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National Strategy and Implementation Plan for Invasive Species Management

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Forest Service

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National Strategy and Implementation Plan



for Invasive Species Management

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Executive Summary

Invasive species have been identified by the Chief of the U.S. Department of Agriculture Forest Service as one of the four significant threats to our Nation's forest and rangeland ecosystems. In response to this identified threat, a multidisciplinary team of specialists, managers, and researchers has worked together to produce this *National Strategy and Implementation Plan for Invasive Species Management* (national strategy) to guide the Forest Service as it takes on the invasive species challenge.

A strategic Forest Service response to invasive species is a large and significant undertaking. We have come far in addressing the invasive species problem in the United States, but we want to improve our effectiveness. This new strategy identifies those next steps we need to take as an agency, often by working with partners.

This document is not designed to serve as a comprehensive, all-encompassing strategy. Instead it is intended to identify a strategic direction for Forest Service programs spanning Research and Development, International Programs, State and Private Forestry, and the National Forest System. To help us reach our goal, we have identified the most significant strategic actions leading us in that direction.

The strategy begins with a short description of the magnitude of the problem, characterizing invasive species as a "catastrophic wildfire in slow motion" because of the seriousness of the problem and its impacts, which know no boundaries.

A species is considered invasive if it meets these two criteria:

1. It is nonnative to the ecosystem under consideration.
2. Its introduction causes or is likely to cause economic or environmental harm or harm to human health.

This definition is derived from Executive Order 13112 issued February 3, 1999.

The Forest Service role results from its unique ability to make a difference nationally, including the agency's:

- Broad existing authorities and responsibilities assigned to the Chief of the Forest Service.
- Expertise in land management, research, entomology, pathology, ecology, and countless other specialties.
- Presence across the country and around the world.
- Relationships with every State and territorial agency with responsibility for invasive species.

As a result, the Forest Service is well positioned to be a leader nationwide and worldwide in the battle against invasive species. Our challenge is to learn to lead collaboratively.

This national strategy encompasses four program elements:

- 1. Prevention.**
- 2. Early detection and rapid response.**
- 3. Control and management.**
- 4. Rehabilitation and restoration.**

Each program element includes a description of success, accountability measures, a summary of the current program, and a list of strategic priorities. These strategic priorities are divided into short- and long-term actions, with longer term actions presented in three categories: implementation, information and technology development, and communication and technology transfer.



The Goal

Reduce, minimize, or eliminate the potential for introduction, establishment, spread, and impact of invasive species across all landscapes and ownerships.

The strategy also contains four themes common to all program elements:

1. Partnerships and collaboration.
2. Scientific basis, which includes conducting appropriate research activities to develop scientific information and technology, to ensure that assessment and management programs are effective and science based. Scientific basis also includes setting priorities based on risk assessment results.
3. Communication and education.
4. Organizing for success—incorporating the themes of improving capacity, procedural streamlining, and funding flexibility with long-term commitment.

Additional short-term actions are tied to these common themes. All short-term actions are summarized as an attachment in this executive summary.

Short-Term Actions

Element 1: Prevention

- Work with Animal and Plant Health Inspection Service and other partners to conduct pathway and species risk assessments for terrestrial and aquatic pests (plants, animals, insects, and pathogens) to identify priority invasive species for regulatory action.
- With partners, build awareness of invasive species and their threat at all levels and jurisdictions.
- Complete a national research risk assessment to identify high-priority exotic species and continue working in their countries of origin to develop techniques to deal with these high-priority pests.
- Finish developing, and then populate, these Forest Service databases—Exotic Forest Pest Information System, Natural Resource Information System, financial and business functions accounting system, and Forest Service Activity Tracking System.
- Based on risk assessments, develop and implement prevention programs for identified priority invasive species and areas.

Element 2: Early Detection and Rapid Response

- Establish a Forest Service-wide Early Detection and Rapid Response (EDRR) emergency fund and guidelines to ensure that funds are immediately available to respond to new introductions.
- Invest in translating foreign language invasive species literature into English and vice versa.
- Develop maps of priority ecosystems and habitats placed at risk by invasive species.
- Working with partners, develop rapid response incident teams that cross jurisdictional lines and respond quickly to any invasive species outbreak.
- In partnership with the Departments of Homeland Security, the Interior, and Agriculture; State agencies; and others; develop high-speed, reliable, and robust technology to detect and respond to introduced invasive species.

Element 3: Control and Management

- Complete the comprehensive (all invasive species) inventory and mapping for all national forest land and water, including neighboring land where appropriate.
- Conduct a comprehensive (all invasive species) risk assessment based on existing information for the specific purpose of identifying priority species and areas for program focus.
- Focus resources on priority species control in priority areas as identified through risk assessments. Place specific emphasis on control of noxious weeds and other aquatic and terrestrial invasive species in national forests and associated areas.
- Through research and other means, develop additional tools, such as biological, cultural, chemical, and physical controls, for priority species; identify mechanisms involved in their expansion.
- Monitor long-term invasive species population trends and the effectiveness of treatments. Make this information readily available to all stakeholders, public and private.

Element 4: Rehabilitation and Restoration

- Compile, highlight, and share information about existing restoration and rehabilitation successes around the country about invasive species.
- Develop and implement national Forest Service policy that incorporates the best available science on using native or desired nonnative species for restoration and rehabilitation.
- Working with partners, develop an infrastructure for producing, purchasing, and warehousing seed supplies and other native and desirable nonnative plant materials on a regional basis.
- Prioritize and develop native plant stock that is resistant to invasive insects and pathogens.

Short-Term Actions for Themes Common to All Program Elements

- Work internally and externally to identify budget and capacity to implement the national strategy.
- Establish multidisciplinary (for example, wildlife biologists, forest health protection specialists, botanists, forest and rangeland staff, researchers, engineers, ecologists, and hydrologists) invasive species management coordination teams in each region/station to implement the national strategy and implementation plan.
- For all program areas of the Forest Service, develop a comprehensive invasive species policy that incorporates the National Fire Plan and Healthy Forest Restoration Act as they relate to invasive species and that provides guidance for incorporating related desired conditions, goals, and objectives into forest plan revisions.
- Pursue using the National Environmental Policy Act categorical exclusions and emergency authorities to ensure that environmental analysis does not inhibit environmentally sound rapid response or control efforts.
- Update, revise, and enhance the Forest Service's invasive species Web site to serve as a comprehensive internal and external communication tool.
- Work with partners to accomplish these tasks:
 - ◆ Develop a targeted marketing strategy to achieve public awareness of invasive species and understanding of the role citizens can play in all program elements.
 - ◆ Complete the invasive species best management practices video series and handbook.
 - ◆ Expand quarantine facilities for plant, insect, and pathogen control research.
 - ◆ Increase availability of taxonomists to identify new invasive species.
- Host a national Forest Service invasive species conference to improve coordination and collaboration among managers, researchers, and partners.
- Work with other agencies, such as Economic Research Service, to expand economic impact assessments for priority invasive species.
- Develop standard invasive species prevention language for use in contracts, permits, and closure orders.
- Ensure that national and regional programmatic performance measures correlate directly with the Forest Service Strategic Plan and track activities to achieve the goal in the national invasive species strategy.
- Work with agencies and partners to develop common, agreed-upon, and desired conditions in priority areas; reference points characterizing existing conditions/trends; and performance measures that use sustainability criteria and indicators that link to desired conditions and multiscale monitoring efforts designed to gauge progress and help focus scarce resources to highest priority areas.



