CalEPPC NEWS

NEWSLETTER OF THE CALIFORNIA EXOTIC PEST PLANT COUNCIL

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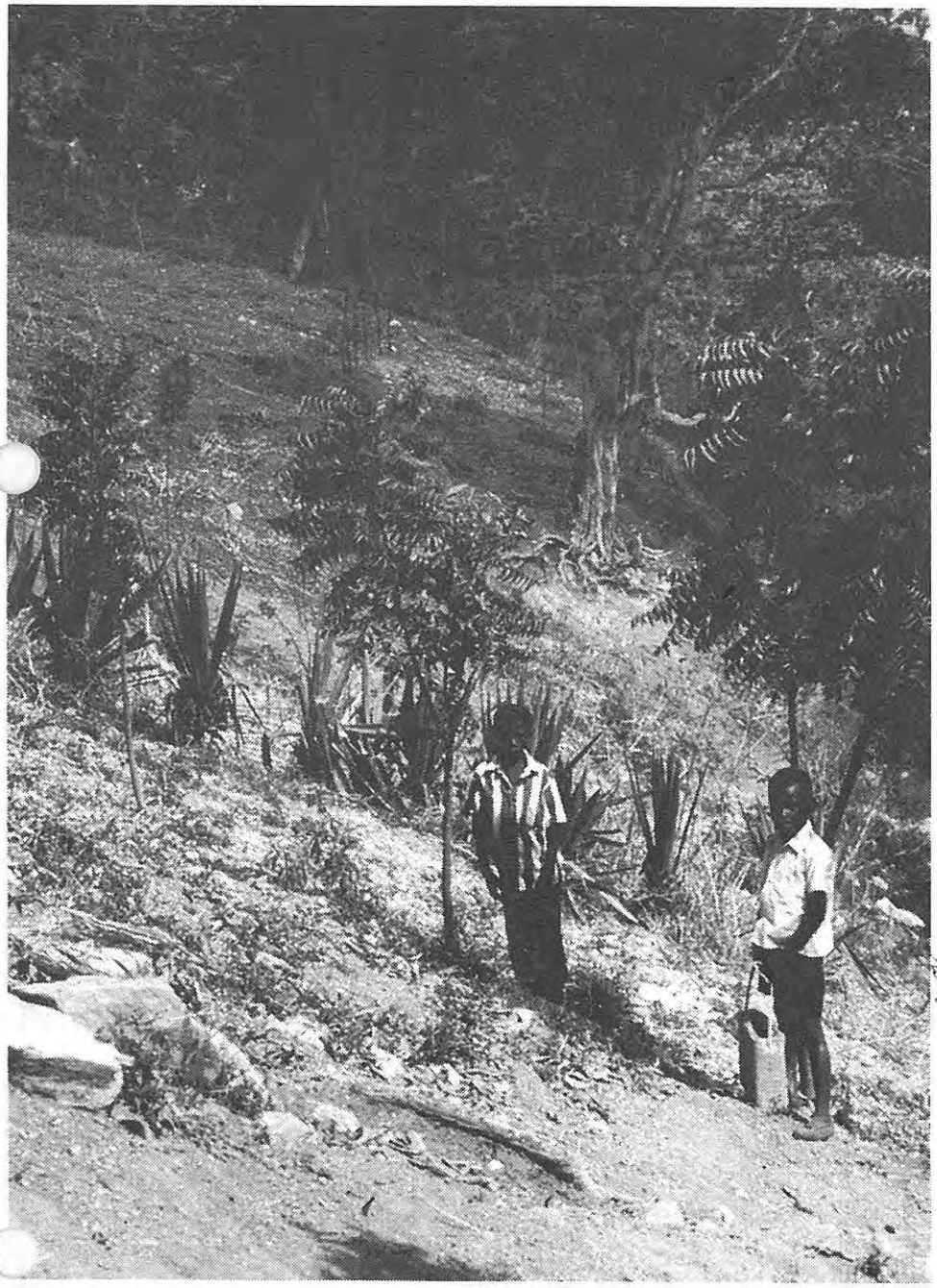

INSIDE

Row plantation of neem (*Azadirachta indica*), an often-used multipurpose exotic tree species, within fallow fields, Haiti.
See story page 3.
Photo by Roland de Gouvenain

Who We Are

CalEPPC NEWS is published quarterly by the California Exotic Pest Plant Council, a non-profit organization. The objects of the organization are to:

- provide a focus for issues and concerns regarding exotic pest plants in California;
- facilitate communication and the exchange of information regarding all aspects of exotic pest plant control and management;
- provide a forum where all interested parties may participate in meetings and share in the benefits from the information generated by this council;
- promote public understanding regarding exotic pest plants and their control;
- serve as an advisory council regarding funding, research, management and control of exotic pest plants;
- facilitate action campaigns to monitor and control exotic pest plants in California; and
- review incipient and potential pest plant management problems and activities and provide relevant information to interested parties.

Newsletter Submissions

Letters to the Editor, notices, articles of all types, volunteer workday schedules, photographs, and line drawings are welcome and may be submitted directly to the editor at the address to the right. We invite you to utilize *CalEPPC NEWS* as a forum for describing your project, asking for help, or bringing new issues or developments to the forefront. Electronic submission is gratefully accepted in PC-formatted 3.5" or 5.25" disks utilizing WordPerfect or Microsoft Word. Please enclose a letter quality hard copy with your disk. Copy for the Spring 1996 edition is due to the editor by March 15, 1996.

