Volume 8, No. 1, Spring 2004

Forest Health & Biodiversity News
Canadian Forest Service

Alien Forest Insects: What's Bugging Us in Ontario? Emerald Ash Borer and Asian Longhorned Beetle

The emerald ash borer (EAB), *Agrilus planipennis*, and the Asian longhorned beetle (ALB), *Anoplophora glabripennis* are two exotic insects that have become established in southern Ontario in recent years. The Canadian Forest Service is leading the science research activities for both pests in an effort to better identify, understand, control, and hopefully eradicate these alien insects from Canada.

The EAB was first detected in North America in the spring of 2002 in southeastern Michigan, near Detroit. Based on evidence collected from dead green ash trees (*Fraxinus pennsylvannica* var. *subintegerrima*), it was concluded that it has been present in Michigan for at least five years. This insect is native to Asia, and was likely transported to North America in solid wood packing material, or in logs used to stabilize cargo within shipping containers.

In July 2002, EAB-infested ash trees were detected within the city limits of Windsor, in southwestern Ontario, by a team of forest health technicians from the Canadian Forest Service (CFS) and the Ontario Ministry of Natural Resources. Subsequent surveys by the Canadian Food Inspection Agency (CFIA) showed the beetle has spread some distance from the Windsor area (Fig. 1). The CFIA estimates that 100,000 - 200,000 ash trees in Essex County have been infested by the beetle.

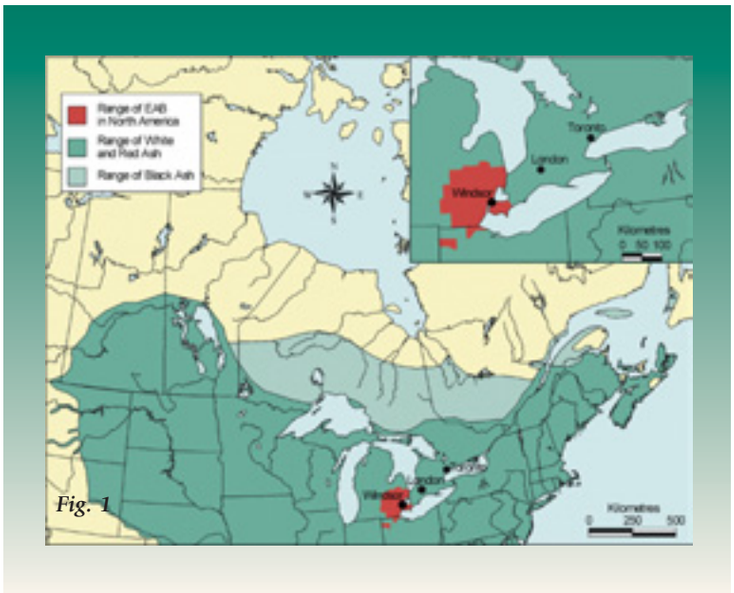

Fig. 1

The adult beetle is a slender, elongated, bright green beetle, approximately 7.5 to 13.5 mm long, with metallic, emerald green wing covers (Fig. 2). Larvae are 26 to 32 mm long, and are cream colored with a flattened brown head. Mature larvae overwinter in a shallow chamber excavated in the sapwood and adults emerge the following spring through D-shaped exit holes, 3 - 4 mm in diameter.

The larvae feed on the phloem and outer sapwood for several weeks, creating S-shaped feeding galleries up to 50 cm in length. In heavily infested trees, the numerous galleries soon girdle the stem, killing a tree in as little as two to three years. All native and cultivated species of ash are at risk of attack. The EAB is capable of attacking stressed and healthy, urban and forest trees of all sizes. Other biotic and abiotic factors have been affecting the health of ash trees in Ontario for the past several years. Some of these factors can result in symptoms very similar to those outwardly displayed by EAB-infested trees, making it difficult to properly identify an EAB-infested tree without stripping off some of the bark or seeing evidence of exit holes.

