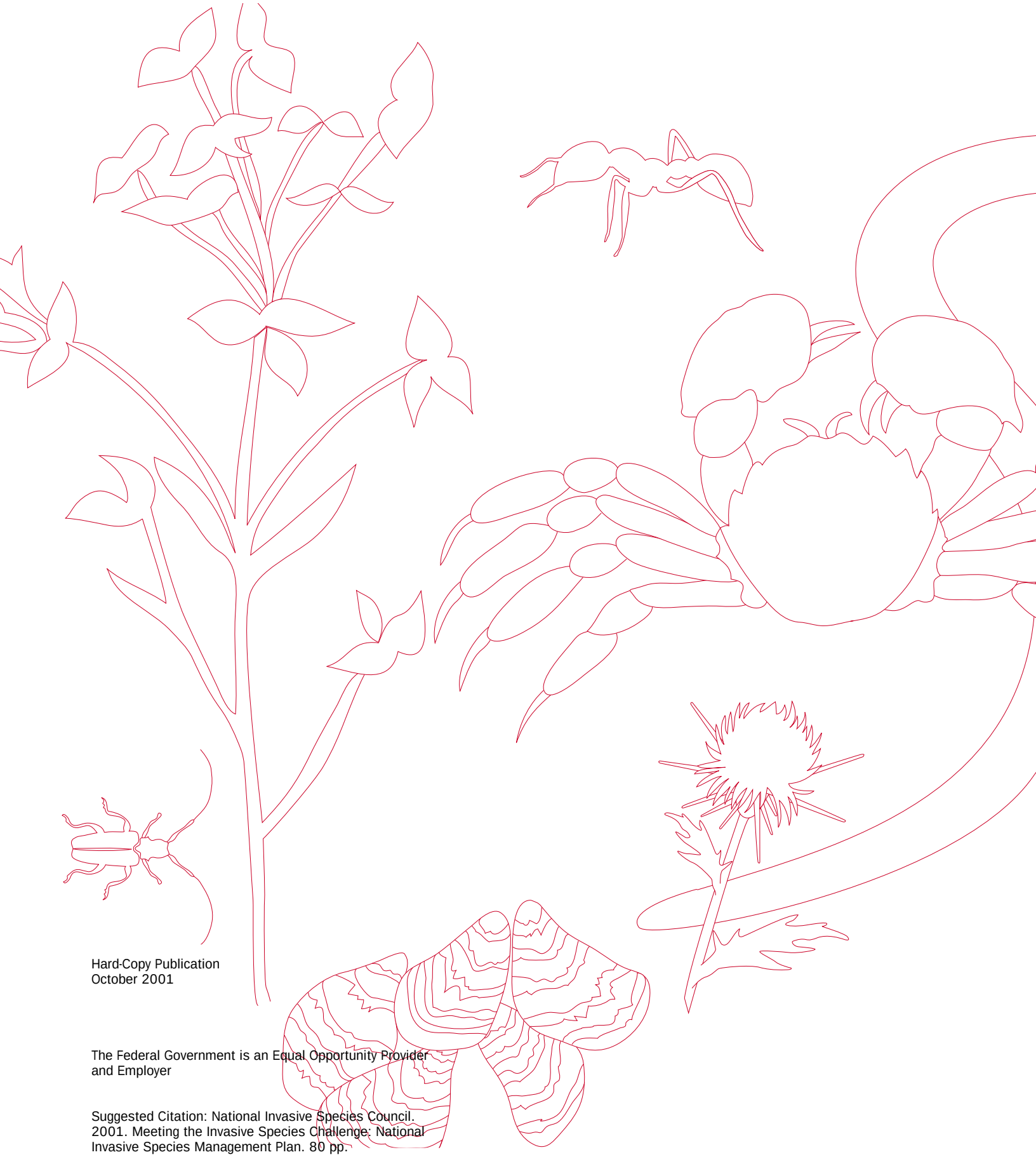
MEETING THE INVASIVE SPECIES CHALLENGE

Management Plan
National Invasive Species Council
2001



Hard-Copy Publication
October 2001

The Federal Government is an Equal Opportunity Provider
and Employer

Suggested Citation: National Invasive Species Council.
2001. Meeting the Invasive Species Challenge: National
Invasive Species Management Plan. 80 pp.

MEETING THE INVASIVE SPECIES CHALLENGE

Management Plan
National Invasive Species Council
2001

National Invasive Species Council

Hon. Gale Norton
Co-chair
Secretary of the Interior

Hon. Ann M. Veneman
Co-chair
Secretary of Agriculture

Hon. Donald L. Evans
Co-chair
Secretary of Commerce

Hon. Colin L. Powell
Secretary of State

Hon. Norman Y. Mineta
Secretary of Transportation

Hon. Donald H. Rumsfeld
Secretary of Defense

Hon. Paul H. O'Neill
Secretary of the Treasury

Hon. Tommy G. Thompson
Secretary of Health and Human Services

Hon. Christine T. Whitman
Administrator
Environmental Protection Agency

Hon. Donald L. Pressley
Administrator
U.S. Agency for International Development

Council Staff

Lori Williams
Executive Director

Chris Dionigi
Assistant Director
Domestic Policy, Science and Cooperation

Jamie K. Reaser
Assistant Director
International Policy, Science and Cooperation

Kelsey A. Passé
Program Analyst

Stephanie Parrish
Invasive Species Ecologist

Alexis T. Gutiérrez
Website Coordinator

Richard Orr
Risk Analysis Specialist and
Detailee from the Department of Agriculture

Department Liaisons

A. Gordon Brown
Department of the Interior

Rebecca A. Bech
Department of Agriculture

Dean Wilkinson
Department of Commerce

TABLE OF CONTENTS

Executive Summary 2

Introduction 10

Survey of Federal Roles and Responsibilities 18

An Action Plan for the Nation 26
- A. Leadership and Coordination 26
- B. Prevention 29
- C. Early Detection and Rapid Response 34
- D. Control and Management 37
- E. Restoration 40
- F. International Cooperation 41
- G. Research 43
- H. Information Management 45
- I. Education and Public Awareness 47

Conclusion 50

Appendix 1: Executive Order 13112 and Guiding Principles 51

Appendix 2: Summary of Federal Roles and Responsibilities 53

Appendix 3: Legal Authorities Related to Invasive Species 62

Appendix 4: Invasive Species Advisory Committee Members and Working Group Co-chairs 71

Appendix 5: List of Acronyms Used 72

Appendix 6: Guiding Principles 73

Appendix 7: References 74

Executive Summary

Invasive species affect each of our lives, all regions of the U.S., and every nation in the world. Society pays a great price for invasive species – costs measured not just in dollars, but also in unemployment, damaged goods and equipment, power failures, food and water shortages, environmental degradation, increased rates and severity of natural disasters, disease epidemics, and even lost lives. Stimulated by the rapid global expansion of trade, transport, and travel, invasive species and their costs to society are increasing at an alarming rate.

For centuries, people have moved organisms around the world. Plants and animals, and their products, are imported into the U.S. to be used, for instance, as food, construction materials, ornamental plants, livestock, and pets. Organisms that have been moved from their native habitat to a new location are typically referred to as "non-native," "nonindigenous," "exotic," or "alien" to the new environment. Most U.S. food crops and domesticated animals are non-native species, and their beneficial value is obvious – for instance, managed livestock are examples of non-native species that are not invasive. Many other non-native species are simply benign. However, a small percentage cause serious problems in their new environments and are collectively known as "invasive species."

Invasive species are non-native to an ecosystem... whose introduction causes or is likely to cause economic or environmental harm.

An "invasive species" is defined as a species that is 1) non-native (or alien) to the ecosystem under consideration and 2) whose introduction causes or is likely to cause economic or environmental harm or harm to human health (Executive Order 13112, Appendix 1). This National Invasive Species Management Plan (Plan) focuses on those non-native species that cause or may cause significant negative impacts and do not provide an equivalent benefit to society.

The means and routes by which invasive species are imported and introduced into new environments are called "pathways." Some non-native organisms that are intentionally imported escape from captivity or are carelessly released into the environment and become invasive. While most importations are legal, smuggling of invasive species also occurs. Some invasive species arrive as hitchhikers on commodities such as produce, nursery stock, and livestock. Other invasive species are stowaways in transport equipment, such as packing materials or a ship's ballast water.

One report indicates that the economic cost of invasive species to Americans is an estimated $137 billion every year (Pimentel *et al.* 2000). The Formosan termite costs an estimated $300 million in property damage annually in New Orleans (Bordes pers. comm.). Zebra mussels invaded the Great Lakes through ballast water, and clog water intake pipes needed by a variety of industries.

Up to 46% of the plants and animals federally listed as endangered species have been negatively impacted by invasive species (Wilcove *et al.* 1998). While purple loosestrife has beautiful purple flowers, it also diminishes waterfowl habitats, alters wetland structure and function, and chokes out native plants. The Asian

longhorned beetle, which probably arrived in solid wood pallets made in China, is causing the destruction of valuable city trees and could spread to natural forests. The nutria, a large rodent native to South America originally imported for a private zoo, now exists in the wild and is devastating large portions of wetland ecosystems.

The newly introduced West Nile virus, an invasive virus which is transmitted to humans by mosquitoes that feed on the blood of infected animals, now threatens people and animals in 12 eastern States and the District of Columbia. Cholera and some of the microorganisms that can cause harmful algal blooms along the U.S. coast are moved in the ballast water carried by large ships. Imported red fire ants cause painful and potentially deadly stings to humans, livestock, and pets in the southern U.S.

Farmers, ranchers, scientists, State officials, and many others have urged the Federal Government to consider invasive species issues a priority and to develop a coordinated national effort to address the problem. In response, the President issued Executive Order 13112 on Invasive Species (Order) in February 1999. The Order established the National Invasive Species Council (Council), co-chaired by the Secretaries of Agriculture, Commerce, and the Interior; and includes the Secretaries of State, Treasury, Defense, and Transportation, and the Administrator of the Environmental Protection Agency. The Order directs the Council to form a non-Federal Invasive Species Advisory Committee (ISAC) to advise the Council in its work. The Council (specifically, the eight department members) is to: provide national leadership on invasive species; see that their Federal efforts are coordinated and effective; promote action at local, State, tribal and ecosystem levels; identify recommendations for international cooperation; facilitate a coordinated network to document and monitor invasive species; develop a web-based information network; provide guidance on invasive species for Federal agencies to use in implementing the National Environmental Policy Act; and prepare the Plan – this document.

This Plan presents nine interrelated and equally important areas that the Council considers priorities in addressing invasive species problems. The following actions are recommended. The Council will undertake these actions in coordination and partnership with other stakeholders as appropriate:

Leadership and Coordination: The Council is directed by the Order to provide national leadership and oversight on invasive species and to see that Federal agency activities are coordinated, effective, work in partnership with States, and provide for public input and participation.

When appropriate, the Council and its staff will draw on various existing organizations for coordination and leadership. These include, among others, State agencies, State invasive species committees and councils, regional organizations

such as regional weed boards, the Aquatic Nuisance Species Task Force (ANSTF), the Federal Interagency Committee on the Management of Noxious and Exotic Weeds (FICMNEW), the Committee on Environment and Natural Resources (CENR), and various non-government organizations. The States play a key role in the management of invasive species within their borders; therefore, this Plan reflects the need to build capacity and capability at State and local levels to coordinate, detect, and respond to invasive species. Additional steps are also needed to ensure a unified, effective, and coordinated Federal response.

Response:

- Establish a transparent oversight mechanism for use by Federal agencies in complying with the Order and reporting on implementation.
- Ensure that a clearly defined process will be developed and procedures will be in place to resolve jurisdictional and other disputes regarding invasive species issues.
- Conduct an evaluation of current legal and regulatory authorities relevant to invasive species.
- Prepare an analysis of legal and policy barriers to coordinated and joint actions among Federal agencies.
- Identify at least two major invasive species issues, regulations, or policies where coordination is inadequate and take action that fixes the problem.
- Coordinate and provide to the Office of Management and Budget (OMB) a proposed cross-cut budget for Federal agency expenditures concerning invasive species.
- Convene a working group of agency leads on international agreements relevant to invasive species.
- Prepare a 2-year work plan identifying specific initiatives to work with State, local, and regional organizations.
- Prepare and issue guidance on invasive species for Federal agencies to use in implementing the National Environmental Policy Act (NEPA).

Prevention: The first line of defense is prevention. Often, the most cost-effective approach to combating invasive species is to keep them from becoming established in the first place. Diverse tools and methods are needed to prevent invasive species from becoming established in ecosystems where they are not native. A risk-based approach is mandated by the Order and requires consideration of the likelihood an invasive species will establish and spread as well as the degree of harm it could cause.

Response:

- Develop a fair, feasible, risk-based comprehensive screening system for evaluating first-time intentionally introduced non-native species in consultation with the Invasive Species Advisory Committee (ISAC), State governments, scientific and technical experts and societies, and other stakeholders, including affected industries and environmental groups.

- Develop modifications to the screening system or other comparable management measures (i.e., codes of conduct, pre-clearance or compliance agreements) to formulate a realistic and fair phase-in evaluation of those intentional introductions currently moving into the U.S., in consultation with ISAC, State governments, scientific and technical experts and societies, and other stakeholders, including affected industries and environmental groups.
- Identify the pathways by which invasive species move, rank them according to their potential for ecological and economic impacts, and develop mechanisms to reduce movement of invasive species.
- Take the steps to interdict pathways that are recognized as significant sources for the unintentional introduction of invasive species.
- Implement a process for identifying high priority invasive species that are likely to be introduced unintentionally and for which effective mitigation tools are needed.
- Develop a risk assessment program for the intentional and accidental introduction of non-native species through U.S. international assistance programs and encourage other countries and international organizations to do the same.

Early Detection and Rapid Response: We cannot prevent all introductions. However, early detection of introductions and quick, coordinated response can eradicate or contain invasive species at much lower cost than long-term control, which may be infeasible or prohibitively expensive. Invasive species should be detected and dealt with before they become established and spread. An integrated approach involving research and development, technical assistance, and operations is needed to facilitate and implement effective action. No comprehensive national system is in place for detecting and responding to incipient invasions. Unfortunately, inadequate planning, jurisdictional issues, insufficient resources and authorities, limited technology, and other factors often hamper early detection and rapid response in many locations.

Response:

- Take steps to improve detection and identification of introduced invasive species, recognizing the need for jurisdictional coordination.
- Develop a program, in close cooperation with State and local efforts, for coordinated rapid response to incipient invasions.
- Develop and recommend to the President draft legislation, in consultation with the States, to address rapid responses to incipient invasions, possibly including permanent funding for rapid response activities.

Control and Management: When invasive species appear to be permanently established, the most effective action may be to prevent their spread or lessen their impacts through control measures. Control and management of invasive species encompasses diverse objectives such as eradication within an area, population suppression, limiting spread, and reducing effects. Complete eradication is not generally feasible for widespread invasive species or where adequate

control methods are not available. Integrated pest management (IPM) is an approach to pest control (including invasive species) that flexibly considers available information, technology, methods, and environmental effects. Methods include physical restraints (e.g., fences and electric dispersal barriers), mechanical removal (e.g., hand-pulling, burning and mowing), judicious use of pesticides, release of biological control agents (such as host-specific predatory organisms), cultural practices (e.g., crop rotation), and interference with reproductive capacity (e.g., pheromone-baited traps and release of sterile males). Consideration of cumulative environmental impacts requires that environmentally sound methods be deployed, especially in vulnerable areas. Because control actions have local effects and cross jurisdictional borders, they are often carried out by or in cooperation with State or local agencies. Adequate funding and public awareness are critical to success.

Response:

- Land management agencies will seek additional resources - through the annual appropriations process consistent with Administration policy - to significantly enhance control and management of invasive species on Federal lands.
- Develop and recommend to the President draft legislation to authorize matching Federal funds for State programs to manage invasive species.
- Explore and, as appropriate, adopt sanitation and exclusion methods for preventing spread of invasive species.
- Develop and issue a protocol for ranking priority of invasive species control projects at local, regional, and ecosystem-based levels.
- Develop a proposal for accelerating the development, testing, assessment, transfer, and post-release monitoring of environmentally safe biological control agents.
- Develop a proposal for cooperation with private industry to utilize current programs and to facilitate development, testing, transfer, and training concerning use of environmentally compatible pesticides and herbicides in controlling invasive species.
- Prepare a list of connecting waterways to develop a strategy for preventing movement of aquatic species among watersheds and initiate a research program on methods to prevent such movement.
- Expand opportunities to share information, technologies, and technical capacity on the control and management of invasive species with other countries, promoting environmentally sound practices.

Restoration: Executive Order 13112 requires Federal agencies to “provide for restoration of native species and habitat conditions in ecosystems that have been invaded.” Without restoration, areas may become reinfested by the same or new invasive species.

Response:

- Develop and issue recommendations, guidelines, and monitoring procedures for Federal land and water management agencies to use, where feasible, in restoration activities.
- Identify sources of propagative material for native species in areas of restoration or reclamation projects.
- Prepare draft legislation to authorize tax incentives and otherwise encourage participation of private landowners in restoration programs.
- Develop criteria for the use of non-native species in overseas restoration projects.

International Cooperation: The U.S. cannot succeed in addressing its domestic invasive species problems unless it takes a leadership role in international cooperation and invests in strategies that raise the capacity of other nations to manage the movement of invasive species. Our ability to prevent invasive species from entering the U.S. depends a great deal on the capability of other countries to effectively manage invasive species and invasion pathways domestically. Once invasive species become established within one country, they pose a threat to an entire region, as well as to trading partners and every country along a trading pathway. If an invasive species never leaves its native country, it will never become a problem in the U.S.. Actions by the U.S. have sometimes contributed to the invasive species problems faced by other countries. Despite good intentions, we have occasionally facilitated the introduction of invasive species to other countries through development assistance programs, military operations, famine relief projects, and international financing.

Response:

- Strengthen and expand U.S. participation in mutually supportive standards and codes of conduct within international fora.
- Develop a strategy and support materials for U.S. representatives to encourage and assist all countries with development of coordinated policies and programs on invasive species.
- Identify the limitations and strengths of existing international agreements and develop a program of work to further strengthen them.
- Outline an approach to a North American invasive species strategy.
- Establish an ongoing process to consider the risks of invasive species during the development of U.S. trade agreements.
- Sponsor technical assistance workshops in other countries.
- Provide financial and technical support to international meetings of policy makers, as well as regional and global programs.
- Conduct a study of international assistance as an invasion pathway.

Research: Research supports each aspect of the Plan. Complementary research projects ranging from basic investigations with broad application to highly targeted applied efforts are required. Federal research outcomes, where appropriate, will be transferred to Federal, State, local, tribal, and private sector stakeholders for their utilization.

Response:

- Include, as part of the cross-cut budget proposal, an initiative to adequately fund Federal invasive species research programs.
- Establish and coordinate a long- and short-term research capacity that encompasses the range from basic to applied research for invasive species. This initiative will build on existing efforts that reflect a range of perspectives and program approaches.
- Prepare a catalog of existing aquatic and terrestrial control methods.
- Develop and implement a plan to strengthen international research collaborations between the U.S. and other countries.

Information Management: The Council is charged with establishing a coordinated, up-to-date information-sharing system. Although there are many sources of information concerning invasive species, incompatible database formats and other factors impede information sharing. The Council is currently developing an information "gateway" accessible through the Council's website – www.invasivespecies.gov. The long-term goal is to provide accessible, accurate, referenced, up-to-date, comprehensive, and comprehensible information on invasive species that will be useful to local, State, tribal, and Federal managers, scientists, policy-makers, teachers, students, and others.

Response:

- Develop guidance for managing information concerning invasive species in aquatic and terrestrial environments.
- Maintain and enhance the Council's website, www.invasivespecies.gov, on a continuing basis.
- Post and maintain "case studies" on control and rapid response efforts on the Council's website.
- Include a locator for occurrences of invasive species in the United States by county.
- Link the website to major U.S. databases, websites, and most State information networks that deal with invasive species, and to websites in other nations that have active invasive species programs.
- Develop and implement a memorandum of understanding among appropriate Federal Departments to establish an invasive species assessment and monitoring network.

- Expand the website to include information on internationally relevant agreements, codes of conduct, meetings, publications, experts, programs, and financial resources, as well as regional and global invasive species databases.
- Produce an Invasive Species Compendium for North America.

Education and Public Awareness: Views of invasive species issues are molded by human values, decisions, and behaviors. The prevention and control of invasive species will require modifying behaviors, values, and beliefs and changing the way decisions are made regarding our actions to address invasive species. A wide variety of education, outreach, and training programs are needed.

Response:

- Coordinate development and implementation of a national public awareness campaign, emphasizing public and private partnerships.
- Identify and evaluate existing public surveys of attitudes and understanding concerning invasive species issues.
- Compile a comprehensive assessment of current invasive species communications, education, and outreach programs.
- Develop a model public awareness program that incorporates national, regional, State, and local level invasive species public education activities, including a plan for testing the model over the next year.
- Coordinate development and implementation of an international education campaign.
- Develop a series of education materials to guide organizations in development assistance, industry, international finance, and government sectors to write and implement “codes of conduct.”
- Co-host a series of international workshops on invasive species in different regions for policy makers.

Introduction

The Problem

Invasive species are everywhere. They damage our crops, our industries, the environment and public health. Scientists, academics, leaders of industry, and land managers are realizing that invasive species are one of the most serious environmental threats of the 21st century (Mooney and Hobbs 2000).

For centuries people have moved plants, animals, and microbes around the world. Most countries now rely on plants and animals from other regions of the world in order to meet their dietary needs. People in the U.S. also import plants and animals, and their products, for such things as construction materials, ornamental plants, and pets. Organisms that have been moved from their native habitat to a new location (often in a different country) are typically referred to as "non-native," "nonindigenous," "exotic," or "alien" to the new environment. A small percentage cause serious problems in their new environments and are collectively known as "invasive species." Most of U.S. food crops and domesticated animals are non-native species and their beneficial value is obvious – for example, managed livestock are non-native species that are not invasive.

An "invasive species" is defined by the Executive Order as a species that is 1) non-native (or alien) to the ecosystem under consideration and 2) whose introduction causes or is likely to cause economic or environmental harm or harm to human health. The Order further provides that a Federal agency may make a determination that the benefits of an action, which may lead to the introduction or spread of an invasive species, clearly outweigh the potential harm caused by the species and take steps to minimize that harm (Executive Order 13112, Appendix 1). This Management Plan is focused on those non-native species that cause or may cause significant negative impacts and do not provide an equivalent benefit to society.

Invasive species have been introduced in a variety of ways. The means and routes by which they are introduced are called invasion "pathways." Some non-native species, intentionally introduced for beneficial purposes, later turn out to be invasive. In the U.S., examples include purple loosestrife, which is sold as an ornamental plant, as well as saltcedar which was introduced for erosion control. Many invasive species are unintentionally introduced; they move as unknown stowaways and "hitchhikers" when people and their products are transported by air, water, rail, or road. Examples of invasive species unintentionally introduced into the U.S. include chestnut blight, the naval shipworm, and imported fire ants. Chestnut blight is one of the most destructive plant diseases ever recorded. This fungus, believed to have come from Asia in imported wood, has forever changed the forest tree composition in the eastern United States. The naval shipworm was introduced into San Francisco Bay via wooden ships in the early part of the 20th century. It excavated the majority of the wood pilings, causing warehouses and loaded freight cars to fall into the Bay. Imported fire ants entered the U.S. with soil removed from ships that transported goods to the U.S. As their name suggests,

they cause painful stings. Where they have established in the southern U.S., they can be found in large numbers. They can seriously injure livestock, pets, and humans. They also feed on crops and build large, hard mounds that damage farm and field machinery.

Invasive species can take a heavy economic toll. Researchers at Cornell University estimate that invasive species are costing Americans approximately $137 billion every year (Pimentel *et al.* 2000). Even controlling a single unwanted invader can carry a price tag in the millions. The United States and Canada are spending $14 million a year just to control the sea lamprey. This species caused the collapse of the lake trout and whitefish fisheries in the Great Lakes (Wilkinson pers. comm.). In 1994, the impacts of invasive plants in the United States were estimated at $13 billion per year (Westbrooks 1998). The list of invaders is long, and the cost of prevention and control is high and going up.

The environmental costs of invasive species can also be staggering. Invasive species typically have high reproductive rates, disperse easily, and can tolerate a wide range of environmental conditions. Often, they lack predators in their new environments. As a result, invasive species may out-compete native species for prey or other resource needs (e.g., breeding sites). They may also prey upon native species, spread pathogens and parasites, or alter the genetic make up of closely related species. Wilcove *et al.,*1998, estimate that invasive species have contributed to the placement of 35 to 46 percent of the plants and animals on the Federal Endangered Species List. The brown tree snake is a well-known example — it arrived in the U.S. territory of Guam in the 1940s, probably hidden in military transport planes. It is mildly venomous and an aggressive predator that has driven nine of Guam's eleven native land bird species to extinction.

Invasive plants are estimated to infest 100 million acres in the United States. Every year, they spread across three million additional acres, an area twice the size of Delaware. Every day, up to 4,600 acres of additional Federal public natural areas in the Western continental United States are negatively impacted by invasive plant species (Bureau of Land Management 1996).

Invasive species have also dramatically modified habitats. In some cases, invasive species have altered the ecology of an area to such an extent that the original ecosystem is fundamentally changed. For example, in the U.S., cheatgrass has accelerated the fire cycle in western States by twenty-fold, while saltcedar has altered soil chemistry and impacted native plants and wildlife.

Some invasive species threaten plant, animal, and/or human health. Pathogens and parasites may themselves be invasive species or may be introduced by them (invasive vectors). Bubonic plague is perhaps history's most infamous example of a vectored disease. It was spread by non-native black rats carrying disease-infected fleas. The recently introduced West Nile virus, which is transmitted to

humans by mosquitoes that feed on the blood of infected animals, now threatens people and animals in 12 eastern states and the District of Columbia. Cholera and microorganisms that cause certain types of harmful algal blooms are moved in the ballast water carried by large ships.

In many cases, invasive species cause a combination of economic, environmental, and health threats. Typically, studies that document the harm caused by invasive species conclude that the U.S. needs to strengthen its legal authorities and existing programs. A 1993 report by the Office of Technology Assessment, "Harmful Non-indigenous Species in the United States," states that "Federal laws leave both obvious and subtle gaps in the regulation of harmful NIS [invasive species]" (U.S. Congress, OTA 1993). The 1999 report compiled by the National Plant Board for the Animal and Plant Health Inspection Service, "Safeguarding American Plant Resources," notes that the laws giving the agency its authorities "were passed in response to specific plant health crises" and that "overlaps and gaps in this array of statutes often leave the Agency unsure of which authority to apply in any given case…" (National Plant Board 1999). A 1996 publication by The Nature Conservancy notes that the laws that do exist often are not effective or adequately enforced (Stein and Flack 1996). A recent review by Cornell University researchers concludes, "Although [Federal] policies and practices may help reduce accidental and intentional introduction of potentially harmful exotic species [invasive species], there is a long way to go before the resources devoted to the problem are in proportion to the risks" (Pimentel *et al.* 2000).

Efforts by the U.S. (and all other countries) to prevent the introduction and control the spread of invasive species face a number of challenges:

- Determining whether a non-native species is invasive requires a context-specific analysis. For example, a species may cause harm in one type of ecosystem, but not others. Because ecosystems are dynamic, their vulnerability to invasion changes over time. Thus, it would be impossible to develop a definitive or complete list of invasive species at the national level. A limited number of invasive species are listed as regulated species under Federal laws governing specific types of species such as noxious weeds, injurious fish or wildlife species, or aquatic nuisance species. States also compile lists of invasive species under their authorities. Although incomplete, this information can be used in setting priorities.
- Estimates of the number of non-native species that have been introduced into the United States vary widely (from 5,000 to as many as 50,000) (Pimentel *et al.*, 2000). The Office of Technology Assessment report estimates that 10 to 15 percent of introduced species will become established and about 10 percent of established species may become invasive (U.S. Congress, OTA 1993). Many additional species could create problems if introduced. For example, the Animal and Plant Health Inspection Service (APHIS) of the Department of Agriculture has intercepted 7,400 species of plant pests at ports of entry since

1985 of which some could have become invasive if they entered the United States (APHIS unpublished data).

- The diversity and number of pathways complicate efforts to prevent introduction and control the spread of invasive species. Green crabs may have hitchhiked in bait shipments, while citrus canker is carried on citrus trees. Many pathways are unknown and pathways have a tendency to change over time.
- Once an invasive species becomes established at a new location, it may spread. The pace of establishment and spread depends on numerous factors, including the invasive species' reproduction mechanisms, ability to acclimatize or adapt, whether it has predators or competitors, and what pathways are available for further movement.

