INVASIVE SPECIES IN THE UNITED STATES

- Invasive species harm our Nation's environment, human health, and economy, directly and indirectly costing the United States over $100 billion per year.
- Invasive species are the cause of more than 50 percent of native species being classified as either endangered or threatened.
- Invasive species cause harm to our Nation's native fish and wildlife resources.
- Zebra and quagga mussels and other aquatic invasive species reduce the quality and quantity of recreational opportunities, clog water delivery systems, and damage essential infrastructure.
- Public awareness and coordinated action among local, state, federal, and tribal governments as well as private entities and stakeholders is essential to invasive species prevention and control efforts.
- Our Nation needs to increase awareness and foster coordinated action to address invasive species issues, and to examine laws, policies, and creative and efficient approaches to prevent the spread and introduction of invasive species because:
    - Preventing and controlling invasive species supports our Nation's economic well-being and productivity.
    - Invasive species pose a persistent threat to our native fish and wildlife resources.
    - A coordinated approach to advance efficient and cost-effective regulatory, outreach, and management approaches will lessen the economic impact of invasive species.

NISAW

National Invasive Species Awareness Week

The Economic Impact of Invasive Species in the United States – Regional Case Studies

"Nonindigenous invasive species may pose the single most formidable threat of natural disaster of the 21st century. The threat of invasive species is perhaps our most urgent economic and conservation challenge."

~ Joint NASA / U.S. Geological Survey invasive species project

Ways in which invasive species pose an economic burden:

- Reduced grazing potential
- Alteration of fire regimes
- Reverse salmon recovery efforts
- Fewer recreational opportunities
- Loss in agricultural productivity
- Reduced ability to export goods
- Reduced property values
- Disease in domesticated livestock populations

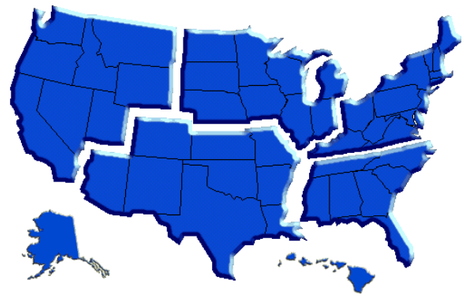
The causes of species extinction are, in order of magnitude of impact on biodiversity . . . Habitat destruction, Invasive species, Pollution, human over-Population . . .

~ Edward O. Wilson

The Economic Impacts of Invasive Species in the United States

Invasive species are forever altering the natural areas that make our country so unique. Invasive species outcompete native plants and animals, devastating industries, communities, and native cultures that rely on the country's natural resources. They also degrade waterways, harming water quality and limiting recreational opportunities.

The estimated damage from invasive species worldwide totals more than $1.4 trillion, or five percent of the global economy. The annual U.S. cost from invasives is estimated to be $120 billion, with more than 100 million acres affected (i.e., about the size of California). A NASA report, heralding a novel effort to monitor the progress of alien species via satellite, placed the economic cost of invasive species in the United States between $100 billion and $200 billion.



Emerald Ash Borer

Looking out of a tall building in fall over a typical Midwestern city like Madison, the capitol of Wisconsin, the brilliant gold and red blush of ash leaves make the ash trees stand out against the maples, oaks, and walnut trees. This color highlights the gap that the loss of the 21,700 estimated ash trees would leave along the streets and parks of just one city once the wood boring pest emerald ash borer arrives. Emerald ash borer kills ash trees unless individual trees are protected with regular doses of insecticides that can cost hundreds of dollars for a single large, valuable tree. Ash trees are comprise about 7 percent of the tree cover in the northern hardwood forests of the Midwest and about 9 percent of the urban tree cover. The USFS estimates the removal and replacement of the 17 million ash trees in about 25 states to cost $10.7 billion dollars in affected communities alone, excluding forest lands. Projections on the cost to households and forest landowner losses are not included in this estimate. In addition, the loss to households is estimated to be about $350 million dollars, with another $380 million in estimated property value loss.

Emerald ash borer is destructive, but it is not a strong flyer. Once established in an area with ash trees, it will move about ½ mile per season. But this species occasionally hitches a ride on firewood and other untreated logs. It arrived in North America sometime before June 2002 from its native range of eastern Russia, northern China, Japan, and Korea, likely in untreated ash wood used in packaging or crating. Stopping the long distance transport of untreated wood will reduce the risk of moving other damaging wood boring pests. Investing in biological control and research on both urban and wildland forest management will provide options for managing emerald ash borer and other forest pests.

