Natural Areas Report

Vol. 7, No. 2 Summer 1995

Information Exchange for Natural Area Scientists and Managers

No Silver Bullets

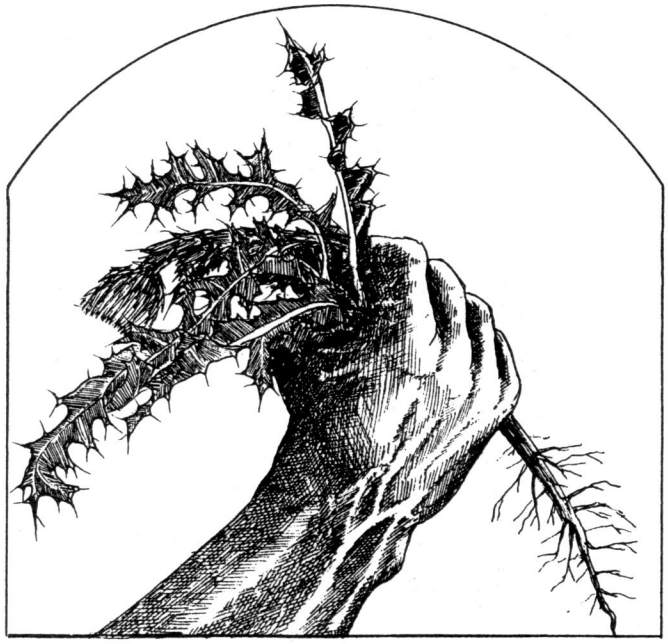
A brief review of weed control tools and strategies

The invaders:

Bastard toadflax. Stink tree. Cheat grass. Bindweed. Loosestrife. Spurge.

It is said that the invasion of introduced weeds wipes out more natural communities every year than development. It is a problem faced by every natural area manager, and by a growing number of scientists, regulatory agencies, and policymakers.

What can be done about all these weeds? We polled natural area scientists and managers around the country to find out what they were doing to control invasive, non-native plants this field season. What we thought would be a straightforward review of field tools has led to a much broader discussion of a complex management issue.



artist: Margaret Herring

Weeds inflict ecological and economic damage to ecosystems across the country. In many ways, they are growing faster than the efforts to control them. Our conversations with scientists and managers represent just a small sampling of the possible approaches to weed control in natural areas.

Approaching stem-by-stem

There are several tools available that are useful for stem-by-stem selection of large woody invasives. In limited infestations, or where invasive shrubs are few and scattered, several managers recommend a lever-action gripper, such as the *Weed Wrench*[1]. Birdie Davenport (Natural Area Preserves, Washington Department of Natural Resources) has used the gripper to pull out hundreds of scots broom plants, some six feet tall with stems up to 2.5 inches in diameter. "It is the only tool I've used that doesn't kill my back," she says. Mike Parker (Wildlife Biologist, San Francisco Bay National Wildlife Refuge) reports successful results pulling french broom in several California wildlife refuges. The device grips the stem just above the ground and levers out the plant and its attached root mass. It works best when it is supported on a board or plywood platform so it does not dig into soft, wet soil. In dry soil, the tool is less successful in removing the entire rootmass. Managers at the Everglades National Park have used a handmade version of the tool to successfully remove seedling trees. They report that in wet soil the root mass tends to slide out, leaving less soil disturbance for subsequent weed invasion.

Going one-on-one with larger invasive trees, a few managers mentioned a chemical ax (sold variously as *Hypo-Hatchet* or *Chop 'n Squirt*) that injects herbicides into the cambium with every whack. Or a chemical handgun (sold as *EZ Ject*) that shoots .22 caliber herbicide bullets into the boles of the unwanted exotics. Both have the advantages of stem-specific application and no messy chemical spills. However, those who have used them say that, in order to deter resprouting, you must girdle the tree with hacks or bullets, which is time-consuming, and rather gruesome.

Finding the Labor

Who is on the other end of a weed gripper or a pesticide pistol? No matter the tool, stem-by-stem eradication of weeds is labor intensive.

