

An Introduction to Invasive Plant Species in the West



**Western Forestry Leadership Coalition
Invasive Plant Strategy Report**

The Silent Wildfire

The Western Forestry Leadership Coalition

The Western Forestry Leadership Coalition is a unique state-federal partnership working with the people and resources in the west delivering State and Private Forestry Programs. The WFLC is the result of a more than 50-year working partnership between State Forestry Agencies and the USDA Forest Service. The members of the WFLC are the 17 western State Foresters, 6 Territorial Foresters and the seven USDA Forest Service western Regional Foresters, three Research Station Directors, and the Forest Products Lab Director.

The mission of the WFLC is to promote science-based forest management that serves the values of society and ensures the health and sustainability of western forests. To achieve that mission the members of the WFLC have chosen Invasive Species as one of five top western forestry priority issues. Addressing this major threat is critical to preserving the health and sustainability of the forests and grasslands of the west.

Introduction

THE SILENT WILDFIRE - TELLING THE INVASIVE SPECIES STORY

The Western Forestry Leadership Coalition (WFLC) created this document to demonstrate the extent and devastation of western plant invasive species, a document that would spark interest and action. To accomplish this effort, the WFLC appointed a science-based task force to develop this primer on invasive plant species to give readers a sense of the scale and urgency of the invasives issue.

This document provides a sampling of invasive plant species in the West. It provides a snapshot of the invasive plant issue, extent, and the different approaches, challenges, and opportunities for coordinated actions within and across the major coarse-scale ecosystems of the Western United States. Invasive plant status and level to which they are being addressed varies greatly. Some plants such as salt cedar and spotted knapweed have received extensive research regarding ecological effects and control methods; other invasive plants are just beginning to move into natural systems, and there is limited research concerning their effects or potential treatment.

INVASIVE SPECIES – PREFACE

Invasive species can come in many forms such as insects, diseases, plants, and other taxa. The continued introduction and spread of invasive species along with catastrophic wildfire, are the two greatest natural resource threats facing western forests. Invasive plants already have taken over more than an estimated 133 million acres nationally and are continuing to spread to an additional 1.7 million acres every year. If we are to address this critical issue in the west we must understand how to facilitate and coordinate action to combat this forest threat. The WFLC is committed to be a partner in this effort and to help make a difference in the control of invasive plant species in the west.

A Plant Is Considered Invasive If It Meets Two Criteria:

- It is non-native to the ecosystem under consideration, and
- Its introduction causes or is likely to cause economic or environmental harm or harm to human health.

Noxious weeds are a legally defined subset of invasive plants within each state or province.

(Definition from Executive Order 13112, issued February 1999.)



Pacific Shipping Activities for one year. – PacPol.

Invasive plant species know no boundaries; they span landscapes, land ownerships and jurisdictions. As international and interstate commerce and travel increases, invasive plant spread is increasing. Shipping of goods spans the globe and will only increase in the next fifty years. The Western United States has seen profound biological, economic, and social impacts from invasive plants. The full effects for many invasive plants within each state or province on western ecosystems are difficult to quantify.

The task force used seven major ecosystems in the West (Figure 1). The summaries of each ecosystem highlight characteristic invasive plants and discuss approaches, challenges and opportunities. These ecosystem areas are delineated based on similar climate, vegetation and topography (Baileys Ecoregional classification –see Nationalatlas.gov).

Theses seven geographic areas are:

1. Temperate Steppe Ecosystems (Interior West, east of Rockies)
2. Subtropical Desert and Subtropical Steppe Ecosystems (Desert Southwest)
3. Temperate Desert Ecosystem (Intermountain area)
4. Marine Ecosystem (Western Oregon and Washington and southeast Alaska)
5. Mediterranean Ecosystem (much of California),
6. Subarctic and Tundra Ecosystems (much of Alaska)
7. Tropical Rainforest Ecosystem (Pacific Islands)

To provide strategic focus, some or all of the following five topics are addressed for each ecosystem:

1. Prevention - Stop new unwanted introductions before they arrive,
2. Early Detection and Rapid Response - Aggressive actions to detect and eradicate any new introductions before they become established,
3. Control and Management - Contain and reduce established infestations,
4. Restoration – Minimize or reverse the harmful effects of invasive plant species,
5. Research – Conduct research to fill knowledge gaps and develop new scientifically based treatment options.

“State and local action is essential to ensuring early identification and rapid response to incipient infestations”

- Michael Buck, former State Forester, Hawaii before the House Resources subcommittee. April 04.

