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Invasive Species: Issues in Brief

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Summary

For the first few centuries after the arrival of Europeans in North America, plants and animals of many species were sent between the two continents. The transfer of non-natives consisted not only of intentional westbound species ranging from pigs to dandelions but also of intentional eastbound species, such as gray squirrels and tomatoes. And for those centuries, the remaining non-native species crossing the Atlantic, uninvited and often unwelcome, were ignored if they were noticed at all. They were joined by various species arriving deliberately or accidentally from Asia and Africa. The national focus on invasive species arose in the 19th century, primarily owing to losses in agriculture (due to weeds or plant diseases), the leading industry of the time. A few recently arrived invasive species, and estimates of adverse economic impacts exceeding $100 billion annually, have sharpened that focus.

Very broadly, the unanswered question regarding invasive species concerns whose responsibility it is to ensure economic integrity and ecological stability in response to the actual or potential impacts of invasive species. As this report shows, the current answer is not simple. It may depend on answers to many other questions: Is the introduction deliberate or accidental? Does it affect agriculture? By what pathway does the new species arrive? Is the potential harm from the species already known? Is the species already established in one area of the country? Finally, if the answers to any of these questions are unsatisfactory, what changes should be made?

The specific issue before Congress is whether new legislative authorities and funding are needed to address issues related to invasive species and their increasing economic and ecological impacts on such disparate matters as power plant operations, grazing lands, and coral reef fishes. Such legislation could affect domestic and international trade, tourism, industries dependent on importing non-native species and those dependent on keeping them out, and, finally, the variety of natural resources that have little direct economic value and yet affect the lives of a broad segment of the public.

In the century or so of congressional responses to invasive species, the usual approach has been an ad hoc attack on the particular problem, from impure seed stocks to Asian carp in the Chicago Sanitary and Ship Canal. A few notable attempts have begun to address specific pathways by which invasives arrive (e.g., ship ballast water), but no current law addresses the broad general concern over non-native species and the variety of paths by which they enter this country. A 1999 executive order took a step in bringing together some of the current authorities and resources to address a problem that has expanded with both increasing world trade and travel and decreasing transit time for humans and cargo. Multiple bills have been introduced on this subject in recent Congresses as well as in the 114th Congress.

There are two basic approaches to addressing invasive species: a species-by-species assessment of the risks or benefits of admitting or excluding species, and a policy based on controlling pathways of entry in which vigilance is maintained on incoming ballast tanks, cargo holds, packing materials, and similar vehicles for unwanted organisms. These two approaches may complement each other. Policymakers also have the choice of an emphasis on preventing the arrival or establishment of more invasive species versus post hoc control of species that have already arrived and become established.

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Introduction

A full list of the damaging biological and economic effects of invasive plants and animals risks sounding like hyperbole.[1] It includes loss of western rangelands to invasive plants, blockage of power plant intakes to invasive mussels, and major declines of birds and mammals to invasive snakes in the Everglades. So vast is this "bioinvasion" (as some have termed it) that only rough estimates can be made of the numbers of non-native species now in North America or in the rest of the world. Moreover, despite a few rare successes, eradication of these species, once they become established, is extremely improbable.[2] But because of the number and variety of non-native species, it is unclear how best to manage or prevent these effects or what legislation would be needed to address these problems.

Laws concerning wild plants and animals do not form a comprehensive body at the federal level. Under the U.S. system, inherited from English legal tradition, the government regulates the taking of native wild animals generally while landowners control the native (and other) plants growing on their lands. Thus, colonial governments regulated native wild animals (to the extent there was regulation of the take of wild animals at all) and, after the U.S. Constitution was ratified, states retained the rights they had as colonies to control the wildlife within their boundaries.[3]

With states retaining the regulation of wildlife, the majority of wild plant and animal species are not federal responsibilities under current law. Moreover, because the problem of invasive species presents itself as a series of seemingly disconnected crises, legislation has become a patchwork, enacted as each crisis was addressed. The absence of a general federal responsibility for wildlife affects the federal role in addressing invasive species.