NOTE: THE EDITOR HAS MOVED!!

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Agroforestry and the Conservation of Native Biodiversity

Roland C. de Gouvenain, USDI Bureau of Land Management

Exotic plant species have been introduced from one part of the globe to another throughout human history, many times with beneficial economic results, sometimes with disastrous ecological consequences. Perhaps the worst of these may be the loss of native biodiversity. The invasion of approximately 25 million acres of Australian farmland by prickly pear (*Opuntia* sp.) in the 1920s or the current spread of salt cedar (*Tamarix* sp.) in the riparian areas of the American Southwest (Lovich et al. 1993) are but two examples of the impacts exotic plants can have on native plant communities when they become weedy in their new environment.

Agroforestry, which has been adopted in many developing countries as one of the most promising land use systems in the fight against poverty and environmental degradation, has often focused on identifying species of trees that can produce fuelwood, stabilize soils, provide food for people and fodder for livestock, among other things. Some of these trees, exotic species introduced because of their multipurpose value, have acquired the name of "miracle trees." Yet little is known about the impacts such trees may have on local native flora and fauna.

Some tree species associated with agroforestry, while providing beneficial uses in fields and gardens, have behaved as weeds in the surrounding countryside. Foroughbakhch (1992) describes that *Eucalyptus camaldulensis* and *Leucaena leucocephala*, both introduced in the past for fuelwood tree plantations are, respectively, "in the process of invading at the sides of roads, fields and the edges of the natural vegetation" and spreading "naturally in the region, invading more humid parts of southern Mexico."

Biodiversity is more than the sum of the species present in a community. Angermeier (1994) shows that introduction of exotic species into native communities, far from adding biological diversity, can in fact result in a loss of such diversity. For instance, what were previously different species assemblages within a common landscape may, after the introduction of exotic species in that landscape, share one or more of these exotic species and thus be more similar to each other than before. He argues that "native diversity is inherently more valuable over the long term than artificial diversity and should be the primary focus of conservation efforts."

Yet the food and fuelwood crisis that is worsening in many developing countries is all too real. Gentry (1992) recognizes that combining the preservation of species diversity with the sustained utilization of native resources may be the only alternative to massive social and economic disintegration and misery in many developing countries. In solving these social and economic problems, managed agroforestry systems, although less diverse than most "natural" forests, have significant advantages over some other land use forms such as selective logging or forest conversion (Padoch and Peters, 1993).

For some agroforesters, Gentry's (1992) challenge is met by the systematic use of multipurpose trees. For Owino (1992), the tree is treated as an engineered commodity more than as a biological organism. He emphasizes that agroforestry is above all a strategy "to produce the maximum amount of tree product and/or services in the shortest possible time thus enabling maximum economic returns." Shiva et al. (1991) argue that while production is a required objective of agrosystems, "the deliberate substitution of diversity by uniformity - of crops, trees, and livestock... has worsened the biodiversity crisis." They assert that biodiversity cannot be preserved if production systems are not themselves based on a policy of biodiversity conservation.

Other agroforesters have included native species in their search for multipurpose trees, often with the help of indigenous people. Rocheleau et al. (1988) reports on how local farmers in Kenya, although initially focusing primarily on exotic tree species, often came back to agroforestry staff with lists of local tree species and with suggestions on how to incorporate them in an agroforestry scheme. Altieri and Montecinos (1993) describe how naturally rich and diverse native agroecosystems are in Latin America, including traditional agroforestry systems such as those managed by some Amazonian ethnic groups, which often contain well over 100 plant species per field.

There is no question that the dilemma noted by Gentry (1992) calls for innovative agroforestry schemes to be designed and implemented so as to raise production levels. Given the weediness of some multipurpose tree species that are still introduced today by some agroforestry projects, it is urgent that such schemes be revised to consider the ecological cost/benefit ratios of such introductions and to provide for more emphasis on using native tree species. The conservation of native species diversity of many developing countries may be at stake.

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The Use of Fire for Yellow Starthistle (*Centaurea solstitialis*) Management and the Restoration of Native Grasslands at Sugarloaf Ridge State Park

Project Summary as presented to the California Weed Conference, January 1996

Marla Hastings and Joseph DiTomaso

Abstract

Three consecutive prescribed summer burns conducted within Sugarloaf Ridge State Park have demonstrated a marked reduction in the occupation of yellow starthistle while nearly doubling the cover of other forbs and native species. Essential elements to assure project effectiveness are identified, which include the critical timing for conducting the burns and the requirement to burn annually over a three year period.

Introduction

Sugarloaf Ridge State Park, Sonoma County, is located in the northern Coast Range near Santa Rosa, California. It contains a complex mosaic of vegetation types which include chaparral, mixed evergreen forest, woodland-savanna, grassland, and coniferous forest. Open grasslands occupy approximately 350 acres of the park's 2700 acres. Livestock grazing and related agricultural practices since before 1900 heavily impacted the grassland areas.

The current grassland complex of the park includes both a native perennial component dominated by purple needlegrass (*Nassella pulchra*), blue wildrye (*Elymus glaucus*), and (*Leymus triticoides*), and an exotic annual European grassland component dominated by ripgut brome (*Bromus diandrus*), soft brome or blando brome (*Bromus hordeaceus*), silver European hairgrass (*Aira caryophyllea*), wild oats (*Avena fatua*), and little quakinggrass (*Briza minor*). Significant populations of yellow starthistle (*Centaurea solstitialis*) are found throughout the grassland areas. Mixed evergreen forest, composed of Douglas fir (*Pseudotsuga menziesii*), canyon oak (*Quercus chrysolepis*), tanoak (*Lithocarpus densiflora*), and madrone (*Arbutus menziesii*), is the major vegetation type throughout the park.

