

UNWELCOME

guests

*A global economy grapples
with the economic and ecological
effects of invasive species*

BY CHARLES GERENA

Every year, peregrine falcons join thousands of other migratory birds that fill the autumn skies over the Eastern Shore of Virginia National Wildlife Refuge. This isolated spot on the southern tip of the Delmarva Peninsula is merely a pit stop on a much longer journey that eventually brings these birds back to their native habitats.

Generally a plant or animal is tied to a single place that has what it needs to live and grow. Sometimes organisms cross natural boundaries like a mountain range or a river to find a new home, but such natural dispersal is usually rare and gradual. This enables ecosystems to adjust to changes.

As trade has crossed the boundaries of land and water, however, people have carried large numbers of plants and animals into new habitats accidentally and intentionally. This has greatly accelerated the rate of dispersal beyond nature's grasp.

Nonnative species are generally benign, and often beneficial, from an economic and ecological standpoint. But a few become invasive and overpower native plants and animals, causing greater harm than good. Beaver-like nutrias from South America destroy productive wetlands in Maryland. An

Asian beetle discovered in Northern Virginia this year led to the removal of 200 ash trees to prevent its spread. Stilt grass, which may have come to America as packing material for Japanese porcelain, overtakes riverbanks and forestland in West Virginia.

Humans are starting to recognize the unintended consequences of their globetrotting: The estimated price tag for the damage caused by invasive species and for controlling their spread is well over \$100 billion annually. However, researchers are only beginning to understand what triggers an invasion. As a result, policymakers still can't assess the risks of invasion in order to make the best investments in prevention and control.

Until researchers can reliably predict invasions and that knowledge is translated into tangible actions, global commerce won't bear the monetary costs that nonnative organisms may impose. According to several economists, invasive species may be the only negative externality of world trade.

"Anti-globalization people tend to point their finger at trade as causing all kinds of problems, but usually those problems can be mitigated in other ways besides reducing trade," says economist Christopher Costello at the University

of California, Santa Barbara. "The damaging [aspect of invasive species] is inherently bundled with trade."

The Great Migration

Plants and animals have been imported since colonial times. In fact, the first major product of Chesapeake colonists was tobacco grown with imported seed. Currently, nonnative crops like corn and wheat, and nonnative livestock account for nearly all food production.

Organisms have been introduced for non-food uses, too. Insects have been recruited for biological pest control, birds from around the world have served as pets, exotic plants have beautified backyards, and fish have been stocked in lakes for anglers.

Such intentional introductions of nonnative species have been beneficial. Others have been failures. Nutrias were brought to Maryland in the 1940s and 1950s to help the fur industry, but they either escaped or were accidentally released into the wild and started chewing up marshes along the Eastern Shore.

Introductions aren't always obviously good or bad notes David Lodge, a biology professor at the University of Notre Dame. The rewards of introducing a nonnative species can be immediate, while potential damages

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The potential threat that the northern snakehead posed to native fish prompted Maryland officials to eradicate it in 2002.

from a species becoming invasive can take years to emerge and are spread among millions of people.

Damage may also be less visible if it occurs underwater or in the wilderness. It's even harder to detect when a plant or animal is introduced accidentally. John Randall, acting director of the Invasive Species Initiative at The Nature Conservancy, says researchers have a better sense of what has been deliberately introduced.

Ballast water is a major pathway for accidental introductions. Ships take on water at a port to compensate for the weight of offloaded cargo, then discharge water at the next port when it loads a new shipment. Floating in the water and inhabiting the sediment on the bottom of ballast tanks are countless microbes and small sea creatures that move from port to port. Some of these nonnative organisms become invasive, such as the infamous zebra mussel that migrated from the Caspian Sea in ballast water and eventually clogged water intake pipes throughout the Great Lakes region.

Global shipping provides other means for nonnative species to hitch a ride. Insects and fungi can stowaway on wood pallets or packaging material, as well as on horticultural and food imports. Even places like West Virginia with no international port can have unwelcome guests because highways and railroad tracks also facilitate interstate and international commerce.

Using these and other pathways, numerous invasive plants and animals have relocated to the Fifth District. One of the biggest invaders is kudzu, an Asian import initially used by Southern farmers in the 1930s to prevent soil erosion. Today, the vine covers an estimated 7 million acres in

the Southeast, smothering native plants and damaging man-made structures like power lines. Two insects also originated in Asia but probably got here accidentally: the hemlock woolly adelgid that affects forests in Maryland, Virginia, North Carolina, and South Carolina; and the emerald ash borer found in landscape trees shipped to Maryland from Michigan.

Other nonnative plants and animals are on the radar screen. They include the lionfish, a venomous tropical fish sighted off the coast of North Carolina, and the Rapa whelk, a Japanese snail that could prey on native oysters in the Chesapeake Bay.

When Animals Attack

Is the lionfish or the Rapa whelk considered invasive? Generally, scientists differ on where they draw the line between a migration and an invasion.

They agree that a nonnative species is considered invasive when it escapes the bounds of cultivation or captivity and out-competes species that are more desirable, imposing ecological and economic damages that exceed their benefits. This doesn't happen often — about 10 percent of plants and animals live outside of their usual habitat and roughly 10 percent of those survivors are troublemakers. Still, given the many thousands of species that inhabit the earth, that is a significant number.

Researchers have been trying to figure out how invasive species beat the odds, and they have found some clues. It typically takes a large contingent of a nonnative organism to survive in a new environment. Also, the organism needs a new home that is comparable to its original habitat, doesn't have too much competition for food and space, and doesn't experience adverse weather for several years.

