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Invasive Plants and Animals: Globalization's Impacts on America's Economy, Health and Environment

The invasion of non-indigenous plants and animals continues to sweep across literally every part of the country, including croplands, rangelands and pastures, wetlands and waterways, wilderness areas and parks, even highways and railways. In Western states particularly, the invasion destroys the economic value of land. Invasive species have damaged native plant and animal communities, increased soil erosion and sedimentation, and interfered with outdoor recreation. Over time, invasive species have adapted, grown, and multiplied to unmanageable levels, causing them to become enduring and abundant. New invasive species continue their costly and harmful rampage.

Invasive species cause many native species to become endangered and threaten the integrity and stability of U.S. biodiversity and ecosystems. In addition to harming the environment, the U.S. economy faces billions of dollars worth of damage from non-native plants and animals. These escalating losses occur in agriculture, forestry, and several other segments of the U.S. economy. This biological invasion is an unintended consequence of globalization, which facilitates the movement of species across all geographical and physical boundaries with the vastly increased movement of people and materials.

The growing invasion of non-indigenous animals and plants provides an opportunity for Governors to work cooperatively and to take an Enlibra approach to solving this national crisis. The Enlibra process provides a commonsense framework for organizing collaborative consensus-building efforts to more efficiently and effectively address a difficult problem or issue with the goal of reaching a definite plan of attack. Applying the principles of Enlibra will shift efforts toward effective cooperation across state and jurisdictional lines, involving all stakeholders. Governors can focus their efforts on the highest priorities, dedicating the appropriate resources to build necessary capability at the federal, state and local levels.

Pathways and Consequences of Invasion

Introduction of invasive species may be intentional or accidental. Some intentional introductions have had, and will continue to have, beneficial significance for U.S. commerce, particularly in agriculture, aquaculture, recreation, and landscaping. Some beneficial introductions of non-native species include soybeans, wheat, cattle, and poultry. However, both accidental and intentional introductions can result in catastrophic consequences. Some intentional introductions may be present for years before their unanticipated negative impacts are even observed.

Examples of invasive plants and animals transforming our natural ecosystems and impairing our productivity are numerous.

- Invasive plants are spreading along highways and railways causing an increase in road maintenance costs, obscured vision at intersections, and obstructive access to gas and power lines.
- On rangelands and pastures, invasive species compete for and restrict access to food and water for grazing animals, cause soil erosion, and alter soil chemistry and nutrient composition. In some cases, the invasive plants are toxic to animals and grazing lands must be removed from use.
- In estuaries and coastal waters, invasive species interfere with boat travel, restrict water intake pipes, and crowd out native plants and animals.
- Invasive plants and animals can threaten the production of agriculture. Weeds and insects can reduce the yield and quality of crop production, interfere with harvesting operations, and reduce land values.
- Invasive species continue to threaten and increase the numbers of endangered species.

In recent years, the introduction of invasive species has increased dramatically. Some contributing factors include increases in the number of people traveling; enhanced speed and ability to transport plants and animals so they are more likely to survive the journey; an increase in the modes of transport for hitchhiking organisms, such as airplane wheel wells, bilge water, and pallet wood; and globalization of trade. Also, some species may be accidentally or intentionally released in the wild when owners of exotic plants or animals tire of them. The specter of terrorists using invasive species has also been raised.

There are many reasons why invasive species may become abundant and enduring, including:

- The lack of controlling natural predators — Without the presence of natural predators, an invasive species can competitively overrun an entire ecosystem. In California, yellow star thistle now dominates more than 4 million hectares of northern California grassland.
- The ability of an alien parasite to switch to a new host — Highly mobile invasive species can quickly destroy ecosystems and native fauna. In Brooklyn and Chicago, Asian longhorn beetles have caused workers to cut down, chip, and burn nearly 5,500 trees that were infested.

- High adaptability to new surroundings — Though invasive species can be found throughout the United States, mild climate, geographic isolation, and a high rate of exposure to invasive species can make one region more susceptible to invasion than others. Oceanic islands are particularly vulnerable to invasive species. Hawaii has one-third of the endangered species in the United States. Of Hawaii's 2,690 plant species, 946 are non-indigenous.