Table 1. Examples of the economic effects of invasive species.

Industry/Area Affected	Invasive Species	Cost
Agriculture (U.S. cotton industry)	Boll weevil	$50 billion dollars (total cost since 1890s)
Western U.S. rangelands	Leafy spurge	$110 million in 1990
Canadian agriculture	Weeds	$2.2 billion annually
U.S. agriculture	Weeds	$30.6 billion in control costs and production losses
Western U.S. forests	Asian gypsy moth	$20 million eradication campaign
U.S. waterways	hydrilla and water hyacinth	$100 million annually
Aquaculture industry in Washington	Non-native *Spartina*	$26 million since 1996
U.S. infrastructure	Zebra mussels	$1.12 billion in control costs and damages
Eastern U.S. forests	Gypsy moths	$764 million in 1981
Canadian rangeland and wetlands	Purple loosestrife	$20 million in 2008
Canadian rangeland and agriculture	Cheatgrass	$10 million in 2008

Asian Carp and the Great Lakes

The images of hundreds of silver carp leaping out of the water are a dramatic view. Fish surveys in Mississippi River areas that used to support many species, from paddlefish to gar, now find Asian carp species comprising almost 95% of the biomass at some sampling sites. Black, bighead, and silver carp are species of Asian carp that were introduced intentionally from Eurasia to fish farms in the Gulf states to eat algae. Flooding and accidental transport allowed these species to move out of aquaculture areas and into river systems. Asian carp are changing the Mississippi River system. Their impact on the Great Lakes is unknown, but is a concern to the people who live here. More than $80 million has been spent fighting Asian carp in the past two years from federal Great Lakes funds.

Knotweeds and Garden Introductions

In retrospect, it's difficult to understand why a plant like knotweed was imported as a garden plant in the late 19th century from Asia to the United Kingdom (UK) and later to North America. Hybrid knotweed kills any plant trying to grow nearby, while spreading rapidly by underground runners. In the UK, Japanese knotweed, which grows sturdy bamboo-like canes that are about 10 feet fall, is considered to be a threat to pavement, sidewalks, and house foundations as new shoots can push into and expand small crevices with unfortunate results—mortgage lenders may avoid funding the purchase of a property with a patch of knotweed within 10 meters of a building. Given the toughness of the plant and the difficulty removing it upon establishment, country-wide control in the UK was estimated at $2.45 billion in 2004.

In the Midwest, Japanese knotweed and giant knotweed are spreading along stream banks, roadsides, and forest edges, blocking access for fishing and recreation, paving over native plants, and adding a pile of tall, dry stems every fall to the local fuel load. Mowing gives the plants a lift as the fragments created by cutting are easily spread and resprout.

Although volunteer groups work to remove stands of knotweed from stream banks and parks, the next knotweed "miracle plant" may be in a pot at a local garden. Regulating weeds once they have started eating into local highway department's roadside maintenance budgets can help raise awareness and reduce the rate of introductions, but it doesn't prevent the ongoing harm. Forecasting the likelihood of a plant to become invasive is key to prevention efforts. The US Department of Agriculture and many states are using well-tested risk assessments to encourage a proactive approach that encourages the importation and use of non-invasive plants instead of the few likely to become the next house-busting, stream-chocking mistake.

The Southwest

Giant Reed

Giant reed (*Arundo donax*) can grow up to 30 feet tall, clogging streambeds and increasing the risk of wildfire. Stands of giant reed lead to increased flooding in adjacent areas, and have been blamed for bridge washouts. Its dense growth creates a fire hazard, causing fires to start in riparian areas where they did not before.

The cost of controlling giant reed is high due to the plant's high biomass, difficulty to control, and its growth in sensitive habitat where control activities are highly regulated to protect wildlife. A total of $70 million has been spent controlling giant reed in California watersheds over 15 years. Damage from fires started in giant reed in California is estimated at $38.8 million over ten years, and water savings from removing giant reed in California is estimated at $49.6 million over ten years. A study on the Rio Grande River in Texas estimated that water savings from removing giant reed gave a benefit four to eight times greater than the cost.