Rick Hayes (Army Corps of Engineers, Fern Ridge Lake) has found help from prison inmates. For several

[1] No endorsement is expressed or implied by the mention of this or other product names.

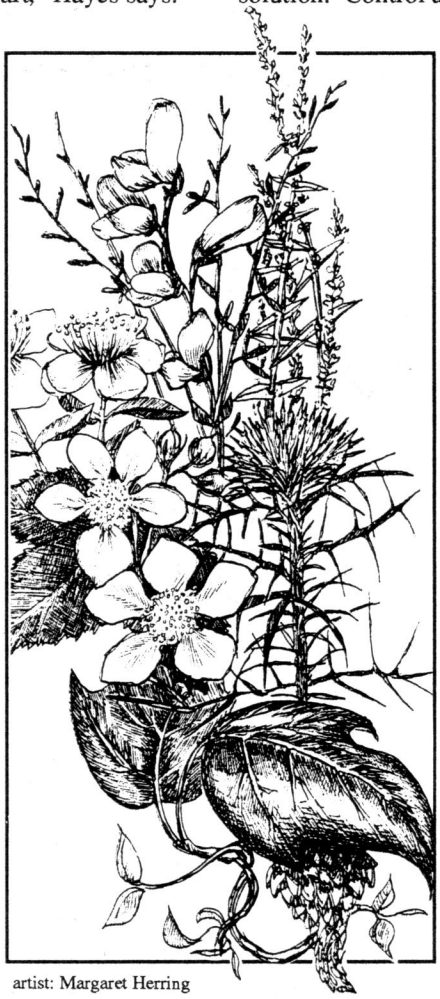
...continued on page 2

continued from page 1...

field seasons, Hayes has contracted with the local county corrections office to provide inmates to pull scots broom and blackberry on the Fern Ridge RNA in Oregon's Willamette Valley. The prison provides transportation, supervision, and basic tools for a ten-man crew, for which they are paid a nominal fee. The crew has been successful at removing most of the overburden of mature plants, but the remaining seedbanks are enormous, so pulling resprouts will be ongoing for many more seasons. "We have long-term prescriptions for weed control here, of which the prison labor crews are one part," Hayes says. "Crew labor is usually very expensive, prohibitively expensive, but the affordable cost of a prison crew makes it possible to try mechanical, labor-intensive experiments." As for their quality control and performance? "I give them an A+," says Hayes. "I wish all our contractors were as thorough and pleasant to work with."

Another source of labor comes from President Clinton's forest plan for the Pacific Northwest, which includes programs and money to provide jobs for displaced timber workers. One program, known as "Jobs in the Woods," will provide money to help eradicate weeds from Myrtle Island RNA on the Roseberg (OR) district of the BLM. This small island in the Umpqua River, which includes stands of California laurel and Douglas-fir, is threatened by an invasion of scots broom. The District is planning to use "Jobs in the Woods" money to hire displaced timber workers to cut, pile, and burn the broom. Photo monitoring points will be set up before the eradication effort begins.

Increasingly, local volunteers are organizing to lend a helping hand to natural areas, and earn the feeling of ownership of these last best places. Among the volunteers registered with the Golden Gate National Recreation Area is a woman who brought her birthday party to the park to pull weeds. The Nature Conservancy maintains a toll-free hotline number in some of its state offices to connect interested volunteers with the latest opportunities to get blisters and sore backs against the backdrop of exquisite landscapes. The annual trip to pull fennel on Santa Cruz Island (the largest of California's Channel Islands and owned by TNC) is booked to capacity months in advance.



artist: Margaret Herring

Using Integrated Pest Management (IPM)

Any mention of specific weed control tools will lead to a discussion of IPM and the appropriate use of a variety of tools, including manual and mechanical removal, least toxic herbicides, and cultural and biological control. Stressing techniques that are economically and ecologically sound, IPM requires an understanding of the nature of the resource, the pest, and the pest's natural enemies, and uses monitoring and other decision-making tools to apply the most appropriate prescription.