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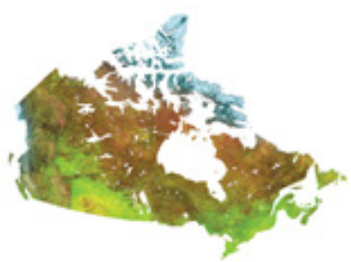

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Publication Sales Agreement #40035189
Return Address
Atlantic Forestry Centre
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E3B 5P7

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Ash trees are a very important component of the forests in eastern Canada, both ecologically and economically. They are a significant component of the southern Ontario forest, particularly in southwestern Ontario, and a common shade tree species in cities and towns. Ironically, many of the large urban ash trees that now exist were originally planted to replace trees killed by Dutch elm disease, yet another introduced pest. The EAB, if not effectively controlled, has the potential to spread across the entire range of ash. Control of this insect is proving very costly, being estimated at $ 8 - 12 million for this year alone, not including the direct cost to cities such as Windsor, where the removal of individual trees can cost up to $800.

The EAB was previously unknown in North America and little was known about the beetle in its native range. Because of this, the CFIA requested the assistance of the CFS to conduct a research program on the following areas:

• Assessment of trapping methods for detection of adult EAB. As part of any control program, development of effective traps to locate the insects before they infest new trees is critical. Woodborers such as the EAB are usually attracted to trees by odors or color. Work is underway to test the effectiveness of different traps.

• Evaluation of the effectiveness and movement of tree-injected insecticides to control EAB. A study has been initiated to evaluate imidacloprid, a synthetic chemical, as a systemic insecticide to kill EAB larvae feeding under the bark. There is no single answer to the control of EAB. Current techniques to control the spread of EAB rely on tree removal and destruction of the infested wood. Although this will likely remain the most effective approach, methods are urgently needed to prevent complete elimination and destruction of valuable trees from streets or parks.

• Study of the biology and seasonal development of the insect to determine emergence patterns, adult longevity, and possible natural enemies, examination of site and tree factors affecting susceptibility and vulnerability to damage by EAB, and the susceptibility of other hardwood species to EAB infestation.

▲ *Fig. 2 - Emerald ash borer adult beetle on inner bark*

▼ *Fig. 3 - Emerald ash borer galleries*

• Determination of the dispersal distance of EAB in a single season and under what conditions it takes flight. The beetle was not believed to be a strong flier in its native habitat, but work conducted by the CFS has shown the beetle can fly up to 5 km per day. This has greatly influenced the size of the ash-free zone needed to contain the insect. Based on these and other findings, the CFIA is attempting to contain the beetle through the creation of a 10 km-wide ash-free zone between Lake St Clair and Lake Erie (Fig. 1), within which all ash trees will be removed. In addition to the ash-free zone, a 10-km area of suppression, west of the no ash zone, will be established in which all infested trees will be removed.

• Development of early detection methods for trees infested with EAB. Presently, EAB is only detected when the tree shows evidence of insect galleries (Fig. 3), or beetles have emerged, creating their classic D-shaped holes. EAB can also attack the top of the tree where detection is extremely difficult, even if exit holes are present. Identification of early symptoms is needed to detect new infestations earlier and to prevent the further spread of the insect.

The CFS and CFIA are also working closely with government and university scientists in the United States, who are also combatting the EAB.

The Asian longhorned beetle (ALB) was discovered in the Toronto/Vaughan area in September 2003, after discovery of the EAB in southwestern Ontario. The ALB was first discovered at several US locations: New York City (1996), Chicago (1998), and New Jersey (2002). In Canada, the CFIA had intercepted the beetle before but this was the first record of an established population in Canada. The ALB is another exotic insect pest from Asia that likely arrived in wood packing material in the industrialized area in which it was found. All infestations in North America, including that in Toronto, predate the recent adoption of new standards that require phytosanitary treatment of wood packing material. These new standards which the CFS helped develop should reduce this threat.

