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Report to Congressional Requesters

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INVASIVE SPECIES

Obstacles Hinder Federal Rapid Response to Growing Threat

GAO-01-724

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Abbreviations

APHIS	Animal Plant and Health Inspection Service
ARS	Agricultural Research Service
CCC	Commodity Credit Corporation
GAO	General Accounting Office
USDA	U.S. Department of Agriculture

United States General Accounting Office
Washington, D.C. 20548

July 24, 2001

The Honorable Sherwood Boehlert
The Honorable Wayne T. Gilchrest
The Honorable Richard Pombo
The Honorable Jim Saxton
House of Representatives

Invasive species—harmful, nonnative plants, animals, and microorganisms—are found throughout the United States, causing billions of dollars of damage annually to crops, rangelands, and waterways.[1] For example, zebra mussels are a widely known aquatic invasive. Transported into the Great Lakes in ships' ballast water, zebra mussels have clogged the water pipes of electric companies and other industries; infestations in the Midwest and Northeast have cost power plants and industrial facilities almost $70 million between 1989 and 1995. Invasive species have also had a devastating effect on natural areas, where they have strangled native flora, taken over wetland habitats, and deprived waterfowl and other species of food sources. Scientists, academicians, and industry leaders are recognizing invasive species to be one of the most serious environmental threats of the 21st century.

Sometimes invasive species enter the United States accidentally; for example, as weed seeds in commodities, in ballast water from ships, or in untreated wood-packing material. In other instances, invasive species are brought in deliberately as ornamental plants, as pets, or for purposes such as erosion control. Increased travel and global trade have resulted in growing numbers of invasive species gaining entry into the United States. Species from countries such as China and Russia with habitats similar to our own are especially likely to gain a foothold in the United States. Expanded trade within North America has also increased the risk of spreading established invaders from one country to another.

Over 20 federal agencies—including the U.S. Departments of Agriculture (USDA), Commerce, Defense, and the Interior—have responsibility for some aspect of invasive species management. States also have a significant management role, but the extent of their involvement varies considerably.

[1]A concept basic to invasiveness is that these species have been introduced into an environment in which they did not evolve; thus, they usually have no natural enemies to limit their spread.

USDA, and primarily its Animal and Plant Health Inspection Service (APHIS), has the largest federal role. In fiscal year 2000, USDA spent about $556 million on a wide range of invasive species-related activities—almost 90 percent of the total federal funding directed toward these activities. Interior and Defense accounted for another 5 percent and 2 percent, respectively. Federal invasive species activities include prevention (efforts to keep invasive species from entering the country), detection (surveillance for invasive species), and control (measures to eradicate or limit the spread of invasive species).[2]

An important part of these activities is rapid response—a response conducted in time to eradicate or contain a potentially damaging invasive species. Invasive species can be new to the United States or to an ecosystem (a community of organisms and their environment) within the United States. The time required for rapid response varies depending on the species and its habitat. A response within days may be needed to eradicate many newly detected invasive species that reproduce and spread rapidly; however, months or even years may be sufficient for some weeds and pests that take a long time to proliferate. Since time, however, is often of the essence, effective detection systems are integral to rapid response. Without early detection, a rapid response may be infeasible. Efforts to eradicate or control invasive species may involve, among other things, pesticides, handpicking, and biological controls (that is, the introduction of a natural enemy, predator, parasite, or disease, often from the pest's native range). Because invasive species do not respect jurisdictional boundaries, rapid response often requires cooperation among federal, state, and local government agencies, private land managers/owners, and tribal governments.

In February 1999, invasive species received heightened attention with the issuance of Executive Order 13112. The order was intended to help prevent the introduction of invasive species, control their spread, and minimize their impact on the U.S. economy, the environment, and human health. The order established a National Invasive Species Council, comprising the heads of eight federal departments and agencies,[3] to provide national leadership and coordination in federal invasive species activities.

[2] Other major activities include monitoring; restoration; research and development; education, outreach, partnerships, and cooperative activities; and information management.

[3] The U.S. Agency for International Development and the Department of Health and Human Services joined the Council in February 2001, according to Council staff.

The Council was charged with issuing a National Invasive Species Management Plan. Among other things, the plan was to (1) recommend performance-oriented goals and objectives, (2) recommend measures to minimize the risk of new introductions of invasive species, and (3) review existing and prospective authorities for preventing the introduction and spread of invasive species. The plan, issued January 18, 2001, contained 57 recommendations, including 3 aimed at improving the nation's ability to respond rapidly to invasive species.

Concerned about the growing threat of invasive species, you asked us to conduct two reviews. Our first report—*Invasive Species: Federal and Selected State Funding to Address Harmful, Nonnative Species* (GAO/RCED-00-219, Aug. 24, 2000)—addressed federal and selected state funding for eight activities relating to invasive species. This report responds to your request that we review federal efforts to provide rapid response to invasive species. Specifically, we examined the extent to which the federal government rapidly responds to new invasive species, the obstacles that impede rapid response, and how rapid response can be improved.

Among the steps taken as part of our review, we collected funding data[4] on the rapid responses of federal agencies with invasive species responsibilities, including those within the Departments of Agriculture, Commerce, and the Interior. Since many agency officials were uncertain about what activities should be considered rapid response and their agencies did not routinely track rapid response funding, their estimates of rapid response funding may be somewhat over- or understated. At the same time, however, the officials believe that their estimates are a fairly accurate representation of their rapid response activities. Thus, any unreported amounts should not significantly affect the relative magnitude of agency funding described in this report. Our scope and methodology is more fully discussed in appendix I.

Results in Brief

Federal rapid response to invasive species varies: species that threaten agricultural crops or livestock are far more likely to elicit a rapid response than those primarily affecting forestry or other natural areas, including rangelands and aquatic areas. USDA's Animal and Plant Health Inspection

[4] We collected data on obligations, which are also referred to as "funding" in this report.

Service provided the preponderance of rapid response funding—about $126 million of the estimated $149 million in federal rapid response funding in fiscal year 2000. About 90 percent of this funding was for invasive species (such as citrus canker) that primarily threaten agricultural crops or livestock. Interior officials estimated that they spent about $1.4 million on rapid response activities directed at invasive species (such as giant salvinia) whose primary threat was to natural areas. USDA and Interior officials, among others, said there are many unmet rapid response needs, particularly in natural areas. For example, response to invasive weeds in many national parks is inadequate, according to National Park Service officials. The Park Service has four teams that conduct rapid response. The teams cover 38 parks, even though over 150 additional parks that are seriously infested with invasive weeds have requested teams. When rapid response does not occur, the consequences can be costly. Some researchers, for example, believe that the ruffe (a Eurasian fish introduced into North America through ballast water) could have been contained in the early1990s shortly after it was first detected. However, disagreement on whether to use chemical controls hampered the rapid response and the ruffe has spread. Major damage to commercial fisheries could occur if, as expected, the ruffe reaches the warmer waters of the lower Great Lakes.

A major obstacle to rapid response is the lack of a national system to address invasive species. Such a system could provide (1) integrated planning to encourage partnerships, coordinate funding, and develop response priorities; (2) technical assistance and other resources; and (3) guidance on effective response measures. Without such a system, obstacles to rapid response are less likely to be addressed and invasive species will continue to fall through the cracks. Obstacles to rapid response include the need for additional detection systems to identify new species; improved partnerships among federal, state, and local agencies; and enhanced technologies to eradicate invasive species. A national system would also help ensure that invasive species affecting natural areas receive a level of attention commensurate with their risks. Currently, federal rapid response depends largely on whether invasive species are central to an agency's mission. For example, safeguarding agriculture from invasive species is an integral part of the Animal and Plant Health Inspection Service's mission. In an emergency, the Service also has access to funds transferred from the government-owned and -operated Commodity Credit Corporation, which resides within USDA. On the other hand, invasive species are not specifically identified in the missions of other agencies, such as those in Interior, that have responsibilities for natural areas. These agencies have many priorities that compete for scarce resources.

The Invasive Species Council's Management Plan has several recommendations for improving rapid response, including developing a program of coordinated rapid response and pursuing increases in discretionary spending to support the program. We believe a concerted effort to improve rapid response is clearly needed, and if properly implemented, the Council's recommendations will go a long way toward developing a national system to address this pressing need. However, to develop a sound basis for determining future resource needs, the Council must first provide clarity on several fundamental issues. To this end, we are recommending that the Council, among other things, develop criteria for what constitutes a rapid response and work with its member agencies to develop information on current federal rapid response funding. In providing comments on a draft of this report, 11 agencies within the Departments of Agriculture, Commerce, and the Interior (the Council co-chairs) and the Council staff generally agreed with the substance of the report and with our recommendations. A major theme running throughout their comments was the impact of inadequate resources on the ability of agencies to rapidly respond to new infestations.

Background

Invasive Species Pose a Serious Threat to the Economy and the Environment

Scientists, industry officials, and land managers are recognizing that invasive species are one of the most serious, yet least appreciated, environmental threats of the 21st century. Expanding global trade and travel with countries such as Russia, China, and South Africa have resulted in rapid increases in the rate of introduction and number of newly established invasive species in the United States. While most of the plants and animals that make their way here are benign or even beneficial (for example, cattle, wheat, and tulips are all non-native species), the small proportion that become highly invasive have had huge economic and biological impacts.