Biological control with natural enemies, when successful, offers a relatively permanent management solution. Control agents distribute themselves through time and space in relation to their host, the weed. Peter McEvoy (Associate Professor Entomology, Oregon State University) reports long-term success controlling invasive tansy ragwort in natural areas and agricultural lands along the Oregon coast. By using a combination of ragwort flea beetle, cinnabar moth, and ragwort seed-head fly, tansy ragwort has been reduced to less than 3 percent of its former abundance along the coast. At Cascade Head Scenic Research Area, the reduction of exotic ragwort has allowed an increase in *Viola adunca*, native host to the Oregon silverspot butterfly, a species federally listed as endangered.

Pete Grinde (Little Missouri National Grassland) reports that another kind of flea beetle is finally having an effect at several sites in the Custer National Forest. After years of spraying leafy spurge with 2-4,D, the Forest Service extended its weed management in 1987 to include flea beetles and angora goats, with varying degrees of success. This year Grinde notes a measurable descrease in stems per acre. Grazing goats have been brought in several times during the growing seasons to prevent the surviving plants from going to seed.

Eradicating and Restoring

Once the weeds are pulled (or eaten), then what?

John Randall (The Nature Conservancy's National Coordinator for Wildland Weeds Management and Research) encourages managers to keep in mind the goals of the natural area, and to ask themselves if weeds are interfering with acheiving those goals. "There are almost always more weeds than time and money to deal with them," Randall says, so choose your battles wisely and know what it is you want to acheive on the land.

Lou Whiteaker (Bureau of Land Management, Klamath Falls resource area) agrees with the need for an ecologically-based strategy for weed control. "You must balance the need to remove certain weeds with the chance that you may create a habitat for more weeds. Exotic plant species are often introduced in an area where they have no natural enemies and therefore gain some advantage, but their largest advantage will be in a disturbed, out-of-balance community. A good weed control strategy must give the native plant community a competitive advantage to successfully compete with alien species."

Weed control goes hand-in-hand with site restoration. National Park Service managers used this double-edged strategy when they began to restore bank swallow habitat in the Fort Funston tract of Golden Gate National Recreation Area. During the 1930s, the US Army had bulldozed the area's native dunes and coastal chaparral, replacing them with a monoculture of ice plant and Monterey cypress meant to camoflage the fort's defenses. Beginning in 1991, park rangers, maintenance crews, and armies of volunteers reversed the action. They cut the cypress trees. They began handpulling 35 acres of iceplant, bulldozing the remains into piles to decompose. And each year, they have replanted the newly cleared land with 20,000 native plants propogated onsite.

"Getting rid of ice plant is labor intensive," says Jim Milestone (District Ranger, Golden Gate National Recreation Area), "you need a lot of people." Golden Gate is fortunate to be located in an urban area with a large population interested in the environment, and as a result, it has one of the largest volunteer programs of any park in the nation. Park managers were able to enlist up to 120 volunteers a day, including service groups from Bay Area corporations and local universities.

The project was approached incrementally to avoid clearing too much land vulnerable to erosion or reinvasion of weeds. The size of each section to be cleared was determined by the number of plants ready to go back in the ground. Volunteers helped with the revegetation, toting thousands of containers of nursery stock and transplanting native dune grass from a nearby site.

It had been decided early in the project to use no herbicides. Instead, the ice plant was handpulled, working uphill, grasping stems and ripping the shallow roots from the sand. "We've had to go back a few times with a few people to pull the resprouts," Milestone notes, "and we will until the native community gets established.

Extending the Boundaries

What happens if you manage to get rid of the weeds from boundary to boundary of your natural area, and just beyond the fence on neighboring land is the seedbank for the next invasion?

...continued on page 6

OTA Takes a Hard Look at Weed Control

In 1993, the US Congress Office of Technology Assessment (OTA) published its report, *Harmful Non-Indigenous Species in the United States*. The report concluded that State and Federal policies designed to protect us from the worst species are not safeguarding our national interests in important areas.