Major Ecosystems of the West

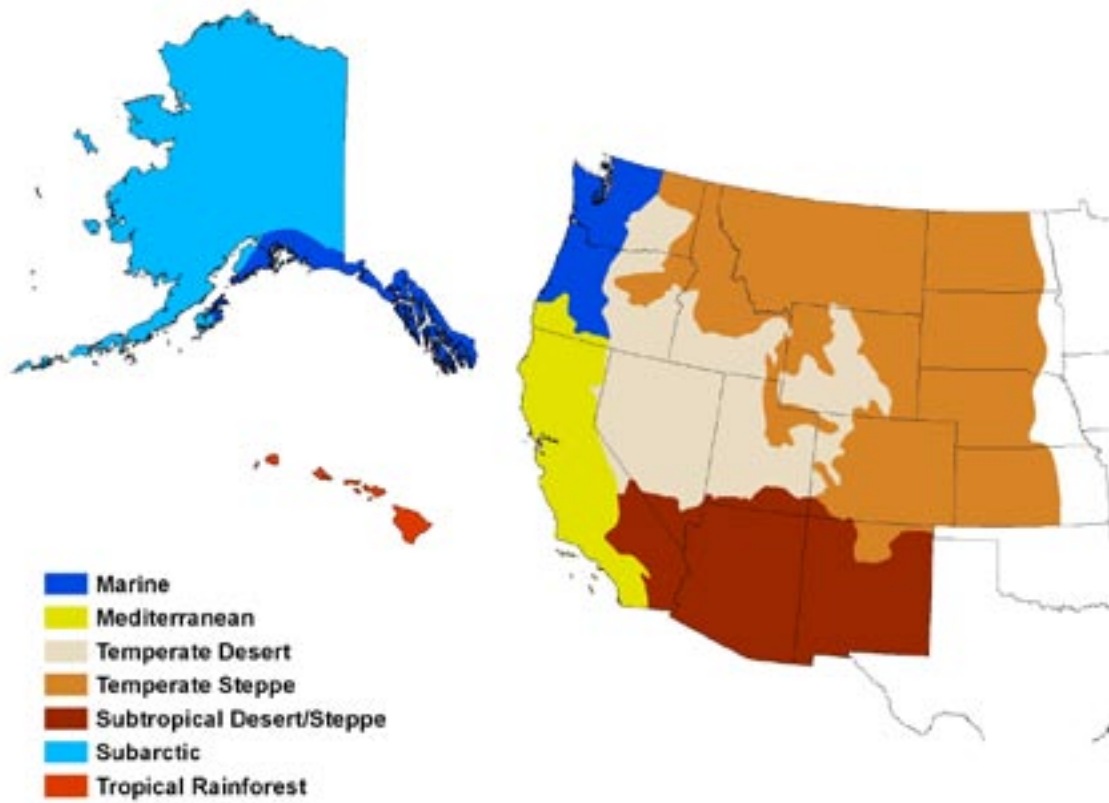


Figure 1

Temperate Steppe Ecosystems



SITUATION:

The temperate steppe ecosystems are located in the semi-arid continental climate zone, where evaporation usually exceeds precipitation, even in years of maximum summer rainfall. One of the fastest spreading and most damaging weeds in the temperate steppe ecosystems is leafy spurge. Leafy spurge is estimated to cause over \$100 million in damage each year. Native prairie plants and grasses are easily displaced by leafy spurge infestations. States with the greatest infestations include Idaho, Montana, Idaho, North Dakota, South Dakota, Wyoming, and Colorado.

Leafy Spurge...

infests more than five million acres of land in 35 states. Because seed banks of up to 1,000 seeds per square foot can remain even a decade after repeated, full eradication is rarely achieved.



Leafy Spurge

Rush Skeletonweed...

spreads by seeds and roots. Its seeds can germinate within 24 hours and new shoots can emerge from a root depth of 4 feet.



Rush Skeletonweed

It has spread from 40 acres to 4 million acres in Idaho in just three short decades, but in many areas east of the Rockies, opportunities

exist for early detection and control. Judicious monitoring, prevention, eradication and habitat restoration will keep Rush Skeletonweed from spreading across the great plans. Left unchecked, Rush Skeletonweed can form dense monocultures on rangelands and displace native plants.

Dalmatian Toadflax...

is native to temperate steppe communities. It's extensive and deep root system along with a wavy leaf help this plant spread rapidly and resist control. Valuable wildlife forage is lost when toadflax invades. Dalmatian toadflax is an escaped ornamental plant that invades dry timber and rangeland areas.



Dalmatian Toadflax

PREVENTION:

TEAM Leafy Spurge is an interagency/interstate research and demonstration program focusing on the Little Missouri River and associated watersheds in Wyoming, Montana, North Dakota and South Dakota. They're working to research, develop and demonstrate ecologically based, integrated pest management strategies for landowners and land managers to achieve effective, affordable leafy spurge control. They've produced a documentary entitled "Purging Spurge: Corraling an Ecological Bandit" in

partnership with Prairie Public Broadcasting, Inc., published “how-to” manual on leafy spurge management, grazing manuals, CDs, biocontrol manuals and produced 1,800 Information Resource Center sets for Extension Agents, Weed Supervisors and others across a six-state region.

DETECTION AND RAPID RESPONSE:

Tribal, federal, state, county, university and producer weed specialists are working together on standardized weed reporting systems. The Montana Noxious Weed Trust Fund sponsors the Montana Noxious Weed Survey and Mapping System. The system is compatible with computer geographic information systems and enhances the effectiveness of weed management by developing and implementing a standardized weed mapping system for Montana. The team developed and maintains a statewide spatial database for weed management. This system can calculate total number of acres infested, determine how fast noxious weeds are spreading, evaluate the usefulness of new technologies for weed mapping, and provide information, training, and technical support.

