# Informing pest prevention efforts through Sentinel Plant Monitoring

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## Abstract

Botanic gardens with international collections provide a unique opportunity to help detect potential invasive threats to forest health. Nursery stock is well-recognized as a major pathway for the introduction of invasive insects and pathogens to native ecosystems. Plant health regulators need help knowing what pests attack host plants abroad so they can develop ways to encourage clean nursery stock production. The New Zealand expatriate plant pilot demonstrated that systematic observation of native plants in botanical gardens overseas is effective. Ten new pests were detected in just 14 overseas site visits. European Union entomologists have initiated collaborative research with Chinese and Russian counterparts to monitor plantings of European trees. A more holistic approach to monitoring and data sharing could greatly strengthen our ability to predict pest problems before they arrive in new lands.

## Keywords

Pathogens, pests, sentinel gardens

## Introduction

Chestnut blight, Eurasian poplar leaf rust, white pine blister rust and sudden oak death are just a few examples of forest diseases that were introduced into the United States via the nursery stock pathway. For many agricultural products, the pests abroad are fairly well-known, and phytosanitary measures can be developed to prevent their spread in fruits and vegetables moving in trade. However, most forest pests were unknown to science before they established in a new land and started causing big problems to the natural environment. Furthermore, the volume of international trade in plants has grown so quickly that inspectors in ports of entry simply cannot inspect them all. In the United States, only 2% of each shipment of incoming nursery stock shipments is inspected. New countries entering the global trade also increase the diversity of pests that can occur on nursery stock. The scientific community recognizes that international communication and collaboration offer the best hopes for preventing new pest incursions.

In response to this threat, we are beginning to develop a Sentinel Plant Network. Initial steps involve enhancing the Botanic Gardens Conservation International (BGCI) databases to include more gardens in PlantSearch, and information in GardenSearch on the plant health expertise present in each garden. Training modules are being developed to help garden staff learn to monitor their collections for insect and disease attacks, and know who to call when a new pest is discovered. A unified system of data sharing needs to be developed to ensure that new host/pest associations are recognized and used to help make trade in horticultural plants safer.

## Methods

BGCI received funding from the United States Department of Agriculture (USDA) Animal and Plant Health Inspection Service to increase the scope and content of their two existing global botanic garden databases in order to support key components of the Sentinel Plant Network.

Specifically, they will enhance data representation in regions where botanic garden representation in the databases is lower than in other regions. They will add information on where expertise in horticulture, taxonomy, mycology and entomology can be found in the world's botanic gardens. Finally, they will add information on which plant species demonstrate weediness in their new climate or location. This information will be useful for all countries.

The American Public Gardens Association (APGA) received funding to develop a training and outreach campaign for botanic gardens. APGA will work with the USDA National Institute for Food and Agriculture to develop training modules to teach garden staff to identify and report plant pests. This will help gardens to protect their collections, and to get better diagnostic support and control recommendations. The grant will also help gardens enhance their outreach programmes, with the goal of enlisting plant lovers everywhere in the effort to detect new pests as soon as they arrive. Once these training modules are developed they will be made available to botanic gardens worldwide.

## Pilot Projects

Several pilot projects by other researchers have demonstrated the feasibility and value of a sentinel plant network. The most advanced of these was a five year pilot by the Ministry of Agriculture and Forestry of New Zealand. Fagan *et al*. (2008) first analyzed collection information to select gardens with strong representation of New Zealand plants. Then they performed a climate analysis to find gardens with climates most similar to that of New Zealand. The most suitable sites were in Australia, north-eastern Europe and parts of the western USA. They developed a standard symptom-based survey protocol that could be used by non-specialists. Fourteen gardens were visited and 91 attacks of pests on New Zealand's native plants were observed. Of the 32 pest taxa they diagnosed, 22 were pests already present in New Zealand. Thus ten new pests of concern were identified. An analysis of the costs and benefits of various approaches to collecting such data was conducted (Fagan, *et al*., 2008). However, to date the program has not been fully implemented.

French and Chinese entomologists are collaborating to establish plantations of European tree species in China. Two of four planned plantings, containing over 500 trees, have been established. Monitoring studies have detected a number of insect pests and diseases (Alain Roques, pers.comm.).

## Conclusions

The National Research Council recommended monitoring native plants growing abroad to inform invasive pest prevention efforts. The above examples demonstrate that sentinel plant monitoring approach can help identify potential pests. BGCI member gardens are invited to participate in helping to develop an international network of gardens to help preserve species diversity by preventing the spread of invasive insect pests and diseases.

## References

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