica
John Knapp, Catalina Island Conservancy

2nd Place
Oxalis pes-caprae
Brianna Richardson, Acterra, Mt. View

3rd Place
Mustard
Phillip Roullard, San Diego
www.philliproullardphotography.com

Weed Impacts

1st Place
Carduus pycnocephalus over deer trail
John Knapp, Catalina Island Conservancy

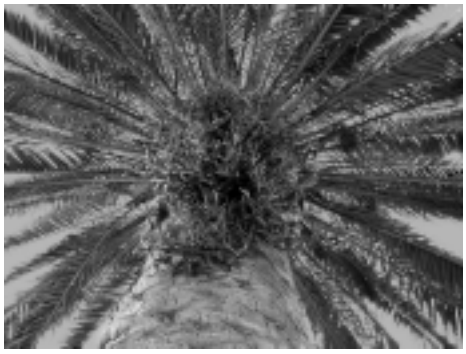
2nd Place
Coastal scrub smothered by annual grasses
John Knapp, Catalina Island Conservancy

3rd Place
Island endemic St. Catherine's Lace
competing with *Genista linofolia*
John Knapp, Catalina Island Conservancy

Funny Weeds

1st Place (series at left)
Aggressive iceplant at Bodega Marine Reserve
Peter Connors,
Bodega Marine Laboratory

2nd Place
Ailanthus at the gas station
Mark Newhouser, Sonoma Ecology Center



3rd Place
Iceplant in palm tree
John Hyde, Carlsbad

Critic's Choice Awards

Oxalis pes-caprae
Kim Munyer, Sacramento

Onopordum acanthium
Josh Huntsinger, Placer County Dept. of Ag.

Wetland Avengers
Aquatic Adventures, San Diego

Profile

An Army of One

One man's fight against broom in Tilden Park

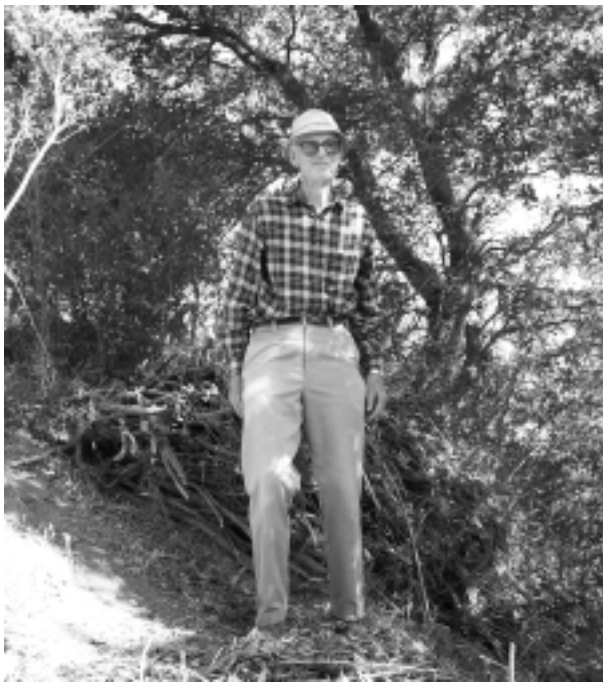
Interview by Brianna Richardson

Throughout California, there are individuals who take it upon themselves to sustain one-person battles against invasive plants in their communities. Robert Connick is one of these people. Robert retired from a career teaching chemistry at UC Berkeley, and now spends his free time pulling broom in Tilden Park in the East Bay hills. I met with Robert in September to tour his personal battleground and talk about his one-man stewardship of public land.

We arrived at a trail stretching along the ridgeline, the place that got Robert started pulling broom. When he began, the trail was entirely overgrown with Scotch broom. His original goal was just to make the trail passable, but once that was done, he just kept going.

Robert began pulling broom over 30 years ago on family property in Humboldt County. They had a portion of the property logged to help pay taxes and broom came in on the trucks, sprouting up along all the roads the trucks used. Robert pulled it regularly, but eventually the family moved, and he says it's still a big mess up there.