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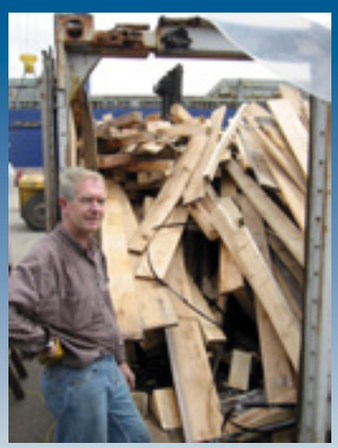
The International Forestry Quarantine Research Group: A global approach to a global problem

Canada has first-hand experience with problems caused by invasive alien species. Historically for example, chestnut blight, white pine blister rust, Dutch elm disease, and gypsy moth have changed the face of the natural and urban Canadian forest landscape. More recently, pine shoot beetle, brown spruce longhorn beetle, emerald ash borer and asian longhorned beetle have joined the list. These species not only kill trees and modify ecosystems, but can also have a serious effect on the international trade of Canada's forest products. Canada is not alone with this problem. In countries all around the world, similar invasions of damaging pest species occur. In response to this threat, plant quarantine agencies throughout the world have developed regulations and inspection systems designed to reduce the influx of unwanted pests.

The World Trade Organization -Sanitary and Phytosanitary (WTO-SPS) agreement requires that phytosanitary regulations be scientifically based. There is a clear need, therefore, for scientists to work closely with regulatory officials to provide up-to-date, sound scientific data to support the development of phytosanitary measures.

In 2000, the North American Forestry Commission, Insect and Disease Study Group formed a committee to identify critical research needs in support of North American phytosanitary regulations. One of the first projects was analysis of the science supporting the development of the North American Plant Protection Organization (NAPPO) solid wood packaging standard. This standard recognized solid wood packaging (e.g., crates, pallets, dunnage) used in international trade as one of the major pathways by which pests were moving around the world. The NAPPO standard served as a model for an international wood packaging standard, ISPM #15, developed by the International Plant Protection Convention (IPPC) that was accepted in April 2002.



Peter Koot (retired PFC technician) examines wood dunnage at the Port of Vancouver.

February 19, 2004 inaugural meeting of the International Forestry Quarantine Research Group, Rome, Italy.

Through this process, the value of an international science-based regulatory advisory group became evident.

The Canadian Forest Service (CFS) has an active program on alien invasive species that is closely affiliated with the Canadian Food Inspection Agency and other science and quarantine agencies around the world. To formalize these relationships and to enable globally coordinated science-based quarantine responses, an international collaboration of science and quarantine agencies has been formed. The International Forestry Quarantine Research Group brings together scientists and plant quarantine experts from around the world and has two primary functions:

1. To provide scientific advice and document review to the International Plant Protection Convention (IPPC).

2. To identify global forestry quarantine research needs and undertake collaborative research studies to support the development of international standards.

More than 40 scientists and quarantine officials from more than 10 countries, namely Australia, Canada, Chile, China, France, Germany, Japan, Korea, Mexico, New Zealand, South Africa, the UK, and the USA are currently participating in the group. CFS scientist Dr. Eric Allen serves as chair of the International Forestry Quarantine Research Group. The research group held its inaugural meeting in Rome in February 2004 and is currently refining the international wood packaging standard. Guidelines for submission of proposed new treatments under ISPM #15 are being developed and expert subcommittees have been formed to evaluate new treatment alternatives. A website (http://www.forestry-quarantine.org/) has been created to provide information about the group's activities and access to a discussion forum and a document library for group members.

A related development is the recent formation of a new Union of Forest Research Organizations (IUFRO) working group "Alien Invasive Species in International Trade". Dr. Hugh Evans of the UK Forestry Commission is coordinating this group. Dr. Allen serves as a deputy of this group that will bring together the broader forest science community to deal with forestry quarantine issues.

For further information, visit the International Forestry Quarantine Research Group website (http://www.forestry-quarantine.org/).