Although most often cited in terms of economic loss to agricultural lands, weeds (and other harmful non-indigenous species [NIS]) are equally damaging to natural areas. Yet, the report points out, "No Federal agency clearly sees its mission as protecting natural areas from harmful NIS. The harmful effects of NIS in natural areas tend to be poorly documented–a cause and a consequence of the lack of focused Federal and State attention."

For example, the report points out a survey conducted among national park managers during the 1980s, to which respondants rated non-indigenous plants as the most common threat to park natural resources (non-indigenous animals ranked fourth). "Yet the National Park Service allocates no more than 2 percent of its annual budget to research, management, and control of NIS and the backlog of unmet needs is growing" (OTA p.33).

To obtain a copy of the OTA report (#OTA-F-565), contact the US Government Printing Office, Mailstop SSOP, Washington, DC, 20402-9328.

Field Notes

Several new Research Natural Areas were established this spring, notable in part because they were a long time coming. Region 6 of the Forest Service established three new areas, the first since 1980.

Sand Lake RNA (134 acres) on the Siuslaw National Forest contains the best remaining example of a parabola dune system found in the Pacific Northwest. The unstabilized dune vegetation is characterized by dune bluegrass (*Poa marcantha*) and red fescue (*Festuca rubra*) communities and a large portion of the area is surrounded by a mature Sitka spruce-western hemlock forest.

Three Creeks RNA (691 acres) on the Willamette National Forest is comprised of north-facing glacial cirques that contain a mosaic of Alaska yellow cedar, Douglas-fir and Pacific silver fir forests. These moist cirques have protected the forests from fire and periodic wind storms for over 800 years.

On the east side of the Oregon Cascades is **Canon Well RNA** (666 acres) on the Winema National Forest. This area is dominated by lodgepole pine forests with understories of bitterbrush and western needlegrass. Many of the trees are suffering from a mountain pine beetle outbreak in the 1980s, a natural phenomenon that has been exacerbated by fire suppression.

Steve Gibbons, RNA Coordinator for the National Park Service Pacific Northwest Region, reports the designation of four longstanding proposed sites within Crater Lake National Park as formal research natural areas. All of the sites fill one or more of the natural area cells that are described in the 1993 Oregon Natural Heritage Plan and two of the areas, Llao Rock and Sphagnum Bog, are unique sites that are not found anywhere else in the state.

Desert Creek RNA (1870 acres), centered on the Desert Creek drainage, consists of gently sloped terrain that is forested by ponderosa and lodgepole pine. Of central importance is the presence of the bitterbrush (*Purshia tridentata*) shrub steppe that dominates large openings along the drainage, and its long stolon sedge (*Carex pensylvanica*) understory, a community type largely lost in Oregon due to livestock grazing. The forested portions of the RNA have been left undisturbed for nearly a century. The ponderosa pine forests display a very high volume of standing old growth trees and the understory ranges from green manzanita (*Arctostaphylos patula*) to bitterbrush and western needlegrass (*Stipa occidentalis*).

Pumice Desert RNA (3055 acres), in the central portion of Crater Lake National Park, appears as a broad, shallow basin or depression on the landscape surrounded by a lodgepole pine forest. Its distinguishing characteristics are its sparse vegetation, with an average plant cover of only 4.5 percent cover overall (Horn 1968), and its mantle of deep pumice from Mt. Mazama. Of particular interest at the Pumice Desert is the slow invasion of lodgepole pine which began around forty-seven years ago.

