



Terrestrial Non-native Species

Formerly Indicator #9002

Overall Assessment

Status: Undetermined

Trend: Undetermined

Rationale: At this time, there is no comprehensive measure of terrestrial non-native species. Terrestrial non-native species are pervasive in the Great Lakes basin. Although not all introductions have an adverse affect on native habitats, those that do pose a considerable ecological, social, and economic burden. Historically, the Great Lakes basin has been particularly vulnerable to NIS. Conditions that make the basin vulnerable to introductions include high population, industrialization, and volume of transboundary movement of goods and people.

Lake-by-Lake Assessment

Standards are being developed within and across states and provinces. However, assessments of individual lake basins are unavailable due to lack of monitoring data. Generalized inferences from the context of land-use can be made. Fragmented and developed landscapes tend to harbor a greater number of terrestrial non-native species.

Purpose of Indicator

To assess the presence, number, and distribution of harmful terrestrial non-native species in the Laurentian Great Lakes basin, and to understand the means by which these species are introduced and persist. To aid in the assessment of the status of terrestrial biotic communities, as non-native species can alter both the structure and function of ecosystems and compromise the biological integrity of the lakes.

Ecosystem Objective

The ultimate goal of this indicator is to limit, or prevent, the unauthorized introduction of non-indigenous species, and to minimize the adverse affects of harmful non-native species in the Great Lakes basin. Such action assists in the accomplishment of the U.S. and Canada Great Lakes Water Quality Agreement objective to restore and maintain the biological integrity of the waters of the Great Lakes ecosystem (United States and Canada 1987).

Ecological Condition

Globalization, i.e., the movement of people and goods, has led to a dramatic increase in the number of terrestrial non-native species that are transported from one country to another. In part a consequence of 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. Once new species arrive to the basin, the status of the landscape: (ie. degradation, fragmentation, and loss of native ecosystems) potentiate non-native species to invade terrestrial habitats as invasive speceis (Ontario Invasive Species Strategic Plan 2011). Invasive species are non-native species that are often prolific and cause social, economic, or ecological harm. Although only a relatively few non-native species become established as invasive, the introduction of invasive species is considered to be one of the greatest threats to the biodiversity and natural resources of this region, second only to habitat destruction (Great Lakes Regional Collaboration Strategy 2004; Canadian Food Inspection Agency 2005).

The majority of non-native species monitoring occurs on geographic scales smaller than states and provinces. Monitoring scales can be as small as individual natural areas, and as expansive as basin-wide. There is a growing number of invasive species monitoring programs at the scale of regions within the basin, ie. the Chicago region. A

comprehensive basin-wide standard for invasive species monitoring has yet to be established. Monitoring data that come from a variety of agencies and organizations throughout the region, and are difficult combine for a useful assessment of the overall presence and impact invasive species are having on the region. Basin-wide data provided in 2003 by the World Wildlife Fund of Canada (Haber 2003) indicates that there were 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 (Figure 1). Invasive Plant Association of Wisconsin (2003) identified 66 non-native plants within the state, while over 100 terrestrial plants have been introduced into the Chicago region alone (Chicago Botanic Garden 2011). While estimates vary, the magnitude of data listed above does not compare to the over 900 non-native plants that have been identified within the state of Michigan (Michigan Invasive Plant Council 2005). Detection and identification of non-native species limits the number of non-native species counted within monitoring programs.

Despite the absence of a basin-wide standard measure for terrestrial non-native species, Great Lakes basin scale mapping efforts are underway for select species. For example, the United States coastal distribution of monotypic *Phragmites australis* stands have been documented for the basin (ex. Figure 2, Lake Erie). The maps represent potential stands of *Phragmites* with a minimum mapping unit of 0.5 acres, and have been produced using a combination of synthetic aperture radar and field documentation. *Phragmites* is a highly productive plant, spreading quickly by horizontal runners, exhibiting a strong tendency to form monotypic stands, exclude native species, and change native plant communities. This invasive species is taking advantage of rapid water level fluctuations and increasing ambient temperatures to invade the coastal wetlands of the Great Lakes (Wilcox et al. 2003). Once established, *Phragmites* is difficult and costly to control. A pilot project by the Ontario Ministry of Natural resources estimates control costs to range from \$865-\$1,112 per hectare (Gilbert et al 2009a, Gilbert et al 2009b).