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The Mountain Pine Beetle Initiative

The mountain pine beetle infestation in the interior of British Columbia (BC) has become the largest infestation in the province's history. Endemic in lodgepole pine stands throughout western North America, the mountain pine beetle is normally limited to highly stressed trees within the pine forest ecosystem. However, when the right circumstances align, such as large areas of mature pine, fire suppression, and several years of warm winters, outbreaks make it the most destructive insect of mature pine forests.

A federal Mountain Pine Beetle Initiative has been established in response to the epidemic that has spread (in varying degrees of severity) across an estimated 4.2 million hectares of pine forests. The five-year, $40 million initiative led by Natural Resources Canada is a partnership of several federal departments, the BC government, national research institutes, First Nations, and industry. It provides assistance for rehabilitating beetle-ravaged federal and private (non-industrial) forestlands, as well as funding for research into quantifying the impacts and reducing the risk of future mountain pine beetle epidemics.

Canadian Forest Service staff at the Pacific Forestry Centre in Victoria, BC play a lead role in the Mountain Pine Beetle Initiative, complementing provincial government efforts in response to the mountain pine beetle epidemic. "The BC Ministry of Forests has worked hard to meet its responsibilities on provincial Crown land. Natural Resources Canada is addressing areas of federal jurisdiction," explains Dr. Paul Addison, Director General at the Pacific Forestry Centre.

Conducting Research

Under the Mountain Pine Beetle Initiative, a research agenda has been established called the Mountain Pine Beetle Epidemic Risk Reduction Research and Development Program. It is designed to enhance the understanding of factors influencing the magnitude and geographic distribution of mountain pine beetle. This will lead to a more efficient use of control options on future beetle outbreaks. "Enhanced research will concentrate on epidemic dynamics such as detection, mapping, and prediction; forest ecology, including responses and impacts; and management options at both landscape and stand levels," explains Dr. Bill Wilson, Director of Industry, Trade and Economic Research at the Pacific Forestry Centre and Canadian Forest Service leader of the Mountain Pine Beetle Initiative.

Mountain pine beetle damage in British Columbia

The Mountain Pine Beetle Epidemic Risk Reduction Research and Development Program includes research on product and market options, timber supply, and economic modeling to enhance community and manufacturing stability within sustainable forest resource management.

Dr. Wilson notes, "The program will also include research on factors influencing the shelf-life of beetle-kill timber and mapping these factors to improve scheduling information. Interested researchers are invited to consider participating in the Mountain Pine Beetle Epidemic Risk Reduction Research and Development Program."

Rehabilitating Federal and Private Lands

The Federal Forestlands Rehabilitation Program is part of the Initiative that, in cooperation with Parks Canada, Indian and Northern Affairs Canada and the Department of National Defence, addresses mountain pine beetle impacts on national parks, First Nations reserve lands, and military and other federal forestlands. The focus is on identification and containment of the infestation in parks; on control, rehabilitation, and forest management skills on First Nations reserves; and on forest rehabilitation on military lands and other federal forestlands.

The Private Forestlands Rehabilitation Program assists non-industrial private landowners within the mountain pine beetle-infested area. Emphasis is on early mountain pine beetle control efforts and rehabilitation of beetle-infested forestlands. To participate in the program, a landowner must have a minimum of 10 contiguous hectares of productive forest land in BC, on which the main focus is forest management.

Further information on the Mountain Pine Beetle Initiative, including detailed information about ongoing Initiative activity and procedures for applying to the Federal and Private Forestlands Rehabilitation Program or the Mountain Pine Beetle Epidemic Risk Reduction Research and Development Program, is available at www.mpb.cfs.nrcan.gc.ca.

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The ALB is much larger than the EAB, although no more destructive. Adults are large, bluish-black beetles (2.5 - 3.5 cm. in length) with white spots and very long antennae (Fig. 4) and emerge through round exit holes 10 - 15 mm in diameter. Unlike the EAB, ALB larvae bore into the heartwood, riddling it with round holes (Fig. 5). Trees can appear healthy for several years.