In addition to harming the environment, some invasive species have caused major economic losses in various sectors of the U.S. economy. Efforts to control invasive species cost the U.S. economy several billion dollars annually. Currently, no one federal agency assesses the total economic impact associated with invasive species, thus, estimating this information is difficult. According to a recent report by Cornell University, *Environmental and Economic Costs of Non-Indigenous Species in the United States*, controlling invasive species and associated economic and environmental damages amount to approximately \$137 billion per year. Damages vary by species and sectors, but some effects include power outages; contamination of grain and loss of farmland property value; spread of disease; inefficient irrigation; loss of sport, game, or endangered species; and ecosystem disturbance. According to the report:

- Control of invasive weed species in lawns, gardens, and on golf courses costs approximately \$36 billion per year.
- \$100 million annually is invested in the control of invasive aquatic species.
- Current livestock losses to invasive species are estimated to be approximately \$9 billion per year.
- The total annual cost of invasive weeds to the U.S. agricultural economy is approximately \$26.4 billion.
- Approximately \$2.1 billion in U.S. forest products are lost each year to invasive plants.

The zebra mussel is causing large-scale ecosystem changes throughout the Great Lakes and Mississippi basins, has shut down electrical utilities by clogging water intake pipes, and could lead to the extinction of native freshwater mussels. The U.S. Fish and Wildlife Service expects the zebra mussel invasion to cause \$5 billion in damages by the year 2002. According to the U.S. Department of Agriculture, the European gypsy moth caused an estimated \$764 million in losses in one year. Economists estimate \$138 billion in damage to the U.S. economy if the Asian longhorn beetles that devastated trees in New York and Chicago were to spread nation wide.

FEDERAL GOVERNMENT EFFORTS

Executive Order

On February 3, 1999, President Clinton signed an executive order creating an Invasive Species Council and directing federal agencies to create a framework for planning and coordination involving all

stakeholders. Under Executive Order 13112, federal agencies whose actions may affect the status of invasive species are required to identify their activities, such as using non-native seed mixes for post-fire restoration. Agencies are directed, subject to their appropriated budgets, to:

- Prevent the introduction of invasive species;
- Detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner;
- Monitor invasive species populations accurately and reliably;
- Provide for restoration of native species and habitat conditions in ecosystems that have been invaded;
- Conduct research on invasive species and develop technologies to prevent introduction and provide for environmentally sound control of invasive species; and
- Promote public education on invasive species and the means to address them.

The order also directs agencies not to authorize, fund, or carry out any action that is likely to cause or promote the introduction or spread of invasive species in the United States. Agencies are permitted to make a public determination that the benefits outweigh the potential harm and then make sure that measures will be taken to minimize the harm.

The order establishes a federal Invasive Species Council, co-chaired by the Secretary of the Interior, the Secretary of Agriculture, and the Secretary of Commerce. The Council also includes the Secretaries of Defense, State, Transportation, Treasury, and the Administrator of the Environmental Protection Agency. An advisory committee of stakeholders has also been established to provide information and advice for the Council's consideration. Governor Dirk Kempthorne (ID) represents NGA on the advisory committee.

The Council is charged with several tasks, including:

- Overseeing implementation of the order and seeing that federal agencies activities are coordinated, complementary, cost-efficient, and effective;
- Encouraging planning and action in cooperation with stakeholders;
- Developing recommendations for international cooperation;
- Developing, in consultation with the Council on Environmental Quality, guidance to federal agencies under NEPA on prevention and control of invasive species, including the procurement, use, and maintenance of native species;
- Facilitating the development of a coordinated network among agencies to document, evaluate, and monitor impacts from invasive species on the economy, the environment and human health;

- Facilitating establishment of a coordinated Internet-based network for exchanging information; and
- Preparing and issuing a national Invasive Species Management Plan.

The Invasive Species Management Plan, due in August 2000, will be drafted with the help of the Advisory Committee and will include a review of existing and prospective approaches and authorities for preventing introductions, coordinating research needs, and recommending measures to minimize the risk. The Council is directed to update the Management Plan biennially and evaluate and report on successes in achieving its goals and objectives.

The Management Plan also will identify any additional legislative authority needed by federal agencies, personnel and resource needs, and additional levels of coordination. Eighteen months after the recommendations have been made by the Council, each federal agency whose action is required must either take the action recommended or explain to the Council why it cannot comply.

Department of Agriculture

Agricultural Research Service (ARS). ARS provides scientific and technical support for other USDA agencies, including APHIS.

