

Phytosanitary Risks Associated with Mountain Pine Beetle-killed Trees

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Abstract

The risks associated with transporting mountain pine beetle-killed trees outside of the infestation area are being determined. Concerns regarding log movement within Canada focus on the mountain pine beetle, *Dendroctonus ponderosae* (Hopkins) and its potential for establishment in other parts of Canada. Other secondary pests that may be associated with trees killed by mountain pine beetle, including insects, fungi and nematodes, are being identified and evaluated for their potential to be of phytosanitary concern in international trade.

Introduction

Trees killed by *Dendroctonus ponderosae* (Hopkins) and the fungi associated with the beetle will, over time, become host to a variety of organisms including insects, fungi and nematodes. Organisms found in beetle-killed trees will include both those that were present prior to beetle kill (nematodes, stain and decay fungi, yeasts, bark and wood boring beetle species including mountain pine beetle) and those that infest trees after tree death. Some of these organisms may pose a threat to forests outside of the province of British Columbia (BC) and their inadvertent movement through domestic or international trade of logs, lumber or other wood products could result in damage to forests in other areas and provoke phytosanitary controls that jeopardize market access of BC wood products. Through current industry practices and market expectations, most lodgepole pine harvested in central BC is milled into lumber and kiln-dried. Some wood is exported as material for log home building or as raw logs to offshore markets. For example, more than 300,000 m³ of logs (species unspecified) were exported to Korea in 2002 (BC Ministry of Forests, unpublished statistics). However, as the large volume of mountain pine beetle-killed timber enters the system, there are expected to be shifts in processing methods and wood marketing, resulting in untreated wood of potentially high phytosanitary risk leaving the province. It is critical that wood destined for international markets be free of potentially damaging agents. The results of this study will provide the

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first data available to support market access for wood products derived from mountain pine beetle-killed timber for current and future outbreaks.

Domestic Risk Assessment

The objective of the domestic risk assessment is to assess the risks associated with the movement of mountain pine beetle-killed wood to markets within Canada. Currently, two Canadian provinces, Alberta and Saskatchewan, have enacted legislation to prevent the movement of lodgepole pine logs with bark-on from BC. The concerns raised by these provinces are largely based on the recognition that jack pine (*Pinus banksiana* Lamb.), a host of *D. ponderosae*, is a major component of the boreal forest east of the Rockies and overlaps in distribution with lodgepole pine in Alberta. Based on historical records, mountain pine beetle outbreaks have been observed west of the Rockies (with one outbreak in the Cyprus Hills in southeastern Alberta, southwestern Saskatchewan and some activity in the foothills of western Alberta). The eastward restriction of the beetle's distribution is thought to be a function of climate; however, there is speculation that with changes in climate, the beetle could move further east into the jack pine forest.

Methods

The risk analysis is currently underway and will follow the protocol used by the Canadian Food Inspection Agency, which includes identifying high risk pathways, likelihood of establishment in new ecosystems (under current and modified climate change scenarios), predicted economic and ecological consequences of establishment, and potential domestic and international trade implications. The risk assessment will conform to international standards (IPPC 2003) and will be defensible in international law.

International Risk Assessment

The objective of the international risk assessment is to determine population levels of insects, fungi and nematodes in beetle-killed timber and to provide advice to the BC forestry export sector regarding the risks of incorporating untreated wood in international trade.

Methods

Secondary pest populations are being determined by isolating organisms from wood samples collected from within the beetle-infested area. Trees are sampled from three mountain pine beetle attack categories: green, red, and grey attack. The green and red attack trees cover the range of ages that timber is expected to be salvaged from and thence enter the production stream. At each sample location, 10 trees in each of the sample categories are felled. From each tree, 1 m bolts are taken from the base and upper stem (below crown) and returned to Canadian Forest Service, Pacific Forestry Centre for insect rearing. Middle and upper stem samples for both insects and fungi are being taken in order to determine secondary organisms associated with mountain pine beetle-killed trees; their incidence, and hence quarantine significance. Additionally, 30 cm bolts immediately adjoining the 1 m bolts are cut for fungal isolation and returned to the University of BC. Moisture and pinewood nematode (*Bursaphelenchus xylophilus*) samples will be obtained from three 5-cm discs cut from the base, middle and upper stem.

Log bolts are placed in rearing cages constructed for insect emergence and held for up to one year. Insects isolated from sampled trees are identified using the laboratory rearing facilities and insect collection at Pacific Forestry Centre in Victoria.

Decay and blue stain fungi are being isolated and identified using both morphological and molecular identification methods. A minimum of three blue stain isolations are cultured from each bolt and maintained at the University of BC. Morphological identifications based on cultural characteristics are verified using DNA sequence information (beta-tubulin gene, ITS-1). Decay fungi are isolated and identified using similar techniques.

Nematodes are extracted from both wood (three 5-cm discs/tree for a total of 90 extractions/site) and insects (*Monochamus* spp.) emerging from sample wood using a modified Baermann funnel technique. DNA was obtained from extracts using reversible adsorption of DNA to paramagnetic beads. The initial approach was to use a species-specific probe (Abad 2000). However, this probe was found to cross-hybridize with DNA from lodgepole pine. Therefore, a new approach was adopted using polymerase chain reaction techniques (PCR). We designed PCR primers for a microsatellite sequence specific to *Bursaphelenchus xylophilus* (Steiner and Buhner) Nickle (pinewood nematode). PCR amplification of this sequence was used to screen samples for the presence of *B. xylophilus*. The PCR approach was successful in amplifying *B. xylophilus* DNA, but not lodgepole pine DNA. Preliminary experiments were conducted to determine the efficacy of the PCR amplification in varying mixtures of *B. xylophilus* and a related nematode, *B. mucronatus*. Mamiya and Enda DNA from *B. xylophilus* cultures was used as a control in all experiments and in extraction identifications to confirm the presence of *B. xylophilus*. Preliminary results indicate that this method can be used to detect a single individual nematode in a wood sample. Extractions of live nematodes from wood positive for *Bursaphelenchus xylophilus* will be used to determine the population dynamics of nematodes in trees killed by mountain pine beetle.

Conclusions

This project is in its first year of establishment. Log bolts have been collected from five sites throughout the infestation area including: Princeton, Cranbrook, Radium, Riske Creek and Little Fort.

Eric Allen is a research scientist with the Canadian Forest Service, Pacific Forestry Centre.

Literature Cited

- Abad, P. 2000. Satellite DNA used as a species-specific probe for identification of *Bursaphelenchus xylophilus*. EPPO Bulletin. 2000 30 (3/4), p. 571-574. Paper presented at the European Mediterranean Plant Protection Organization Conference on diagnostic techniques for plant pests, Wageningen (NL). February 1-4, 2002.
- International Plant Protection Convention 2003 (IPPC). Pest risk analysis for quarantine pests including analysis of environmental risks. International standards for phytosanitary measures #11 Revision 1. FAO, Rome. 36 p. <http://www.ippc.int/IPP/En/ispn.jsp>