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1. INVASIVE SPECIES: Closing the door to exotic hitchhikers

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The first in an ongoing series of reports.

They arrive by land, by sea or through the air. Sometimes they are imported on purpose, but often they are unwelcome hitchhikers that stow away inside the hulls of cargo ships or in packing materials carried from distant lands. While most fail to establish new colonies, some will thrive in their new environment, and if not identified and contained, they can spread rapidly.



Zebra mussels, difficult-to-control invasive mollusks, have proliferated throughout the Great Lakes and Mississippi River. Photo courtesy of U.S. Geological Survey.

They are exotic, invasive species -- plants, animals and microorganisms -- and in very real ways, they threaten to choke out native species while causing billions of dollars a year in direct damage and costs for control.

The most comprehensive survey of non-native species in the United States was developed by David Pimentel and colleagues at Cornell University's College of Agriculture and Life Sciences. They have concluded that invasive species cause major environmental damage and losses amounting to over \$137 billion per year.

Out of 750,000 species in the United States, the group calculated that more than 50,000 alien-invasive species have been introduced in the history of the nation. Many have now become part of our way of life, and introduced species such as corn, wheat, rice, cattle, poultry and livestock are the foundation of our approximately \$800 billion/year food economy.

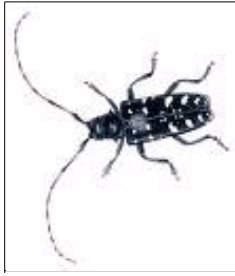
However, a relatively small portion of the non-native species are anything but benign, and the Cornell researchers calculated that about 5,000 alien plant species have escaped their bounds and spread, in many instances displacing native species. According to one study, alien weeds are spreading at the rate of 1.75 million acres each year -- roughly the size of the entire state of Delaware.

"Most non-native species, even those that get established, are not harmful," said Lori Williams, executive director of the National Invasive Species Council. "You want to look at the impact that species has, how it got here, and how to mitigate it."

NISC was established by a 1999 executive order issued by former President Clinton and was charged with the task of coordinating federal agency efforts to manage invasive species. The executive order draws a distinction between non-native and invasive species, which it defined as "an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health."

The extent of harm can be breathtaking. For instance, the emerald ash borer, an exotic beetle that was first discovered in the Detroit area in 2002, has since been responsible for killing more than 20 million ash trees in Michigan, Ohio and Indiana. Scientists believe the ash borer arrived in crates or packing material before spreading through firewood and living trees. It most recently has been identified at least twice in Maryland and is the subject of a major public campaign

to find and eradicate the beetle before it spreads.



The asian long-horned beetle, another unwanted hitchhiker like the ash borer, evidently arrived on U.S. shores along with imported goods. Photo courtesy of the National Park Service.

Jil Swearingen, invasive species and pest management coordinator for the National Park Service, called the situation in the Chesapeake Bay region, "a smoldering fire at the moment. Everyone thought it had been eradicated, then they found it again."

Swearingen said that early detection and elimination efforts are needed to prevent far worse consequences of mitigation. In the Midwest, the devastation was so severe that forest managers ended up cutting down ash trees ahead of the path of the beetles' invasion. "It's amazingly expensive and it draws all the money away from other programs," she said.

Similarly, the Park Service faces a major problem in the Great Smoky Mountains, where the hemlock adelgid, an aphid-like pest that feeds off the needles of the Canadian hemlock tree "threatens to destroy some of the most scenic and highly valued parts of the park," Swearingen said.

The bug has affected over 100,000 acres of the park and is very difficult to control because "you can't spray from the air, you have to have individuals treating individual trees," she explained. "It saps resources of money and people, and it takes away from other things that you need to do."

The pretty pest

While not so obviously or rapidly destructive, some invasives nonetheless are responsible for slowly choking out native species from their habitats. One example is the purple loosestrife, a perennial herb that can grow to as tall as 10 feet under the right conditions. Introduced as an ornamental plant to the northeastern United States and Canada in the 19th century -- and possibly to provide pollen for honeybees -- the plant has escaped its domestic bounds and now occurs in every state except Florida, according to the U.S. Fish and Wildlife Service.

While it has some benefits in terms of honey production, the plant reduces bird diversity and causes other environmental impacts. One study determined that the plant causes about \$46 million per year in damage and costs of control, compared to about \$1.5 million in economic benefits.

Known as the "pretty pest," the purple loosestrife adapts rapidly to wetlands, and a single mature plant can generate 3 million seeds per year. Eradication is problematic, requiring intense manual efforts to pull out the plant or spot application of herbicides. More recently, researchers have been developing "bio-controls" to contain its spread by introducing two species of beetles that feed specifically off the plant's leaves.

Swearingen said that an earlier attempt to use a stem-eating weevil was less successful because it had to be placed on each plant by hand and proved too difficult to establish on a broad basis.