Animal and Plant Health Inspection Service (APHIS). APHIS conducts agriculture quarantine inspection programs at 178 U.S. ports of entry to prevent the introduction of foreign pests. APHIS also cooperates with federal and state agencies and non-governmental organizations to detect, contain, and eradicate infections of foreign pests before they become well-established and spread. APHIS may also approve and issue permits for importing non-indigenous species following preparation of an environmental assessment.

Cooperative State Research, Education, and Extension Service (CSREES). Several CSREES programs support research relevant to improving understanding of invasive species. Other CSREES initiatives fund research on best management practices for cost-effective, environmentally safe control of invasive species.

Economic Research Service (ERS). ERS focuses on developing decisionmaking tools for comparing the consequences of alien plant invasions with possible control costs.

Farm Service Agency (FSA). In managing the Conservation Reserve Program, FSA requires all participants to control noxious weeds, insects, pests, and other undesirable species on enrolled lands.

Forest Service (FS). The FS conducts research programs focused on invasive plant species, as well as disease research. In addition, the FS seeks to control and mitigate the effects from non-native insects.

Department of Commerce

National Oceanic and Atmospheric Administration (NOAA). NOAA funds research to prevent and control invasions in marine environments. In addition, NOAA also funds graduate student fellowships related to aquatic nuisance species research.

National Sea Grant College Program. The program funds research, education, and outreach to address threats from invasive species.

Department of Defense

The DoD engages in invasive species activities through the development and implementation of the Navy's ballast water management policy; in partnership with the Armed Forces Pest Management Board and the National Wildlife Research Center; and through maintenance of a noxious and nuisance plant management information system. A DoD Invasive Species Management Program seeks to prevent the entry of invasive species, to control invasive species present on DoD installations, and to restore DoD lands using native plants.

Army Corps of Engineers. The Corps supports an aquatic plant control research effort and broader DOD invasive species initiatives.

Department of the Interior

Bureau of Land Management (BLM). BLM has implemented an action plan, Partners Against Weeds, to prevent and control the spread of noxious weeds on public lands. BLM has adopted specific policies to address weed infestation, and has instituted a Communication and Environmental Education Plan. BLM also studies biological, chemical, and physical treatment protocols for invasive plants in the western United States.

Fish and Wildlife Service (FWS). The FWS focuses on efforts to prevent introductions and spread of invasive species. Its broad authority under the Endangered Species Act gives it some authority should a proposed introduction of a non-native species harm a protected species.

Geological Survey (USGS). The Biological Resources Division of USGS researches the invasion by non-native species and the effects of invasive species, particularly on DOI lands. USGS provides information through its National Biological Information Infrastructure. It manages the national Non-indigenous Aquatic Nuisance Species Data Base, as well as several regional databases.

National Park Service (NPS). Through fences and other techniques, the NPS works to remove or control large non-native animals on NPS properties. NPS is also testing potential biocontrol agents. It

has regulations to minimize the potential for the spreading of non-native species and can regulate or prohibit fishing on its lands.

Office of Surface Mining Reclamation and Enforcement (OSM). OSM allows the use of some non-native species in revegetating reclamation sites, but only if appropriate field trials demonstrate that such species are superior or necessary.

Department of State

The Department of State engages in negotiations, international treaty activities, and regional and bilateral efforts related to invasive species.

Department of Transportation

Coast Guard. Under the Non-indigenous Aquatic Nuisance Prevention and Control Act, the Coast Guard has responsibility for developing and implementing a ballast water management program to minimize the transportation of invasive species in the ballast water of ocean vessels.

Federal Highway Administration (FHA). The FHA develops guidelines for combating invasive species in vegetation along federally funded highways. The FHA also disperses information on biocontrol research and supports an inventory of invasive plant species.

Environmental Protection Agency (EPA)

EPA has developed ecological risk assessment guidelines for non-indigenous aquatic organisms, and created a web site publicizing the activities of the Aquatic Nuisance Species Task Force. EPA wrote the draft guidance for use by states and interstate planning bodies in developing management plans to qualify for federal funding under the Non-indigenous Aquatic Nuisance Prevention and Control Act of 1990. EPA also regulates invasive species by establishing criteria for the issuance of operations permits for aquaculture projects.

National Science Foundation (NSF)

The NSF funds basic and applied research on invasive species.

Smithsonian Institution (SI)

SI research centers measure the patterns, impacts, and management of non-native species invasions. Its scientists assist in the detection and identification of alien species.

