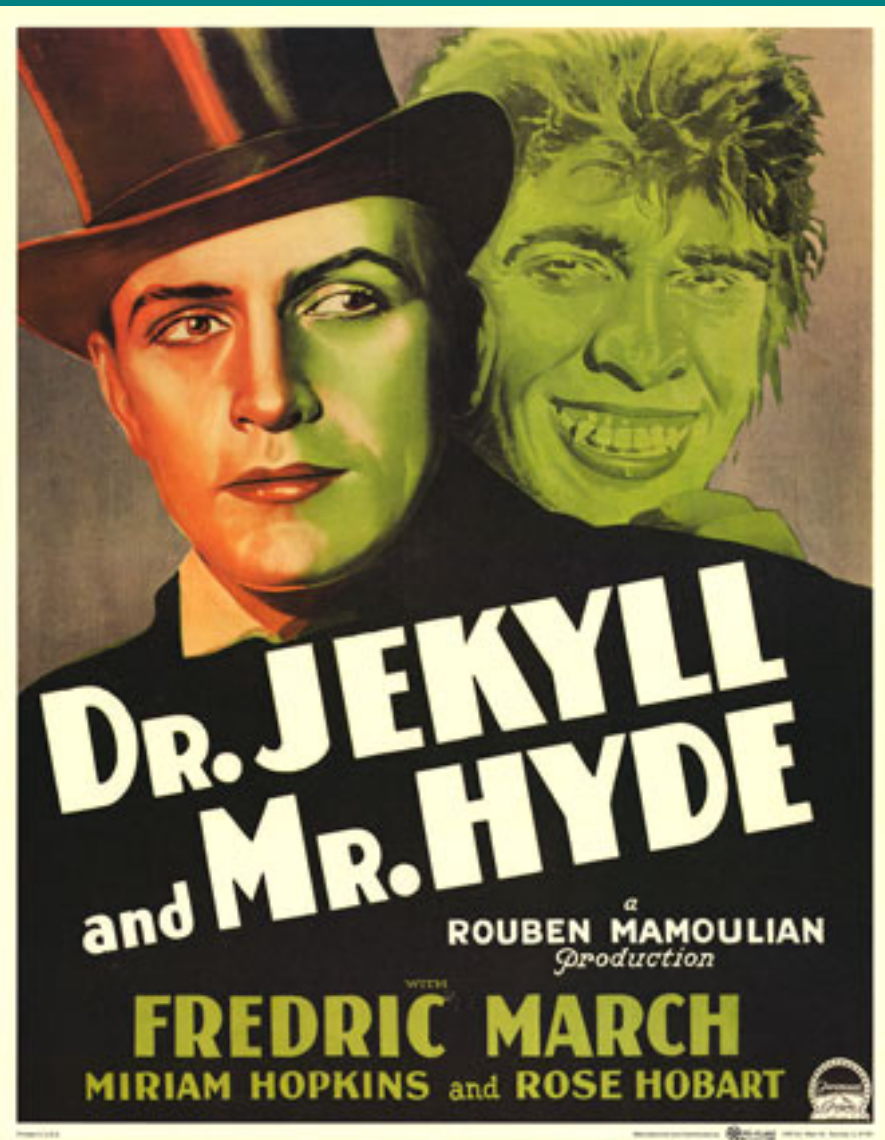


Ignorance is Bliss: Pathogens and Changing Ecosystem Processes

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[www.allposters.com/
IMAGES/ROM/X156.jpg](http://www.allposters.com/IMAGES/ROM/X156.jpg)

A few notions to dispel about forest pathogens:

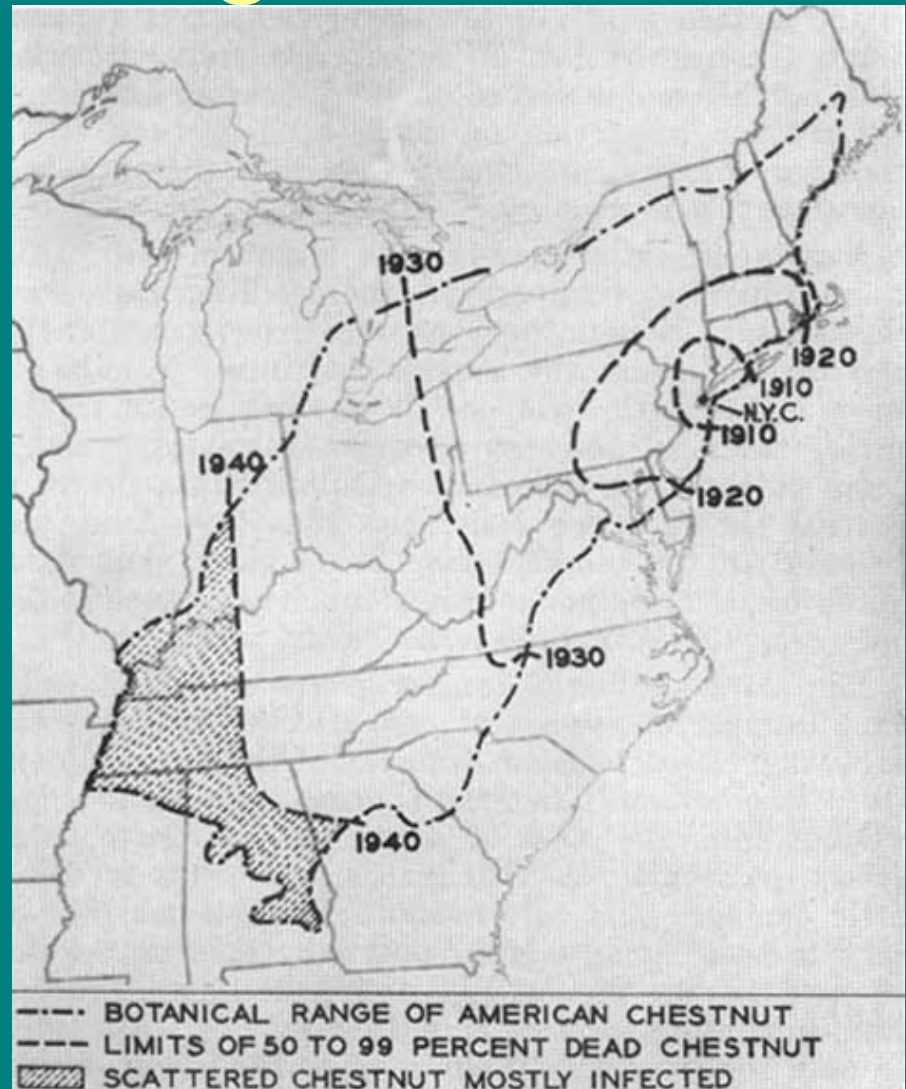
- Forest pathogens cause subtle impacts



A few notions to dispel about forest pathogens:

- Forest pathogens cause subtle impacts
- Forest pathogens move slowly

http://www.fao.org/documents/show_cdr.asp?url_file=/docrep/x5348e/x5348e02.htm



- **Introduced Pathogens**

- Little resistance in native tree species
- Rapid spread, significant damage

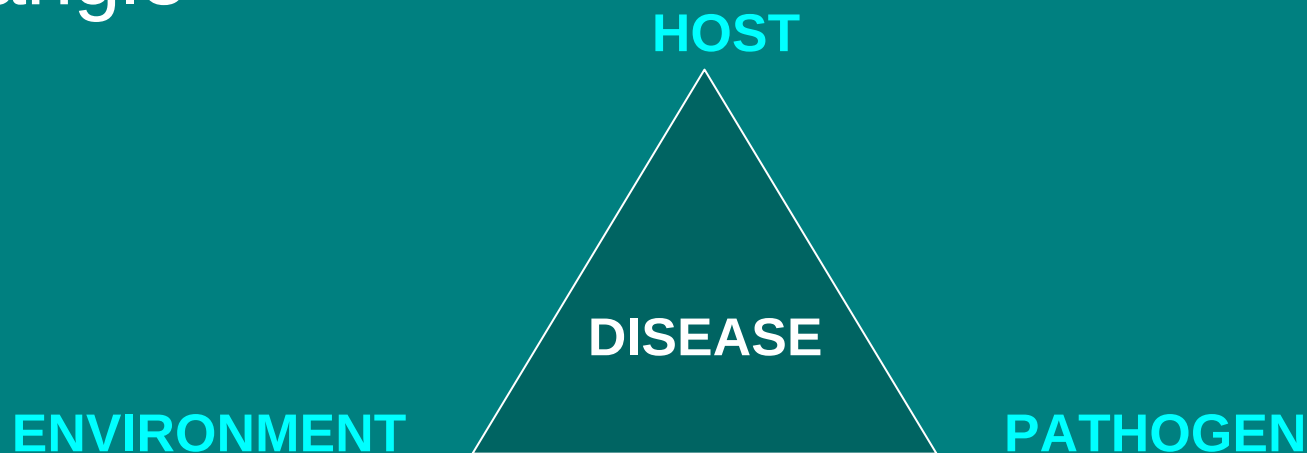
- **Ignorance**

- Enormous number and diversity of potential pathogens
- Enormous number and diversity of potential entry routes



Native Pathogens

- Part of forest ecosystems
- Host trees resistant, tolerant
- Effects in natural systems TEND to be limited by some aspect of the disease triangle



Example #1 – Armillaria root disease

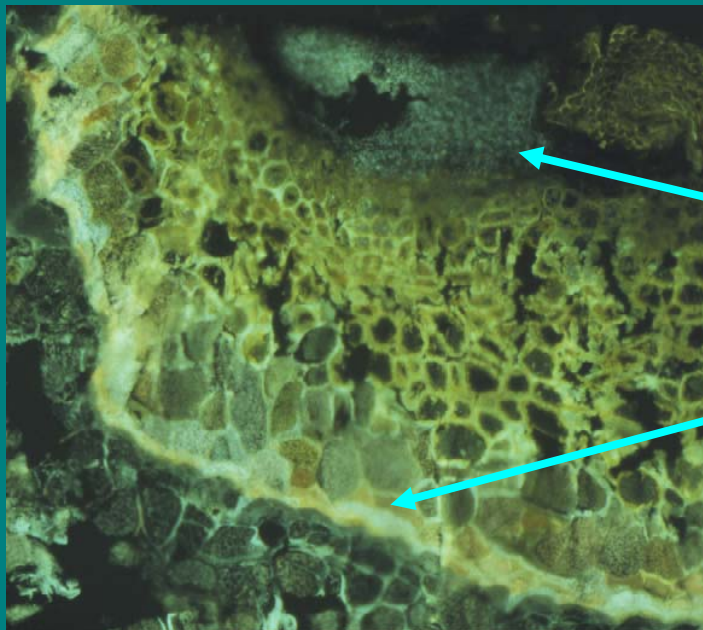
- Southern interior, managed forests
- Commercial species and stand management practices
- Ubiquitous pathogen, especially in ICH
 - Morrison and Pellow





Limited by:

- Range in host resistance and tolerance = host diversity
- Opportunistic pathogen, limited by host resistance mechanisms