CONTROL AND MANAGEMENT:

One hundred percent eradication of species such as leafy spurge is rarely achieved, but infestations can be reduced to a manageable level through integrated pest management. Counties in Wyoming have cooperatively identified and contributed to manage their top weed species: A \$150,000 fund was developed to identify and test Dalmatian toadflax bio-control agents. The Rush Skeleton Task Group was developed in part to find and establish effective biocontrols, coordinate control efforts over the long-term and educate the public. This interagency effort includes the entire state of Idaho and will benefit other states.

RESTORATION:

The Ninepipes Center for Wildlife Research and Education is the site of a collaborative project to provide new techniques for revegetating weed-infested lands, manage invasive species by addressing components of plant community change and increase the cover, density, and biomass of drought-resistant native vegetation. Collaborators include the Center for Invasive Plant Management, the county weed district, the Confederated Salish and Kootenai Tribe and Montana Fish, Wildlife & Parks.

RESEARCH:

A small experimental release of the first new bio-control agent for Rush Skeletonweed made in Idaho in 2002 and 2003 was successful. Research is occurring in Bozeman, Montana to develop methods for mass rearing, study biology and evaluate climate matches. This information will be used in the future for collecting new populations around the Black Sea.

Subtropical Desert and Subtropical Steppe Ecosystems



SITUATION:

Southwestern plant communities range from arid deserts to coniferous forests and alpine meadows. Slight increases in elevation can cause a semiarid steppe climate on plateaus and high plains that would otherwise be desert. Although the most troublesome invasive plants vary throughout the region, each climatic zone has been degraded by exotic invasive species.

Riparian corridors at all elevations are especially important features of these ecosystems that are being impacted by invasive plants. Particularly widespread and troubling species of riparian zones include salt cedar and Russian olive. Salt cedar has invaded nearly every drainage system in the Southwest, becoming naturalized along streams, canals and reservoirs. Salt cedar and Russian olive form dense thickets that exclude native plants, increase the frequency and intensity of fire, and reduce stream flow. Salt cedar is more drought and salt tolerant than native species, and can out compete native species such as cottonwood and willow that protect stream banks from erosion and provide habitat and food for native birds.

Lehmann lovegrass...

a perennial South African grass introduced in the 1930s for livestock forage and erosion control has expanded explosively in southeastern Arizona. Lehmann lovegrass initiates spring growth a few weeks before native grasses, and thus leaves native grasses with less available soil water, and a reduced ability to compete for soil water.



Lehmann lovegrass

Camelthorn...

is an invasive herbaceous perennial weed of emerging importance to riparian areas of the Southwest. Native to the Middle East, infestations are commonly found along rivers and in floodplains, where they form thick dense stands. Infestations may also occur along roadsides and in pastures. Perennial roots of camelthorn penetrate deep into the soil and store large amounts of energy as the season progresses, making eradication difficult. Camelthorn currently poses a large and serious problem in Arizona. In New Mexico, several large infestations exist in southern portion of the state, with a handful of small patches in the Albuquerque area.



Russian olive

Russian olive...

effectively takes over stream banks and other wet areas. Impacts from both salt cedar and Russian olive are detrimental to native wildlife because infested habitats are inferior in terms of food value and shelter compared to native plant species.

DETECTION AND RAPID RESPONSE:

In Arizona, an interagency working group was established to apply science-based criteria to evaluate and categorize non-native plants that occur in and are potentially detrimental to the state's wildlands. To date 52 plants have been evaluated. This prioritization effort is critical for focusing limited control dollars on the most invasive species and on those most likely to be eradicated. A number of invasive plants known to be highly invasive in other regions have recently been documented in southwestern woodlands and forests. Included in this list are three species of knapweed: spotted, diffuse and squarrose; Dalmatian toadflax; and leafy spurge. Unlike other mountainous regions in the west, population levels of these species are mostly small and scattered, and eradication is still possible.

CONTROL AND MANAGEMENT:

Control of salt cedar has become a top priority of both politicians and land managers in the Southwest. For example, the 2002 New Mexico Legislature appropriated five million dollars for the purpose of controlling Salt Cedar and Russian Olive, along the Rio Grande and Pecos River corridors. Salt cedars are prolific seed producers that quickly colonize moist areas. Areas infested with salt cedar cannot be treated easily. Mature plants resprout after fire, flood or herbicide treatments. Most control efforts rely on herbicide application, alone or in combination with mechanical treatment. Fifteen insects are being investigated as potential biological control agents for saltcedar. Two now have preliminary approval for release. Once established, Russian olive also is difficult to control because it forms root shoots and suckers. Control efforts have included mowing, cutting, burning, herbicide treatments, and combinations of these methods.

Camelthorn is best controlled when it is young and establishing. Several herbicides have been effective in eradicating established infestations, but follow-up spot treatments to resprouting plants were necessary. The effectiveness of chemical treatment is dependant upon the age of the plants, so the earlier populations can be detected and sprayed, the better the success of the treatment

RESTORATION:

Restoration efforts must include measures to reduce salt cedar, protect stream banks, and restore wildlife habitats. With the decline in native riparian species, salt cedar infestation can be expected to intensify. Russian olive has the potential to expand in riparian woodlands where it could become the dominant woody plant.