Damages resulting from invasive species may include power outages; loss of farmland property values; increased operating costs; and loss of sport, game, or endangered species. While the damages caused by these species have been considerable, their precise economic impacts—particularly those that do not damage agriculture, industry, or human health—are not well documented.

However, a recent study by Cornell University scientists[5] estimated the total annual economic losses and associated control costs to be about $137 billion a year—more than double the annual economic damage caused by all natural disasters in the United States.

Because invasive species encompass plants, animals, and microbes, the problems they cause vary. The following examples demonstrate some of their impacts:

- On rangelands, leafy spurge, an invasive plant from Eurasia, crowds out desirable and nutritious forage, reduces land values, and degrades wildlife habitat. Annual damages from this weed are estimated to exceed $100 million in the Great Plains states.
- In U.S. forests, 19 of the 70 major insect pests are invasive species. Also, over the past several years, over 6,700 trees were destroyed in New York and Chicago after the discovery of the Asian long-horned beetle, an insect that most likely arrived in packing material or wood from China. According to USDA's Agricultural Research Service (ARS), if this beetle and other wood-boring pests become fully established in the United States, they could damage industries that generate combined annual revenues of $138 billion.
- In freshwater habitats, aquatic invasive species, such as the zebra mussel, clog lakes and waterways and adversely affect fisheries, public water supplies, irrigation, water treatment systems, and recreational activities. Great Lakes water users spend tens of millions of dollars annually to control zebra mussels.
- In saltwater habitats, the European green crab has been associated with the demise of the soft-shell clam industry in New England. The green crab has recently been introduced to the West Coast where there is serious concern that it could affect shellfish aquaculture and Dungeness crab populations. In 1996, the most recent estimate, researchers calculated that the potential economic damage to shellfish production there could be as high as $44 million a year.
- A threat to humans and animals, the West Nile virus, commonly found in Africa, West Asia, and the Middle East, is an invasive virus now present in 12 eastern states and the District of Columbia. Birds are the natural hosts for this microbe, which mosquitoes transmit from infected birds to humans and other animals.

[5] David Pimentel, et al. "Environmental and Economic Costs of Nonindigenous Species in the United States," *Bioscience*, Jan. 2000.

Figure 1: Leafy Spurge, Asian Long-Horned Beetle, Zebra Mussels, and Green Crab

Leafy spurge, an invasive plant from Eurasia, crowds out desirable and nutritious forage, reduces land values, and degrades wildlife habitat.

Before

After

Asian long-horned beetle infestations in New York and Chicago have resulted in the destruction of thousands of trees in residential areas.

Zebra mussels clogging a pipe.

The European green crab, an invasive predator that feeds voraciously on shellfish, may seriously affect shellfish aquaculture and Dungeness crab populations on the West Coast.

Source: Leafy spurge, ARS Photo Library; Asian long-horned beetle and resulting damage, APHIS; zebra mussels, Craig Czarnecki, Michigan Sea Grant; green crab, Paul G. Olin, University of California Sea Grant Program.

While the ecological impacts of invasive species can be devastating, they are hard to quantify. However, many scientists believe that invasive species are a significant threat to biodiversity—second only to habitat loss and degradation. Further, they are a major or contributing cause of declines for almost half the endangered species in the United States.[6]

Invasive Species Council Established to Provide Leadership and Coordination

On February 3, 1999, President Clinton issued Executive Order 13112 on invasive species. Among other things, the order requires federal agencies to (1) prevent the introduction of invasive species and (2) detect, respond rapidly to, and control them in a cost-effective, environmentally sound manner.[7]

The order established a National Invasive Species Council—chaired by the Secretaries of Agriculture, Commerce and the Interior—with members including the Departments of State, Treasury, Defense, and Transportation, and the Environmental Protection Agency. The order directs the Council to provide national leadership on invasive species and to see that federal agency efforts are coordinated and effective. The Secretary of the Interior was also directed to form an advisory committee (the Invasive Species Advisory Committee) to provide information and advice to the Council.

The order emphasizes the need for federal and state cooperation, as the states have a key role in managing invasive species within their borders. For example, in fiscal year 2000, Florida—which has a strong invasive species program—spent over $127 million on invasive species activities. States also retain general control over state lands and determine how they will address invasive species on their lands. The order also states that the Council shall develop recommendations for international cooperation. An effort already underway before the Council was established is the joint U.S./Canadian effort to combat the sea lamprey—an eel-like ocean fish that fastens onto other fish and eats until sated. Since 1956, the two

[6] William Gregg and Randy Westbrooks, "Super Invaders Spreading Fast," *Trio—The Newsletter of the North American Commission for Environmental Cooperation*, Winter 2000-2001.

[7] A full description of the executive order can be found at http://www.invasivespecies.gov/laws/main.shtml.

governments have worked jointly through the Great Lakes Fishery Commission to control the spread of this invasive aquatic, which has had a detrimental impact on the Great Lakes fishery.

The Council was also directed to prepare a National Invasive Species Management Plan. The plan, issued in January 2001, provides a general blueprint for dealing with invasive species and contains 57 recommendations—3 of which focus on rapid response.

Federal Agency Funding and Authorities Vary

The Council's member agencies obligated about $631.5 million in fiscal year 2000 on invasive species-related activities; USDA provided almost 90 percent of this amount. USDA's and particularly APHIS' programs are significant in their breadth and scope. For example, APHIS has jurisdiction over plant pests, certain biological control organisms, the import and export of plant species, and animals and animal diseases considered harmful or a threat to livestock or poultry health. In addition, the Forest Service, which manages about 191 million acres of federal land, has authority for forest and rangeland pest and plant control.

Interior provided the second largest amount of federal invasive species funding, $31.1 million in fiscal year 2000, or 5 percent of the federal invasive species funding. Interior agencies—such as the Fish and Wildlife Service, Bureau of Land Management, National Park Service, and Bureau of Reclamation—are involved in regulating the import of animals found injurious under the Lacey Act, enforcing laws and regulations governing the import and export of wildlife into the United States, implementing actions to address aquatic invasive species, and managing invasive species on various publicly owned lands.

Defense provided the third largest amount of funding, about 2 percent. As the fifth largest federal land manager, Defense is responsible for controlling invasive species infestations on its installations and uses native plants to restore Defense lands. In addition, the Army Corps of Engineers spends several million dollars annually for controlling invasive aquatic plants and zebra mussels and for supporting research to develop control technologies for managing these invasive species.

All told, at least 20 different federal agencies share responsibility and authority over some facet of invasive species management. In addition, several interagency groups help coordinate activities in this area. Executive Order 13112 directs the Council to work with the:

- Aquatic Nuisance Species Task Force, which coordinates activities relating to aquatic invasive species;
- Federal Interagency Committee on the Management of Noxious and Exotic Weeds, which coordinates weed management efforts primarily on federal lands; and
- Committee on Environment and Natural Resources of the National Science and Technology Council, which coordinates research efforts.

Invasive species management covers such activities as prevention, detection, control, restoration, research and development, information management, and public education. Prevention—the exclusion of invasive species from the country or from specified regions or ecosystems—is the first line of defense. When this fails, successful management often hinges on early detection and rapid response to an invasion. Eradication or containment of invasive species is most efficient, and sometimes only possible, at an invasion's earliest stages. Once an area becomes altered, control activities, which may be costly, are needed to restore the habitat.

Federal Rapid Response to Invasive Species That Threaten Natural Areas Has Been Minimal

Invasive species that threaten agricultural crops or livestock are far more likely to elicit a rapid response than those affecting mainly natural areas.[8] As shown in table 1, APHIS provided most federal rapid response funding—an estimated $125.8 million out of a total $148.7 million reported for fiscal year 2000. About 90 percent of APHIS' funding was directed at invasive species that primarily threaten agricultural crops or livestock; another 9 percent was spent on the Asian long-horned beetle, which primarily threatens forestry. Interior, second among federal departments in total funding for invasive species, estimated that its agencies provided about $1.4 million for rapid response activities. Its rapid responses were directed at species that threaten natural areas.

Many rapid response needs are not being met, according to agency officials and others, particularly for invasive species that threaten natural areas. When these needs are not met, the consequences—to the economy and the environment—can be costly.

[8] Some invasive species harm more than one type of resource. For example, noxious weeds that invade rangelands affect both agricultural grazing and the biodiversity of natural areas. We have placed invasive species in their category of primary or most immediate impact.

