A Report on Invading Species HIGH LEVEL 4

A

A Report on the Status of Purple Loosestrife in Ontario Directed to the Honourable Minister of Environment

The following report outlines the ecological and economic impact of purple loosestrife (*Lythrum salicaria*) in Ontario and proposes immediate and long-term action plans for control and eradication. Purple loosestrife is an invasive species that is becoming widespread throughout Ontario. Now known as the "purple plague," this invasive plant poses a serious threat to wetland vegetation and wildlife throughout Ontario (Ruddell, 2003). The need for an action plan is immediate.

Characteristics and Habitat

Purple loosestrife is a herbaceous perennial of Eurasian origin (Swearingen, 2003). Purple loosestrife is an aggressive invader, and it poses special challenges to management due to multiple characteristics. Firstly, it has a high sexual reproduction rate, both through self-pollination and cross-pollination (NPWRC, 2003). A plant can produce 2.7 million seeds each year, each about the size of a grain of sand, which can remain viable in soil for many years until conditions are optimal (NPWRC, 2003). It also has the ability to reproduce vegetatively through the formation of adventitious shoots and rooting of buried and cut stems (NPWRC, 2003). This plant's optimal habitats are those which are wet or moist for at least part of the year, such as marshes, and in slightly acidic soils, although established plants can tolerate drier conditions and a wide variety of soil types (Ruddell, 2003).

B

Its relative stout and firm stems make the plant difficult to mow and manage (Weed Watch, 2003). The plant can form dense, impenetrable stands that are unsuitable as cover, food or nesting sites for a wide range of native wetland animals (Weed Watch, 2003). The showy purple flowers, which bloom from July to September, make it desirable to horticulturists for its beauty as a landscape plant, but one which can readily invade adjacent lands and become a menace (Ruddell, 2003). When conditions are not optimal, purple loosestrife has the ability to adapt. It responds to soil nutrient (P and N) deficiencies by increasing the root to shoot ratio. When water levels rise, purple loosestrife grows *aerenchyma* in the submerged stem tissue. A decrease in light can trigger a change in leaf morphology (National Wildlife Refuge, 2003).

An additional advantage of purple loosestrife is that in Ontario there are no native predators, such as insects and diseases, to maintain balanced population levels (USGS, 2003).

The rapid spread of purple loosestrife in Ontario is shown in Figure 1. The purple shading shows the area in which purple loosestrife was found in 1980 and in which it was still present in 1995. The red shading shows the new areas invaded between 1980 and 1995.

C

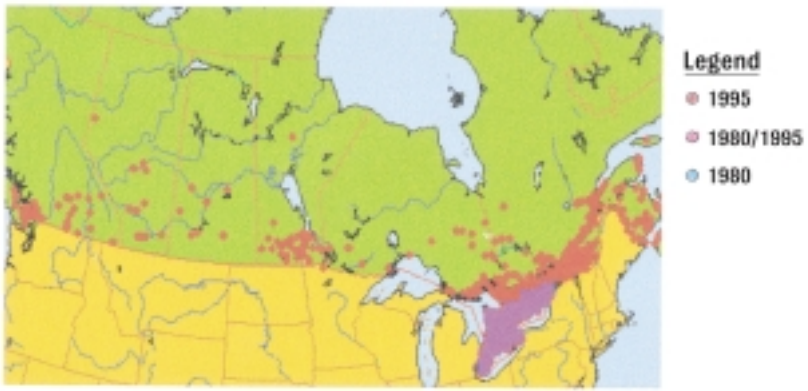

Figure 1

Distribution of Purple Loosestrife in Ontario as of 1980 and 1995 based on historic collections and sight records made as part of a national Purple Loosestrife survey.

Environmental and Economic Impacts

Purple loosestrife is invasive and competitive (Invasive Plant Council, 2003). It can quickly adapt to environmental change and as it establishes and expands, it out grows and replaces native plants used for ground cover, food, nesting material, and habitation for native animals (Invasive Plant Council, 2003). This in turn leads to a variety of environmental and economic impacts (see Figure 2). In North America, 190,000 hectares of wetlands, marshes, pastures and meadows are affected each year, with an economic impact of about $40 million (Pimentel et al, 2003).

D

Immediate	Long-term
- Replaces native wetland communities (USGS, 2003)	- Reduces bio-diversity and creates a monoculture (Blossey, 2001)
- Eliminates food and shelter for wildlife species; muskrat, bog turtles, marsh wrens, herons, etc. (USGS, 2003)	- As vegetation areas are displaced, many plants, such as Swamp Rose mallow are being forced to extinction (Blossey, 2001)
- Reduces habitat for waterfowl; food, shelter and nesting (Blossey, 2001)	- Reduces waterfowl production, eventually decreasing their population (Blossey, 2001)
- Impacts fish spawning habitats (USGS, 2003)	- Significant economic cost for Wetland Restoration projects (USGS, 2003)
- Impedes water flow in drainage and irrigation ditches (Lindgren, 2003)	- Alters decomposition rates and nutrient cycling in marshes (Blossey, 2001)
- Decreases crop yields and degrades forage values of lowland pastures (Lindgren, 2003)	- Decreases property value of rural land (Lindgren, 2003)
- Reduces recreational use of wetlands; hunting and trapping grounds are being lost (Lindgren, 2003)	- As food, shelter, and breeding areas decrease, many native animal species are becoming endangered (Blossey, 2001)

