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Invasive Species: A Brief Overview

An *invasive species* is a nonnative (also known as an *alien)* species that does or is likely to cause economic or environmental harm or harm to human health. The human-mediated spread of species has occurred throughout history. However, as society has become more globalized, opportunities for the spread of nonnative and invasive species have increased (e.g., trade shipments can carry species and introduce them to many different regions of the world). In addition, changing environmental, ecological, and socioeconomic conditions could alter the risk for invasive species introductions in the future.

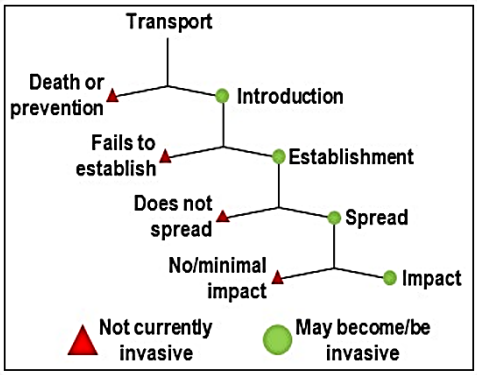
Invasive species include terrestrial and aquatic plants, animals, and microbes. Their introduction—whether deliberate or unintentional—can pose threats to native animal and plant communities, can lead to ecosystem disruptions, and may contribute to extinctions of native species. Invasive species also can directly cause or transmit threats to human health. The introduction and spread of invasive species also can result in significant economic costs related to damages as well as management, mitigation, and recovery activities. As of 2011, researchers at Cornell University estimated that approximately 50,000 nonnative species have been introduced to the United States, with potential related costs exceeding $100 billion per year. Inherent in any calculation of the costs of invasive species, however, is valuation of economic and societal factors on which expert opinion differs.

Terrestrial and aquatic invasive species can cause environmental degradation and threaten certain U.S. industries, such as agriculture and fisheries. Impacts can include power outages, contamination of agricultural commodities, spread of diseases, increased operating costs, loss of irrigation water, competition with native plants, loss of sport game or endangered species, and ecosystem disturbance. For example, among other impacts,

- Burmese pythons (*Python bivitattus*) have multiplied in south Florida and prey on native species of reptiles, birds, and mammals;
- zebra mussels (*Dreissena polymorpha*) and quagga mussels (*Dreissena rostriformis bugensis*) from Eastern Europe have clogged intakes for urban water supplies and nuclear power plants in the Great Lakes and compete with native species;
- citrus greening (*Candidatus Liberibacter asiaticus*) or Huanglongbing, a citrus plant disease originating from Asia, is spread by disease-infected insects and infects citrus trees, threatening the U.S. citrus industry;
- the light brown apple moth (*Epiphyas postvittana*), a native pest of Australia, has spread to the United States and is causing damage to a range of commercial fruit and vegetable crops; and
- leafy spurge (*Euphorbia esula*) has reduced the forage value of western grazing land, resulting in lower overall value to private landowners.

A Simplified Model of the Invasion Process

The invasion process consists of multiple stages. At any stage, the species may fail to progress to the next stage of invasion, leading to a significant disparity between the number of species transported and those that ultimately become invasive.



1. **Transport:** Movement of a species from its source location (where the species is native, has already invaded, or is temporarily present) to a recipient location. Movement occurs as the result of a pathway (the economic or cultural forces driving the movement, e.g., commercial trade) via a vector (the agent responsible for moving a species, e.g., ballast water).
2. **Introduction:** Deposit of a species in a novel location, which may occur through a deliberate (e.g., planting of ornamental species) or an unintentional (e.g., incidental introduction through the offloading of ballast water) action.
3. **Establishment:** The point at which a species becomes self-sustaining, without additional human intervention.
4. **Spread:** The increase of a species' population and expansion beyond the point of initial establishment. Secondary transport pathways and vectors also can facilitate the spread of species (e.g., regional trade and personal water craft).
5. **Impact:** The economic, ecological, or health impacts of the species in the novel location. To be considered invasive, a non-native species must cause or have the potential to cause a negative impact in the receiving location.

Resource managers, at the federal, state, local, and other levels, may choose to address invasive species in numerous ways (see "Management"). After establishment, some invasive species may persist at a small population before undergoing a population increase and spread. This is often referred to as a lag phase, during which detecting a species can be difficult or impossible.

Figure Source: Adapted from Julie L. Lockwood et al., *Invasion Ecology*, 2nd ed. (West Sussex, UK: Wiley-Blackwell, 2013), p. 14.

