Regional strategies for laurel wilt management

Karen Garrett and Robin Choudhury
A common problem in disease or pest management

- A disease management concept or technology may work well in an experiment, but...
  - How well do we really understand its performance across a region?
  - Will a critical mass of people learn about it and adopt it?
  - Will the "management landscape" slow epidemics enough to protect production?

- Our role in this project is to integrate the results of other research into a regional scenario analysis to support decision making
Part of the solution

• Understand how the socioeconomic and biophysical networks that affect laurel wilt compose a single system, and what is needed for successful management

• Still need
  • Good management tools
  • Managers to be convinced to use management tools appropriately
Dynamic network models

**Link weight:** Level of interaction between the pair of nodes

**Dynamic nature:** Link weights change over time
Traits of network nodes

• In a socioeconomic network, nodes are people or human institutions (managers/farmers, extension agents, scientists, ...)

• In a biophysical network, nodes are geographic locations (individual plants, farms, storage facilities, wildlands, ...)

• Degree centrality – number of links

• Betweenness centrality – importance as a bridge between other nodes
Ecological Networks in Stored Grain: Key Postharvest Nodes for Emerging Pests, Pathogens, and Mycotoxins

JOHN F. HERNANDEZ NOPSA, GREGORY J. DAGLISH, DAVID W. HAGSTRUM, JOHN F. LESLIE, THOMAS W. PHILLIPS, CATERINA SCOGLIO, SARA THOMAS-SHARMA, GIMME H. WALTER, AND KAREN A. GARRETT

John Hernandez Nopsa

BioScience 2015
Wheat rail movement in US 2006-2010

2015;biosci.biv122

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Multilayer network in stored grain system

a. Grain movement network

b. Management communication network

c. Insect and fungus movement network


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The Garrett Lab is developing INA as a platform for evaluating system management strategies (such as crop breeding networks, seed systems, and integrated pest and disease management)

Impact **OF** research products such as information/training, disease resistance, and disease-free seed production technologies

Impact **ON** spatial ecological processes, such as gene/genotype spread, pathogen invasions or ecosystem services more broadly

Impact **THROUGH** communication and decision-making networks, and linked biophysical networks
Impact network analysis

Socioeconomic network
(exchange of ideas and money)

Biophysical network
(movement of plants, pathogens, and pests)

Management technologies

Integration of socioeconomic and biophysical components
Heterogeneity
Phenotypes
Constraints

Outcome: yield, profit, system resil, etc.

Garrett, in review
Impact networks, broadly

**Realism** Questions like: How do changes in network traits, such as changes in mechanisms for interpersonal influence, affect system outcomes?

**Generality** Questions like: How can a change in impact network components compensate for increased risk to maintain system sustainability?

**Precision** Questions like: Which particular communication or land nodes are key control points for transmission through the landscape?
Impact network analysis of LW management

Impact Network Analysis (INA) Components

Disease management components
Quality of information or management

Communication network
Decision network
Ecological (Dispersal) network
Establishment network
Avocado growers management networks

Beetle and *Raffaelea lauricola* population spread

Communication networks that influence avocado grower decision making, with or without full information

Avocado growers management networks
Impact Network Analysis (INA) of Laurel Wilt

• Integrate the socioeconomic and biophysical analyses of the laurel wilt management system

• Evaluate the effects of cumulative decisions by growers about whether and how to manage laurel wilt

• The INA will be used in scenario analysis to evaluate questions such as
  • how effective a management approach would have to be for system-level benefits
  • potential effects of policies related to laurel wilt management
  • identify key risk locations in the epidemic network for sampling and mitigation.
Two Scales in Modeling

- **Within-grove** epidemics and management strategies
- Epidemics and management **at a regional scale**, and beyond
Within Grove Management of LW
Time 1

[Diagram of a grid with a highlighted dot]
Time 13
Regional Management of LW
Regional Management of LW
Next steps

• We are incorporating available data to characterize the scenario for laurel wilt management in Florida

• Evaluating
  • The effects of within-grove management decisions on success
    • Within groves
    • Across the region

• We welcome input from managers about what types of scenarios and decisions are most important to evaluate
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