Figure 2

Environmental and economic impacts of purple loosestrife

HIGH LEVEL 4

E

Predictions for the Future

Natural plant diversity in an ecosystem is crucial for attracting and supporting a variety of life forms (Blossey, 2001). Purple loosestrife invades wetlands and chokes the native vegetation and wildlife, thereby diminishing the area's ecological value (LARSEES, 2003). Purple loosestrife in turn disrupts the fragile ecosystem, which has endless repercussions within the environment and economy (LARSEES, 2003).

The spread and dominance of purple loosestrife in North America has shown a pattern of exponential increase (USGS, 2003). Therefore it can be predicted that purple loosestrife will continue to invade and expand, displacing vegetation, thereby decreasing food, shelter, and nesting for native wildlife (Blossey, 2001). If this continues, the end results may be the endangerment and in severe cases, extinction of native vegetation and wildlife. Decreasing populations of native vegetation and wildlife reduces bio-diversity and creates a monoculture (Blossey, 2001). Purple loosestrife will also continue to be a menace to farmers and landowners, who will face loss of crop yield and income. As purple loosestrife becomes more widespread, the economic expenditures will also vastly increase. The expenditures will encompass the cost of unclogging drains and irrigation ditches, the cost of restoration projects, and the loss of income at ecological tourist sites such as national parks, marshes, and recreational sites.

F

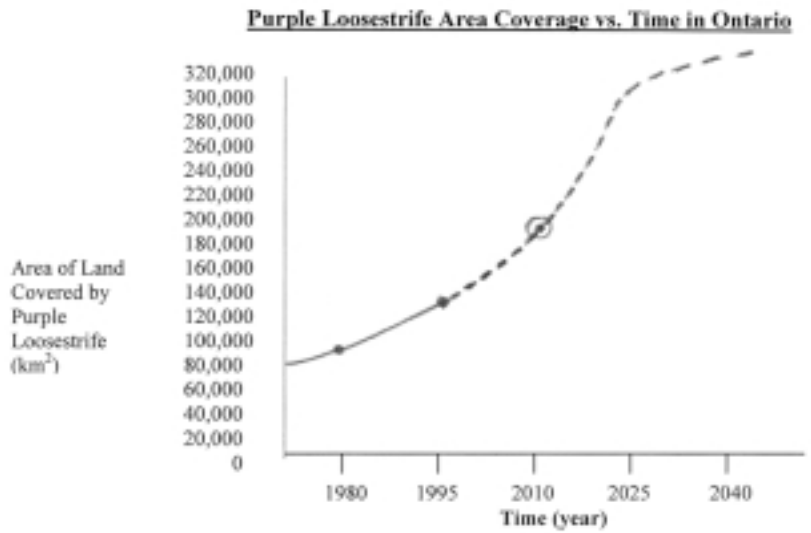

Figure 3:

Area of land covered by purple loosestrife in Ontario. Data taken from distribution maps from 1980 and 1995, and predicted area coverage based on exponential growth and eventual stability.

In 1980, purple loosestrife covered 90,229.4 km2, while in 1995, it covered 131,646.1 km2. This was an increase of 46% in 15 years. It can be predicted that the area in which purple loosestrife is found will continue to grow exponentially at a rate of 46% every 15 years. Eventually the population of purple loosestrife will level off because of the absence of further land to invade (see Figure 3). However, this is in the distant future, as there is still a large area of untouched land which provides the optimal habitat for purple loosestrife to grow, and because of purple loosestrife's ability to adapt to new environments, it may in the future invade outside of its predicted range.

G

Control Measures

Purple loosestrife may be controlled using physical means, including hand pulling, cutting, mowing, cultivation, inundation and fire (Department of Natural Resources, 2003). However, these methods are labour-intensive, and are only effective in small populations of newly established purple loosestrife (Department of Natural Resources, 2003). Bio-control, which works by using a plant's natural enemies against it, is now considered the most viable for more complete control of heavy infestations, because (1) negative ecosystem impacts of purple loosestrife in North America justify control of the species and that (2) detrimental effects of purple loosestrife on wetland systems and biota and the potential benefits of control outweigh potential risks associated with the introduction of bio-control agents (Blossey, 2001). In 1992, five insect species which feed exclusively on purple loosestrife in Europe were approved as bio-control agents in North America. After years of rigorous testing, it was ensured that these insects would not eat agricultural crops, and that they would not have a significant impact on wetland species other than purple loosestrife (U.S. Fish and Wildlife Service, 2003).