Table 1. Estimated Federal Funding for Invasive Species Activities, FY2017, Enacted (dollars in thousands)

	USDA	DHS	ACE	DOI	EPA	DOS	Other	Total	% Total
Prevention	116,630	920,338	30,963	11,077	59,000	994	273	1,139,275	38%
Early Detect. / Rapid Resp.	320,562	0	19,726	17,413	—	792	250	358,743	12%
Control / Management	685,511	0	58,371	48,451	—	12,121	100	804,554	27%
Research	382,953	0	9,085	5,335	107	2,002	2625	402,106	13%
Restoration	91,479	0	13,302	18,890	0	0	199	123,871	4%
Educ. / Public Awareness	149,356	0	6,985	572	—	128	1115	158,156	5%
Leadership / International	2,475	0	1,851	2,000	0	2,454	69	8,849	<1%
Total	1,748,966	920,338	140,283	103,738	59,107	18,490	4,632	2,995,553	100%
% Total	58%	31%	5%	3%	2%	1%	<1%	100%	

Source: CRS. Data from National Invasive Species Council (NISC), "Invasive Species Interagency Crosscut Budget," January 25, 2018, https://www.doi.gov/sites/doi.gov/files/uploads/crosscut_25january2018.pdf.

Notes: USDA (Dept. of Agriculture); DHS (Dept. of Homeland Security); ACE (Army Corps of Engineers); DOI (Dept. of the Interior); EPA (Environmental Protection Agency); DOS (Dept. of State); Other includes Dept. of Transportation, National Aeronautics and Space Administration, and Dept. of Commerce. Does not include funding for U.S. Agency for International Development. Data are self-reported by the federal agencies engaged in these activities and are not independently compiled. According to NISC, values are conservative estimates of agency expenditures on invasive species. Totals and percentages may not add up due to rounding.

Management

Managing invasive species often involves multiple efforts throughout the stages of invasion (see **text box**). Prevention of transport and/or introduction is the primary means to avoid a new invasion. When an invasive species is introduced, control efforts may involve eradication where possible and, where not possible, efforts may reduce populations to manageable or tolerable levels. Early detection and rapid response (often by federal agencies) to eradicate invasive populations before they become established can be critical to manage invasive species.

Federal Framework for Invasive Species Management

Federal efforts to control invasive species have included both administrative and legislative actions. For example, several executive orders (EOs) have provided an overarching federal framework to address invasive species. In 1977, President Carter signed EO 11987, which required federal agencies to restrict the introduction of "exotic organisms." In 1999, President Clinton signed EO 13112, which revoked EO 11987, extended federal requirements to address invasive species, and established the interagency National Invasive Species Council (NISC). NISC provides national leadership in addressing invasive species. It is cochaired by the Secretaries of the Interior, Agriculture, and Commerce. In 2016, President Obama signed EO 13751, which expanded the membership of NISC and increased the responsibilities of federal agencies to prevent and respond to invasive species.

Several statutes provide federal agencies authorities to address invasive species in the United States. The current statutory framework includes broad environmental laws and laws that directly address invasive species. For example, the Nonindigenous Aquatic Nuisance Species Act, as amended (16 U.S.C. §§4701 et seq.), and the Noxious Weed Control and Eradication Act of 2004 (7 U.S.C. §§7781 et seq.) are tailored to species' groups or habitats. Broad statutes also can provide authority to address invasive species based on their impacts and include the Endangered Species Act (16 U.S.C. §§1531 et seq.), the Lacey Act (18 U.S.C. §42, 16 U.S.C. §§3371-3378), and the National Environmental Policy Act (42 U.S.C. §§4321 et seq.).

Federal Funding for Invasive Species Activities

Several federal entities share the responsibility to manage invasive species. In FY2017, the U.S. government spent an estimated $3.0 billion across a range of federal agencies and activities in an effort to prevent, control, and eradicate invasive species domestically (**Table 1**). Activities at the U.S. Department of Agriculture, including those related to agriculture, national forests, and the Animal and Plant Health Inspection Service, accounted for the bulk of federal funding, nearly $1.7 billion (58% of total funds). Activities at the Department of Homeland Security, including border protection and security, accounted for about $0.9 billion (31% of total funding). The remainder of federal funding, about $0.3 billion (about 11% of total funding), covered activities across other departments and agencies, including the Departments of the Interior and Commerce.

For more background, see CRS Report R43258, *Invasive Species: Major Laws and the Role of Selected Federal Agencies*.

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