Sphagnum Bog RNA (180 acres) straddles the crest of the

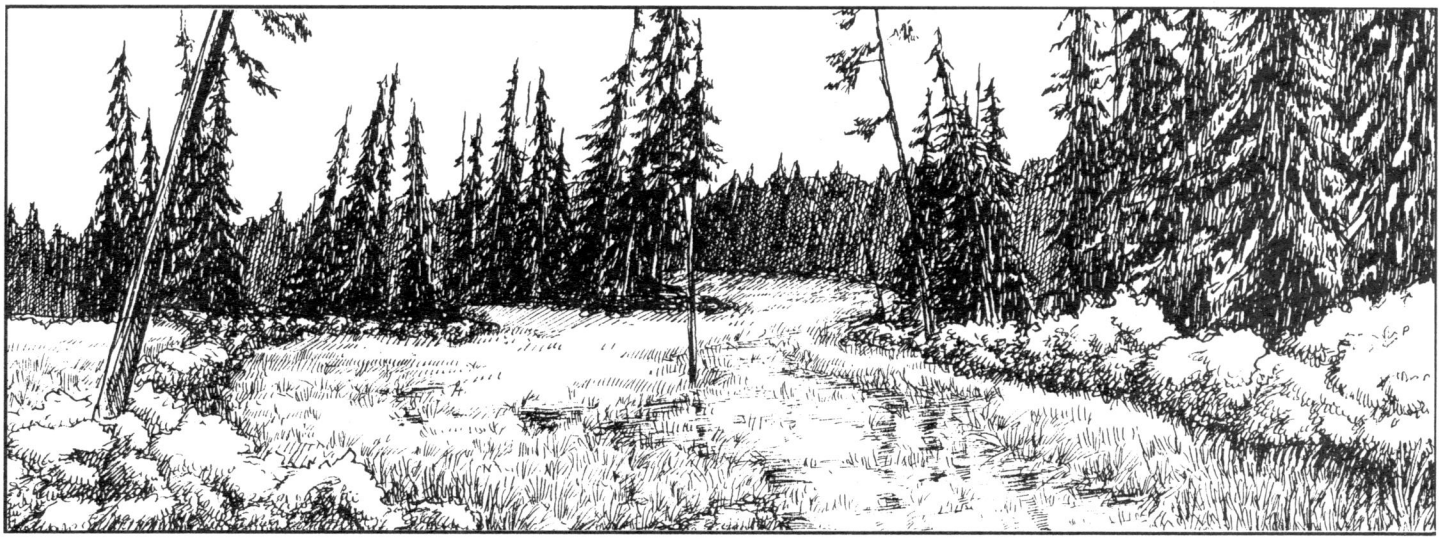
The Nature Conservancy Funds Ecosystem Research in Natural Areas

The Nature Conservancy has instituted a new ecosystem research program in the recognition that the successful protection of biological diversity requires a better understanding of the habitats and ecosystem processes that support species. Realizing that it could not accomplish this kind of understanding alone, TNC has embarked on a program that seeks out research partnerships with agencies, universities and other non-profit organizations. The new Ecosystem Research Program provides the vehicle to create the partnerships and fund the research.

In 1993 the A.W. Mellon Foundation gave The Nature Conservancy (TNC) $1.5 million to begin the Ecosystem Research Program (ERP). TNC agreed to fundraise an additional $1.5 million for the program, and each participating researcher is required to match, dollar for dollar, the funds they receive from the ERP.

The first set of proposals has been awarded. Twenty-two grants have been given to scientists in the United States, Equador, Indonesia and Panama. The studies cover a diverse range of topics including hydrologic studies on a number of riparian ecosystems, integration of socioeconomics of palm fruit and game hunting with sustainable use, modeling of a boreal macrotidal estuary, the role of fire on insect diversity, and new strategies for prairie conservation, restoration and management.