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. In a study by WWF Canada, most (19 of 29) high impact non-native species in the basin are plants. Select non-native plant species, which are 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 high impact invasive plant species. The Asian longhorn beetle, Dutch elm disease, emerald ash borer (see Figures 3 and 4), leafy spurge, and the West Nile virus are other terrestrial invaders that have had a significant impact in the Great Lakes basin.

Linkages

The growing transboundary movement of goods and people has heightened the need to prevent and manage terrestrial invasive non-native species. Most invasive species introductions can be linked to 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 strict preventive measures are enforced. The expansion of population, recreation and tourism all contribute to the number of non-native species 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 invasive non-native species will persist unless it is addressed on all fronts.

Management Challenges/Opportunities

“Invasive non-native species are a significant stressor on ecosystem functions, processes, and structure in terrestrial, freshwater, and marine environments. This impact is increasing as numbers of invasive non-native species continue to rise and their distributions continue to expand” (Canadian Biodiversity: Ecosystem Status and Trends 2010).

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 non-native species 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 non-native species 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 non-native species 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. Collaboration between the two countries is reflected in the similarities between the respective approaches to non-native species issues. Tri-nationally, the North American Invasive Species Network (NAISN) was legally created in 2011. The Commission for Environmental Cooperation (CEC) is providing funding to NAISN and the Global Invasive Species Information Network (GISIN) for, amongst others, enhancing NAISN/GISIN for web-based information and data sharing.

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* prioritizes prevention, early detection, rapid response, and effective management. In 2005, the Canadian federal budget contained the first line item ever to target invasive species directly, for \$85 million.

At the provincial level, Ontario’s Invasive Species Plant Council is the organizing center for non-native species prevention and management. The latest articulation of non-native species philosophy and management is found in the Ontario’s Invasive Species Strategic Plan for 2011 (OISSP 2011). The Strategy continues emphasis on

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prevention, early detection, rapid response, and effective management, but includes progressive views of ecosystem resilience, biodiversity, climate change and adaptive management as relates to invasive species. The strategy acknowledges that invasive species are best able to invade degraded environments, and forwards the view that managing for healthy, resilient ecosystems, is an additional preventative strategy to the spread and naturalization of non-native species. “Ensuring ecosystems are healthy and resilient will increase their capacity to cope with disturbances, such as invasive species. Efforts by the Ontario Government and our partners to protect healthy ecosystems and rehabilitate degraded ecosystems will help prevent invasive species from establishing” (Ontario Invasive Species Strategic Plan 2011).

Examples of additional ongoing Canadian multi-level responses within the basin include: Biodiversity Institute of Ontario- and 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 (which includes an invasive species reporting hotline); and the State of the St. Lawrence program 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 author(s)

Terrestrial invasive non-native species degrade the biological integrity of the whole Great Lakes ecosystem through the erosion of the ecological services that the watershed provides. The health of the Great Lakes cannot be maintained through management of the waters alone.

Assessing Data Quality

Data Characteristics	Strongly Agree	Agree	Neutral or Unknown	Disagree	Strongly Disagree	Not Applicable
1. Data are documented, validated, or quality-assured by a recognized agency or organization						x
2. Data are traceable to original sources						x
3. The source of the data is a known, reliable and respected generator of data						x
4. Geographic coverage and scale of data are appropriate to the Great Lakes basin						x
5. Data obtained from sources within the U.S. are comparable to those from Canada						x
6. Uncertainty and variability in the data are documented and within acceptable limits for this indicator report						x

Clarifying Notes: No data is utilized in the non-assessment of terrestrial non-native species status and trend.