RESEARCH:

Salt cedar has received extensive research into ecological effects, and attention to developing sound methods of reduction and control. Currently, researchers at the Rocky Mountain Research Station are working with the Middle Rio Grande Conservancy District, Bosque del Apache National Wildlife Refuge, City of Albuquerque Open Space, and others to identify methods for controlling invasive phraetophytes along the Rio Grande from Albuquerque to Socorro. The Rocky Mountain Research Station, in collaboration with Northern Arizona University and University of Arizona, is conducting research on several invasive plant topics; one study is aimed at designing prescribed burns (and their timing) to favor native species over Lehman lovegrass.

Temperate Desert Ecosystem



SITUATION:

A common misconception is that these areas are too dry for invasive plants. To illustrate how susceptible these areas are, consider these statistics: Noxious weeds are increasing on western BLM administered lands at approximately 2,300 acres per day. Weeds are spreading at a rate that is doubling the affected acreage every five years.

Cheatgrass provides an example of the tremendous environmental impact that invasive exotic weeds can have. There were no significant annual grasses in the Intermountain West until cheatgrass was introduced in the early 1900s. Now, cheatgrass is the dominant species on more than 100 million acres in the intermountain west. Cheatgrass carries fire easily and is fire adaptive, which allow it to reestablish rapidly after a fire. When cheatgrass invades an area, the frequency of fire is likely to increase. For example, cheatgrass invasion has increased the frequency of fires from once every sixty to 110 years to once every three to five years on millions of acres of rangeland in the Great Basin. Native plant communities become infested with cheatgrass, which is then commonly invaded by medusahead, which is then frequently invaded by yellow starthistle or knapweed, which is then invaded by sulfur cinquefoil. With each step of the downward spiral, one annual weed is replaced by another deeper rooted annual plant, which is replaced by more tenacious extensively, rooted perennial weeds, resulting in reduced site productivity and restoration becomes more difficult if not impractical.



Cheatgrass

Cheatgrass...

monocultures exist on more than 12.5 million acres in Idaho and Utah, and 9 million acres in Nevada.

Tansy ragwort...

has infested areas west of the Cascades for decades, but it is now invading the temperate desert ecosystem, brought in via hunter's contaminated straw and hay. Current infestations of tansy ragwort in Montana exploded following the 1994 fire season and road closures enacted as part of the fire recovery were critical in reducing the spread of tansy ragwort seed.



Tansy ragwort



Purple loosestrife

Purple loosestrife...

impacts on native vegetation have been disastrous, displacing more than 50 percent of the biomass of some wetland communities. Dense infestations choke off wildlife habitat, waterfowl nesting areas and access to water. Currently, isolated infestations occur throughout the Intermountain West. Purple Loosestrife can produce up to 3 million seeds and 50 new shoots yearly.

PREVENTION:

Nevada's War on Weeds Series includes building coalitions, mapping, prioritizing, prevention, detection, project plans, monitoring, funding and resources. The University of Nevada, Reno Cooperative Extension has developed posters for over 30 different invasive plant species. Their "Wanted: Dead, Not Alive!" poster on purple loosestrife is part of a campaign to manage invasive and noxious weeds and includes information on identification and control. Another example of education is the Center for Invasive Plant Management's brochure "After The Fire - Restore and Protect Our Western Ecosystems" discusses invasive weeds such as cheatgrass – an invader of burned areas.

DETECTION AND RAPID RESPONSE:

Continued effort is being focused on inventory work on weeds within the intermountain west. The Tansy Ragwort Cooperative of NW Montana, has divided up a 500,000 acre project area into sections based on infestations level, land ownership and management goals and is beginning an inventory and mapping effort that includes 100% inventory of road systems and off-road inventory of high risk areas.

An overall inventory system for invasive plants would be helpful to maintain current inventory information across jurisdictions.

CONTROL AND MANAGEMENT:

Agencies throughout the Intermountain West are implementing an integrated approach using several methods (biological, chemical control, mowing, grazing, prescribed burning, and revegetation with competitive species) to control these weeds. Regulation is another example of control. Because weeds like purple loosestrife can be spread by escaping cultivation, Nevada state law prohibits nurseries and mail order companies from selling purple loosestrife or its cultivars; North Dakota state law requires that any cultivars of purple loosestrife growing in private gardens or in a public planting be removed.

RESTORATION:

The Nature Conservancy's Zumwalt Prairie Preserve in Oregon is the site of a collaborative project aimed at restoring a native plant community. The project is evaluating how seeding of native bunchgrass and forb species, cattle grazing, and their interactions may affect the cover, density, richness, and biomass of both desirable native species as well as undesirable exotic grasses and forbs.

RESEARCH:

Cooperative efforts in Oregon, Utah, Idaho and Nevada are underway to address the cheatgrass problem. Research is looking at natural community changes, restoration potential, and controlling the spread of the cheatgrass seed with grazing and burning.

Marine Ecosystem



SITUATION:

The marine ecosystem has moderate temperatures and annual rain fall averages ranging between 20-150 inches annually. The region has many ports of entry and diverse ecological and agricultural areas. Invasive weed issues range from terrestrial to aquatic species and encompass a variety of environmental settings from production lands to urban parks.

