

## A Report on Invading Species HIGH LEVEL 2

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### A Report for the Ministry of the Environment: An Invading Species

#### Pine Shoot Beetles

#### The Present Problem

The common pine shoot beetle (*Tomicus piniperda*) was first discovered in North America in July, 1992. The beetle originates from parts of Europe and Asia. It was first discovered in Ohio, subsequent studies throughout the years have shown the presence of the beetle in 26 counties of Southern Ontario, parts of Quebec, and 6 US states; Illinois, Indiana, Michigan, New York, Ohio, and Pennsylvania. Although these beetles are very small, they can create massive amounts of damage for their size. Cylindrical in shape, they have a length anywhere from 3-5mm and a width of about 2mm, with colours ranging from reddish brown to black.

Pine shoot beetles were thought to only infest Scots pine trees, but soon it was found that they can attack other native species. This invading species most likely arrived in this continent from ships coming from Europe, the packing materials such as skids, or wood logs used to protect cargo could have easily contained these beetles within. Characteristics of an infested tree are pin head sized holes approximately 2mm in diameter near the shoots of trees. The beetles eat the pith of shoots. They usually feed in each shoot for a length of approximately 1-10 cm. These holes are usually surrounded by a crust of dried tree sap. Other symptoms include damaged or yellowing shoots near the top of the tree. Damaged shoots will tend to droop over and can eventually fall off the tree. These beetles, if left untreated can cause total tree death or mortality, in 2 years. The threat may occur

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anywhere there are Scots pine or other native species of pine trees in Ontario. This may eventually have a large impact on our economy by damaging the forestry industry in Canada.



A picture of an entrance hole made by a pine shoot beetle.

Photo courtesy of Natural Resources Canada

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**A Scientific Point of Vie**

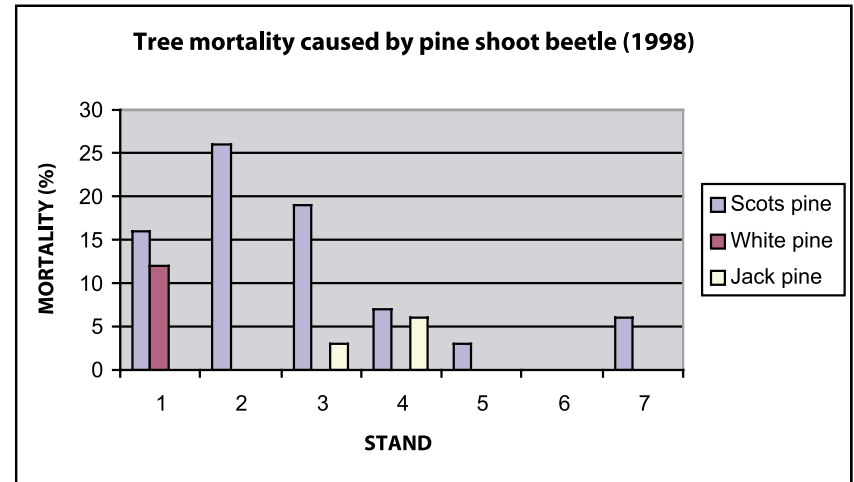
It was once thought that the pine shoot beetle would only attack aging, or unhealthy forests. Studies have shown that this is not true, can areas that have strong, healthy trees can also be infected. Earlier studies showed that *Tomicus piniperda* was thought to only nest or brood, in fallen trees, dead trees, and freshly cut tree stumps. But, until recently, studies have shown the pine shoot beetle may produce its own nesting areas in living trees. If nesting areas are not adequate in an area, adult beetles can fly several hundred kilometres in search of nesting material. One generation of beetles is produced a year. A female pine shoot beetle can burrow into a tree and lay a nesting gallery from 10-25 cm in length, with each egg measuring 1mm long. Upon hatching, larvae will produce their own feeding galleries which radiate from the original gallery and feed on the tree until they are large enough to burrow out and find a new tree to feed on.

These beetles usually work their way from the top of a tree to the bottom, feeding on the pith of shoots. One adult pine shoot beetle may feed on approximately seven shoots a year. During the winter, an adult beetle may over winter in the fallen shoots in warmer climates, but generally spend the winter under bark scales at the base of the tree or in the soil where they are insulated by snow. The beetles emerge around the warm days of Spring when the temperature reaches 10-12° C. When population of beetles is high, they may nest in other types of pine trees including Austrian pine, eastern white pine, red pine, and jack pine.

The amount of eggs laid by an adult female varies greatly between each beetle; it is because of this that it is hard to determine any solid population numbers. Other factors for the population to be hard to determine are the size of the beetle and the fact that they remain burrowed underneath tree bark for the most part of the year. However, there have been studies in areas to show how these beetles affect certain stands of trees. This graph, provided by the Ontario Ministry of

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Natural Resources to show confirmed damage of the known species of pine the pine shoot beetle will attack:



The information from the graph is shown in this table:

Stand	Mortality (%)		
	Scots Pine	White Pine	Jack Pine
1	16	12	
2	26		
3	19		3
4	7		6
5	3		
6			
7	6		

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If left untreated, the damage this beetle can cause will be immense. Regulations have already been put on the lumber trade, stating all lumber removed from areas of infestation must be either kiln dried, or treated with chemicals to prevent further spread of this invading species of beetle.