A local or state government, faced with the recent arrival of a new invasive species—whether terrestrial, freshwater, or marine; plant or animal; agricultural pest or recreational nuisance—has no single source to query to begin its response or guide it through a maze of options. Moreover, federal help, especially any timely help in the weeks or months after initial discovery, is rare to nonexistent and, if forthcoming, focuses more on information and less on practical assistance.

The National Invasive Species Council (NISC) was created by Executive Order 13112 in 1999, and has addressed some aspects of the invasive species problem. It has taken steps toward sharing more information across governments and with the public. NISC asks specific agencies to take the lead in developing policies within their existing legislative mandates. In its 2008-2012 report, NISC outlined a set of actions to address the bulk of existing problems.[4] These actions include

[1] For more information on the scale of invasions, see the companion CRS Report R43258, *Invasive Species: Major Laws and the Role of Selected Federal Agencies*, by (name redacted) and (name redacted).

[2] Control, rather than eradication, is nearly always the main option once a species is widely dispersed. The authors in the course of their research discovered very few instances (e.g., smallpox, nutria in East Anglia, UK) of control measures on a well-established species leading to long-term eradication. For an example of a recent eradication, see "Hawadax Island recovery exceeding expectations" at http://www.fws.gov/alaska/external/newsroom/pdf/13-20_hawadax_island.pdf. The success of the intensive rat eradication project on a remote island in the Alaska Maritime National Wildlife Refuge resulted in nesting seabirds recolonizing Rat Island, which was renamed Hawadax Island in 2012. For very recent arrivals, eradication may be possible. In contrast, prevention (including a reduction in the number of non-natives establishing breeding populations each year) probably is more feasible.

[3] For a general discussion of early development of federal wildlife law, see *The Evolution of National Wildlife Law*, 3rd ed., by Michael J. Bean and Melanie J. Rowland (Westport, CT: Praeger Publishers. 1997), pp. 7-14.

[4] National Invasive Species Council (NISC), *2008-2012 National Invasive Species Management Plan*, at
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developing legislative proposals to fill gaps in current law. However, legislative efforts to date have tended to focus on well-established problems: the invasion of a single species, a specific pathway of introduction, or damage or risks to agriculture.

Unusually Susceptible Habitats

Invasive species occur throughout the United States, but some ecosystems are more susceptible to invasion than others. Hawaii and Florida are perhaps the major examples of this phenomenon in the United States. Both states have many threatened and endangered species and, not coincidentally, many invasives, and both were long isolated biologically and have a number of native species found nowhere else. The mild climates of Hawaii and Florida make it easier for the rich flora and fauna from other tropical and semitropical regions to survive, and they also make the states attractive to businesses that import, maintain, or breed non-native animals and plants, such as tropical fishes and ornamental plants.

Another factor putting some environments at risk is the plethora of opportunities for new introductions. Easy transportation access increases the likelihood of invasion in aquatic habitats such as the Great Lakes.[5] Seaports, where many ships exchange ballast water, are at particular risk. Even if only a tiny fraction of newly arriving non-native species survive in San Francisco Bay or Chesapeake Bay, the actual number of successful invasive species may be very large. The areas around airports, with increased levels of international traffic and tourism, also are at risk.

Pathways of Invasion

Between or within countries, some pathways for species invasions already are well-known. They include transportation corridors, intentionally imported non-native pets, landscaping plants, aquaculture, and non-native organisms deliberately released for propagation in the wild.[6]

To some extent, the pathways of invasion between countries can be predicted. For example, brown tree snakes have a propensity to hide in dark places, and the damage they have caused on Pacific islands such as Guam has done much to focus attention on air stowaways. The arrival of a number of beetle species has played a similar role in focusing attention on pallet wood, packing crates, live plants, and airport warehouses as pathways and centers of biotic invasion. Legally shipped live animals or plants may harbor microorganisms, parasites, or seeds that pose a danger to other species, even if the animal or plant itself does not survive in the wild. In general, any arrival of living or untreated material offers a possible pathway for biotic invasion. A comprehensive review of possible pathways, their risks, options for control, and research needs is, to the authors' knowledge, currently lacking.[7]

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http://www.invasivespeciesinfo.gov/council/mp2008.pdf. (Hereinafter cited as *NISC Management Plan*.)This report has not been updated.