Yellow starthistle first invaded open grassland sites within the San Francisco Bay Area before 1869 (Maddox, D.M., and A. Mayfield. 1985) Today, yellow starthistle is the most widely distributed weed in California, occupying over 10 million acres. This represents approximately 10 percent of the total surface area of the state. Infestations of yellow starthistle lower forage yield and quality, interfere with grazing, cause problems in harvesting of forage and crops, and cause "chewing disease" in horses. In many areas of California, including Sugarloaf Ridge State Park, yellow starthistle reduces wildlife forage and habitat, displaces native plants, and decreases native plant and animal diversity (Sheley, R.L. and L.L. Larson, 1994).

The historical fire frequency within the Sonoma Valley was analyzed utilizing fire scars on redwoods at Annadel State Park, located approximately 10 miles northwest of Sugarloaf Ridge. Finney and Martin (1992) reported that the mean fire intervals from all stumps varied from 6.2 to 20.9 years, with many intervals between 2 and 1- years. The native vegetation at Sugarloaf Ridge flourishes under this historical regime of relatively low intensity frequent fire. California natives have become fire adapted in that plants are dependent on fire to arrest succession, reduce competition, remove thatch, provide soil enrichment and seed scarification. Douglas fir invasion into the open grasslands and oak woodlands within the park is a specific example of the effect of fire exclusion. Under the historical, frequent fire regime, the Douglas fir would experience fire-caused mortality. Modern fire suppression activities curtailed frequent fires. Approximately 50 years of fire suppression have allowed many unnatural conditions to occur.

Fire exclusion has jeopardized essential wildlife habitat, biodiversity, and the open character provided by the park's grasslands and oak woodlands. Preliminary investigations at Sugarloaf Ridge document that Douglas fir invasion, biodiversity loss, and the rampant invasion of yellow starthistle are all occurring within the park's grassland sites (Whatford, 1994).

Methods

In 1984, yellow starthistle was identified as a seriously invasive component of the vegetation at Sugarloaf Ridge. Yellow starthistle had become dominant within the 10-acre meadow portion of the developed campground. It then rapidly spread within the park's 350 acres of grassland.

In 1993, park resource managers initiated an active yellow starthistle management program. A 30-acre (Pony Gate Compartment) prescribed burn was conducted within a targeted high-priority location in the park. This burning program had two main objectives: 1) eliminate the current year's yellow starthistle seed production by causing seed death; and 2) stimulate yellow starthistle seed germination. This, in theory, would rapidly exhaust the yellow starthistle seed bank. It was anticipated that seed bank depletion and long-term yellow starthistle control could be achieved by annual burning.

The burn was located directly adjacent to the park's entry road. Its location was selected for good accessibility during prescribed burning operations, and high public visibility for interpretation of the yellow starthistle management program.

Prescribed burning was again conducted in July 1994, and during July 1995 an additional 155 acres were treated. The third consecutive annual Pony Gate prescribed burn was also completed while burning the new compartment. In all locations, the fire carried well, and nearly complete yellow starthistle mortality was observed.

One eroded gully within the Pony Gate compartment was occupied with a 100 percent cover of yellow starthistle. There

was insufficient grass fuel to carry a surface fire during either the 1993 or 1994 burn. As a result, yellow starthistle mortality was limited. During December 1994, annual grasses blando brome and zorro fescue were sown to produce fuel for the 1995 burn. Even with this added fuel, yellow starthistle remained dominant in this location.

At Sugarloaf Ridge, fall burning is not appropriate for yellow starthistle control. Burning must occur after the annual and perennial grasses have cured and set their seeds, but prior to yellow starthistle seed development. Early or mid-summer burns also provide two to three extra months of fire protection due to the blackened area against the homes in urban interface locations.

Results

The 1993 burn was too cool to fully consume all of the yellow starthistle plants, yet nearly 100 percent of the yellow starthistle plants not consumed by the fire demonstrated complete foliar scorch two days following the burn. Yellow starthistle flowers and immature seed heads remained on the plants. The seeds of these plants did not mature during that growing season. The objective of eliminating yellow starthistle production was fully achieved.

In May 1995, results following the second annual consecutive burn showed a 90 percent reduction in relative yellow starthistle cover (rosette stage). Even at maturity in July, two consecutive annual burns reduced yellow starthistle cover by 62 percent, while nearly doubling the relative cover of other forbs, particularly native species. perennial grass cover was reduced by 40 percent in the burned areas in May, but subsequently increased by nearly 300 percent in July.

The effectiveness of burning for yellow starthistle control was also reflected in significant seed bank reduction. After a single burn, the soil seed bank was reduced by 74 percent, and after three years of burning, the reduction was over 99 percent, (see Table below).

SEED BANK ANALYSIS
SUGARLOAF RIDGE STATE PARK

Burn Sequence	Yellow starthistle seeds in the soil per square meter (5 cm deep)
Unburned	10,000
After 1 burn	2,600
After 3 burns	52

As is generally the case in grassland burning, each of the annual prescribed fires burned in a mosaic of lesser and more severe fire intensity. Variability in volumes and flammability of surface fuels produces a full range of fire intensity. Although the fire intensity was not measured during the burns, the dramatic reduction in yellow starthistle cover and seed bank documents that fire intensity is not crucial to the reduction of yellow starthistle. Burning during the appropriate phenological stage is critical for the elimination of seed production. Full consumption of yellow starthistle plants by fire is not crucial. Only sufficient heat to produced foliar scorch and stem girdle the plants is necessary, thereby arresting their development to maturity. Heat is critical for seed bank depletion.