Rhizomorph

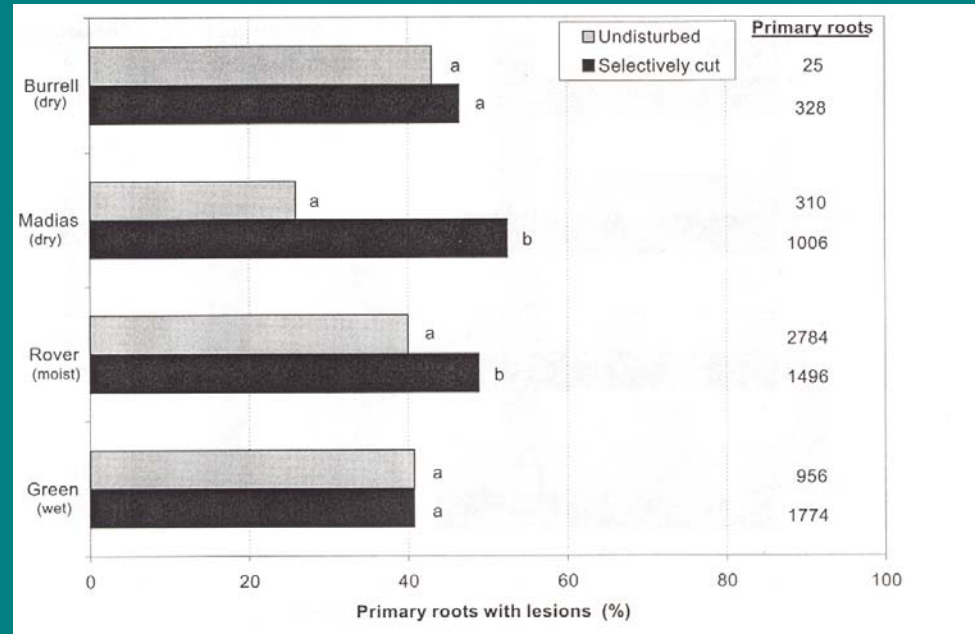
Wound periderm

photo by Michelle Cleary

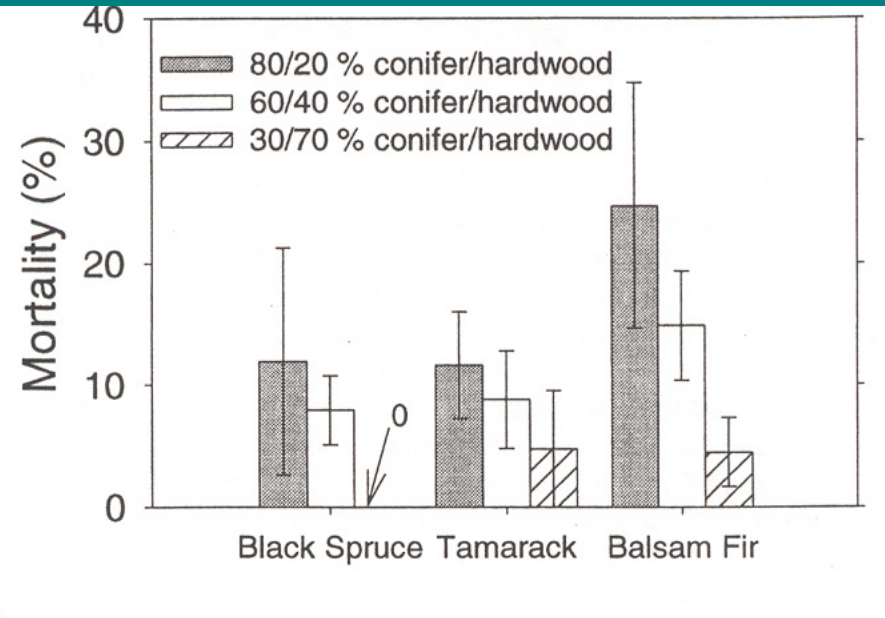
Inoculum and damage increase with disturbance

- Cruikshank et al. 1997,
- Edgar et al. 1976,
- Woods 1994,
- Morrison et al. 2001

Morrison et al. 2001



Acceptability of Deciduous species



Gerlach et al. 1997

- Mounting evidence that mixedwood stands limit disease, or that brushing deciduous species increases disease incidence
 - Gerlach et al. 1997
 - Simard and Heineman, 1996
 - Simard et al. 2001

- Movement towards increasing allowable deciduous component
 - Taylor et al. 1994
 - Simard et al. 2001
- Natural compositions
 - Biodiversity (Burton et al. 1992)
 - Range of structure and compositions (Lautenschlager 2000)
- Changes in reforestation guidelines
 - Acceptable deciduous component