The latter study uses the Willamette Valley Natural Areas Network in Oregon. TNC preserves and Research Natural Areas managed by the Army Corps of Engineers and US Fish and Wildlife Service will be the focus of an attempt to refine a model initially developed to predict vegetation community response to natural disturbance. It is hoped that the revision of the model will provide clues to grassland manipulations that enhance native species and discourage or diminish the spread of exotics.



artist: Margaret Herring

Sphagnum Bog RNA, Crater Lake NP

Oregon Cascades Mountains, at an elevation range from 1,600 to 1,630 meters. The Sphagnum Bog is enclosed in a large, gently sloping basin at the head of Crater Creek where two large springs emerge into an open forest of Shasta red fir and mountain hemlock. The bog site consists of a series of inter-connected openings in the forest that contain a diverse assemblage of montane bog plant communities ranging from *Carex rostrata* sedge wetlands to *Vaccinium occidentale* bog huckleberry shrub thickets to *Salix barclayi* willow carrs. The entire bog, formed after the Mt. Mazama eruption some 7,700 years ago, is underlain by dacite pumice deposited by the cataclysm.

Llao Rock RNA (435 acres) is located on the gently sloped broad top of Llao Rock and includes a portion of the steep terrain on the inner caldera of Crater Lake. Alpine conditions dominate most of Llao Rock; small stringers of mountain hemlock forest are found only at the lowest elevations on the north side of the RNA. Interspersed in the alpine zone are stands of whitebark pine (*Pinus albicaulis*) but much of the site is vegetated by small alpine cushion plants growing in pumice. Of particular interest are the whitebark pine stands and the occurrence of two rare plant species at the site, pumice grapefern (*Botrychium pumicola*), a Category 1 candidate for federal listing; Crater Lake rockcress (*Arabis suffrutescens var. horizontalis*), a Category 2 candidate for federal listing.

Canopy Crane is Up and Running

The canopy crane (featured in the Fall 1994 issue of the *Natural Areas Report*) is up and running in the T.T. Munger Research Natural Area in southern Washington. The tower crane was erected this winter with considerable care to protect the natural features of the area. At the request of the Pacific Northwest Interagency Natural Areas Committee, arborists were hired to give advice on how best to protect the trees along the road into the crane site. The arborists, Whole Tree Works of Portland, convinced contractors to trench above the tree roots that crossed the roadway, and surgically repaired roots that were damaged.

Since its dedication in late April, the crane has been cruising the top of a 5.5-hectare area of old growth conifer forest. All the trees within the area have been tagged and stem-mapped on the ground, and currently scientists are tagging and photographing all of the tree tops from the crane gondola as a baseline for detecting any potential decline that might occur in the canopy. These data will be used to create a three dimensional map of the area, from tree top to ground stem.

Research proposals to use the crane continue to come in. The crane is already being used by University of Washington and NASA to look at reflectance at different wavelengths of individual canopy trees. This kind of information should improve our ability to use remote sensing imagery to determine forest age and structure. Other studies involve quantifying forest structure to characterize space between and among trees; canopy clipping to look at insect populations; and possibly using the crane to look at niche separation in canopy and ground-based birds.

If you are interested in using the tower crane to facilitate research projects, contact Dave Shaw at the Wind River Canopy Crane Research Facility, Carson, WA 98610, or call (509) 427-7028.

continued from page 3...

Bill Stephenson (Regional Conservation Biologist, Parks Canada) urges natural area managers to involve neighbors in an ecosystem approach to weed control. The Exotic Vegetation Management Process he helped to develop for Point Pelee National Park in Ontario begins with the twin objectives to reduce exotics and restore native communities. His process pushes jurisdictional boundaries to support larger scale restoration of marginal and abandoned agricultural land within the region in order to reduce invasions into the park.

In order to accomplish this ecosystem-based approach, the park managers at Point Pelee have enlisted partnerships with nearby landowners, regional agencies, and local schools and businesses. They have encouraged local nurseries to propogate native plants for sale to the park as well as to the public and to other agencies for landscaping, roadside plantings, erosion control, and restoration.

"The more partners you enlist, the quicker you see your desired results," Stephenson says. "You help them to understand the context of the protected area and the surrounding community. And you show them the benefits." Among the benefits to the Point Pelee neighbors are guaranteed customers for the nurseries' native plants; cheaper roadside maintenance costs; and schools landscaped with native plants which are linked to an educational curriculum about biological diversity and natural communities. "You change the way people and governments make decisions, and so you become a social manager as well as a natural resource manager."