Table 1: Estimated Federal Obligations for Rapid Responses to Invasive Species

Dollars in millions

Department/agency	Fiscal year 2000 obligations: Agricultural crops and livestock	Fiscal year 2000 obligations: Forestry and other natural areas	Total[a]	Examples of invasive species addressed
Department of Agriculture				
Animal & Plant Health Inspection Service	$113.7	$12.1	$125.8	Citrus canker, glassy-winged sharpshooter, Mediterranean fruit fly, Asian long-horned beetle, plum pox virus.
Agricultural Research Service	4.5	0.7	5.3	Glassy-winged sharpshooter, brown citrus aphid, citrus psylla, papaya mealybug, pink hibiscus mealybug.
Forest Service		16.1	16.1	European gypsy moth, Asian long-horned beetle, hemlock woolly adelgid, Port-Orford-cedar disease, Miconia.
Agriculture subtotal	**$118.2**	**$28.9**	**$147.1**	
Department of the Interior				
Fish & Wildlife Service (aquatic species)		$0.4	$0.4	Caulerpa taxifolia, Asian swamp eel, zebra mussel, brown tree snake, round goby.
Bureau of Indian Affairs		0.2	0.2	Cogongrass, purple loosestrife, Russian knapweed.
Bureau of Land Management		0.6	0.6	Giant salvinia, yellow starthistle, purple loosestrife, Dyers woad, squarrose knapweed.
Geological Survey		0.1	0.1	Asian swamp eel; giant salvinia; garlic mustard; round goby; black, silver, and bighead carp.
Bureau of Reclamation		0.1	0.1	Giant salvinia.
Interior subtotal		**$1.4**	**$1.4**	
Department of Commerce				
National Oceanic and Atmospheric Administration		$0.1	$0.1	Caulerpa taxifolia.
Commerce subtotal		**$0.1**	**$0.1**	
Federal Total	**$118.2**	**$30.4**	**$148.7**	

Notes:

1. The reported obligations may be under- or overestimated because many agency officials do not routinely track rapid response obligations and were uncertain as to which obligations to include. For example, the distinction between control and rapid response activities is sometimes ambiguous. However, to the extent possible, agencies identified those activities that corresponded to the rapid response definition that we provided. We did not independently verify the accuracy of the agencies' data. Numbers may not add due to rounding.

2. For Agriculture's APHIS and ARS and Interior's Fish and Wildlife Service and Bureau of Land Management, invasive species are listed by the amount obligated, from largest to smallest. The

information provided by Agriculture's Forest Service and Interior's Bureau of Indian Affairs and U.S. Geological Survey did not allow for such ordering. See app. II for a more complete list.

[a]Several other agencies performed rapid response, but did not provide funding estimates.

Source: GAO's analysis of agencies' data.

APHIS Does Most Rapid Response, Focusing on Species That Threaten Crops or Livestock

Invasive species that threaten crops or livestock are the most likely to be quickly addressed since APHIS, which is responsible for protecting agriculture from invasive species, does the lion's share of federal rapid response. In fiscal year 2000, APHIS estimated that it spent $125.8 million for rapid response—about 85 percent of the estimated $148.7 million federal agencies spent on this activity. About $113.7 million of APHIS' funding went toward species that primarily threaten crops or livestock. All told, total federal rapid response funding for species that primarily affect agriculture was reported to be about $118 million.

Most of APHIS' rapid response funding was spent on relatively few invasive species. APHIS' biggest expenditure, almost $81 million, was for citrus canker, a highly contagious bacterial disease that affects Florida's citrus crops. This effort entailed tree removal, destruction, and replacement. Another $15 million went toward combating the glassy-winged sharpshooter, an insect that transmits Pierce's disease, a disease of grapevines that threatens California's grape and wine industry.

While APHIS has lead responsibility for responding to invasive species that threaten agriculture, ARS funds research to support these activities. In fiscal year 2000, ARS spent $4.5 million on projects that involved, among other things, developing control methods and identifying species.[9] For example, it spent $900,000 on research to support APHIS' response to the glassy-winged sharpshooter.

Invasive Species That Threaten Natural Areas Receive Considerably Less Funding Than Those That Threaten Crops or Livestock

As shown in table 1, reported federal funding for invasive species that threaten forestry and other natural areas was about $30 million, compared to the $118 million spent on agriculturally related invasive species. A further breakdown of the $30 million shows that 80 percent of this amount was spent on two species that threaten forestry and related industries—the Asian long-horned beetle and the European gypsy moth. In total, federal

[9] ARS spent another $0.7 million on research to support rapid response efforts toward species that threatened forestry and other natural areas.

rapid response funding for infestations affecting natural areas other than forests (for example, rangelands and aquatic areas) was estimated at $2.9 million for this period.

The Forest Service was the chief contributor to efforts to protect forests (federal and nonfederal) from invasive species, obligating an estimated $15.1 million[10] for rapid response and associated research for these activities. Its rapid responses included about $1.8 million for the Asian long-horned beetle and about $10.4 million for the European gypsy moth—an insect that has defoliated, and sometimes killed, hardwood trees in eastern forests. In addition, APHIS spent $11.8 million (about 9 percent of its rapid response funding) on species that primarily threatened forests. Almost all of this funding—about $11.5 million—was spent on efforts to eradicate the Asian long-horned beetle. ARS spent $660,000 on research to support rapid response to this beetle.

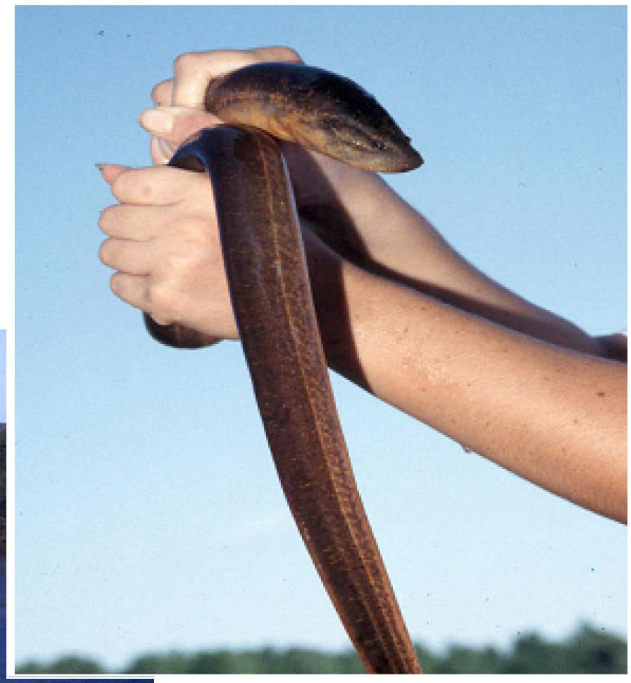
Finally, rapid response funding for invasive species affecting natural areas other than forestry, such as rangelands or aquatic areas, was about $2.9 million. Interior estimated that it spent about $1.4 million for rapid response aimed at these activities. The Interior agencies that funded rapid response activities included the:

- Bureau of Land Management, which funded efforts directed at invasive plants that affect grazing, wildlife, and recreation on rangelands;
- Fish and Wildlife Service, which funded efforts directed at aquatic invasive species, such as Caulerpa taxifolia, an invasive aquatic plant that threatens native species and fishing in coastal waters, and the round goby, a Eurasian fish that has displaced native fish in parts of the Great Lakes;
- Bureau of Indian Affairs, which funded efforts directed at invasive plants on lands under its jurisdiction;
- Bureau of Reclamation, which funded efforts against giant salvinia, an aquatic plant from South America that degrades water quality, kills fish, and chokes out other plants; and
- U.S. Geological Survey, which funded research supporting rapid response directed at various species, such as the Asian swamp eel, a potential threat to native fish, frogs, and aquatic invertebrates in the Florida Everglades.

[10] The Forest Service also obligated almost $1 million for invasive plants affecting rangelands.

Figure 2: Two Serious Threats to Aquatic Areas: Caulerpa Taxifolia and Asian Swamp Eel

Caulerpa taxifolia (a.k.a. "killer algae") grows as a dense blanket, smothering and killing aquatic vegetation. It is shown here invading a native eelgrass bed in a coastal lagoon north of San Diego.



The Asian swamp eel thrives in adverse conditions. This air-breathing creature has a voracious appetite for fish, frogs, and aquatic invertebrates. It has turned up in a canal adjacent to the Florida Everglades.

Sources: Caulerpa taxifolia, Rachel Woodfield, Merkel and Associates, Inc.; Asian swamp eel, U.S. Geological Survey.

The remaining funding for natural area infestations came from the Forest Service (for invasive plants on rangelands), APHIS (for noxious weeds in an Idaho wilderness area and for giant salvinia), ARS (for giant salvinia and three other species), and Commerce's National Oceanic and Atmospheric Administration, which spent $100,000 to support a rapid response to Caulerpa taxifolia.

In interpreting these funding estimates, it should be noted that many agency officials were uncertain as to which activities should be included in rapid response. For example, invasive species, such as leafy spurge, may exist in one area for a long time (where they are subject to control activities) and then appear in a new area where rapid response is required to eradicate them or prevent their spread. For our report, to the extent possible, agencies identified those activities that corresponded to the rapid response definition that we provided. In addition, agencies did not routinely track funding for these activities.[11] The officials, however, believe that their estimates are a fairly accurate representation of their rapid responses. Some agencies could not provide estimates of their rapid response funding. For example, Defense officials said that while the Department probably does minimal rapid response, it does not track these responses and could not estimate the associated funding. The National Park Service;[12] the Fish and Wildlife Service division that manages National Wildlife Refuges; and USDA's Cooperative State Research, Education, and Extension Service also said they perform or support some rapid response. While these agencies could not estimate their rapid response funding, officials generally stated that it was minimal. Thus, while agency estimates may be somewhat over- or understated, any unreported amounts should not significantly affect the relative magnitude of funding described in this report. (See app. 1 for further discussion of agencies' funding estimates.)