Recommended Action Plan

It is strongly recommended that the Ministry of Environment immediately put the following action plan in place, with the overall objective of introducing two leaf-feeding beetles to areas in Ontario, to significantly reduce purple loosestrife. This would involve the following:

- instruct the Biological Control Laboratory of Ontario to rear two leaf-feeding beetles, *Galerucella calmariensis* and *G. pusilla*;
- create community-based groups across Ontario who will be in charge of running their community's beetle release;

H

- have each community identify areas of infestation with area reports being sent to the Ministry of Environment to determine severity of problem and number of beetles needed for each area;
- recruit and teach volunteers from the community to become educated on issues surrounding purple loosestrife and become involved with the release of the beetles in their community;
- work together with municipalities, naturalist groups, and interested individuals to release beetles into designated areas in Ontario;
- create a purple loosestrife database and provide feedback on the progress of the program to the community;
- long-term experiments and monitoring programs to be established to evaluate the impact of these insects on purple loosestrife, on wetland plant succession and other wetland biota.

HIGH LEVEL 4

I

Bibliography

Blossey, B.
Available: http://sgnis.org/publicat/skinblos.htm
Date Last Accessed: 19/05/03

Invasive Plant Council of New York State
Available : http://www.bouquetriver.org/purloostf.html
Date Last Accessed: 24/05/03

LARSEES
Available: http://larsees.geog.queensu.ca/html/loostrife.html
Date Last Accessed: 18/05/03

Purple Loosestrife
Available: http://www.great-lakes.net/envt/flora-fauna/invasive/loosestf.html
Date Last Accessed: 8/05/03

Purple Loosestrife
Available: http://www.wapms.org/plants/purpleloosestrife.html
Date Last Accessed: 8/05/03

University of Guelph
Available: http://www.uoguelph.ca/mediare1/96-07-19/purple.html
Date Last Accessed: 18/05/03

Weed Watch Canada
Available: http://coosswed.oacd.org/Purple%20Loosestrife.htm
Date Last Accessed: 9/05/03

Wisconsin Department of Natural Resources
Available: http://www.dnr.state.wi.us/org/land/er/invasive/factsheets/loose.htm
Date Last Accessed: 16/05/03

Teacher's Notes

Knowledge/Understanding

– The student demonstrates a high degree of understanding of how the invading species has adapted. He or she describes numerous adaptations that make purple loosestrife successful in the environment (e.g., "It responds to soil nutrient (P and N) deficiencies by increasing the root to shoot ratio"; "firm stems make the plant difficult to mow"; "can form dense, impenetrable stands"; "When water levels rise purple loosestrife grows *aerenchyma* in the submerged stem tissue").

Inquiry

– The student analyses the actual or potential problem with a high degree of effectiveness. He or she describes many aspects of this plant that may negatively affect the human population and the environment. For example, the student mentions that the spread of the plant "Reduces recreational use of wetlands" and "Decreases property value of rural land". He or she also mentions that the environment is affected through the reduction of biodiversity, the elimination of food and shelter for such native wildlife species as "muskrat, bog turtles, marsh wrens, herons, etc.", and the alteration of "decomposition rates and nutrient recycling in marshes".
– The student predicts the future impact of the invading species with a high degree of effectiveness. In addition to the long-term impacts listed in Figure 2 of the report, he or she predicts the results of future population increases (e.g. "As purple loosestrife becomes more widespread, the economic expenditures will also vastly increase. The expenditure will encompass the cost of unclogging drains and irrigation ditches, the cost of restoration projects, and the loss of income at ecological tourist sites such as national parks, marshes, and recreational sites").

Communication

– The student communicates information in graph/chart/table format with a very high degree of clarity. He or she uses a map to show the rapid spread of purple loosestrife in Ontario. The map includes a legend, which is explained in a paragraph of the text and in the caption to the figure. The

graph shows the area of land covered by purple loosestrife in Ontario in the past and projected into the future. The graph is titled and clearly labelled and has a caption. The graph is consistent with the description in the subsequent paragraph of the text.

– The student communicates ideas and information with a very high degree of clarity. The report is very well organized into logical sections, and it flows well. The student writes clearly and uses scientific terms appropriately. A minor criticism is the use of commas instead of spaces in large numbers (e.g., "20,000", instead of 20 000).

Making Connections

– The student recommends and justifies a highly effective course of action. He or she describes current research on control methods, and uses this research to develop a very detailed plan "to significantly reduce purple loosestrife" by "introducing two leaf-feeding beetles". The student also uses current research to justify the recommendation (e.g., "the potential benefits of control outweigh potential risks associated with the introduction of bio-control agents").

Comments

This work is representative of a high level-4 performance. The student demonstrates a high degree of achievement of the expectations in the Knowledge/Understanding, Inquiry, and Application categories of knowledge and skills. However, in the Communication category, the student demonstrates a very high degree of achievement.

Next Steps

In order to improve his or her performance, the student should:

- use spaces instead of commas in writing large numbers.