Yellow Starthistle

Yellow starthistle (*Centaurea solstitialis*) is one of the most widespread weeds in California, infesting more than 14 million acres and spreading to other western states. It degrades rangeland forage quality for livestock and wildlife, and can decrease the capacity of pastures by 50%. In agricultural fields, its seeds contaminate grain harvest and lower crop quality and value. Yellow starthistle is a major consumer of groundwater, costing millions of dollars in lost water for wildlife, agriculture, and municipal use. The weed is estimated to consume up to $75 million of water a year in the northern Sacramento valley along. Its spiny heads can also impede access to recreation areas. In 2003, it was estimated that California spends $12.5 million annually on this species.

Water Hyacinth in the Sacramento-San Joaquin River Delta

Water hyacinth (*Eichhornia crassipes*) was introduced as an ornamental aquatic plant for its showy purple flowers, and is still sold for use in backyard ponds. Water hyacinth grows extremely fast, able to double in size every six to ten days. It can create mats up to six feet thick that impede boat traffic, swimmers, and wildlife access to the water, while decimating aquatic life.

California spends approximately $7 million each year to control water hyacinth and another aquatic invasive plant, *Egeria densa*, in the Sacramento-San Joaquin River Delta. Resource managers estimated that this amount was about half of what is needed to meet state-mandated goals for control of these species.

The South/Southeast

Feral Swine

The range and abundance of feral swine in the United States has increased markedly since 2000. Feral swine are known or suspected to exist in at least 40 states, and the region between Texas and South Carolina is the core. Recent research indicates feral swine populations number in the millions. Texas estimates its population at 1.9-3.4 million animals occupying 99% of its counties.

Feral swine damage property, agricultural commodities, infrastructure, aquatic systems, natural systems, and native wildlife. Economic losses resulting from feral swine damage is estimated at greater than $1 billion per year and is increasing. A 2011 survey conducted by the University of Georgia estimated private property damages in Georgia by feral swine to be $57 million.

Feral swine are highly mobile disease carriers of at least 30 viral and bacterial diseases and 37 parasites that affect humans, pets, livestock, and wildlife. They may also play a role in the establishment of new strains of influenza viruses (e.g., H1N1 virus). The potential disease transmission from feral to commercial swine has serious implications to the U.S. economy and jeopardizes ongoing efforts to control livestock diseases. For example, the commercial swine industry in the U.S. recently achieved pseudorabies-free status after a 17-year effort and a cost of approximately $200-250 million.

The control and eradication of feral swine is costly to state and federal agencies. Control expenditures vary greatly among states, and some agencies with extensive control programs face substantial financial commitments that may not be sustainable in the future. Tennessee estimated that it spent $500,000 for personnel costs in the first quarter of 2012 and an additional $100,000 in equipment costs. Funds are needed not only for current control programs but also for research into more economical and effective control methods.

Burmese Python

More than $6 million has been spent since 2005 finding and applying solutions to the growing problem of Burmese pythons and other large invasive constrictor snakes in Florida, which are causing major economic losses and expenditures. Control actions include capture and removal, public education and awareness, spatial ecology and movement studies, diet analysis, thermal biology, trap development and trials, impacts analysis, pilot studies for genetics and salinity tolerance, potential use of unmanned aerial vehicles with thermal infrared cameras to detect large constrictor snakes in the field, and training dogs to find nonnative constrictor snakes. Agencies are attempting to prevent the extinction of endangered species, two of which have been found as prey in Burmese python stomachs—Key Largo woodrat recovery ($1.4 million expended to date) and wood stork recovery ($101.2 million). Puerto Rican parrots, although not found as prey yet, have cost Federal and State agencies $17.2 million during that period. In addition to these three examples, many other endangered species are found in Florida and other states and territories that would be threatened by large constrictor snakes.

The Pacific Northwest

Non-native Cordgrass (*Spartina*)


Dense-flowered cordgrass forming a continuous meadow on the salt marsh near the mouth of Jacoby Creek, Humboldt Bay National Wildlife Refuge.

Along the Pacific Coast, there are four species of invasive cordgrass (*Spartina* spp.) that have invaded ecologically critical habitat within the intertidal and low marsh communities of estuaries and their outlets. *Spartina* forms dense monocultures that disrupt the ecology, structure, and function of mudflats and intertidal habitat, which provide the basis for a complex food web that includes invertebrates, fish, shorebirds and waterfowl. Monocultures also alter the hydrology of the estuaries by creating deep drainage and surge channels, increasing elevation that can affect navigation and cause coastal flooding.