Example #2 - Dothistroma



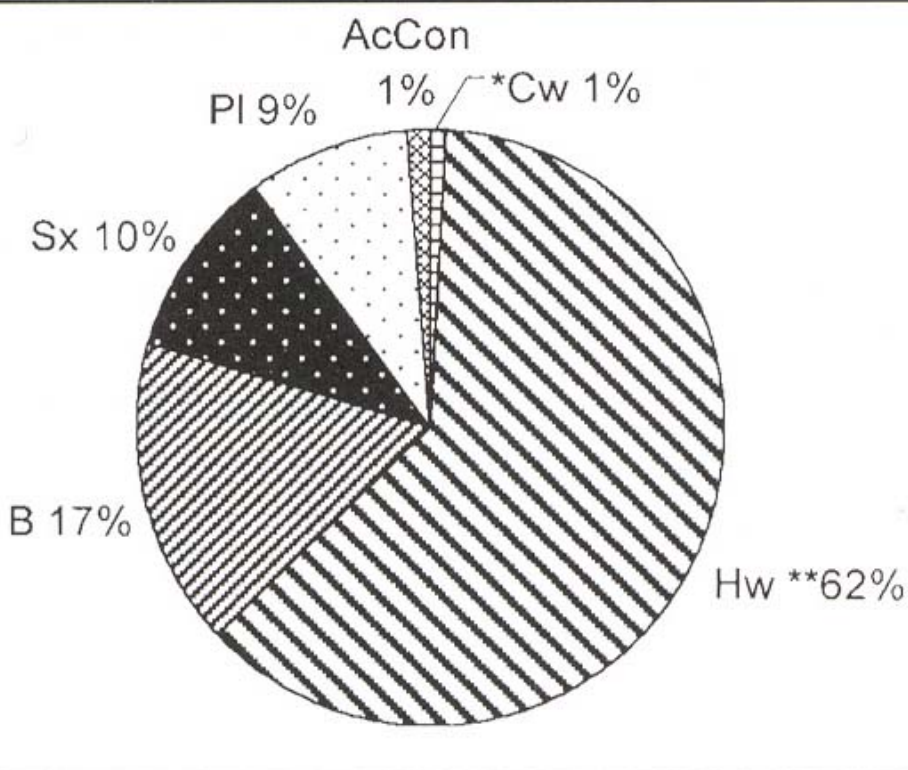
- Wet, productive ecosystems
- “Native” foliage pathogen
- Serious damage in S. Hemisphere (introduced)
- Limited damage in native range



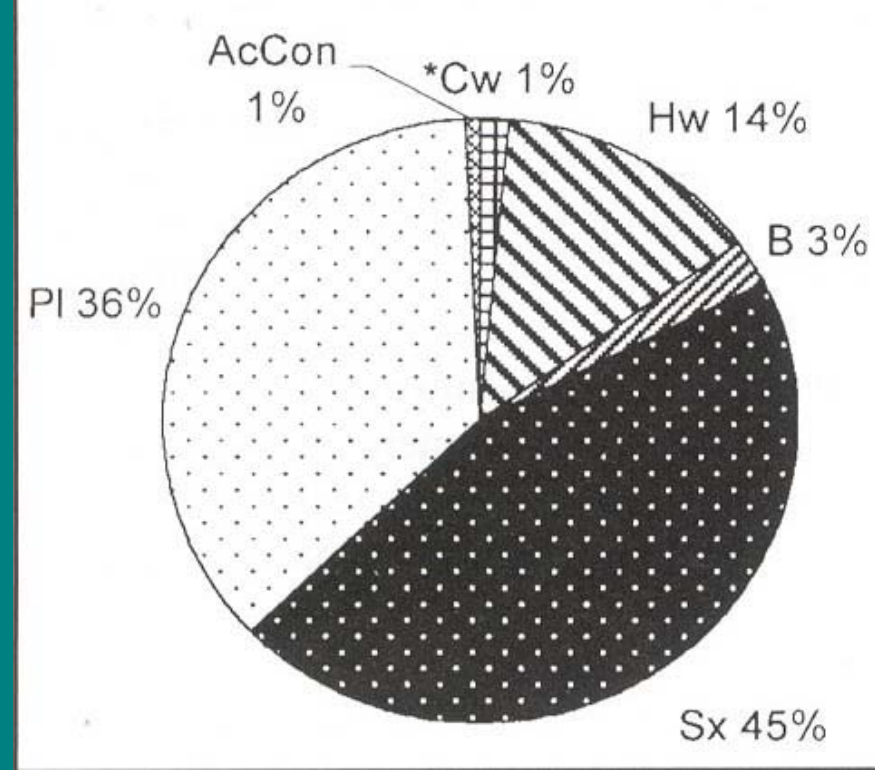
Limited by:

- environmental threshold (precipitation)
- host availability = inoculum potential