Unifying the Efforts

Changing the way decisions are made has become part of the work of the Exotic Pest Plant Council. The EPPC, a national (US) coalition of state and regional groups, coordinates the efforts of managers and scientists across agency jurisdictions in order to develop broad-based management strategies to control exotic weeds. The first EPPC was started in 1984 in Florida, where it is estimated that 40 percent of plants growing wild are exotics. In particular, the fast-growing melaleuca, brought in from Australia at the turn of the century to dry out south Florida's swamps, was threatening to convert the Everglades "river of grass" into a dense monoculture of trees.

Begun as an interagency task force, the EPPC designed not only a research and management plan for melaleuca within the national park, but also provided information to regulatory agencies on the extent and the consequences of invasive exotics. They estimated the rate of spread of melaleuca to be 50 acres per day, and management costs approached a $1 million annually. Additionally, they drafted a model ordinance for local governments which combines weed control with regulation of land development. Their "Model Exotic Species Ordinance for Municipalities and Counties" includes:

- prohibition of importation, sale, propagation, and culture of particular pest plants;
- techniques and precautions for removing exotic vegetation;
- requirements to remove of pest plants on land before development is permitted;
- property tax reductions to landowners for removal of pest plants;
- a procedure for encouraging long-term protection of ecologically important areas with an emphasis on maintaining them free of exotic vegetation.

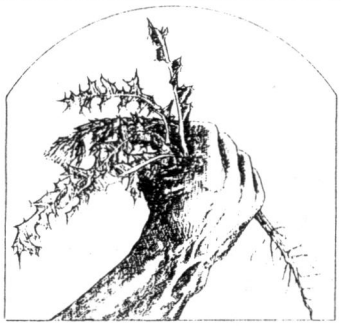
As a result of coordinated efforts, the spread of melaleuca has been halted within the Everglades National Park and prevented from reinvading for the last 14 years[2]. Similar plans and ordinances have been drafted for Brazilian pepper (which crowds out native mangroves in southwest Florida) and Australian pine (which encourages erosion at its base making beaches too steep for threatened sea turtles or endangered American crocodiles to nest).

In recent years other councils have been established in Tennessee, California, and the Pacific Northwest. "The interest is growing as more people recognize the overwhelming need to confront the problems of pest plant invasions," says Dan Thayer (Director of Vegetation Management, South Florida Water Management District). "Now we can speak with a unified voice to regulatory agencies and local governments."

Adapting Policy

The EPPC works as a collaboration among science, management, and policymaking in states and, now, as a national organization to affect Federal policy. They recently joined with the Intermountain Noxious Weed Advisory Committee, the National Association of State Departments of Agriculture, and the Weed Science Society of America to support changes in the

[2]Although the invasion of melaleuca has been controlled in the Everglades National Park, the plant is still spreading on hundreds of thousands of acres in other parts of south Florida. Efforts to control this and other pest plants were dealt a blow in 1992 following Hurricane Andrew, whose winds spread seeds across the torn up landscape of south Florida. Florida's Department of Natural Resources estimates that, as a direct result of the hurricane, costs to control exotic plants will approximately triple over the next five years, approaching $14 million.



Federal Noxious Weed Act, contained within the Farm Bill currently being debated in Congress. The changes will expand the bill to include concern for non-agricultural lands. It authorizes listing weed species that damage natural areas, wetlands, parks, and refuges, and it grants emergency authority to eradicate newly discovered exotic pest plants which may not be formally listed as Federal noxious weeds. As the bill's supporters state: "The protection of agricultural and natural ecosystems must be a cooperative effort initiated between regulatory agencies, the scientific community, importers, the agricultural industry and the general public. In the final analysis, this concerted effort will prevent the establishment and spread of non-indigenous plant species and protect our valuable ecosystems."