In response to the threats posed by invasive species and the challenges to minimizing their spread, the President issued Executive Order 13112 (Order) on Invasive Species, February 3, 1999 (Appendix 1).

Executive Order 13112 on Invasive Species

In 1997, 500 scientists and resource managers wrote to the Vice President and requested action on invasive species. Their letter stated: "We are losing the war against invasive exotic species, and their economic impacts are soaring. We simply cannot allow this unacceptable degradation of our Nation's public and agricultural lands to continue." An interagency team was launched in response to develop a comprehensive and coordinated strategy for the problem. The team prepared a review of the issue with recommendations, of which the foremost was that an executive order be issued providing standards and a framework for ongoing action.

The Order applies to all Federal agencies which may take actions affecting the status of invasive species, and requires agencies to identify such actions and to the extent practicable and permitted by law (1) take actions specified in the Order to address the problem consistent with their authorities and budgetary resources; and (2) not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere unless, "pursuant to guidelines that it has prescribed, the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions" (Executive Order 13112, Appendix 1). Although the Order applies to all Federal agencies, most of the duties required by the EO are the responsibility of the ten Council members. Given the scope and complexity of the invasive species problem, it is necessary to prioritize actions to deal with the most pressing invasive species problems first.

The Order establishes the National Invasive Species Council (Council), which is chaired by the Secretaries of Agriculture, Commerce, and the Interior and

includes the Departments of State, Treasury, Defense, Health and Human Services, Transportation, the Environmental Protection Agency, and the U.S. Agency for International Development. Throughout this document, the term "Invasive Species Council" or "the Council" means the 10 member Departments and their constituent agencies, as well as a small staff assigned specifically to the Council. The Order directs the Secretary of the Interior to establish an advisory committee including diverse stakeholders to assist the Council (Advisory Committee), to appoint an executive director with concurrence of the other co-chairs, and to provide necessary staff and administrative support. Current Advisory Committee members are listed in Appendix 4.

The Order directs the Council to provide national leadership and oversight on invasive species and to see that Federal agency activities are coordinated and effective. In addition, the Council has specific responsibilities including: promoting action at local, State, tribal, and ecosystem levels; identifying recommendations for international cooperation; facilitating a coordinated network to document, evaluate, and monitor invasive species' effects; developing a web-based information network on invasive species; developing guidance on invasive species for Federal agencies to use in implementing the National Environmental Policy Act; and preparing this document for the National Invasive Species Management Plan.

National Invasive Species Management Plan

Requirements of the Order: The Council was directed by the President to release the first edition of the Plan 18 months after the Order was issued, and to include performance-oriented goals and objectives and specific measures of success for Federal agency efforts concerning invasive species, including objectives and measures for each of the Federal agency and Council duties described above. The Plan is also to identify the personnel, other resources, and additional levels of coordination needed to achieve its goals and objectives. The purpose of the Plan is to provide a blueprint for Federal action (in coordination with State, local, and private programs and international cooperation) to prevent the introduction of invasive species, provide for their control, and minimize their economic, environmental, and human health impacts. The focus of the Plan is on those non-native species that cause or may cause significant negative impacts and do not provide an equivalent benefit to society.

The Order requires that the Plan be developed through a public process and in consultation with Federal agencies and stakeholders. The first edition of the Plan is to include a review of existing and prospective approaches and authorities for preventing the introduction and spread of invasive species, including those for identifying pathways by which invasive species are introduced and for minimizing the risk of introductions via those pathways. Based on this review, the Plan is to identify research needs and recommend measures to minimize the risk of introductions. The Order states that those measures are to provide for a science-

based process to evaluate risks associated with introduction and spread of invasive species and a coordinated and systematic risk-based process to identify, monitor, and interdict pathways that may be involved in the introduction of invasive species. If any recommended measures are not authorized under current law, the Council is charged with recommending legislative proposals for new authority.

The Council is required to update the Plan biennially and report on success in achieving its goals and objectives. Within 18 months after measures have been recommended by the Council in any edition of the Plan, each Federal agency whose action is required to implement such measures is required to take the action recommended or provide the Council with an explanation of why the action is not feasible.

The Management Plan: 1st Edition

This first edition of the Plan is the result of extensive consultation with many organizations and individuals with differing interests. Valuable guidance came from the Invasive Species Advisory Committee and members of six working groups made up of both Federal and non-federal experts under the auspices of the Advisory Committee (Appendix 6). The working groups are: (1) international, (2) communication, outreach, and education, (3) policy and regulation, (4) risk analysis and prevention, (5) management, and (6) research, information sharing, documentation, and monitoring. This Plan contains a number of actions recommended by the working groups and discussed in the reports of the groups. These are available for review at the Council's website, www.invasivespecies.gov.

The Council also heard from a wide range of organizations and individuals at five public listening sessions held in July 2000 around the country and through numerous written comments. In addition, the Advisory Committee and the Council adopted a set of Guiding Principles, which are located in Appendix 6 of this document. The Council provided a 60-day public comment period on the Draft Management Plan that ended December 1, 2000. As a result, the Council received 181 written comments on the Plan, a few of which were signed by multiple groups or individuals. The majority of the submissions were from non-federal stakeholders. The input from all of these processes is reflected in this edition of the Plan. Although a draft Plan was made available for comment on the Council's website in early August of 2000, before the deadline set by the EO, the final version is being issued five months after the EO's deadline, due to extensive revisions made in response to public comment and delays in hiring Council staff.

This first Plan provides a general blueprint for action to deal with the threats posed by invasive species; however, many of the details of the actions called for will require further development in the implementation phase. At that point specific measures of success as well as personnel and other resources needed to achieve the Plan's goals will be described. The action items included in the Plan

outline an array of prospective approaches for preventing the introduction and spread of invasive species. The Plan requires agencies to report on their invasive species activities and steps taken to comply with the Order and with the Plan, and provides for an oversight mechanism to ensure agency compliance.

Clearly, many of the actions and goals outlined in the Plan will not succeed unless they are undertaken in cooperation with stakeholders that have extensive programs dealing with invasive species, including other nations, States, tribes, and local governments. The essential and often leading role of State and local efforts and the importance of coordinated Federal and State action are mentioned throughout this edition. It was not within the scope of the Plan to report on or analyze the myriad State and local invasive species programs or plans, although

Invasions in the San Francisco Estuary

The San Francisco Bay/Delta Estuary is an example of how species invasions can change an entire ecosystem. It is possibly the most invaded estuary in the entire world (Cohen and Carlton 1998). More than 230 non-native species have become established in the system, and there are an additional 100-200 species that may be non-native but whose origin cannot yet be determined. The known invasive species cover a wide range of taxonomic groups: 69 percent of the species are invertebrates such as mollusks, crustaceans, and tubeworms; 15 percent are fish and other vertebrates; 12 percent are vascular plants; and 4 percent are microbial organisms. Non-native organisms dominate many estuarine habitats, accounting for 40 to 100 percent of the common species at many sites in the estuary, whether calculated as a percentage of the number of species present, the number of individuals, or of total biomass (Cohen and Carlton 1995). In some areas, it is difficult to find a native organism.

European green crab is native to both the Baltic and North Seas. Green crabs have invaded both coasts of North America and other locations. An able colonizer and efficient predator, this species has the potential to significantly alter any ecosystem it invades.

Smithionian Envrionmental Research Center
Photo by Greg Ruiz

Non-native species introductions have dramatically reduced some native populations, altered habitat structure and energy flows, and caused billions of dollars in economic damage (Cohen and Carlton 1995). The pace of invasion is apparently accelerating. Roughly half of the non-native species have arrived in the last 35 years. Between 1851 and 1960, a new species was established in the estuary every 55 weeks. From 1961 to 1995, the rate was a new species detected every 14 weeks (Cohen and Carlton 1998).

A number of different pathways have led to new introductions, but there are definite historical patterns to the most significant pathways. Many of the early introductions were organisms transported on the hulls of wooden ships. A number of introductions around the beginning of the 20th century were due to the importation and cultivation of non-native oysters. Even though these oysters did not become established in the estuary, the oyster shipments contained a variety of other species that did. Most recently, the major pathway has been the discharge of ballast water from large ships. In other aquatic systems, additional pathways have been significant. These pathways include the introduction of pathogens and parasites via aquaculture, establishment of ornamental plants, and introduction of species as bait.

such an analysis would clearly be useful. As appropriate, coordination with State and local programs and plans will be addressed in the Plan's implementation phase.

Our efforts to minimize the spread of invasive species have begun. Along the way, we will need to more efficiently use our existing resources, as well as obtain additional and sustained resources, both human and financial. This edition of the Plan provides a blueprint for immediate action. To make tangible progress we need to ensure that this Plan is promptly implemented and that future editions follow in a timely manner. We can meet the challenge of invasive species by harnessing the energy, resources and intellect of all concerned.

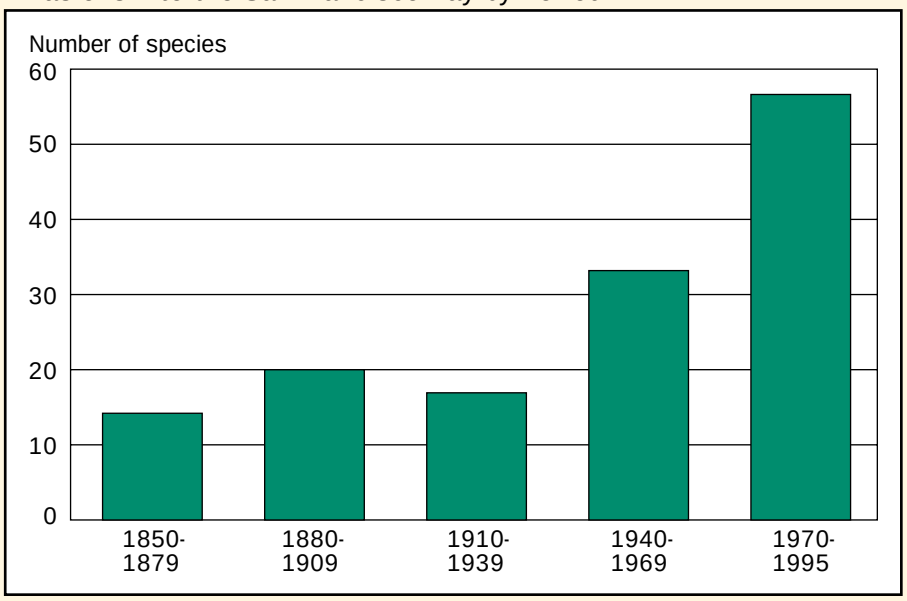
Multiple impacts from a single species–*Potamocorbula amurensis*

In October 1986, three small clams were collected in San Francisco Bay by a college biology class. They were later identified as an Asian species (Potamocorbula amurensis) that had never before been seen on the West Coast. Nine months later, this species had become the most abundant clam in the northern part of the Bay, ultimately reaching densities of nearly 50,000 clams per square meter (Peterson 1996). Other clams were displaced and the biodiversity of bottom-dwelling organisms was reduced (Nichols 1990, Thompson 1998).

This Asian clam is also a highly efficient filter feeder. It has been estimated that clams in the northern portion of the Bay have the capacity to filter the entire water column at least once and possibly more than twice in a single day (Thompson and Luoma 1999). As a result, the clam has virtually eliminated the annual phytoplankton blooms. Phytoplankton are at the base of the food chain and are preyed upon by zooplankton, which in turn are eaten by juvenile fish. There is preliminary evidence that this cascading impact on the food chain has resulted in a reduction in zooplankton populations.

– Andrew Cohen (San Francisco Estuary Institute)

Invasions into the San Francisco Bay by Period



Data from: Biological Study, Nonindigenous Aquatic Species in a United States Estuary: A Case Study of the San Francisco Bay and Delta, U.S. Flish and Wildlife Service, 1995, page 159.

Andrew N. Cohen and James T. Carlton

Survey of Federal Roles and Responsibilities

Invasive species and the problems they create are far from new. The River and Harbors Act of 1899 directed the Department of Defense's Army Corps of Engineers to manage aquatic invasive plants. State laws requiring the eradication or control of invasive weeds have been on the books for more than 100 years. Many Federal laws, authorities, and programs, as well as international agreements and treaties, have been established as part of efforts to prevent, control, and manage the many different types of invasive species and their impacts. More than 20 Federal agencies now have responsibilities, authorities, and programs that address some aspect of the invasive species issue. Some of these programs are significant in their breadth and scope [e.g., the U.S. Department of Agriculture's Animal and Plant Health Inspection Service (APHIS)] and some focus on specific, high-profile aspects of the overall problem (e.g., the Department of the Interior's Office of Insular Affairs oversees a program to control and contain the brown tree snake).

The major Federal invasive species efforts currently in place are outlined in this section. Further detail is provided in Appendix 2. A list of legal authorities can be found in Appendix 3. Although many Federal programs and responsibilities cut across several aspects of the invasive species issue, they have been grouped under the headings of prevention; early detection and rapid response; control, management, and restoration; research and monitoring; international measures; public outreach and partnership efforts; other interagency efforts; and related issues. More complete reports describing Federal authorities are available elsewhere (e.g., U.S. Congress, OTA 1993; National Plant Board 1999; U.S. General Accounting Office 2000).

The States have numerous programs relating to the wide variety of invasive species issues and also play a critical role in preventing and controlling the spread of invasive species. Generally, the States, except on Federal lands and where specifically provided by Federal law or international treaty, have jurisdiction over resident fish and wildlife. Nothing in this Plan alters or modifies existing State or Federal jurisdiction in any way. A description or analysis of the wide variety of State policies and programs is beyond the scope of this Plan. However, coordination and joint action with State partners is an important element of many of the Plan's action items (next section). State, tribal, local, and foreign government participation will be critical to addressing the U.S.'s invasive species problems.

Overview

The Council's member Departments spent approximately $631.5 million in Fiscal Year (FY) 2000 on invasive species issues (U.S. General Accounting Office 2000). The Department of Agriculture (USDA), a Council co-chair, has by far the largest budget to address invasive species, with USDA agencies accounting for almost 90 percent of the spending. USDA has jurisdiction over the importation and exportation of plant species, plant pests, biological control organisms, and animals

considered to be plant pests or a threat to livestock or poultry health. It also has authority over forest pests and management of invasive species in the U.S. 190-million-acre National Forest and Grasslands System.

The Department of the Interior (Interior) has a much smaller program – approximately $31 million in FY 2000 – accounting for about 5 percent of the total Federal invasive species expenditures (U.S. General Accounting Office 2000). Interior regulates the importation of animals found to be injurious, enforces laws and regulations governing the import and export of all wildlife into the U.S., plays a key role in implementing actions to address aquatic invasive species and has responsibility for management of invasive species on the lands managed by its agencies.

The Department of Commerce, through the National Oceanic and Atmospheric Administration (NOAA), is trustee for the Nation's marine resources and has programs to deal with aquatic invasive species. NOAA's primary focus has been on research and outreach regarding aquatic invasive species. In FY 2000, NOAA spent a total of $5.5 million on these programs.

The Department of Defense (Defense) spent a total of $14.5 million in FY 2000 controlling invasive species on its installations and ensuring that invasive species are not transferred into the United States or to other nations during its operations (U.S. General Accounting Office 2000). Most of these funds ($9.1 million) were spent to control aquatic plant growth (most of which are invasive species) and support research on zebra mussels.

Other Federal Departments play limited but important roles. For example, U.S. Customs Service (USCS), works with USDA and Interior to enforce laws prohibiting or limiting the entry of invasive species. The Environmental Protection Agency (EPA) regulates chemical pesticides and biopesticides. It also reviews environmental impact statements.

Prevention

The protection of agriculture has been, and continues to be, the primary focus of Federal efforts to prevent invasions of non-native species, but damage to natural areas is increasing in priority. About half of the total Federal expenditures on invasive species are for prevention activities. The new Plant Protection Act (PPA), which consolidated the authorities in the Plant Quarantine Act, Federal Plant Pest Act, Federal Noxious Weed Act, and other plant-related statutes, authorizes USDA to prohibit or restrict the importation or interstate movement of any plant, plant product, biological control organism, or plant pest. "Plant pest" is defined very broadly to include almost any living organism (other than humans) that damages or causes disease to any plant. The PPA specifically authorizes USDA to hold, seize, quarantine, treat, or destroy any plant or plant pest moving in interstate commerce if necessary to prevent the movement of a plant pest or federally

listed noxious weed into a new area. In addition, USDA "preclears" some shipments before they can be exported from foreign countries to the United States to ensure that they are free of certain invasive species. It has long been recognized that the resources for USDA's exclusion activities have not kept pace with the increased volume of trade and tourism.

USDA also has authority to regulate the importation and interstate movement of certain invasive animal species under a number of statutes collectively referred to as the animal quarantine laws. These laws authorize USDA to prevent the introduction and dissemination of communicable diseases and pests of livestock and poultry. The USDA also regulates the importation or exportation of veterinary biological products and prohibits the importation or shipment of any veterinary products that are contaminated, dangerous, or harmful.

The movement of seed is regulated under the Federal Seed Act, which prohibits the importation of any agricultural or vegetable seed containing high-risk weed seeds. The Federal Seed Act also allows the interstate transport of seed containing other specifically listed weed seeds, as long as the shipment is accurately labeled and the density of those weed seeds does not exceed the tolerance levels for the State in which it is offered.

Interior regulates the importation of animals found to be injurious under the Lacey Act. The species that have been specifically listed as injurious include 12 genera of mammals, 4 species of birds, 1 reptile, 1 mollusk, and 1 crustacean. Interior's port inspection program is relatively small – in FY 1999, the budget was just over $3 million. Several provisions within the Lacey Act limit Interior's ability to comprehensively address invasive species introductions. Most notably, the Act is limited to only vertebrates, mollusks, and crustaceans.

A number of Departmental agencies are charged with preventing and controlling the introduction of aquatic nuisance species under the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990. The Fish and Wildlife Service (FWS), NOAA, the EPA, USDA, Defense, and the Departments of Transportation (Transportation) and State (State) are all represented on the Aquatic Nuisance Species Task Force (ANSTF), which coordinates Federal activities to implement the Act. Transportation is charged with issuing regulations to prevent introductions through the ballast water of vessels. Specifically, they have issued regulations requiring management of ballast water in the Great Lakes and Hudson River, and issued voluntary guidelines to prevent the introduction and spread of non-native species from ballast water in ships entering other U.S. waters from outside the exclusive economic zone.

Defense transports large shipments of equipment into the U.S. that could harbor invasive species. These shipments are inspected by USDA agents. In addition, Defense and other departments ship a great number of items to other countries

and take actions to ensure they do not cause problems in other countries. The U.S. Customs Service assists USDA and Interior in the enforcement of plant and animal regulations by detaining, where applicable, imported or exported products pending their clearance by agency inspectors.

The Federal land management agencies in both USDA and Interior have internal prevention strategies as well as interagency programs such as Noxious Weed-Seed Free Forage and Mulch program and the Slow the Spread program (which is intended to prevent the further spread of gypsy moth in the eastern forests).

Early Detection and Rapid Response

A number of Federal Departments have programs to detect, assess, and respond to invasions by non-native species. This section specifically addresses Departments that have special or emergency authority to identify and address new or incipient invasions rapidly - before invasive species can become established or widespread, while eradication is still cost effective and possible. Only USDA has emergency authority to deal with an incipient invasion. Both the PPA and the animal quarantine laws described above provide authority to seize, quarantine, destroy, hold, and treat prohibited species that are imported into the United States or moved between States. These authorities also authorize the USDA to declare an extraordinary emergency in order to address a situation in which the prohibited species has not been moved but a State is unable or unwilling to take appropriate action to prevent dissemination of a plant pest or a communicable disease of livestock or poultry.

In addition, Interior has established four exotic plant management teams to identify, eradicate, or control small, localized infestations on lands managed by the National Park Service. Many departments have interagency and interdepartmental rapid response teams. All Federal rapid response actions must comply with the National Environmental Policy Act (NEPA).

Control, Management, and Restoration

All Federal land and water management agencies within Interior, NOAA, and Defense have authority to control and manage invasive species as well as restore affected areas on their lands and waters. This authority arises from the various agency organic acts and other statutes that govern management, uses, and planning on the lands and waters under their jurisdiction. The level of effort and budgetary resources for management, control, and restoration vary with each Department. None of them has the resources to control every invasive species present on Federal lands and waters. Departments and their agencies also work in partnership with States and private landowners to control invasive species on public lands. These efforts are summarized below in the section on Partnership Efforts.

The Nonindigenous Aquatic Nuisance Prevention and Control Act (NANPCA) enables the Federal members of the ANSTF to undertake control actions in addition to prevention and monitoring activities. NANPCA also provides regulatory authority to FWS, NOAA, and Transportation for control activities. To date, this regulatory authority has not been used because it is only applicable to unintentional introductions, and there is uncertainty as to the extent of the authority.

The EPA has authority under three statutes that can be used to control and manage invasive species. The EPA may have authority under the Clean Water Act to control and manage invasive species through permits or other requirements and programs and is currently reviewing its authorities under the Clean Water Act relative to invasive species. The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) requires manufacturers and importers who produce or sell a pest control product to register the compound with the EPA. FIFRA is a critical statute for invasive species whenever pesticides are used to control or reduce the impact of invasive species. Examples include the use of a pesticide to control lamprey populations in the Great Lakes and the use of herbicides to control noxious weeds. FIFRA also gives EPA review authority for biopesticides when they are used to control invasive pests. Finally, EPA reviews all environmental impact statements under NEPA. This review, conducted in EPA's regional offices, now includes an explicit consideration of the proposed action with regard to invasive species.

A number of Departments are involved in control and management efforts. USDA has authority under the PPA and other statutes for the control and management of invasive species. The PPA specifically authorizes USDA to develop integrated management plans for noxious weeds for the geographic region where the weed is found. The Emergency Watershed Program gives the Natural Resources Conservation Service (NRCS) authority to provide technical and financial assistance to carry out restoration following declaration of a disaster. Defense manages aquatic plants and other invasive species in 562 reservoirs, 237 navigation locks, 962 harbors, 75 hydropower projects, and 25,000 miles of inland and coastal waterways through its operations and maintenance activities.

Research and Monitoring

Almost all the Departments with major responsibilities in the areas of prevention and control of invasive species also have research and monitoring programs to support their efforts. For several agencies with USDA, Interior, and NOAA, research and monitoring are very significant activities. USDA regularly monitors its emergency programs to determine efficacy and potential environmental impacts, and through the Cooperative Agriculture Pest Survey program has developed a database system to store information collected in the surveys of agricultural pests, which is called the National Agriculture Pest Information System (NAPIS). USDA also conducts significant research efforts on invasive species under its various authorities. It provides leadership in developing

biological control technologies, as well as research on invasive insects and pathogens of concern to forest, rangelands, and wetlands. It also establishes partnerships for the integrated management of invasive species. Defense has a number of research programs focused on aquatic plant problems and zebra mussels. In addition, EPA conducts research on the risks associated with invasive species and monitors the extent of invasive species spread by ecosystem type as part of its research and development authority. Interior coordinates important information systems on non-native aquatic species in ecosystems.

Information Management

Departments engaged in invasive species prevention and control activities have developed a variety of databases and decision support tools to increase predictive capacity for preventing introduction of new invasives and to improve control efforts in both agricultural production and conservation areas. The Smithsonian Institution and various research and development bureaus and agencies of the Council (especially USDA, Interior, and NOAA) have incorporated computer-assisted digital photography and rapid dissemination to taxonomic experts via the World Wide Web to speed identification of pests and noxious weeds in trade. Databases at USDA record and analyze information on pests intercepted at ports of entry. Research and informatics programs at the USDA Forest Service and the Interior's U.S. Geological Survey document and analyze the spread of invasive species such as forest pathogens and aquatic nuisance species. These structured databases and other new technologies under development for locating and treating aquatic and terrestrial invasive species have greatly enhanced the ability of land and water managers to stop the spread of some of the most invasive species. Interior and USDA have joined efforts to combine components of the National Biological Information Infrastructure (NBII) and various research and bibliographic databases at the National Agricultural Library (NAL) to assist the Council in its charge to implement a web-based network capability for information sharing among professionals and the public at large.

International Measures

The global dimensions of the invasive species problem increase as trade, tourism, and transport expand. Any realistic strategy to prevent the spread of invasive species must be built upon international agreements, cooperation, and capacity building. The U.S. Government plays an active role and provides leadership in efforts to prevent and control invasions of non-native species internationally. For example: USDA leads U.S. negotiations under the International Plant Protection Convention (IPPC) and works with the World Trade Organization to facilitate regulations concerning imports to prevent invasions under the Application of Sanitary and Phytosanitary Measures. The Office of the U.S. Trade Representative (USTR) leads or directs U.S. negotiations with other countries through meetings of the World Trade Organization (WTO) and the North American Free Trade Agreement (NAFTA). Interior leads the United States in negotiations on invasive species in the Convention on International Trade in Endangered Species of Wild Fauna

and Flora (CITES). State leads negotiations under the Convention on Biological Diversity (CBD) and is providing financial support to several international meetings of policy makers. Transportation has led U.S. efforts to address the issue of ballast water management within the International Maritime Organization (IMO). It has also sponsored the resolution adopted by the International Civil Aviation Organization (ICAO) that calls for participation by ICAO and national aviation authorities in the prevention and control of invasive species transported by air. Defense undertakes agreements on the management of invasive species with the defense departments of other nations and supports the development and implementation of regional programs of cooperation on invasive species, such as the South Pacific Regional Environment Programme (SPREP). The EPA leads U.S. activities under the North American Agreement for Environmental Cooperation (NAAEC). In the Great Lakes region, the EPA and NOAA work on invasive species issues in close association with the governments of Canada and the Baltic region, the U.S.-Great Lakes Fisheries Commission, and the U.S.-Canada International Joint Commission (IJC). The U.S. Agency for International Development (USAID) supports projects to control invasive species in developing countries, especially when food, water, or health security are at risk. The National Science Foundation (NSF) promotes exchanges of scientists and research collaborations with other countries.

Public Outreach and Partnership Efforts

Given the scope and pervasiveness of the invasive species problem, outreach and partnership efforts play a center stage role in many Federal efforts. Prevention efforts will not be fully successful without the participation of an informed public. Control efforts in many cases cannot be successful unless all affected landowners —- including State, local, tribal, and private — cooperate and coordinate the control action. A number of Federal Departments have special projects and programs that provide information to the public or assistance to State, local, and private landowners for control efforts, especially agencies within the Departments of the Interior, Agriculture, and Commerce. Commerce conducts outreach efforts on aquatic invasive species. USDA conducts public information campaigns directed at travelers and their extension specialists provide information to the public. (See Appendix 3, Public Outreach and Partnership Efforts.)

Other Interagency Efforts

There are a number of Federal entities that provide coordination among Federal agencies regarding different aspects of the invasive species problem. The Executive Order on Invasive Species specifically directs the Council to work with three of these, the:

1) Aquatic Nuisance Species Task Force (ANSTF), which coordinates activities relating to aquatic invasive species;
2) Federal Interagency Committee on the Management of Noxious and Exotic Weeds (FICMNEW), which coordinates weed management efforts on Federal lands; and
3) Committee on Environment and Natural Resources (CENR) of the National Science and Technology Council (NSTC), which coordinates research efforts.

There are many other important organizations and interagency efforts that Council members have and will continue to work with on invasive species issues.

Related Issues

A number of related issues repeatedly emerged during the development of information on Federal roles and responsibilities. The first issue is whether existing legal authorities are sufficient and whether and how they can be better utilized. The second issue is whether existing legal and regulatory authorities are being adequately enforced. These issues will be addressed in the analysis required under the leadership and coordination section of the plan. The third issue is whether human and financial resources are adequate to address the problem. A number of action items in the Plan highlight the need for additional resources.

An Action Plan for the Nation

The purpose of the National Invasive Species Management Plan (Plan) is to provide a blueprint for Federal action (in coordination with other nations, States, local, and private programs) to prevent the introduction of invasive species, provide for their control, and minimize their economic, environmental, and human health impacts.

This section reviews actions already taken to implement the Executive Order on Invasive Species (Order), as well as actions planned or recommended for the future. Its intent is to address the most pressing invasive species problems, not to encompass every useful agency action that could be taken. When applicable, the items discussed below will build upon existing regulatory structures, including databases, programs, facilities, and policies. The actions are described in nine categories: leadership and coordination, prevention, early detection and rapid response, control and management, restoration, international cooperation, research, information management, and education and public awareness. Although there is not a specific section that addresses monitoring, it is essential for activities ranging from restoration to detection. In addition, monitoring is needed to validate specific actions. These categories and actions are based on the duties of the ten Federal agencies constituting the National Invasive Species Council (Council) as established by the Order and informed by the deliberations of the Council, its Advisory Committee and working groups, and comments received by the Council during an extensive review process.