The area he's clearing now is just downslope from the ridgeline, where large, mature broom plants share space with poison oak, Himalayan blackberry, and coyote bush. "As you can see," he says, "this is pretty messy to take out." He's right. The broom is entirely enmeshed in blackberry. I ask if he ever uses a weed wrench along with his trusty clippers, hand saw and small digging tool, and he says no, it would be "a pain to carry." I see what he means. The narrow track we follow leads steeply downhill through the brush. Descending requires the use of all four limbs.



Robert Connick stands in front of a dead broom pile.

We reach a small spot, clear of brush and overtopped by oaks. This area had been entirely covered in broom before Robert cleared it. He will continue uphill until he reaches the ridgeline—a year's work he figures.

A tall mound of dead broom occupies the clearing where Robert has neatly piled the plants he's pulled. It's hard to distinguish from the wood rat's nest a few feet away. Robert has seen areas where the tops of broom seedlings have been nipped off, and he suspects the wood rats. He doesn't know if the rats eat them or build with them, but he says he's seen small plants kept under control this way.

As we start pulling the numerous small seedlings that dot the clearing, I ask Robert about his motivations for what he's doing.

BR: *When you clear an area of large plants, and come back in the spring to find an infinite number of seedlings, what keeps you going through what must be sheer frustration?*

RC: The knowledge that it's always worst in the beginning. You gain that by seeing it in action. Pulling repeatedly, you see a steady decline in what comes back. I remember one spot where the trail was covered in plants 3 and 4 inches in diameter. Once I cleared them, the ground was covered in leaf litter, and when the seedlings came up they lifted the litter layer into the air. It was frightening. But it's not hard to keep going when you know you've made a dent.

BR: *East Bay Regional Parks doesn't know you're out here. No one is expecting you to do this work. You long ago achieved your initial goal of making the trails passable, what impels you to keep going—do you feel a sense of responsibility to keep clearing the broom?*

RC: Well I started to just clear the trails, but I knew it was a weed. I knew it's good to get rid of it. You don't have to hate the plant. It's really a beautiful plant, and an interesting plant, all the ways it can adapt to our climate. But I know if I don't pull it it will take over. It's really a pest, but all the invasive exotics are pests. It's a pest in the sense that it's a threat, a real threat to what humans value.

BR: *Not everyone is moved to care for the natural landscape around them. Did you have any naturalist influences that you credit for your desire to do so?*

RC: When I was young, each summer we'd go camping for a month or more on our family property in Humboldt County. The property was the tail end of a sheep ranch. When the ranch was sold, the family kept 120 acres that stretched to the south fork of the Eel River. Being out in nature so much growing up created an appreciation in me. And my mother and father grew up in the country, they had an appreciation.

BR: *What's more fun—pulling lots of little seedlings or a few big plants?*

RC: Big plants are much more fun. If you get out enough of the root to know it's not coming back, you can feel you've really accomplished something. But the art or skill of clearing an area of broom is one of perseverance. People who want to get rid of the plant need to understand the commitment it requires, over several years. It's not a one-time job.

On the walk back to his house, Robert expressed concern about what would happen in the area when he could no longer get out there to pull the broom. There's nobody poised to take over when he stops, and he's afraid the broom will come right back if allowed. He may be right, but then again, there may be another lone weed warrior out there, just looking for their spot to pitch in.

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Tale of two invaders, cont'd from page 5...

until 1946 when an individual growing along San Antonio Creek in Ventura County was collected.

Following these first signs of trouble, *C. jubata* caused increasing concern as it continued to expand along coastal California. In an interesting contrast to its diverse native range and to the more diverse habitat range of *C. selloana* in California, *C. jubata* in California is restricted to a narrow coastal band. While it is currently naturalized from Humboldt to San Diego counties, its distribution is centered in northern California. Ninety-one percent of all documented naturalized populations are located north of Point Conception. Also, in contrast to *C. selloana*, both the invasiveness and morphology of *C. jubata* has changed little over the last 100 years.

The impact of this spread on central and north coast plant communities has been severe: thousands of acres of logged redwood forest in Humboldt County have been invaded; Bureau of Land Management personnel have fought a continuing battle to keep *C. jubata* out of *Baccharis* and northern coastal scrub communities on the former Fort Ord Military Reservation; and on Vandenberg Air Force Base the highly restricted and unique Burton Mesa Chaparral is under direct assault from *C. jubata* invasion. Outside of these communities, however, in most instances *C. jubata* seems to require high levels of disturbance in order to become established. Over 83% of the *C. jubata* populations that have been documented come from ruderal habitats such as roadsides, vacant lots, and cleared areas.