Many Rapid Response Needs Have Not Been Met, With Costly Consequences

Officials from USDA, Interior, Commerce, and Defense have reported that many rapid response needs have not been and are not being adequately met. Many unmet needs stem from inadequate resources or attention to the problem. In other instances, rapid response may not have occurred because the infestation was not detected early on, technologies were not available to combat the invasive species, or there was insufficient understanding about the risk of the threat. The following examples demonstrate some of these unmet rapid response needs:

- According to Park Service officials, rapid response to invasive weeds in many national parks is inadequate. The Service has 4 invasive plant

[11] To facilitate consistency, we provided a working definition of rapid response as "a response carried out in time to contain or eliminate a potentially damaging invasive species—the actual time required for rapid response varies depending on the species."

[12] In commenting on a draft of this report, the Park Service said that it obligated an estimated $1.2 million for the 4 teams that conduct control and rapid response.

teams that, among other things, conduct rapid response in 38 parks. However, over 150 additional parks with serious weed infestations have requested coverage by invasive plant teams.

- A Fish and Wildlife Service official said there is minimal rapid response on its over 500 national wildlife refuges, although invasive species are estimated to affect over a third of the refuge lands in the continental United States. Moreover, a recent National Audubon Society study[13] assessed 10 wildlife refuges, described as "in crisis," and found that invasive species were damaging biological values in 4 of them. The Service estimates that over $120 million a year is needed to combat invasive species on wildlife refuges.
- A USDA inventory of the nations' private rangelands concluded that at least 69 million acres (about 17 percent) were adversely affected by invasive plants, including unwanted brush.[14]
- APHIS' fiscal year 2001 budget request for $8.8 million for an invasive species program to protect agricultural and nonagricultural resources was not funded. The agency also requested a $1.7 million increase (from $424,000 to $2.1 million) for a noxious weed program that was viewed as an initial step toward a national rapid response system for invasive plants. The program received an increase of about $700,000.

When newly detected invasive species are not addressed in time, the results can be greater federal and state expenditures to control the infestation. In agriculture, invasive species, such as the Mediterranean fruit fly and citrus canker, are significant pests in terms of control costs. Examples of costly control programs for invasive species that affect natural areas also abound. Commonly cited programs include those aimed at reducing populations of leafy spurge, sea lampreys, hydrilla, zebra mussels, purple loosestrife, and brown tree snakes.

The response to the ruffe, a perch-like Eurasian fish, illustrates the difficulties in mounting rapid response efforts and the economic consequences of not doing so. The ruffe invaded North America in the 1980s through ballast water and soon colonized bays and tributaries along parts of Lake Superior. A rapid response among federal, state, Canadian, and other entities to contain the ruffe foundered because of a dispute over

[13] *Refuges in Crisis*, National Audubon Society, Feb. 2001.

[14] *America's Private Land: A Geography of Hope*, U.S. Department of Agriculture, Natural Resources Conservation Service, Dec. 1996.

whether to use chemical controls. Although subsequent control efforts have slowed the ruffe's spread, it is expected to reach the warmer waters of the lower Great Lakes fisheries where its economic consequences may be devastating. For example, the Ohio Great Lakes fishery alone is worth about $600 million a year.

Figure 3: Ruffe, an Aggressive Eurasian Fish

The ruffe grows fast, has a high reproductive capacity, and is highly adaptable. It is a serious threat to commercial and sport fishing in the Great Lakes.

Source: Michigan Sea Grant Archives.

Several federal land managers considered the lack of adequate funding and resources to manage noxious weeds on federal agencies' land as shortsighted, a "penny wise, pound foolish" approach. Although 90 percent of the 350 million acres of federal western land are not yet significantly infested, invasive weeds increase on average about 14 percent a year. When a rangeland infestation becomes severe, the costs of weed control often exceed the land's market value. In 1991, for instance, a 3,200 acre ranch in North Dakota sold at 60 percent below market value because it was infested with leafy spurge. Even when land values deteriorate, weed

control is still needed to keep weeds from spreading to nearby areas. The need to deal with invasive species was succinctly summarized by a Bureau of Land Management official, who said "you can pay now or later, but you will eventually pay sometime."

Lack of a National System Is a Major Obstacle to Rapid Response

A major obstacle to rapid response is that there is no national system that addresses all types of invasive species infestations—those affecting aquatic areas, rangelands, and forests as well as crops and livestock. Without such a system, problems that have hampered past rapid response efforts are less likely to be resolved. Further, a national system would help assure that invasive species that affect natural areas receive a level of attention commensurate with their risks.

APHIS is the only federal agency with a systematic rapid response process.[15] However, its coverage has primarily been limited to pests affecting crops and livestock. Other agencies with responsibilities for natural areas, such as those in Interior, face competing demands for their resources and often respond to infestations in an ad hoc manner.

National System Is Needed to Address Problems That Have Stymied Past Rapid Response Efforts

The United States lacks a comprehensive national system for rapidly responding to newly detected invasive species. Among other things, such a system could provide (1) integrated planning to encourage partnerships, coordinate funding, and develop response priorities; (2) technical assistance and other resources; and (3) guidance on effective response measures.

Without a national system, recurring problems are less likely to be uniformly addressed. Several problems that we identified—the need for more detection systems; better mechanisms for developing federal, state, and local government partnerships; and improved technologies to eradicate and contain invasive species—are described below.

[15] We did not assess APHIS' implementation of its rapid response system. However, a review of APHIS' system, *Safeguarding American Plant Resources: A Stakeholder Review of the APHIS-PPQ Safeguarding System*, July 1, 1999, conducted by the National Plant Board (an organization of state plant regulatory agencies) included several recommendations for improving APHIS' response activities.

Additional Detection Systems Are Needed for Earlier Identification of New Infestations

Rapid response has been significantly hindered by the lack of early detection systems to identify infestations when they are small and most easily addressed. Without early detection, years may pass before an invasive species is discovered or recognized as harmful. Detection of new infestations falls short in several areas.

First, surveillance and monitoring for new invasive species are inadequate. Visual surveys, traps, physical inspection, and water sampling can locate infestations so that they can be mapped and responded to. However, many species are not easily detected because they are microscopic, aquatic, or difficult to recognize as new or invasive. Surveillance is particularly important near high-risk areas (e.g., major shipping ports, airports, and warehouses) where species are most likely to be introduced.

For example, some USDA officials believe that the Asian long-horned beetle was in the United States up to 10 years before it was discovered in New York in 1996. As of May 2001, this infestation (the first of five in New York) has resulted in the destruction of over 2,500 trees. Late detection and insufficient surveying of early infestations have made eradication efforts more difficult. Whether the beetle can be totally eradicated is still uncertain. The Caulerpa taxifolia, or “killer algae” infestation near San Diego, is another example of a belated detection. Experts believe that this aggressive aquatic plant was likely introduced about 4 years before it was officially reported in June 2000. It is expected to have a devastating economic impact on California coastal communities and significant ecological consequences if it becomes permanently established and spreads.

Surveillance efforts for new infestations vary among agencies, with APHIS having the most extensive federal system. APHIS systematically monitors for several agricultural pests, including gypsy moths, fruit flies, and cotton boll weevils.[16] In other agencies, surveillance is more limited. For example, Park Service officials said that their four invasive plant teams systematically survey for invasive plants; however, the teams cover only about one-tenth of the parks. Officials from the Fish and Wildlife Service and Bureau of Land Management said they periodically surveyed only a small percentage of their lands for new infestations. (In commenting on our draft report, the Bureau noted that it has an inventory program that monitors and detects weed infestations.) An official from Commerce's National Oceanic and Atmospheric Administration said that few marine or estuarine areas have baseline monitoring data.

Second, increased knowledge is needed about the biology of invasive species to detect and identify new species and assess their potential threats. For example, information on insects' lifecycles can help detect pests at various stages of their development. Similarly, risk assessments of potentially invasive species are needed to prioritize response actions and develop contingency plans. Agencies need to know, for example, whether the species was invasive in other areas, what conditions (e.g., native range, rate of population growth, ability to disperse within a new area) are conducive to its invasiveness, and whether it is a threat to native species.[17] APHIS is working with several scientific organizations (e.g., the Weed Science Society of America) to develop a list of the most potentially serious invasive plant pests for use in targeting detection efforts and developing contingency plans.

Stronger Federal, State, and Local Partnerships Can Help Address Common Problems

Since invasive species ignore boundaries, rapid response often involves coordination among multiple government agencies. The complex interplay among federal, state, and local agencies adds to the potential for inefficiencies in these efforts. In the past, issues concerning leadership, funding, and other organizational responsibilities have hampered such efforts.

[16] "Safeguarding American Plant Resources: A Stakeholder Review of the APHIS-PPQ Safeguarding System," found problems with APHIS' detection efforts and made several recommendations to address them.

[17] Even changes within an ecosystem can cause a previously benign non-native species to become invasive. For example, a ficus tree in Florida, harmless for decades, became invasive when its pollinator wasp was introduced.