Many of the action items in the Plan can be completed or at least initiated with current resources. The Council recognizes that without significant additional and sustained resources for existing and new programs, it will not be possible to accomplish the goals of the Plan within the specified time frames. Resources are also needed for assisting and encouraging the coordinated and joint actions with State, tribal, local, and foreign governments that are essential for many parts of the Plan. These resources will be needed to enable existing programs to take on new or enhanced responsibilities and are in addition to the resource needs associated with specific action items listed in the Plan. Estimates of the actual amount of additional support required will depend upon the details of each implementation schedule as these are developed by the lead Federal agencies and relevant States and stakeholders. These resources will then need to be requested by the individual agencies through the annual appropriations process.

Note: Throughout this document, the term "National Invasive Species Council" or "the Council" means the ten member Departments and their constituent agencies, with support provided by the staff assigned to the Council.

A. LEADERSHIP AND COORDINATION

The Council is directed by the Order to provide national leadership and oversight on invasive species issues and to see that Federal agency activities are coordinated, effective, partnered with States, and provide for public input and participation. The Council established permanent staff positions, and the Departments of the Interior (Interior), Agriculture (USDA), and Commerce (Commerce) appointed liaisons from their Departments to assist the Council. Other agencies with responsibilities for invasive species appointed technical liaisons to the Council. These people represent an informal but effective interdepartmental liaison group that works directly with Council staff to complete activities assigned by the Council and has been instrumental in assisting the Council. The group also facilitates information flow among the Council members, Council staff, and the other Federal agencies.

The Council will meet in plenary session at least twice annually, and will convene meetings of the Advisory Committee on a regular basis and no less than four times before the first revision of this Plan in January 2003. At least two of the Advisory Committee meetings will be held in conjunction with Council meetings.

The Council staff plans to meet at least every 3 months with the interdepartmental liaison group. The primary purpose of these meetings will be to ensure that the duties assigned to Federal agencies in the Order are being carried out, including implementation of the actions recommended in this Plan. The interdepartmental liaisons will inform the Council of progress on recommendations, suggest new recommendations, and facilitate the exchange of information among all involved. The development of an Internet-based information sharing network, as mandated by the Order, will greatly facilitate coordination and information exchange, (see Section H; Information Management).

When appropriate, the Council and its staff will draw on various existing organizations for coordination and leadership. These include, among others, State, tribal, and local government agencies, State invasive species committees and

councils, regional organizations such as regional weed boards, the Aquatic Nuisance Species Task Force (ANSTF), Federal Interagency Committee on the Management of Noxious and Exotic Weeds (FICMNEW), Committee on Environment and Natural Resources (CENR), international bodies, and various non-government organizations.

The States play a key role in the management of invasive species within their borders. Therefore, this Plan reflects the need to build capacity and capability at State and local levels to coordinate, detect, and respond to invasive species. However, additional steps are needed to ensure a unified, effective, and coordinated Federal response. One critical step is the development of an oversight mechanism for use by Federal agencies in complying with the Order and reporting on implementation. An example of an oversight mechanism is the policy adopted by the U.S. Coral Reef Task Force, which was established by E.O. 13089. This policy can be reviewed at http://coralreef.gov. In addition, the Departments of the Council shall submit a written report on an annual basis summarizing their invasive species activities during the previous year and including a description of their actions to comply with the Executive Order on invasive species, budget estimates, and progress in implementation of the Plan.

Coordination and Leadership

ACTION PLANNED

1. By April 2001, the Council will establish a transparent oversight mechanism for use by Federal agencies in complying with the Order and reporting on implementation. The oversight mechanism will employ an interactive process that engages public involvement.
2. By July 2001, the Council will ensure that a clearly defined process will be developed and procedures will be in place to help resolve jurisdictional and other disputes regarding invasive species issues. The goals will be to resolve disputes at the most effective and least formal level possible, in an unbiased manner, and to involve only those parties with an interest in the dispute. The process will use unbiased third party mediators if appropriate. When requested by a State, the process may apply to disputes between Federal and State entities.
3. By January 2002, the Council will conduct an evaluation of current legal authorities relevant to invasive species. The evaluation will include an analysis of whether and how existing authorities may be better utilized. If warranted, recommendations will be made for changes in legal authority.
4. Starting in October 2001, each member Department of the Council shall submit an annual written report summarizing their invasive species activities, including a description of their actions to comply with the Order, budget estimates, and steps in implementing the Plan. These reports will be used in preparing the invasive species cross-cut budget and will help the Council in drafting the biannual updates to the year Management Plan.
5. By January 2002, the Council will prepare an analysis of barriers to coordinated and joint actions among Federal agencies, including legal and policy barriers and barriers relating to the transfer and pooling of funds for invasive species projects. The analysis will include consideration of a standard Memorandum of Understanding that would allow interagency transfer of funding for invasive species actions identified in the Plan.
6. By July 2002, the Council will identify at least two major invasive species issues, regulations, or policies where coordination is inadequate and will take action that fixes the problem.
7. Beginning with Fiscal Year (FY) 2003, and each year thereafter, the Council will coordinate and provide to the Office of Management and Budget (OMB) a proposed cross-cut budget for Federal agency expenditures concerning invasive species, and in particular will address implementation of the actions recommended in this and future editions of the Plan. The cross-cut budget will take into account views of the Advisory Committee, States, and the full range of stakeholders. In addition, it will be used as a tool for planning and coordination, giving emphasis to funding priorities to implement action items.
8. By January 2003, and every 2 years thereafter, the Council will give a report on success in achieving the goals and objectives of the current Plan, and issue an updated Plan. These updates and reports will be prepared in consultation with the Advisory Committee and through mechanisms securing comment from stakeholders and the general public.
9. By 2004, the Council will assess the effectiveness of the Order, as required by section 5(c) of the Order. The assessment will include an evaluation of whether the President should expand, or propose legislation to expand, the authorities of the Council to ensure that the requirements

of the Order and the Plan are carried out effectively and efficiently. The assessment process will include the solicitation of comments from program participants, including State partners and other interested stakeholders.

10. By February 2001, the Council will convene a working group of agency leads on international agreements relevant to invasive species in order to facilitate communication and the development of U.S. positions that have adequate stakeholder input and are mutually supportive.

Facilitating Non-Federal Action

The Council is charged with facilitating action at local, State, tribal, regional, and international levels. It has reviewed opportunities for encouraging non-federal efforts through discussions with the Advisory Committee, participation in listening sessions, and interaction with the general public.

Many of the actions and goals outlined will not succeed unless they are done in cooperation and partnership with the State, tribal, and local governments, given their critical role and extensive programs dealing with invasive species. The essential and often leading role of State and local efforts and the importance of coordinated Federal and State action are mentioned throughout this Plan.

ACTION PLANNED

11. By June 2001, Council staff will prepare a 2-year work plan identifying specific initiatives for presentation to the Council and will pursue projects in the interim as feasible and appropriate. The Council will develop and pursue joint projects in collaboration with the Advisory Committee and, when appropriate, the Aquatic Nuisance Species Task Force (ANSTF), the Federal Interagency Committee on the Management of Noxious and Exotic Weeds (FICMNEW), and the Council on Environment and Natural Resources (CENR). In preparing the work plan, the Council staff will seek advice from, and coordinate with, non-federal agencies and organizations, including the National Governors Association, managers of State invasive species programs, State plant boards, tribal governments, the National Association of Counties, the National Plant Board, the U.S. Animal Health Association, the National Association of Conservation Districts, the North American Weed Management Association, the International Association of Fish and Wildlife Agencies, land trusts, environmental non-profit organizations, community organizations, regional compacts such as the Great Lakes Panel on Aquatic Nuisance Species, the Intermountain Noxious

Federal / State Coordination in Action: TEAM Leafy Spurge

Leafy spurge overtaking a natural hillside in Colorado.

Agricultural Research Service, USDA
Photo by Norman Rees

Since its introduction into the United States, leafy spurge has doubled its acreage every 10 years (USDA Agricultural Research Service 1999). This formidable terrestrial weed now infests at least 5 million acres in 29 States. Costs to agricultural producers and taxpayers for production losses, control expenses, and other economic impacts are estimated at $144 million every year in North Dakota, South Dakota, Montana, and Wyoming alone.

In 1999, USDA's Agriculture Research Service (ARS) began The Ecological Area-wide Management (TEAM) Leafy Spurge, a $4.5 million, 5-year area-wide pest management demonstration project in the Little Missouri River drainage. Partners include the Animal and Plant Health Inspection Service (APHIS), Forest Service (FS), National Park Service (NPS), Bureau of Land Management (BLM), U.S. Geological Survey (USGS), State departments of agriculture and other State agencies, land grant universities, county weed managers, and landowners.

TEAM Leafy Spurge's integrated pest management strategy relies on biological control agents and techniques such as combined sheep and cattle grazing. There has been progress on several fronts. The effectiveness of one biological control agent, the leafy spurge flea beetle, has been demonstrated at numerous test

Weed Advisory Committee, and international bodies, such as the Global Invasive Species Programme (GISP), as well as other stakeholders.

National Environmental Policy Act Guidance

Federal agency decisions to undertake many Federal actions that affect or are affected by invasive species are usually preceded by the need to comply with the National Environmental Policy Act (NEPA). Under NEPA, Federal agencies, often in cooperation with State, local, and tribal governments, must analyze the environmental, economic and social effects of their proposed actions and alternatives to the proposed action. Through greater familiarity with the issue and available literature, such analyses can be utilized to identify more efficient and effective means of addressing invasive species issues in the course of undertaking numerous Federal actions.

ACTION PLANNED

12. By August 2001, the Council in cooperation with the President's Council on Environmental Quality (CEQ) will prepare and issue guidance to Federal agencies based on the National Environmental Policy Act (NEPA) for prevention and control of invasive species.

sites. Successful establishment of flea beetles has improved because TEAM Leafy Spurge members are working directly with landowners on the proper methods for release of the insect. Tours of the demonstration sites as part of a comprehensive public education program have already begun, and the response by farmers and ranchers has been overwhelming. Research funded by TEAM Leafy Spurge in the United States and abroad seeks improved understanding of how biological controls work and is attempting to identify new leafy spurge parasites and pathogens for testing.

Aphthona flava is a type of flea beetle that feeds on leafy spurge. This insect may help control leafy spurge populations.

Agricultural Research Service, USDA

B. PREVENTION

The first-line of defense and, over the long term, the most cost-effective strategy against invasive species is preventing them from becoming established. Prevention is two-pronged because some species are intentionally introduced for a specific purpose, whereas others arrive unintentionally as "hitchhikers" on a commodity, conveyance, or person.

The brown tree snake is a mildly venomous species native to eastern Indonesia, northern Australia, Papua New Guinea, and the Solomon Islands. It was accidentally introduced into Guam in the late 1940's to early 1950's, where it has spread throughout the island. Eleven bird species have been affected by this snake. Eight of them — some native only to Guam — have been decimated, while three others are listed as threatened or endangered. Brown tree snakes are excellent climbers, and can cause short-circuits and frequent power outages by climbing on electrical transmission lines. Keeping this snake from reaching Hawaii and the contiguous United States in cargo holds is a high priority for USDA and the Department of Defense.

Animal and Plant Health Inspection Service, Program Aid # 1636, Photo by Daniel Vice.

Diverse tools and methods are needed to prevent invasive species from becoming established in ecosystems where they are not native. A risk-based approach is mandated by the Order, and requires consideration of the likelihood an invasive species will establish and spread, as well as the degree of harm it could cause.

Currently, a limited number of invasive species are listed as regulated species under Federal laws governing specific types of species such as noxious weeds, injurious fish or wildlife species, or aquatic nuisance species. These laws provide for public input and stakeholder involvement in the listing process.

At present, there are procedures for listing species that are known to be invasive. Such listings may be petitioned and involve stakeholders and the public in the course of the rulemaking process. Importation and interstate transport is prohibited for species that are Federally listed as noxious weeds or injurious wildlife. The adequacy of such listing procedures will

Jack Russell terriers are used by inspectors to sniff out tree snakes stowing away in shipments to help prevent them from "hitching a ride" off of Guam.

Animal and Plant Health Inspection Service, Program Aid # 1636, Photo by Daniel Vice

be examined in the analysis of legal gaps, which is listed as an action item under Section B: Leadership and Coordination. Enforcement of prohibitions on listed species and exclusion of invasive species is largely dependent on inspection services at ports of entry.

For species that have not been listed, a key tool for prevention is a risk analysis and screening system for evaluating first-time intentional introductions of non-native species, before entry is allowed, and realistically applying similar principles or other management options for species currently in trade. In addition, a key priority will be identifying high-risk invasive species pathways and developing effective technologies and

Ballast Water Introductions of Nonindigenous Species

Ballast water is the water used by ships to provide stability and adjust a vessel's trim for optimal steering and propulsion. It is carried in ballast tanks that are distributed along the bottoms, tops, and sides of vessels. Ballast water often originates from ports and other coastal regions that are rich in planktonic organisms. Ballast water may be discharged as cargo is loaded or unloaded or when sea conditions change. The discharged water may contain myriad aquatic organisms from a wide range of taxonomic groups.

Currently, ballast water is probably the most significant pathway for the introduction of non-native species into coastal ecosystems. An estimated 50,000 commercial vessels enter the United States each year from overseas. A single vessel may carry more than 21 million gallons of ballast water. In 1991, the total volume of ballast water discharged into U.S. waters was estimated to be less than 79 million metric tons, most of which originated from foreign ports. With a typical transoceanic voyage duration of about 10-14 days, many of the organisms contained in ballast water survive the journey and are capable of invasion. For example, a large commercial vessel (such as a bulk carrier) arriving in the Chesapeake Bay from Europe will often carry millions of large planktonic organisms in their ballast water, and microorganisms occur in even greater abundance.

To stabilize the empty freighters, large amounts of water are carried in ballast. Small planktonic organisms--sometimes even fish--are pumped in with the ballast water and may survive the ocean voyage.

Photo by L. David Smith of Smith College

Historically, the transfer of organisms by ships has resulted in the unintentional introduction and establishment of hundreds of freshwater and marine non-native species into the United States. Ballast water was the likely pathway for the introduction of species such as the clam Potamocorbula amurensis into San Francisco Bay and zebra mussels and the fishhook water flea into the Great Lakes. Introduced dinoflagellates have contributed to harmful algal blooms in Australia, and recent studies have shown that ballast water may contain microbes that can cause human disease, including cholera. In recent years, the rate of new invasions in coastal ecosystems is apparently increasing, and most of this

education programs to reduce the movement of invasive species through those pathways. Pathway management is the most efficient way to address unintentional introductions. Another line of attack is to identify high-risk invasive species not yet established, the likely pathways for their entry, and then management of the pathways to prevent introduction.

Preventing invasions requires more than analysis. Both appropriate regulation and voluntary codes of conduct are essential. Research is needed on the biology of invasive species and ecosystem vulnerability to them, and on means to detect and interdict invasive species that are en route to establishment. Finally, steps are needed to make sure the general public

An international passenger being interviewed at Dulles International Airport to help prevent the spread of invasive species.

USDA Photography Center, Photo by Ken Hammond

Zebra Mussel populations can completely restrict flows in intake pipes.

Department of the Interior, United States Geological Survey, Photo by Don Schloesser

increase is attributed to shipping through a combination of ballast water discharge and hull fouling.

At present, ballast water exchange is the only management tool used routinely to reduce the risk of ballast-mediated invasion. Ballast water exchange involves replacing coastal water with open-ocean water during a voyage. This process reduces the density of coastal organisms in ballast tanks that may be able to invade a recipient port, replacing them with oceanic organisms with a lower probability of survival in near shore waters. There are two shortcomings with this procedure. First, the ability to safely conduct ballast water exchange depends upon weather and sea surface conditions; thus, it is not always possible to perform an exchange. Second, there is still some residual density of coastal organisms in ballast tanks following exchange, so this process is only partly effective. To address these shortcomings, additional ballast management practices (e.g., design and testing of shipboard technologies) are also being advanced as long-term strategies.

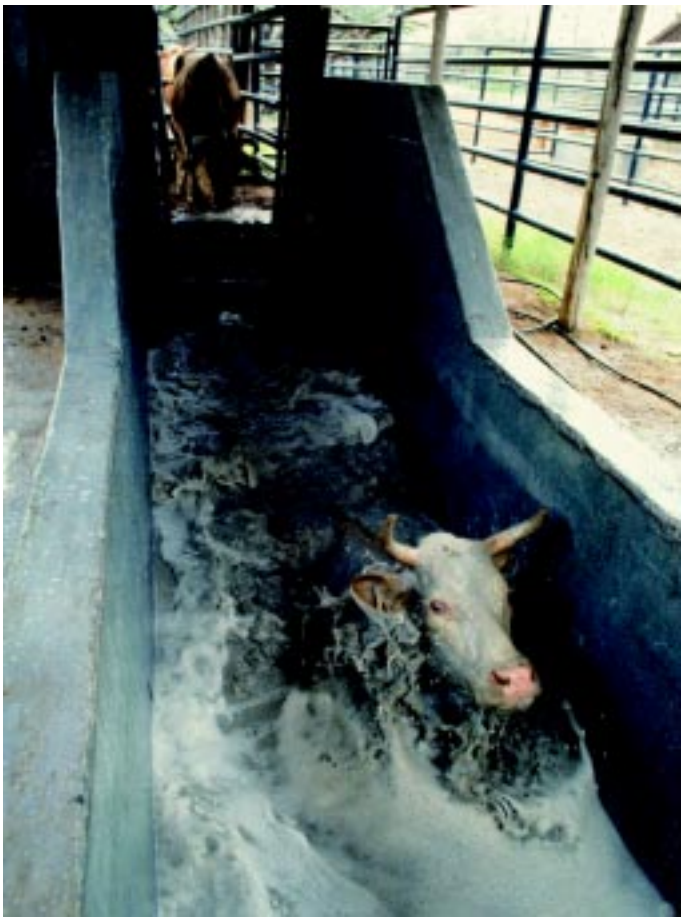
Ballast water management has been encouraged through a variety of national and international venues:

- Ballast water exchange is recommended as a voluntary measure by the International Maritime Organization (IMO).
- The Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (P.L. 101-646) required that all vessels entering Great Lakes ports or the upper Hudson River from overseas undergo ballast exchange or some comparably effective ballast treatment.
- The National Invasive Species Act (NISA) of 1996 (P.L. 104-332) reauthorized and amended the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990. NISA requires mandatory ballast management reporting and voluntary ballast exchange guidelines for most vessels that enter U.S. waters. Recognizing that ballast water exchange is likely to be only an interim measure, the law also sets up a research program for the development of new technologies for ballast water management. Among technologies being evaluated are filtration, ozone injection, ultraviolet radiation, and chemical treatment.

The Eurasian ruffe is a small but aggressive fish that was probably introduced into Lake Superior in 1985 via the ballast water from a transoceanic vessel. This species was later found in Lake Huron in 1995. It is now the most common fish at the mouth of the St. Louis River in Minnesota.

Department of the Interior, United States Geological Survey, Photo by Gary Chowlek

GREGORY RUIZ—SMITHSONIAN ENVIRONMENTAL RESEARCH CENTER



After a 36-year campaign, cattle fever ticks were finally declared eradicated from the United States in 1943. Today, the only remaining area where these ticks are found is a narrow strip of land along the Texas-Mexico border that has been quarantined since 1938. These cattle are going through a tick treatment bath at an APHIS facility in McAllen, Texas.

Agricultural Research Service, USDA, Photo by Scott Bauer

understands the harm that invasive species cause and the importance of preventing their introduction.

General

Currently, one of the most effective means of excluding invasive insects, other animals, and plants is inspection of shipments at ports of entry. Port of entry inspection works in two ways, first by directly examining pathways for the presence of invasive species and second, by monitoring imports to insure that regulatory requirements for reducing the risk of introduction have been met. Both APHIS and FWS have relevant inspection services. Even though they have made an effort to focus on shipments from high-risk areas, they are unable to examine more than a small percentage of shipments entering the United States.

ACTION PLANNED

13. As resources permit, APHIS and FWS will dedicate additional human and financial resources to strengthening inspection services at ports of entry.

Intentional Introductions

The action items below call for the development of a risk-based screening process for intentionally introduced species in a series of steps or phases. During the first phase a screening system for first-time intentional introductions will be developed, with different agencies taking the lead as appropriate for the different types of species. The screening system will then be modified by those same lead agencies during the second phase to deal with species already moving in the U.S.

14. By December 2003, the Council will develop a fair, feasible, and risk-based comprehensive screening system for evaluating first-time intentionally introduced non-native species (see items a-e below). To accomplish this task, appropriate Federal agencies will take the lead in developing and testing the screening system based on input from other Council members, ISAC, State governments, scientific and technical experts and societies, and other stakeholders — including affected industries and environmental groups. The system will include recommendations regarding implementation issues, including: the scope of taxonomic coverage, the degree of initial screening coverage, and the role of appropriate regulatory and non-regulatory risk-reducing tools.

15. By 2006, the same Federal agencies (as designated under a-e below) will develop modifications to the screening system or other comparable management measures (i.e., codes of conduct, pre-clearance or compliance agreements) to formulate a realistic and fair phase-in evaluation of those intentional introductions currently moving into the U.S., in consultation with ISAC, State governments, scientific and technical experts and societies, and other stakeholders, including affected industries and environmental groups.

Recommendations will be provided to the Council for the following screening processes:

a. Introduction of non-native biological control organisms for animal pest control within the continental U.S. to complement measures already in place for screening of plant biological control organisms. Lead Departments: USDA, Interior, and Environmental Protection Agency (EPA).

b. Introduction of all non-native freshwater or terrestrial organisms for any purpose into Hawaii, Puerto Rico, the U.S. Virgin Islands, or U.S. territories or possessions in the Pacific and the Caribbean (because of the vulnerability of insular areas, a separate screening process for those areas is needed). Lead Departments: USDA, Interior, EPA, the State of Hawaii, and the Governments of Puerto Rico and the Virgin Islands.

c. Introduction of non-native propagative plants or seeds for any purpose (e.g., horticulture or botanical gardens) within the continental United States. Lead Departments: USDA and Interior.

d. Introduction of non-native land animals for any purpose (e.g., insects, zoo animals, terrestrial pets, or food animals) within the continental United States. Lead Departments: USDA and Interior.

e. Introduction of non-native aquatic organisms for any purpose (e.g., fish or shellfish stocking, aquarium organisms, aquaculture stock, aquatic plants and biological control agents) within the continental United States. Lead Departments: USDA, Interior, Commerce, EPA, and the Army Corps of Engineers.

Unintentional Introductions

The most effective method of preventing the unintentional introduction of non-native species is to identify the pathways by which they are introduced and to develop environmentally sound methods to interdict introductions. Some pathways are already known to be significant sources of invasive species. For example, ballast water is probably the largest single source of non-native species introductions into coastal and estuarine waters. Solid wood packing materials are a source of serious forest pests. As a first step in dealing with unintentional introductions, Federal agencies should take steps to address pathways already known to be significant. In addition, it is important that other pathways be analyzed to determine their significance as a source of invasive species. The term "pathways" is also used in another context to describe the means by which an already established species may be spread to other areas. For example, the movement of aquatic species among watersheds is through interconnecting waterways and the weed seeds move in forage. Such pathways and action items to address them are covered under Section D, Control and Management.

USDA's, Agricultural Research Service entomologist Elmer Ahrens (left) and animal caretaker Adolfo Peña inspect for cattle fever ticks.

Agricultural Research Service, USDA, Photo by Scott Bauer

ACTION PLANNED

16. Federal agencies will take the following steps to interdict pathways that are recognized as significant sources for the unintentional introduction of invasive species:

a. By July 2001, NOAA, the Coast Guard, Interior, and EPA will sponsor research to develop new technologies for ballast water management, because the current method of ballast water management — ballast water exchange — is recognized as only an interim measure to address non-native species introductions.

b. By January 2002, the U.S. Coast Guard will issue standards for approval of ballast water management technologies, because actual deployment of new ballast water technologies on ships is contingent on a standard by which to judge their efficacy.

c. By January 2002, USDA will issue additional regulations to further reduce the risk of species introductions via solid wood packing materials.

17. By January 2002, the Council will implement a process for identifying high priority invasive species that are likely to be introduced unintentionally (e.g., Mediterranean fruit fly and brown tree snake), and for which effective mitigation tools are needed.

18. By June 2001, the Council will outline a plan for a campaign that will encourage U.S. travelers to voluntarily reduce the risk of spreading invasive species overseas. This project will seek to engage a diverse array of organizations related to aviation, travel, and tourism.

19. By December 2002, the Council, led by USDA, Defense, and Interior and in cooperation with the U.S. Agency for International Development (USAID), will develop a risk assessment program for the intentional and accidental introduction of non-native species through U.S. international assistance programs and encourage other countries and international organizations to do the same.

20. By January 2003, the Council will implement a system for evaluating invasive species pathways and will issue a report identifying, describing in reasonable detail, and ranking those pathways that it believes are the most significant. The report will discuss the most useful tools, methods, and monitoring systems for identifying pathways, including emerging or changing pathways, and for intervening and stopping introductions most efficiently.

C. EARLY DETECTION AND RAPID RESPONSE

Even the best prevention efforts cannot stop all introductions. Early detection of incipient invasions and quick coordinated responses are needed to eradicate or contain invasive species before they become too widespread and control becomes technically and financially impossible. Populations that are not addressed early may require costly ongoing control efforts. Spotted knapweed was introduced to Montana in the 1920s, and by 1988, had infested more than 4.7 million acres. The economic impact is approximately $42 million annually (Westbrooks 1998).

Although early detection and rapid response are important elements of invasive species management, currently there is no comprehensive national system for detecting, responding to, and monitoring incipient invasions. The approach used by the Centers for Disease Control and Prevention (CDC) may offer a useful model of a decentralized system that could be applied to incipient invasions. However, inadequate planning and technologies, jurisdictional issues, insufficient resources and information currently hamper early detection and rapid response efforts in many locations. Key elements needed in an early detection and rapid response system include: 1) access to up-to-date reliable scientific and management information; 2) facilitate rapid and accurate species identification; 3) establish a standard procedure for rapid risk assessment; 4) provide new and enhanced mechanisms for coordinating the efforts of Federal, State and local agencies, tribal governments, and private entities; and 5) provide adequate technical assistance (e.g., quarantine, monitoring, information sharing, research and development, and technology transfer) and rapid access to stable funding for emergency response efforts, including funding for accelerated research of invasive species biology, survey methods, and eradication options. The system's success will depend in part on public participation in efforts to report and respond to invasions.

Early Detection

ACTION PLANNED

21. The Council will improve detection and identification of introduced invasive species, recognizing the need for jurisdictional coordination, by taking the following steps:

a. By January 2002, USDA, Commerce, and Interior, and the Smithsonian Institution (SI), and the National Science Foundation (NSF), in consultation with other contributors to the Integrated Taxonomic Information System (ITIS) and utilizing existing inventories and directories (e.g., Taxonomic Resources and Expertise Directory), will compile a list of existing taxonomic experts in the United States and other countries. Contact information for sources of taxonomic expertise will concentrate on taxa where the need for identification is greatest, be distributed widely, and posted on the Council's website. The list will also identify current gaps in taxonomic expertise.

b. By January 2003, USDA, in consultation with the USGS National Wildlife Health Center, NOAA, CDC, the U.S. Public Health Service, appropriate scientific societies, and others will initiate a program for the development of new methods of detection for specific pathogens and parasites that may affect human, animal, or plant health. An enhancement of current competitive grants programs will be considered as a component of this program.

c. By January 2003, USDA, Interior, Commerce, and EPA will institute systematic monitoring surveys of locations where introductions of invasive species are most likely to occur (e.g., ports, airports, railroads,

Removing trees infested with Asian Longhorned Beetle in Chicago. Currently, the only available way to eradicate Asian Longhorned Beetle from an area is to identify which trees are infested, cut them down, and chip the wood into tiny pieces. Such an approach can turn a tranquil neighborhood with tree-lined streets into a barren landscape.

Agricultural Research Service, USDA, Photo by Michael T. Smith

Adult Asian Longhorned beetle.