Some Revisionist History

In retrospect, we can understand some of the forces that have shaped the contrasting history of the two *Cortaderia* species in California. The more rapid spread of *C. selloana* was undoubtedly aided by its extensive horticultural use. Ever since the enterprise of Joseph Sexton, the *Cortaderia* species sold in nurseries and used in landscaping has been almost exclusively *C. selloana*. Every new use in a back yard garden or in roadside landscaping has therefore created potential new foci of infestation.

That is not the entire story, however. The more rapid spread of *C. selloana* relative to *C. jubata* was also a consequence of *C. selloana*'s greater habitat breadth. It seems that California populations of *C. jubata* represent only one of the probably many ecotypes that exist in its native range. In addition, *C. jubata* populations are entirely asexual, with extremely low levels of genetic variation, and consequently scant ability to adapt through natural selection to different conditions. In contrast *C. selloana* has naturalized in a number of different habitats, and this ability seems to have gradually developed over the last 130 years. Populations of *C. selloana* in California are exclusively out-crossing. The genetic variation that this out-crossing promotes might have afforded *C. selloana* greater evolutionary flexibility in adjusting to California's diverse habitats.

Finally, the impact that both species have had on native vegetation has also changed over time with the tumultuous changes in human land use that have swept through California. The native vegetation along California's coast is increasingly fragmented, isolated, and disturbed. In southern California, in particular, the native patches of shrublands and wetlands now sit amidst a vast matrix of urban sprawl. The increasing ability of *C. selloana* to invade native vegetation is probably related as much to these landscape changes as it is to any evolutionary adjustments. Along the central coast, as well, the damage that *C. jubata* has inflicted on native shrublands has increased dramatically in the last 50 years, hand-in-hand with the dramatic human-induced loss and degradation of these habitats.

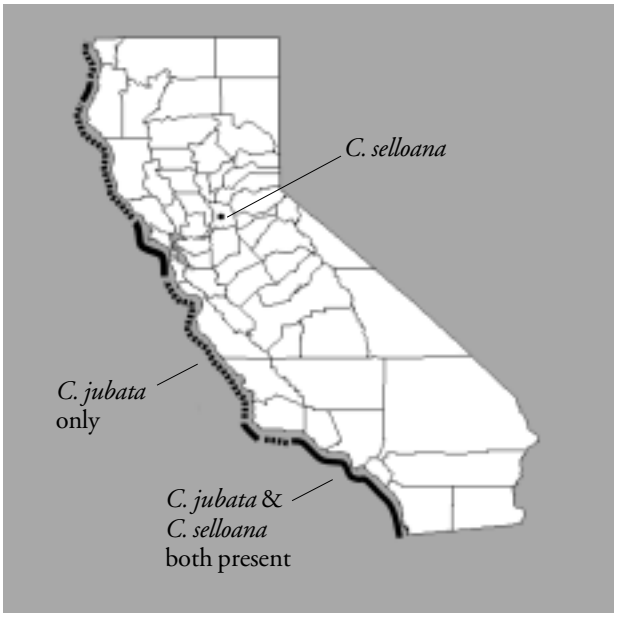
Lessons from History

The tale of these two species in California illustrates the critical importance of comprehensively monitoring plant invasions. The ecological and evolutionary forces that shape invasions are by their very nature fluid. Management strategies that are not equally dynamic will be doomed to failure.

In her 1976 dissertation, Martha Costas-Lippmann described a population of *C. selloana* in Orange County that seemed to be escaping from a roadside planting into coastal sage scrub. She warned that, although *C. selloana* was generally not considered aggressive, the progress of this population should be monitored. Unfortunately, little monitoring seems to have been done. Perhaps more importantly, at the time, there was no central clearing house for concerned people to share information about invasive plants. If there had been, it might have been realized that there were other similarly aggressive populations in southern California.