Aquatic Nuisance Species (ANS) Task Force

The ANS Task Force is an intergovernmental entity consisting of seven federal agency representatives and ten ex-officio members. Federal agency members include the FWS, NOAA, EPA, the Coast Guard, the Army Corps of Engineers, USDA, and the Department of State. The task force's purpose is to implement the Non-indigenous Aquatic Nuisance Prevention and Control Act of 1990. It coordinates government efforts related to invasive aquatic species in the United States with those of the private sector and other North American interests.

Federal Interagency Committee for Management of Noxious and Exotic Weeds

The Committee is composed of federal agency representatives from USDA, DOI, DOT, DoD, and DOE. The Committee fosters integrated ecological approaches to management of non-native weeds on federal lands and provides technical assistance on private lands. It has published fact books and documentaries on invasive weeds.

PREVENTION AND CONTROL: STATE BEST PRACTICES

The accelerating number of costly invasive species introductions is causing states to investigate and develop new responses to the problem.

California's Pest Prevention Program

The California Department of Food and Agriculture's (CDFA) Pest Prevention Program is California's only comprehensive statewide program directed at preventing the introduction, establishment and spread of non-native species. CDFA's program has long recognized prevention as the most cost effective and environmentally safe method to manage invasive and exotic species. This comprehensive program is directed at insect pests, terrestrial and aquatic noxious weeds, exotic and injurious vertebrates, and plant or animal disease.

The four major components of the Pest Prevention Program are as follows:

- **Exclusion** — Exclusionary activities are directed at preventing the introduction of destructive pests into California and limiting the spread of these species within the state. This is accomplished through the Exterior Program, which conducts inspections at border stations and ports of entry, and the Interior Program, which facilitates inspections of nurseries and other commodities.

- Detection — The detection component is directed at finding incipient infestations before they become widely established. This proactive approach to detection includes use of traps and visual surveys on a statewide basis in cooperation with federal, local, and other state agencies.
- Control and eradication — Once an infestation is detected, CDFG conducts an extensive analysis of the situation and the feasibility of eradication. If eradication is feasible, treatment activities are initiated immediately, integrating various control methodology when appropriate. If eradication is not feasible, CDFG cooperates with the private and public sector on control and/or a suppression program. To accomplish this, CDFG administers a biological control program responsible for finding, rearing, releasing, and monitoring natural enemies to reduce exotic and invasive species populations to a nondestructive level.
- Pest identification and diagnosis — The pest identification and diagnosis component provides scientific support for all aspects of the Pest Prevention Program.

In addition, CDFG scientists actively participate in CDFG's Public Awareness and Outreach Program, which informs Californians on the threat of exotic and invasive species and the need to control or eradicate them.

Florida's Invasive Plant Management Program

The Florida legislature passed laws that direct the Department of Environmental Protection (DEP) to make rules governing the importation; transportation; and non-nursery cultivation, collection, sale, and possession of aquatic and upland plant species. DEP facilitates a multi-agency invasive plant management prevention program with the U.S. Department of Agriculture, the Florida Department of Agriculture, and several federal, state, and local governments to minimize the ecological and environmental damages of invasive plants. Through permits and inspections, DEP ensures that businesses are not selling or distributing prohibited species.

Florida's Invasive Plant Management Program aims to reduce the threat of aquatic and upland invasive species. DEP is the lead agency coordinating aquatic plant control in public waters and coordinates its efforts with the Fish and Wildlife Conservation Commission, the U.S. Army Corps of Engineers, and several state and local governments. Florida's upland invasive plant management strategy focuses on reducing the dangers of upland exotic plants, including increase of wildfire risk, loss of biodiversity, increase in land management costs, and loss of agricultural revenues. Through the use of chemical, mechanical, and biological control technologies, DEP's integrated control program

- targets the eradication of new populations of upland invasive plant species on Florida's public conservations lands;
- focuses on containment of large existing populations; and
- provides for maintenance control of populations of invasive exotic plants previously identified as targets for initial control.

During fiscal year 1998-1999, DEP funded thirty-four projects for controlling invasive exotic plants. DEP was able to control more than 12,000 acres of weeds utilizing resources available through eleven regional working groups, more than \$680,000 in local cost share/in-kind services, and \$1 million in

appropriated funds from the Florida Legislature. With the exception of 56 cents, all appropriated dollars were utilized for control operations.