Biodiversity was also measured in the unburned and burned compartments at Sugarloaf Ridge. Significant increases in forb or non-grass species within the burn compartments dramatically contrasted with unburned locations. In addition, the vegetative cover of native species increased two-fold. Six species, all non-California natives, increased in both frequency and vegetative cover in the unburned sites. By contrast, 15 species were more prevalent in the burned sites. Of these, eight were California broadleaf natives.

Light interception and soil temperature were also measured at and near the soil surface. Unburned plots contained noticeably more thatch, with a corresponding reduction in light penetration to the soil surface. Increased soil temperatures were measured when burning removed the thatch layer. Although other factors may also be involved, it is possible that reduced yellow starthistle competition, increased light and higher soil temperatures in the spring could influence the establishment and success of native plant species following burning.

Discussion

The resource management strategy for the park is to continue with annual consecutive prescribed burns within the larger 155 acre, along with other additional burning compartments. The Pony Gate compartment will not be burned during the next three years so that yellow starthistle recolonization can be monitored. This analysis will allow park resource managers to develop the fire regime required to maintain sustainable control of yellow starthistle.

It is extremely difficult to have complete success with burning alone in the park. Prescribed fire is very reliable in reducing yellow starthistle in most park locations, yet problems are presented with burning in near-proximity to facilities and in roadside locations. Non-flammable, fleshy yellow starthistle does not readily burn during the appropriate phenological stage without sufficient grass fuel to carry the fire. A flame thrower will be used to produce foliar scorch on roadside plants that do not burn during future broadcast burns. Fuel can be provided for large areas dominated by yellow starthistle without a grass component by sowing grass seed the winter prior to a planned prescribed burn. The preferable treatment would be to sow locally collected native seed. Unfortunately, financial limitations may make this option infeasible.

Herbicide application has also been integrated into the park's management strategy. Within the 10-acre developed campground area at Sugarloaf Ridge, a private contractor applied three separate herbicide treatments during Winter and Spring 1994, and early Winter 1995. A solution of Garlon 4, (Triclopyr) along with Telar (Chlorsulfuron) was used during the winter applications. Garlon 4 was applied solely during a Spring 1994 treatment. Summer mowing occurred in 1994 and 1995

after the relic perennial grasses set seed. Isolated yellow starthistle plants were hand-pulled during the summer of 1994 and 1995.

Although the results are very favorable to date, burning is clearly the preferred management technique for the reduction of yellow starthistle at Sugarloaf Ridge. Since the seed bank analysis documents such a remarkable reduction in yellow starthistle seeds following burning, the campground meadows will be burned in late June or early July 1996, during the other prescribed burning operations in the park. Herbicides will continue to be applied as spot treatments, and along some roadsides to plants escaping the burning.

Research continues to be conducted within the park. Full project documentation is forthcoming in an upcoming edition of *California Agriculture.*

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EMPLOYMENT OPPORTUNITY

Vegetation Management Specialist

Jones & Stokes Associates, a leading environmental consulting firm, is seeking a Vegetation Management Specialist for its Sacramento office.

The selected candidate will conduct site work to quantify vegetation management requirements in developed and undeveloped settings, identify noxious weeds and other weedy vegetation, and prescribe vegetation management approaches consistent with IVM (e.g., chemical, mechanical, biological, manual, and cultural approaches). Other duties will be to develop and prepare vegetation management plans for developed and undeveloped settings and develop and monitor experimental plots to determine efficacy of vegetation management treatments. This position also will provide support to the management staff by performing other various technical and administrative duties.

Minimum requirements include a B.S. in weed science, range management, agronomy, ecology, or related field and a valid Pest Control Advisory license from the California Department of Food and Agriculture within six months of hire. Two years experience in developing and preparing vegetation management plans, and working knowledge of applicable laws and regulations regarding vegetation management also are required. The ideal candidate must have excellent written and verbal communication skills, strong organizational and analytical skills, and the ability to work as a member of multi-disciplinary project teams.

Preferred qualifications include knowledge and experience with computer spreadsheet and word processing programs, and participation/membership in professional organizations focused on vegetation management (e.g., CalEPPC).

We offer a competitive benefits package. Please send a cover letter, resume, and three references, ASAP to:

Human Resources/95-041
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Contributing Members

CalEPPC is pleased to welcome the following people who joined November 1995 through January 1996:

Peggy Barker
Shawna Bautista
Rachel Couch
Marilyn Davis
Dexter Hake
Robert Gilbert
Cort Johnson
Diane Renshaw
Sara Stein

Notes from Symposium '95 Working Group Meetings

Saturday, October 7, 1995, Asilomar, CA

Lepidium Working Group Meeting

The Lepidium working group meeting was chaired by Joel Trumbo, Pesticide Use Coordinator for the California Department of Fish and Game. Since this was the group's first meeting, most of the time was spent discussing areas in California where Lepidium has recently become invasive. Other topics that were touched upon include methods of control, toxicity, distribution mechanisms, seed longevity, and sources of information.