Today the situation is much better. The California Department of Food and Agriculture (CDFA) has shifted away from its historically exclusive focus on monitoring agricultural pests to also monitor wildland noxious weeds, although the department's noxious weed programs have been severely cut during the state's latest fiscal crisis. In addition, Cal-IPC has emerged as a critical resource for wildland weed monitoring in the state. Currently, Cal-IPC is working on a revision to its list of wildland weeds that will include references to documentation detailing the rationale for each species' listing. The database supporting the list will be continually adjusted with new and up-to-date information.

Without clear, verifiable, and contemporary documentation such as this, perceptions can be hard to change. Although both species of *Cortaderia* are now on the Cal-IPC list, only *C. jubata* is currently listed on the CDFA noxious weed list. As a consequence, *C. selloana* can legally be sold and transported throughout the state. Government agencies such as CalTrans have stopped using



Distribution of *Cortaderia jubata and C. selloana* in California. From University of California Weed Research and Information Center.

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***Tale of two invaders**, cont'd...*

Cortaderia for landscaping and erosion control, but the nursery trade continues to be a source of *C. selloana*. The horticulture industry often reiterates the still lingering perception that *C. selloana* is not aggressive. Moreover, some claim that only female plants are sold, thus limiting the potential of sexual propagation. However, juveniles of *C. selloana* propagated from seed are impossible to sex using the naked eye, and consequently many ornamental populations of mixed gender have probably been established from stock sold at nurseries. In addition, at this point, selling only female plants does little to hinder spread, since large mixed-gender populations are already established throughout the state, and during the flowering season of late summer and early autumn there is an ample supply of pollen for all but the most isolated female plants. On the bright side, many new horticultural varieties of *Cortaderia* are sterile, and these could provide a minimally disruptive alternative for the industry.

In 2003, a Cal-IPC member in the San Diego area successfully lobbied Wal-Mart to stop selling *C. selloana* in its California stores. Currently, Cal-IPC is working collaboratively with nurseries to reduce the sale of invasive plants. Understandably, the horticulture industry has been generally reluctant to take action voluntarily without clear evidence of a problem. This is even more so in cases such as *C. selloana* where the status of a species changes.

Finally, the monitoring of invasive plants should go beyond the basics of range distributions and habitat associations, and attempt to document quantitatively the impact that species have on native ecosystems. The damage caused by an introduced plant can vary between regions and also change over time. Tracking these differences and changes is vitally important for steering policy and allocating management resources.

Invasions are inherently historical processes, whose dynamics can and often do change with time. As the awareness of the threats posed by invasive plants grows, a concerted emphasis should be placed on continued and comprehensive monitoring of the status of invasive plants across the state. In the absence of monitoring, invasive threats can quietly develop into major problems before anyone notices.

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Welcome to the Homogocene:

The Environmental Threat of Non-Native Invasive Species

By Jim Johnson

[Jim Johnson is Streamkeeper for San Francisquito Creek Watershed in Santa Clara and San Mateo Counties. This the text of his address at the Cal-IPC Symposium in Ventura, October 7, 2004.]

From earliest days, watching luminous, disembodied animal eyes staring at us from just outside the circle of campfire light, we humans have had a relentless drive to understand, to render safe and to control for our comfort the inexorable forces of nature. Only an eye-blink ago in geologic time our surging brain began to plant wheat, forge metal, chant magic names. And then came science, a tool so powerful that we can now destroy what we fear at the touch of a button from half a world away. Now we are everywhere, multiplying and transforming natural resources to serve us, moving restlessly about the globe and transporting immense quantities of goods, including plants, animals and microbes between the continents.

About 240 million years ago, the giant landmass Pangaea began to break apart, sending the rudiments of the present continents and their cargo of life forms on separate and divergent evolutionary journeys. Along the way intricate, balanced and interdependent webs of life slowly developed, separated by vast oceans into the diffusion of life forms. Only occasionally did continents collide or landbridges form.

But today, we think nothing of jetting in a day from Sydney to San Francisco or from New York to New Delhi. Inadvertently or purposefully, all manner of biological entities are transported between ecosystems which have been separately evolving for a quarter of a billion years. The interactions of these reunited life streams can be surprising and devastating.