Musseling in on new territory

Among the most pervasive and damaging aquatic invasive species is the zebra mussel, initially determined in the 1980s to be an invader to the Great Lakes. The mollusk causes as much as \$1 billion in damage each year to Great Lakes fisheries, and recently has been implicated in large-scale killing of ducks and other birds that feed off the mussel because it collect toxins and other pathogens.

Despite being the subject of widespread control efforts by state and federal agencies, the mussel has spread down the entire length of the Mississippi River over the past 15 years and occasionally is detected as far away as California, carried on the hulls of boats being hauled across the country.

NISC's Williams said that rather than eradication, the main effort of a "stop aquatic hitchhikers" public awareness campaign is to prevent the zebra mussel from establishing in the western United States.

The concept of prevention has slowly taken hold as the most cost-effective method of controlling invasive species, and NISC has devoted much attention to identifying common pathways that invasives take to enter the country or expand their territory. "There are thousands of species but a limited number of pathways," Williams said.

Within the past year, the United States and international agencies have developed standards for certifying that crates and packing materials entering the country are free of insects and other pests. "All packing material has to be treated in a specific way and certified. If not, it just gets shipped back to the country of origin," Williams noted.

Faith Campbell, a senior policy representative for the Nature Conservancy, said that while the international program has been in full effect for less than six months, "everyone seems very pleased by the level of apparent compliance. It's



The purple loosestrife is called 'the pretty pest' because it chokes out native species in wetlands. Photo courtesy of the National Park Service.

a little early to say we know it's completely effective, but it's an approach the Nature Conservancy thinks makes sense." Prevention is more effective and what Campbell called "pathway cleanliness" is preferable to taking a species-by-species control approach.

Next on the priority list of strategies to curb invasives is "early detection and rapid response," particularly applied to species that may be well established in one region, like the kudzu vine that is now endemic to the Southeast, that potentially could spread.

Williams cited an example of an Oregon man who recognized the plant and acted immediately to eradicate it. "The first acre of kudzu is cheap to get rid of," she said. In contrast, where it has had decades to establish, "there are probably areas where eradication is impossible."

While considered key to addressing the invasive species problem, prevention and rapid response are not necessarily the largest budget items for federal agencies -- and together represent less than one-third of fiscal 2006 program expenditures, though they are growing compared to other categories. The combined budget devoted to invasive species for seven top agencies last year was \$1.25 billion, with the Department of Agriculture allocated more than \$1 billion of the total.

Spending by agency fiscal 2006	
Agency	Amount spent (\$millions)
USDA	1,095.5
Army Corps	74.4
Interior	60.5
State	12.2
EPA	1.4
Commerce	6.5
Health Services	4.0
Transportation	0.5
TOTAL	\$1,255.0

Prevention programs were budgeted at \$137 million and rapid response \$257 million, while \$465 million was spent on control efforts and \$227 million on research. Far behind in spending were education/public awareness at \$60 million and restoration with \$42 million. Still compared to the previous year, the budget for rapid response grew by nearly 20 percent and prevention picked up by 7 percent.

Williams said the final figures for fiscal 2007 have not been finalized because of the delay by Congress in passing appropriations measures, but the president's proposed budget calls for essentially flat spending next year.

While research spending is a significant portion of the federal effort, some who are active in the field feel there is a mismatch between research and practical applications. Doug Johnson, executive director of the California Invasive Plant Council, said, "We need to make sure research is useful to the people on the ground."

Spending by program	
Program	Amount spent (\$millions)
Prevention	137.0
Rapid response	257.0
Control	465.9
Research	227.7
Restoration	42.2
Education/public awareness	60.2
International coordination	65.0
TOTAL	\$1,255.0

Part of the problem is that the bulk of funding flows through the Department of Agriculture focuses on crop impacts, leaving little money for parks and other public lands. Another problem is within the field of natural sciences, said Chris Haney, chief scientist for Defenders of Wildlife. "Natural scientists don't like to study invasives. They consider them a kind of ecological pollution. Reptiles, amphibians and birds don't get a lot of attention. There's a professional bias to not give much credence to these things, that means we're flying blind on their impacts," Haney said.

Finally, law sets much of the spending priorities, with many bills from lawmakers devoted to trying to solve a particular problem in a specific region. "People focus on particular critters that are causing them problems," said Campbell of

the Nature Conservancy. "They don't yet see the broader picture of what could help everybody."

In part, that is one reason why the National Invasive Species Council was established, said Williams, to reduce duplication of effort, provide guidance for priorities and move away from reactive species-by-species approaches. "It's a massive coordination exercise," she said.

In the coming weeks, Land Letter continues this series with reports on how invasive species affect forests, grasslands and waterways, plus a review of legislation and some success stories in the control of invasive species.