

Protocols for long term monitoring of biological invasions

Asia Pacific Forest Invasive Species Network

Beijing China
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Natural Resources Canada / Ressources naturelles Canada
Canadian Forestry Service / Service canadien des forêts
biological pests

Alien Invasive Species in Forests....



More aliens....



Even more aliens....

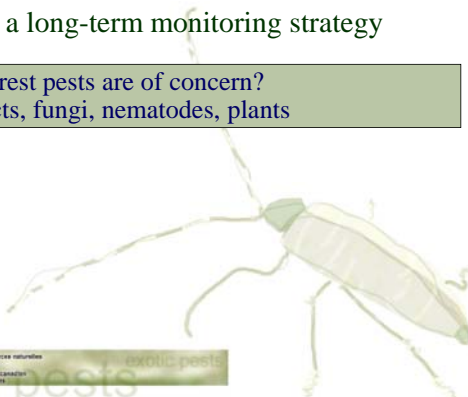


Purpose of long-term monitoring strategy

- Early detection of alien invasive pests
- Reduce spread of established pests
- Effective forest resource protection
- Facilitate trade through compliance with International Phytosanitary Regulations
 - Pest Free Areas (ISPM 4)
 - Areas of Low Pest Prevalence (ISPM 10, RSPM 20)
- Develop effective prevention strategies

Planning a long-term monitoring strategy

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 - insects, fungi, nematodes, plants



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- Pest identification – diagnostic tools?

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- What detection tools are available?
- Pest identification – diagnostic tools?
- Infrastructure – collections, databases, data sharing
- Standardized protocols, statistical design

Natural Resources Canada
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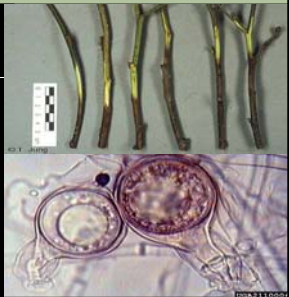
exotic pests

How do pest organisms enter and spread? Where are pests on the pathway?

Anoplophora – wood packaging



Phytophthora alni – live plants



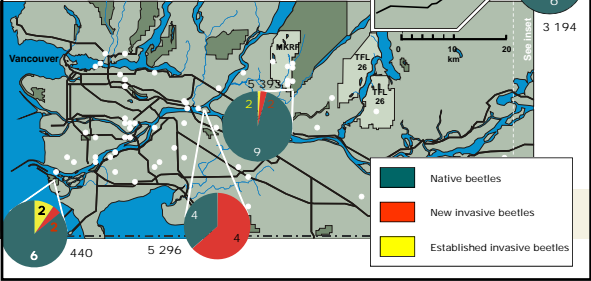
Pathway Analysis

- Pest interception databases
- Detection failures – establishments
- Targeted sampling of imports
- Trapping “hot spots”
 - import warehouses
 - horticultural nurseries
 - wood packaging disposal sites



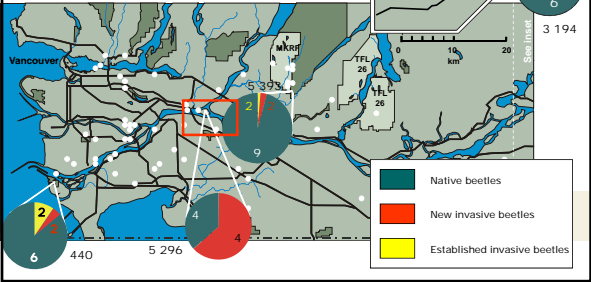
Targeted Insect Trapping in Vancouver Canada

(courtesy Dr Lee Humble)

