

## **Alien species**

In Brooklyn and Chicago, residents spot unusual, voracious beetles boring through hardwood street trees. In California, scientists track the spread of Africanized honeybees from South America. In Maryland, officials poison three ponds after anglers discover a population of predatory snakehead fish from China.<sup>1</sup> All around the world, **nonnative species**—from microbes to mussels to monkeys—are arriving in unexpected places. A nonnative species is any species that has been taken from its native habitat and transplanted to a new environment. Nonnative species do not always disrupt their new-found habitat, but when they do, the costs can be enormous.

When the introduction of a nonnative species causes or is likely to cause economic, environmental, or human health damage, it is called an invasive species. An **invasive species** is defined as a species that is

1. nonnative to the ecosystem under consideration, and
2. whose introduction causes or is likely to cause economic or environmental harm, or to cause harm to human health.

Invasive species can be plants, animals, or other organisms (for example, microbes). In their new locations, invasive species do not have the natural controls that serve to limit their population in their native range. This lack of limits, coupled with the fact that they typically have a high rate of reproduction and are tolerant of a large array of conditions, enables them to thrive and even dominate in nonnative areas. See “Common Characteristics of Invasive Species” on the following page.

**The more of the following characteristics that an introduced species possesses, the more likely it is to become invasive and to threaten the environment:**

- **Tolerates a wide range of conditions**

Example: The European starling can live in a variety of habitats from woodlands to open fields to cities.

- **Has a long growing season or short generation time**

Example: Common buckthorn has a much longer growing season than native plants.

- **Has few natural controls such as predators, diseases, or insects**

Example: Leafy spurge is inedible to the native insects and animals of the American West; it has greatly reduced the populations of plants that native species can eat.

- **Disperses itself with ease**

Example: Cogongrass was introduced from Southeast Asia into the southeast United States in the early 1900s to help control soil erosion. Each plant produces several thousand seeds that can be dispersed up to 15 miles by wind.

- **Produces lots of seeds or eggs**

Example: One zebra mussel can release up to one million eggs per year.

- **Enjoys a new location that has climate and environmental conditions similar to native habitat**

Example: Burmese pythons have invaded the Everglades after pet owners have released them into the wild. Global climate change could result in more foreign tropical species finding their way to, and prospering in, nonnative tropical environments. *European starlings Zebra mussels*

Scientists believe that invasive species are among the most significant threats to **biodiversity** at every level. Although habitat loss and pollution have gained more attention as causes of biodiversity decline, invasive species have steadily been pushing hundreds of native species into threatened or endangered status, thus driving many endangered species to the point of extinction. Scientists have calculated that nonnative species are taking a toll on 49 percent of all endangered species. And they think that nonnative species have played a role in 25 percent of known fish extinctions, 42 percent of reptile extinctions, 22 percent of bird extinctions, and 20 percent of mammal extinctions.<sup>3</sup>

The nonnative species that cause the most problems are usually fast-reproducing and are adaptable to a variety of habitats and prey. And they often arrive in the new location without any, or enough, predators to control them. Those species can quickly alter an ecosystem in dramatic ways, such as decimating prey populations, out competing other predators for a particular prey species, and changing the structure of a habitat. For example, introduced dogs, pigs, and rats in Hawaii have preyed on many ground-nesting bird species, driving many of them to extinction.<sup>4</sup>

Zebra mussels have caused native freshwater species to decline by filtering out tremendous amounts of the phytoplankton upon which they all depend.<sup>5</sup> Purple loosestrife, an escaped ornamental plant, has replaced cattails in many U.S. wetlands, creating habitats unsuitable for nesting bitterns and other native species.<sup>6</sup> (See the “Invasive Species in the United States” box on this page for a list of some common invasive species in the United States by region.)

The following is a small sample of troublesome invasive species found in different regions of the United States.

**Northeast**

Asian longhorned beetle, common buckthorn, Dutch elm disease, European green crab, European gypsy moth, European starling, hemlock woolly adelgid, hydrilla, mute swan, purple loosestrife, West Nile virus

**Southeast**

Chinese tallow, cogongrass, European green crab, hydrilla, Japanese honeysuckle, kudzu, melaleuca, nutria, red imported fire ant, water hyacinth, wild boar

**Midwest**

Asian longhorned beetle, Dutch elm disease, Eurasian ruffe, Eurasian water milfoil, European gypsy moth, leafy spurge, purple loosestrife, sea lamprey, spotted knapweed, zebra mussel

**West**

Africanized honeybee, Chinese mitten crab, Chinese tallow, European green crab, giant reed, hydrilla, red imported fire ant, Scotch broom, spotted knapweed, sulfur cinquefoil

**Southwest**

Africanized honeybee, Asian clam, camelthorn, cheatgrass, fountaingrass, giant reed, red imported fire ant, tamarisk, toadflax

**Hawaii**

American chameleon, apple snail, black rat, Chinese tallow, Indian mongoose, Japanese honeysuckle, Miconia, red imported fire ant, strawberry guava, wild goat

In addition to those ecological costs—which affect humans and wildlife alike—  
invasive species are creating big economic costs for people. The Atlantic comb  
jelly, for example, devastated stocks of anchovies and other native fish in the  
Black Sea, leading to an estimated \$350 million annual loss in fisheries  
revenue.<sup>7</sup>