With urban sprawl throughout the region, invasive weed issues are both social and environmental issues. Escaped urban garden plants, like ivy and purple loosestrife, are rapidly taking over many urban forests and moving into adjacent forests, aquatic environments, and agricultural lands. Ecologically essential natural areas, for species such as the endangered salmon, are rapidly deteriorating due to the onset of hundreds of escaped ornamentals.

The land stewards in this region work together with various government agencies and non-profit programs to achieve weed control. Legislation mandates control for many invasive weeds. Each state allocates funding to state wide weed control programs with a focus on localized applications. Weed control programs in this region focus on preserving natural biodiversity and protecting localized commodities from weed invasions.

Giant Hogweed...

a federally listed noxious weed, is a prime example of an ornamental plant gone bad. Distribution in Washington is less than 100 acres state wide, with most populations found in urban gardens and along riparian areas near cities. This plant towers in local gardens as a prized ornamental but once escaped it aggressively invades riparian areas shading out native vegetation. The large showy plant has a very caustic sap that causes sever blistering and burning. This plant is designated for eradication based on its limited distribution and potential for large scale environmental and public health impacts.



Giant hogweed



Knotweed

Knotweeds...

are capable of monopolizing the sensitive riparian zones and gravel bars through out the temperate region. Seeds and root fragments are easily moved along the streams with hard rains and high water. Knotweeds have also popped up all around urban neighborhoods in back yard gardens, in local parks and along roadsides. This plant is capable of pushing through concrete and monopolizing abandoned homesteads. They can produce new plants from a stem or root fragment less than 1 inch in length. Bohemian, giant, Japanese and Himalayan Knotweeds were originally brought from England as an ornamental fence. This plant is invading hundreds of acres

of the region's watersheds. The extent of infestation for these weeds is not fully known, but many groups are determined to control knotweeds because they threaten vital salmon habitat.



Eurasian Watermillfoil

Eurasian Watermillfoil...

is an invasive aquatic weed spread throughout the marine ecosystem by boats and other aquatic recreational equipment. The plant creates thick mats clogging waterways and crowding out native plant species from ponds and lakes. The thick mats then change the water pH and cause temperatures to vary. Control programs for this plant are based around information at boat docks and through lake stewardship forces. Programs for control vary, ranging from aquatic herbicide use in small lakes to using harvesting machines in rivers. Control of this plant is difficult due to the ease of its spread and close relation to a native

milfoil species. These plants are sometimes sold in the aquarium industry and “set free” when people dispose of their fish in local waterways.

One Eurasian Millfoil fragment left on a boat can infest an entire lake or start a new infestation in a river.

PREVENTION:

Much effort is being put into education and activation of the public. Many of the state listed noxious weeds have educational publications available on line and in extension offices and many of the plants on these states noxious weed lists are prohibited for sale. The states’ noxious weed programs work closely with local weed control programs and other environmental organizations to provide a communications network for reporting and preventing establishment of new infestations. Both Oregon and Washington have statewide weed programs, with professional staff, to provide the public with information on local weed problems and control efforts.

CONTROL AND MANAGEMENT:

In Washington each of the counties are required to have a weed control program and are required by law to control many weeds of environmental and economical concern in the region. In Oregon the Department of Agriculture has vegetative management programs that are focused on the control of weeds throughout the state. Many non-government agencies and government agencies are teaming up to create Cooperative Weed Management Areas (CWMAs) throughout the region. Many of these forces focus on a few invasive plant species within specific ecologically sensitive areas, including watersheds and estuaries.

RESEARCH:

The region is rich with research on invasive species and impacts on natural environments. Many research projects take place at the state universities, who coordinate with agencies and local non-government organizations on control and restoration research programs. Some plants currently being researched are knotweed species, reed canary grass, common reed, and scotch broom. Researchers are also beginning to study the broader impacts of escaped ornamentals and invasive plants in urban forestry.

Mediterranean Ecosystem



SITUATION:

There are roughly 70 million acres of forests, range, and brushlands in California. This represents about 70% of the land area of the state. About 25 million of these wildland acres are in non-Federal ownership, while 45 million acres are managed mainly by the Forest Service, Bureau of Land Management, the National Park Service, and the Department of Defense. Because of the Mediterranean climate, this area of the West contains many highly urbanized areas where the awareness of noxious and invasive weeds is low, especially concerning wildland weeds. Although the Mediterranean ecosystems of the West have been exposed to many invasive weeds for a long period of time, the forested ecosystems remain relatively free of invasive weeds.

The knapweeds...

(spotted, diffuse, squarous, Russian) are examples of species that are generally considered for eradication. Russian knapweed was introduced into California's Central Valley in the nineteenth century directly from Europe as a contaminant in agricultural seed. It is likely that the other knapweeds were introduced through interstate movement of contaminated seed early in the twentieth century.



Knapweed

Knapweed occurrences are generally considered for eradication using herbicides and cultural methods such as burning, pulling, mulching, and cutting.