So great is this mixing of life forms today, that it has been suggested, only half-facetiously, by Dr. Gordon Orians the eminent University of Washington ecologist, that the present geologic period be henceforth known as the Homogocene. Indeed our ongoing change of the global climate due to the accumulation of anthropogenic greenhouse gases in the atmosphere, the massive alteration or destruction of marine and terrestrial habitats, the rapid extinction of species, the human race's shear dominance of most areas of the globe and our incipient alteration of space and other planets, would seem to require a new designation for this geologic time period.

Even more surprising, we are now mixing the genomes of biological kingdoms, never mind different species, inserting, for example, cold resistance genes from deep ocean fish into strawberries to improve their frost tolerance. Thus the very concept of species, previously inviolate, is thrown into question. How about inserting plant chloroplast DNA into our own, so we can walk about naked, green and proud, fixing the sun's energy as we go. Now *there's* a 21st century energy independence platform for a truly Green Party presidential candidate.

Perhaps the great question, answerable only in retrospect, is: Are we entering merely a new period, or a new epoch, age or eon? What, truly, is the impact of the evolution of consciousness on the history of Earth?

Welcome to the Homogocene!

But seriously, the problems caused by non-native invasive species of all taxa is great, is global and is not going away. Dr. Hal Mooney of Stanford, one of the world's leading authorities on the subject, states, "Invasive species are one of the most serious environmental threats of the 21st century."

The threat to agricultural systems from plant, animal, fungal and microbial pests has been known and fought vigorously for millennia. But the problems invasive species cause to the broader environment has been seriously studied only since 1958 when an ecologist, Dr. Charles Elton, brought the subject to the attention of the scientific community in his landmark book, *The Ecology of Invasions by Animals and Plants*.

Twenty-five years ago he wrote, "We must make no mistake; we are seeing one of the great historical convolutions of the world's fauna and flora." Since then, the problems he heralded, from killer bees to cheat grass to AIDS, have become evident to multitudes around the globe.

In 1992 world leaders met in Rio de Janeiro for the first Earth Summit where they agreed upon the value of biodiversity, "a combination of life forms and their interactions with each other and with the rest of the environment that has made Earth a uniquely habitable place for humans." They agreed upon a comprehensive strategy for "sustainable development." One of the key documents to come out of this summit was the Convention on Biological Diversity which "sets out commitments for sustaining the world's ecological underpinnings as we go about the business of economic development." Almost 100 nations have signed this convention. The United States is not among them.

Even the Work Bank, recognizing the serious threats to biodiversity and world-wide economic stability, established GISP, the Global Invasive Species Program. Since then international, national, state and regional entities, as well as private organizations such as Cal-IPC have begun to grapple seriously with the threats caused by what have been called "biological pollution."

No remote spot on the globe is free from the changes we have set in motion. We have treated this planet which has given us everything, even life itself, thoughtlessly and shamefully and therefore owe a sacred debt to Earth and to future generations. The whole planet is, by our interference, a managed landscape and we must therefore work tirelessly to heal the rift we have created in the fabric of life. And then pass the torch to those who come after us.

Fortunately, there are many willing hands, and governments are coming to the table to help. We are becoming smarter about what we do and are enlisting environmentally safe chemical and well-tested biological helpers where appropriate.

Tonight we honor some of the fingers in the leaky dike with the hope that the townspeople awaken and spring to action before the breach debouches.

Readings & Resources

Updated List: The **Oregon Invasive Species Council** has reissued its list of the Top 100 most dangerous invasive species, which includes nine aquatic plants and 21 terrestrial plants, none of which are horticulturally significant. <*www.oda.state.or.us/plant/Inv_spp/*>

New Book: ***Biological Control of Invasive Plants in the United States*** was published by Oregon State University in October 2004. It includes information on 39 target plants, 94 biocontrol agents, and features over 300 color photographs. <*oregonstate.edu/dept/press/a-b/BioControl.html*>

Seed Law: The 2004 edition of the publication, ***States Noxious Weed Seed Requirements Recognized in the Administration of the Federal Seed Act*** has been released. <*www.ams.usda.gov*>

Special Issue: The August 2004 issue of the journal ***Risk Analysis*** focuses on invasive species. <*www.blackwell-synergy.com/*>