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Introduction

The Chief of the U.S. Department of Agriculture Forest Service has identified invasive species as one of the four critical threats to our Nation's ecosystems. In response to this national threat, we have evaluated the role of the Forest Service as a leading forest research, forest health, and Federal resource management agency. We are aware of our significant role in addressing invasive species threats at the local, State, and national levels, as well as internationally. We have found the best opportunity for success comes from working strategically, using all our scientific, management, and partnership resources in unison.

This document is not designed to serve as a comprehensive, all-encompassing strategy. Instead it is intended to identify a strategic direction for Forest Service programs spanning Research and Development, International Programs, State and Private Forestry, and the National Forest System.

To that end, a multidisciplinary team of specialists, managers, and researchers developed this *National Strategy and Implementation Plan for Invasive Species Management (national strategy)*.

The strategy is predicated on the following elements:

1. Prevention—Stop invasive species before they arrive.
2. Early detection and rapid response—Find new infestations and eliminate them before they become established.
3. Control and management—Contain and reduce existing infestations.
4. Rehabilitation and restoration—Reclaim native habitats and ecosystems.

Interwoven with these program elements is the need to employ a science-based approach, work collaboratively and expand our partnerships, apply a prioritized system for taking action, and improve our efficacy and accountability. This national strategy builds from existing field information, policy, strategic plans, and authorities from Forest Service program areas.

Four themes are common among all program elements:

1. Partnerships and collaboration.
2. Scientific basis, which includes conducting appropriate research activities to develop scientific information and technology to ensure that assessment and management programs are effective and science based. A scientific basis also includes setting priorities based on risk assessments.
3. Communication and education.
4. Organizing for success—incorporating the themes of improving capacity, procedural streamlining, and funding flexibility with long-term commitment.

In all cases, we will strive to be proactive rather than reactive in our actions, holistic across landscapes and ownerships, and collaborative with partners.

Background

Invasive species have been characterized as a “catastrophic wildfire in slow motion.” Thousands of invasive plants, insects, fish, mollusks, crustaceans, pathogens, mammals, birds, reptiles, and amphibians have infested hundreds of millions of acres of land and water across the Nation, causing massive disruptions in ecosystem function, reducing biodiversity, and degrading ecosystem health in our Nation's forests, prairies, mountains, wetlands, rivers, and oceans. Invasive organisms affect the health of not only the Nation's forests and rangelands but also of wildlife, livestock, fish, and humans.

A species is considered invasive if it meets these two criteria:

1. It is nonnative to the ecosystem under consideration, and
2. Its introduction causes or is likely to cause economic or environmental harm or harm to human health.

This definition is derived from Executive Order 13112, issued on February 3, 1999.



Kudzu



Cogon Grass



Emerald Ash Borer



Tree of Heaven Infestation Impacting Powerline Right-of-Way

The Threat

Invasive species know no boundaries; they span landscapes, land ownerships, and jurisdictions. Their consequences cost the American public an estimated \$138 billion each year (Pimentel et al. 2000). They are a significant drain on the national economy.

- Private landowners and small communities are some of the hardest hit by invasive species infestations.
- Invasive species can be exceptionally damaging in urban environments where ecological systems are already stressed. Invasive species threaten the quality of life and the property values of millions of metropolitan residents across the country.
- Currently, 42 percent—400 of 958—of the plant and animal species listed by the Federal Government as threatened or endangered have been negatively affected by invasive species (Nature Conservancy 1996; Wilcove et al. 1998).
- Invasive species populations have depleted water supplies, poisoned wildlife and livestock, and directly impacted thousands of acres of native forests and rangelands.
- Public recreational opportunities and experiences have become severely degraded by rapid infestations of invasive species, in many cases hampering access, reducing recreational quality and enjoyment, and decreasing the aesthetic values of public lands.

Today's Focus

Global trade and transportation have increased the opportunities for insects, plants, diseases, and other invasives to cross geographic boundaries like never before. Invasive species are not new. The invasive species problem is expanding rapidly, however, because of the introduction of an increased variety of nonnative species and many new types of infestation pathways.

Natural controlling processes and limiting factors that kept species in check in their native ecosystems are not present in their new homes, thereby enabling their populations to thrive. Invasive species can out-compete native species, especially when ecosystem health is stressed by factors such as drought, fire, pollution, resource overutilization, or other disturbances.

Our lack of knowledge about how invasive species function in their new environment significantly undermines our ability to detect and eradicate new or small infestations. Our efforts to find and eliminate new infestations are hampered by the lack of an effective national early warning and rapid response system. In addition, we have a shortage of safe and effective techniques to limit the impact on nontarget areas or sensitive native species. Control efforts can be hampered when they extend across multiple political jurisdictions and ownerships, especially in urban areas. Rehabilitation and restoration efforts require new and expanded sources of native plant materials and require improved techniques to repair damaged ecosystems.

The Forest Service is addressing each of these major factors in invasive species management in programs such as:

- Forest restoration under the Healthy Forest Restoration Act.
- Emphasis on influences from roads and transportation corridors under recent roads and roadless policies.
- Current schedule of forest plan revisions under the National Forest Management Act.

Existing Forest Inventory and Analysis and Forest Health Monitoring programs for all forested lands in the Nation, including urban areas, now include invasive plant species monitoring and analysis.



Damage from Sudden Oak Death



Gypsy Moth

Forest Service Role

The Forest Service has several unique characteristics that compel it to play a primary role in the fight against invasive species.

The Forest Service has the authority to directly manage 192 million acres of national forests and grasslands. The agency also has the responsibility and authority to provide technical and financial assistance (primarily for insect, disease, and invasive plant suppression) for all the Nation's 731 million acres of forest lands, including urban, State, private, and tribal lands, and forested lands managed by other Federal agencies.

The Forest Service is recognized internationally for its land management and research expertise. The Forest Service conducts research, scientific collaboration, and reviews to fill priority information gaps on a scientific foundation. In addition to more than 500 research scientists, its thousands of specialists include forest entomologists, forest pathologists, botanists, wildlife and fisheries biologists, and ecologists. Forest Service Technology and Development Centers specialize in developing and applying the latest in technology. Other Forest Service staff that will support the strategy include experts in public communication, legislative affairs, technology transfer, and education.