Yellow starthistle

Yellow starthistle...

is widespread through much of California, especially in the Central Valley and oak woodlands where control and restoration methods are being used to reduce the impacts of this weed. Control efforts for yellow starthistle include chemical, biological (including grazing), and cultural (burning and mowing). Several insects have been introduced over the last twenty years as biological control agents, and more recently, host-specific rust has been introduced.

Yellow starthistle is widespread throughout much of the Mediterranean ecosystem, with an estimated 12 million acres infested in California, where it was introduced in the mid-1800's.

The Brooms...

primarily French broom and Scotch broom, but also Spanish broom, were introduced as an erosion control planting. The qualities that made brooms useful initially now make it difficult to control. The brooms were introduced into California in the mid-1800's. They can be found throughout the wildlands in this area. Dense stands of older broom present a high fire hazard.



Scotch broom

PREVENTION:

The California Department of Food and Agriculture (CDFA) maintains the list of state-designated noxious weeds, regulates plant movement and commerce, coordinates eradication efforts, and provides funding, oversight and guidance to county-based cooperative weed management areas (CWMAs).

Many of the CWMAs have developed noxious and invasive weed guides for distribution in the local area. These guides are useful as an educational tool, but are also critical in conducting surveys for these weeds.

New wildland locations of knapweeds have often been the result of vehicle or equipment movement from infested parts of the West into uninfested areas of the state, often as a result of wildfire suppression activities. This has spurred the development of weed prevention practices, such as equipment washing techniques.

DETECTION AND RAPID RESPONSE:

Surveys are a priority for Federal, State, and County agencies, and many of the CWMAs are involved in coordinated surveys across land ownerships. As an example, over the last few years, the El Dorado CWMA has been involved in surveys along roadways throughout El Dorado, Alpine, and Amador counties. In most cases, weeds were eradicated as they were found, and their location recorded for future re-visits.

CONTROL AND MANAGEMENT:

Some of the more familiar noxious and invasive weeds in California have been in the state for many years and have become firmly established. A couple of examples:

Control efforts for yellow starthistle include chemical, biological (including grazing), and cultural (burning and mowing). It is widespread through much of California, especially in the Central Valley and oak woodlands where control and restoration methods are being used to reduce the impacts of this weed. Several insects have been introduced over the last twenty years as biological control agents, and more recently, host-specific rust has been introduced.

For the brooms, control efforts include chemical, cultural (burning, cutting, pulling), and biological (including grazing). Current efforts are underway by a force called the International Broom Initiative to identify additional biological agents that can be introduced for broom control.

RESTORATION:

Much of the work done on private lands (primarily rangelands) with yellow starthistle involves not only a control component but a restoration component as well. Restoration of native or desirable non-native grasses and forbs in former yellow starthistle-infested habitat is critical to successful control, as this thistle is not an especially strong competitor. Restoration is necessary to replace the starthistle as well as prevent invasion by other undesirable weeds, such as cheatgrass or medusahead. Combining herbicides and prescribed burning over a several year period has been successful in reestablishing rangeland habitat in northern California.

RESEARCH:

Much of the rangeland and forest noxious weed research is coordinated or conducted by the University of California Cooperative Extension Service. This is where the strategy for large-scale restoration of yellow star thistle using fire and herbicides was developed. The California Department of Fish and Game conducts applied research on riparian invasive species, such as giant reed (*Arundo donax*).

Subarctic and Tundra Ecosystems



SITUATION:

Alaska is over 350 million acres of land area with significant area of both subarctic/tundra ecosystems and the temperate coastal rainforest ecosystem in the southeast panhandle. Due to perceived remoteness and lack of exposure, past attention to invasive plants in these ecosystems has been limited. In the last few years agencies and the general public have gained an increased recognition of more incursions than previously thought. This has resulted in several cooperative efforts by a variety of agencies and interested individuals to address the issue.

Even so, Alaska is currently in a unique position to prevent this potentially severe problem before it quickly develops into the ecological and management quagmire familiar to many other parts of the country. The costs can be low, if infestations are quickly identified, controlled and eradicated. In 2000, a Memorandum of Understanding among federal agencies, the state of Alaska and major invasive plant interest forces was instituted to address the introduction of invasive and noxious plant species. Working together, this force developed a strategic plan that lays the groundwork for cooperative surveys, education, prevention, control, and eradication measures.

Alaska has small isolated infestations of several invasive plant species for which rapid response to eradicate would be appropriate. Two rapid response priority species are; Spotted Knapweed and Orange Hawkweed.

Spotted knapweed...



Spotted knapweed

has been found in Alaska at five separate locations. Each spot had between 30 and 100 plants. Each is now being controlled with the goal of eradication of this species. Quick detection and quick response is the goal for Alaska.

Orange Hawkweed...

is now spreading from many different communities and villages out into the native grassland and rich forb meadows in different parts of Alaska. It is one of the

first species that will need a long-term control program.



Orange knapweed

Canada Thistle...



Canada thistle

is one of the few that is now making the leap from our roadsides into Alaska's native ecosystems. It is spreading rapidly within urban areas, and is now found in beach meadows in Southeast Alaska. Biological control agents may be appropriate for this species in the near future.