Illinois Natural History Survey, Photo by Michael R. Jeffords

highway rights-of-way, trails, utility rights-of-way, logging and construction sites). In addition, by January 2002, highly vulnerable sites that may warrant more intensive and frequent monitoring than other sites will be identified. The surveys will be developed in cooperation with Federal, State, local, and tribal agencies, taking advantage of the existing network of plant and animal diagnostic clinics, reporting networks such as the National Agricultural Pest Information System (NAPIS) and the Cooperative Agricultural Pest Survey (CAPS), the extension service within the Cooperative State Research Education and Extension Service (CSREES), FICMNEW, ANSTF, and other working groups.

d. By January 2004, United States Geological Survey (USGS) and USDA will develop a more "user-friendly" means to help identify species and report the occurrence of invasive species and provide information about species and invasions to Federal, State, tribal, and local agencies. This initiative will be developed in consultation with the Council staff, SI, U.S. Army Corps of Engineers, NOAA, and State agencies, and will be made available at the Council's website and through publications. Mapping of a limited number of high-priority invasive species will be considered as a component of public-private partnerships for local involvement, including affected industries.

e. By December 2001, USDA will develop an early detection module available on the World Wide Web within the PLANTS database which provides information on invasive and noxious plants. The module will allow users to check the national, State and county distribution maps and submit new records. This information will be validated and included as appropriate as part of the PLANTS database. Future development will continue to be done in consultation with Federal and State agencies, Council staff, and public users.

Rapid Response

ACTION PLANNED

22. Starting in January 2001, Interior (especially USGS/Biological Resources Division) and USDA, in cooperation with the NSF and SI, will expand regional networks of invasive species databases [e.g., the Inter-American Biodiversity Information Network, (IABIN)] and produce associated database products, to cooperate with the Global Invasive Species Programme (GISP) and other partners to establish a global invasive species surveillance and rapid response system.

23. By July 2003, the Council in coordination with other Federal, State, local, and tribal agencies, will develop a program for coordinated rapid response to incipient invasions of both natural and agricultural areas and pursue increases in discretionary spending to support this program. Actions include:

a. Establishment of interagency invasive species "rapid response" teams, that include management and scientific expertise. Teams will focus on taxonomic, ecosystem, and regional priorities, and coordinate with local and State governmental and non-governmental efforts, including standing and ad-hoc State invasive species councils.

b. Developing and testing methods to determine which rapid response measures are most appropriate for a situation.

c. The Council will review and propose revisions of policies and procedures (i.e., advance approval for quarantine actions, pesticide applications, and other specific control techniques, and interagency agreements that address jurisdictional and budget issues) concerning compliance with Federal (e.g., Clean Water Act, National Environmental Policy Act, Endangered Species Act) and non-federal regulations that apply to invasive species response actions. The proposed revisions will be made available for public comment and will take into account local and State requirements.

d. Preparing a guide to assist rapid response teams and others that will incorporate the methodology developed for response measures and guidance on regulatory compliance and jurisdictional and budget issues.

24. Within FY 2003 budget development, the Council, in consultation with the States, will develop and recommend to the President draft legislation for rapid responses to incipient invasions, including the possibility of permanent funding for rapid response efforts as well as matching grants to States in order to encourage partnerships. The recommended legislation will augment existing rapid response mechanisms.

D. CONTROL AND MANAGEMENT

When invasive species appear to be permanently established, the most effective action may be to prevent their spread or lessen their impacts through control measures. For certain invasive species, adequate control methods are not available or populations are too widespread for eradication to be feasible. For example, zebra mussel control is focused largely on preventing clogging of water intake pipes and preventing spread from infested waters to other areas rather than the eradication of populations within infested waters.

Control and management objectives may include: eradication within a local area, population suppression, limiting dispersal, reducing impacts, and other diverse objectives. Control and management of invasive species populations is accomplished using an integrated pest management (IPM) approach. The IPM approach considers best available scientific information, updated target population monitoring data, and the environmental effects of control methods in selecting a range of complementary technologies and methods to implement to achieve a desired objective. These methods may include: 1) cultural practices (e.g., crop rotation, revegetation, grazing, and water level manipulation); 2) physical restraints (e.g., fences, equipment sanitation, and electric dispersal barriers); 3) removal (e.g., hand-removal, mechanical harvesting, cultivation, burning, and mowing); 4) the judicious use of chemical and biopesticides; 5) release of selective biological control agents (such as host-specific predator/herbivore organisms); and 6) interference with reproduction (e.g., pheromone-baited traps and release of sterile males). Often several methods are used within an overall integrated strategy. For example, control of purple loosestrife may involve biological control, mechanical removal, and other methods. Consideration of the environmental impacts of control actions requires that environmentally sound methods be available and judiciously deployed, especially in highly vulnerable areas.

Control actions are often carried out by or in cooperation with State or local agencies and may span jurisdictional borders. For example, more than 60 percent of noxious weed infestations in Montana are on private lands. Adequate funding of cross-jurisdictional efforts along with support and understanding are critical to success. Full funding of existing Federal cost-share programs and for programs for species and areas with no current programs is needed.

ACTION PLANNED

25. Starting in January 2001, the Council will work with Global Invasive Species Programme (GISP) and other relevant bodies to expand opportunities to share information, technologies, and technical capacity on the control and management of invasive species with other countries, promoting environmentally sound control and management practices.

26. By February 2002, the Council will identify and, as appropriate, adopt sanitation and exclusion methods for preventing spread of invasive species (e.g., restrictions on use of contaminated soils and fills, cleaning fire-fighting equipment before deployment to new areas, requiring pest-free forage and mulch and weed-free sod, washing of construction equipment, and managing ballast water).

Purple loosestrife is a beautiful but aggressive invader that arrived in eastern North America in the early 1800s. It has spread westward and can be found across much of the US and Canada. This hardy perennial takes over wetlands, decreasing habitat for native wildlife. It can also impair the recreational use of wetlands and rivers and impede water flow, requiring costly management efforts.

Illinois Natural History Survey, Photo by David Voegtin

A leaf-feeding beetle, Galerucella calmariensis, is showing great promise in helping to curb populations of purple loosestrife.

Illinois Natural History Survey, Photo by David Voegtlin

The sea lamprey attacks and parasitically feeds on other fish, such as this lake trout, often causing death of the prey either from loss of fluids and tissues or from secondary infection of the wound.

U.S. Fish & Wildife Service

Of the fish that survived attacks by lampreys, 85% had been attacked up to five times by the round sucker like mouth of the Sea Lamprey.

Greatlakes SeaGrant Exotic Species Graphics Library

27. By January 2002, the Council will develop and propose to the President draft legislation, in full consultation with States, to authorize matching Federal funds for State programs to manage invasive species, including a provision to provide assistance to States for the development of State invasive species management plans. The draft legislation proposal may also include tax incentives or other provisions to encourage voluntary participation of private landowners in control programs and to promote their actions to prevent the spread of invasive species. Consideration will also be given to extending current Federal authority to conduct control activities on State and private lands where invited by the landowner.

28. By January 2002, the USDA, in consultation with regional, State, tribal, and local agencies, will develop a proposal for accelerating the development, testing, assessment, transfer, and post-release monitoring of environmentally safe biological control agents and submit the proposal to the Council for review.

29. By January 2002, EPA will develop and provide to the Council a proposal for cooperation with private industry. The proposal will utilize current programs to facilitate development, testing, and training of personnel concerning proper use of environmentally sound pesticides in controlling invasive species populations, consistent with the 1996 Food Quality Protection Act (P.L.140-170) and the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). In

Alligator weed: A Case Study in Biological Control

Alligator weed.

Photo by, Michael Battey

Alligator weed, a plant native to South America, made its first appearance in the United States in about 1890. Within a few years, it was well established from Virginia to Florida in the east and westward to Texas, with populations also existing in California. This aquatic invasive species takes root in shallow water and then forms dense floating mats that expand rapidly causing major problems for navigation, irrigation, and flood control.

Alligator weed was the first aquatic plant targeted for biological control research in this country. In 1959, the U.S. Army Corps of Engineers and USDA began a collaborative effort based on research conducted at a facility in Argentina established by USDA to search for potential biological agents to manage alligator weed. Three insects, the alligator weed flea beetle, alligator weed stem borer, and alligator weed thrips, were

A volunteer removing weeds is an example of mechanical weed control.

Photo by S. Dewey, Utah State University, Logan

Scientists in Lincoln, Nebraska, practice controlled burning to prepare a site for planting native forage grasses without tillage. This was done in the spring to remove plant residue remaining after herbicide treatments killed weeds growing there the preceding autumn.

Agricultural Research Service, USDA, Photo by Robert Masters

identified as potential biological control agents. After host-specificity testing in Argentina and U.S. quarantine facilities, all three species were approved for use in the U.S. The flea beetle was released first. Although highly successful in Florida, the beetle has not controlled the weed farther north. However, the combined impact from the three agents was so effective that Florida curtailed the use of herbicides to control alligator weed just three years after the insects were released in that State. Australia, New Zealand, China, and Thailand also report success in using these insects as biological agents to control alligator weed.

– Al Cofrancesco (U.S. Army Corps of Engineers)

addition, maintaining registrations for useful and safe products should be considered since the relatively small market for many invasive species control products makes it less economical for registrants to pay the registration costs.

30. By January 2002, the U.S. Army Corps of Engineers will prepare a list of connecting waterways in the U.S. to develop a strategy for preventing movement of aquatic species among watersheds and initiate a research program on methods to prevent such movement.

31. By FY 2003, additional funding will be requested through the annual appropriations process, consistent with Administration policy, for Federal agencies' control and management activities to reduce the spread of invasive species from Federal lands to neighboring areas and to lessen the impact of invasive species on natural areas. Consideration should be given within existing authorities to provide additional funding for control work on neighboring State or private lands where invited by the landowners. Volunteers should be utilized wherever appropriate to help extend the limited funds available for control efforts.

32. By January 2003, the Council will develop and issue guidance for ranking the priority of invasive species control projects at local, regional, and ecosystem-based levels. The guidelines will provide for consultation with expert individuals and organizations, including consultation with ANSTF, FICMNEW, CENR, and regional, State, tribal, and local agencies, affected industries, and private landowners.

E. RESTORATION

The Order requires Federal agencies to "provide for restoration of native species and habitat conditions in ecosystems that have been invaded." Invasive species are often found in disturbed environments, and they can cause a wide range of disturbances, both to the structure of ecosystems and their processes. For example, in the southern U.S. the invasive plant, kudzu, covers and shades out other vegetation and can cause a wide variety of plants to die. In Africa's Lake Victoria, water hyacinth (a fast growing plant native to the Amazon basin) forms large floating mats that deplete dissolved oxygen concentrations in the water and can kill fish. Water hyacinth has had a profound effect on the region's water cycle, causing lake levels to drop dramatically (Mooney and Hobbs 2000).

If an invasive species is eradicated in an area and the impact on the environment was small, recovery can be rapid. In many cases, however, disturbances caused by invasive species have multiple effects throughout an ecosystem and may be exacerbated by human alterations of the environment. For example, invasive species can dramatically reduce biodiversity and alter the ecosystem processes that provide surface water and other natural resources. These alterations are not easily healed. Depending on the scale, duration, and frequency of the invasion, restoring the ecosystem to its original condition may not be technically or financially feasible.

Geneticist Tom Jones (left) and plant physiologist Doug Johnson (right), from USDA's Agricultural Research Service, observe seed head maturity in a cultivated plot of squirreltail. Jones and his colleagues selected Sand Hollow Squirreltail, a perennial grass, from among other grasses collected at sites in California, Colorado, Montanta, Nevada, Utah, Washington, and Wyoming. It is intended to be used primarily for restoring rangeland currently overtaken by invasive plants such as cheatgrass or medusahead wildrye.

Agricultural Research Service, USDA, Photo by Jack Dykinga

Restoration is an integral component of comprehensive prevention and control programs for invasive species that may keep invasive species from causing greater environmental disturbances. Although restoration efforts have certain elements in common, each invasion and area is unique. Restoration projects need to be based both on general principles and site-specific considerations and analysis. Resource managers need the research community to provide them with information for the development of a wide range of environmentally sound management strategies and tools, including detailed site assessments and information on the inter-relationships of the species involved. These assessments can help identify the key factors that will affect the success of restoration projects. In addition, monitoring programs are needed to track the success of control and restoration efforts and to ensure that the area is not reinvaded.

Ecological information and restoration techniques have improved. With attention to site preparation, hydrology, nutrient cycling, beneficial plantings, and monitoring the effects of natural disturbances, some terrestrial systems can be extensively recovered. Restoration of aquatic systems has proven more difficult, but significant progress is being made. Resource managers believe that restoration efforts will contribute to control actions and that once habitats have been restored, they will be less vulnerable to future invasions by the same or other invasive species. From this perspective, restoration is an important part of a site-specific prevention and control strategy.

ACTION PLANNED

33. Starting in January 2001, the USDA, Interior, and the U.S. Army Corps of Engineers will identify sources of propagative material for native species in areas of restoration or reclamation projects.

34. By January 2002, the Council will prepare draft legislation to authorize tax incentives and otherwise encourage participation of private landowners in restoration programs.

35. By July 2002, the Council will develop and issue recommendations, guidelines and monitoring procedures for

Tom Jones examines Utah sweetvetch flowering at North Ogden Pass in the Wasatch Mountains.

Agricultural Research Service, USDA, Photo by Jack Dykinga

Federal land and water management agencies to use, where feasible, in restoration activities. Among other things, these will:

a. Address restoration programs mandated by law (e.g., natural disasters, oil and chemical spills, and acid mine drainage).

b. Identify appropriate use of native and desirable non-native (non-invasive) species and encourage management practices that promote regeneration of native species.

c. Develop and describe the best available techniques for restoring habitats such as arid and aquatic environments and highly eroded or disturbed sites, and identify research needs for technique development.

36. By April 2003, the Council, led by Interior and USDA in cooperation with NSF, USAID, and other relevant bodies, will develop criteria for the use of non-native species in overseas restoration projects.

F. INTERNATIONAL COOPERATION

The U.S. cannot succeed in addressing its domestic invasive species problems unless it takes a leadership role in international cooperation and invests in strategies that raise the capacity of other nations to manage their invasive species problems. Our ability to prevent invasive species from entering the U.S. depends greatly upon the capability of other countries to effectively manage invasive species and invasion pathways domestically. Once invasive species become established within one country, they pose a threat to an entire region, as well as to trading partners and every country along a trading pathway. If an invasive species never leaves another country, it will never become a problem in the U.S.

The U.S. faces several challenges in preventing and controlling the spread of invasive species globally. Only a few countries (e.g., Australia, New Zealand, and South Africa) have invested in the development of well-coordinated policies and programs to address the problem. Developing countries that recognize the gravity of the situation and want to take immediate action are hampered by a lack of scientific, technological, and financial resources. Efforts of most governments to address invasive species problems are poorly coordinated. Neighboring countries are often unaware of each other's policies and practices.

Clearly, the U.S. needs to promote international consistency and adequate standards in policies to prevent and control the spread of invasive species. Governments and international organizations are using conventions, treaties, and other international agreements to raise awareness of the invasive species issue and take coordinated steps to establish prevention and control policies. These range from trade-related agreements that play a significant role in the regulation of invasion pathways to agreements focused on the protection of specific ecosystems (see Appendix 3). These efforts need to be strengthened and expanded. The U.S. also needs to encourage industry and other sectors to adopt codes of conduct, thus setting voluntary standards to help limit the spread of invasive species.

Actions by the U.S. have sometimes contributed to the invasive species problems faced by other countries. Despite good intentions, we have, on occasion, inadvertently facilitated the introduction of invasive species to other countries through development assistance programs, military operations, famine relief projects, and international financing. In meeting de-

The water hyacinth is a beautiful aquatic plant native to the Amazon basin. However, its beauty belies the fact that it can form dense mats that not only block waterways, but also increase nutrient levels in the water as they decay, thereby depriving fish of oxygen in lakes, wetlands, rivers, and canals in the U.S. and Africa. It is one example of an international problem that requires international solutions.

Agricultural Research Service, USDA, Photo by Willey Durden

mands for U.S. products, we have exported organisms that are invasive here and have the potential to be invasive elsewhere. While traveling the world, U.S. tourists may accidentally relocate organisms in their luggage, on their bodies, and through their means of transport.

By openly sharing information and technologies and cooperating in international research, the U.S. can raise awareness of the causes and consequences of invasive species, increase the capacity of other governments to prevent and control invasive species, and lower the costs of invasive species management here and abroad. For many years, various agencies of the U.S. Government have assisted countries with scientific information on the invasive species that threaten their economies and human health. We have also provided technologies, such as biological control agents, that have helped countries eradicate or control invasive species. These efforts support the U.S.'s broader development assistance objectives of securing food, water, and human health through economic growth and environmental protection.

International Agreements

ACTION PLANNED

37. The Council will strengthen and expand U.S. participation in the development and application of mutually supportive standards and codes of conduct within international fora:

- **a.** By December 2001, the Council will develop a strategy and support materials for U.S. representatives to use in international meetings to encourage and assist all countries with development of coordinated policies and programs on invasive species, both domestically and internationally.
- **b.** By June 2002, the Council, in cooperation with other relevant bodies, will identify the limitations and strengths of existing international agreements to adequately prevent and control the spread of invasive species and develop a program of work with other governments and international organizations to improve the effectiveness of these agreements.

38. By December 2001, the Council will outline an approach to a North American invasive species strategy, to be built upon existing tripartite agreements and regional organizations, and initiate discussions with Canada and Mexico for further development and adoption.

39. By December 2001, the Council co-chair agencies and State, in conjunction with U.S. Trade Representative, will establish an ongoing process to consider the risks of invasive species during the development of U.S. trade agreements and ensure that U.S. trade agreements facilitate a country's abilities to prevent the movement of invasive species in a manner that is transparent, non-discriminating, and based on sound science.

International Assistance

ACTION PLANNED

40. By February 2001, USDA, in cooperation with USAID, will sponsor three technical assistance seminars in eastern, western, and southern Africa. These events will highlight exchange of technical information, including material about invasive species.

41. Starting in January 2001, Council will provide financial and technical support to international meetings of policy makers, as well as regional and global programs of cooperation, that are working to establish and implement mechanisms to limit the spread of invasive species.

42. By December 2001, the Council and U.S. AID will initiate a study, with GISP and international development and finance institutions, of international assistance as an invasion pathway, as well as options for minimizing the impact of this pathway.

Note: Each section of the Action Plan contains additional "Actions Planned" regarding International Coordination.

G. RESEARCH

Research supports each aspect of the Plan. Research assists policy makers in assessing gaps in authority and program policy, and it supports invasive species resource optimization, prioritization, and public outreach efforts. Additionally, research increases the effectiveness of a wide range of invasive species efforts carried out by Federal, State, local and tribal governments and the private sector. Although progress continues, research challenges also expand as new invasive species issues come to light. The growing demand for research is also increasing the need for trained personnel, such as taxonomists who can help identify species.

Complementary research projects ranging from basic investigations with broad application to highly targeted applied efforts are required. Basic research needs include: gaining a more thorough understanding of invasive processes and factors that affect those processes; an improved ability to assess the risk of a non-native species becoming invasive; development of a more comprehensive understanding of the consequences of invasions on ecological, agricultural, economic, animal health, human health, and social systems; and improving the ability to predict new or expanding pathways of invasion. More applied research needs include: developing and testing enhanced environmentally sound invasive species control and restoration methods; developing better methods and technologies for managing invasion pathways such as ballast water and horticultural materials; improving the ability to assess and monitor invasive population parameters on appropriate spatial and temporal scales; and developing enhanced means to collect and more fully utilize data obtained and improve research support for cooperative efforts. Where appropriate, Federal research outcomes will be transferred to Federal, State, local, tribal and private sector stakeholders for their utilization.

The CENR of the National Science and Technology Council (NSTC) identified invasive species research as a priority focus area within integrated ecosystems research (see *www.nnic.noaa.gov/CENR/cenr).* CENR indicated that while the scientific capacity to address many research needs exists, core research programs are substantially under-funded. Adequately funding Federal, State, and academic research is critical. CENR stresses the importance of sustaining long-term research focused upon priorities identified by Federal, State, local, tribal government and private sector stakeholders. Additionally, the need to strengthen core research efforts was emphasized to build a thorough understanding of invasion biology

Imported Red Fire Ants are disliked for their venomous, painful stings. This species has spread across much of the southern United States.

Agricultural Research Service, USDA, Photo by Scott Bauer

Entomologists David Williams (left) and David Oi, from USDA's Agricultural Research Service, compare a fire ant colony infected with the Thelohania solenopsae pathogen (left) to one that is uninfected.

Agricultural Research Service, USDA, Photo by Scott Bauer

In less than 10 seconds, an unwary scientist was stung over 250 times on one leg when he accidentally knelt on a collapsed fire ant mound. The sterile pustules developed to this stage in 3 days.

Agricultural Research Service, USDA, Photo by Daniel Wojcik

and an enhanced capacity to predict invasiveness. CENR indicated the need for research coordination and cooperation among Federal agencies and for increased standardization to facilitate data management and utilization.

ACTION PLANNED

43. By July 2001, the Council, in coordination with FICMNEW, SI, ANSTF, and CENR, will prepare a catalog of existing aquatic and terrestrial control methods (e.g., by taxon and ecoregion) and propose strategies to determine their effectiveness in different U.S. habitats, including recommended cost and effectiveness monitoring protocols for use by field personnel. The catalog should include the following:

- **a.** Validation methods to measure and report removal efficiency, cost-effectiveness, safety, and practicality under real-world conditions.
- **b.** Treatments and effectiveness measurement protocols.
- **c.** Adaptive management measures for field personnel that base predictive models for invasiveness and priority setting on clearly delineated factors that may affect invasiveness, such as biological and ecological factors.

44. By December 2001, the Council co-chair agencies, in cooperation with NSF and SI, will develop and implement a plan to:

- **a.** Strengthen international research collaborations to study the biological, social, and economic aspects of invasive species ecology and management, as well as develop and test monitoring and control technologies and strategies.
- **b.** Identify and strengthen opportunities to exchange scientists between the U.S. and other countries to improve their training in technologies and techniques (especially taxonomic identification) concerning invasive species.

45. By July 2002, the Council, SI, and NSF, utilizing input from CENR, will establish and coordinate a long- and short-term research capacity ranging from basic to applied research on invasive species. This initiative will build on existing efforts that reflect a range of perspectives and program approaches. It will address research, monitoring, information sharing (including mapping), assessment, control, and restoration. It will identify personnel and resources needed to sustain fundamental research and tactical or field-level scientific support which include:

- **a.** Improvement of Federal agency core research capa bilities.
- **b.** Enhancement of current competitive grants programs and mechanisms for cooperative support of research by public and private universities, Federal and State governments, and the private sector to complement core research capabilities.

46. As part of the cross-cut budget proposal for FY 2003, the Council will include an initiative to adequately fund Federal invasive species research programs. The Council (including research agencies within Council departments) will prepare the initiative in consultation with ISAC, SI, NSF, CENR, and other stakeholders. The proposal will address research issues such as:

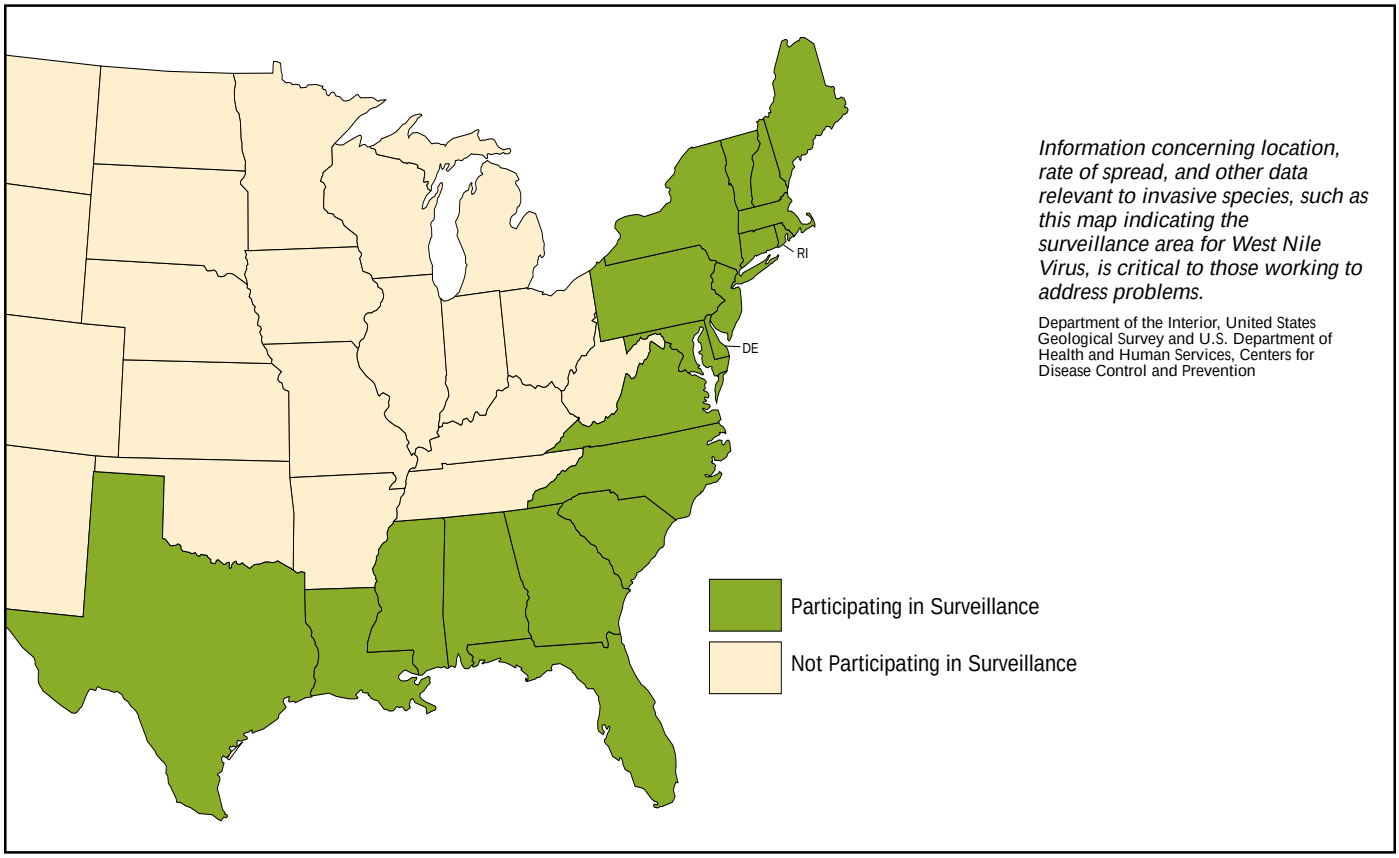
- **a.** The ability of a species to be invasive in a region is an important predictor of whether that species will become invasive in other regions/countries that contain similar habitats. Investigations will be conducted in source and receiving countries to determine parameters, such as biological, economic, cultural, and ecological factors, which may affect their susceptibility to new invasions.
- **b.** Investigate “lag period” invasive processes that occur between initial introduction, establishment, and invasion outbreaks and assess the value of using epidemiological approaches to support monitoring, control, restoration, and eradication efforts. Additionally, enhance the ability to rapidly identify effective environmentally sound control methods for targets of rapid response efforts that are conducted at critical points in the invasive process.
- **c.** Determine how and to what extent invasive species affect populations of native species, endangered and threatened species, habitats, animal health, human health, and native species biodiversity.
- **d.** Determine how and to what extent invasive species alter ecosystem functions (e.g., water quality, hydrology, nutrient cycling, and disturbance regimes such as fire cycles), and agricultural, economic, and social processes.
- **e.** Develop and test monitoring and control protocols, methods, tools, and strategies to support the prevention of introduction and spread, rapid response, restoration, and containment strategies, including the evaluation of impacts from management activities.

H. INFORMATION MANAGEMENT

The Council is charged with establishing a coordinated, up-to-date information-sharing system which emphasizes the use of the Internet for documenting, evaluating, and monitoring impacts from invasive species on the economy, the environment, and human and animal health. Although there are many sources of information concerning invasive species, incompatible database formats and other factors impede information sharing. Computer technology will in part help to meet this challenge. However, in many parts of the U.S. and other countries, limited computer resources require less costly solutions and programs to increase access to technology and information.

The Council is currently developing an information "gateway" accessible through the Council's website – *www.invasivespecies.gov.* Information about the Council, its staff and activities, and other related material will be made available. In addition, the Council staff plans to help develop a fully integrated Internet-based network system that eventually will support rapid and accurate discovery of data, the automatic correlation and synthesis of pertinent data from many sources, and provide a presentation of the results of data synthesis that meets the needs of users. The long-term goal is to provide accessible, accurate, referenced, up-to-date, comprehensive, and comprehensible information on invasive species that will be useful to local, State, tribal, Federal managers, scientists, policy-makers, teachers, students, and others. To help ensure that stakeholder needs are met, the Council will form a steering committee that includes State, tribal, Federal, local governments, non-government organizations, the private sector, and other stakeholders. Some basic elements of this site are now in operation, and extensive work is ongoing. In order to fully develop this site, additional resources must be identified.