Forest Service responsibilities extend across the United States from Alaska and Hawaii to the Caribbean and New England. With national forests and grasslands in 44 States and Puerto Rico, the agency maintains offices in more than 650 communities nationwide and has established relationships in thousands of communities across the country.

The Forest Service has working relationships with other agencies involved in invasive species, including the Animal and Plant Health Inspection Service (APHIS) and the other government departments in the National Invasive Species Council. In addition, the Forest Service maintains working relationships with leading national and international organizations that focus on invasive species and has ongoing partnerships with each State and territorial agency with invasive species responsibility. The Forest Service has a long history of providing technical and financial assistance to States and territories to handle natural resource problems. The Forest Service has formal working relationships with most major colleges and universities and with international partners.



The Goal

Reduce, minimize, or eliminate the potential for introduction, establishment, spread, and impact of invasive species across all landscapes and ownerships.



Guiding Principles—Foundation for the National Strategy

All aspects of the national strategy will include direction to implement an invasive species management program through these guiding principles:

- Science-based **prioritization** of invasive species problems,
- Enhanced **collaboration** on the solutions to those problems, and
- An improved system of **accountability** that ensures the most efficient use of limited resources at all levels of the organization.

The National Strategy

Program Elements—Approaches To Address Invasive Species

The information provided in this national strategy will guide Forest Service programs to apply a more effective approach to address the invasive species problem that will support its stewardship mission and the execution of Executive Order 13112 regarding invasive species. Implementation will occur at all levels and include accountability measurements to track performance.



Leafy Spurge



Hemlock Woolly Adelgid

Hemlock Woolly Adelgid: The Forest Service has undertaken an expanded program to develop and implement management strategies to control hemlock woolly adelgid and mitigate its long-term effects. Progress is occurring, but more rapid progress is needed.

- **Prevention:** Hemlock woolly adelgid is native to Asia; nothing was known about this insect pest, however, before it was discovered on western hemlock in British Columbia in 1924. Although it was first reported on eastern hemlock in Virginia in the 1950s, the potential impacts of this insect to eastern hemlock were not recognized and no effort was made to prevent the hemlock woolly adelgid's spread.
- **Early Detection and Rapid Response:** Hemlock woolly adelgid currently infests about one-half of the native range of hemlock in the Eastern United States, and it continues to spread. It is the single greatest threat to the health and sustainability of hemlock as a forest resource in eastern North America. Without intervention, the entire range of eastern hemlock may become infested, but detection of low-level populations is difficult, and survey and monitoring techniques are insufficient for early detection and rapid response.
- **Control and Management:** Management tools and strategies to control this pest are limited and inadequate. No effective natural enemies occur in eastern North America to keep hemlock woolly adelgid in check, and control with insecticides is limited to accessible areas. Biological control using natural enemies from its native range offers the only potential means of managing this pest in forest environments.
- **Rehabilitation and Restoration:** Areas of extensive tree mortality and decline are found throughout the 15-State infested region. Hemlock harvesting is proceeding at a rapid pace as land managers attempt to salvage value from threatened trees. Without intervention, impacts on ecosystems are expected to intensify. Damaged areas need to be restored to desired conditions, and vulnerability to this and other invasive species should be reduced.

This national strategy identifies four primary categories of efforts, termed “program elements,” to address invasive species:

- 1. Prevention**—Keep the invasive species out.
- 2. Early detection and rapid response**—Detect and eradicate invasive species to stop them from spreading.
- 3. Control and management**—Eliminate or control the problem of invasive species.
- 4. Rehabilitation and restoration**—Heal, minimize, or reverse the harmful effects from invasive species.

These four program elements reflect the priority areas of emphasis identified in the National Invasive Species Management Plan of 2001, issued by the National Invasive Species Council. This invasive species strategy also correlates to the Forest Service Strategic Plan for 2004–08 and addresses each of the Chief’s four threats either directly or indirectly. For a list of other documents related to this strategy, see the references at the end of this report.

This national strategy comprises two major components: the program elements, which are the approaches to address invasive species issues, and themes common to all program elements.

Element 1: Prevention

The Forest Service will actively seek to prevent the introduction and spread of invasive species into U.S. forest and rangeland ecosystems.

The most effective strategy against invasive species is to prevent them from ever being introduced and established. Preventive measures typically offer the most cost-effective means to minimize or eliminate environmental and economic impacts. Prevention relies on a diverse set of tools and methods, including education. The Forest Service has a wealth of experience and skills within its own organization and has access to those available through numerous collaborators. As an agency capable of working across the landscape and with international partners, the Forest Service is in an excellent position to lead efforts to prevent potential invaders.

The emphasis will be on identifying and protecting forests and grasslands that have not been invaded by invasive species. Prevention tactics include education and outreach to raise the awareness of the invasive species problem and reduce the possibility of unintentional introduction of invasive species. By enlisting the resources of our science and education programs and staff, we can create a successful invasive species prevention awareness campaign on a national scale. Establishing effective domestic and international partnerships is also critical for effective prevention programs.

Current Program

Prevention is the cornerstone of an effective invasive species program, and the Forest Service currently participates in major prevention programs that include these types of activities:

- Regularly sanitizing maintenance equipment, requiring weed-free certified seed for restoration, requiring the use of certified weed-free hay, and training to identify invasive species.
- Cooperating with the North American Forestry Commission, National Plant Board, International Plant Protection Convention, APHIS, and others to prevent the introduction of new forest pests from other countries.
- Maintaining the Exotic Forest Pest Information System (EXFOR) database of approximately 150 insect and pathogen species that pose significant threats to North America.
- Providing technical assistance, educational materials, and funding for public education and prevention measures for invasive species on all lands, regardless of ownership.
- Developing a national guide for best management practices for invasive plants.
- Initiating programs to implement preventive measures when conducting ground-disturbing activities, timber harvest, fire suppression, off-road vehicle use, or contracted activities.
- Working with international partners to develop tools for detecting and controlling invasive species in their countries of origin.

- Participating in training programs to communicate the potential for fire management activities to spread terrestrial and aquatic invasive species, including whirling disease.
- Coordinating with States, especially in the Rocky Mountains and upper Midwest, to increase public awareness of carcass management to prevent the spread of chronic wasting disease.
- Working with international scientists on research to understand the biology and develop detection and control tools for high-priority pests, such as the emerald ash borer, Asian longhorned beetle, and the pathogen that causes sudden oak death.

Description of Success

New introductions of invasive species are prevented and infestations of established invasive species are contained.

Accountability Measures

The number of areas where introductions of invasive species occur and the number of previously infested acres where targeted invasive species reinvasions occur.