Paula Hubbard, Dale Schmidt, and Sally Manning said that Lepidium seems to be spreading in the Owens Valley (Inyo County) where it invades communities found in alkaline soils, such as alkali meadows. Several rare plants are found in communities where Lepidium is making inroads. The Los Angeles Department of Water and Power has used flooding as a control method in the Owens Valley without success.

Joel Trumbo and Ann Howald described substantial recent increases in distribution of Lepidium at several Department of Fish and Game Wildlife Areas, including Grizzly Island (Solano County) and Los Banos (Merced County). At Grizzly Island, past habitat management practices included annual plowing, resulting in rapid spread of Lepidium over hundreds of acres. Small-scale tests with Roundup, Garlon, and Telar indicated that Roundup and Garlon were less effective than Telar in controlling Lepidium after one application. Telar doesn't harm desirable grass species, but it cannot be used in water environments. DFG is conducting a large-scale test with Telar to determine control effectiveness. At Grizzly Island, Lepidium seed seems to be dispersed by air and water. Seed dispersal can be curtailed by clipping the heads before the seed is mature.

Jo Kitz noted that Lepidium has become widespread in the brackish lagoon area of the Malibu Creek watershed (Los Angeles County). High water years have encouraged its spread.

Stephen Jones reported an infestation of Lepidium has recently been found along Alameda Creek (Alameda County).

In 1995, Lepidium was seen at about 4,000 feet in the Sierra Nevada, growing in a wet ditch along Highway 50. It may have reached this area as seed in hay bales used for erosion control.

Seed longevity for Lepidium is 10-15 years. The seed germinates under a variety of conditions. Open sites in alkaline wetlands can be rapidly colonized by Lepidium seedlings.

Is Lepidium toxic to livestock? It is indigestible, and has a high silica content.

Working group members agreed that more information on Lepidium control is needed. Research priorities include a study of the ecosystem impacts of Lepidium invasions, including the effects of large-scale Lepidium infestations on wildlife populations and rate plant populations.
Working group participants included: Ann Howald, Paula Hubbard, Stephen Jones, Jo Kitz, Sally Manning, Dale Schmidt, and Joel Trumbo.

Lepidium Information sources:

Trumbo, J. 1994. Perennial pepperweed: a threat to wildland areas. CalEPPC News 2(3):4-5.

Young, J. and C. Turner. 1995. *Lepidium latifolium* L. in California. CalEPPC News 3(1):4-5.

Young, J.A., C.E. Turner and L.F. James. Perennial pepperweed. Rangelands 17(4):121-123.

Tamarisk Working Group Meeting

The Tamarisk working group meeting was chaired by Bill Neill. Bill Wiesenborn, of the Bureau of Reclamation, reported on the USDA tamarisk/saltcedar biocontrol project. jack DeLoach, of the Agricultural Research Service in Texas, has 2-3 insect species from Asia that are approved by APHIS and ready for trial release. one proposed release site is the TNC/BLM Dos Palmas Reserve in Coachella Valley. The trial released has been stalled by recent listing of the Southwestern Willow Flycatcher by the Fish & Wildlife Service. The listing decision reportedly acknowledges habitat degradation by tamarisk, but indicates nesting use by the flycatcher, so a consultation is required. The group's conclusion was that biocontrol of tamarisk should not harm the flycatcher because introduced insect agents can only reduce population densities, not extirpate exotic tree species.

After attending CalEPPC Symposium '94 in Sacramento, Carl Bell of UC Cooperative Extension, tested and confirmed the efficacy of Arsenal herbicide on tamarisk, in dilute foliar applications, with and without the addition of glyphosate (Roundup). Arsenal, marketed by American Cyanamid, is available in other states but is not registered by California due to minor deficiencies in the manufacturer's test procedures. Having validated studies in New Mexico which show that Arsenal kills tamarisk, Carl's next step will be to request state approval for special local needs registration in California's desert areas. Carl Bell has also received USDA grant funds to publish an information brochure on tamarisk, and sponsor a conference in Coachella Valley, tentatively scheduled for next spring.

Ellen Mackey, with the Metropolitan Water District, reported that MWD intends to remove tamarisk around Lake Matthews, a large reservoir south of Riverside, by cut-stump treatments using Rodeo, followed by inundation of the resprouts.

Bert Anderson, of the Revegetation and Wildlife Management Center, and the group discussed habitat quality

and groundwater transpiration rates of tamarisk/saltcedar relative to arrowweed and native riparian trees. Bill Neill concludes that tamarisk can be considered desirable habitat in especially dry or saline areas where nothing else grows, but such conditions do not apply to most infested areas in California.

Other participants in the tamarisk working group discussion were: Brian Cashore, Graciela Hinshaw, Julie Osborn, Steve Silvers, David Thompson, and Betty Warne.

German Ivy Working Group

The German ivy group was chaired by David Chipping. The group discussed Carla Bossard's presentation on German ivy at the symposium. Vince Cicero, of San Luis Obispo, applied the study mix of .25% triclopyr (as T3 ester in water) and 0.25% glyphosate and got good kill with survival of poison oak and hummingbird sage in the spray area. In experiments in San Francisco, Scrophularia died but came back, poppy and phacelia were killed. Vines in trees were killed by basal application. Triclopyr might volatize at temperatures greater than 90°F and kill non-target plants in the canopy, so don't spray on hot days. The best time to spray is after the plant has flowered and when the energy is going back to the roots.

Solarization does not appear to work. It took four years to kill bagged plants in a bag house on Audubon Ranch. It took 2 ½ weeks in an agricultural dryer to desiccate the plant at 80°C. The conditions under which bagged plants will die is unknown.