Acknowledgments

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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

Figure 2. Lake Erie Potential Phragmites locations, 2011

Source : Laura Bourgeau-Chavez, Michigan Tech Research Institute

Figure 3. Emerald Ash Borer Regulated Areas of Canada, 2011

Source: Canada Food Inspection Agency

Figure 4. Emerald Ash Borer Distribution in the Great Lakes and beyond, 2010

Source : Cooperative Emerald Ash Borer Project 2010

Last Updated
 State of the Lakes Ecosystem Conference (SOLEC) 2011

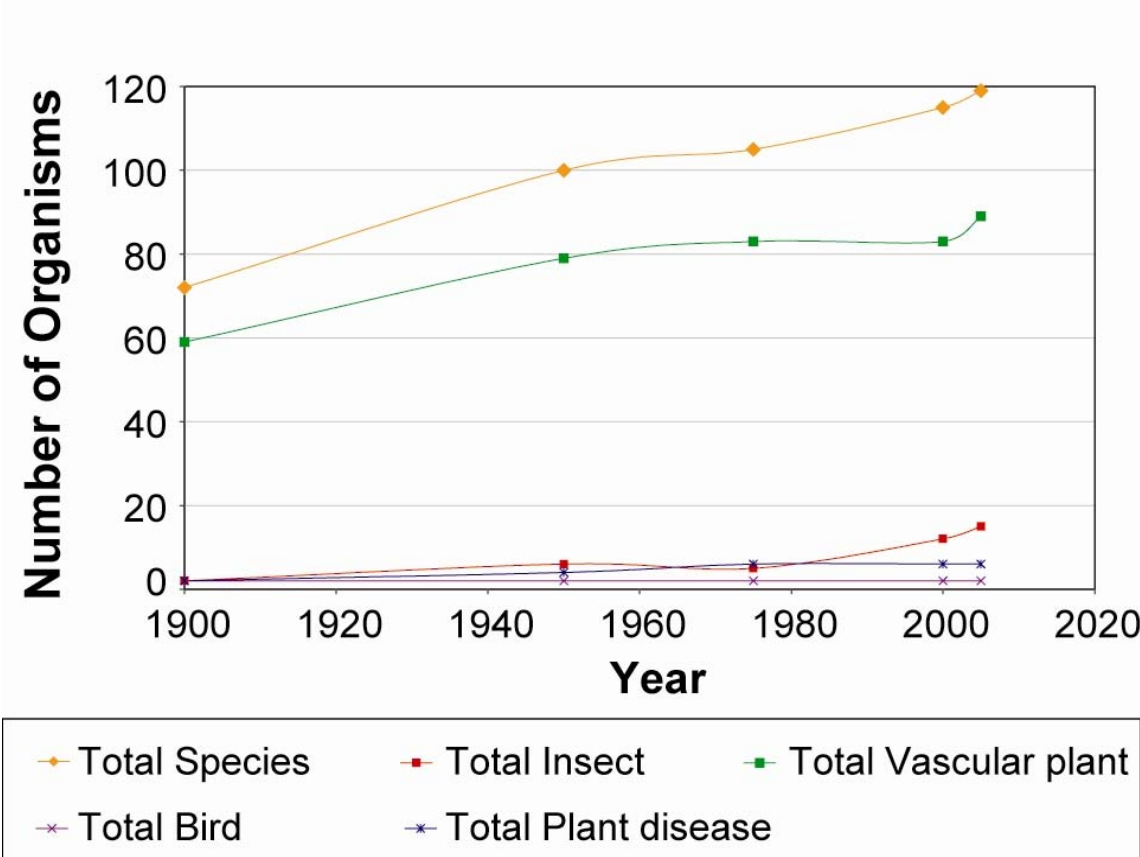


Figure 1. A timeline of terrestrial introduction in the Great Lakes basin by taxonomic group, 2003
 Source: World Wildlife Fund-Canada’s Exotic Species Database, and the Canadian Food Inspection Agency