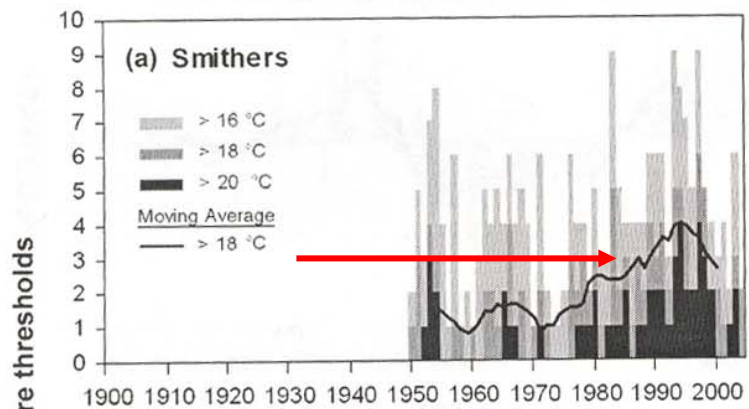
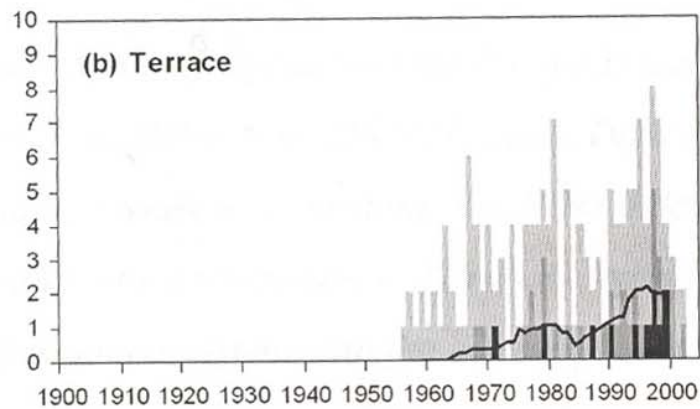
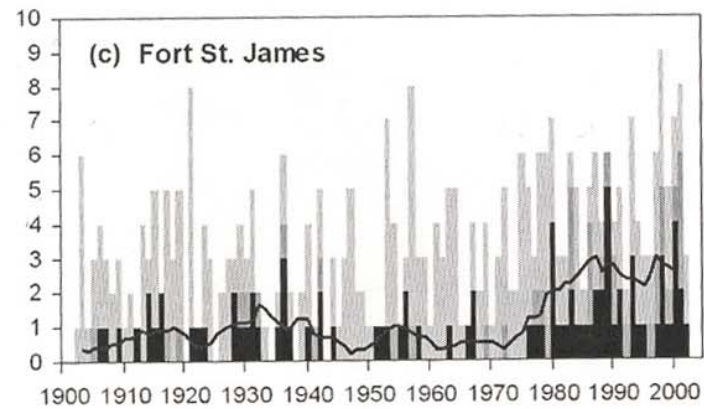
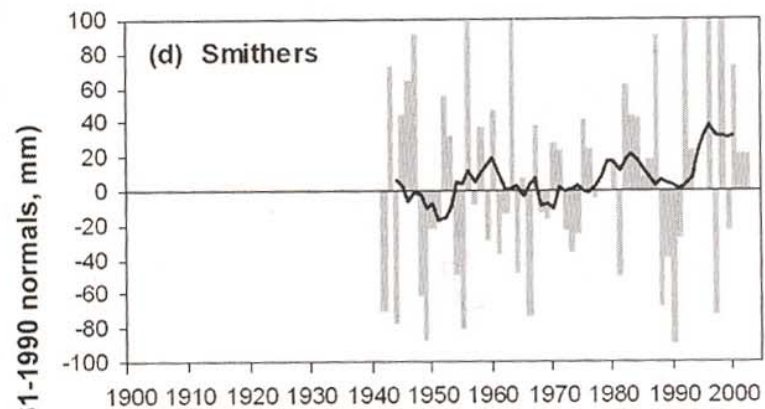
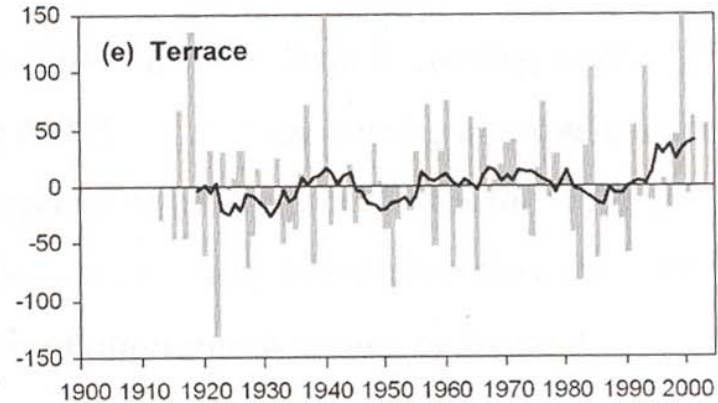
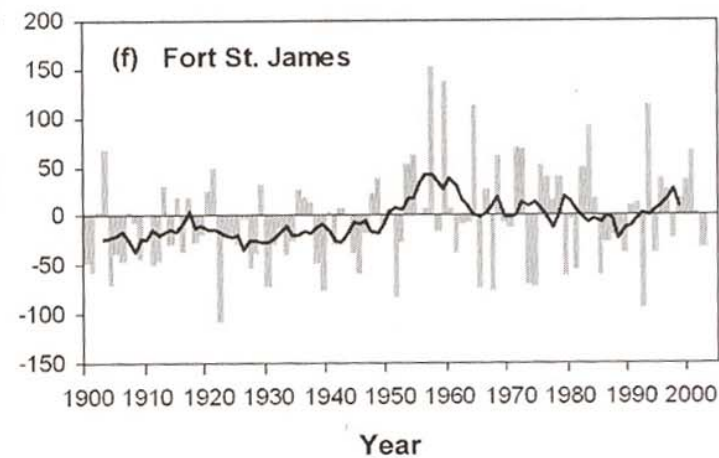