West Nile Virus Surveillance Area



Information concerning location, rate of spread, and other data relevant to invasive species, such as this map indicating the surveillance area for West Nile Virus, is critical to those working to address problems.

Department of the Interior, United States Geological Survey and U.S. Department of Health and Human Services, Centers for Disease Control and Prevention

ACTION PLANNED

47. On an ongoing basis, the Council (with the assistance of the National Agricultural Library, National Biological Information Infrastructure and others) will maintain and enhance its website (www.invasivespecies.gov) in consultation with State, tribal, and local governments, regional compacts, non-government organizations, the private sector, and other stakeholders. In order to address stakeholders' needs, the Council will form a website steering committee to advise in the continuing development of its website.

48. Starting in January 2001, the Council will include and update information on internationally relevant agreements, codes of conduct, meetings, publications, experts, programs, and financial resources, as well as regional and global invasive species databases on its website.

49. By July 2001, the Council will post and maintain on the Council's website "case studies" highlighting successful regional, State, local, and international management practices to control and respond rapidly to invasive species and helpful suggestions to assist other efforts.

50. By November 2001, the Council will develop and secure implementation of a memorandum of understanding among appropriate Federal Departments to establish an invasive species assessment and monitoring network comprised of on-the-ground managers of Federal invasive species programs and appropriate technical specialists. The network leadership, in conjunction with Council staff, will work with appropriate Federal, State, and local agency personnel to implement the monitoring recommendations in this Plan.

51. By January 2002, Interior, USDA, Commerce, EPA and U.S. Army Corps of Engineers will develop guidance for managing information concerning invasive species in aquatic and terrestrial environments. The guidance will be developed in consultation with ISAC, FICMNEW, ANSTF, CENR, SI, and other stakeholders and will address:

- **a.** Current and emerging technologies for information collection (e.g., GIS and remote sensing) and data analysis and dissemination, including lower-cost information tools for wide distribution.
- **b.** Standard protocols for information collection and sharing, including taxonomy, identification, inventory and mapping, monitoring, and assessments of invasive species populations.

This map indicates the location of Zebra Mussel populations in 1988.
Department of the Interior, United States Geological Survey

This map indicates the location of Zebra Mussel populations approximately 10 years later in 1999.
Department of the Interior, United States Geological Survey

c. Most effective means and appropriate contacts – including those of the Council – for sharing information with local, State, tribal, Federal, and international agencies, non-governmental organizations, private citizens, and other stakeholders, that link to systems currently underway.

52. By January 2002, the Council's website will be linked to major U.S. databases, websites, and most State information networks that deal with invasive species, and to websites in nations that have active invasive species programs, particularly those cooperating with the Global Invasive Species Programme.

53. By June 2002, the Council, led by USDA, will produce an Invasive Species Compendium for North America. The Compendium, to be published in CD and Internet formats, will include a broad array of searchable information relevant to the biology, distribution, and management of invasive species. The project will be undertaken in close cooperation with CABI on behalf of the GISP and other partners.

54. By January 2003, subject to available resources, the Council's website will include a locator for occurrences of invasive species in the United States within each county.

55. By June 2003, the Council will provide information about species currently regulated by Federal Departments on the Council's website.

I. EDUCATION AND PUBLIC AWARENESS

How invasive species are viewed is filtered by human values and perceptions. We all have a stake in reducing the negative impacts of invasive species. The prevention and control of invasive species will require modifying behaviors, values, and beliefs and changing the way decisions are made. A successful plan to address invasive species issues will depend on the public's understanding and acceptance of the actions needed to protect our valuable resources. To that end, a wide variety of education, outreach, and training programs are needed to help motivate people to take action and raise awareness of the causes of establishment and consequences of invasive species.

The Order directs Federal agencies to promote public education and awareness on invasive species, as well as actions to minimize their impacts. While Federal agencies can play a key role in the development and support of education, outreach, and training programs for a wide variety of sectors, the actions that need to be taken to minimize the spread of invasive species are ultimately driven by the public. Public action (by individuals, businesses, organizations, local agencies, and others) needs to be supported by and integrated with U.S. Government programs within the United States and in other countries.

Because many people are unaware that their actions can result in the introduction and spread of invasive species, education and outreach programs constitute an important line of defense for prevention and control. In the long run, informing people of the actions they can take to reduce the threats posed by invasive species and to avoid contributing to the problem may be more effective than passing laws or enforcing regulations. Once aware of invasive species and the options for their management, gardeners, boaters, fisherman, pet owners, and others can take simple steps to reduce the likelihood that they will inadvertently spread invasive species while engaging in their favorite hobbies. For example, the spread of Eurasian water milfoil, hydrilla, and zebra mussels can be reduced with the proper cleaning of boats, fishing gear, and water sports equipment.

Effective communication is the cornerstone of effective action. Therefore, the Council agencies will work to ensure that the education, outreach, and training programs they develop and support will:

1) target the needs of specific audiences (resource managers, researchers, policy makers, hobbyists, business

owners, etc); 2) reflect a sound understanding of what motivates people and how they respond to information; 3) clearly communicate the relationship between actions that facilitate or prevent invasions and human values (e.g., quality of life, biodiversity conservation); and 4) identify the wide range of actions that can be taken to minimize the spread of invasive species and enable people to take these actions, both domestically and internationally.

The Federal agencies recognize that many non-federal stakeholders play important roles in the development and dissemination of information on invasive species. For example, land grant universities and other educational institutions, State departments of natural resources, State departments of agriculture, and civic and environmental organizations often have significant expertise in education and outreach relevant to natural resource issues. The Council hopes to engage these experts, as well as educators, public communicators, and trainers from a variety of disciplines, in the design and implementation of its programs.

The Federal agencies will have to meet certain resource challenges. Information needs to reach decision makers and program managers in a timely manner. Long-term funding, staffing, and an appropriate infrastructure need to be provided. To ensure that the current programmatic objectives are met and future needs are anticipated, the overall education, outreach, and training strategy must include a credible monitoring and evaluation process. The Council plans to support a wide variety of training programs that will enable individuals and organizations to minimize the spread of invasive species. Some of these programs are discussed in the other sections of the Plan.

ACTION PLANNED

56. By July 2001, the Council will coordinate development and implementation of a national public awareness campaign, emphasizing public and private partnerships. The campaign will be initiated after available resources are assessed and target audiences identified, and will include these actions:

a. By December 2001, the Council will identify and evaluate existing public surveys of attitudes and understanding concerning invasive species issues, as well as develop and complete a public survey to fill the gaps in knowledge. These analyses will establish a baseline for determining the success of communications strategies. This will be accomplished by using knowledge gained through social science research and contracting with entities such as the National Environmental Education Training Foundation, which conducts an annual Roper survey of public opinions and understanding of environmental issues, or other appropriate organizations.

b. By January 2002, USDA and Interior, consulting with ANSTF and FICMNEW, and other State, local and tribal organizations, will compile a comprehensive assessment of current invasive species communications, education, and outreach programs. The assessment will evaluate the strengths and weaknesses of the major programs and identify new initiatives for reaching target audiences more effectively. The information will be disseminated through the Council's website.

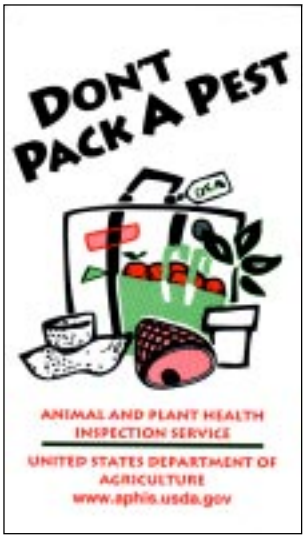
c. By June 2002, the Department of Commerce's National Sea Grant Program and USDA will develop (in consultation with Interior and the U.S. Army Corps of Engineers) a model public awareness program that incorporates national, regional, State, and local level invasive species public education activities, including a plan for testing the model over the next year. The model will: 1) identify key messages, 2) identify the critical target audiences, accounting for the diversity of economic and social interests and backgrounds in the U.S., 3) determine which combination of delivery techniques works best and key actions stakeholders can take, 4) provide training and training materials, 5) provide for public and private partnerships (including support of school programs), 6) include measures for evaluating program effectiveness, 7) identify contacts for professional support, and 8) budget for implementation of new and ongoing programs.

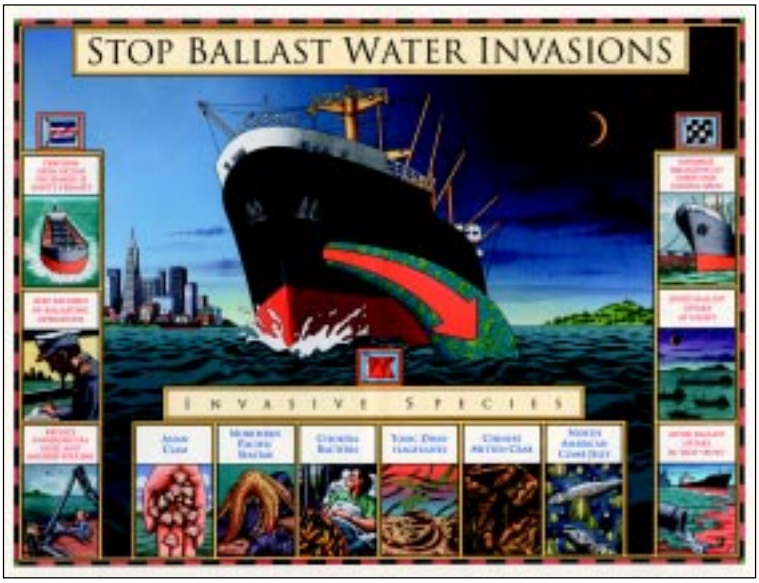
57. The Council will also coordinate development and implementation of an international education campaign, emphasizing the need to strengthen international policies by governments and voluntary codes of conduct by the industry sector. The campaign will initially focus on these actions:

a. By December 2001, the Council, in conjunction with GISP, will begin to develop a series of education materials (booklets, fact sheets, etc.) to guide

organizations in development assistance, industry, international finance, and government sectors to write and implement "codes of conduct" for minimizing the risk of introduction and spread of invasive species. This information will not be limited to print, but will include broadcast media such at the radio and the Internet.

b. By June 2002, the Council, led by the Department of State, will co-host a series of regional workshops on invasive species for policy makers. The intent of the workshops is to raise awareness of the issue, as well as to identify regional needs, priorities, and opportunities for further cooperation. Co-hosts will include GISP and the governments of Brazil, Costa Rica, Denmark, New Zealand, and South Africa.





Examples of public education materials

Conclusion

Invasive species are found in every country and type of environment. They have damaged our waters, farms, natural areas, and even our backyards. They have abetted the collapse of valuable commercial fisheries; ruined thousands of acres of food crops and livestock forage; nearly eliminated several native tree species; interrupted utility services; hastened the decline of many endangered species; and harmed animal and human health. Scientists, academics, leaders of industry, and land managers now recognize invasive species as one of the most serious environmental threats of the 21st century (Mooney and Hobbs 2000).

Despite an array of Federal programs designed to stop or control them, the number of invasive species and their cumulative impacts is accelerating at an alarming rate. This Plan is an important first step for a unified and cooperative approach to address invasive species issues.

The Plan is intended to present an ambitious yet "doable" blueprint from which the U.S. Federal agencies, along with their partners, can work to minimize the significant impacts of invasive species. The next and most difficult step will be implementation of the Plan – which is the highest and most immediate priority. To implement the Plan, the Council will provide coordination as the Federal agencies work to integrate the Plan's recommendations into their existing programs.

The Council recognizes that other governments, many Federal agencies, and interagency groups (e.g., ANSTF, FICMNEW, CENR), as well as State and local entities, have prepared plans on invasive species. These plans provide an opportunity for the Federal agencies to identify the priorities they share with other stakeholders and thus establish cooperative, well-coordinated approaches to Plan implementation.

As implementation proceeds, the Council will provide updates on its website and continue to expand its information-sharing network. The website will become a "gateway" to Federal information and a link to non-Federal resources, especially international, State, local, and regional invasive species priorities and data. The site itself will function as an important coordination tool, bringing multiple kinds of information to one location.

In the past, it was common to regard individual invasive species and geographic areas in isolation. Furthermore, attempts to deal with invasive species problems have suffered from a lack of coordination among Federal agencies, and between Federal agencies and other stakeholders. This uncoordinated approach has contributed to the invasive species problem we face today.

With a global economy, increasing demand for foreign products, great mobility, and more accessibility to distant locations, former methods of dealing with invasive species are no longer adequate. By adopting a comprehensive plan and coordinating our efforts, the Federal agencies can help minimize the spread of invasive species. Ultimately, the greatest asset in meeting the invasive species challenge is an informed and involved public.

APPENDIX 1:

Executive Order 13112 and Guiding Principles

Executive Order 13112 of February 3, 1999

Invasive Species

By the authority vested in me as President by the Constitution and the laws of the United States of America, including the National Environmental Policy Act of 1969, as amended (42 U.S.C. 4321 et seq.), Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990, as amended (16 U.S.C. 4701 et seq.), Lacey Act, as amended (18 U.S.C. 42), Federal Plant Pest Act (7 U.S.C. 150aa et seq.), Federal Noxious Weed Act of 1974, as amended (7 U.S.C. 2801 et seq.), Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.), and other pertinent statutes, to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause, it is ordered as follows:

Section 1. *Definitions.*

(a) "Alien species" means, with respect to a particular ecosystem, any species, including its seeds, eggs, spores, or other biological material capable of propagating that species, that is not native to that ecosystem.

(b) "Control" means, as appropriate, eradicating, suppressing, reducing, or managing invasive species populations, preventing spread of invasive species from areas where they are present, and taking steps such as restoration of native species and habitats to reduce the effects of invasive species and to prevent further invasions.

(c) "Ecosystem" means the complex of a community of organisms and its environment.

(d) "Federal agency" means an executive department or agency, but does not include independent establishments as defined by 5 U.S.C. 104.

(e) "Introduction" means the intentional or unintentional escape, release, dissemination, or placement of a species into an ecosystem as a result of human activity.

(f) "Invasive species" means an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health.

(g) "Native species" means, 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.

(h) "Species" means a group of organisms all of which have a high degree of physical and genetic similarity, generally interbreed only among themselves, and show persistent differences from members of allied groups of organisms.

(i) "Stakeholders" means, but is not limited to, State, tribal, and local government agencies, academic institutions, the scientific community, nongovernmental entities including environmental, agricultural, and conservation organizations, trade groups, commercial interests, and private landowners.

(j) "United States" means the 50 States, the District of Columbia, Puerto Rico, Guam, and all possessions, territories, and the territorial sea of the United States.

Sec. 2. *Federal Agency Duties.*

(a) Each Federal agency whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law.

(1) identify such actions;

(2) subject to the availability of appropriations, and within Administration budgetary limits, use relevant programs and authorities to: (i) prevent the introduction of invasive species; (ii) detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner; (iii) monitor invasive species populations accurately and reliably; (iv) provide for restoration of native species and habitat conditions in ecosystems that have been invaded; (v) conduct research on invasive species and develop technologies to prevent introduction and provide for environmentally sound control of invasive species; and (vi) promote public education on invasive species and the means to address them; and (3) not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere unless, pursuant to guidelines that it has prescribed, the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions.

(b) Federal agencies shall pursue the duties set forth in this section in consultation with the Invasive Species Council, consistent with the Invasive Species Management Plan and in cooperation with stakeholders, as appropriate, and, as approved by the Department of State, when Federal agencies are working with international organizations and foreign nations.

Sec. 3. Invasive Species Council.

(a) An Invasive Species Council (Council) is hereby established whose members shall include the Secretary of State, the Secretary of the Treasury, the Secretary of Defense, the Secretary of the Interior, the Secretary of Agriculture, the Secretary of Commerce, the Secretary of Transportation, and the Administrator of the Environmental Protection Agency. The Council shall be Co-Chaired by the Secretary of the Interior, the Secretary of Agriculture, and the Secretary of Commerce. The Council may invite additional Federal agency representatives to be members, including representatives from subcabinet bureaus or offices with significant responsibilities concerning invasive species, and may prescribe special procedures for their participation. The Secretary of the Interior shall, with concurrence of the Co-Chairs, appoint an Executive Director of the Council and shall provide the staff and administrative support for the Council.

(b) The Secretary of the Interior shall establish an advisory committee under the Federal Advisory Committee Act, 5 U.S.C. App., to provide information and advice for consideration by the Council, and shall, after consultation with other members of the Council, appoint members of the advisory committee representing stakeholders. Among other things, the advisory committee shall recommend plans and actions at local, tribal, State, regional, and ecosystem-based levels to achieve the goals and objectives of the Management Plan in section 5 of this order. The advisory committee shall act in cooperation with stakeholders

and existing organizations addressing invasive species. The Department of the Interior shall provide the administrative and financial support for the advisory committee.

Sec. 4. Duties of the Invasive Species Council. The Invasive Species Council shall provide national leadership regarding invasive species, and shall:

(a) oversee the implementation of this order and see that the Federal agency activities concerning invasive species are coordinated, complementary, cost-efficient, and effective, relying to the extent feasible and appropriate on existing organizations addressing invasive species, such as the Aquatic Nuisance Species Task Force, the Federal Interagency Committee for the Management of Noxious and Exotic Weeds, and the Committee on Environment and Natural Resources;

(b) encourage planning and action at local, tribal, State, regional, and ecosystem-based levels to achieve the goals and objectives of the Management Plan in section 5 of this order, in cooperation with stakeholders and existing organizations addressing invasive species;

(c) develop recommendations for international cooperation in addressing invasive species;

(d) develop, in consultation with the Council on Environmental Quality, guidance to Federal agencies pursuant to the National Environmental Policy Act on prevention and control of invasive species, including the procurement, use, and maintenance of native species as they affect invasive species;

(e) facilitate development of a coordinated network among Federal agencies to document, evaluate, and monitor impacts from invasive species on the economy, the environment, and human health;

(f) facilitate establishment of a coordinated, up-to-date information-sharing system that utilizes, to the greatest extent practicable, the Internet; this system shall facilitate access to and exchange of information concerning invasive species, including, but not limited to, information on distribution and abundance of invasive species; life histories of such species and invasive characteristics; economic, environmental, and human health impacts; management techniques, and laws and programs for management, research, and public education; and

(g) prepare and issue a national Invasive Species Management Plan as set forth in section 5 of this order.

Sec. 5. Invasive Species Management Plan.

(a) Within 18 months after issuance of this order, the Council shall prepare and issue the first edition of a National Invasive Species Management Plan (Management Plan), which shall detail and recommend performance-oriented goals and objectives and specific measures of success for Federal agency efforts concerning invasive species. The Management Plan shall recommend specific objectives and measures for carrying out each of the Federal agency duties established in section 2(a) of this order and shall set forth steps to be taken by the Council to carry out the duties assigned to it under section 4 of this order. The Management Plan shall be developed through a public process and in consultation with Federal agencies and stakeholders.

(b) The first edition of the Management Plan shall include a review of existing and prospective approaches and authorities for preventing the introduction and spread of invasive species, including those for identifying pathways by which invasive species are introduced and for minimizing the risk of introductions via those pathways, and shall identify research needs and recommend measures to minimize the risk that introductions will occur. Such recommended measures shall provide for a science-based process to evaluate risks associated with introduction and spread of invasive species and a coordinated and systematic risk-based process to identify, monitor, and interdict pathways that may be involved in the introduction of invasive species. If recommended measures are not authorized by current law, the Council shall develop and recommend to the President through its Co-Chairs legislative proposals for necessary changes in authority.

(c) The Council shall update the Management Plan biennially and shall concurrently evaluate and report on success in achieving the goals and objectives set forth in the Management Plan. The Management Plan shall identify the personnel, other resources, and additional levels of coordination needed to achieve the Management Plan's identified goals and objectives, and the Council shall provide each edition of the Management Plan and each report on it to the Office of Management and Budget. Within 18 months after measures have been recommended by the Council in any edition of the Management Plan, each Federal agency whose action is required to implement such measures shall either take the action recommended or shall provide the Council with an explanation of why the action is not feasible. The Council shall assess the effectiveness of this order no less than once each 5 years after the order is issued and shall report to the Office of Management and Budget on whether the order should be revised.

Sec. 6. Judicial Review and Administration.

(a) This order is intended only to improve the internal management of the executive branch and is not intended to create any right, benefit, or trust responsibility, substantive or procedural, enforceable at law or equity by a party against the United States, its agencies, its officers, or any other person.

(b) Executive Order 11987 of May 24, 1977, is hereby revoked.

(c) The requirements of this order do not affect the obligations of Federal agencies under 16 U.S.C. 4713 with respect to ballast water programs.

(d) The requirements of section 2(a)(3) of this order shall not apply to any action of the Department of State or Department of Defense if the Secretary of State or the Secretary of Defense finds that exemption from such requirements is necessary for foreign policy or national security reasons.

WILLIAM J. CLINTON
THE WHITE HOUSE,
February 3, 1999

APPENDIX 2:

Summary of Federal Roles and Responsibilities

Appendix 2 provides additional information about Federal programs dealing with invasive species, and is intended to supplement the chapter on Federal Roles and Responsibilities of the Plan. Although it is more detailed, it does not represent a complete list of all programs pertaining to invasive species. It is organized according to the overall goals of the effort, including: prevention, control and management, international measures, and education and outreach.

Prevention

Department of Agriculture

The Animal and Plant Health Inspection Service (APHIS) within the Department of Agriculture (USDA) is the primary agency charged with preventing invasive species from entering the country. APHIS authority arises from laws such as the Plant Protection Act and a number of statutes collectively referred to as the animal quarantine laws. Using current authorities, APHIS can prohibit, inspect, treat, quarantine, or require mitigation measures prior to allowing entry of plant species, plant pests, biological control organisms, animals, animal products and by-products, or their host commodities or conveyances. These laws also authorize APHIS to prevent the introduction and dissemination of diseases and pests of livestock and poultry. APHIS has a number of domestic quarantines in place to prevent invasive species from moving within the country. In addition, APHIS "preclears" some shipments of plants or plant products and animal or animal products through inspection and quarantine in the country of origin to ensure that they are free of certain invasive species prior to arrival at a U.S. port of entry. APHIS is involved with overseas control and eradication of some invasive pest species, such as screwworm and medfly. APHIS also regulates the importation/exportation of veterinary biological products intended to treat animal disease and prohibits the importation or shipment of any products that are contaminated, dangerous, or harmful. APHIS prevention efforts are collaborative and draw on the knowledge, technology, and operational support of a broad array of Federal, State, and non-federal partners.

One of USDA's research arms, Agriculture Research Service (ARS), provides support to its regulatory and action agency partners providing taxonomic and identification expertise, monitoring methods for targeted pests, and developing eradication technology for invasive species.

The Forest Service (FS) has authority over forest pests and management of invasive species in its 192 million acre national forest and grasslands system. The FS has broad authority to prevent the spread of invasive species onto National Forest System (NFS) lands, and is authorized to assist other Federal, State, and private entities in preventing the spread of invasive species onto non-federal lands under its cooperative authorities. In addition, the FS provides research and development support to USDA's action programs to prevent invasive species problems. For example, FS works closely with APHIS to develop risk assessments to prevent the introduction of pests into the U.S., and conducts research relating to the prevention of introductions of invasive species.

Natural Resource Conservation Service (NRCS) has authority to aid in prevention through education and outreach funded by cost-share programs and conservation technical assistance.

Department of Defense

The Defense Transportation Regulation provides direction for the routine maintenance and washing of vehicles after field operations to remove mud/particulate matter which, in addition to extending the life of the vehicle, also prevents introduction of invasive or exotic species. The regulation requires conformance to U.S. Customs/APHIS requirements for international transport. Defense's Medical Service Quarantine Regulations are intended to prevent the introduction and dissemination, domestically or elsewhere, of diseases of humans, plants, or animals, prohibited or illegally taken wildlife, arthropod vectors, and pests of health and agricultural importance.

The U.S. Navy conducts numerous control and management efforts, including: ballast water and anchor system management practices; participation in the Aquatic Nuisance Species Task Force's (ANSTF) Ballast Water and Shipping Committee meetings; working with Environmental Protection Agency (EPA) to jointly establish Uniform National Discharge Standards (UNDS) for management of liquid discharges (including clean ballast water) from vessels of Armed Forces; and pest management of ships, aircraft, and shore facilities.

Early Detection and Rapid Response

Department of Agriculture

APHIS has emergency authority to deal with incipient invasions and works in cooperation with other Federal agencies, State departments of agriculture and other State agencies, academia, regional and local agencies, and non-governmental stakeholders. APHIS has several programs which address early detection and rapid response issues. For example, APHIS sponsors the Cooperative Agricultural Pest Survey Program (CAPS). Through the CAPS program, cooperation and collaboration with State regulators and university cooperators results in surveys for a number of identified high-priority pests. Through the State CAPS coordinator's office, data is routinely entered and summarized, and survey findings are disseminated to interested parties. The National Agriculture Pest Information System (NAPIS) is a nationally coordinated web-based information and data system that includes the survey results and ancillary survey and pest information for many species that are non-endemic, and considered to be potential invasive species. Summaries of survey and interception results are provided at county-level resolution and, in many cases, can be presented as maps. Many surveys are conducted in areas surrounding ports of entry as well as follow-up surveys at locations, such as warehouses, that received shipments of items coming through the ports.

When entry of a new plant pest is detected, a New Pest Advisory Group (NPAG) is convened. An NPAG consists of knowledgeable experts (both Federal and non-federal) who are charged

with recommending the appropriate response to be taken. The agency then follows up on the recommendations of the NPAG. In the case of an invasive animal or poultry disease, Veterinary Services, a unit within APHIS, moves rapidly to contain and then eradicate the disease. Veterinary Services performs regular surveillance for foreign animal diseases and pests of livestock and poultry. Private veterinary practitioners that have been through a foreign animal disease training process and are accredited by USDA report through an established process all suspect foreign animal disease cases encountered when these veterinarians visit sick animals. Other private veterinary practitioners are required to report all suspect animal disease cases to State authorities. State authorities then assign a USDA accredited veterinarian to investigate and report on the suspect case. Once a disease or pest has been confirmed by the National Veterinary Services Laboratories as a foreign animal disease or pest, an emergency response is implemented through the Regional Emergency Animal Disease Eradication Organization.

FS works to identify and control new or incipient invasions of invasive species through its research and cooperative authorities. FS research and development provides critical information and technology for early detection and rapid response. FS has rapid response teams which respond, primarily in cooperation with APHIS, to major insect and disease outbreaks and conduct studies in support of these efforts. In addition, FS has databases under development with direct benefits to early detection and rapid response (Exotic Forest Pest Information System and the Weed Invaders Database). FS's ability to respond to invasive species is hampered by the absence of a flexible funding mechanism that would allow research and operations relating to newly introduced invasive species to be accelerated within the year of introduction. Currently, funding for new control, research, and development activities, which are essential for early eradication and containment, are not appropriated for 1 to 2 fiscal years after the introduction occurs.

ARS provides research in support of early detection and rapid response activities of its regulatory and action agency partners by confirming identifications of invasive species, developing eradication technology, and taking part in rapid response teams.

NRCS provides information on invasive and noxious plants through the PLANTS website, (http://plants.usda.gov). NRCS field office staff also work with the Cooperative extension to disburse information on invasive species and their control. The NRCS National Plant Data Center has developed an alpha version of an automated plant identification tool that permits users to identify plant species. Wetland plant and grass data have been developed cooperatively for this tool by the U.S. Fish and Wildlife Service (FWS), NRCS, EPA, U.S. Army Corps of Engineers (CE), North Carolina Botanical Garden-Biota of North America Program, and the University of Northeastern Louisiana. An interagency effort to develop invasive plant data for this tool would assist field staff immensely. Also, NRCS, FS, and APHIS are cooperating to develop a module on the PLANTS website that will enable professionals and the public to review known distributional data and submit new county records, including their supporting data. These records will be funneled back through the Early Detection and Rapid Response network to the field level, where they can be closely watched in the event something elevates to a higher concern.

Control, Management, and Restoration

Department of Agriculture

FS manages 192 million acres and, in its report Stemming the Invasive Tide, the Forest Service Strategy for noxious and non-native invasive plant management, lays out priorities of prevention, eradication, and control. FS has authority to control Federal and State listed noxious weeds as well as invasive plants, insects, and pathogens deemed to cause environmental or economic damage through local forest and grassland management plans. FS also manages forest pests on National Forest System lands and provides funding, research and development, and technical assistance and advice for insect and disease control on private lands, as well as cost share and grant programs. FS has direct authority to control invasive plants in the Pacific Islands. The Wyden Amendment (temporary authority) allows Federal funds to be used on lands adjoining Federal lands. Many FS timber sale contracts and service contracts have provisions that permit FS to lessen risk of spread of "unwelcome" noxious weeds. FS research and development provides research in support of control, management, and restoration activities for forest ecosystems and rangelands.