Eva Grotkopp's genetic study is still at the early stage with no data yet. BUT there seems to be different resistances to heat in as much as plants collected from Redwood National Park fared worse in Davis than plants collected in San Diego and San Francisco.

More chemical good news. A fatty acid, SCYTHE, rips open cell walls to allow for better herbicide penetration. It was suggested to use with glyphosate, or to spray prior to bagging to aid in dehydration. Garlon may not be used near water. DowElanco is helpful with information on application constraints and label information.

Manual removal works if you persist, with many return trips (monthly at GGNRA). After bagging the ivy, bury it deeply in the city dump. At Camp Alice Eastwood, similar results with a six-month return cycle.

German ivy working group participants included: Greg Archbald, Jack Beigle, Len Blumin, Carla Bossard, Dave Chipping, Woody Elliot, Kim Hayes, Sue Hubbard, Dave Kaplow, Judith Lowry, Dave Nelson, Ray and Judy Peterson, Dave Schmidt, Adrian Stroganoff, Pam Van der Leeden, Peter Waldberger, and Sue Weis.

Broom Working Group

The Broom Workgroup discussed French, Spanish and Scotch broom. The group was chaired by Ray Swartley, of Coastlands in Big Sur. One of the first topics of discussion wasthe need to create "UNWANTED" posters to educate the general public, funded by a grant, in collaboration with CalEPPC, State Parks, Forest Service, and local businesses interested in preserving ecosystem diversity. Distribution coul be through the Leage of California Cities.

The group discussed the need for the CalEPPC Board of Directors to form an exotic policy/public statement addressing plant diversity and herbicide issues. Also suggested was developing a phamphlet on Integrated Pest Management (IPM) stressing biocontrol.

Strategies on French broom (*Genista monspessulana*) included working on the small, scattered pioneer populations. Pull out the little ones, work from the outside toward the center of any given population (The Bradley Method). Cut French broom when it is at its weakest, which will often kill the mature plants, which live up to 12 years. Top quality seed production of the plant is from 4-8 years of age. Seed longevity is speculated to be up to 25 years.

Ray Swartley led a discussion of control of French broom by burning. Ray employs burning on steep slopes in the Big Sur area by backing fires, moving against the wind, and downslope. This is cleaner, makes less smoke, burns hotter, and melts off the waxes that are the seed's protective coating. The coating is the reason the seeds remain ungerminated in the soil for such a long period of time.

A heavy germination of seedlings follows a fire. The temperature appears to be important. It was suggested to be 200-225°F. Some people reported that they didnt get comple germination at lower temperatures. As fire moves through olde populations where French broom has been cut, or is closer to the ground, the fire burns at a temperature high enough to cause germination. The maximum temperature of the fire is at the "flame front."

Some participants reported burning at 1-3 year intervals during August and September in the Northwest. These months are a high fire risk time for the rest of California.

The group discussed the need for significant distances between test control burns to avoid overseeding and reseeding. The concept of planting an annual, non-regenerative cover crop in the ash of burned French broom was discussed. This cover crop would provide a carrier fuel through the abundant seedlings, which would otherwise be too green to burn.

Ants carry the starchy broom seeds to their nests,affording the opportunity for the seeds to germinate a significant distance from the mother plant.

Contact your local County Agricultural Commissioner's office. They can offer information on biological pest controls for your area.

Highways as Corridors of Dispersal

John Madison

As cars, and especially trucks, speed up and down our highways, they create turbulence. Vortexes of wind follow after the vehicles and carry dust, debris, and plant seeds along the shoulder, and, if present, the divider strips. In addition, the highways shunt rain drainage to the shoulders. Seeds, plus extra water, encourages growth of adapted seeds, especially in low rainfall areas where water may be limiting.

I first became entranced by this effect of car and road a decade ago when traveling east from San Diego on I-8. There, the ornamental African fountain grass (*Pennisetum setaceum*) appeared as a prominent feature of the desert landscape, forming a thriving ribbon of grass bordering the highway. As I traveled east, and the annual rainfall became less and less, the height of the grass decreased and the stands became thinner and thinner. After an hour of driving, the grass was no longer found.

Travel corridors have long been recognized as paths along which weeds have been dispersed. When horses were prominent, the feed carried along to fuel them usually contained weed seeds in the hay or grain. Fresh harvested grain, not yet cleaned, was shipped to market on the railroads. Seeds of contaminating weeds sifted through cracks and many weeds thrived along the railroad roadbeds. Since summer grass fires were regularly started by coals from steam engines firing the weedy growth along the tracks, an early effort at weed control by the University of California was directed to toxifying railroad roadbeds with arsenates and borates to destroy all vegetation.

In the late 1940s, when Cornell was promoting birdfoot trefoil (*Lotus corniculata*) as a forage, country roadsides were rapidly decorated with yellow flowers on the verges. Farmers bringing hay in from the fields spread the trefoil, for its hay provided seeds in all stages of development, no matter when the hay was harvested.

If you examine an aerial photo of the California coastal area from a photo that was taken around the month of September, you can trace ranch roads winding into the hills by the line of white plumes of Andean jubatagrass (*Cortaderia jubata*) lining the road wherever a dozer has cut into a bank. Raw cuts are home to the jubatagrass. I find myself admiring the ability of jubatagrass to colonize and protect bare, droughty, infertile areas of raw rock. I do not like that it replaces pleasant native species that accomplish the same end. Our road cuts provide it a home and traffic distributes seeds along the roads.