The discovery of giant salvinia in the Lower Colorado River in 1999 illustrates some of the pitfalls of rapid response involving multiple jurisdictions. The infestation, found on a river bordering Arizona and California, affected state, tribal, private, and federally managed land. Interior agencies—the Fish and Wildlife Service, Bureau of Reclamation, and Bureau of Land Management—Arizona and California state agencies, local water districts, and other affected parties quickly formed a task force to coordinate action. According to an Interior representative, the goal of rapid response evaporated in the face of funding obstacles and disagreements over who should be the lead agency and appropriate control strategies. Had immediate action been taken, eradication of this infestation would have been possible, according to a science advisory panel and California officials.

Disagreements over funding reportedly contributed to delays in responding to the Asian long-horned beetle. Although the beetle was first reported in New York in August 1996, the removal of the first several hundred infested trees was not completed until June 1997, nearly a year later. New York State officials said that their response was delayed because the federal and state officials initially involved in the effort lacked the authority to make funding commitments. Additional delays occurred because of state and local concerns regarding the sufficiency of federal funding available for tree removal and restoration costs.

On the other hand, officials cited several response efforts that exemplified effective partnerships, one being the response to Caulerpa taxifolia.[18] Federal and state participants said the response was effective largely because of the (1) early involvement of a public-private action team that recognized the urgent need for rapid response and (2) active involvement of several key players, including the consulting firm that discovered and treated the infestation, the regional water quality control board, and the state agriculture department. The regional water board was instrumental in obtaining state emergency cleanup and abatement funding, enabling eradication efforts to quickly begin. Surveying began a day after the infestation was identified; within 2 weeks, an action team was formed and initiated response measures. Initial treatment was completed in 3 months.

[18]Other efforts include the (1) Maui Invasive Species Committee, a partnership of federal, state, and county agencies, and (2) National Park Service's Exotic Plant Management Teams. Even exemplary responses, however, do not necessarily result in the eradication of an infestation.

Periodic monitoring and treatment are ongoing, but it will take years to know whether complete eradication can be achieved.

Executive Order 13112 emphasizes the need for federal agencies to cooperate with states. Many state officials are concerned about what role they will play in a national rapid response system and have differing views on what their roles should be. For example, in commenting on recommendations in the draft invasive species management plan, some states emphasized the need to respect the sovereignty of state, local, and tribal authorities, particularly in managing fish and wildlife within their borders. Others emphasized the importance of a strong national effort to address invasive species given their limited ability to address interstate problems. The rapid response capabilities of states also vary. For example, a 1993 Office of Technology Assessment study reported that most state agencies rated their invasive species implementation and enforcement resources as "less" or "much less" than adequate.[19] Finally, some states, such as Minnesota and Hawaii, have substantial legal structures in place, while others have barely addressed the issue.

To develop partnerships in areas relating to agriculture, APHIS has established memorandums of understanding with state departments of agriculture in all 50 states. These agreements define, among other things, federal and state rapid response duties.

Enhanced Technologies and Additional Research Are Needed to Facilitate Rapid Response

An effective rapid response to invasive species requires having sufficient information on and access to environmentally sound, cost-effective control methods.[20] Many responses fail or are only partially successful because they lack information on how best to control the species or because control methods are unavailable or politically infeasible to use.

[19] *Harmful Non-Indigenous Species in the United States*, Office of Technology Assessment, OTA-F-565, Sept. 1993.

[20] Control methods include cultural practices (e.g., crop rotation, revegetation), physical restraints (e.g., electrical barriers), removal (e.g., hand removal, burning), use of chemical or biopesticides, biological control (e.g., release of predator/herbivore organisms), and interference with reproduction (e.g., release of sterile males).

Agencies' inability to fund accelerated research on emerging threats has limited the availability of effective control methods. For example, according to Forest Service scientists, research to develop control methods and basic knowledge about sudden oak death, a new destructive invasive forest disease in California, was delayed by the time-consuming process used to obtain funding. The scientists noted that although $3.5 million was needed to do the research, it took 7 months, from late June 2000 until late January 2001, for the Forest Service to obtain about one-third ($1.1 million) of the requested amount from Commodity Credit Corporation (CCC).[21] Consequently, the Forest Service was unable to develop basic knowledge about this little known disease as quickly as it would have had the research been fully funded immediately. Furthermore, the Service estimated that it needed an additional $875,000 in fiscal year 2001 for immediate research and development in connection with other emerging invasive threats, such as the exotic spruce aphid which has caused severe damage to forests in the Southwest.

Likewise, a Geological Survey scientist said that his agency does little rapid research relating to newly detected species because funding is not readily available. He said that research managers must often seek resources from other agencies if they want to initiate research and surveys to support rapid response. However, according to this scientist, whether the funding comes from within the Survey or without, the amount of time spent in obtaining it frequently makes rapid response infeasible.

For certain invasive species, particularly those affecting aquatic areas, environmentally sound control methods are not available. According to a Commerce official, control methods in aquatic areas are much less developed than those in terrestrial settings because (1) awareness of the need for aquatic control methods is relatively recent and (2) industry has little incentive to develop control methods for aquatic areas. Unlike controls used in terrestrial settings, those developed for aquatic areas have few commercial applications; thus, the return on investment tends to be low. This official added that no feasible methods currently exist for

[21] CCC, located within USDA, is the government's financing arm for an array of domestic and international agriculture programs. According to a Forest Service official, at the time the CCC funds were made available, there was an understanding between the Forest Service and the Deputy Secretary of Agriculture that the Service would provide $1 million for this effort. In March 2001, the Forest Service provided $500,000, which could be used for surveys and technology development, but not for basic research. As of July 2001, the remaining $500,000 had not been provided.

controlling some invasive species, such as the spotted jellyfish, which was detected in the Gulf of Mexico in 2000.

In other instances, effective chemical pesticides may be available, but have not been registered under the Federal Insecticide, Fungicide, and Rodenticide Act for use in aquatic settings.[22] A number of aquatic species—including the zebra mussel, round goby, and ruffe—continue to spread, in part because of the lack of environmentally sound control methods. Moreover, the number of pesticides available for invasive species control is declining. The Environmental Protection Agency has ruled that methyl bromide—the major fumigant option used in food and fiber quarantine pest treatments—is scheduled to be phased out by 2005. Reassessment of important pesticides, including malathion and guthion, may result in these being phased out as well.

Finally, control methods are sometimes too costly. For example, in assessing controls to prevent the Asian swamp eel[23] from moving into the Everglades National Park, an interagency task force considered installing an electrical barrier. Although this was regarded as the most effective control method available, it was rejected due to its high cost. Instead the task force chose to test physical removal, which cost less but, according to some task force members, is likely to be less effective.

Rapid Response Depends Largely on the Centrality of Invasive Species to an Agency's Mission

A federal agency is more likely to respond rapidly to infestations if eradication or containment of invasive species is central to the agency's core mission. An activity that is central to an agency's mission is more likely to have ready access to resources than one that must compete with other important activities. While safeguarding agriculture from invasive pests is a primary mission of APHIS, safeguarding natural areas from invasive species is not specified in other agencies' missions and competes with other important activities for scarce resources. For the most part, responses to such infestations (if they are responded to at all) occur on an ad hoc basis.

[22] The Federal Insecticide, Fungicide, and Rodenticide Act (1947), as amended (7 U.S.C. 136) provides for federal control of pesticide distribution, sale, and use. Pesticides used in the United States generally must be registered by the Environmental Protection Agency.

[23] The Asian swamp eel is an aquatic invasive species that has been detected in canals near the Everglades.

A Primary Mission of APHIS is to Safeguard Agriculture From Invasive Pests

APHIS' mission statement specifically identifies safeguarding agriculture from invasive pests; it has clear responsibilities and authorities to rapidly respond to infestations viewed as significant threats to that sector. APHIS' activities in this area have strong constituency backing and receive the majority of rapid response funding.

APHIS has authority to take various steps to deal with an emerging invasion. It has the authority to seize, quarantine, treat, and/or dispose of plants and animals and their products to prevent the importation or interstate movement of plant and animal diseases, pests, and noxious weeds that are new to or not known to be widely prevalent or distributed within and throughout the United States. In the event of a severe disease or pest outbreak which threatens U.S. agricultural production, the Secretary of Agriculture can declare an emergency that, among other things, allows the Secretary to transfer CCC funds to APHIS to pay for eradication activities and to indemnify producers.[24] USDA can also declare, under certain circumstances, an "extraordinary emergency," triggering intrastate authority to address situations in which measures being taken by a state are inadequate to eradicate a plant pest or noxious weeds.

In conjunction with its core mission of safeguarding agriculture from invasive species, APHIS has implemented a systematic process for responding to newly detected plant pests. Its rapid response system includes guidance and procedures, a process for evaluating the risks posed by new plant pests, the ability to take some initial actions within 72 hours, and access to resources and funds for emergency response. Its New Pest Advisory Group, which includes experts within and outside of APHIS, is responsible for evaluating new or reintroduced plant pests and recommending response actions to a Deputy Administrator. To date, APHIS is the only federal agency to implement such a systematic rapid response process.