[5] See U.S. Environmental Protection Agency, "Invasive Species," at http://epa.gov/greatlakes/invasive/index.html for a list of invasive animals and plants in the Great Lakes area.

[6] For a discussion of these pathways, see CRS Report R44011, *Invasive Species: Control Options and Issues for Congress*, by (name redacted) and (name redacted).

[7] However, an expert at NISC stated "working with [the Aquatic Nuisance Species Task Force], we [NISC] have been updating work on pathways from 2005 and 2007 to include a revised set of pathway diagrams that will include links to available guidance. The revisions to the diagrams are complete and we are now going through a process to update our (continued...)

Predicting an Invasion: Black and White?

Federal laws have tended to focus on *black lists* (anything not on the list is allowed) in contrast to *white lists* (anything not on the list is excluded). Each requires some, or even considerable, knowledge of the species to be listed to predict the likelihood of invasion.

A black list can be prepared in various ways, but usually it is made up of species already shown to cause serious damage to fisheries, endangered species, or (especially) agriculture. This evidence may be based on experience with the species domestically or in other countries. Preventing the spread of the species after it enters the United States may rely on public education, penalties for shippers, monitoring, and other means. In general, black lists require time to gather information on the damage created by the species and then proceed through a regulatory response. This approach allows more flexibility for industries that depend on the importation of new species of plants or animals. Black lists do not readily address introductions by persons who are unaware that they are bringing in non-native organisms.

With the white list approach, there is an attempt to predict potential harm before a species' arrival. The prediction would be based on known characteristics of a species, such as how it reproduces, the number of seeds or offspring, etc. Any species not on the list would be excluded. The mongoose, for example, has a history of becoming a pest on islands where it has been introduced. It seems unlikely that the mongoose would ever be placed on a (white) list of allowable species. In contrast, new varieties of orchids, sheep, tulips, or any other species with a long track record in this country likely would gain admission.

The existence of a list, whether white or black, implies that importers actually know they are importing living organisms. An effort to prevent unintentional introductions would be compatible with any shade of list or no list at all. Potential pathways for unintentional introductions continue to be discovered, and there are likely other pathways yet to be determined.

Issues for Congress: Actions and Approaches

Federal laws concerning invasive species form a patchwork, stronger in some areas, such as agriculture and ballast water, and weaker or absent in other areas.[8] Current laws do not clearly address

- prevention of biological invasion across foreseeable pathways (with the exception of ship ballast water); or
- early detection and rapid response (EDRR) before the establishment of the new species, when the focus of effort shifts from less expensive prevention to more expensive and less efficient control.

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website to enable this function on-line. This work may provide a useful structure for categorizing the pathways.... Our three main categories of pathways are 1) trade and living industry (e.g., landscaping plants, aquaculture, pets); 2) transportation (e.g., ballast water, hull fouling); and 3) infrastructure and resource management (e.g., introductions for erosion control, canals/waterways, waste disposal)." Stanley Burgiel, NISC, Dec. 1, 2014. Personal communication.

[8] For more information, see CRS Report R43258, *Invasive Species: Major Laws and the Role of Selected Federal Agencies*, by (name redacted) and (name redacted).

Coordination of current efforts alone means that gaps will remain if they are due to lack of coverage by existing laws or agency jurisdiction. Congress could choose to address these gaps either by explicitly delegating such authority to the President or by crafting legislation.

Federal Agency Actions: Patchwork and Gaps

NISC has become the focus for federal efforts to control and prevent invasive species affecting a broad range of industries or ecosystems. However, gaps in authorities or shortages of personnel that have hampered efforts to limit the entrance of and damage from invasive species continue. Four agencies have had major roles in addressing invasive species for many years: Animal and Plant Health Inspection Service (APHIS), U.S. Army Corps of Engineers, Fish and Wildlife Service (FWS), and National Marine Fisheries Service.[9] Yet even for these four agencies, important gaps in their authorities remain.[10]

Approaches to Regulation: Species-by-Species Versus Pathways

Legislation to address invasive species could take a species-by-species approach, a pathway approach, or a combination of the two. The species approach implicitly assumes knowledge about a species' risk (black list) or safety (white list). A central dilemma, however, is the difficulty in making this prediction.[11] Moreover, it assumes knowledge that a particular species actually is being imported. A pathway approach does not assume knowledge about any particular species, only that a particular set of circumstances favors the arrival of unwanted organisms.