Occasionally, roach catch basins will accumulate water in low areas. Our rare Coast Lily (*Lilium maritimum*) survives and spreads to some extent in the seasonally wet highway catch basins. In Humboldt County, *Lilium columbianum* increase in the gutters, where a narrow Highway 101 provides no place for cards to stop, and the banks are too steep for deer to browse. Common European mint and pennyroyal (*Mentha arvensis* and *M. pulegium*) will decorate moist verges in late summer with ribbons of blue. Other low, wet basins will abound with poison hemlock (*Conium maculatum*) or water parsley (*Oenanthe sarmentosa*).

Other umbellifers also include the wild carrot (*Daucus carota* L.), and in coastal areas you find more and more roadsides bordered by European fennel (*Foeniculum vulgare*). Fennel and carrot spread in the fields, but along highways they occur in continuous stands.

Other plants noted as colonizing road shoulders include Gorse (*Ulex europa*), Scotch broom (*Cytisus scoparius*), French broom (*Genista monspessulana*) and perennial sweet pea (*Lathyrus latifolia*). Colonies of these legumes extend into Oregon, the brooms into Washington, and some damn fool, nostalgic Scot even brought gorse to Vancouver Island. Of the many grasses, dallisgrass (*Paspalum dilatatum*) from South America is often favored by the wetness, and forms large stands. Its grain is about the size of a grain of millet.

A unique infestation occurs along Highway One at Little River, in Mendocino County. Here, the South African *Watsonia bulbilifera* forms a dense stand. The flower culm forms several hundred bulbils in the axils of the flower bracts. About 1/4 - ½ inch in diameter, the bulbils are heavier than the seeds of plants mentioned. They are not so readily moved, and most fall to the ground and grow among the parent plants. In time, the basal bulbs form a solid mat. I estimate the main colony to cover about three acres, with smaller colonies scattered along Highway One. The plants produce spikes of smoky orange flowers in May. There is a growing coterie of admirers who make an annual pilgrimage to Little River each spring to see the flowers. I don't know what they call them, for the common name is not generally known.

Im sure many of you have noticed what I am reporting. To my knowledge, we have not shared the observation as an element of common concern in our evaluation of exotic pests. Having noted it, we may make and record further observations to help our understanding. The spreading of weed seeds by auto turbulence will provide Caltrans with a further argument for spraying shoulders. For them, contract spraying of shoulders greatly simplifies management as compared to mowing, which requires signing of the road, and often a flagman in addition to the operator. In following up after roadside spraying, I have found the result to be a great reduction in diversity of roadside plants, rather than elimination, although some species may be eliminated. I'll withhold comments on other objections to spraying.

John Madison, formerly of Gualala, CA currently resides in the Great Smokey Mountains.

French Broom Seedbank Depletion: A Micro-experiment on Summer Die-off

Greg Archbald

If you are involved in the battle to control French broom, you have probably had moments like this. After clearing or burning an infested area you watch in horror the following winter as broom seedlings come up out of the seedbank like alfalfa sprouts at a health food store. The urge to dig, burn, chop or spray is almost irresistible.

On April 5, 1995, rangers of the Marin County Open Space District burned broom piles on the preserve near my home in Mill Valley, California. These were big piles, over 3 by 3 meters square at the base and over 1 meter high. Pulled broom was piled there after cutting or pulling from a long-established infestation nearby. Very few plants piled had seeds on them. After the burn, there was a tremendous flush of broom seedlings where the piles had been. It was one of those moments. But I kept my impulses in check and decided to do a little experiment instead. On June 3, when the flush of seedlings was well established, I carefully measured and dug out one square foot of a typical seedling flush on the burn site. I then counted all broom sprouts that had green stems and at least one whole set of living leaflets. The total number of seedlings in that one square foot was 2, 775!

Over the summer, I simply let the seedlings cook in the sun, struggling for survival. The site was near the base of a south-facing hillside on deep soil heavy with clay. Moisture retention in the soil was not measured but appeared to be high. (There were a few wild oat plants -- *Avena spp.* -- nearby that stayed green all summer.) On November 5, 1995, I cut out another square foot from the same burn site. The second square foot had been marked in June as comparable to the first square foot counted. A total of only 86 seedlings survived -- a reduction of about 97%. Competition with other species was not a factor in this reduction since the small squares counted were broom monocultures.

The main conclusion, of course, is that there was enough broom left in that square foot to make a preserve manager's life miserable were nothing done to remove it. (Typical seedling height above ground at summer's end was 14 cm, with roots down to 9 or 10 cm already.) Yet a comforting finding here is that nature will greatly thin those horrifying "alfalfa sprout" seedling flushes given reasonably dry and sunny summer conditions. There is no need to panic. It's simple enough to come around anytime late in the summer with a brushcutter and tri-blade or even a string trimmer and clear off the still-vulnerable seedlings.

Greg Archbald, Golden Gate National Park Association, Fort Mason, Bldg. 201, 3rd Floor, San Francisco, CA 94123, 415.673.4067 Ext. 25

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Upcoming Meetings of Interest

February 14, 1996

"*Controlling Arundo donax in the Riparian Ecosystem: A Workshop and Discussion Forum*" sponsored by the Sonoma Ecology Center's Creek Restoration Program. 9:00-4:30 at the Westerbeke Ranch, 2300 Grove Street, Sonoma, CA. Guest speakers include Paul Frandsen, co-founder of Team Arundo, Nelroy Jackson, Ph.D., of Monsanto Company, and Gary Bell, Ph.D., of The Nature Conservancy, who will lead in presentations and discussions of the biology of the plant and the process of organizing a comprehensive Arundo control program on a watershed scale. For information contact Richard Dale at 707.996.9744.