DEP actively seeks funding for aquatic plant control. Funds available for fiscal year 1999-2000 total \$14,422,376, but falls about \$10 million below funds needed to eradicate the problem.

Invasive Species in Hawaii

Hawaii's Coordinating Group on Alien Pest Species (CGAPS) is an alliance of biodiversity, agriculture, health, and business interests established in 1995 to address invasive pest problems. The innovative quality of CGAPS is suggested by the fact that Alan Holt, CGAPS' first chairman, was invited to give a presentation on CGAPS at a United Nations Conference on Alien Species in Trondheim, Norway, in July 1996. Holt's presentation was well received at the meeting, and CGAPS has since been looked to by many as a national and world model.

Grassroots efforts are underway on several Hawaiian islands to deal with incipient invasions. Working together on Maui to address the perceived threat of invasion was stimulated by the threat to conservation lands from three aggressively invasive species in the plant family Melastomataceae. A Melastome Action Committee (MAC) was formed in August 1991 through the initiative of the Maui Land and Pineapple Co. and the Maui County Resource Conservation and Development Office of USDA. Since then, they have been meeting regularly and combined their efforts with several state, private, and federal entities. The U.S. Fish and Wildlife Service and the Hawaii National Guard have recently become active participants. Activities of the Committee include public education; providing information to the Hawaii legislature and Maui County; and planning, coordinating, and facilitating cooperative chemical, mechanical, and biological control programs.

In December of 1997, MAC members decided to form a group that would address Maui County's invasive pest species problems beyond the Melastomataceae family. This group, the Maui Invasive Species Committee (MISC), is a voluntary partnership of private, government, and nonprofit organizations to prevent new pest species from becoming established in Maui County and to stop newly established pests from spreading wherever possible. The MISC works to enhance the effectiveness of pest prevention and control through communication and coordinated planning. The group measures progress in terms of pest infestations prevented, contained, or eradicated, and avoids the creation of new bureaucratic processes. MISC was successful in raising nearly \$800,000 from federal, state, county, and private sources in fiscal year 1999.

Other islands followed Maui's lead. Hawaii established The Big Island Invasive Species Committee (BIISC) in early 1999. BIISC is working to emphasize the importance of an island-wide forum for discussion and promoting local public awareness of non-native species issues. In April 1998, Oahu formed the Oahu Invasive Species Committee (OISC), which targets a dry land invasive fountain grass and has had considerable success in removing and/or controlling populations of this pest using volunteer labor. Recently, OISC obtained funding to hire two field personnel and is in the process of expanding to include control efforts against other incipient pest species. Kauai is in the process of forming an island Invasive Species Committee. Oahu and Kauai have a great advantage in that the dreaded species miconia was discovered at an early stage and is under control and near eradication. It

is becoming increasingly clear that each island has a different mix of agencies, personalities, interests, and strengths that it can uniquely contribute toward effective grassroots action against invasive species that pose common island-wide threats.

The Montana State Weed Management Plan

As a result of an October 1998 Montana Weed Summit, four working groups were organized and have been meeting regularly. The Weed Management Task Force, Prevention Task Force, Research Task Force, and Education Task Force will incorporate their research and results into a new Montana State Weed Management Plan. The new plan will be presented at a follow-up Summit in October 2000. With the active support of Governor Marc Racicot, the Montana Weed Management Plan is currently being updated to prioritize invasive weeds. The plan will contain a strategy for controlling current invasive weeds, and for preventing and managing future invasions. The Research Task Force is also developing a plan for support of needed research to solve problems associated with the invasion of weeds in the state.

Montana also maintains an invaders database for plants to help determine the potential invasiveness of plants in and around Montana. With support from the U.S. Forest Service, the invaders database has been expanded to include regional statistics.

Other programs that manage invasive plants and animals in Montana include:

- The Statewide Education and Awareness Campaign — This program is designed to provide information on the seriousness of the weed problem in Montana, and tools and programs that are available to help combat the problem.
- The Montana Noxious Weed Trust Fund Grants Program — This program encourages the development of weed management areas and cooperative weed control programs across all land ownerships.
- The Montana Noxious Weed List Advisory Committee — This committee reviews request for plants to be added to the state noxious weed list. The committee makes recommendations based on the location of the plant in the state or region, and by identifying potential problems the plant may cause in a variety of regions in and around Montana.

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