Non-native Species – Terrestrial

Indicator #9002

Overall Assessment

Status:	**Not Assessed**
Trend:	**Undetermined**
Rationale:	**Terrestrial non-indigenous species are pervasive in the Great Lakes Basin. Although not all introductions have an adverse effect on native habitats, those that do pose a considerable ecological, social, and economic burden. Historically, the Great Lakes basin has proven to be particularly vulnerable to non-indigenous species, mainly due to population, industrialization, and the high volume of transboundary movement of goods and people. Data are disorganized, inhibiting an adequate assessment of the status, trends, and impacts of non-indigenous species in the region.**

Lake-by-Lake Assessment

Individual lake basin assessments were not prepared for this report due to lack of monitoring data.

Purpose

- To evaluate the presence, number, and impact of terrestrial non-indigenous species in the Great Lakes basin
- To assess the biological integrity of the Great Lakes basin ecosystems

Ecosystem Objective

The ultimate goal of this indicator is to limit, or prevent, the unauthorized introduction of non-indigenous species, and to minimize their adverse affect in the Great Lakes basin. Such actions would assist in accomplishing one of the major objectives of U.S. and Canada Great Lakes Water Quality Agreement, which is to restore and maintain the biological integrity of the waters of the Great Lakes ecosystem (United States and Canada 1987).

State of the Ecosystem

Globalization, i.e., the movement of people and goods, has led to a dramatic increase in the number of terrestrial non-indigenous species (NIS) that are transported from one country to another. As a result of its high population density and high-volume transportation of goods, the Great Lakes basin is very susceptible to the introduction of such invaders. Figure 1 depicts this steady increase in the number of terrestrial NIS introduced into the Great Lakes basin and the rate at which this has occurred, beginning in the 1900s. In addition, the degradation, fragmentation, and loss of native ecosystems have also made this region more vulnerable to these invaders, enabling them to become invasive (non-indigenous species or strains that become established in native communities or wild areas and replace native species). The introduction of NIS is considered to be one of the greatest threats to the biodiversity and natural resources of this region, second only to habitat destruction.

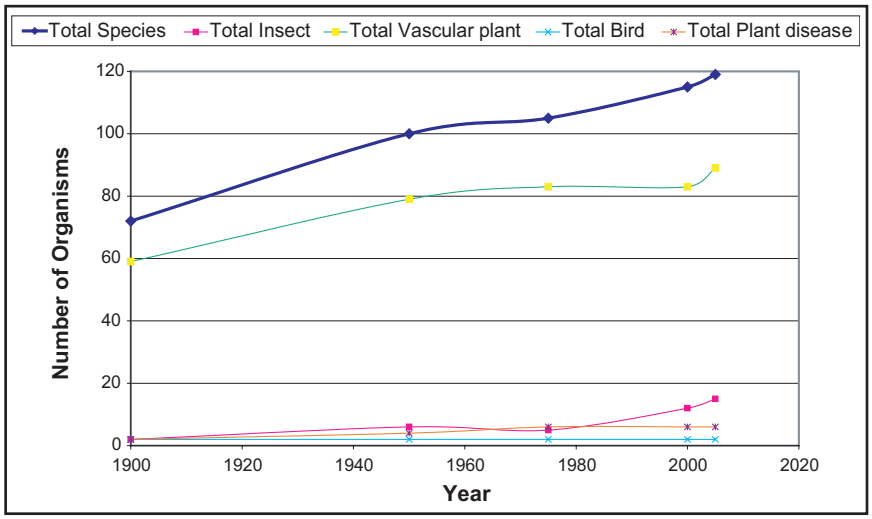

Figure 1. A timeline of terrestrial introduction in the Great Lakes Basin by taxonomic group.