Unlike the EAB, the ALB attacks many hardwood species in Canada, including maple, elm, poplar, birch, and sycamore. There are currently no known natural enemies of the ALB in North America. Some pest management alternatives are being tested in Asia. However, because the detection of ALB-infested trees is far less than 100% accurate, the only effective control technique is removal and chipping of infested trees, and the removal of non-infested host trees in advance of the infestation to prevent the spread of the insect. A number of other science-based issues, such as clarification of susceptible local tree species, the rate of insect spread, and population growth, still need to be answered by CFS and US scientists.

As with the EAB, the CFIA is the lead agency for identification and control of ALB. The CFS is collaborating closely with the CFIA, collecting necessary scientific data, and providing scientifically sound advice on the insect and control recommendations. Other partners in this effort include the Ontario Ministry of Natural Resources, and the cities of Toronto and Vaughan. The CFIA and CFS are also working closely with US government scientists and municipal foresters who have experience with this insect.

These two beetles are the most recent in a long line of introduced forest pests in the Great Lakes area. The economic consequences of both these insects will be in the tens, if not hundreds, of millions of dollars if control measures fail. A study by the US Forest Service estimated that ALB, if left unchecked, could kill 1.2 billion trees and cause losses of $669 billion in US cities alone.[1] Municipalities will likely face enormous costs from removing killed and infected trees and replanting with species not susceptible to the EAB or ALB. Both insects have the potential to move across the range of their respective hosts threatening both urban and commercial trees. The CFS is continuing to work with the CFIA and provincial agencies to improve methods of detection and control and, most importantly, prevent future introduction of these unwanted visitors.

A.A. Hopkin, P. deGroot and J. Turgeon, Great Lakes Forestry Centre

[1] Nowak, D. J.; Pasek, J. E.; Sequeira, R. A.; Crane, D. E. ; Mastro, V. C. 2001. Potential effect of *Anoplophora glabripennis* (Coleoptera: Cerambycidae) on urban trees in the United States. Journal of Economic Entomology 94 (1): 116-122.

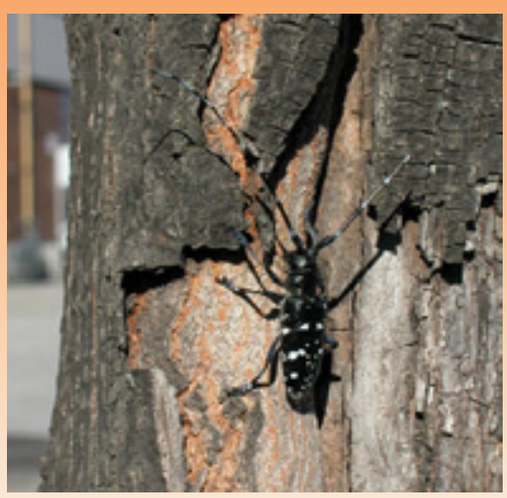

Fig. 4 - Adult Asian longhorned beetle

Fig. 5 - Distinctive round exit holes of the Asian longhorned beetle

Old-growth Forests in Canada - More than “big trees”

Have you visited the Canadian Forest Service old-growth website lately?

- Links to old-growth published papers in the special issue journals - *Environmental Reviews and Forestry Chronicles*
- Abstracts of papers presented at the symposium “Old-Growth Forests in Canada: A Science Perspective” Sault Ste. Marie, ON, 14-19 October 2001
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FYI

Volume 8 No. 1 - Spring 2004
ISSN 1206-7210

Forest Health and Biodiversity News is published regularly by the Atlantic Forestry Centre, Canadian Forest Service, Natural Resources Canada.

Correspondence and article submissions may be directed to:
Canadian Forest Service
Atlantic Forestry Centre
P.O. Box 4000
Fredericton, NB, Canada
E3B 5P7

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Printed in Canada on ChorusArt Silk, a 50% recycled paper containing 15% post-consumer waste.