Strategic Actions

Implementation

- Conduct risk assessments at multiple levels (national, ecoregional, and forest) for various invasive species taxa, ecosystems vulnerable to invasion, and pathways facilitating introductions.
- Use these assessments to identify priority pathways of introduction and work with APHIS and other commerce regulators to minimize or close these pathways for priority species.
- Based on risk assessment information, develop and implement forest plan standards and guides, best management practices, and contract and permit language for resource management across various ownerships.
- Conduct surveys, inventories, and monitoring and risk analyses at various spatial scales for priority species and areas.
- Expand use of preventive measures, including sanitizing equipment after work in infested areas, requiring certified weed-free seed and other materials for restoration, and requiring the use of certified weed-free hay.

Information and Technology Development

- Conduct research, refine existing tools, and develop new tools (methods, models, applications, solutions, decision guides) for resource specialists, resource managers, and regulatory agencies to identify targeted invasive species.
- Through research and other means, refine existing and develop new preventive treatment methods, including chemical, biological, cultural, and genetic.
- Synthesize, develop as needed, and maintain a comprehensive database on invasive species, vulnerable locations and habitats, and management practices that facilitate invasive species population establishment.
- Update and expand the EXFOR database to include additional taxa.

Technology Transfer

- Develop tools to convey current prevention and awareness information, such as posters, public service announcements, booth displays, refrigerator magnets, teachers packets, and ID cards.
- Develop and transfer technology for resource specialists and managers.

Short-Term Actions

- Work with APHIS and other partners to conduct pathway and species risk assessments for terrestrial and aquatic pests (plants, animals, insects, and pathogens) to identify priority invasive species for regulatory and management action.
- With partners, build awareness of invasive species and their threat at all levels and jurisdictions.



Asian Longhorned Beetle



Early Detection and Rapid Response

Models such as the Federal Interagency Committee for the Management of Noxious and Exotic Weeds conceptual design will be used to develop an EDRR system in the Forest Service.



Early Detection and Rapid Response Pilot Tests

Between 2001 and 2003 the Forest Service and APHIS pilot-tested a regionally coordinated national survey for exotic bark beetles. A team of Federal, State, and local partners collaborated to develop pilot test protocols. Federal and State taxonomists identified the bark beetles caught in the pheromone traps and notified regulatory agencies and team members. In 2003 *Scolytus schevyrewi* was discovered on elms in 13 Western States. Because the only available information on the biology and management of this bark beetle was a few lines in a Chinese publication, research scientists are now researching the beetle's biology and developing tools for more effectively detecting and controlling the beetle. In 2004, the EDRR Bark Beetle Survey will be expanded to all regions of the United States.



- Complete a national research risk assessment to identify high-priority exotic species and continue working in their countries of origin to develop techniques to deal with these high-priority pests.
- Finish developing, and then populate, these Forest Service databases—Exotic Forest Pest Information System, Natural Resource Information System, financial and business functions accounting system, and Forest Service Activity Tracking System.
- Based on risk assessments, develop and implement prevention programs for identified priority invasive species and areas.

Element 2: Early Detection and Rapid Response

The Forest Service will work with partners to detect new invasive species infestations and support the infrastructure necessary to rapidly contain or eradicate these infestations.

Sometimes considered the “second line of defense” after prevention, early detection and rapid response (EDRR) is a critical component of any effective invasive species management program. When new invasive species infestations are detected, a prompt and coordinated containment and eradication response can reduce environmental and economic impacts. This action results in lower cost and less resource damage than implementing a long-term control program after the species is established. Early detection of new infestations requires vigilance and regular monitoring of the managed area and surrounding ecosystem.

The Forest Service is well suited to improve its early detection capabilities through the collaborative and coordinated efforts of numerous agency programs, field offices, and partners. We will be proactive in developing broad networks with many partners to detect, contain, and eradicate new invasive species before they become established.

Current Program

The degrees of EDRR infrastructure (detection, assessment, and response) vary throughout the agency depending on the locations and taxonomic groups. No complete system for EDRR exists in the Forest Service. We are, however, working across the landscape in partnership with other Federal, State, and local organizations to build the capacity to detect and respond rapidly to invasive species introductions. The Forest Service has implemented the Forest Health Monitoring Program to assess long-term forest health conditions and contribute scientific information on sustainable natural resources of Federal, State, and private lands, including a special pilot component for urban areas.

The Forest Service currently manages components of a significant EDRR program that includes actions such as the following:

- Conducting an annual survey of more than 238 million acres of Federal and tribal forest land and 493 million acres of cooperative land for damage caused by forest insects and pathogens.
- With APHIS and other partners, establishing an EDRR system for invasive insects in 10 ports and surrounding urban forests in 2001 that has identified at least 1 new exotic bark beetle each year.
- With partners, conducting emergency research that developed EDRR technology for bark beetles that was implemented in detection and delimitation surveys.
- Providing weed management funding to States for use in EDRR programs on State and private land.
- Responding to nationwide threats to forest ecosystems from outbreaks of invasive species, such as sudden oak death and emerald ash borer, by developing risk hazard maps for national monitoring efforts and by helping to guide detection, control, and eradication efforts.
- With partners, disseminating materials designed to educate the public on identification, proper handling, notification, avoidance procedures, and eradication of invasive plants and animal diseases.
- Establishing partnerships with volunteers and others to conduct surveys and eradication programs for new infestations on national forests, grasslands, and associated areas.

Description of Success

New occurrences of targeted invasive species are detected and eliminated before establishment and spread.

Accountability Measures

The number of times an invasive species has been detected and eliminated across ownerships and ecosystems aided by Forest Service actions.

Strategic Actions

Implementation

- In concert with other organizations and programs, use existing EDRR models to build a functioning EDRR system—with capacity for detection, verification, assessment, planning, and response—in the Forest Service.
- Based on results from risk assessments, and using ranking systems for various species groups, create invasive species priority lists and incorporate these lists in the detection and assessment components of the EDRR system.
- Provide leadership and support to increase EDRR capacity across all ownerships and ecosystems.
- Develop guidelines for using existing funding sources for EDRR across the Forest Service and other ownerships.
- Identify and implement ways to use partnerships to fund and prioritize rapid response effectively across ownerships and ecosystems.

Information and Technology Development

- Summarize existing information for early detection protocols.
- Continue to conduct the research needed to provide scientifically based information on basic biology of priority invasive species.
- Develop tools and technology required for EDRR systems.
- Continue to develop EDRR systems for plants, insects, and diseases and expand efforts to include other terrestrial and aquatic pests.
- Improve and refine existing Forest Service EDRR systems in data management, communication, detection protocols, and rapid response capabilities and develop new ones where these systems do not exist.
- Develop and implement emergency authority and funding mechanisms to increase capability for rapid research and management response to invasive species.
- Work with partners to develop a Web-based database system to identify and communicate information on invasive species from any source.