Source: World Wildlife Fund-Canada's Exotic Species Database, and the Canadian Food Inspection Agency

Monitoring of NIS is largely locally based, as a region-wide standard has yet to be established. The data that are generated come from a variety of agencies and organizations throughout the region, and they are difficult to use to assess the overall presence and impact

these species are having on the region. Information provided by the World Wildlife Fund of Canada (Haber 2003) indicates that there are 157 non-native terrestrial species located within the Great Lakes basin, including: 95 vascular plants, 11 insects, 6 plant diseases, 4 mammals, 2 birds, 2 animal diseases, 1 reptile, and 1 amphibian. Meanwhile, the Invasive Plant Association of Wisconsin (2003) has identified 66 non-native plants within the state, while over 100 plants have been introduced into the Chicago region (Chicago Botanic Garden 2007). Even though these figures are greater then the one provided by WWF-Canada, they do not compare to the over 900 non-native plants that have been identified within the state of Michigan by the Michigan Invasive Plant Council (2005).

The impact NIS have on the areas in which they are introduced can vary greatly, ranging from little or no affect to dramatically altering the native ecological community. Figure 2 shows the degree to which each taxonomic group has had an impact on the ecoregion. The WWF of Canada has listed 29 species, 19 of which are vascular plants, as having a "severe impact" on native biodiversity. These species, which were generally introduced for medicinal or ornamental purposes, have become problematic because they are well adapted to a broad range of habitats, have no native predators, and are often able to reproduce at a rapid rate. Common buckthorn, garlic mustard, honeysuckle, purple loosestrife, and reed canary grass are several examples of highly invasive plant species. The Asian longhorn beetle, Dutch elm disease, emerald ash borer, leafy spurge, and the West Nile virus are other terrestrial invaders that have had a significant impact in the Great Lakes basin.

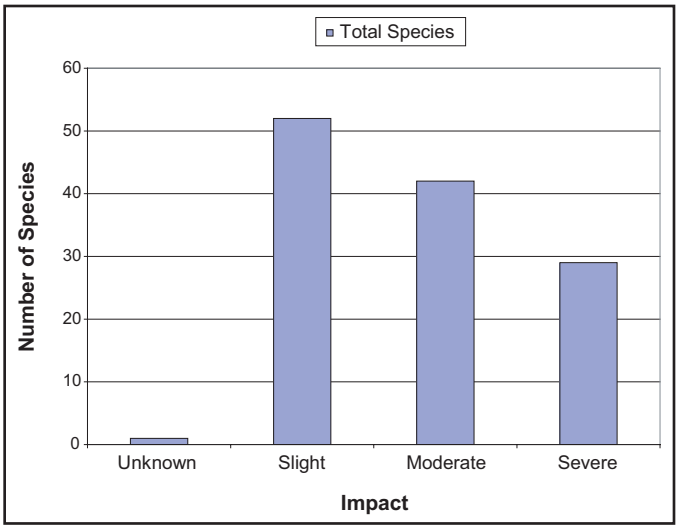

Figure 2. Estimated impact of 116 known terrestrial NIS in the Great Lakes Basin.
Source: World Wildlife Fund-Canada's Exotic Species Database

One type of terrestrial non-native species that is causing some concern is genetically modified organisms (GMOs). Although GMOs are typically cultivated for human uses and benefits, the problem arises when pollen is moved from its intended site (often by wind or pollinator species) and transfers genetically-engineered traits, such as herbicide resistance and pest resistance, to wild plants. This outward gene flow into natural habitats has the potential to significantly alter ecosystems and create scenarios that would pose enormous dilemmas for farmers. Both Canada and the U.S. are major producers of GMOs. Although GMO crops are monitored for outward gene flow, no centralized database currently exists that describes the number of GMO species or the land area covered by GMOs in the Great Lakes basin.

There are currently numerous policies, laws and regulations within the Great Lakes basin that address NIS. However, similar to NIS monitoring data, they originate from state, provincial and federal administrations and thus have similar obstacles associated with them. Strict enforcement of these laws, in addition to continuous region-wide mitigation, eradication and management of NIS, is needed in order to maintain the ecological integrity of the Great Lakes basin.

Pressures

The growing transboundary movement of goods and people has heightened the need to prevent and manage terrestrial NIS. Most invasive species introductions can be linked to the intended or unintended consequences of economic activities (Perrings *et al.* 2002). For this reason, the Great Lakes basin has been, and will continue to be, a hot bed of introductions unless preventive measures are enforced. The growth in population, threats, recreation and tourism all contribute to the number of NIS affecting the region. Additionally, factors such as the increase in development and human activity, previous introductions and climate change have elevated the levels of vulnerability. Because this issue has social, ecological, and economic dimensions, it can be assumed that the pressure of NIS will persist unless it is addressed on all three fronts.