PREVENTION:

This is the cornerstone of the invasive plant species work in these ecosystems. A number of invasive plant brochures, a booklet covering 24 selected invasive plants, and a gardening Voluntary Codes of Conduct have been published in Alaska. In addition, accelerated public outreach through Cooperative Extension Service and work to determine spread of invasives through hay and other materials has been initiated with the Agricultural Research Service.

DETECTION AND RAPID RESPONSE:

Continued effort is focused on inventory work to support a better understanding of what invasive plants occur, and which infestations should be targeted for eradication/control. Over the last three years inventories have been conducted in most Southeast Alaska communities, the Matanuska-Susitna River Valleys and the Kenai Peninsula. This inventory information is being entered into the Alaska Exotic Plant Clearinghouse database. Private individuals, many different tribal, state, and federal agency representatives have all contributed to the building and population of this database. New records of non-native species are turning up regularly.

In cooperation with the Alaska Association of Conservation Districts a Rapid Response Program has been developed to target the incipient infestations that are now showing up. This program will lead establishment and implementation of CWMAs that are now being created across Alaska.

CONTROL AND MANAGEMENT:

At this time, control projects are limited. Projects are being conducted in the area of Delta Junction to control Canada thistle and sow thistle, on the Kodiak National Wildlife Refuge to control Orange Hawkweed, and around Juneau to control garlic mustard. Increased control work is anticipated in the near future as Weed Management Areas become established and focus on specific projects.

RESTORATION:

Work to date has focused on small acreage where there is typically sufficient native seed for restoration. As control efforts accelerate in the future, additional restoration needs are anticipated.

RESEARCH:

Little research has occurred in Alaska to date, this is now changing as white sweet clover, Japanese knotweed and other species, and basic patterns of movement of invasive plants are now being studied.

Tropical Rainforest Ecosystem



SITUATION:

Tropical forests in Hawaii and the U.S. affiliated Pacific Islands (Pacific Islands) provide critical habitat to endangered plants and animals and vital watershed services. Oceanic islands are characterized by geographic isolation, high levels of species endemism, limited spatial extent, and heterogeneous landscapes, all of which make island ecosystems and their economies particularly vulnerable to invasive plant species impacts.

Although their land areas are small, Hawaii and the Pacific Islands have significant invasive plant problems. Hawaii's problems have been recognized for more than 25 years, and to address this issue, Hawaii has engaged major stakeholders to develop the framework for multi-agency coordination through locally driven public-private partnerships on each major island. These forces set priorities to address local issues for species control and coordinate actions and resources. Recently, the State of Hawaii formed a cabinet-level coordinating force to address invasive species issues, developed a statewide strategic plan and dedicated funding to accomplish its goals. Other Pacific Islands are developing similar structures suited to their own local needs. Examples of invasive plant species include:

Downy rose myrtle...

is an attractive ornamental spread by gardeners. On Maui, early detection and a rapid response led to the eradication of three new populations.



Downy rose myrtle



Fountain grass

Fountain grass...

covers over 200,000 acres on the island of Hawaii, severely impacting critically endangered dry forests. Current research on forest restoration techniques holds promise for replacement of fountain grass with native understory species and ecosystem restoration on a landscape level. Reduction in fountain grass cover would also reduce fire occurrence in some of Hawaii's most fire prone areas.

Miconia, Strawberry Guava, and Siam Weed...

calls for an integrated approach. Control of these widespread species involves reducing the spread of current populations and the use of carefully screened biological agents. Scientists in Hawaii and Guam, are exploring natural enemies within the native ranges of these species and they have identified several promising agents.



Miconia

PREVENTION

Ever increasing global trade ensures a continued source of plant introductions to Hawaii and the Pacific Islands. Improved inspection and quarantine capabilities and the application of newly developed tools to prevent intentional introductions are needed. The Secretariat of the Pacific Community is developing an international database to track the movement of pests throughout the Pacific. Additional tools include readily accessible online information on invasive species ecology and distribution (www.hear.org) and a scientifically based protocol to assess risk that a species once introduced will become invasive developed by the University of Hawaii and the U.S. Forest Service. Voluntary codes of conduct for nurseries, botanical gardens and others and alternative planting lists are also under development.

DETECTION AND RAPID RESPONSE

Through the deployment of rapid response teams, the Island Invasive Species Committees in Hawaii have eradicated populations of several invasive plants and monitoring continues to prevent re-infestation. Palau has identified several invasive plants for eradication within the next ten years through a focused and coordinated effort involving all communities. Roadside surveys in Hawaii have identified many newly established species, some of which will be targets of rapid response efforts. More inventory work is needed to assess the importance of all major invasion pathways.



Biological control using insects

CONTROL AND MANAGEMENT

While the urgent need for control of certain particularly harmful invasive plants, including Miconia, is widely recognized and indeed galvanized Hawaii's awareness of the problem, control programs are becoming more strategic and integrated with ecosystem management. Successful site-based chemical and mechanical control is conducted in National Parks and National Wildlife Refuges within Hawaii. Watershed partnerships bring together landowners to manage ecologically meaningful areas and practice integrated control of invasive plants. An interagency biological control working force coordinates plant biological control research and implementation

statewide. The U.S. Forest Service, Hawaii Department of Agriculture and the U.S. Geological Survey are active in development and evaluation of biological agents for pest plant control, including Miconia, strawberry guava, and others. In the western Pacific, the University of Guam is working on biological control for Siam weed and giant sensitive plant in the Pacific.