Treatment can be done by various methods. The cheapest and probably the most effective tool against the spread of the pine shoot beetle is to remove all possible nesting material. Removing these pine materials can dramatically help the spread: recently cut stumps, cut trees with bark attached, branches over 5 cm in diameter, stressed or dying trees. All material should be chipped, burned or buried under at least 30 cm of soil no later than May 31. This countermeasure can be taken by any citizen, not just by the government. Another way to help eradicate the pine shoot beetle is to lay down nesting traps. Laying down cut logs at least 5” in diameter along the ground near stands of pine trees in areas that are known to be infected can lure these beetles into these logs. Once inside the logs can be burned or chipped.

The problem we are facing from these beetles is not only environmental, but also economically. Tree stands will weaken if these beetles are left to continue feeding on trees. Forests will slowly degenerate, and the health of old growth forests will decline. With the decline of old growth forests from the forestry industry, we sure do not need another threat to help us further damage the ecosystem. The economy of our country also takes impact from these beetles. The regulations put forth by the government to try and control the beetle population is also making costs of foresting higher, also these beetles can degrade the quality of wood being exported. With control and careful countermeasures, the pine shoot

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beetle population can be kept at bay, and may also decline. This map shows the known areas of infection in Ontario and other surrounding areas:



Courtesy of Natural Resources Canada

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**Bibliography**

Ministry of Agriculture, Food, and Fisheries, “Pest Control: Pine Shoot Beetle” 2001

<<http://www.agf.gov.bc.ca/cropprot/psbeetle.htm>>

Ontario Ministry of Natural Resources, “Pine shoot beetle” November, 2002

<http://www.ontariosforests.mnr.gov.on.ca>

Pacific Forestry Centre, “The Pine Shoot beetle” October, 1998

<<http://warehouse.pfc.forestry.ca/pfc/5134.pdf>>

**Teacher’s Notes****Knowledge/Understanding**

- The student demonstrates considerable understanding of how the invading species has adapted. The student describes the life cycle of the pine shoot beetle, and he or she links various characteristics to adaptations (e.g., “may produce its own nesting areas in living trees”; “generally spend the winter under bark scales at the base of the tree or in the soil where they are insulated by snow”). However, the student has not linked the adaptations to the environmental conditions in Ontario (e.g., many living trees, cold winters).

**Inquiry**

- The student analyses the actual or potential problem with some effectiveness. He or she identifies the food source of the beetle and describes how an infestation occurs in a given area (e.g., “When population of beetles is high, they may nest in other types of pine trees”). The student notes reasons for the lack of population data. However, the report lacks a detailed description of the economic impact of the beetle on the forestry industry.
- The student predicts the future impact of the invading species with some effectiveness. He or she states that “These beetles, if left untreated can cause total tree death or mortality, in 2 years” and that “This may eventually have a large impact on our economy by damaging the forestry industry in Canada.” However, the magnitude of this possible “large impact” is not made clear. The student also suggests that “With control and careful countermeasures, the pine shoot beetle population can be kept at bay, and may also decline.”

**Communication**

- The student communicates information in a graph/chart/table with some clarity. The report includes a graph and a map that are credited to other sources, rather than being student generated. The report also includes a table, which is set up very clearly. However, it is not very useful because it duplicates the data already shown in the graph.

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- The student communicates ideas and information with some clarity. The writing is generally clear, but the report does not have appropriate sub-headings to aid the reader. Parts of the report are not well organized (e.g., the opening paragraph describes the distribution of the beetle in North America, but the corresponding map does not appear until the end of the report).

**Making Connections**

- The student recommends and justifies a course of action of some effectiveness. He or she describes some measures that can be taken (e.g., removing nesting material, setting traps) and the government regulations that “have already been put on the lumber trade”. However, there is no indication of the effectiveness of existing measures, and no suggestions for additional measures that might be taken by the government, the forestry industry, or members of the public if the problem persists or worsens.

**Comments**

This work is representative of a high level-2 performance. The student demonstrates some degree of achievement of the expectations in the Inquiry, Communication, and Making Connections categories of knowledge and skills. However, in the Knowledge/Understanding category, the student demonstrates a considerable degree of achievement – i.e., achievement that is more characteristic of level 3.

**Next Steps**

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

- link adaptations to the environmental conditions in Ontario;
- include a detailed description of the economic impact of the invading species;
- use scientific data to predict the future impact of the invading species in more detail;
- use scientific data to generate his or her own graph;
- use appropriate subheadings in the report;
- edit and proofread the report to improve organization;
- make a more detailed recommendation;
- use scientific data to justify the recommendation.