

Exotic Species Threats

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Situation Overview

The introduction of exotic (non-native) plants, animals and pathogens is one of today's most pressing global environmental challenges and one of the leading causes of biodiversity loss and ecosystem change worldwide (Wilcove et al. 1998; Mooney and Hobbs 2000). Michigan's position in the Great Lakes watershed and location at the northern end of the Gulf Coast and Mississippi River migration corridor make us vulnerable to invasive organisms. Invasive species are permanently changing our agricultural croplands, forests, wetlands and aquatic communities, eliminating or displacing many native species. Non-native plants such as purple loosestrife, garlic mustard and buckthorn threaten Michigan wetland and forest habitats. Invasive insects such as the emerald ash borer and gypsy moth attack our forest resources, while the soybean aphid and Japanese beetle infest the state's agricultural crops, and the Asian ladybeetle invades homes each fall. Ruffe, round gobies and other exotic fish species, as well as zebra mussels, are irreparably changing the Great Lakes ecosystem. Pathogens such as soybean rust, plum pox and sudden oak death are serious potential threats to our agricultural and forest communities. Recent estimates of the economic costs of invasive species to the United States exceed \$135 billion per year (Pimentel et al. 2000).

Michigan's plant-based agriculture and natural resource industries are vulnerable to a number of pathogens that are not yet in Michigan or elsewhere in the United States. Because agriculture in Michigan is so diverse and extensive, and because we have many international borders and ports, the threat of the introduction of exotic plant pathogens and insect pests is constant. If not detected and effectively dealt with early, these pests and pathogens could cause major economic losses — reduced yields, changes in our natural plant resource systems and quarantines of our plant products. Many of our crops have no resistance to the potential pathogens, and disease could develop rapidly if a new pathogen is introduced.

Non-agricultural ecosystems usually evolve over very long periods of time, passing through predictable successional stages. Populations of species become more or less numerous over time, depending on their ability to adapt to changing conditions. Changes are generally gradual and predictable because the species have co-evolved. Barring undue human influences or catastrophic events, predators are unable to drive prey species to extinction and parasites do not kill off all of the host individuals. However, because exotic and native species did not co-evolve, exotics often have an enormous competitive or predatory advantage. The sudden introduction of an exotic species into a system can be extremely disruptive. Under the right conditions (e.g., the habitat is suitable, temperature fluctuations are not too extreme), exotic species can thrive because they have no natural predators or, in the case of pathogens and insects, the host has no resistance. The native species may be killed or driven to extinction because they cannot compete successfully with the exotic.

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Many non-native species have been purposefully introduced into Michigan (e.g., ring-necked pheasants for recreational hunting, purple loosestrife as an ornamental plant) or in an attempt to rectify problems associated with another invasion. For example, the Great Lakes salmon fishery was developed, among other reasons, to reduce exploding populations of alewives. Alewife populations exploded because populations of their most important predator — the native lake trout — had been decimated by the non-native parasitic sea lamprey.

Inadvertent introductions occur when exotic species are accidentally released into Michigan. Bird and mammal species are often, but not always, legally brought into the state. There is now a reproducing population of Russian boar in the Upper Peninsula, begun by escapees from a captive game ranch. Exotics may “hitchhike” into the state on materials from other national or international locations. This is rare for birds and mammals, but species of mice and other small rodents, snakes and insects have been transported all over the planet on cargo ships.

A less obvious form of exotic introduction occurs when individuals of the same species from a different geographic area are brought into an ecosystem. When these foreigners breed with the natives, less well-adapted foreign genes are introduced into the native gene pool.

Major Issues, Opportunities and Challenges

Invasive species have caused widespread ecological and economic damage, but current federal law offers limited control of this problem. The current fragmented federal laws deal mainly with agriculture and do not adequately address the potentially catastrophic damage to our natural resource base. State intervention is needed.

The introduction of invasive exotic species into Michigan's ecosystems presents a number of significant challenges. Introduced species can displace or even eliminate native species. Such changes ripple through the system, affecting other species and potentially disrupting both the structure and the function of the ecosystem.

Exotics often bring additional exotics with them in the form of pathogens and parasites. Native animals may be ill adapted to deal with these new health threats. The primary theory offered to explain the sudden rapid spread of chronic wasting disease to wild deer and elk populations in the Midwest centers around the captive deer and elk industry through which diseased but asymptomatic animals unknowingly are moved from state to state for hunting or breeding purposes. Similar problems can exist with introduced exotic plant species which carry insects and pathogens that can attack native plant species.

Recent studies conclude that the presence of one invasive species may predispose habitat to invasions by additional invaders. This so-called “invasional meltdown” poses grave threats to both aquatic and terrestrial ecosystems (Ricciardi 2001, Simberloff & Von Holle 1999) and has implications for prevention and survey as well as research efforts to mitigate the disaster.

Programmatic and Public Policy Implications

Michigan has recognized the threat that invasive exotic species pose to its natural and economic assets. Some state plans, laws and regulations are already in place and recognized for their value in dealing with a particular species or ecosystem (see Michigan's recently updated [October 2002] management plan for aquatic nuisance species). Implementing this plan effectively will be a critical element in Michigan's efforts to manage invasive aquatic exotic species.

However, a report by the Environmental Law Institute (ELI 2002), *Halting the Invasion: State Tools for Invasive Species Management*, suggests several additional options to prevent, mitigate and minimize the harm caused by invasive exotics. The ELI report discusses 17 tools that state governments can use to create a comprehensive policy for dealing with invasive exotic species. The tools fall into five categories: prevention, regulation, control and management, enforcement and implementation, and coordination. Although Michigan uses aspects of each of these tools in existing laws and policies, a comprehensive integrated assessment of Michigan's legal structure could clarify, coordinate and integrate the various roles played by state agencies to address the invasive species problem.

State government must support the expansion of outreach and education programs to inform the public about the dangers of bringing exotic organisms into our state. Such programs pay multiple dividends — fewer exotics enter the state and, because detections are often made by the public, the state's early warning capacity is increased. Supporting the development of reliable science based early warning detection systems that regularly monitor vulnerable hosts can help the state be proactive about invasive organisms.

Michigan might also lead the Council of Great Lakes Governors in conducting a Great Lakes regional assessment of exotic invasive species management. This broad ecosystems approach would allow the individual Great Lakes states to strengthen their legal frameworks, while protecting sensitive habitats. The net result would be greater regional protection and reduced costs for each of the states involved.

Resources

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MSU Resources

Michigan Sea Grant: www.miseagrant.org

MSU Diagnostic Services: www.cips.msu.edu/diagnostics/

MSU Crop Advisory Team Alerts: www.msue.msu.edu/~ipm/index.htm

Asian Ladybeetle Web page: www.msue.msu.edu/~ipm/asianladybeetle.htm

Purple Loosestrife Page: www.miseagrant.org/pp/

Michigan Invasive Plant Council Web site: <http://forestry.msu.edu/mipc/default.htm>

MSU is also home of the North Central Region Plant Disease and Pest Detection Center, part of a national network for rapid detection and diagnosis.

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