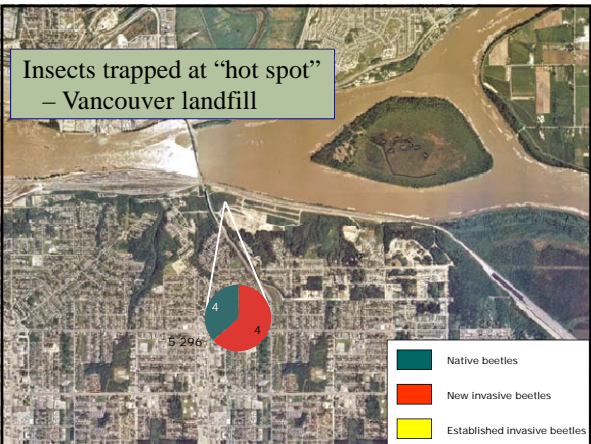


Targeted Insect Trapping in Vancouver Canada

(courtesy Dr Lee Humble)



Insects trapped at "hot spot" – Vancouver landfill



What detection tools are available?

Insect traps

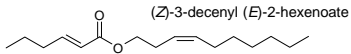
- sticky traps
 - barrier traps
- } Often combined with attractants



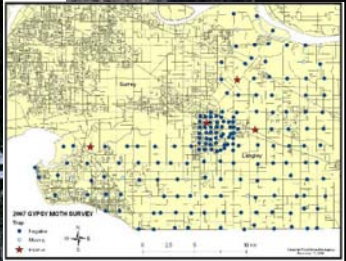
What detection tools are available?

Insect lures

- Kairomones
 - broad spectrum
 - most beetle species respond
 - value in studying diversity
- Pheromones
 - can be highly specific
 - sex attractants, aggregation



Annual pheromone gypsy moth detection surveys





“Bait” logs attract secondary bark beetles

Global network of “Sentinel Plant” test gardens



Pest Diagnostics

Traditional morphological methods

- keys, voucher specimens



Molecular methods

- accurate genetic information
- proper collection techniques
- Bar Code of Life initiative

Reference Collections

- Critical for verifying pest identification
- Taxonomic clarification
- Type specimen libraries
- DNA sequence libraries
- Collection protocols are important
- International collaboration - specialists



Other Detection Strategies

- Identify pests on hosts grown offshore
- Strategically located test gardens to detect pests and determine host range
- Public awareness
- Training arborists, master gardeners



Canadian spruce in Scotland



Arborist training

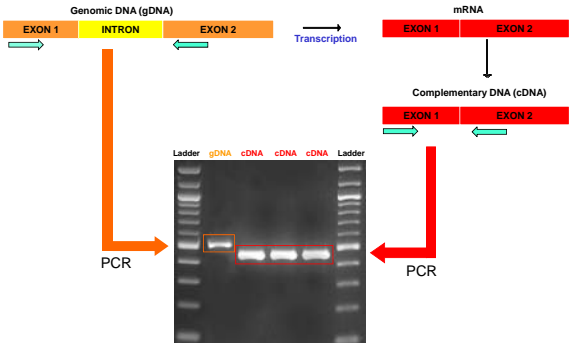
What about nematodes?

Pinewood nematode

- Poor landscape level distribution records
- Sampling challenges
 - within stand / tree distribution
- Baermann funnel method
- Kairomone attractants (Zhao et al. 2009)
- DNA techniques
 - highly sensitive
 - live-dead determination

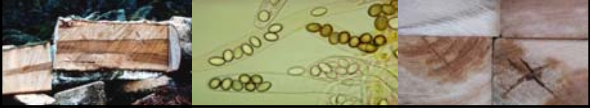


Molecular determination of live vs dead pinewood nematode



What about fungi?

- What are the fungi of concern? ...or not?
- Detection tools
 - incomplete distribution records
 - spore traps
 - bioassays (wood discs, stream baiting)
- Diagnostic challenges
 - diminishing global expertise
 - poor representation in DNA libraries



Monitoring Challenges

- Looking for unknown organisms
- Different approaches for landscape, entry port
- Detection at low population levels
- Inadequate baseline information on native/alien species
- Appropriate use of advancing technology
 - semiochemical issues
 - DNA databases
- Size of forest, size of country
- Funding

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