Communication and Technology Transfer

- Develop the following technology and information transfer tools for EDRR systems and market them internally and externally:
 - ◆ Tools to inform invasive species managers of targeted invasive species and the need to maintain overall vigilance.
 - ◆ Tools with detection methods for varying degrees of specificity for resource specialists and the public.
 - ◆ Tools to provide effective eradication methods for invasive species managers.
- Establish through formal and informal agreements lines of communication required to support EDRR and ensure the timely progress from detection to response.
- Develop an “early alert” system to enable all entomologists, pathologists, botanists, weed scientists, invasive species specialists, and forest health specialists in all Federal, State, and local governments; profit and nonprofit organizations; and educational institutions to communicate and learn about new infestations.

Short-Term Actions

- Establish a Forest Service-wide EDRR emergency fund and guidelines to ensure that funds are immediately available to respond to new introductions.



Paradise Lost?

Miconia (Miconia calvescens), a tree reaching a height of 50 feet at maturity, is native to Central America. In Tahiti, miconia is known as the “green cancer,” because it spread from three small garden plantings in 1937 to an invasion that now covers 70 percent of the island’s forests.

Producing leaves up to 3 feet long and thousands of tiny seeds, miconia is public enemy number one in the State of Hawaii. Miconia was introduced as an ornamental to the island of Hawaii in the 1960s and the island of Maui about 1970. Miconia plants have now been found on the islands of Hawaii, Maui, Oahu, and Kauai. Only Molokai and Lanai remain uninfested.

Miconia grows aggressively, forming dense thickets that block the sunlight, which prevents most other plants beneath it from surviving. As miconia grows, it destroys natural habitat, depriving native plants of sunlight and nutrients from the soil, and depriving native animal species of the plants they need to survive. As miconia’s thick shade kills ground cover, its shallow roots cannot hold the soil, leaving it very susceptible to erosion.

“Operation Miconia,” an emergency statewide weed eradication effort in Hawaii, was launched to locate and eliminate the invasive alien weed. The consortium of Federal, State, and county agencies; businesses; nonprofit organizations; and various other groups represents the largest mobilization effort in the history of the State.

A containment and control strategy was implemented in January 1994. The initial control phase involved uprooting, aerial herbicide application, and subsequent monitoring of treated trees by helicopter. A biocontrol strategy using a leaf pathogen and several insects is also being investigated to suppress the miconia population.

Control program costs on the islands of Hawaii and Maui, including Forest Service financial assistance, exceed \$1.5 million per year.



Spotted Knapweed

- Invest in translating foreign language invasive species literature into English and vice versa.
- Develop maps of priority ecosystems and habitats placed at risk by invasive species.
- Working with partners, develop rapid response incident teams that cross jurisdictional lines and respond quickly to any invasive species outbreak.
- In partnership with the Departments of Homeland Security, the Interior, and Agriculture; State agencies; and others; develop high-speed, reliable, and robust technology to detect and respond to introduced invasive species.

Element 3: Control and Management

The Forest Service will identify and prioritize which invasive species will be controlled and managed and will effectively implement management plans to do so.

When invasive species become established as free-living populations in an ecosystem, a strategic approach for control is required to minimize their effects or limit their spread. Effective control relies on a clear understanding of the target species, including its biology, the ecosystem it has infested, associated introduction pathways, and effective control tools. It also relies on persistent follow-through with monitoring of control efficacy.

The key is to establish a perimeter around existing infestations to contain the spread, eradicate outliers and gradually eliminate the infestation.

Current Program

Forest Service control and management activities are based on integrated pest management principles that may include any combination of physical/mechanical, biological, cultural, and chemical techniques. This integrated approach also includes risk assessment, identification of thresholds for action, and planning to reach the most desired outcome. The Forest Service currently has programs for management and control of numerous terrestrial and aquatic invasive species (for example, 200,000 acres treated in fiscal year 2003 for invasive plants and 1.055 million acres treated for invasive insects and pathogens). Many of these activities are accomplished with partners across jurisdictional boundaries. Tools developed by Forest Service Research and Development, Engineering, and partners support its control and management activities. International Programs, Research and Development, and other partners identify potential new biological control agents for control and management.

Current Forest Service programs include activities such as the following:

- Preventing gypsy moth from becoming established in the Western United States by implementing a slow-the-spread strategy to control gypsy moth infestations on 91,000 acres on Federal lands and 500,000 acres of State and private lands from North Carolina to Wisconsin.
- Treating invasive plants on 94,000 acres each year on State and private forested lands and approximately 100,000 acres throughout the National Forest System.
- Working with international partners on research to identify biological controls for hemlock woolly adelgid, kudzu, and other invasive species and develop technology to use these controls.
- Streamlining National Environmental Policy Act (NEPA) planning and Endangered Species Act requirements activities for invasive species management.
- Collaborating with biological control specialists to produce a guide to "Biological Control of Invasive Plants in the Eastern United States."
- Working with State fish and game agencies and other partners to eradicate invasive fish and invasive snails from national forest watersheds.
- Collaborating with State and local partners to control invasive species, such as the mongoose, black rats, rusty crawfish, earthworms, and others that threaten native aquatic and terrestrial ecosystems on national forests and grasslands.



Role of Salt Cedar (Tamarix) in Changing the Hydrology and Plant and Animal Communities in Southwestern Riparian Ecosystems

Salt Cedar, a native of North Africa and the Middle East, spreads rapidly and forms dense thickets along waterways in the Southwestern United States. Water in streams adjacent to Salt Cedar can be severely limited. The tree is more drought tolerant than native species and out-competes native species, such as cottonwood and willow, that protect streambanks from eroding and provide habitat and food for native birds. Salt Cedar is detrimental to native wildlife species. Restoration efforts must include measures to reduce Salt Cedar, protect streambanks, and restore hydrology and wildlife habitats.

Description of Success

Existing infestations of targeted species are eradicated, controlled (ongoing suppression), or contained (outlying infestations are eradicated). Existing infestations of targeted species are reduced.

Accountability Measures

Number of acres infested with targeted invasive species. Rate of spread of targeted invasive species.

Strategic Actions

Implementation

- Prioritize target species or areas for eradication, control, or containment at the national, regional, and local levels and expand invasive species management activities.
- Create and maintain invasive species inventories and infestation maps.
- Expand technical and financial assistance funding to Federal, State, and tribal partners as well as to national forests and grasslands for on-the-ground management and control activities.
- Fast-track implementation of cost-effective management solutions for priority invasive species.
- Expand partnerships to control or manage invasive species across jurisdictional boundaries.
- Complete programmatic NEPA analysis; develop standard contract language for treatment of invasive species.
- Increase efforts with partners to develop biological controls and create centralized locations to provide controls “certified” as safe and effective for release.

Information and Technology Development

- Identify information gaps and develop new or improved control, management, and monitoring technology—including biological controls for priority species based on the latest research and adaptive management feedback—and transfer this technology to users.
- Coordinate funding in the agency for fast-tracking development and transfer of cost-effective management solutions for priority invasive species.