>20-year-old stands



< 20-year-old stands

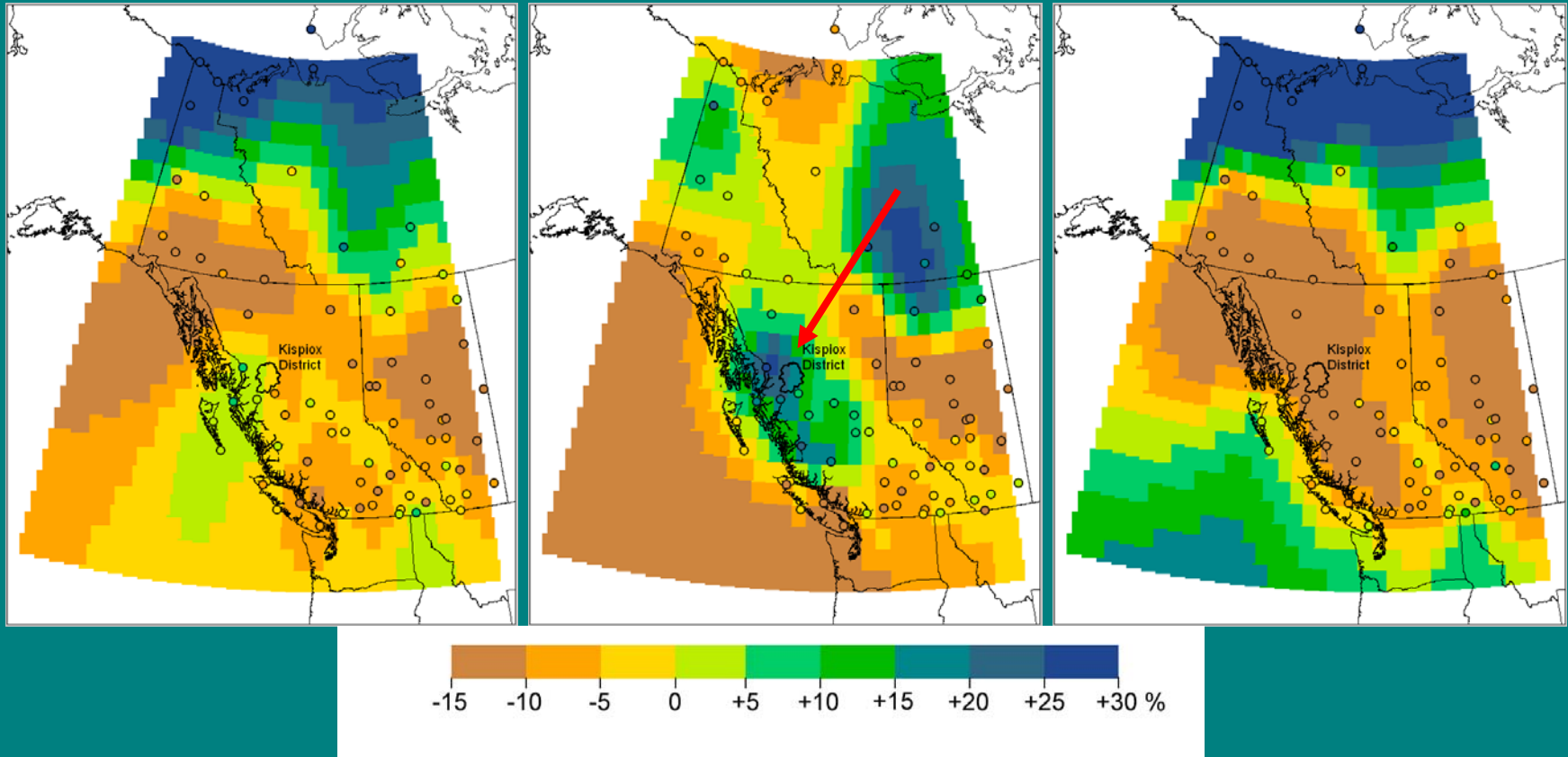
- Leading species in old growth: hemlock, *Abies* sp.
- Species acceptability: pine, spruce preferred
- Nursery stock availability, free-to-grow regulation
- Leading species in plantations: spruce, pine