Some agencies, including APHIS and FWS, analyze the risk presented by particular species that may become invasive. However, addressing the multitude of agricultural pests relies on scarce agency resources at APHIS. In addition, FWS has been criticized for its slow response to the blacklisting of species under the Lacey Act.[12] Both agencies would benefit from faster assessments of either species or pathways so they could direct resources to the most critical areas.

Regulation by pathway is an approach suited to unintentional or unknowing introductions, as no list needs to be created. Among the most comprehensive pathway approaches to date has been the Non-indigenous Aquatic Nuisance Prevention and Control Act.[13] Its goals put prevention on an equal or higher footing compared with control of species that are already established. It requires the participation of several federal agencies, promotes research, and implements regulations on the mid-ocean exchange of ballast water and other measures to exclude invasives from U.S. ports.

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[9] Many other federal agencies have had some role, however. Their current roles, responsibilities, and statutory authorities are described in the companion CRS Report R43258, *Invasive Species: Major Laws and the Role of Selected Federal Agencies*, by (name redacted) and (name redacted).

[10] Specific gaps in their authorities are described in CRS Report R43258, *Invasive Species: Major Laws and the Role of Selected Federal Agencies*, by (name redacted) and (name redacted)

[11] One method used to predict such risks is that of Hazard Analysis and Critical Control Points (HACCP) to create a stepped analysis of the critical points at which an invasion may be prevented or stopped. For a sample HACCP analysis (applied to the risk of transporting invasive species during the harvest of aquatic weeds), see seagrant.uconn.edu/whatwedo/ais/mechanical.doc.

[12] The Lacey Act of 1900 has two different functions: it bars importing species found to be injurious to the United States (18 U.S.C. §§42-43) and addresses illegal wildlife trade to protect species at risk (16 U.S.C. §§3371-3378).

[13] P.L. 101-646 (104 Stat. 4761, 16 U.S.C. 4701); this law was amended by the National Invasive Species Act (P.L. 104-332).

Future Legislative or Policy Options

A review of writings by various specialists in this field suggests a number of areas that might be explored by policymakers.[14] The list below is compiled from many sources. Not all would require new legislation; some might benefit from congressional oversight.

- **Research to identify pathways**. Research goals in this area might overlap with research designed to prevent certain kinds of security threats and might benefit from cooperation with agencies involved in antiterrorism programs.
- **Expert review of planned releases**. Panels of experts might be created to analyze risks and make recommendations on planned releases by governmental or nongovernmental sources into any environment in which species are not native. According to NISC,[15] steps along these lines are planned. For instance, experts could provide a public warning on planned releases of exotic grasses by federal agencies or of non-native game fish. In addition, various exotic plants are proposed as feedstocks for biofuels, and such a release might benefit from expert review.[16]
- **Educational campaign**. An educational campaign to prevent inadvertent acts by the public might help prevent some invasive species introductions.[17] This type of approach might be particularly effective at preventing releases of exotic pets and aquarium species after the point of sale.
- **Warning list**. An informational *warning list* (or *gray list*) of species might be created by the collaboration of federal and state agencies. The warning list might include species currently restricted under state laws, species thought to be newly arrived from other countries, and other species felt to merit special attention by regulators.[18] Although a gray list would lack regulatory force at the federal level, it could be designed to provide information on species whose eradication or control is in its early phases.
- **Review of industries dependent on importing and transferring non-native species**. Such a review could include a focus on cooperative methods to reduce releases after the point of sale. The focus of past efforts has tended to be on the

[14] Over the years, Congress has considered many issues related to particular invasive species. The list of options above focuses only on topics that cover a broad range of species, pathways, or agencies.

[15] *NISC Management Plan*, pp. 32-33.