Management Implications

Since the early 1800s, biological invasions have compromised the ecological integrity of the Great Lakes basin. Despite an elevated awareness of the issue and efforts to prevent and manage NIS in the Great Lakes, the area remains highly vulnerable to both intentional and non-intentional introductions. Political and social motivation to address this issue is driven not only by the effects on the structure and function of regional ecosystems, but also by the cumulative economic impact of invaders, i.e., threats

to food supplies and human health.

Managers of terrestrial NIS in the Great Lakes basin recognize that successful management strategies must involve collaboration across federal, provincial and state governments, in addition to non-governmental organizations. Furthermore, improved integration, coordination and development of inventories, mapping, and mitigation of terrestrial invasive species would improve future strategies and enable the examination of trends in terrestrial NIS at a basin-wide scale.

In the U.S., many organizations and activities have emerged in recent years to address invasive species issues. Their activities are numerous, but focus on four major areas: prevention (according to the National Invasive Species Council Management Plan (NISC 2001), the first line of defense against invasive species is to prevent them from becoming established); early detection and rapid response programs (which work in coordination with state and local efforts "to eradicate or contain invasive species before they became too widespread and control becomes technically and/or financially impossible"); ranking systems (which are designed to assess the relative threat posed by each invasive species in order to prioritize policy, management and education efforts); and regional or state plant councils (which include the NISC, Midwest Invasive Plant Network, Indiana Invasive Plant Species Assessment Working Group, Michigan Invasive Plant Council, Minnesota Invasive Species Advisory Council, Ohio Invasive Plants Council, Wisconsin Council on Invasive Species, and the Invasive Plants Association of Wisconsin). Bi-nationally, the Invasive Species Council is also entering discussions with Environment Canada on the development of a North American approach to invasive alien species.

Environment Canada plays a coordinating role on the issue of non-native species working closely with other federal departments and agencies as well as provincial and territorial governments and stakeholders. Mirroring the U.S. NISC's objectives, Canada's *Invasive Alien Species Strategy* (Environment Canada 2004) prioritizes prevention, early detection, rapid response, and effective management through legislation and regulation, science, risk analysis, education and public awareness, and international cooperation. In 2005, the Canadian federal budget contained the first line item ever to target invasive species directly, for $85 million. Much of this funding was earmarked for battling the emerald ash borer and another forest pest, the Asian longhorn beetle, both which have infected hardwood trees in the basin.

Examples of ongoing Canadian multi-level responses within the basin include: the Biodiversity Institute of Ontario, University of Guelph-led Ontario Invasive Plant Information System (OIPIS), which was developed as a tool in the assessment, detection and prevention of invasive alien plants in Ontario; the Ontario Federation of Anglers and Hunters' and Ontario Ministry of Natural Resources' Invading Species Awareness Program; and the Environment Canada-led Monitoring the State of the St. Lawrence program, in partnership with Lake Saint-Pierre ZIP Committee, Société d'aménagement de la baie Lavallière, and Laval University, which utilizes community-based monitoring to track temporal and spatial trends in invasive plant species

Although current monitoring programs in the basin are fragmented, collaborative efforts are being developed to determine future monitoring priorities. This information will be applied to risk analysis, predictive science, modeling, improved technology for prevention and management of NIS, legislation and regulations, education and outreach and international co-operation.

Comments from the authors

In 2000, the World Wildlife Fund of Canada amassed information about 150 known NIS in Canada in a centralized database, based on books, journal articles, websites, and consultation with experts. The data also include information on NIS present in the U.S. portion of the Great Lakes basin. Currently, there is no central monitoring site for terrestrial NIS in the basin. The authors of the chapter acknowledge that a lack of centralized data was a limitation of the project. The information contained in this indicator is based on the WWF-Canada database and has been updated with several more recent insect invaders present in the Great Lakes basin.

Acknowledgments

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