ID DVD: The ***Interactive Encyclopedia of North American Weeds***, a new software program to aid in identification of almost 500 weeds in the US and Canada, is available as a DVD-ROM with 2,400 photographs, an illustrated glossary of 565 botanical terms, professionally-narrated lessons that provide interactive instruction on the basics of plant taxonomy, distribution maps, a habitat key, weed history articles, and the unique visual weed and crop identification key. <*www.thundersnow.com/weedid*>

Handbook: The US Forest Service Northeast Area has released the ***Invasive and Exotic Plant Species Playbook***, listing info sources and contact numbers. <*www.na.fs.fed.us*>

New Book: In ***Alien Species and Evolution*** (Island Press, 2004), biologist George W. Cox reviews and synthesizes emerging information on the evolutionary changes that occur in species when they colonize new geographical areas, and on the evolutionary responses of native species with which alien species interact. <*www.islandpress.org/books/*>

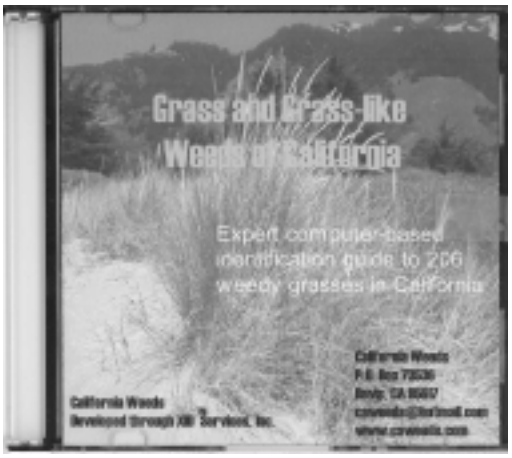
Sargasso Sea of iceplant As the tide of holiday season rolls in, it's always good to remember fearless weed warriors of times past, including the many poor privateers who went to Davy Jones locker in gales of surging *Carpobrotus*. *(Halloween display in Pacifica)*

Website: The National Wildlife Federation and eNature have launched a website for gardeners giving state-by-state information on invasive plants to avoid and native plants that work well in the garden setting. <*enature.com/native_invasive/natives.asp*>

Clearinghouse: The ***Western Weed Resources Catalog***, from the Center for Invasive Plant Management, is a compilation of more than 1,000 brochures, booklets, videos, and other educational materials. The searchable database is available. <*www.weedcenter.org*>

Website: Member Lynn Watson helped prepare a detailed webpage on Santa Barbara-area invasives for the More Mesa Preservation Coalition. <*www.moremesa.org/mesa_weed_int.htm*>

Photos: The Mid-Atlantic EPPC has compiled an image library of invasive plant photos. <*www.invasive.org/maweeds.cfm*>



Grass and Grass-like Weeds of California Identification CD-ROM, by Dr. Joe DiTomaso of UC Davis and the Weed Research & Information Center, is now available from Cal-IPC. This CD allows you to identify 200 weedy grasses using only plant parts visible to the naked eye. The intuitive keys offer a great way of self-tutoring on grass identification.

$32.00 + $3.00 s/h
Call Cal-IPC at 510.843.3902

The WILDLAND WEED CALENDAR

Know of an event that be posted here?
Please contact dwjohnson@cal-ipc.org.

California Native Grasslands Association
April 14-16, 2005
Woodland

15th Anniversary Annual Conference, "Successes, Failures, and Lessons Learned: 15 Years of Native Grassland Restoration in California" <*www.cnga.org*>

Invasive Weed Day at the Capitol
March 9, 2005
Sacramento

The 2nd annual education and advocacy event organized for weed workers to meet with agency managers and elected officials to discuss weed work in the state.
<*www.cal-ipc.org*>

National Invasive Weed Awareness Week
February 27-March 4, 2005
Washington D.C.