[16] Adam S. Davis, Roger D. Cousens, and Jason Hill, et al., "Screening bioenergy feedstock crops to mitigate invasion risk," *Frontiers in Ecology and the Environment*, vol. 8, no. 10 (December 2010), pp. 533-539.

[17] Although Smokey Bear has become a widely recognized symbol of an educational effort to prevent human-caused wildfires, other such efforts have been less successful. For example, the Forest Service's other symbol, Woodsy Owl, has been far less effective in reducing pollution and littering. In the early 1960s, the U.S. Department of Agriculture attempted to create the character "Pestina" to help educate the traveling public to the perils of non-native species imports. There was little effort to evaluate effectiveness and little work with private and other federal agencies. The program was eventually dropped. (U.S. Congress, Office of Technology Assessment (OTA), Harmful Non-Indigenous Species in the United States, OTA-F-565 [Washington, DC: U.S. Government Publishing Office, September 1993], p. 142.) "Sammy Soil," however, has been a soil conservation icon at the Natural Resources Conservation Service since 1967 and is featured in his own coloring book, *The Adventures of Sammy Soil*.

[18] Appendix III of the Convention on International Trade in Endangered Species could provide a model for this type of approach. A nation may list any species native to it under this Appendix; through listing, it requests the assistance of other member nations in controlling imports of that species when they arrive from the host nation.

entry of these species into the United States. To protect their businesses, import-dependent industries naturally have tried to reduce current obstacles and to prevent imposition of new ones. Yet there are other avenues to reduce risk besides prohibition. These avenues might include incentives for the sale of sterile animals or plants only[19] or efforts to create point-of-sale educational programs about the risk of, or penalties for, releasing pets or plants into the wild.[20]

- **Measures to reduce the risk of exporting invasive species**. The United States might take further internal steps to avoid exporting potentially invasive species to other countries. These measures could be as simple as preventing their accidental export in bilateral aid programs or certifying that identified U.S. products (e.g., used tires) are free of pests. Such certification is done for agricultural shipments. A review might examine disaster aid and emergency relief, for example; in the rush to provide humanitarian relief, shipments of supplies, equipment, and personnel may inadvertently introduce diseases or pests unknown in the receiving country. Because such supplies sometimes are prepared for shipment in advance, they could be examined to reduce the risk of such transfers.[21]
- **Multi-agency federal or cooperative center for first-strike prevention and control**. Since the creation of NISC, agencies have begun to respond across a broad front in the days, weeks, or months after an invasion is discovered. NISC is beginning to model its efforts on interagency fire management, a federal program that has long faced similar issues.[22] It seems possible that a similar center devoted to first-strike prevention and control of invasive species, regardless of affected industry, ecosystem, or lead agency, could provide critical support at a time when eradication of a new animal or plant invader still might be possible.

These options are not mutually exclusive. They likely would be under the jurisdiction of multiple committees in both the House and Senate. They may offer opportunities for savings both to the economy and to ecosystems.

[19] Some local laws already make a similar distinction favoring sterilized animals by charging a lower licensing fee for dogs that have been spayed or neutered than for intact dogs. The authors are unaware of any similar benefit for sterilized animals at the federal level.

[20] The Wild Bird Conservation Act (16 U.S.C. 4901 et seq.) could provide a model for legislation if the goal is to encourage homegrown (if not native) species over additional foreign imports.

[21] In the case of introduced human diseases, a tragic example occurred after a major earthquake in Haiti in October 2010. Nepalese soldiers arriving under United Nations auspices apparently inadvertently introduced cholera (*Vibrio cholerae*) into an already catastrophic situation. Cholera had been unknown in Haiti for many decades before the earthquake. See Alejando Cravioto, et al., *Final Report of the Independent Panel of Experts on the Cholera Outbreak in Haiti*, at http://www.un.org/News/dh/infocus/haiti/UN-cholera-report-final.pdf.

[22] Wildfire management is addressed by the federally coordinated National Interagency Fire Center, coordinated primarily through the Bureau of Land Management. All federal land managing agencies participate, and a great deal of the program focuses on work with tribal, state, and local governments to bring many diverse resources to bear on major fires.

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