

Toward better biosecurity in plant trade networks

Why are networks important in the live plant trade?

A major biosecurity challenge is the effective containment and management of threats from pests and pathogens following their establishment in New Zealand. In the live plant trade, the contact structure of trade networks can affect the likelihood that a pathogen outbreak will take place, and the options for controlling it. However, little is known about the current contact structure of horticultural networks within New Zealand or how it might be changing. This is of concern, given the many examples of recent emerging plant diseases overseas which have been facilitated by trade movements of infected material (Fig. 1). Such information is important for risk assessment and plant health controls. Even if eradication is not feasible, there are considerable economic, and environmental benefits to containing outbreaks and actively slowing pathogen spread before impacts can be fully realised and widespread management is required.

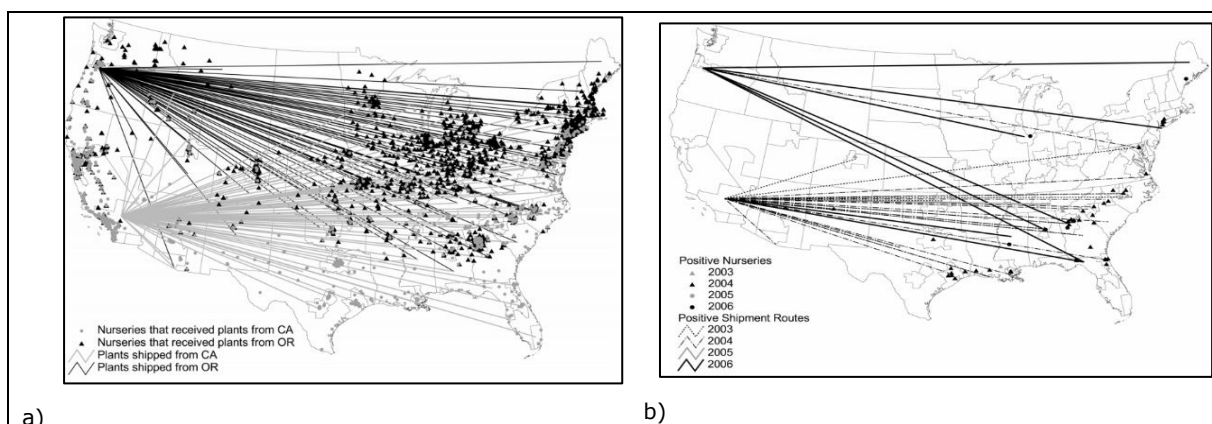


Figure 1. a) Total shipments of plants from two nurseries in the USA infected with *Phytophthora ramorum* and b) the consequent pattern of infection in recipient nurseries.

By working closely with New Zealand Plant Producers Incorporated (NZPPI), as well as examining the less formal nursery trade, our research aims to collate spatial data on the movement of live plants in New Zealand. This information will be used to describe the live plant trade network, to investigate how different soil-borne plant pathogens could spread through the network and what options for mitigation might be available.

Proposed approach

To build our models we will need to:

- Use questionnaires and interviews to capture the size, diversity of stock, position in supply chain and hygiene standards of plant producers.
- Characterise “formal” plant trade movements through analysis of the origin, destination, frequency and size of deliveries undertaken by major nurseries and specialist freight services.
- Characterise “informal” plant trade movements through analysis of the locations (postcode accuracy) of sellers and buyers of live plants through Trade Me as well as interviews with traders at farmers markets.
- Incorporate biological data on one or more soil-borne pathogens that pose a threat to plant trade e.g. *Phytophthora cinnamoni*, *Phytophthora ramorum* and/or *Ceratocytis fimbriata*

The models will be used to examine:

- The relative risk arising from formal and informal plant trade.
- How risk might grow if the network changes, e.g. more nurseries or trade links.
- Effectiveness of movement controls in different plant trade networks.
- Role of nursery hygiene standards, levels of uptake and compliance required to limit pathogen spread.
- Optimal designs for national pathogen surveillance across plant nurseries.
- Economic analysis of benefits from hygiene standards versus implementation costs.

Use of data

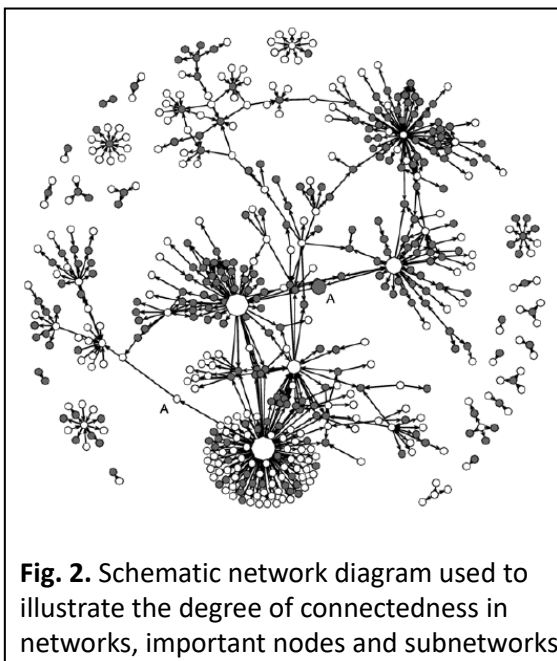


Fig. 2. Schematic network diagram used to illustrate the degree of connectedness in networks, important nodes and subnetworks

All data will be treated in confidence and not shared with third parties. There will be no analysis or presentation of data that will enable the identity of any data providers or plant suppliers to be revealed. Thus explicit representations as maps (e.g. Fig. 1) are not our goal and the network structure will be illustrated in terms of network diagrams (Fig. 2) where identify and spatial location of each plant supplier cannot be discerned. Given that the dynamics of plant trade in New Zealand can change from year to year, the project aims to generate generic insights that will be robust to annual variations in plant movements. The data gathered will be primarily used to ensure

our parameterisation of models is accurate and that our scenarios are realistic.