Technology Transfer

- Synthesize available internal and external information and provide to partners and users.
- Develop and implement technology transfer tools for invasive species control, management, and monitoring, including protocols for inventory and post-treatment monitoring.
- Provide education for resource managers and the public on the importance of invasive species management and control and the effects of various management and user practices.

Short-Term Actions

- Complete the comprehensive (targeted aquatic and terrestrial invasive species) inventory and mapping for all national forest land and water, including neighboring areas where appropriate.
- Conduct a comprehensive (all invasive species) risk assessment based on existing information for the specific purpose of identifying priority species and areas for program focus.
- Focus resources on priority species control in priority areas as identified through risk assessments.
- Place specific emphasis on control of invasive plants/noxious weeds and other aquatic and terrestrial invasive species in national forests and associated areas.
- Through research and other means, develop additional tools, such as biological, cultural, chemical, and physical controls, for priority species; identify mechanisms involved in their expansion.
- Monitor long-term invasive species population trends and the effectiveness of treatments. Make this information readily available to all stakeholders, public and private.



White Pine Blister Rust

White pine blister rust is caused by a nonnative invasive pathogen, *Cronartium ribicola*, introduced to North America from Europe almost a century ago. The impact of the rust, combined with lack of regeneration opportunities, threatens to eliminate white pines as functioning components of forest ecosystems and endangers native plant and wildlife species. Increased collaboration and partnerships among land managers and researchers will facilitate the long-term restoration of white pine ecosystems.

The Forest Service (Samman et al. 2003) has a strategy for protecting, sustaining, and restoring white pine ecosystems devastated or threatened by white pine blister rust. The plan complements the Healthy Forest Initiative and the National Fire Plan. Options for control of the disease include pruning, silvicultural strategies focused on planting, and thinning and genetic strategies dedicated to rust resistance.



Trees Resistant to Dutch Elm Disease



Rehabilitation and Restoration

Using National Fire Plan funds and State and Private Forestry Forest Stewardship Funds, the Forest Service has partnered with the State of Utah, Ephraim City, Rocky Mountain Elk Foundation, and other organizations to construct a 17,100-square-foot facility that will store up to 500,000 pounds of native seed to be used for fire rehabilitation, wildlife habitat improvement, and other projects.



Containerized Native Plants for Rehabilitation Plantings



Yellow Starthistle Plant

Element 4: Rehabilitation and Restoration

The Forest Service will strive to restore or rehabilitate degraded areas to their proper ecological function to prevent invasive species infestations or to prevent reoccurrence after invasive species removal.

Because each invasion characteristic is unique, specific restoration and rehabilitation programs need to be designed at the appropriate level. The application of appropriate restoration and rehabilitation concepts to invasive insect, animal, or pathogen problems is also a critical component of a fully functional invasive species program.

The Forest Service can improve its effectiveness by pooling the expertise of partners in rehabilitation and restoration efforts and technology development.

Current Programs

The Forest Service is experienced in conducting rehabilitation and restoration programs—from the project level to broader ecoregional scales, which address the effects of disturbance from a variety of sources—and restoring ecosystem sustainability. For example, recent changes in the Burned Area Emergency Rehabilitation (BAER) policy have provided direction to restore burned areas with native species that have the greatest chances of success and where native seed is readily available. Resource managers have an increased awareness of invasive species issues and the need to incorporate native or desired nonnative species into restoration and rehabilitation planning to mitigate mining, road construction and maintenance, recreation, and other ground-disturbing activities. The Forest Service has strong partnerships with other Federal, State, and non-governmental entities. Although invasive species management may not be a stated purpose for these entities, their activities may lead to ecosystem restoration that may help the ecosystem resist future invasions.

In addition to the abilities of its employees, the Forest Service can pool the expertise of its partners in rehabilitation and restoration efforts. Examples of the results of effective Forest Service partnerships include:

- Providing funding for developing resistant planting stock for five-needle pines restoration efforts following white pine blister rust mortality and developing and using Port-Orford-cedar trees that are resistant to root disease.
- Working with the American Chestnut Foundation to develop a breeding program for American chestnut. Over the last 20 years, developing disease-resistant elms that are now being produced to replace American elms lost to Dutch elm disease.
- Shifting restoration projects from using exotic species, such as smooth brome and timothy, to employing native species and more desirable nonnative species.
- Coordinating at the national and regional levels to address the need for and supply of native plant materials (for example, seed and seedlings) for restoration.
- Implementing BAER projects that treat new or expanding noxious weed populations for the first year after a fire; monitoring and following up treatments for up to 3 years after the fire.
- Decommissioning roads to improve the agency's ability to restore degraded sites and prevent invasive species re-establishment or spread.

Description of Success

Ecosystems impacted by invasive species have been effectively restored or rehabilitated to desired conditions and to conditions that reduce vulnerability to invasion or reinvasion by invasive species.

Accountability Measures

Number of acres/watersheds restored or rehabilitated to desired conditions in which ecosystems are no longer impaired by invasive species.

Strategic Actions

Implementation

- Take actions when and where possible during project implementation to protect intact ecosystems and restore degraded ones.
- Use ecological assessments to identify better ways to restore ecosystem functions.
- Produce and use resistant plant stock from local origins for restoration and rehabilitation.

Information and Technology Development

- Use research and other means to increase information and the knowledge base about native species, plant resistance, role of intact ecosystems, restoration ecology, disturbance ecology, and invasive species.
- Synthesize multiscale monitoring results and assess effectiveness of restoration action.
- Develop establishment methods, species-habitat relationships, genetic range, and other information for natives.
- Refine establishment techniques and explore opportunities to use native plants when reestablishing native communities.
- Collaborate with organizations such as native plant societies, exotic pest plant councils, and higher education institutions to develop educational outreach materials and demonstration areas that illustrate landscape designs and management techniques that facilitate native plant species use and resistance to nonnative species.

Communication

- Educate resource managers and the public on the importance of maintaining intact ecosystems and applying ecological principles to invasive species management.
- Work with partners to increase outreach to nurseries regarding desired native and nonnative species.
- Develop appropriate guidance documents on effective rehabilitation and restoration practices for resource managers.
- Ensure that BAER training includes the use of native and desirable nonnative species.
- Develop Web-based or other information and technology transfer tools to communicate disturbance ecology and invasive species, establishment methods for natives, species-habitat (native community) relationships, and genetic range.

Short-Term Actions

- Compile, highlight, and share information about existing restoration and rehabilitation successes around the country about invasive species.
- Develop and implement national Forest Service policy that incorporates the best available science on using native or desired nonnative species for restoration and rehabilitation.
- Working with partners, develop an infrastructure for producing, purchasing, and warehousing seed supplies and other native and desirable nonnative plant materials on a regional basis
- Prioritize and develop native plant stock that is resistant to invasive insects and pathogens.