It helps if an organism is "weedy," meaning it can tolerate wide variations in its environment. Furthermore, natural forces or human activity can alter an environment in such a way that creates an opening for nonnative species. For instance, stilt grass readily grows in West Virginia along roads cut into forests for logging and coal mining.

Even when a nonnative organism

persists, it usually settles into a niche and doesn't overwhelm other plants and animals. The problems start when predators, pathogens, or other natural barriers fail to limit the expansion of the organism's population.

When these variables trigger an invasion is the \$64,000 question. "Nobody can tell you what the effect of introducing an organism into a novel habitat is yet," says A. Whitman Miller, assistant director of the Marine Invasions Research Program at the Smithsonian Environmental Research Center. "You can introduce the same organism 100 times and it won't take, then on the 101st time it will."

The ecological damage of invasive species also is an open question, but researchers know enough to be concerned about the planet's future biodiversity. Henry Lee II, a research ecologist with the U.S. Environmental Protection Agency, says that invasive species threaten to homogenize ecosystems. "It's like all of the restaurants turning into McDonalds."

One would think that the arrival of a new species broadens biodiversity. That's true in the short run, but in the long run invasive plants and animals can push native species into the margins of an ecosystem. In fact, invasive organisms are thought to be a leading cause of species endangerment and extinction.

In contrast, some researchers have asserted that the spread and dominance of invasive species is part of the process of natural selection, where only the strongest survive. Lee concurs that many invaders are organisms that have managed to survive polluted environments and are colonizers.

However, the outcome of this process may be unacceptable. "We'll get harder species [as a result of the spread of invasive plants and animals], but they're not also ones that we want," explains Lee. He cites the Norway rat, a scourge of city dwellers across Asia, Europe, and North America.

The widening presence of invasive species could have other long-term consequences. Less redundancy of natural resources could weaken ecosystems to outside shocks. In addition,

there could be less fodder for the discovery of new products. The Pacific yew, a tree native to the northwestern United States, supplies the active ingredient in a chemotherapy drug.

Invasive species also have economic consequences in the short term. They damage billions of dollars in crops, timber, and other natural resources. They can also depress property values. There are examples of ranches in the West and Midwest that have lost value because of leafy spurge, which overtakes grazing land used by livestock, while the loud calls of coqui frogs in Hawaii have been blamed for declining property values and tourism.

Eradicating Nutrias without Killing the Golden Goose

The economic and ecological consequences of invasive species can be significant. Yet globalization has made it nearly impossible to prevent every plant and animal from escaping its habitat. The challenge is to manage the impact of invasive species without choking off trade.

Do we know enough to do this? Ann Bartuska, an ecologist and deputy chief of research and development at the USDA Forest Service, thinks there is sufficient information to act. "We won't be 100 percent certain about the outcome, but we can monitor the effects of regulations and adjust them when necessary."

Policymakers can do two things — prevent future invasions of destructive organisms and control existing pests. Since there is uncertainty about which nonnative species pose the greatest threat, they have favored control measures says Jason Shogren, an economist specializing in natural resource conservation and management at the University of Wyoming. Risk-averse officials prefer "to control the things they already see than prevent things that might not be there."

Such caution avoids investing in preventive measures whose cost effectiveness would be unclear. But it can backfire, says Shogren. By only combating existing invasive species, "you end up with greater probabilities of invasions" in the future. Additionally, the money spent on control efforts represents resources that

would have been used for something else, plus future invasions will require additional trade-offs.

Ecologists strongly believe that preventing an invasion is better than managing the aftermath. Once a population of invasive species starts expanding, its exponential growth makes eradication exponentially difficult.

A variety of prevention tools are currently employed, including regulation of plant and animal imports and fumigation of wood packaging material entering the country. The U.S. Coast Guard is considering mandating ships to use some form of ballast water management. Also, federal legislation is pending that would require treatment of ballast water, establish a screening program, and require the creation of a monitoring and early detection plan.

Federal officials could choose to follow Australia, New Zealand, and South Africa in creating a "white list" of plants and animals evaluated and approved for importation. Organisms that haven't been screened would be an assumed threat and kept out of the country. While the horticulture and pet trades have objected to this approach, the opposite approach of assuming that an organism is innocent until proven guilty has one big disadvantage. You have to wait until an invasion has occurred before reacting.

Anti-globalization advocates and others believe that the threat of invasive species justifies banning or restricting trade with other countries. Economist Chris Costello counters that freer trade may actually mitigate some of the damaging effects of invasions.

"... Although reduced protectionism raises the volume of trade and hence the platform for biological invasions, it also changes the production mix of participating countries..." he noted in a August 2001 paper co-authored with Carol McAusland. This could make these countries less susceptible to invasive species. "... For countries that initially import agricultural products, reduced tariffs will lead to a decrease in the volume of agricultural output. This reduces both the quantity of crops available for damage by exotic pests and the amount of land that is dis-

turbed and thereby aiding the propagation of exotic species."

Tariffs could be selectively applied to countries with species that are the most likely to cause harm in the United States. However, such a system would have to be based on sound science and not used as a form of disguised protectionism, notes Shogren.

Costello suggests imposing liability rules on global transactions. A contract could hold a seller responsible for any invasive species that is found in the buyer's country that could only have resulted from the transaction. The seller could post a bond to cover that liability and get it back after 10 years of no invasions.

The result is that sellers would have an incentive to reduce the risk of invasions. In addition, the costs of invasive species management would eventually be reflected in the price of goods from exporting countries.

Tariffs or liability rules would impose costs on global trade. Such costs might disproportionately affect developing countries that want to export, but they also stand to benefit the most since they are less equipped than rich countries to deal with the damage wrought by inadvertently imported plants and animals. **RF**

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