Your chance to talk directly to legislators about invasive plants and their impact. Californians will join delegations from other states to discuss weed policy with legislators and federal agency managers.
<*www.nawma.org*>

American Society for Testing and Materials: Symposium on Invasive Species
April 19-20, 2005
Reno, Nevada

"Invasive Species: Their ecological impacts and alternatives for control" is the title of this Symposium hosted by one of the largest voluntary standards development organizations in the world.
<*www.astm.org*>

Invasive Plants in the Mediterranean Type Regions of the World
May 25-27, 2005
Montpelier, France

An international workshop organized by the The World Conservation Union (IUCN), Center for Mediterranean Cooperation, Mediterranean Botanic Conservatory, the Council of Europe and the European and Mediterranean Plant Protection Organization.
<*www.ame-lr.org/workshop*>

Weed News, cont'd from p.3...

agricultural experts qualified to detect introductions of dangerous pests at US borders. According to the DHS, 375 of the 1,800 positions at 145 ports of entry are currently unfilled. However, the National Association of Agriculture Employees, a labor union representing government workers, calculates the shortage at more than 500. <*www.stltoday.com*>

U.C. Berkeley is wrapping up a fire prevention project that will **remove almost 6,000 eucalyptus trees** from the hills surrounding the campus. <*www.berkeley.edu*>

A new study conducted by the EPA has found pollen from genetically modified, **Roundup-resistant bentgrass** developed by Monsanto and Scotts can reach and pollinate bentgrass plants up to 13 miles away (see story *Cal-IPC News* 12(1) Spring 2004). The study will be publiched in the Proceedings of the National Academy of Sciences.
<*www.nytimes.com*>

USDA-ARS scientists working on revegetation of western rangelands are experimenting with planting small **native grasses "islands"** to serve as seed sources. <*www.ars.usda.gov/is/AR/archive/nov04/plants1104.htm*>

Quotable:

"Alaska is our 50th chance to get it right. We have screwed it up 49 other times, and the economic and environmental losses are in the billions [of dollars]."

Jamie Snyder, coordinator for the University of Alaska Fairbanks Cooperative Extension Service, speaking about the incipient invasion of non-native, invasive plants on the Kenai Peninsula in Alaska.

"We have all heard the breathless tales of the dangers of "invasive alien species," but what does science say about them? Did you know that studies show that purple loosestrife does not affect species richness of native plants? That saltcedar supports native birds and insects in high numbers and at high levels of diversity, including endangered species? That the "invasive alien" hydrilla supports the highest bird species diversity in Florida, and it supports higher fish species density and many times the fish biomass than natives? That the zebra mussel increased the catch of yellow perch five-fold, and that it improves water quality? That in all cases, including even oceanic islands, introduced species have increased biodiversity?"

David I. Theodoropouloss, from
Invasion Biology: Critique of a Pseudoscience

Steve "Letterman" Schoenig's Top 10 Definitions of a Weed:

[as read at the 2004 Symposium Banquet]

10. Landscaping for the Global Village.
9. Nature's weapons of mass destruction.
8. Nature's way of telling you something's wrong.
7. The Starbucks of the plant world.
6. Alien exotic non-native non-indiginous, not-necessarily-noxious invasive opportunistic pest plants out-of-place.
5. Those pretty plants you see weird people killing when you're out walking the dog.
4. This is your landscape on drugs.
3. The only thing ranchers and environmentalists agree on.
2. Plants in need of a little TLC: Totally Lethal Control
1. Job security!

Cal-IPC Membership Form

We're working to protect California's wildlands from invasive plants—join us!

Cal-IPC's effectiveness comes from a strong membership, including scientists, land managers, policy makers, and concerned citizens. Please photocopy the form below, complete, and mail with your payment. Additional donations are always welcome to support our projects; we are a 501(c)3 nonprofit organization, and donations beyond regular membership rates are tax deductible.

Individual

❑ **Regular**	**$35**
❑ Family	$60
❑ Contributing	$75
❑ Life	$1,000
❑ Joint Cal-IPC/SERCAL	$55
❑ Joint Cal-IPC/CNGA	$70
❑ Cal-IPC/SERCAL/CNGA	$95
❑ Student/Volunteer	$15

Institutional

❑ Regular	$150
❑ Contributing	$300
❑ Patron	$600
❑ Sustaining	$1,000
❑ Small company or Nonprofit	$100

Ways to join:

Mail: send this form with check (made out to "Cal-IPC") or credit card info to Cal-IPC, 1442-A Walnut Street #462, Berkeley, CA 94709

Fax: fax form with credit card info to 510/217-3500

Email: send contact and credit card info to *dwjohnson@cal-ipc.org*

Phone: call us at 510/843-3902 and provide contact and credit card info

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Affiliation

Address

City, State & Zip

Work Phone Home Phone

Fax E-mail

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