Common Themes

The Forest Service's ability to implement the four program elements identified for the national strategy in a proactive, holistic, collaborative, and adaptive manner is dependent on the agency and its partners having the capability and sufficient knowledge for invasive species management. Several keys to enhancing this capability can be grouped into four categories: (1) partnerships and collaboration, (2) scientific basis, (3) communication and education, and (4) organizing for success.

Partnerships and Collaboration

Collaboration is an important overarching need in all the national strategy elements. Forest Service invasive species management activities need to be coordinated at all levels of the organization and



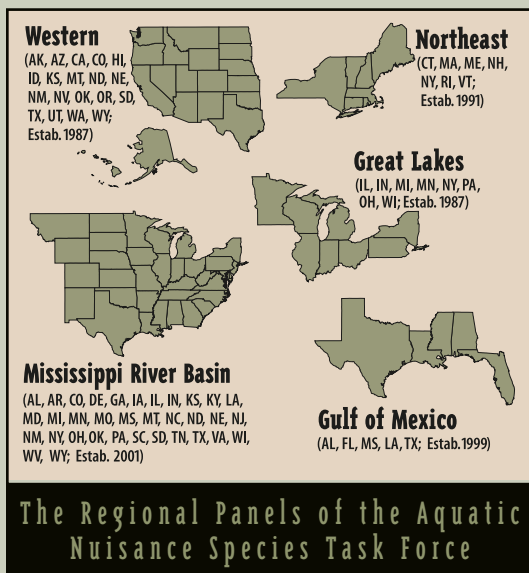
Partnerships: Whirling Disease Initiative

Whirling disease, caused by a parasite introduced from Europe in the 1950s, infects the head and spinal cartilage of fingerling salmonids, impeding fish mobility and causing mortality in young fish. It has spread during the past decade, infecting streams and hatcheries in 23 States.

The National Partnership for the Management of Wild and Native Coldwater Fisheries is a consortium of public agencies and nongovernmental organizations whose mission is to advance the understanding of whirling disease biology and management by overseeing the Whirling Disease Initiative funded by the U.S. Fish and Wildlife Service. Administered by the Montana University System Water Center located at Montana State University, the program provides a multiyear outlook for advancing whirling disease management and provides funding for research and technology development, information transfer, and education. The Forest Service, as a manager of many of the Nation's coldwater systems, is a charter member of the Partnership's Board of Representatives.



Garlic Mustard



Partnerships Against Aquatic Invasive Species

The Nonindigenous Aquatic Nuisance Species Prevention and Control Act of 1990 (amended as the National Invasive Species Act of 1996) set up a national framework to strategically manage aquatic invasives (aquatic plants and animals) across all land ownerships. The intergovernmental Aquatic Nuisance Species (ANS) Task Force encourages the development of regional panels that comprise Federal and State agencies, as well as selected industries, to address aquatic invasive species issues.

To date, these panels have been established for the Great Lakes (1991), Gulf of Mexico (1999), Mississippi River Basin (2002), Western Region (1997), and Northeast Region (2001). The invasive species programs on national forests and grasslands can link their work with existing State aquatic invasive species plans or work with these regional panels and contribute to the future development of State plans to achieve the goal of the *National Strategy and Implementation Plan for Invasive Species Managements*.



Eurasian Watermilfoil

across all programs. Collaboration also extends outside the agency to the broader Federal family, State and local governments, tribal interests, nongovernmental organizations and others in the private sector, and international stakeholders. Collaboration also implies cooperating across ownerships, State lines, and political jurisdictions. Examples of some opportunities include coordination with native plant species groups or invasive plant coalitions, aquatic nuisance species organizations, pest advisory groups, international agencies, and invasive insect and pathogen coalitions. The Forest Service will expand partnership development with nontraditional organizations and increase national cooperation and coordination with environmental groups, recreational groups, and industry. The Forest Service will also facilitate the establishment of cooperative invasive species management areas, participate in research activities, and design recreation and management programs that do not increase the threats and impacts of invasive species.

Scientific Basis

Based on research and used in conjunction with other socioeconomic considerations, scientific information is the basis not only for determining actions appropriate to achieving the desired result but for prioritizing those actions as well.

Incorporate Scientific Information

The Forest Service will conduct appropriate research and development activities to ensure management programs are effective and science based. Sound scientific information is critical in guiding management activities, determining the magnitude of invasive species problems, planning future research and management programs, and improving intervention efforts. Where technology or knowledge gaps occur, the extensive and diverse research and technology of the Forest Service and other entities can serve a vital role in developing new techniques and obtaining up-to-date information to achieve comprehensive invasive species management goals. Collaborative partnerships with universities, States, other agencies, and the private sector can be the foundation of invasive species science and technology programs.

Assess and Monitor for Success

The current invasive species monitoring and inventory systems need to be improved through research and expanded to provide an adequate baseline of infested forest and grassland acres. These systems will also enable us to adjust, if needed, the prioritizations of actions, targeted species, and methods and to modify activities contributing to the invasive species spread. Measuring performance and reporting accomplishments will be managed through existing networks with emphasis on cross-program reporting requirements. Monitoring for prevention and early detection of invasive species in urban areas is one of the first lines of defense in protecting all lands, including forests and rangelands. The massive amount of diverse information requires us to improve our data management systems and increase our networking capacity with the external data sources of our partners. Such a system will build on existing databases of inventory and monitoring information and link to protocols, models, assessments, and analysis results.

Prioritize

Prioritization of programmatic and species-specific activities is critical if the Forest Service is to effectively use limited resources. Prioritization must be a dynamic and flexible process that enables decisions to be made by using the best available scientific information. Risk assessments will be used to set priorities. Priority setting will occur at different hierarchical levels (for example, spatial, agency, taxonomic) as appropriate. Priorities should be set at the lowest level practical to ensure that the appropriate result is achieved on the ground. Generally, the Forest Service will prioritize activities by focusing on highly productive and efficient elements first, such as prevention or ERDD; for example, treating “outliers” may be a productive strategy. When setting priorities; species characteristics; infestation consequences; and the availability, feasibility, and likelihood of success of treatment versus nontreatment must all be considered. Developing risk assessment models can help achieve consistency in prioritization among landowners and invasive species managers.

Communication and Education

An important factor that spans all elements is the need to clearly communicate information and ensure that it is understood. We need communication for the public to gain understanding and acceptance of the magnitude and urgency of the invasive species problem. Education, communication, and interpretation programs can convey how the public can help prevent, identify, detect, and control invasive species and gather public input into program plans and promote partnerships in their implementation.

Internal communication will raise awareness among Forest Service employees and help them incorporate practices sensitive to invasive species control into their day-to-day activities. Communication with other agencies will foster relationships and partnerships.