USDA's response to karnal bunt illustrates its ability to react quickly to invasive species. On March 7, 1996, ARS scientists confirmed that the spores on a wheat sample from Arizona were karnal bunt, a fungal disease of wheat first reported in India. Within 4 days, APHIS officials activated a

[24] In an emergency that threatens agricultural production, the Secretary of Agriculture has authority to transfer funds from other appropriations or funds available to the agencies or corporations of USDA for the (1) arrest, control, eradication, and prevention of the spread of a plant pest or noxious weed and for related expenses and (2) arrest and eradication of contagious or infectious diseases of animals or poultry. 7 U.S.C. 147b; 7 U.S.C. 7772.

rapid response team to begin quarantine and survey work. On March 21, 1996, the Secretary of Agriculture announced that he had signed a Declaration of Extraordinary Emergency, which allowed USDA to take a wide range of actions to control and eradicate the fungus, including compensating farmers for losses and imposing quarantines in Arizona and several counties in New Mexico and Texas.

While the Plant Protection Act of 2000 expanded APHIS' authority to address invasive species that threaten natural resources and the environment, APHIS has done relatively little in this area. APHIS has recently revised its mission statement to specifically identify safeguarding natural areas from invasive species; however, APHIS officials said that the agency has been reluctant to rapidly respond to natural area infestations, in large part because it lacks the funding to do so. They noted that the Congress has not responded favorably to APHIS' requests for additional funds to expand its traditional mission. Some USDA and Interior officials said that in the absence of strong constituency or industry backing, there has been little impetus for the Congress to support an expanded USDA role.

Invasive Species That Threaten Natural Areas Are Less Likely to Receive a Rapid Response

Invasive species that threaten natural areas are generally not subject to processes equivalent to those applicable for agricultural pests. An important reason for this is that while Interior and the Forest Service and, to a lesser extent, entities such as Commerce and Defense have responsibilities for protecting the environment, invasive species are a small part of the activities conducted under their missions. As a result, competing priorities and other factors have limited their ability to respond to natural area infestations.

The Department of the Interior's management of invasive species is limited by several factors that are detailed below:

- If an invasive species affects Interior lands, Interior can use its land management authorities to address the situation as quickly as funding and staffing allow. There are, however, many other environmental issues that compete for Interior's resources, so there is little assurance they will be available for responding to invasive species.
- Unlike USDA, Interior lacks access to another funding source for rapid response. Also, unlike APHIS, Interior agencies rarely receive appropriations from the Congress directing them to address specific infestations. Therefore, Interior's invasive species programs tend to focus on control and restoration rather than rapid response. For

example, a National Wildlife Refuge official noted that invasive species funding on refuge lands is used for projects identified in previous annual budget cycles. As a result, funds are directed toward recurring or well-established problems rather than toward rapid response.

- Although Interior has authority to conduct control and eradication programs on its lands, its authorities are not nearly as specific as APHIS' invasive species authorities—even in natural areas. APHIS' authorities cover movement into the United States and interstate movement of insects, plant pathogens, exotic plants, and aquatic organisms that might threaten natural ecosystems. In contrast, rather than preventing the spread of invasive species overall, many of Interior's statutes are general land management statutes or protect a particular species or group of species. For example, according to an Interior attorney, the Endangered Species Act may result in actions against invasive species, but they would be a byproduct of protecting listed endangered species.

Competing priorities have also limited other agencies' abilities to obtain the resources needed to rapidly respond. For example, the Forest Service has authority and responsibility for promoting environmental protection of forests and rangelands, including protection against invasive species. However, this particular environmental objective must compete with others for funding, including programs aimed at improving and protecting water quality and quantity and reducing fire hazards near urban areas. Moreover, the Service has additional priorities relating to the human use of these natural resources, such as improving the capability of forests and rangelands to provide products (water, timber, and minerals) and services (recreational opportunities) and improving Service roads and facilities.

According to Forest Service officials, a lack of resources for accelerated research, management, and technical assistance has impeded their efforts to be more actively involved in rapid responses.[25] At the same time, they emphasized that the agency works actively with APHIS and other partners to perform risk assessments and surveys critical to eradication and control of invasive species in national forests and in partnership on other lands. In commenting on a draft of our report, the Forest Service said that when given adequate resources, it has successfully implemented rapid response actions in full cooperation with its partners.

[25] We note, however, that the Secretary of Agriculture–in an emergency that threatens agricultural production–can declare an emergency and can transfer funds to any agency within USDA, including the Forest Service.

A Defense official said that Defense's response to invasive species has been minimal because it does not consider the activity to be directly related to its mission. Although Defense is responsible for managing invasive species on military installations, the manager acknowledged that some invasive species are not being addressed. With many competing funding priorities, only the most invasive plants have become rapid response priorities. The U.S. Army Corps of Engineers also has invasive species responsibilities; it helps manage and remove aquatic nuisance species. For example, the Corps is authorized to implement cost-sharing arrangements with state and local governments for managing nuisance aquatic plants in waterways not under the control of the Corps or other federal agencies. A Corps official said that the lengthy planning studies required for these grants virtually preclude assisting states with rapid response, and this program has not been funded since 1996.

Commerce—through its National Oceanic and Atmospheric Administration—has, as a peripheral part of its mission, responsibility for managing aquatic invasive species. However, according to a Commerce official, only a few of its activities involve rapid response. For example, Commerce resources helped support the rapid response effort to eradicate Caulerpa taxifolia.

Since invasive species that threaten natural areas are not central to any agency's mission, they are more likely to fall through the cracks. A good example of this is giant salvinia, widely regarded as one of the most devastating aquatic weeds in the world. Although APHIS listed giant salvinia as a Federal Noxious Weed in 1983, this aquatic nuisance continues to be sold at commercial nurseries, even in states where its sale is prohibited. Giant salvinia was first reported in the United States outside of cultivation in South Carolina in 1995. According to a retired APHIS official, APHIS was asked to fund this eradication effort but declined. South Carolina's Department of Natural Resources cobbled together sufficient funding to eradicate this infestation. A similar response was absent in Texas, however, where the plant was discovered in 1998. As of March 2001, it has been confirmed in 4 public reservoirs, 7 rivers or streams, 6 river basins, and 27 private lakes in that state. In addition, giant salvinia now occurs in water bodies in Arizona, California, Louisiana, Mississippi, Alabama, North Carolina, Georgia, Florida, and Hawaii.

Figure 4: Giant Salvinia Covering a Pond in Texas

Once the home of trophy bass, this 6-acre pond east of Houston, Texas, became completely covered with giant salvinia within months of the initial infestation.

Source: Texas Parks and Wildlife Department and U.S. Geological Survey.

The Council's Management Plan Has Recommendations for Addressing Obstacles to Rapid Response

The Invasive Species Council's management plan, issued in January 2001, provides a broad plan of action with 57 recommendations covering 9 key areas of invasive species management. Three of the recommendations specifically address rapid response; a number of others address related areas including early detection. In general, the plan's rapid response recommendations call for developing a coordinated rapid response program; developing draft legislation for rapid response, with the possibility of permanent funding; and expanding regional networks of invasive species databases. At the same time, the Council acknowledges that many of the recommendations lack specificity and will require further development before they can be implemented. (See app. III for details on the rapid response recommendations and the Council's actions and planned actions to address them.)

Taken in their entirety, the plan's recommendations would appear to address the obstacles to rapid response described in our report. These include, first and foremost, the need for a national rapid response system to provide guidance, technical assistance and other resources, and integrated planning. Other obstacles that we identified in this report include the need for (1) additional detection systems; (2) improved partnerships among federal, state, and local agencies; and (3) enhanced technologies for eradicating invasive species.

Specifically, the Council's plan calls for:

- **A national system**. The plan recognizes the need for a system that would provide, among other things, for rapid response to new invasions. It recommends that by July 2003, the Council develop a program of coordinated rapid response to new invasions of natural and agricultural areas and pursue increases in discretionary efforts to support the program. The Council is to coordinate with other federal, state, local, and tribal agencies in developing the program. According to Council staff, a working group of representatives from the Council's member agencies will be responsible for implementing this recommendation in cooperation with other stakeholders. The working group is to be established before the end of August 2001.
- **Developing additional early detection systems**. The plan has one recommendation aimed at improving the detection and identification of new invasive species. The recommendation contains a series of steps, including (1) compiling a list of taxonomic experts; (2) developing new methods for detecting pathogens and parasites; (3) instituting systematic surveys of high-risk locations; (4) developing a more user-friendly approach to identifying and reporting invasive species; and (5) developing—for use on the Internet—an early detection module that will provide information on invasive plants.
- **Developing stronger partnerships**. The plan emphasizes the need to build partnerships with state and local entities, improving coordination, and resolving jurisdictional issues. Moreover, many recommendations incorporate consultations with states and other affected parties as part of the implementation process. For example, regarding rapid response, the plan calls for the Council to develop—in consultation with the states—draft legislation, including the possibility of a permanent funding mechanism and matching grants to states to develop strong partnerships. Other recommendations call for developing (1) clearly defined processes and procedures to help resolve jurisdictional and other disputes regarding invasive species and (2) a national public

awareness campaign, emphasizing public and private partnerships. These are only a few examples of the initiatives aimed at developing stronger partnerships.

- **Improving technologies for use in rapid response**. The plan calls for developing and testing methods to determine which rapid response measures are most appropriate for specific situations. In addition, the plan recommends (1) preparing a catalog of existing aquatic and terrestrial control methods and proposing strategies to determine their effectiveness in different U.S. habitats; (2) establishing and coordinating a long- and short-term research capacity (ranging from basic to applied research) on invasive species; and (3) as part of a cross-cutting budget proposal for fiscal year 2003, including an initiative to adequately fund federal invasive species research programs.