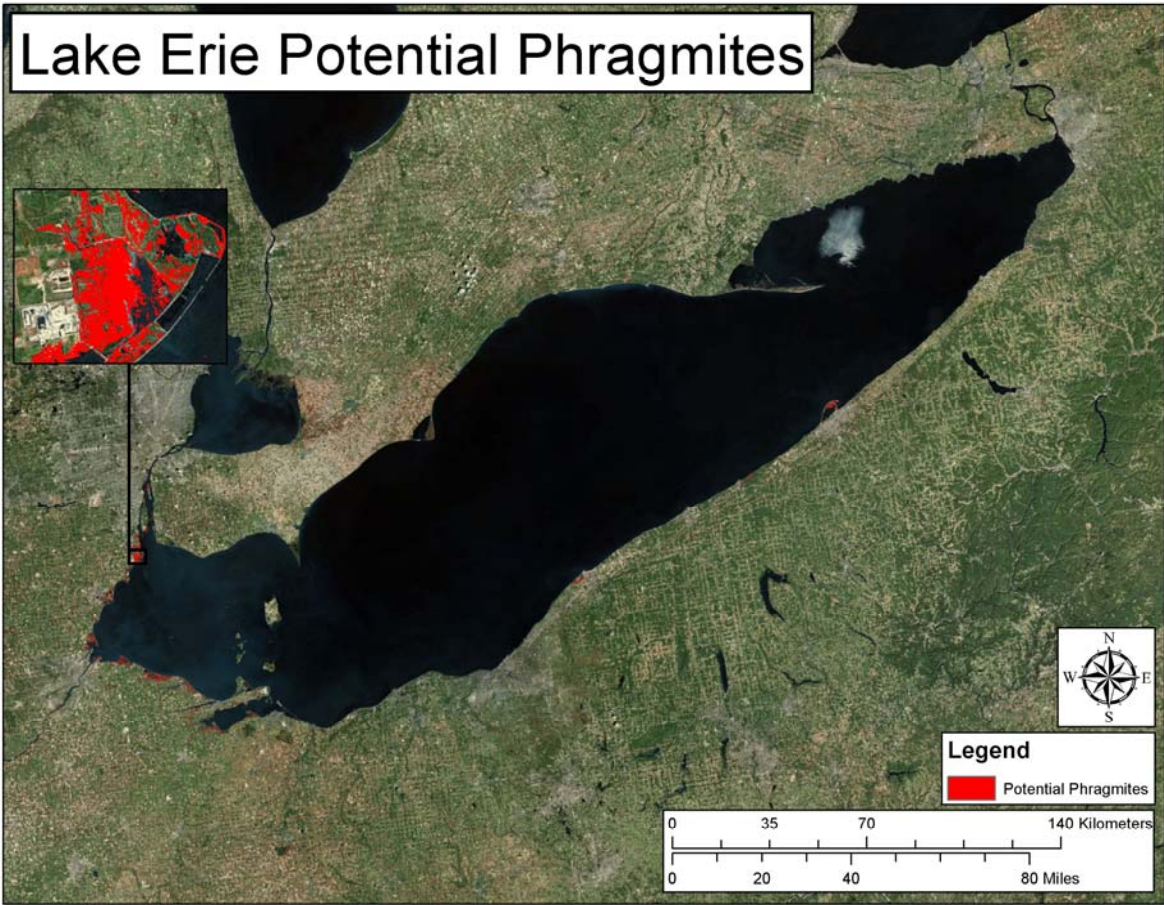


Figure 2. Lake Erie Potential Monotypic Phragmites locations, minimal unit of 0.5acres, 2011
Source: Laura Bourgeau-Chavez, Michigan Tech Research Institute