RESTORATION

Natural ecosystem restoration following large-scale invasion by introduced plants is still in its infancy in Hawaii. Some notable projects include efforts to control assemblages of invasive plants within high-priority natural areas in Hawaii Volcanoes National Park, the efforts of the Dry Forest Working Force on Hawaii to reduce the cover of fountain grass in fire prone ecosystems in West Hawaii, and the koa reforestation project of the Leeward Haleakala Watershed Restoration Partnership on Maui.

RESEARCH








Research by the U.S. Forest Service and others is focused on understanding the impact of invasive species on forest ecosystems, on the development of safe, effective biological control agents for forest weeds, and on the understanding of factors leading to invasiveness of introduced species.

Summary

Table 1.

The following table provides a snapshot of the invasive plants discussed in this document and displays the differing occurrences and responses across the West. It lists invasive plant name, geographic extent and current status of action, ranging from prevention and early detection/rapid response, to control.

The table also illustrates the complexities of coordinating management of invasive plant species and the need for identifying priority species locally. In some ecosystems Prevention (P) is used to keep them out, while in a neighboring ecosystem full-scale control (C) or Biological Control (BioC) efforts may be underway. Early Detection (E) is always an important tool to use in eventual control.

							
SPECIES	Tropical Rainforest	Mediterranean	Marine	Subarctic	Temperate Steppe	Temperate Desert	Subtropical Desert/Steppe
Miconia	E/C						
Fountain Grass	E/C						
Siam Weed	BioC						
Strawberry Guava	BioC						
Knapweeds (all spp.)	P	E/C	C	E	C	C	E
Yellow starthistle	P	E/BioC	E		E	C	
Brooms (Fr. Sc. Sp.)	P	E/C/BioC	C	P	E		
Giant Hogweed		P	E	P	E	E	
Japanese knotweed (related spp)			C	C			
Eurasian water milfoil			C	P	E	E	
Orange hawkweed			C	P/E	C	C	
Thistles	E	C	C	E/C	C	C	C
Leafy Spurge		P/E		P	C	C	E
Rush skeletonweed		P/E			E/C	E/C	
Dalmatian toadflax		E	C	P	E/C	E/C	E
Cheat grass		E/C		E	C	C	
Tansy ragwort			C	E	E	E	
Purple loosestife		E		P	C	C	
Russian Olive					C	C	C
Lehmann lovegrass						C	
Salt Cedar		E			C	C	C
Camelthorn							E/C

P=Prevention status; E=Early Detection/Rapid Response status; C=Control status; BioC=Biological Control status; If blank=Not a target in this ecosystem

Conclusion

The Western Forestry Leadership Coalition encourages and promotes the development of federal/state partnerships to address invasive species in the west. To facilitate this endeavor, this report has been created to highlight some of the vital concerns regarding western invasive plants and identifies several of the key species known at this time.

A successful invasive species program must address the complexity and wide-ranging agency and community needs at regional, state, and local levels. This includes developing initiatives that are non-regulatory and incentive driven, and which support and build capacity at the state and regional level. A successful program will also encourage voluntary cooperation of private entities and communities.

The WFLC supports actions and goals for a west-wide invasive species prevention and control strategy by implementation of a WFLC Policy Statement titled “The Threat and Impact of Invasive Species in the West: Strategies for Success.” This document is online at www.wflccenter.org/pressandpolicy. The policy statement supports the National Invasive Species Council’s approved guidelines at www.invasivespecies.gov/council/nmp.shtml, and the U.S. Forest Service’s National Strategy for Invasive Species Management at www.fs.fed.us/foresthealth/publications/Invasive_Species.pdf.

Related Documents and Websites

A National Early Detection and Rapid Response System for Invasive Plants in the United States: Conceptual Design. September 2003.

http://ficomnew.fws.gov/FICMNEW_EDRR_FINAL.pdf

Ecoregions and Subregions of the United States, Puerto Rico, and the U.S. Virgin Islands: Map Layer. 1995. R. Bailey, USDA Forest Service,

<http://nationalatlas.gov/ecoregm.html>

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Halting the Invasion: State Tools for Invasive Species Management. 2002. Environmental Law Institute, Washington D.C. 112 p.

Preparing for Invasive Species: A workbook for State Foresters. October 2003.

Invasive Insects, Pathogens, & Plants in Western and Pacific Island Forests, July 2002. W. Ciesla, Western Forestry Leadership Coalition

http://www.wflcenter.org/info_reports.html

National Association of State Foresters, Forest Health Committee.

<http://www.stateforesters.org/pubs/InvasivesWorkbook.pdf>

Southwest Exotic Plant Information Clearinghouse.

<http://www.usgs.nau.edu/SWEPIC/>

Weeds – The Silent Invaders. A USDA Forest Service Report on Invasive Plants. 2003. R10-TP-121. 11p. Western Forestry Leadership Coalition

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