Since the plan is relatively new, implementation of its recommendations is just getting underway. The Council has, however, taken steps to establish priority areas for implementation, rapid response being one of these areas, according to its executive director.

Conclusions

Some non-native species arrive in the United States as accidental tourists; others are brought in purposely—for example, to beautify gardens or as fish or game for sportsmen. However, one thing invasive species have in common is that their numbers are increasing dramatically. The explosive growth of invasive species has been accompanied by an increased awareness of the threat they pose and damages they cause. However, heightened awareness has not yet resulted in a systematic national approach to rapid response. As a result, opportunities for eradicating potentially devastating invasive species continue to be lost.

Currently, if an invasive species is a serious threat to agricultural crops or livestock there is a good chance that APHIS will address it in some way. APHIS has a process in place for evaluating new invasive species and obtaining resources for responding to serious threats. On the other hand, if an infestation threatens primarily natural areas, the odds of it being rapidly responded to are significantly less. For these infestations, it is sometimes uncertain which, if any, agency will take the lead; ready access to funds is often a problem; and generally no one agency is held accountable if the infestation spreads.

At this point, it is unlikely that a single agency, such as Agriculture or Interior, will unilaterally develop a systematic process for evaluating and

rapidly responding to invasive species that threaten natural areas. Without specific responsibility for rapidly responding to natural area infestations and resources to implement such a program, agencies have little impetus to take on this responsibility. Thus, we believe that a coordinated approach for dealing with rapid response nationwide offers the best opportunity for ensuring that invasive species of all types will get a level of attention commensurate with their risks. Such a system would bring federal agencies and other stakeholders to the table to address invasive species as a national problem—one that requires integrated planning, resources, and guidance.

The Invasive Species Council's management plan provides a structured framework for dealing with the threat of invasive species nationwide. The plan covers activities on many fronts—from prevention to educational outreach—and will likely take many years to fully implement. As a result, the plan's recommendations will need to be implemented incrementally. In this regard, we agree with the Council's decision to treat rapid response as an area requiring priority attention. Rapid response provides an excellent target of opportunity, offering the potential to save millions of dollars in damages and control costs and for preserving natural habitats and native species.

We believe that if the recommendations are properly implemented, they will go a long way toward developing a systematic national approach toward rapid response. At the same time, while a concerted effort is clearly needed to slow the onslaught of invasive species, we believe that before drafting rapid response legislation and requesting increases in funding, the Council needs to clarify several fundamental issues. In particular, many agency officials are uncertain as to what types of activities should be considered rapid response and, consequently, how much funding their agencies devote to that activity. In order to make a convincing case for additional legislation or resources, the Council must first define rapid response and obtain a solid understanding of how much federal funding is already being directed toward this activity. Only then will the Council have a sound basis for determining future needs.

Recommendations

We recommend that the co-chairs of the Invasive Species Council—the Secretaries of Agriculture, Commerce, and the Interior—direct the Council members to:

- Develop criteria for what constitutes a rapid response, including examples of activities that fall into that category.

- Based on the criteria established above, develop information on their Departments' rapid response funding and the programs and activities that receive funding.
- In consultation with the Invasive Species Advisory Committee, establish rapid response priorities to help identify resource needs and guide the discretionary actions of agencies in addressing invasive species.

Agency Comments

We provided a draft copy of this report for review and comment to the Departments of Agriculture, Commerce, and the Interior and to the Invasive Species Council. We met with the Council's staff and the three departmental liaisons who provided comments from their respective Departments and agencies: Agriculture (Agricultural Research Service, Animal and Plant Health Inspection Service, Forest Service, and Natural Resources Conservation Service); Commerce (National Atmospheric and Oceanic Administration); and Interior (Bureau of Land Management, Bureau of Reclamation, Fish and Wildlife Service, Minerals Management Service, National Park Service, and U.S. Geological Survey). The Departments, agencies, and the Council's staff generally agreed with the substance of our report and with our recommendations. A major theme running throughout the comments was the impact of inadequate resources on their ability to rapidly respond to new infestations and the need for additional funding to develop an effective rapid response capability. They also provided technical comments that we incorporated throughout our report as appropriate. Appendix IV provides a summary of the major points raised in the comments and our response, as appropriate.

As agreed with your offices, unless you publicly announce its contents earlier, we plan no further distribution of this report until 7 days from the date on this letter. At that time, we will send copies of this report to interested congressional committees and members; the Executive Director of the National Invasive Species Council; the co-chairs of the National Invasive Species Council (the Secretaries of Agriculture, Commerce, and the Interior); and to the other Council members. We will also make copies available to others upon request.

If you or your staff have any questions about this report, please contact me on (202) 512-3814. The key contributors to this report are listed in appendix V.

Lawrence J. Dyckman
Director, Natural Resources and
the Environment

Scope and Methodology

To determine the extent of federal rapid response to new invasive species, we reviewed the activities of the federal agencies responsible for invasive species activities and asked the agencies that conducted rapid response for data on which species they rapidly responded to and the related obligations for fiscal year 2000.

The following agencies provided funding estimates for their rapid response efforts:

- U.S. Department of Agriculture: the Animal and Plant Health Inspection Service, the Agricultural Research Service, and the Forest Service;
- Department of the Interior: the Bureau of Indian Affairs, the Bureau of Land Management, the Bureau of Reclamation, the Fish and Wildlife Service, and the U.S. Geological Survey; and
- Department of Commerce: the National Oceanic and Atmospheric Administration.

The following agencies did not provide funding estimates on rapid response:

- Department of Defense; Agriculture's Cooperative State Research, Education, and Extension Service; APHIS' Wildlife Services program; and Interior's National Wildlife Refuge System, Coastal Program, and National Park Service do not track budget information on their rapid response activities and could not estimate funding for these activities.
- Officials from Transportation, the Environmental Protection Agency, Agriculture's Natural Resources Conservation Service, Interior's Minerals Management Service, and Defense's Army Corps of Engineers said that although their respective organizations conducted invasive species activities, they did not perform rapid response in fiscal year 2000.

Agencies' reported obligations may be under- or overstated for several reasons. First, officials said that rather than using a specific fund for rapid response activities, their agencies rely, at least in part, on programmatic and contingency funds that fund many activities. Agencies do not routinely track the rapid response portion of this funding. While much of APHIS' funding for rapid response is transferred from CCC, it also relies on programmatic and contingency funds. The basis for agencies' funding estimates ranged from analyses of funding records to an agency official's informed opinion. The Bureau of Indian Affairs, Bureau of Reclamation, Forest Service, Agricultural Research Service, National Oceanic and

Atmospheric Administration, and U.S. Geological Survey listed the rapid response activities that they funded; the Fish and Wildlife Service provided funding information on its rapid responses to aquatic nuisance species; and the Bureau of Land Management estimated that its rapid response funding was 8 percent of its total invasive species obligations.

Further, the agencies were somewhat uncertain as to which activities to include in rapid response. To facilitate consistency among the agencies, we provided a definition of rapid response as being "a response carried out in time to contain or eliminate potentially damaging invasive species—the actual time required for rapid response varies depending on the species." We also worked with the agencies while they prepared their data to further ensure consistency. We did not verify the accuracy of the agencies' data. However, we did compare their data with other available data in an effort to identify inconsistencies. We resolved all substantive inconsistencies with agency budget and program officials.

To determine the obstacles to rapid response, we interviewed officials and scientists and obtained plans, status reports, budget requests, and other documents from the agencies cited above and from the Department of Transportation, Environmental Protection Agency, Smithsonian Institution, U.S. Army Corps of Engineers, and Invasive Species Council staff. We also interviewed representatives and reviewed documents from two interagency groups: the Aquatic Nuisance Species Task Force and the Federal Interagency Committee for Management of Noxious and Exotic Weeds. In addition, we obtained views on obstacles from representatives of state agricultural or natural resource agencies in California, Florida, Hawaii, Minnesota, and Texas and with nonprofit organizations involved with invasive species efforts, including the American Lands Alliance, Nature Conservancy, and Charles Valentine Riley Memorial Foundation. We selected the states cited above because agency officials stated that they have significant invasive species problems and/or strong and innovative invasive species programs.

In addition, we analyzed studies, reports, the National Invasive Species Management Plan and public comments on the plan, and other documents describing invasive species response systems, problems, and obstacles to more timely rapid response. To review the actions of federal agencies in greater detail, we analyzed four invasive species threats—the Asian long-horned beetle, Asian swamp eel, Caulerpa taxifolia, and giant salvinia. Agency officials identified these invasive species as being serious threats and relatively recent introductions into the United States. Furthermore,

these infestations have received varying levels of rapid response from federal agencies.

To determine how federal agencies can improve rapid response, we interviewed officials from the entities cited above to obtain their views on solutions to obstacles impeding rapid response. In addition, we interviewed invasive species experts at several universities. We analyzed and synthesized recommendations obtained in interviews and from reports, plans, documents, and literature relating to rapid response. We also reviewed invasive species legislation and Executive Order 13112 and analyzed the rapid response recommendations in the National Invasive Species Management Plan.

