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The impact of *Phytophthora ramorum* on Canada

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To date, neither Sudden Oak Death (SOD) nor its causal agent *Phytophthora ramorum* has been detected in Canada, despite 2 years of concerted effort by Canadian regulatory and scientific authorities. Nonetheless, economic consequences for Canadian governments and industries can be attributed to the discovery of SOD in California and the subsequent regulatory activities undertaken to protect Canadian resources from this potentially devastating disease.

The Canadian Food Inspection Agency (CFIA), the federal body responsible for phytosanitary issues in Canada, first saw reports of SOD in California in the fall of 1999 and soon after published a pest alert on the disease. Through 2000, as reports of the disease spreading within California grew, so did concern within and outside the United States. It was recognized that trade in horticultural and forest products originating in infested areas could spread this disease. In 1999, before any regulatory controls were established for SOD, Canada imported nearly 1.9 million live plants from the State of California, presenting potential pathways for introducing the pathogen to new areas. In light of the possibility that these imports could introduce *P. ramorum* to Canada with potentially serious consequences, regulatory controls were considered necessary.

In March 2001, Canada imposed import restrictions on commodities deemed to be high risk and originating from areas of the U.S. and Europe known to have the disease. These included all propagative and non-propagative material including nursery stock, logs with bark attached, lumber, bark, mulch, acorns, sawdust, pulpwood, and firewood, of all species of oak (*Quercus* spp.), tanoak (*Lithocarpus* spp.), and rhododendron (*Rhododendron* spp.), as well as soil alone or in association with plant material.

A Canadian pest risk assessment (PRA), completed in the fall of 2001, identified the potential distribution and host range of *P. ramorum* should it be introduced to Canada, the means by

which introduction could occur, and the potential magnitude of the economic and environmental impacts that could result. Limited knowledge about *P. ramorum* contributed to a high level of uncertainty in the assessment. Nonetheless, the PRA concluded that the potential consequences of introduction were high and that economic loss to both the forestry and horticulture industries and damage to susceptible flora in natural environments could be expected to occur where the organism became established. Potential impacts were estimated to include direct and indirect losses to the horticulture industry through loss of markets and increased costs of production for rhododendrons and other species, and direct and indirect costs to the forest sector through impacts on oaks and maples in particular. Environmental impacts were estimated to be high due to the environmental significance of many of the known host species, particularly effects to understory species in natural forest stands. For example, failure to maintain pest-free status could jeopardize Canada's export trade for rhododendrons, which was valued at \$5 million in 2000. The potential losses could be much higher than that if one considers consequential losses to other exports of horticultural stock or wood products and the potential for direct losses to various important domestic resources, including eastern red oaks.

As scientific understanding of the disease has improved, the CFIA has responded by relaxing some import measures such as regulatory controls applying to lumber, sawdust, and fruits. At the same time new hosts have been reported, and these have come under regulatory control over time. At present, Canada regulates the entry of 17 genera, many of which are imported horticultural species. The current version of the regulations may be viewed at:
(<http://www.inspection.gc.ca/english/plaveg/protect/dir/d-01-01e.shtml>).

These quarantine actions have had economic impacts. Canadian importers and distributors of propagative plant material have found it hard to obtain desired products from some traditional sources as a result of controls or prohibitions applied to some of these commodities. At the same time, significant government resources have been expended in designing and implementing regulations and surveillance activities and in engaging foreign authorities in monitoring exports. These activities in support of Canada's current pest-free status are an integral part of ongoing efforts to combat SOD.

The horticultural nursery industry, particularly in British Columbia, is the key sector being affected by import regulations. The most significant impact to the horticultural sector has been to those commercial nurseries that import retail planting and propagation stock from California or Oregon. Some nurseries estimate that sales of up to \$250,000 (Can\$) were lost when access to propagative material was restricted by the SOD quarantine. This figure represents 6-7% of the total Canadian nursery farm sales. One retail nursery reported that in

2001 approximately \$50,000 (Can\$) in sales of indoor palms normally obtained from California was lost as a consequence of the exporting nursery being brought under regulatory prohibitions. In addition, for some nurseries, the total effects of the quarantine will not be felt for several years because propagative material that could not be obtained in 2002 would not have been ready for sale until 2005 or 2006. The opportunity costs of such future impacts will be affected by future trade patterns and value of the Canadian dollar at the time the plants mature and are therefore difficult to quantify.

Trade statistics (Table 1) further demonstrate the significant impact to horticultural revenues as a consequence of SOD quarantines. These figures indicate a 60% drop in imports of regulated commodities whereas unregulated commodities were unaffected. Although other economic factors may have influenced changes in the numbers provided in Table 1, the application of the SOD quarantine had some measurable impact. The prohibition of importation of strawberry plants with soil from California, for example, had an initial impact on strawberry production in Canada that was relieved after the establishment of a certification program that allowed trade to resume.

Table 1 - Quantity of Imports¹

Commodity imported from California	Prior to Canadian SOD Quarantine (1999²)	Following establishment of Canadian SOD Quarantine (2001²)	Following establishment of Canadian Quarantine and introduction of certification approaches to permit some imports (e.g., non-hosts in soil (Jan. - Sept. 2002³))
Rhododendron (a host of SOD prohibited entry to Canada)	\$50,300	\$19,000	N/A
Strawberry plants for propagation (not a regulated host but exported in soil which	\$1,020,300	\$411,700	\$821,600

was prohibited entry in 2001 but was brought under a certification option in 2002)			
Cut flowers (no regulatory controls applying)	\$8,379,900	\$8,545,800	\$5,981,600
Plants for cuttings, budding, grafting etc. (no regulatory controls applying)	\$22,000	\$28,000	\$15,000

¹Canadian dollars, ² full year data, ³ Jan-Sept data
Source: Statistics Canada

In addition to the direct impact on industry from market access restrictions, significant financial and human resources have been expended by government departments in developing and implementing regulations. A small part of this was in the actual crafting of the necessary documentation, including the PRA, import policy documents, and publications for public dissemination. A much more significant effort was made in undertaking a national survey to determine whether *Phytophthora ramorum* was present in Canada. The survey targeted Canadian nurseries that imported potential *P. ramorum* host material from California, Oregon, and other infested areas from 1997 to 2002 as well as established botanical gardens known to feature susceptible host genera. Plant material from these nurseries and gardens and from known hosts within a 100-meter buffer around such the nurseries was sampled and cultured for diagnostic purposes. The cost of this survey was in excess of \$120,000 (Can\$).

In summary, while Canada currently remains free of Sudden Oak Death, the mere presence of the pathogen elsewhere in the world has resulted in an estimated domestic economic impact approaching \$1 million (Can\$). This figure will grow as further trade impacts are felt and as surveys for the disease continue. Although this cost is relatively small compared with the potential costs of introduction of *P. ramorum*, it is nonetheless substantial to the small businesses that rely on uninterrupted trade and that are the most affected by current quarantine measures. As our scientific understanding of this disease improves, regulatory responses will evolve that provide necessary phytosanitary protection with minimal impact on trade.