APHIS authority for control and management of invasive species, both plant and animal, is authorized and limited by the same authorities used to prevent the introduction or dissemination of plant pests and animal diseases. Examples of APHIS involvement in this area include participation with FS in the Slow-The-Spread program to control gypsy moth. Another example is the cooperative Boll Weevil Eradication Program, initiated in 1983. The program is designed to eliminate the cotton boll weevil, an invasive pest that has plagued the U.S. cotton industry for over 100 years. Moving in a series of sequential expansions across the southern cotton-producing states, the program is scheduled for completion in 2005. The cooperative program involves USDA, States, and cotton growers – usually organized into statewide or regional foundations. APHIS provided the initial program management and direction, but as the program matured and demonstrated its ability to succeed, cotton growers assumed greater responsibility for daily program operations. APHIS continues to provide technical support and limited cost-share funding (5% in FY 2000) along with the Farm Service Agency-sponsored low interest loans. Regulatory authority for the program rests with the participating States.

Wildlife Services (WS), a unit of APHIS, assists in solving problems involving damage or hazards caused by invasive species. When requested, WS provides help through technical assistance, direct control, and research of invasive vertebrate pest species to Federal, State, local, tribal, and other partners. WS has conducted operational activities on a minimum of 44 species of invasive animals, including 17 species of invasive mammals, 25 species of invasive birds, and 2 species of invasive reptiles. Since

its introduction in the late 1940s, the invasive brown tree snake has been detrimental to the native fauna of Guam. The snake has eliminated 8 species of birds, 2 species of bats, and several reptiles. The invasive snake is also detrimental to the electric utility industry, as well as a threat to human health and safety. WS conducts operations in Guam and Hawaii aimed at keeping the invasive brown tree snake from reaching other destinations. WS' National Wildlife Research Center (NWRC), has developed and registered a toxicant of control brown tree snake. NWRC is also developing snake lures and irritants, along with delivery systems for these products, to improve brown tree snake control programs.

ARS provides holistic, ecosystem-level research in support of control, management, and restoration activities in cooperation with its land management agency partners. ARS develops integrated pest management programs, area-wide pest management programs, weed management areas, and biological, chemical, and cultural control strategies, emphasizing biologically based approaches where possible, and incorporating restoration, revegetation, and rehabilitation of ecosystems where appropriate. Restoration is particularly important to integrate with biological control of weeds programs. ARS now requires this integration for its biological control of weeds programs.

NRCS works primarily with private landowners and is simultaneously linked to local, State, and other Federal agencies as well as non-governmental organizations, through State technical committees and county level local working groups in each of the 3000 Soil and Water Conservation Districts. This relationship includes sharing technical advice or recommendations regarding invasive species control, and management of healthy ecosystems in order to preclude the displacement of native and non-invasive species by invasive species. In addition, NRCS plays a large role in land restoration following catastrophic events through the Emergency Watershed Program. Following flooding, fires, and other types of natural destruction, NRCS provides technical and financial assistance to help restore land to its native and/or desirable non-invasive species pre-disturbance composition. NRCS is the major natural resource conservation information provider to private landowners, including invasive species information. Integrated state noxious weed lists, invasive plant lists, links to key sources of weed species biology and management information throughout the U.S. and the world, and Plant Guides used for restoring native plant communities are provided through the NRCS PLANTS website. PLANTS will exhibit APHIS information on key foreign species that are high threats targeted for exclusion.

Cooperative State Research, Education, and Extension (CSREES), through its partnership with the Land Grant University System, supports research, extension and education efforts aimed at control, management, and restoration in all 50 states (3,150 counties), the District of Columbia, and the 6 territories. These efforts include participation by scientists and educators at other non-land grant universities and from private sector organizations. In addition, CSREES supports surveys, eradication, and management efforts with both formula-based and competitive funding. These funds have supported a broad spectrum of technologies, philosophies, and methodologies.

Department of Commerce

Under the Nonindigenous Aquatic Nuisance Prevention and Control Act, National Oceanic Atmospheric Administration (NOAA) (together with FWS) has responsibility for control and management of invasive aquatic species. NOAA's Sea Grant program has been actively involved in research on methods to reduce the impact of zebra mussels and a number of other species. Although set up for other purposes, NOAA also has programs to deal with pathogens and parasites of shellfish and threats to essential fish habitat that have involved control of invasive species.

The NOAA Restoration Center within the National Marine Fisheries Service is engaged in restoration activities to restore coastal and estuarine habitats, to advance the science underlying habitat restoration, and to transfer restoration technology to the private and public sectors. Projects involve on-the-ground habitat restoration. Invasive species removal and native habitat restoration is often a component of these projects. The program has removed invasive species from bays and estuaries in Florida, Hawaii, Massachusetts, and the State of Washington. An effort is made to develop techniques to make restoration areas more resistant to invasive species, (e.g., improving salt-water circulation, correcting tidal heights, and increasing native plant density).

Department of Defense

The Department of Defense (Defense) manages over 25 million acres of lands within military installations. Defense controls and manages invasive species in accordance with the individual plans governing each installation or base. The goals of Defense's Invasive Species Management Program are prevention, control of invasive species present on Defense installations, and restoration using native plants. Defense Instruction 4715.3 Environmental Conservation Program addresses ecosystem management, biodiversity conservation, and maintaining and restoring native ecosystems to support the military mission of the installation. Defense Instruction 4150.7 Pest Management Program establishes and assigns responsibilities for a safe, effective, and environmentally sound integrated pest management program for the prevention and control of pests and disease vectors that may adversely impact readiness or military operations by affecting health of personnel or damaging structures, materiel or property. These two instructions require compliance with applicable U.S. statutes, regulations, Executive Orders, binding international agreements, other legal requirements, and U.S. environmental, safety, occupational health, explosives safety, fire and emergency services, and pest management policies.

Defense maintains Master Memoranda of Agreement with the Departments of Agriculture (USDA) and Interior (Interior). The agreements cover research requirements of mutual concern between Defense and the two Departments. USDA and Interior are to coordinate requirements and consider Defense as one of their constituent customers when developing their respective research requirements. Invasive species have been included in these requirements.

The U.S. Army Environmental Center and the Army Corps of Engineers Laboratories (working with the Installation operators) have developed an Integrated Training Area Management (ITAM) Program for restoration. They engage contractors to restore training areas and protect them from erosion, loss of endangered species habitat, and degradation of land resources for training, which in turn may help such areas resist establishment by invasive species. Through this program and the National Defense Industrial Association, Defense can assist in restoration efforts.

CE has a number of control programs, including the Aquatic Plant Control Program, Zebra Mussel Program, and the Removal of Aquatic Growth Program. It is also authorized to implement a 50/50 Federal/local cost arrangement with State and local governments for managing nuisance aquatic plants in waterways not under the control of the CE or other Federal agencies.

Department of the Interior

The Bureau of Land Management (BLM) focuses primarily on controlling invasive plants, which has been identified as a top priority for the agency (Congressional Research Service 1999) and has implemented an action plan, called Partners Against Weeds, to prevent and control the spread of noxious weeds on public lands. APHIS regulates animal pests on BLM land under a memorandum of understanding between the two agencies.

The National Park Service (NPS) manages more than 83 million acres, and approximately 200 parks have identified exotic species as an important resource management threat. NPS' management policies prohibit the introduction of exotic invasive species to a few situations and require the use of an Integrated Pest Management approach to remove or control exotic species on NPS units. As part of its regulation of fishing in park units, NPS prohibits the use of most bait fish (live or dead), except in specially designated waters in order to reduce the likelihood of the introduction or spread of invasive species.

FWS has multiple programs to address management and control of invasive species. FWS works with ANSTF and leads efforts to develop and implement cooperative plans to manage and control infestations of aquatic nuisance species across the country. The National Wildlife Refuge System has invasive species teams that are currently reviewing strategies and recommending potential pilot projects involving invasive species. In addition, invasive species issues are being included within comprehensive conservation plans that are being written for refuge units. FWS also has several habitat restoration programs that restore habitat degraded by invasive species as part of their overall habitat restoration activities.

The Bureau of Reclamation (BOR) is responsible for programs that control invasive species which infest water systems, including reservoirs, rivers, distribution canals, etc. Species such as zebra mussels, Chinese mitten crabs, hydrilla, and water hyacinth obstruct water flow, reduce recreational access, and can cause structural damage. BOR manages invasive species through its Integrated Pest Management Program under its basic operation and management authority and various reclamation-enabling statutes and directives.

The Minerals Management Service (MMS) recognizes the increasing importance of invasive species. As a result, they have increased research of invasive species. They recently committed $100,000 to a "Survey of the Relationship of the Australian Spotted Jellyfish, Phyllorihiza puncta, and OCS platforms" in the Gulf of Mexico. Invasive species are being introduced into the Gulf of Mexico, and offshore oil and gas platforms in the Gulf are habitat for these species as well as potential pathways of distribution. Oil and gas exploration in the Gulf can at times involve exploratory drilling rigs originating from locations outside the Gulf, as well as foreign ships, whose hulls and ballast water often carry invasive species. The presence of oil and gas platforms has promoted the dispersion of species otherwise not found in the offshore region. In the coming years, MMS will become more involved in the invasive species issue.

Environmental Protection Agency

Under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), EPA has regulatory authority over certification of such compounds and may place limits on the conditions under which they may be used. In addition, EPA is the lead agency for administration of the National Environmental Policy Act, which may require production of an environmental assessment document for control activities.

Department of Transportation

The Federal Highway Administration (FHWA) has an oversight role in federally funded highway projects that include both Interstate and State highways. FHWA's Vegetation Management Program guides State departments of transportation on invasive species issues. Guidance on E.O. 13112 was issued to the States in September 1999, encouraging inventory and integrated management of roadside weeds before-and-after projects. The guidance requires invasive species assessment during the NEPA process. The FHWA continues to provide technical support to all States on this vegetation issue.

Research and Monitoring

Department of Agriculture

ARS and FS play a critical role in conducting research on the prevention, eradication, and control of agricultural invasive species and conduct critical research on monitoring ecosystems impacted by invasive species.

ARS is also responsible for evaluating new agricultural nonindigenous species before they can be commercially distributed. ARS has established new research partnerships for integrated management of invasive species through its area-wide pest management program, in which partnerships with Federal, State, and local groups are developed. ARS also provides leadership in developing biological control technologies for invasive species, including foreign exploration for natural enemies of the pests, risk assessment and host-specificity testing of high-priority candidate biological control agents, field release and evaluation, and

restoration, revegetation, and rehabilitation of affected areas. ARS budgeted $70 million for this effort in FY 1999.

FS has a research branch focused on issues of environmental concern to forests, rangelands and wetlands. FS is the lead research agency for invasive insects, diseases, and pathogens which affect forests, and is actively engaged in research of invasive species on range and grasslands. FS has an active biological control research program with foreign exploration supporting domestic projects. FS also supports technology development for control, monitoring, and restoration.

NRCS's Plant Materials Centers (PMC) play a role in research through plant screening efforts investigating new species for their potential invasiveness and usefulness as an agronomic or conservation substitute in the event a suitable native species is not available. PMC can contribute technical assistance in the development of native seed banks. The PLANTS database can be used to monitor the spread of invasive species through a particular habitat, and through additional funding, the PMC have the potential to contribute technical assistance in the development of native seed banks.

CSREES works primarily through the Land Grant University System to support research and extension scientists who engage stakeholders and citizen volunteers regarding invasive species issues. Funding opportunities for these scientists include formula funds, special grants, and competitive grants.

Department of Commerce

NOAA has a major role in research regarding invasive aquatic species under the Nonindigenous Aquatic Nuisance Prevention and Control Act. NOAA's Sea Grant program manages a competitive research grant program for all aspects of aquatic nuisance species issues, including the development of ballast water management technology. Under the program, research projects cover a wide range of issues from prevention to control to ecological monitoring. Funding for this program, which includes outreach, has averaged about $2.8 million per year.

In addition, NOAA's National Ocean Service has recognized the importance of monitoring for non-native species within marine sanctuaries and estuarine research reserves and is inaugurating a monitoring program in these areas.

Department of Defense

CE has a number of research programs focused on invasive species. The Aquatic Plant Control Research Program (APCRP) has provided effective, economical, and environmentally compatible technologies for identifying, assessing and managing aquatic plant problems for over 30 years. The Zebra Mussel Program is the only Federally authorized research program for zebra mussel control.

Department of the Interior

The USGS assists resource managers to obtain reliable information on invasive species, develop methods and tools to better prevent and control invasions, and to reduce their impacts on ecosystems and native species.

The U.S. Geological Survey (USGS) Biological Monitoring and Research Program includes research in terrestrial and aquatic ecosystems, including invasive plants, vertebrates, invertebrates, and wildlife disease organisms. Emphasis is given to areas administered by Interior and regions that are particularly threatened by invasive species, such as Hawaii, western rangelands, wetlands, the Great Lakes, and eastern waterways. The program includes: identification and reporting of new invasions and assessment of their environmental risks; methods for monitoring invasions (including remote sensing and GPS technologies), field sampling, and geographic information systems; determination of the effects of invasive species and the susceptibility of habitats to invasions; control approaches, with emphasis on reducing invasion impacts and restoring ecosystem processes and native species; and the development of invasive species information systems, including a national database on nonindigenous aquatic species. USGS is integrating invasive species information from domestic and international sources as part of the National Biological Information Infrastructure, and is working in partnership with the National Agricultural Library (NAL) to assist in developing the Council's website, discussed in Section 3 of the Plan.

The primary responsibility of the Biological Resources Division (BRD) within USGS is to assist resource and land managers (particularly those within Interior's agencies) by providing sound biological information and assisting in applying that information to the managers' needs. Thus, the BRD's mission is to "work with others to provide the scientific understanding and technologies needed to support the sound management and conservation of our Nation's biological resources." Investigating the causes, effects, prevention, and management of invasive and nonindigenous organisms with an eye to developing effective management solutions is one of BRD's identified scientific programs.

NPS is establishing 32 inventories and monitoring networks throughout the Service. The parks within each network are linked geographically and share natural resource characteristics. These networks will provide the parks with inventory and monitoring capabilities for priority needs within each network. Most of these networks have identified exotic or invasive species monitoring as a high priority need.

Environmental Protection Agency

EPA's research activities include evaluation of ecological indicators (including non-native species) for surface waters, the effects of non-native species on wetland restoration, and studies on non-native submerged aquatic vegetation. In addition, EPA's research grant program is in the process of funding several million dollars of research on "biological pollution". There are other programs that can be modified to contribute to the overall assessment of invasive species. Two examples are the Environmental Monitoring and Assessment Program (EMAP) and Regional Vulnerability Assessment program (ReVA).

International Measures

Department of Agriculture

APHIS is involved in a number of bilateral, regional, and global plant and animal international conventions and agreements that deal with invasive species. Most significant at the global level is APHIS involvement with the World Trade Organization on the international agreement referred to as the Application of Sanitary and Phytosanitary Measures, which covers measures adopted to protect plant or animal life or health, which may affect international trade. A number of global standards for protection from invasive plant pests are currently under development (via International Plant Protection Convention). Standards for protection from invasive animal pests (via the Office International des Epizooties) are currently being developed.

ARS works in partnership with international groups with common interests in invasive species, including Agriculture and Agri-Food Canada; Commonwealth Agriculture Bureau International (CABI) Bioscience, UK; Commonwealth Scientific and Industrial Research Organization, Australia; EMBRAPA, Brazil; North American Plant Protection Organization; International Organization for Biological Control; and many others. ARS manages six overseas biological control laboratories (in France, Italy, Greece, Australia, China and Argentina), which facilitate foreign exploration for natural enemies of invasive species. This extensive network of contacts allows ARS to respond quickly to discoveries of new invasive species.

FS, through its International Programs (IP), provides assistance that promotes sustainable development, including cooperating with domestic and international organizations that further international programs for the protection of forests, rangelands, wildlife, and fisheries, and for related activities. These programs also provide assistance to appropriate partners for the prevention and control of insects and diseases. The budget for invasive species for FY 2000 is $1.5 million. It focuses on biological and chemical control of the Asian long-horned beetle, kudzu, mile-a-minute weed, and beech bark scale. FS IP also supports projects to help assess current and potential plant species affecting the Pacific Islands and to provide this information to agricultural and customs inspectors in those countries, providing a first line of defense to invasions into Hawaii, Guam, and Compact countries.

CSREES works in partnership with international groups in a number of different ways when there are common interests regarding invasive species. Multi-State research and extension invasive species projects often have members from Canada or Mexico on issues that cross those borders.

Department of Commerce

NOAA is actively engaged in projects that integrate research with education on aquatic invasives in several regions shared by the U.S., Canada, and Mexico. Under the Council of Commission on Environmental Co-Operation (CEC), NOAA is leading a project to address aquatic pathways of invasion in North America. These projects depend heavily upon partnerships with our neighboring countries for their success and provide a strong foundation on which to build a North American strategy on invasive species. NOAA's expertise on marine invasives is also needed in other regions, e.g., South Pacific Environmental Programme (SPREP).

Department of Defense

Defense has the responsibility to ensure that movement of U.S. military personnel, equipment, and supplies around the world does not provide a pathway for invasions by non-native species. To this end, Defense actively supports research, education, and policy development in such areas as brown tree snake containment and control, ballast water and aquatic weed management, and military quarantine. Defense also undertakes agreements on the management of invasive species with defense departments in other nations through bilateral, trilateral, or multilateral agreements and supports the development and implementation of regional programs of cooperation on invasive species, such as SPREP.

Department of the Interior

Interior supports work on invasive species internationally through a wide variety of scientific, technical, and policy activities. For example: the USGS's BRD coordinates and promotes the invasive species components of the Inter-American Biodiversity Information Network (IABIN) and the North American Biodiversity Information Network (NABIN). BLM is leading efforts to exchange information and technical capacity on "best practices" for the management invasive species with South Africa through the U.S.-South Africa Binational Commission. NPS partners with other countries around the world to help conserve biodiversity within protected areas. The Secretary of the Interior has delegated FWS the lead in U.S. negotiations on invasive species under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and plans to support development of a Global Invasive Species Database and Emergency Response System, with a focus on risk assessment and intentionally imported live animals and plants. The Office of Insular Affairs shares responsibility for brown tree snake control in the Pacific Islands.

Department of State

The Bureau of Oceans and International Environmental and Scientific Affairs (OES) is the U.S. focal point for foreign policy formulation and implementation on global environment, science, and technology issues. The Department of State (State) has, however, given lead negotiator privileges to other agencies when that agency's specific expertise clearly makes it in the U.S.'s best interest to do so. OES considers invasive species a high priority and has a proactive program to raise awareness of the issue among other governments, encourage intergovernmental cooperation, foster capacity-building efforts in developing countries, and support the Global Invasive Species Programme (GISP). OES directs U.S. negotiations under the Convention on Biological Diversity (CBD).

Department of Transportation

International programs in the Department of Transportation (DOT) are not limited to ensuring safe and efficient transportation within the U.S., but aim to support and enforce a wide variety of U.S. interests. Many of DOT's actions have a direct impact on invasive species pathways. For example, the U.S. Coast Guard works closely with other agencies to develop and enforce international fisheries and maritime agreements, including those negotiated on ballast water management under the International Maritime Organization (IMO). DOT's Federal Aviation Administration addresses air transport issues and considers invasive species in the various actions that it takes. DOT has brought about involvement by the International Civil Aviation Organization.

Environmental Protection Agency

While most of EPA's work with respect to invasive species is domestically focused, it does undertake programs of work in cooperation with other governments. In the Great Lakes region, for example, EPA works closely with Canadian agencies, as well as governments of the Baltic region through the Great Lakes/Baltic Sea Partnership Program. EPA leads U.S. activities under the North American Agreement for Environmental Cooperation (NAAEC).

Agency for International Development

U.S. foreign assistance has always had a twofold purpose of furthering the U.S.'s foreign policy interests (e.g., opening free markets) while improving the lives of citizens of the developing world. U.S. Agency for International Development (USAID) is the principal U.S. agency extending assistance to developing countries, and works in four major topical areas: economic growth and agricultural development; population, health, and nutrition; environment; and democracy and governance. These programs are targeted to four broad geographic regions: Sub-Saharan Africa; Asia and the Near East; Latin America and the Caribbean; and Europe and Eurasia. USAID has responsibility for ensuring that the U.S.'s development assistance programs do not lead to the introduction of invasive species in other nations. It is also well positioned to use its programs to support projects to eradicate and control invasive species where they are already established in developing countries, especially when food, water, and health security are at risk.

National Science Foundation

The National Science Foundation (NSF) enables and encourages U.S. scientists, engineers, and their institutions to enhance their research and education programs through international cooperation. Support is available through a wide variety of programs, including fellowships, travel grants, workshops, research, and education projects. A set of these programs is explicitly dedicated to collaborative projects, the development of reliable data on the science and engineering resources in other countries, the advanced training of U.S. scientists and engineers overseas, and the development of international electronic networks. While NSF does not have a specific grant program on invasive species, projects relevant to minimizing the spread of invasive species have been funded under its existing programs.

Office of the U.S. Trade Representative

The U.S. Trade Representative (USTR) is responsible for developing and implementing trade policies which promote economic growth, support efforts to protect the environment, advance core labor standards, and create new opportunities for U.S. businesses, workers, and agricultural products. USTR sets and coordinates U.S. international trade, commodity, and direct investment policy. It also leads or directs U.S. negotiations with other countries (through entities such as the World Trade Organization (WTO) and the North American Free Trade Agreement (NAFTA)). Increasingly, invasive species are included among the issues that USTR considers within its efforts to protect the environment. The USTR/CEQ Guidelines for implementation of Executive Order 13141, Environmental Review of Trade Agreements, specifically references the need to analyze "changes in volume, pattern, and modes of transportation (e.g., increased or decreased potential for spread of invasive species, . . ." and "the potential for invasive species to compromise such biodiversity" (65 Federal Register 79449; Appendix C, II(b) and IV(E); December 19, 2000).

Global Invasive Species Programme

GISP is a multi-faceted effort undertaken by the Scientific Committee on Problems of the Environment (SCOPE) – a component of the International Council for Science (ICSU), in collaboration with the World Conservation Union (IUCN) and CABI. GISP's mission is to raise awareness of the issue of invasive species and to develop new tools and approaches for dealing with the problem. GISP engages many constituencies in its efforts, including experts from a wide variety of disciplines, leaders in industry and international organizations, and government officials. GISP works closely with the Convention on Biological Diversity (CBD), providing scientific and technical expertise, and is building strong relationships with other international programs, such as the International Plant Protection Convention (IPPC) and WTO.

Public Outreach and Partnership Efforts

Department of Agriculture

APHIS has a public affairs effort in place to respond to emergency situations and eradication programs. State and industry programs supplement this effort. APHIS provides information to the traveling public through programs that focus on pest exclusion efforts such as "Don't Pack a Pest," and provides information on program activities through its website and the NAPIS database. In addition, APHIS maintains a website

(www.aphis.usda.gov) that provides a wealth of information on current invasive species activities within APHIS.

NRCS administers the Environmental Quality Incentive Program (EQIP), the Wildlife Habitat Incentives Program (WHIP), the Wetlands Reserve Program (WRP), and the Forestry Incentive Program (FIP), which distribute monies to priority projects at the State level. Invasive species is one of the fundable topic areas. In the Conservation Reserve Program (CRP), administered by the Farm Service Agency, NRCS provides technical support to help farmers identify and control noxious weeds and invasive plant species on farmland enrolled in the program. Private landowners and agricultural producers enrolled in the CRP, WRP, and WHIP are responsible for controlling noxious weeds and invasive plant species on their respective acreage. Invasive species is one of the fundable topic areas. NRCS also is the major natural resource conservation information provider to private landowners, including invasive species information. The NRCS PLANTS website (HYPERLINK http://plants.usda.gov # http://plants.usda.gov) provides a single site for integrated State noxious weed lists, invasive plant lists, links to key sources of weed species biology and management information throughout the U.S. and the world, and plant guides used for restoring native plant communities. APHIS is cooperating with NRCS to expand the invasive plant information available through PLANTS, which receives over 2 million hits a month by users of plant information. PLANTS will exhibit APHIS information on key foreign species that are high threats targeted for exclusion.

FS administers a number of cooperative programs that assist partnerships and encourage forest stewardship for non-industrial forest landowners, including control of invasive species. The Forest Stewardship Program provides professional expertise and advice, and the Stewardship Incentive Program, which provides cost-share, supports private non-industrial forest landowners in implementing Forest Stewardship Plans. Other FS programs also provide technical assistance and educational technology transfers to partners.

CSREES is actively involved in public outreach and partnership efforts through its association with the Land Grant University System. The Extension Service provides a vital link, through on-campus programs and county offices across the U.S., bringing together the USDA, stakeholders and concerned citizens on this issue. County Extension Agents partner with research and extension scientists to deliver information to the general public on a variety of pest management issues, including invasive species.

ARS has extensive public outreach and partnership activities. For example, the Area wide Pest Management programs provide about $1 million per year for five years to transfer technology to manage invasive species. These programs concentrate on managing a single species, such as leafy spurge, codling moth and corn rootworm. About half of these funds are provided to Federal, State and local partners. NAL plays a key role in public outreach, such as developing and managing the website (www.invasivespecies.gov) for the National Invasive Species Council. All ARS individual research programs produce non-technical information about its activities, and ARS scientists participate in many public field days each year.

Department of Commerce

NOAA's Sea Grant Program provides matching grants for outreach and education efforts dealing with aquatic nuisance species under the Nonindigenous Aquatic Nuisance Prevention and Control Act.

Department of Defense

CE has a 50% Federal / 50% local cost share arrangement with State and local governments, as mentioned above in the Control, Management, and Restoration section. The Army Corps of Engineers Waterways Experiment Station has produced a set of CD-ROMs. The first CD provides detailed information – identification, geographic distribution, and recommended control methods relating to 61 invasive terrestrial plants occurring on Defense lands. The second CD, subject to the availability of funding, will provide similar management information for the worst 100 noxious plant species on Defense's lands (target date of 2000).

Defense's Armed Forces Information Service is used to educate laypersons within Defense, and could be helpful in an invasive species outreach and education program.

Department of the Interior

BLM, as part of its Partners Against Weeds program, funds cooperative efforts with landowners to control invasive species. It also funds cooperative outreach and education projects with schools and local/ county governments.

NPS partners with the ARS, FS, and the State of Hawaii to develop and test biological control agents.

FWS works in partnership through many programs, such as the Partners for Fish and Wildlife Program and the Coastal program, to provide outreach, technical, and financial assistance to private landowners for habitat restoration issues including those involving invasive species.

Interagency Groups

ANSTF is a statutory entity set up under the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990. It is co-chaired by FWS and NOAA. Other Federal members are the U.S. Coast Guard (USCG), CE, EPA, USDA, and State. ANSTF also includes 13 ex officio non-federal stakeholders. ANSTF and its constituent agencies are responsible for carrying out and coordinating Federal invasive aquatic species activities, including: prevention of new introductions; monitoring nonindigenous species that have become established; controlling aquatic nuisance species; developing an education program; and sponsoring scientific research in order to reduce the impacts of such species.

The Federal Interagency Committee for the Management of Noxious and Exotic Weeds (FICMNEW) was established in August 1994 through a memorandum of understanding. The 16 Federal members participate voluntarily, with most agencies' representation considered a collateral duty of their position. Project support is currently provided on an ad hoc basis, usually from

discretionary funds, by participating agencies and groups. FICMNEW's charter is to coordinate, through the respective Secretaries, Assistant Secretaries, and Agency heads, information regarding the identification and extent of invasive plants in the U.S. and to coordinate Federal agency management of these species. FICMNEW accomplishes this charter by sharing scientific and technical information, fostering collaborative efforts among Federal agencies, and sponsoring technical and educational conferences and workshops concerning invasive plants. Through its open meetings and various forums, FICMNEW facilitates cooperation between the signatory agencies and numerous non-federal agencies and private organizations. It also sponsors the Pulling Together Initiative (PTI) on invasive species, managed by the National Fish and Wildlife Foundation. PTI is a cost share program, funded by seven Federal agencies, which encourages partnerships for invasive weed management areas.