We performed our work from October 2000 through May 2001, in accordance with generally accepted government auditing standards.

Invasive Species Rapidly Responded to by Federal Agencies

The federal Departments that provided estimates of their rapid response obligations for fiscal year 2000—Agriculture, Interior, and Commerce—also provided information on the invasive species that they rapidly responded to in that period. For Agriculture's APHIS and ARS and Interior's Fish and Wildlife Service and Bureau of Land Management, the invasive species listed are ordered by the amount obligated, from largest to smallest. The information provided by Agriculture's Forest Service and Interior's Bureau of Indian Affairs and U.S. Geological Survey did not allow for such ordering.

Department of Agriculture

Animal and Plant Health Inspection Service: Citrus bacterial canker, glassy-winged sharpshooter/Pierce's disease, Mediterranean fruit fly, Asian long-horned beetle, plum pox virus, West Nile virus, transmissible spongiform encephalopathy in sheep, olive fruit fly, Asian gypsy moth, giant salvinia, pink hibiscus mealybug, federally listed noxious weeds, rabbit calcivirus disease, screwworm.

Agricultural Research Service: Glassy-winged sharpshooter/Pierce's disease, brown citrus aphid, citrus psylla, papaya mealybug, pink hibiscus mealybug, Asian long-horned beetle, plum pox virus, karnal bunt, sorghum ergot, tropical soda apple, giant salvinia, West Nile virus, Caulerpa taxifolia, yellow unicorn plant, elongate mustard, blissid cinchbug, waterlettuce.

Forest Service: European gypsy moth, Asian long-horned beetle, hemlock woolly adelgid, Port-Orford-cedar disease, Asian gypsy moth, pine shoot beetle, sudden oak death, pink hibiscus mealybug, giant salvinia, yellow starthistle, purple loosestrife, Dyers woad, leafy spurge, spotted knapweed, Canada thistle, orange hawkweed, Dalmatian toadflax, rush skeletonweed, whitetop, Miconia, banana poka, cheatgrass, Scotch broom.

Department of the Interior

Fish and Wildlife Service (aquatic species): Caulerpa taxifolia, Asian swamp eel, zebra mussel, brown tree snake, round goby, New Zealand mud snail, ruffe.

Bureau of Indian Affairs: Cogongrass, purple loosestrife, Russian knapweed, musk thistle.

Bureau of Land Management: Giant salvinia, yellow starthistle, purple loosestrife, Dyers woad, squarrose knapweed, salt cedar, leafy spurge, spotted knapweed, Canada thistle, Scotch thistle, and others.

U.S. Geological Survey: Asian swamp eel; giant salvinia; garlic mustard; round goby; black, silver, and bighead carp; green mussel; zebra mussel; other aquatic invasive species.

Bureau of Reclamation: Giant salvinia.

Department of Commerce

National Oceanic and Atmospheric Administration: Caulerpa taxifolia.

Management Plan's Recommendations on Rapid Response

The Invasive Species Council's management plan contains three recommendations that specifically address rapid response. The recommendations and the Council's stated and planned actions to address them are as follows:

1. Starting in January 2001, Interior (especially U.S. Geological Survey/Biological Resources Division) and USDA, in cooperation with the National Science Foundation and Smithsonian Institution, will expand regional networks of invasive species databases (e.g., the Inter-American Biodiversity Information Network) and produce associated database products, to cooperate with the Global Invasive Species Programme and other partners to establish a global invasive species surveillance and rapid response system.

Actions Taken to Address Recommendation:

Interior's U.S. Geological Survey received a grant in September 2000 from the U.S. Department of State to (1) provide technical assistance in implementing the Inter-American Biodiversity Information Network and (2) convene a meeting in conjunction with the Global Invasive Species Programme and provide seed funding for regional hubs in Mexico and South Africa. The meeting, a workshop on developing regional invasive species information hubs, was held in February 2001. It brought together scientists from Africa, North America, and international organizations who are working on ways to facilitate invasive species efforts by strengthening taxonomic services and/or information networks.

2. 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 Planned to Address Recommendation:

- Establish 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.
- Develop and test methods to determine which rapid response measures are most appropriate for a situation.

- 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 laws 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.
- Prepare a guide to assist rapid response teams and others that will incorporate the methodology developed for response measures and guidance on (1) regulatory compliance and (2) jurisdictional and budget issues.

3. Within fiscal year 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.

Action Taken to Address Recommendation:

The Council is seeking recommendations from its member agencies for nominees to a working group that will draft legislation.

Summary of Agency Comments and Our Response

The following summarizes the key points raised in the comments provided on a draft of our report by the Departments, agencies, and Council staff and our response, as appropriate.

Agriculture's APHIS agreed with the need to develop criteria for what constitutes a rapid response. The Forest Service noted that (1) it has full authority to respond to invasive species on national forests and in partnership on other lands and that its response has been limited by inadequate resources, not by lack of authority, as suggested in our report; (2) our report does not discuss the impediments to rapid response resulting from compliance with the National Environmental Protection Act; and (3) regarding the statement in our conclusions that "a national rapid response system offers the best opportunity for ensuring that invasive species ... gets a level of attention commensurate with their risks," Executive Order 13112 and the National Invasive Species Management Plan endorse building on existing strengths, not creating new structures, to enhance coordination and program response to invasive species.

First, we agree that the Forest Service has the authority to rapidly respond to invasive species under the conditions it described. However, having authority and having resources to carry out that authority are not the same thing. In particular, we believe that the ability to obtain resources for rapid response is related to the centrality of invasive species to an agency's mission. Invasive species is one of many important Forest Service responsibilities; however, it is not specifically identified in the Forest Service's mission as it is for APHIS. Second, regarding the National Environmental Protection Act, agency officials that we interviewed during our review had differing views on the extent to which compliance with the act hindered rapid response, with some believing that adequate planning could minimize the impediments and others maintaining that the act was a major hindrance. While we agree that compliance with the act may slow rapid response in some circumstances, we believe that any impediments it creates are not of the magnitude of those described in our report. Finally, we agree with the Forest Service that a national system for rapid response should be built on existing strengths and we do not mean to imply otherwise. In fact, our conclusions note that the Council's plan provides a structured framework for dealing with the treatment of invasive species nationwide and that if its recommendations are properly implemented, they will go a long way toward developing a systematic national approach toward rapid response.

Commerce said that the report was well written and accurate in its discussion of the difficulties in rapidly responding to invasive species. Commerce also commented on the problems posed by resource shortages. It noted that rapid response needs in aquatic ecosystems are unpredictable; in some years there may be no need to mount a rapid response effort and in others, several seriously invasive species may be introduced. Given this variability, most of Commerce's invasive species funding is directed toward preventing and controlling invasive species that have been identified in advance. Commerce further noted that a rapid response to a new, potentially serious, infestation may require large amounts of money and extensive reprogramming of funds committed to other priority areas.

Interior said the report was well written and generally precise in its observation of Interior's program efforts to support rapid response. Interior also said that the report will focus congressional attention on the opportunity to clarify authorities (particularly in interjurisdictional response efforts) and consider multi-year emergency response funding for such harmful, unpredictable invasions. Interior also noted that (1) the shortage of resources in the land and water management activities of the bureaus continue to be exacerbated by broadening mission goals; (2) there is an increasing need for technological improvements to enhance monitoring and rapid assessment of priorities for action; (3) planning processes have not yet been fully integrated with state and local stakeholders into regional or statewide rapid response contingency plans; and (4) an important aspect of assessing the true risk and cost of invasive species on natural areas is the ability to assess economic value for wildlife habitat and recreational losses resulting from plant infestations. This is an area that lags well behind agronomic assessment.

The Invasive Species Council staff said that the report covered a high-priority area for the Council. They further noted that the key issue concerning rapid response is readiness and that a consistent and universal agency complaint is that even when an infestation is detected early, the lack of coordination and a contingency fund or funds-transfer mechanism were major obstacles to quick action. They added that our report's recommendations did not reflect the need for a flexible contingency funding mechanism.

Regarding our first recommendation (developing criteria for what constitutes a rapid response), the Council staff agreed that the definitions for rapid response vary even among the Departments surveyed in our review. They also said that while this recommendation can be done

relatively quickly, it should not be the primary focus for the Council action put forth in our report. Regarding the second recommendation (developing information on Departments' rapid response funding and the programs that are receiving funding), the Council staff said that work on this effort is already underway. Finally, they suggested that we recommend that the Council fully implement the National Invasive Species Management Plan's recommendations regarding early detection and rapid response.

We appreciate the need that the Council staff and many agencies expressed for additional funding and a flexible funding mechanism to rapidly address new invasions. Our report documents some of the consequences of the lack of resources in addressing some invasive species. At the same time, we believe that the funding issue is ultimately a policy concern that is best addressed by congressional decisionmakers in their deliberations on national spending priorities. Thus, we are not making a recommendation or endorsing recommendations in the Invasive Species Management Plan regarding the adequacy of rapid response funding or the need for a flexible funding mechanism. Finally, we continue to believe that before the Council requests additional legislation or resources it must first develop criteria for what constitutes a rapid response. The considerable confusion regarding this term makes it critical that Council members reach consensus on what a rapid response is before they undertake activities to strengthen it.

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