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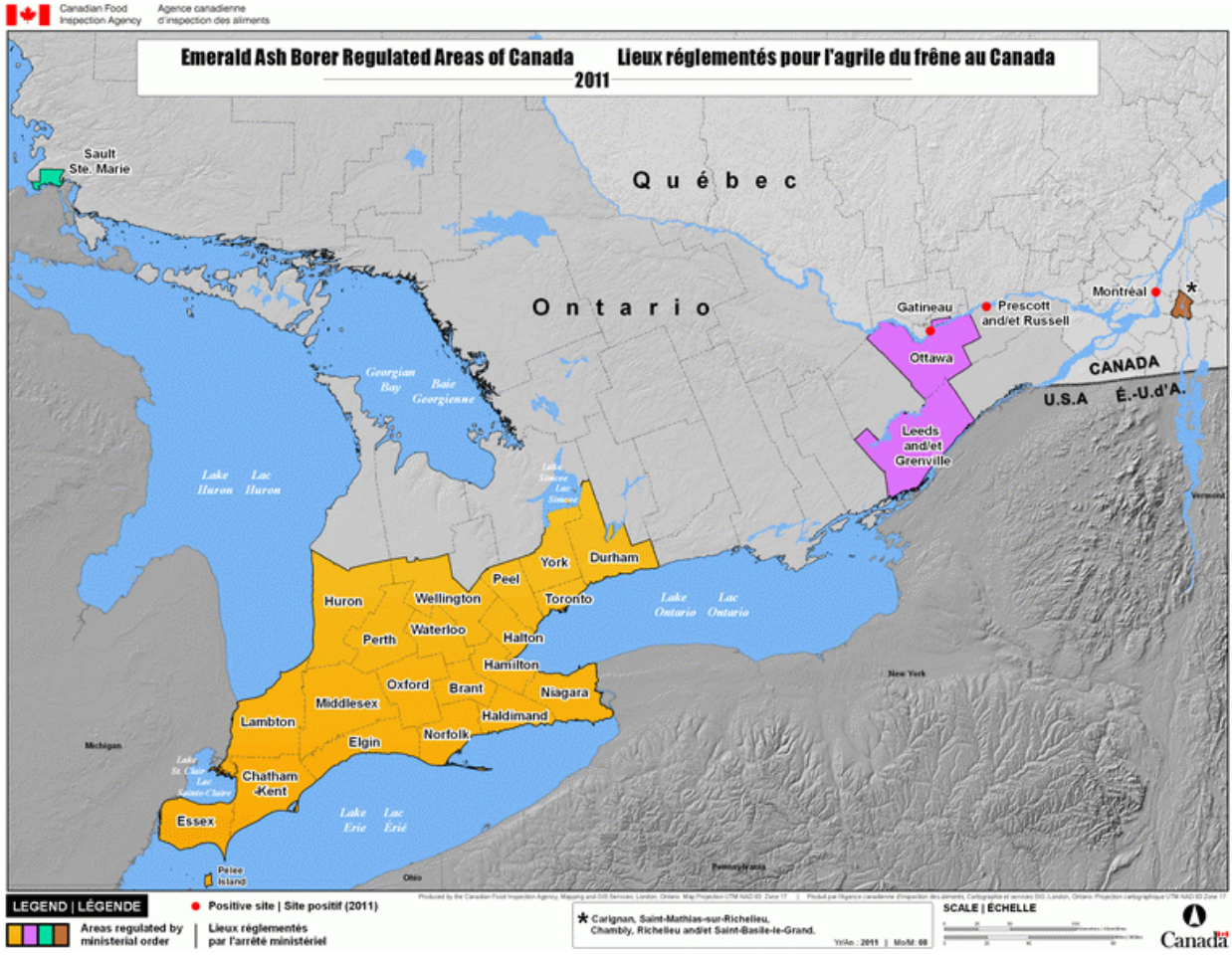


Figure 3. Emerald Ash Borer Regulated Areas of Canada, 2011
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