February 27 - March 1, 1996

"*Third National IPM Symposium/Workshop*," to be held at the Sheraton-Washington Hotel, Washington, D.C. Contact: Barry Jacobsen, USDA IPM Coordinator, Ag Box 2220, Washington, D.C. 20250-2220.

March 12-15, 1996

The Western Weed Coordinating Committee (WWCC) and the Western Society of Weed Science (WSWS) combined annual meetings will be held in Albuquerque, New Mexico. Registration fee is $90, with one-day fees available. For more information, contact Barbra Mullin (WWCC) at 406.444.5400 or Gus Foster (WSWS) at 970.484.8925. To register for either or both meetings, contact Wanda Graves at 510.790.1252.

March 27-29, 1996

The Western Aquatic Plant Management Society, the western chapter of the North American Lake Management Society, and Portland State University will sponsor a "*Symposium on Non-Native Organisms in Western Aquatic Ecosystems.*" The symposium will feature invited speakers who will discuss the biology, impact, and management of non-native organisms in aquatic ecosystems of the west. For more information, contact Mark Sytsma, Program Chair, Biology Department, Portland State University, P.O. Box 751, Portland, OR 97207. Phone: 503.725.3833; FAX: 503.725.3864; E-mail: h2ms@odin.cc.pdx.edu

April 16-18 1996

"*The Broom Symposium,*" jointly sponsored by the California Exotic Pest Plant Council (CalEPPC), the Pacific Northwest Exotic Pest Plant Council (PNW EPPC), the Oregon Department of Agriculture, and the Washington State Noxious Weed Control Board will be held at Portland State University, Portland, Oregon. ***The Broom Symposium*** will gather together a broad range of persons with interest in broom control and management and present information on control techniques, and the biology and ecology of brooms. Attendees are encouraged to bring a poster or display that addresses the biology and/or management of Scotch, French, Spanish, or Portuguese brooms. Speakers and participants will be from Oregon, Washington, California, British Columbia, New Zealand and Australia. For more information, or to volunteer contact Dennis Isaacson at 503.986.4621 or Laurie Penders at 206.872.2972.

April 28 - May 3, 1996

The National Park Service, Pacific West Field Area 1996 Resource Stewardship Workshop, "*West by Northwest - Exploring Common Ground,*" will be held at the Golden Gate National Recreation Area in San Francisco, CA. Contact: Judy Rocchio, 415.744.3872.

May 17 - 19, 1996

Coalition to Restore Urban Waters (CRUW) Conference, "*Friends of Trashed Rivers,*" Chicago, IL. Contact: Laurene Von Klan, 312.939.0490.

June 19-21, 1996

"Vernal Pool Conference," jointly sponsored by CNPS, SERCAL, and the western section of The Wildlife Society, will be held in Sacramento. For information, call Mark Skiller, 916.324.3816, George Clark at 916.355.4362, or Allen Barnes at 916.447.2677.

October 4-6, 1996

San Diego will be the site of ***CalEPPC Symposium '96.*** Mark your calendars and save this weekend for another exciting and fun event!

October 30 - November 3, 1996

SERCAL's ***Fifth Annual Meeting*** will be held in Yosemite National Park.

Exotic Pest Plants in the Press

Plant Invaders: the Threat to Natural Ecosystems

This book is the second in a new series of manuals in plant conservation which contribute to the People and Plants Initiative set up by the World Wide Fund for Nature (WWF), UNESCO and the Royal Botanic Gardens, Kew, England. The main aim of the initiative is to build up the capacity for work with local communities on botanical aspects of conservation of biodiversity.

The aim of this manual is to draw attention to the growing problem of invasive plant species, which are already a serious threat to the biodiversity of many parts of the world. Little is known of the factors that lead to biological invasions, making it difficult to predict which species will become invasive. There is, therefore, a need to increase public awareness of the threat to natural and semi-natural ecosystems. and numerous instances of invasion are given to indicate the nature of the problem. There is also the need to alert research and governmental organizations in order to focus and strengthen research and management strategies, and to give practical information and advice on how to deal with invasive plants. The use of case studies of important species is designed to illustrate the wide variety of invasions and control methods.

The subject is approached in the context of conservation and concentrates on plant invasion as a threat to wild biodiversity, rather than agricultural weeds. The intention is to change current thinking on invasive plants, from an obscure problem to a major hazard to biodiversity.

Cronk, Q.C.B; Fuller, J.L. 1995. *Plant Invaders: the threat to natural ecosystems.* London; Chapman & Hall.

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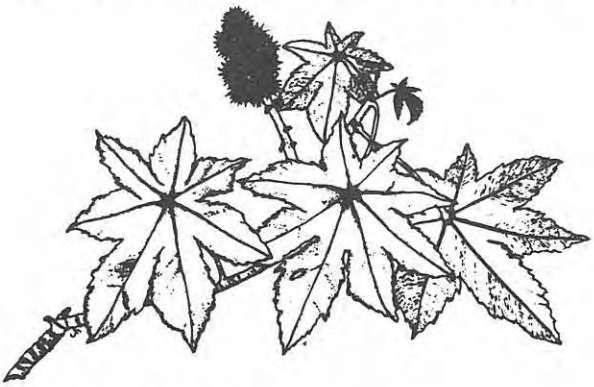

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