The Committee on Environment and Natural Resources Research (CENR) of the National Science and Technology Council (NSTC) was established to advise and assist the NSTC in increasing the effectiveness and productivity of Federal research and development efforts in the area of the environment and natural resources. CENR addresses science policy and research and development that cut across agency boundaries and provides a formal mechanism for interagency coordination relevant to domestic and international environmental and natural resources issues. CENR has identified invasive species as a priority focus for integrated ecosystem research, for which the Subcommittee on Ecological Systems (CENR/SES) has established an interagency Task Team on Invasive Species (TTIS). CENR members include representatives from the White House, NOAA, Smithsonian Institution (SI), EPA, DOE, NASA, NSF, USDA, OMB, Interior, DHHS, DOT, DHUD, Defense, State, FEMA, Tennessee Valley Authority, Office of the Coordinator for Meteorology, Central Intelligence Agency, and Council on Environmental Quality.

The Technical Advisory Group for the Biological Control of Weeds (TAGBCW) is administered by USDA-APHIS, Plant Protection and Quarantine. TAGBCW is an independent voluntary committee that was first formed in 1957 to provide advice to researchers on biological control of weeds. TAGBCW members review petitions for biological control of weeds and provide an exchange of views, information and advice to researchers and those in USDA-APHIS-PPQ responsible for issuing permits for importation, testing, and field release of biological control agents of weeds. TAGBCW members include USDA, Interior, EPA, plant-related boards, and the Governments of Canada and Mexico.

APPENDIX 3:

Legal Authorities Related to Invasive Species

This appendix contains a brief, general description of a number of the major legal authorities of the Council member Departments that deal with invasive species. It does not represent a complete or definitive list of all legal authorities on invasive species, but includes those most important to understanding the National Invasive Species Management Plan and its recommended actions.

1. Legal Authorities Available to the Department of Agriculture:

Plant Protection Act

The Plant Protection Act (PPA, 7 U.S.C. 7701 et seq.), which consolidated the authorities in the Plant Quarantine Act, Federal Plant Pest Act, Federal Noxious Weed Act, and other plant-related statutes, authorizes USDA to prohibit or restrict the importation or interstate movement of any plant, plant product, biological control organism, noxious weed, article, or means of conveyance if the Secretary of Agriculture determines that the prohibition or restriction is necessary to prevent the introduction into the United States, or the dissemination within the United States, of a plant pest or noxious weed. A "plant pest" is defined as any living stage of any of the following that can directly or indirectly cause damage to, or cause disease in any plant or plant product: A protozoan, nonhuman animal, parasitic plant, bacterium, fungus, virus or viroid, infectious agent or other pathogen, or any article similar to or allied with any of those articles. A "noxious weed" is defined as a plant or plant product that can directly or indirectly injure or cause damage to crops (including nursery stock or plant products), livestock, poultry, or other interests of agriculture, irrigation, navigation, the natural resources of the United States, the public health, or the environment.

The PPA specifically authorizes USDA to hold, seize, quarantine, treat, apply other remedial measures to destroy or otherwise dispose of any plant, plant pest, noxious weed, biological control organism, plant product, article or means of conveyance that is moving (or has moved) into or through the United States or interstate, if USDA considers it necessary in order to prevent the dissemination of a plant pest or noxious weed that is new to or not known to be widely prevalent or distributed within or throughout the United States. This authority extends to progeny of prohibited items moved in violation of the PPA. The PPA also authorizes USDA to order an owner, or an agent of the owner, of a plant, biological control organism, plant product, plant pest, noxious weed, article, or means of conveyance to treat, destroy, or otherwise dispose of those items. In addition, when a State is unable or unwilling to take the necessary action to prevent the dissemination of a plant pest or noxious weed, the Secretary has the authority to declare an extraordinary emergency and take the actions described in this paragraph within a State (i.e., when interstate movement is not involved).

The PPA grants specific authority to USDA to control grasshoppers and Mormon crickets on all Federal lands to protect rangeland, and directs the Secretary to work in conjunction with other Federal, State, and private prevention, control, and suppression efforts to protect rangeland. This authority allows treatment of State and private lands if necessary to protect rangeland, and provides for Federal cost sharing of treatment (100 percent of the costs of treatment on Federal land, 50 percent on State land, and 33.3 percent on private land).

The PPA specifically authorizes USDA to develop integrated management plans for noxious weeds for the geographic region or ecological range where the noxious weed is found in the United States.

In addition, the PPA authorizes USDA to cooperate with other Federal agencies or entities, States or political subdivisions of States, national governments, local governments of other nations, domestic or international organizations, domestic or international associations, and other persons to carry out the provisions of the PPA.

Federal Seed Act

The Federal Seed Act (FSA, 7 U.S.C. 1581 et seq.) requires accurate labeling and purity standards for seeds in commerce, and prohibits the importation and movement of adulterated or misbranded seeds. The FSA works in conjunction with the Federal Noxious Weed Act to authorize USDA to regulate the importation and movement of field crop, pasture and forage, or vegetable seed that may contain noxious weed seeds.

The FSA allows interstate movement of agricultural seed containing noxious weed seeds if the shipment is accurately labeled as to the kinds of noxious weed seeds present and their rate of occurrence. The rate of noxious weed seeds in an interstate shipment of agricultural seeds is not allowed to exceed the rate for shipment, movement, or sale in the State in which the seed is offered for transportation or transported, or in accordance with regulations issued by USDA. USDA has promulgated regulations setting tolerances for the nine noxious weeds specifically listed in the FSA in shipments of agricultural or vegetable seeds in interstate commerce.

The FSA also requires shipments of imported agricultural and vegetable seeds to be labeled correctly and to be tested for the presence of certain noxious weeds as a condition of entry into the United States. As is the case with the interstate movement of seeds, tolerances have been established for the seeds of nine specifically listed noxious weeds in imported seed.

There is no authority under the FSA to declare an extraordinary emergency and take action on intrastate matters when a State is unable or unwilling to take action to prevent the dissemination of a noxious weed in a shipment of seed subject to the FSA. Also, there is no authority under the FSA for USDA to seek to recover the cost of actions taken by USDA to prevent the dissemination of a noxious weed from the owner or the owner's agent.

Animal Quarantine Laws

USDA's authority to regulate the importation and interstate movement of invasive animal species derives from several statutes collectively referred to as the animal quarantine laws (21 U.S.C. 101 through 135b and 19 U.S.C. 1306). The animal

quarantine laws authorize USDA to promulgate regulations and take measures to prevent the introduction and dissemination of communicable diseases and pests of livestock and poultry. The animal quarantine laws authorize USDA to regulate the importation and interstate movement of all members of the animal kingdom, domestic and wild, except man, for the purpose of regulating communicable diseases and pests of livestock and poultry. The fact that a disease or pest primarily affects animals other than livestock and poultry, including man, does not limit USDA's authority to regulate a species, as long it carries a communicable disease or pest of livestock or poultry.

Under these laws, USDA is authorized to seize, quarantine, and dispose of animals, animal products, or other material that can harbor disease or pests of livestock or poultry that are moving or are being handled, or have moved or have been handled, in interstate or foreign commerce if they are infected with or exposed to a communicable disease of livestock or poultry, or if the animals are moved contrary to any of the animal quarantine laws. In addition, when a State is unable or unwilling to take the necessary action to prevent the dissemination of a communicable disease of livestock or poultry, the Secretary has the authority to declare an extraordinary emergency and take the actions described in this paragraph within a State (i.e., when interstate movement is not involved).

The animal quarantine laws authorize USDA to cooperate with States in the control and eradication of diseases and pests of livestock and poultry. There is some specific research authority in the animal quarantine laws, but that authority is focused on certain animal diseases and pests such as foot-and-mouth disease and cattle grubs.

The animal quarantine laws do not cover situations involving diseases and pests that are not communicable diseases and pests of livestock or poultry. For example, they do not cover genetic disorders, exposure to radiation in nuclear accidents, or chemical residues. Further, they do not cover situations in which the method of transmission is not clearly communicable. Also, they do not cover progeny of illegally imported animals unless they have or have been exposed to a communicable disease of livestock or poultry. Further, under current law, USDA has authority to take action with regard to an individual premises only if a finding is made that the animals are infected or exposed to a communicable disease of livestock or poultry or they have been moved in violation of regulations. In the early stages of an outbreak, it may be difficult to make such a finding.

Thus, there is no authority for USDA to enter any premises to ascertain whether or not a communicable disease is present without probable cause to believe that it is present. At the present time, USDA must rely on the voluntary permission of the owner or custodian of the animals to conduct tests or State authority to require that such tests be conducted to determine the presence or absence of infection or exposure.

Virus-Serum-Toxin Act

The Virus-Serum-Toxin Act (VSTA, 21 U.S.C. 151 et seq.) authorizes USDA to regulate veterinary biological products that are intended for use in the treatment (i.e., prevention, diagnosis, management, or cure) of diseases of animals. These include, but are not limited to, vaccines, bacterins, sera, antisera, antitoxins, toxoids, allergens, diagnostic antigens prepared from, derived from, or prepared with microorganisms, animal tissues, animal fluids, or other substances of natural or synthetic origin. The VSTA prohibits the shipment or delivery for shipment in intrastate commerce, as well as in interstate commerce, and the importation or exportation of any veterinary biological product that is worthless, contaminated, dangerous, or harmful. It also prohibits the importation or exportation of any biological product not prepared in compliance with regulations prescribed by USDA at an establishment licensed by USDA.

Animal Damage Control Act of 1931 as amended in the Agriculture Appropriations Act of 2001

This provides USDA the general authority under which APHIS' Wildlife Services program functions. This is the lead USDA program responsible for research and control work on the brown tree snake, a particularly aggressive invasive species that has devastated bird populations on Guam.

Organic Administration Act

The USDA's authority to make rules and regulations protecting National Forests is set forth in section 1 of the Organic Administration Act (16 U.S.C. 551). This provision provides broad authority to protect National Forests from "destruction by fire and depredations" and to issue regulations "as will insure the objects of such reservation, namely to regulate their occupancy and use and to preserve the forest thereon from destruction." To the extent that the use of lands adjacent to federally owned land is posing a threat to the Federal resources, the Supreme Court has construed the powers of the Federal Government to prohibit such private activities. United States v. Alford, 274 U.S. 264 (1927). To the extent that invasive species on adjacent private lands threaten public land, the common law concept may be interpreted to allow the Federal Government to abate such infestations.

Multiple-Use Sustained-Yield Act of 1960

USDA manages National Forests for multiple uses under the Multiple-Use Sustained-Yield Act of 1960 (MUSY, 16 U.S.C. 528-531). MUSY provides in part A that "the national forests are established and shall be administered for outdoor recreations, range, timber, watershed, and wildlife and fish purposes" (16 U.S.C. 528).

Statutes Related to Forest Planning

The USDA is required to develop and maintain a forest plan for each administrative unit of the National Forest System by section 6 of the Forest and Rangeland Renewable Resources Planning Act of 1974, as amended by National Forest Management Act (16 U.S.C. 1604). Forest plans establish forest-wide and

area-specific management direction and may include management direction relating to the control of invasive species. Site-specific project decisions must be consistent with applicable forest plan direction (or the plan must be amended to permit the activity). Project decisions are subject to compliance with National Environmental Policy Act (42 U.S.C. 4231 et seq.), and other Federal environmental laws such as the Endangered Species Act, the Clean Water Act, and the Clean Air Act. Most project decisions also are subject to a notice and comment and administrative appeal process under section 322 of the Department of the Interior and Related Agencies Appropriation Act, 1993 (16 U.S.C. 1612 note) and 36 CFR part 215, and are subject to judicial review.

Authority Implemented by Other Federal Agencies on National Forest System Lands

Invasive species on National Forest System lands are regulated under a variety of statutes administered by other Federal agencies, including the Lacey Act, the Plant Protection Act, the Animal Damage Control Act, the Federal Seed Act, the Nonindigenous Aquatic Nuisance Prevention and Control Act, and the Alien Species Prevention and Enforcement Act. The USDA's Forest Service works cooperatively with other Federal agencies to implement these authorities on National Forest System lands.

Federal Noxious Weed Act of 1974 (7 U.S.C. 2814)

Although the Plant Protection Act superseded and repealed most of the Federal Noxious Weed Act of 1974 (FNWA), it left intact section 15 of the act, "Management of undesirable plants on Federal lands" (7 U.S.C. 2814). Section 15 of the FNWA requires Federal land management agencies to develop and establish a management program for control of undesirable plants that are classified under State or Federal law as undesirable, noxious, harmful, injurious, or poisonous, on Federal lands under the agency's jurisdiction (7 U.S.C. 2814(a)). The Act also requires the Federal land management agencies to enter into cooperative agreements to coordinate the management of undesirable plant species on Federal lands where similar programs are being implemented on State and private lands in the same area (7 U.S.C. 2814(c)). The Secretaries of Agriculture and the Interior must coordinate their respective control, research, and educational efforts relating to noxious weeds (7 U.S.C. 2814(f)). USDA's Departmental Regulation 9500-10 sets forth Departmental policy relating to the management and coordination of noxious weeds activities among the agencies within USDA and other entities.

Public Rangelands Improvement Act of 1978; Federal Land Policy and Management Act of 1976

Several statutes provide funding for rangeland rehabilitation and range improvements on public rangelands, including activities designed to control or manage invasive plants. Section 5 of the Public Rangelands Improvement Act of 1978 (43 U.S.C. 1904(c)) authorizes funding for on-the-ground rangeland rehabilitation and range improvements on some of the rangelands managed by the Forest Service. Additionally, range betterment funds, provided under section 401 of the Federal Land Policy and Management Act of 1976 (43 U.S.C. 1751), can be used for variety of range rehabilitation and improvement activities, specifically including weed control, on certain National Forest System rangelands. The Act of April 24, 1950, pertaining to range improvements, states that of the monies received from grazing fees, a portion can be used for the "eradication of poisonous plants and noxious weeds in order to protect or improve the future productivity of the range" (16 U.S.C. 580(h)).

Cooperative Forestry Assistance Act of 1978

Under cooperative authorities, the Secretary of Agriculture may assist other Federal, State, and private entities in controlling and managing invasive species on other Federal lands and non-federal lands. The Secretary's primary cooperative authority for invasive species is section 8 of the Cooperative Forestry Assistance Act of 1978 (16 U.S.C. 2104). Section 8(b) authorizes the Secretary of Agriculture to conduct activities and provide technical assistance relating to insect infestations and disease conditions affecting trees on National Forest System lands, on other Federal lands (in cooperation with other Federal Departments) and on non-federal lands (in cooperation with State officials, other entities, or individuals). These activities include in part: conducting surveys to detect and appraise insect infestation and disease conditions; determining biological, chemical, and mechanical measures necessary to prevent, retard, control or suppress incipient, potential, threatening, or emergency insect infestations and disease conditions affecting trees; planning, organizing, directing, and performance measures the Secretary determines necessary to prevent, retard, control, or suppress incipient, potential, threatening, or emergency insect infestations and disease epidemics affecting trees; and providing technical assistance to maintain healthy forests and manage the use of pesticides (16 U.S.C. 2104(b)). Section 8(g) of the Act (16 U.S.C. 2104(g)) also authorizes the Secretary to provide financial assistance through the Forest Service to State entities and private forestry or other organizations to monitor forest health and protect forest lands. The Cooperative Forestry Assistance Act of 1978 as amended by the Federal Agriculture Improvement and Reform Act of 1996 Subtitle G Sect. 373, gives authority to provide support for good forest management practices, including financial assistance to maintain healthy timber ecosystem to prevent incursion of invasive species, on privately owned non-industrial forestlands.

Section 8 of the Act applies only to insect infestations and disease conditions affecting trees. The Act does not contain similar authority for insect infestations and disease conditions not affecting trees or for invasive plants.

Section 4 of the Act as amended by the Federal Agriculture Improvement and Reform Act of 1996 Subtitle G Sect. 373 provides support for good forest management practices on privately owned non-industrial forestlands.

Hawaii Tropical Forest Recovery Act

Section 3 of the Hawaii Tropical Forest Recovery Act (16 U.S.C. 4502(a)) authorizes the USDA's Forest Service to provide assistance relating to invasive plants species to State officials, Federal agencies, and various other private entities in States with tropical forests.

Statutes Related to Restoration

Restoration efforts following control of invasive species are authorized, and limited, by the same legal authorities that address the control and management of invasive species on National Forest System lands. The Forest Service lacks specific authority to provide technical and financial assistance to State and private entities relating to these types of restoration efforts.

In limited circumstances where the introduction of invasive species into National Forest lands was the result of negligence that could be established in a civil judgment, there is authority for the Secretary to use the proceeds from any damage award or settlement for "rehabilitation work" (See 16 U.S.C. 579(c)).

Forest and Rangeland Renewable Resources Research Act of 1978

The Forest and Rangeland Renewable Resources Research Act of 1978 is the Department of Agriculture's primary authority to conduct research activities, including research relating to invasive species. The Act contains expansive authority to conduct research and technology development on, and with applications for, all U.S. lands related to the protection, conservation, and sustainable use of natural resources. The Act also authorizes competitive grants to conduct research, and authorizes cooperative agreements with university, industry, and other partners as needed to complement national program needs.

International Forestry Cooperation Act of 1990

Under section 602(b) of the International Forestry Cooperation Act of 1990 (16 U.S.C. 4501(b)), the Secretary may, in support of forestry and related natural resource activities outside the United States and its territories and possessions, provide assistance for the prevention and control of insects, diseases, and other damaging agents.

Under these authorities, the USDA's Forest Service delivers research and development products for vegetation management and protection; wildlife, fish, water and air sciences; resource valuation and use; and inventory and monitoring. The Forest Service Research and Development program addresses all aspects of that agency's invasive species program activities. The Forest Service's research authorities provide for the Service to conduct prevention, rapid response, control, and management activities related to invasive species and to restore areas affected by invasive species.

Soil Conservation and Domestic Allotment Act

Under the authority provided by the Soil Conservation and Domestic Allotment Act (16 U.S.C. 590(a)-590(f)), USDA's National Resources Conservation Service (NRCS) operates Plant Materials Centers for the development, testing, and distribution of plants and vegetation management technologies for use by land owners and users of private or other non-federal lands for soil erosion control, water conservation, and wildlife habitat. Participation is voluntary. With regard to specific aspects of this Plan, Plant Materials Centers provide for the following: (1) Prevention — provide technology and plants to maintain healthy ecosystems to prevent incursion of invasive species; (2) Control and management — technical assistance for eradication/control of invasive species and for management of lands with invasive species to prevent their spread; (3) Restoration — technology transfer, technical assistance, and distribution of plants for use in planning and installation of vegetative cover to protect landscape after eradication and to prevent recurrence of invasive species.

Under the same authority, NRCS administers the Conservation Technical Assistance Program, which provides technical assistance to land owners and users of private or other non-federal lands to plan and install measures (structures and land management practices) for soil erosion control and water conservation. Participation is voluntary. With regard to specific aspects of this Plan, the program provides for the following: (1) Prevention — technical assistance to maintain healthy ecosystem to prevent incursion of invasive species and to use cropping systems that discourage introduction/spread of IS; (2) Rapid response — technical assistance on eradication of invasive species; (3) Control and management — technical assistance for eradication/control of invasive species and for management of lands with invasive species to prevent their spread; and (4) Restoration — technical assistance for use of planning and installation of measures to protect landscape after eradication and to prevent recurrence of invasive species.

Food Security Act of 1985

Under the authority provided by sections 1240-1240H of the Food Security Act of 1985 (16 U.S.C. 3839aa-3839aa-8), USDA's National Resources Conservation Service (NRCS) administers the Environmental Quality Incentives Program (EQIP). This program provides technical, educational, and financial assistance to livestock and agricultural producers to, among other objectives, protect against threats to soil, water, and related natural resources. Participation is voluntary. With regard to specific aspects of this Plan, EQIP provides for the following: (1) Prevention — technical, educational, and financial assistance to maintain healthy ecosystems to prevent incursion of invasive species; (2) Control and management — technical, educational, and financial assistance for eradication/control of invasive species and for management of lands with invasive species to prevent their spread; and (3) Restoration — technical, educational, and financial assistance for planning and installation of measures (structural and land management practices) to protect landscape after eradication and to prevent recurrence of invasive species. NRCS

administers the Wetland Reserve Program (WRP) under 7 CFR Parts 620 and 1467. The WRP provide technical and financial support to help landowners with wetland restoration efforts. It provides technical education and financial assistance to maintain health ecosystems and planning and installation of wetland features to restore habitat after disturbance by invasive species.

Federal Agriculture Improvement and Reform Act of 1996

Under the authority provided by section 387 of the Federal Agriculture Improvement and Reform Act of 1996 (16 U.S.C. 3836a), USDA's National Resources Conservation Service administers the Wildlife Habitat Incentives Program (WHIP). This program provides technical and financial assistance to landowners to develop wildlife habitat. Participation is voluntary. With regard to specific aspects of this Plan, WHIP provides for the following: (1) Prevention — technical, educational, and financial assistance to maintain healthy ecosystems to prevent incursion of invasive species, and (2) Restoration — technical, educational, and financial assistance for the planning and installation of habitat features to protect landscape after eradication and to prevent recurrence of invasive species.

2. Legal Authorities Available to the Department of Commerce:

Nonindigenous Aquatic Nuisance Prevention and Control Act

Although there is some minimal activity under other authorities, e.g., control of phragmites under essential fish habitat provisions of the Fisheries Conservation and Management Act and some activity under the Coastal Zone Management Act, the major legal authority for NOAA activities is the Nonindigenous Aquatic Nuisance Prevention and Control Act (NANPCA, P.L. 101-636, as amended (16 U.S.C. 4701-4741)). Specific aspects of NANPCA, as they relate to this Plan, are as follows:

Prevention. Section 1202(j)(1) gives both NOAA and FWS regulatory authority to implement provisions of the Nonindigenous Act that include prevention. The construction is awkward, however, and it is uncertain as to what regulatory authority actually exists. When the ANSTF was petitioned to prohibit the importation of Caulerpa taxifolia, there were significant questions as to whether the regulatory authority would cover such an action. Instead, the Task Force worked with the Department of Agriculture to get the species added to the Noxious Weed List.

Rapid response. Legal authority is lacking under NANPCA for rapid response measures.

Control and management. The authority for control and management is adequate under ß 1202, but authorization levels are not adequate. To put the problem in perspective, control activities for one aquatic species funded separately (the sea lamprey) total $14 million per year. The total authorization for NOAA to implement the Act is $1 million annually. That authorization is to cover not only control activity but also areas such as prevention and monitoring.

Restoration. There is no explicit authority under NANPCA for restoration related to invasive species, but other acts (see below) do give NOAA restoration authority.

Research. There are a number of research authorizations in the NANPCA: Section 1102(e) contains authority for competitive regional research grants, but funds have not been appropriated. Section 1104(b) authorizes competitive research on ballast water management technology. Section 1202(f) contains an authorization for competitive research under the Sea Grant program for all aspects of aquatic nuisance species. Section 1202(i) together with section 1301(b)(3) contains an authorization of $1,625,000 annually for the Great Lakes Environmental Research Laboratory (GLERL) to conduct aquatic nuisance species prevention and control research, with $500,000 of the total being made available for competitive research on Lake Champlain. Funds have never been appropriated for this provision, but NOAA has consistently used $500,000-$750,000 of GLERL's base funding for such research. Although it is probably insignificant in the scheme of things, the fact that so much of the research funding is tied up in competitive grants can affect the ability to focus research on specific problems and to involve NOAA offices and laboratories (other than GLERL) in research projects.

Authorities Other Than NANPCA

Magnuson-Stevens Fishery Conservation and Management Act

Essential fish habitat provisions of the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1855) provide for review of Federal and/or other actions which could affect essential fish habitat with authority to make recommendations necessary to conserve essential fish habitat. In addition, a limited amount of funds has been used for control and restoration activities.

Coastal Zone Management Act of 1972

Invasive species issues could be incorporated into State Coastal Zone Management Plans and projects could be eligible for funding through cooperative agreements. In addition, the Act establishes the National Estuarine Research Reserve System. Under this program, monitoring and other invasive species research could be sponsored.

Interjurisdictional Fisheries Act

Provides grants for fisheries related activities. Since 1991, $182,368 has been provided for support of the Great Lakes Panel of the Aquatic Nuisance Species Task Force from the State of Indiana's apportionment.

Fish and Wildlife Coordination Act

Authorizes the National Marine Fisheries Service to review development projects proposed or licensed by Federal agencies and to make recommendations. It also makes funds available through grants and cooperative agreements that could encompass invasive species projects.

National Marine Sanctuary Act:

Permits may be required for activities in areas designated as marine sanctuaries. Federal agency actions (including private activities authorized by licenses, leases, or permits are subject to consultation with the Department of Commerce). The Act requires the Department to take actions to promote and coordinate the use of sanctuaries for research, monitoring, and education. In addition, grant and contract funds are available for conservation and management activities. The management plan for the Florida Keys National Marine Sanctuary prohibits introduction of exotic species into the Sanctuary.

3. Legal Authorities Available to the Department of the Interior:

The Lacey Act

The Lacey Act (18 U.S.C. 42), administered by the U.S. Fish and Wildlife Service, prohibits importation into the United States or any U.S. territory or possession and shipment between the continental United States, the District of Columbia, Hawaii, the Commonwealth of Puerto Rico, and any possession of the United States of certain categories of animal species determined to be "injurious to human beings, to the interests of agriculture, horticulture, forestry, or to wildlife or the wildlife resources of the United States." Wildlife and wildlife resources are defined broadly to include all wild animals and "all types of aquatic and land vegetation upon which such wildlife resources are dependent." Id. ß 42(a)(1). The statute gives the FWS the authority to export or destroy any injurious species at the expense of the importer, id., although permits may be issued to allow importation of otherwise injurious species for specific purposes, id. ß 42(a)(3). Regulations listing species found to be injurious under the Lacey Act are in 50 CFR part 16.

Several restrictions within the Lacey Act, however, limit its ability to comprehensively address invasive species introductions. First, the Act is limited to animals. In fact, the statute does not apply to all animals, but only those specifically listed along with mammals, birds, fish, amphibians, reptiles, mollusks, and crustaceans generally. In addition, the statute only applies to "wild" birds and mammals; presumably any species that has been domesticated could not be regulated. The statute also excludes restrictions on any species that is regulated under the Plant Pest Act, explicitly stating that section 42 does not authorize "any action with respect to the importation of any plant pest as defined in the Federal Plant Pest Act, insofar as such importation is subject to regulation under that Act." Thus any animal species whose importation is regulated under the Plant Pest Act cannot be regulated under the Lacey Act.

The "other" Lacey Act

A separate provision also known as the Lacey Act (16 U.S.C. 3371 et seq.) also has implications for regulating introductions of invasive species. This law, administered by the Secretaries of the Interior, Commerce, and Agriculture, generally makes it unlawful for any person to import, export, transport, sell, receive, acquire, or purchase (or attempt to commit any such act) in interstate or foreign commerce any fish, wildlife, or plant taken, possessed, transported, or sold in violation of any Federal, tribal, State, or foreign law. Id. ß 3372 (a)(1), (2), (4). Thus, while the statute does not substantively grant authority to regulate the importation, transportation, exportation, or possession of any species, violation of another Federal, State, tribal, or foreign law governing these activities would become a violation of Federal law and subject to particular civil and criminal penalties. See id. ßß 3373, 3374. The Secretaries of the Interior and Commerce have the authority to enforce laws involving fish and wildlife, while the Secretary of Agriculture has the authority to enforce laws involving plants.

This statute also has restrictions, however, that limit its effectiveness to address invasive species introductions. As with 18 U.S.C. 42, the definition of fish or wildlife limits application to "wild" animals. In addition, while the definition of fish or wildlife is broad ("any wild animal, whether alive or dead, including without limitation any wild mammal, bird, reptile, amphibian, fish, mollusk, . . . or other invertebrate"), the definition of plant is limited to "any wild member of the plant kingdom . . . which is indigenous to any State and which is either (A) listed on an appendix to the Convention on International Trade in Endangered Species of Wild Fauna and Flora, or (B) listed pursuant to any State law . . . ." Thus plants covered by the act are limited to those indigenous to the United States and listed under CITES or a State endangered species law; all other plants are not covered.

Nonindigenous Aquatic Nuisance Prevention and Control Act

The Nonindigenous Aquatic Nuisance Prevention and Control Act (NANPCA, 16 U.S.C. 4701 et seq.) also has potential to affect the introduction and dispersal of invasive species. Focused primarily on the spread of nonindigenous species through ballast water releases, it creates a task force co-chaired by the Director of the U.S. Fish and Wildlife Service and the Undersecretary of Commerce for Oceans and Atmosphere to develop and implement a program to prevent the introduction and dispersal of aquatic nuisance species. The task force is to "establish and implement measures . . . to minimize the risk of introduction of aquatic nuisance species to waters of the United States." Id. ß 4722(c). An aquatic nuisance species is defined broadly to mean "a nonindigenous species that threatens the diversity or abundance of native species or the ecological stability of infested

waters, or commercial, agricultural, aquacultural, or recreational activities dependent of such waters," with nonindigenous species defined to include "any species or other viable biological material that enters an ecosystem beyond its historic range." Id. ß 4702. Thus, aquatic nuisance species include any species that are not native to a particular region of the United States and are not limited to foreign species.