Organizing for Success

Although the Forest Service has an organizational foundation for implementing the national strategy, several factors could enhance its ability to succeed.

Improving Capacity

In all aspects of the strategy, the Forest Service can increase effectiveness by building on its existing efforts and those of its partners in invasive species research and management. It is important to assess existing efforts to determine where additional effort is needed. We can increase capability by working with partners that have the needed expertise, training current employees to expand their expertise, enlisting the help of all employees in their daily activities, eliciting volunteer assistance, and hiring new employees with the requisite expertise.

In the Forest Service, making invasive species management a part of the agency's day-to-day activities could be facilitated through appropriate agency policy, guidance, and direction, including manuals, handbooks, and technical guides. This plan includes appropriate forest plan direction, best management practices, contract and permit language, and terms and conditions for issued authorizations.



Procedural Streamlining and Improvement

Under law and policy, the agency is responsible for proper planning and analysis of potential impacts before taking action. As with wildfire situations, however, the Forest Service needs to be able to respond quickly to prevent new invasive species populations from becoming established or to capitalize on opportunities to be more effective in the future. This rapid response needs to occur without violating legal mandates or public trust. We need to identify opportunities in advance and develop guidance and policy to improve our effectiveness and reduce the time required for adequate planning and project analysis.

Funding Flexibility and Long-Term Commitment

Without a flexible, functioning, and responsive budget structure and associated funding mechanisms, our strategic approaches and activities in each program element may not provide the means to achieve our goal. Several years of monitoring may be required to detect sufficient trends in species spread to characterize risks and threats. In the meantime, new invasive species may be detected that have characteristics that may make them a higher priority for treatment. Flexibility in funding, staffing, and program direction will allow a shift in focus as required.

Invasive species management and research efforts operate on long timeframes. Research on control methods, for example, requires several years before protocols can be designed and tested to ensure effectiveness. Prevention and early detection require continued vigilance, and control efforts require persistent efforts to achieve success.

Long-term funding support requires a commitment to the program internally and externally and may also require budget process and structure changes that allow and secure multiyear and continuing funding.





Short-Term Actions for Themes Common to All Program Elements

- Work internally and externally to identify budget and capacity to implement the national strategy.
- Establish multidisciplinary (for example, wildlife biologists, forest health protection specialists, botanists, forest and rangeland staff, researchers, engineers, ecologists, and hydrologists) invasive species management coordination teams in each region/station to implement the national strategy and implementation plan.
- For all program areas of the Forest Service, develop a comprehensive invasive species policy that incorporates the National Fire Plan and Healthy Forest Restoration Act as they relate to invasive species and that provides guidance for incorporating related desired conditions, goals, and objectives into forest plan revisions.
- Pursue using the National Environmental Policy Act categorical exclusions and emergency authorities to ensure that environmental analysis does not inhibit environmentally sound rapid response or control efforts.
- Update, revise, and enhance the Forest Service's invasive species Web site to serve as a comprehensive internal and external communication tool.
- Work with partners to accomplish these tasks:
 - ◆ Develop a targeted marketing strategy to achieve public awareness of invasive species and understanding of the role citizens can play in all program elements.
 - ◆ Complete the invasive species best management practices video series and handbook.
 - ◆ Expand quarantine facilities for plant, insect, and pathogen control research.
 - ◆ Increase availability of taxonomists to identify new invasive species.
- Host a national Forest Service invasive species conference to improve coordination and collaboration among managers, researchers, and partners.
- Work with other agencies, such as Economic Research Service, to expand economic impact assessments for priority invasive species.
- Develop standard invasive species prevention language for use in contracts, permits, and closure orders.
- Ensure that national and regional programmatic performance measures correlate directly with the Forest Service Strategic Plan and track activities to achieve the goal in the national invasive species strategy.
- Work with agencies and partners to develop common, agreed-upon, and desired conditions in priority areas; reference points characterizing existing conditions/trends; and performance measures that use sustainability criteria and indicators that link to desired conditions and multiscale monitoring efforts designed to gauge progress and help focus scarce resources to highest priority areas.

Conclusion

This national strategy and the proposed actions described in this document will guide Forest Service programs to employ an effective, integrated, comprehensive, and science-based approach for addressing the invasive species problem. This document focuses on developing priority operational activities supported by scientific research to achieve results on the ground against the invasive species threat. By effectively executing this strategy, we can fulfill our commitment to protect the Nation's forest and rangeland ecosystems. In the process of fully executing this strategy, we must monitor our progress and make the appropriate corrections on our course to the future.

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Nepalese Browntop

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In addition to the Healthy Forest Restoration Act of 2003, the National Fire Plan of 2001, and "Within Our Grasp: A Plan to Educate Americans About Invasive Plants" by Partners in Resource Education (2000), the following reports and directives were used in developing the National Strategy and Implementation Plan for Invasive Species Management.

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Sudden Oak Death Pathogen Damage

Glossary

Burned Area Emergency Rehabilitation (BAER): Projects undertaken following wildfires that are necessary to minimize negative effects on soil productivity and water quality and on sources of damage to human life and property. Such projects are funded under the burned area rehabilitation funding authority (FSM 2523).

establishment: Development of a free-living, reproducing population of an invasive species.

infestation: An area where a population of invasive species exists.

integrated pest management (IPM): A process that determines an economic or environmental threshold for managing pest populations and prescribes the management technique to reach desired conditions. IPM includes four broad categories of techniques: biological, cultural, mechanical, and chemical.

introduction: The arrival of an invasive species in an area where it was not previously established.

invasive species: An alien (nonnative) species whose introduction causes, or is likely to cause, economic or environmental harm or harm to human health.

native species: With respect to a particular ecosystem, a species that, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem.

Federal noxious weed: Any living stage, such as seeds and reproductive parts, of any parasitic or other plant of a kind, which is of foreign origin, is new or not widely prevalent in the United States, and can directly or indirectly injure crops, other useful plants, livestock or poultry, or other interests of agriculture, including irrigation, navigation, or the fish or wildlife resources of the United States or the public health. (Federal Noxious Weed Act of 1974 [7 USC 2814], as amended by the Plant Protection Act, 2000.)

pathway: The means by which an invasive species enters a new ecosystem.

priority species: The invasive species that has the highest consequences of impact as determined by a risk assessment.

reclamation: Restabilization of land denuded by land management activities.

rehabilitation and restoration: Active or passive management of an ecosystem or habitat following disturbance or management action to minimize subsequent undesirable effects.

risk analysis: The process of using collected data to estimate the potential biological, economic, and social consequences of an invasive species introduction, establishment, and potential for spread.

risk assessment: A collection of data that documents the status and likelihood of an invasive species introduction, the consequences of its establishment as a viable population, and the potential for spread.

targeted species: An invasive species identified for some specified action.

tool: Method, model, application, solution, or decision guide used in invasive species management.



**United States
Department of
Agriculture**



Forest Service

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