Mean annual

Mean summer

Mean winter



Changes in mean precipitation from 1960-1991 normals to the 1998-2002 period. Woods et al. 2005

- Climate change overcame environmental threshold

- Outbreak exacerbated by significant increase in host abundance



Pictures: Alex Woods, BC Ministry of Forests

- Species acceptability guidelines
 - Pine no longer a preferred species
 - Less than 20% of the stocking
 - Preferred species: hemlock, cedar, spruce, true firs
 - Deciduous limits: <200 sph now up to 1000 sph
- Realization of the potential impact of climate change

1. Disease Response Threshold

- Some diseases spread slowly (e.g. root disease)
- Impacts can build slowly over time
- By the time a management response is initiated, it is often too late
 - 2003 Replanted over 500 ha due to *Dothistroma*
 - NSR sites due to *Armillaria*

Knowledge Gaps



- Natural roles of pathogens in ecosystem function
- Basic biology of some pathogens



Lack of monitoring

- Demise of FIDS
- Reduction in Forest Service staff
- Lack of willingness to fund long-term research

2. Management Policies and Practices



- Free growing requirements result in favouring fast-growing species, reduction in deciduous species
- Practices aimed at stand productivity can upset host-pathogen balance

- Ecosystem-based management (EBM)
 - Principles of natural disturbance processes
- Incentive for EBM seems to come more from certification requirements than government policies
 - E.g. Preamble of the FPCA repealed in FRPA
- Natural Disturbance Units (DeLong) is a move in the right direction

3. Climate Change => ??

Adds significant uncertainty

- Environmental thresholds overcome
- Change in ranges of host species
- Stress on host



Yellow cedar decline, Alaska

Conclusions

- Large, complex problems that are linked to:
 - Global trade (introduced pathogens)
 - Tenure system (temporary licenses, free to grow requirements)
 - Economic and social limitations on Ecosystem-based management
 - Uncertainties around climate change

Conclusions cont'd

- Possible actions
 - Improve vigilance around points of entry of forest pests
 - Increase research program on anticipating and avoiding exotic introductions
 - Restore (or increase!) the number of Provincial Pathologists and forest health technicians
 - Long-term, strategic planning and research around potential forest health problems
 - Link disturbance ecology with biotic agents of disturbance