In Washington, Oregon, and California, where *Spartina* has been identified as a problem for some time, millions of dollars are spent annually on *Spartina* management programs. Washington has spent $26 million since 1996 to eradicate *Spartina* from critically important habitats, such as Willapa Bay National Wildlife Refuge. Oregon is implementing a *Spartina* eradication plan, and in 2010, British Columbia predicts it would cost $200,000 annually for five years to eradicate.

Knapweed

Montana has spent more than $42 million annually on the direct and indirect costs of diffuse, spotted, and Russian knapweed. Knapweed invades rangeland, forestland, railway embankments, parks and wildlife areas, road ditches, built-up areas, and river banks. As a result, reduced plant diversity in these "wild lands" lowers their value as wildlife habitat and decreases their water and soil conservation benefits.

Knapweeds release a chemical substance that inhibits surrounding vegetation, by producing a large amount of seed, and by being adapted to a variety of environments and soils. Knapweed seeds tend to be carried in parts of farm machinery, logging equipment, or recreational vehicles. To control knapweeds, herbicide treatments can be used on small patches, and cultural or biological methods for widespread infestations. However, herbicide treatments can be expensive and toxic to other plants. Biological controls that can be used include the introduction of two fly species that reduce the amount of seeds produced, and three moth species that feed on knapweed seed and root tissue. Cultural controls may include cultivation, burning and mowing.

Zebra/Quagga Mussels

Zebra and quagga mussels (*Dreissena* spp.) can foul pipes of hydroelectric facilities, water works, and other industrial facilities, including fish and aquaculture operations. These highly invasive mussels can disperse and grow quickly and reach high densities, impairing facility functions and damaging ecosystems.

An infestation of zebra mussels in the Great Lakes cost the power industry $3.1 billion in the 1993-1999 period, with a total economic impact on industries, businesses, and communities of more than $5 billion.

If the Columbia River Basin were to become infested, it is estimated it will initially cost $21 million plus annual costs of $26 million. Bureau of Reclamation-wide costs attributable to zebra and quagga mussels since 2008 are $12.6 million.

Gypsy Moth

Gypsy moth was brought to this country from Europe in 1869. Since then gypsy moth has developed an appetite for 300 species of trees and shrubs and has spread to 19 states in the eastern part of the United States. Gypsy moth has defoliated 78 million acres since 1970. Suppression programs have been in place with a cost varying from $10.9 million in 1990 to $139,000 2010. The state of PA had the largest suppression program in 2008 at a cost of $7.7 million.

The Northeast

Asian Longhorned Beetle

Asian longhorned beetle (ALB) is an invasive insect of hardwood trees, mainly maple, which has been found in several states since 1996. The beetle has the potential to damage diverse industries such as lumber, maple syrup and tourism accumulating over $41 billion in losses on the East coast alone. It is believed that ALB could find a host in over 35% of America's foliage. ALB was found in Massachusetts in 2008, and since 2009, over $100 million has been spent on eradication efforts in that state. This insect threatens forest ecosystem services such as filtering water, providing habitat for animals and buffering stream temperatures. In Massachusetts, the value of these environmental services is estimated at $2.9 billion.

Hydrilla in Maine: A Tale of Two Lakes

The worst: Maine's first documented finding of hydrilla (*Hydrilla verticillata*) was a well-established population in 46-acre Pickerel Pond in Limerick in 2002. Reported by a shoreline resident after comparing pictures on Google with a specimen of a plant that was overwhelming his dock and swimming area, 70 percent of the shoreline out to depths of 10 feet was infested with "shag astro-turf." Nine consecutive years (2003-2011) of whole-lake herbicide treatments at a cost of > $220,000, resulted in a single hydrilla plant discovered in 2012. A lake stewardship organization will continue to monitor.

The best: Maine's second hydrilla invasion was discovered in 2010 in 4,800-acre Damariscotta Lake in Jefferson. This invasion met a more vigilant adversary—trained volunteers. Fresh from an Invasive Plant Patrol workshop, a citizen scientist discovered a dense hydrilla growth in a 0.3-acre lagoon hear his home. Later that summer, 125 trained monitors from Damariscotta Lake Watershed Association fanned out to conduct surveys of 93 percent of the lake's littoral zone—finding no hydrilla. Rapid response efforts included a single season of herbicide treatment of the lagoon, annual removal by hand and benthic barrier deployment—all at significantly less cost compared to Pickerel Pond.