The task force is charged with developing and implementing a program to, among other things, monitor and control species that qualify as "aquatic nuisance species." The task force or any other affected agency or entity may recommend that the task force initiate a control effort. The statute lays out criteria for determining when a control effort is warranted and requires development of a control program. Public notice and comment on the proposed program is required through the Federal Register.

NANPCA contains a number of provisions to promote research on invasive species that qualify under that act's definition of "aquatic nuisance species," including studies on the introduction of such species by vessels, and ecological and ballast water discharge surveys in particular water bodies. The statute also authorizes funding for research grants to universities and research institutions. The Aquatic Nuisance Species Task Force is likewise charged with developing a research program and authorized to allocate funds in the form of research grants.

Land management authority of Federal land-management agencies

All land-management agencies within the Department of the Interior have the authority to manage the resources on their lands, including taking action to protect those resources from the impacts of invasive species. Authorizing statutes that provide the primary land management authority for Interior agencies include the National Park Service's Organic Act (16 U.S.C. 1 et seq.) which provides the national park system shall be consistent with the purpose of conserving the natural and historic objects and the wildlife therein; the National Wildlife Refuge System Administration Act (16 U.S.C. 668dd) requires the agency to administer lands to provide for the conservation of fish, wildlife, plants and their habitats and to ensure that biological integrity and diversity is maintained; and the Federal Land Policy and Management Act (43 U.S.C. 1701 et seq.) requires that the public lands administered by the Bureau of Land Management be managed to prevent unnecessary or undue degradation.

Endangered Species Act

The Endangered Species Act (ESA, 16 U.S.C. 1531 et seq.) is jointly administered by the Secretaries of Interior and Commerce. It contains provisions regulating import and export of listed species. Other provisions of the ESA, however, relating to how invasive species may negatively affect a listed species are probably more significant and can provide powerful management tools. Section 7 of the ESA requires any Federal agency to insure that any action authorized, funded, or carried out by the agency not jeopardize the continued existence of any endangered or threatened species or adversely modify any critical habitat of such species (16 U.S.C. 1536(a)(2)). Thus, each Federal agency must consult with the U.S. Fish and Wildlife Service or the National Marine Fisheries Service, depending on the species, for any action that may affect a listed species. If the action is not likely to adversely affect a listed species, the appropriate Service issues a Biological Opinion, which may authorize take that is incidental to the action or, if the Federal action would otherwise jeopardize the continued existence of the species, offer alternatives to the Federal action that will avoid such jeopardy. Id. ß 1536(b).

Any take of an endangered or threatened fish species unless otherwise authorized is unlawful under the statute. Id. ß 1538. Thus, a Federal agency will be held responsible for any take — unless authorized through an Incidental Take Statement — directly or indirectly caused by the authorization, funding, or other Federal action associated with invasive species. The ESA treats threatened or endangered plants somewhat differently from fish and wildlife species. Section 9 prohibitions on take do not apply to plants, see id. ß 1538(a)(2), but cautions can be provided in a Biological Opinion on prohibitions against removal or disturbance of plants. Thus, a Federal agency will be held responsible for prohibited acts affecting both wildlife and plants that result from authorization, funding, or other Federal action associated with invasive species. Section 7 consultation requirements apply, however, only to Federal actions.

4. Legal Authorities Available to the Environmental Protection Agency:

Federal Insecticide, Fungicide, and Rodenticide Act

The primary focus of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) is to provide Federal control of pesticide distribution, sale, and use. The Environmental Protection Agency (EPA) has authority under FIFRA not only to study the consequences of pesticide usage but also to require users (farmers, utility companies, and others) to register when purchasing pesticides. Through later amendments to the law, users also must take exams for certification as applicators of pesticides. All pesticides used in the United States must be registered (licensed) by EPA. Registration assures that pesticides will be properly labeled and that if used in accordance with specifications, will not cause unreasonable harm to the environment. FIFRA is a critical statute for invasive species whenever pesticides are used to control or reduce the impact of invasive species. Examples include the use of a pesticide to control lamprey populations in the Great Lakes and the use of herbicides to control noxious weeds. FIFRA also gives EPA review authority for biological control agents when they are used to control invasive pests.

Clean Water Act

The Clean Water Act is the primary Federal law that protects the Nation's waters, including lakes, rivers, aquifers, and coastal areas. It provides a comprehensive framework of standards, technical tools, and financial assistance to address the many causes

of pollution and poor water quality, including municipal and industrial wastewater discharges, polluted runoff from urban and rural areas, and habitat destruction. Among other things, the Clean Water Act protects wetlands and other aquatic habitats through a permitting process that ensures development and other activities are conducted in an environmentally sound manner. The Clean Water Act provides EPA and Defense authority to jointly establish Uniform National Discharge Standards (UNDS) to manage incidental liquid discharges (including clean ballast water) from vessels of the Armed Forces. The Clean Water Act may provide authority for EPA to control and manage invasive species through permits or other requirements and programs. The Agency is currently reviewing its authorities under the Act relative to invasive species.

5. Statutes Affecting All Federal Agencies' Response to Invasive Species:

National Environmental Policy Act

Compliance with the National Environmental Policy Act (NEPA) can serve to identify actions that are likely to affect invasive species or be affected by them. The rationale behind the NEPA process – that agencies should be fully informed of the consequences of their actions before making a decision – is especially important when dealing with an issue like invasive species, where problems are often unanticipated side effects of otherwise desirable actions. Analysis and interagency, intergovernmental, and public review and comment that identify potential problems with invasive species for a particular proposed action may also yield ideas for alternative methods of approaching an issue or other forms of mitigation.

Agencies also need to comply with NEPA for actions that are proposed to respond quickly to invasive species management. In some cases, agencies may choose to prepare programmatic analyses on particular methodologies for addressing either the prevention or control of invasive species. In emergency situations that call for an immediate response by an agency that would normally require preparation of an environmental impact statement, the agency can work out alternative arrangements to their normal NEPA procedures with the Council of Environmental Quality. See 40 C.F.R. 1506.11.

6. International Agreements and Authorities

In addition to the global and regional agreements and authorities listed below, the United States also has bilateral arrangements that can be used to minimize the spread of invasive species. For example, the United States and Canada have obligations under the Boundary Waters Treaty to prevent the harmful effects of aquatic invasive species on the quality of the inland boundary waters they share. Currently, the U.S. and Canada are cooperating along their 5,500 mile long border to protect and restore a number of binational aquatic ecosystems. This effort includes a focus on aquatic invasive species prevention and control.

Convention on Biological Diversity (CBD), 1993

Article 8 of the CBD on In-situ Conservation provides that each contracting Party shall, as far as possible and as appropriate, prevent the introduction of, control, or eradicate those alien species that threaten ecosystems, habitats, or species. The CBD is in the process of developing Guiding Principles for the prevention, introduction, and mitigation of impacts of alien species and will consider options for full implementation of Article 8(h) at its sixth Conference of Parties (April 2002). The Global Invasive Species Programme (GISP) works closely with the CBD, to provide expert assistance through the CBD's Subsidiary Body on Science, Technology, and Technical Advice (SBSTTA). The United States has not ratified the agreement.

The World Trade Organization (WTO) Agreement on the Application of Sanitary and Phytosanitary (SPS) Measures, 1995.

The SPS Agreement is a supplement to the World Trade Organization Agreement. It provides a uniform framework for measures to protect the health and lives of humans, plants, and animals. Sanitary and phytosanitary measures are defined as actions whose goal is to: 1) protect human, animal, or plant health from the entry or spread of pests, disease, or disease carrying organisms; or 2) prevent or limit other damage from the entry or spread of pests. The SPS Agreement has chosen the international standards, guidelines, and recommendations of three organizations – International Plant Protection Convention (IPPC), Codex, and Office International des Epizooties (OIE) — as the preferred measures for adoption by WTO members. The relevant scope and work of those three organizations is discussed below.

International Plant Protection Convention (IPPC), 1951 with revision in 1987

The IPPC applies primarily to quarantine pests in international trade. It creates an international regime, based on standards and policies, to prevent the spread and introduction of pests to plants and plant products. The IPPC's provisions and standards for quarantine pests are applicable to invasive species that harm plants or their products.

In 2000, a working group of the IPPC recommended that the Convention develop a set of standards on the trade of relevant invasive species. Parties to the IPPC have established national and regional plant protection organizations with authority in relation to quarantine control, risk analysis, and other relevant measures. The United States is a member of the North American Plant Protection Organization (NAPPO).

Codex Alimentarius Commission (Codex)

The Codex aims to protect the health of consumers, especially in the area of food safety, while ensuring fair practices in food trade and facilitating international trade in food. Through international negotiation, the Codex has formulated standards for specific food commodities, as well as broader areas of concern such as pesticide and drug residues, food contaminants and additives, labeling, and food safety. Invasive species, especially microbes and their hosts, are relevant to the work of the Codex if they threaten food safety or trade in food.

International Office of Epizootics (OIE)

The mission of OIE (in French, the Office International des Epizooties) is to prevent the spread of animal diseases. OIE's major functions are to collect and disseminate information on the distribution and control of animal diseases, to coordinate research on contagious animal diseases, and to develop international standards for the safe movement of animals and animal products in international trade. While the OIE has traditionally focused on diseases of livestock and on setting diagnostic standards (e.g., for vaccines), it has recently begun to address disease risks associated with wildlife, including aquatic species.

International Maritime Organization (IMO), Resolutions, 1991 and 1997

The IMO requests that all Member State Governments, ship operators, other appropriate authorities and interested parties apply two sets of guidelines [Resolution A.868 (20), 1997; Resolution A.74 (18), 1991] on ballast water exchange. Together, these resolutions provide guidance and strategies to minimize the risk of invasive species, and other unwanted organisms, from ballast water and sediment discharge. In 1999, the Marine Environment Protection Committee Working Group proposed an "International Convention for the Control & Management of Ships' Ballast Water and Sediments." In 2000, a Global Task Force convened by the IMO, in cooperation with the United Nations Development Programme (UNDP) and the Global Environment Facility (GEF), launched the Global Ballast Water Management Programme ("GloBallast") to address harmful marine organisms.

International Civil Aviation Organization (ICAO), Assembly Resolution, 1998

The Assembly of ICAO, a specialized agency of the United Nations, passed a resolution (a) directing its Secretariat to work with other United Nations agencies and (b) encouraging the aviation authorities of its 185 member nations to assist in the prevention and control of invasive species.

Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), 1973

CITES regulates the intentional trade in certain species of wildlife and plants worldwide. Species listed under one of the three CITES appendices may not be exported or imported without appropriate documentation. This ensures, among other things, that the specimen was taken from the originating country in compliance with that country's laws and that the export will not be detrimental to the survival of the species. CITES procedures could be involved when a species listed under one of the appendices has the potential to become invasive in the importing country.

North American Free Trade Agreement (NAFTA), 1994

In Chapter 7 (Sec. B, Art.712) NAFTA states that each Party may, in accordance with this Section, adopt, maintain or apply any sanitary or phytosanitary measure necessary for the protection of human, animal or plant life or health in its territory. These measures may be more stringent than an international standard, guideline, or recommendation. Article 715 in the same chapter requires Parties to consider relevant diseases and pests, as well as specific economic factors, when conducting risk assessments.

North American Agreement for Environmental Cooperation (NAAEC), 1994

Article 10 states that the Council of the North American Commission for Environmental Co-Operation (NACEC) may consider and develop recommendations regarding exotic (non-native) species that may be harmful.

South Pacific Regional Environment Program (SPREP) Convention, 1990

Article 14 states that the Parties shall take measures to protect rare or threatened ecosystems and species within the region. In 1999, SPREP produced an Invasive Species Strategy for the Pacific Islands Region. The Strategy promotes efforts of Pacific Island countries to protect their natural heritage from the impacts of invasive species through cooperative efforts and capacity building.

APPENDIX 4:

Invasive Species Advisory Committee Members and List of Working Group Co-chairs

Invasive Species Advisory Committee

Ted Batkin (Secretary)
California Citrus Research Board

Dennis Brinker
Jackson County Commissioner

Michael Buck
Hawaii Department of Land and Natural Resources

Faith Campbell
American Lands Alliance

Allegra Cangelosi
Northeast Midwest Institute

James Carlton
Williams College

Gabriela Chavarria
National Fish and Wildlife Foundation

Barbara Cooksley
Rancher

Steven Dewey
Utah State University

Celestine Duncan (Vice Chair)
Weed Management Services

Ann Gibbs
Maine Department of Agriculture

Nelroy Jackson
Monsanto Company

Robert Kanter
Port of Long Beach

The Honorable Dirk Kempthorne
Governor of Idaho

William Lindow
Commercial fisherman

David Lodge (Chair)
University of Notre Dame

Ronald Lukens
Gulf States Marine Fisheries Commission

Fred Matt
Confederated Salish and Kootenai Tribes of the Flathead Reservation

Kathy Metcalf
Chamber of Shipping of America

Marshall Meyers
Pet Industry Joint Advisory Council

Harold Mooney
Stanford University

Christian Oseto
Purdue University

Willie Reed
Michigan State University

Craig Regelbrugge
American Nursery and Landscape Association

Sarah Reichard
University of Washington

Linda Sheehan
Center for Marine Conservation

Daniel Simberloff
University of Tennessee

Randall Stocker
University of Florida

W. William Weeks
The Nature Conservancy

David Wilcove
Environmental Defense

Steven Williams
Kansas Department of Wildlife and Parks

Working Group Co-Chairs

Communication, Education, and Outreach Working Group
Federal
Jim Murray
U.S. Department of Commerce
National Oceanic and Atmospheric Administration

Non-Federal
Amy Ferriter
South Florida Water Management District

International Working Group
Federal
Brooks Yeager
U.S. Department of State

Non-Federal
Harold A. Mooney
Stanford University

Management Working Group
Federal
Gary Johnston
U.S. Department of the Interior
National Park Service

Non-Federal
Nate Dechoretz
California Department of Food and Agriculture

Policy and Regulation Working Group
Federal
Keith Pitts
U.S. Department of Agriculture
Animal and Plant Health Inspection Service

Non-Federal
Marc Miller
Emory Law School

Research and Information Sharing Working Group
Federal
Steve Yaninek
U.S. Department of Agriculture
Cooperative State Research, Education, and Extension Service

Non-Federal
David L. Thomas
Illinois Natural History Survey

Risk Analysis and Prevention Working Group
Federal
Borys Tkacz
U.S. Department of Agriculture
Forest Service

Non-Federal
William Pardee
Cornell University

APPENDIX 5:

List of Acronyms Used

ANSTF	Aquatic Nuisance Species Task Force
APHIS	Animal and Plant Health Inspection Service
ARS	Agricultural Research Service
BLM	Bureau of Land Management
BOR	Bureau of Reclamation
CABI	Commonwealth Agriculture Bureau International
CBD	Convention on Biological Diversity
CDC	Centers for Disease Control and Prevention
CE	U.S. Army Corps of Engineers
CENR	Committee on Environment and Natural Resources
CEQ	President's Council on Environmental Quality
CITES	Convention on International Trade in Endangered Species of Wild Flora and Fauna
CSREES	Cooperative State Research, Education, and Extension Service
CWA	Clean Water Act
DHHS	Department of Health and Human Services
DHUD	Department of Housing and Urban Development
DOC	Department of Commerce
Defense	Department of Defense
DOE	Department of Energy
Interior	Department of the Interior
State	Department of State
DOT	Department of Transportation
EO	Executive Order (refers to Executive Order 13112)
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FICMNEW	Federal Interagency Committee on the Management of Noxious and Exotic Weeds
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FS	Forest Service
FSA	Farm Service Agency
FWS	U.S. Fish and Wildlife Service
FY	Fiscal Year
GAO	General Accounting Office
GIS	Global Information Systems
GISP	Global Invasive Species Programme
IABIN	Inter-American Biodiversity Information Network
ICAO	International Civil Aviation Organization
IMO	International Maritime Organization
IPPC	International Plant Protection Convention
ISAC	Invasive Species Advisory Committee
ITIS	Integrated Taxonomic Information System
NAAEC	North American Agreement for Environmental Cooperation
NABIN	North American Biodiversity Information Network
NAFTA	North American Free Trade Agreement
NAL	National Agricultural Library
NANPCA	Nonindigenous Aquatic Nuisance Prevention and Control Act
NAPIS	National Agricultural Pest Information System
NAPPO	North American Plant Protection Organization
NASA	National Aeronautics and Space Administration
NBII	National Biological Information Infrastructure
NEPA	National Environmental Policy Act
NISA	National Invasive Species Act
NISC	National Invasive Species Council
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
NPS	National Park Service
NSF	National Science Foundation
NSTC	National Science and Technology Council
NWHC	National Wildlife Health Center
OIE	Office International des Epizooties
OMB	Office of Management and Budget
OTA	Office of Technology Assessment
PPA	Plant Protection Act
PTI	Pulling Together Initiative
SI	Smithsonian Institution
SPREP	South Pacific Regional Environmental Programme
SPS	Sanitary and Phytosanitary Measures
TAGBCW	Technical Advisory Group for the Biological Control of Weeds
TTIS	Task Team on Invasive Species
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
USAID	U.S. Agency for International Development
USTR	U.S. Trade Representative
VSTA	Virus-Serum Toxin Act
WTO	World Trade Organization

APPENDIX 6:

Guiding Principles

In addition, the Advisory Committee and the Council adopted a set of guiding principles to shape the development of the Management Plan. They provide the general scope and direction for the specific actions to be taken under the invasive species management plan. By reflecting the values and experience of a diversity of stakeholders, they are intended to support efforts to prevent and control the invasive species at local, State, national, and international scales.

Guiding Principle #1 - Take action now.

Many alien species are non-invasive and support human livelihoods or a preferred quality of life. Only those alien species that cause substantial, negative impacts to the environment, economies, and human health fall under the scope of the Invasive Species Council.

Introductions by invasive species can be a consequence of human activities such as trade, travel, and alteration of the environment. Changes in human values, beliefs, and behavior are necessary to alleviate the introduction and spread of invasive species.

In order to protect food, health, and the environment we must now take strategic action to reduce the impacts of invasive species.

Guiding Principle #2 - Be cautious and comprehensive.

Invasions are often unpredictable: caution is warranted in the intentional and unintentional relocation of all non-native organisms.

An effective management strategy for invasive species integrates information exchange, public education, prevention, early detection, rapid response, scientifically informed control, and restoration.

A comprehensive strategy for preventing the introduction and spread of invasive species addresses intentional, unintentional, authorized, and unauthorized movement of organisms among and within countries.

In order to be effective, national and international goals and actions relevant to the management of invasive species need to be congruent, integrated, and mutually supportive.

Policies that address the problem of invasive species will be most effective if they are consistently applied (across pathways, means of invasion and invaders) are comprehensive in scope, and take in the consideration of all stakeholders.

Guiding Principle #3 - Work smart, be adaptive.

Efforts to manage invasive species are most-effective when: (1) they have goals and objectives that are clearly defined and prioritized; and they are (2) proactive rather than reactive; (3) based on current biological, social, and economic information; (4) applied rapidly, even when a reasonable degree of uncertainty is present; and (5) benefit a diversity of stakeholders.

The impacts of invasive species can be significantly reduced if stakeholders work cooperatively to: (1) undertake applied, interdisciplinary research, (2) develop and apply technologies to prevent and control invasive species, and 3) incorporate these advances into management and policy decision making.

A system to coordinate and integrate information of invasive species is desirable, as is an organized approach to disseminating data and ensuring that management strategies evolve based on new information.

Guiding Principle #4 - Find balance.

The prevention and management of invasive species can support economic growth and sustainable development and should be incorporated into policies to meet these objectives.

Develop policies and incentive programs that encourage voluntary cooperation of public agencies, States, and all other stakeholders. Back these measures with effective enforcement authorities and capabilities.

Strive for control methods that are scientifically, socially, culturally, and ethically acceptable and provide the desired affect on the target organism while minimizing the negative impact on the environment.

Guiding Principle #5 - Pull together.

The current capacities of the United States to prevent and manage invasive species are often fragmented and inefficient, and lack sufficient enforcement. Coordination and an effective regulatory framework are required at the Federal level, and a complementary, flexible approach is needed to address the complex, broad needs of stakeholders at more local levels.

Cooperative relationships among Federal, State, and county governments, as well as other stakeholders, need to be encouraged and supported to ensure the development and implementation of an effective invasive species prevention and control program nationwide.

The United States needs to raise the profile of the invasive species issue, provide leadership in the management of invasive species, share information and technologies, and contribute technical assistance to address the problem on a global scale.

Guiding Principle #6 - Be inclusive, meet specific needs.

Everyone has a stake in the management of invasive species and therefore needs to be involved in efforts to address the problem. Education and outreach programs on invasive species will be most effective when they target the information needs and interests of specific audiences, indicate that positive progress can be made, and recommend specific actions. Stakeholder involvement can be expanded by communicating the inter-relationships between invasive species and quality of life issues, and by delivering a consistent message through a diversity of messengers and media.

APPENDIX 7:

References

APHIS, unpublished data.

Bordes, Edgar S. 2000. Personal communication.

Bureau of Land Management. 1996. Partners Against Weeds – An Action Plan for the Bureau of Land Management.

Cohen, A.N. and J.T. Carlton. 1995. Biological Study. Nonindigenous Aquatic Species in a United States Estuary: A Case Study of the Biological Invasions of the San Francisco Bay and Delta. A Report for the U.S. Fish and Wildlife Service, Washington, DC and The National Sea Grant College Program, Connecticut, Sea Grant, NTIS Report Number PB96-166525.

Cohen, A.N. and J.T. Carlton. 1998. Accelerating invasion rate in a highly invaded estuary. Science 279:555-558.

Congressional Research Service, The Library of Congress. 1999. Harmful Non-Native Species: Issues for Congress. Order Code RL30123. 50 pp.

Mooney, H.A. and R.J. Hobbs (eds.). 2000. Invasive Species in a Changing World. Island Press, Washington, D.C. 457 pp.

National Plant Board. 1999. Safeguarding American plant resources: A stakeholder view of the APHIS-PPQ safeguarding system. USDA-APHIS-PPQ.

Nichols, F.H., J.K. Thompson and L.E. Schemel. 1990. Remarkable invasion of San Francisco Bay (California, USA) by the Asian clam Potamocorbula amurensis. II. Displacement of a former community. Mar. Ecol. Prog. Ser. 66:95-101.

Peterson, H. 1996. Potamocorbula amurensis spatial distribution survey. IEP Newsletter (California Dept. of Water Resources, Sacramento) Winter 1996:18-19.

Pimentel, D., L. Lach, R. Zuniga, and D. Morrison. 2000. Environmental and economic costs of nonindigenous species in the United States. BioScience 50:53-65.

Stein, B.A. and S.R. Flack, eds. 1996. America's Least Wanted: Alien Species Invasions of U.S. Ecosystems. The Nature Conservancy, Arlington, Virginia.

Thompson, J.K. 1998. Trophic effects of Potamocorbula amurensis in San Francisco Bay, California. Page 171 in: Proceedings of the Eighth International Zebra Mussel and Aquatic Nuisance Species Conference, March 16-19, 1998, Sacramento, CA. Conference Administrator, International Zebra Mussel and Aquatic Nuisance Species Conference, Pembroke, Ontario, Canada.

Thompson, J.K. and S.N. Luoma. 1999. Food web and contaminant flow effects of an exotic bivalve in San Francisco Bay, California. In: Abstracts of the First National Conference on

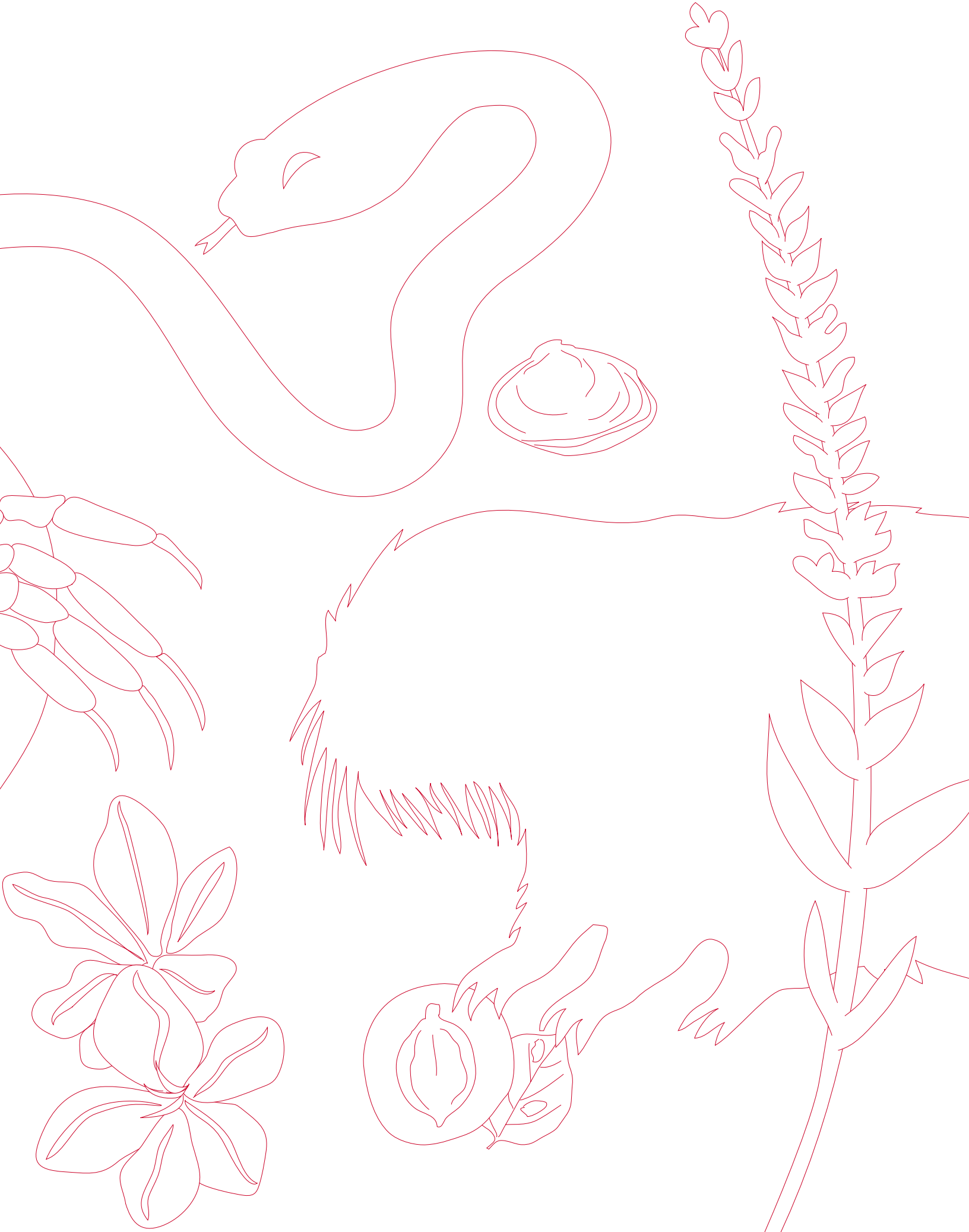
Marine Bioinvasions, January 24-27, 1999, Massachusetts Institute of Technology, Cambridge, MA. MIT Sea Grant, Cambridge, MA.

U.S. Congress, Office of Technology Assessment. 1993. Harmful Non-indigenous Species in the United States. OTA-F-565. U.S. Government Printing Office. Washington, D.C. 391 pp.

USDA Agricultural Research Service, Northern Plains Agriculture Research Laboratory (TEAM Leafy Spurge). 1999. The Spurge Scourge.

U.S. General Accounting Office. 2000. Invasive Species: Federal and Selected State Funding to Address Harmful, Nonnative Species. RCED-00-219. 34 pp.

Westbrooks, R. 1998. Invasive plants, changing the landscape of America: Fact book. Federal Interagency Committee for the Management of Noxious and Exotic Weeds (FICMNEW), Washington, D.C. 109 pp.

Wilcove, D.S., D. Rothstein, J. Dubow, A. Phillips, and E. Losos. 1998. Quantifying threats to imperiled species in the United States. BioScience 48:607-615.

Wilkinson, D. 2000. Personal communication.