Conclusion

Our poll of natural area managers and scientists made it clear that it will take more than a silver bullet to halt the spread of invasive species that are impoverishing the natural wealth of the continent. The campaign to eradicate melaleuca from the Everglades National Park has used an array of tools, from lever-action grippers to state legislation. In order to control invasive weeds in natural areas, it will take information shared among practitioners. It will take partnerships and benefits beyond natural area boundaries. It will take more accountable state and national policies. It will take funding. And it will take time.

Margaret Herring
editor, Natural Areas Report

Natural Areas are a Natural Component of Large-Scale Assessments

Various large-scale assessments and planning efforts have included an examination of protected areas in their analyses (see *Natural Areas Report*, Winter 1995). One of these efforts, the Columbia River Basin assessment, has gone a long way in using natural areas as an important component of many of the analyses being done on the Basin. A Geographic Information System (GIS) layer of natural areas is almost complete for the nearly 145 million-acre watershed of the Columbia River. This layer includes state natural areas, The Nature Conservancy preserves, Research Natural Areas, Wilderness Areas, Wild and Scenic Rivers, Wildlife Refuges, Special Interest Areas, Areas of Critical Environmental Concern, National Parks, National Monuments, and National Natural Landmarks.

Once the natural areas GIS layer is complete, numerous analyses can be done to examine the relationship of natural areas to the ecological and social issues involved in the Columbia River Basin (CRB). The proposed analyses include:

- An assessment of the representation of different vegetative cover types across the CRB landscape, looking at historic vegetation, current vegetation, and current potential vegetation.
- A landscape level analysis of natural areas putting them in context with their surroundings, looking at degree of isolation, connectedness, level of contrast and distribution across the landscape.
- Comparison of the natural areas layer with predicted disturbance regimes to see if natural areas are susceptible to infrequent or high intensity fire regimes.
- Determination of whether natural areas are meeting aquatic and riparian needs.
- Assessment of where natural areas are coinciding with centers of endemism and rare species or communities.
- An analysis of where natural areas are located in relation to expected increases in population in the region.
- A comparison of the natural areas layer to a similar layer that was built based on people's perceptions of natural and naturally appearing landscapes.

The information from the assessments will be used to help build the different alternatives for the Columbia River Basin EIS. The sum total of these kinds of analyses will provide a way of evaluating whether current natural areas are supporting the composition, structure and functions of ecosystems across the Columbia River Basin, and if not, may illuminate strategies for how this can be accomplished. This assessment is among the first to analyze the role of natural areas in the landscape at such a large scale.

Sarah Greene
Natural Area Scientist
Region 6, Forest Service

A Center to Coordinate Biological Control

A proposal to establish a Western Biological Control Center in Bozeman, Montana, is gaining support. The center is planned to be an interdepartmental, interagency facility dedicated to research, technology transfer, and implementation of biological control for weeds and insect pests on rangelands, croplands, and forests. The center will include staff from USDA Agriculture Research Service, Forest Service, Animal Plant Health Inspection Service, Fish and Wildlife Service, BLM, EPA, and others. It is hoped that a regional center will provide coordination and leadership in the development of biological control as an economical, long-term, environmentally sound solution to weed and pest problems.

For more information, contact Dr. Chuck Quimby, Research Leader, USDA ARS Rangeland Weeds Laboratory, Culbertson Hall, Montana State University, Bozeman, MT 59717, (406)994-4526.

Natural Areas Report

Editors: Sarah Greene
Margaret Herring

Natural Areas Report is published three times a year for scientists and managers working in natural areas throughout the country. This issue was supported by the USDA Forest Service Pacific Northwest Research Station natural area program.
Send ideas, letters, and comments to:

Natural Areas Report
Pacific Northwest Research Station
3200 Jefferson Way
Corvallis, OR 97330
503-750-7360

Printed on recycled paper

Natural Areas Report
U.S. Department of Agriculture
Pacific Northwest Research Station
333 SW First Street
PO Box 3890
Portland, Oregon 97208

Official Business
Penalty fo Private Use, $300

Fred Swanson
FSL
3200 SW Jefferson Way
Corvallis, OR 97331