A recent study of the potential effect of Asian longhorned beetles on American  
hardwoods estimates a loss of as much as \$669 million nationwide.<sup>8</sup> In fact,  
scientists in the United States recently estimated that nonnative species  
as a whole have cost the country \$137 billion annually in economic losses.<sup>9</sup>  
With all the problems associated with invasive species, it should come as no  
surprise that people are working actively to try to prevent further invasions and to  
resolve existing problems. Unfortunately, there are no surefire control  
mechanisms. Invasive species are by definition aggressive, adaptable, and  
quick-spreading. And channels that it is hard to guess where and when they will

show up next. Still, many countries (including the United States) are trying to slow the influx of nonnative species by conducting regular customs inspections.<sup>10</sup>

In addition, people are working to physically remove invasive plants from woodlands, wetlands, and other habitats, but this work has proved to be marginally effective, as well as extremely expensive and time-consuming.<sup>11</sup>

Conservationists also have tried to remove invasive animals where they have taken up residence and then restore the ecosystems to their previous condition. Unfortunately, efforts to restore habitats once invasive species have become established are extremely expensive. So, experts agree that the cheapest and easiest way to control invasive species is still to prevent them from coming in at all.

It is difficult to anticipate how invasive species will affect wild and human communities in coming years. Some scientists predict a gradual reduction in biodiversity, leading to the dominance of only the most adaptable, weedy species: rats, pigeons, starlings, cockroaches, house sparrows, raccoons, and humans.<sup>13</sup>

Others are hoping that increased efforts to prevent and control invasive species will pay off. In 1999, President Bill Clinton signed Executive Order 13112 instructing all federal agencies to stop activities that might be helping invasive species to spread. The order also called for the formation of a federal council to devise a management plan for invasive species.<sup>14</sup> The following website provides information on the Executive Order and the formation of the National Invasive Species Council. It also serves as the gateway to information, programs, organizations, and services dealing with invasive species: <http://www.invasivespeciesinfo.gov>.

Invasive species are not a new phenomenon, but globalization has brought increased worldwide travel and shipment of goods. Along with it an ever-increasing number of new invasions. There are many pathways by which invasive species end up in a new location, far away from their native range. In some cases, people intentionally introduce them to the new area, not realizing the untold damage they might cause. For example, nutria are large rodents nearly the size of beavers. Nutria were imported to the United States from Argentina in the 1930s. The purpose was to raise them and produce furs. However, individuals quickly escaped, and by 1955 their population was already in the millions.

This rodent can cause millions of dollars worth of damage by ruining agriculture crops and by weakening levees. Another species, purple loosestrife, was intentionally introduced in the northeastern part of the United States in the 1800s as an ornamental plant and for its medicinal properties. Because purple loosestrife adapts readily to both natural and disturbed wetlands, it out-competes many native grasses and flowering plants, thereby negatively affecting waterfowl

habitat. In other cases, the introduction of invasive species is unintentional. People unknowingly transport species lodged in or on barges, boats, trailers, animals, vehicles, commercial goods, packing materials, produce, footwear, or clothing. Many aquatic invasive species are transported to new regions by way of the ballast water of ships. Ballast water is taken into partially empty cargo ships to provide stability during ocean crossings. Then it is pumped out when the ships pick up their loads somewhere else. Some ships transport millions of gallons of water, laden with organisms, to other locales. were unintentionally introduced into the United States in this way, spreading through interior waterways while traveling on recreational boats and other human activities. For some, the best way to reduce the negative effects of invasive species is to take a diversified approach: prevent every possible invasion, and aggressively combat those that accidentally occur.<sup>15</sup> Because such efforts will require the support and involvement of millions, public education also is an important part of combating invasive species. A good model, some say, is in Australia where as one person puts it “the average taxi driver” is already well informed about the power and destruction of invasive species.<sup>16</sup> Perhaps with good information, public support, and enough financial investment, native species can survive and flourish.

*The mongoose, discussed in “Hawaiian Islands,” was introduced to control rats in sugar cane plantations. This change proved to be one of the worst attempts ever made at biological control. The mongoose did tremendous damage on its own account (eliminating many native species) and only partially reduced the populations of rats.*

*Asian swamp eels, discussed in “Florida Everglades,” are predatory fish. They have no known predators in the United States to control their numbers. They have the potential to disrupt food webs and to compete with native species of fish and wading birds for food.*

*Asian longhorned beetles, discussed in “Chicago Hardwood Forests,” attack and kill many hardwood trees, such as ash, birch, elm, horsechestnut, maple, poplar, willow, and many more. The Asian longhorned beetle has the potential to significantly disrupt forest ecosystems if it becomes established over a large area.*

*Cheatgrass, discussed in “Sagebrush Shrub Steppe,” is a problem because it grows densely and outcompetes native grasses and shrubs. In the spring and summer, the dry cheatgrass is highly flammable and creates a fire danger.*

*The European green crab, discussed in “Atlantic*

*Coastal Estuaries,” is one of the most invasive predators in marine and estuarine habitats. It has caused many native species—some of commercial importance—to dramatically decline.*

*For example, the European green crab has caused significant declines in scallops and is implicated in the destruction of the soft-shell clam fisheries in New England.*

Scientists have successfully controlled invasive species through biological, chemical, and mechanical methods, as well as by ecosystem management. Biological control involves controlling one organism with another organism. Chemical control usually involves the application of herbicides or pesticides. Mechanical or physical control methods include things such as mowing and hand-pulling of invasive plants, or inserting barriers such as nets that prevent fish from entering a river or lake. Ecosystem management involves regular treatment to an entire ecosystem—for example, a simulated natural fire that favors adapted native species over most invasive species.

scientists think that invasive species are one of the top threats to habitats and species worldwide. Invasive species are ranked the second biggest threat to biodiversity, with habit loss being the first biggest threat.