GRANDE PRAIRIE REGIONAL COLLEGE

Bachelor of Applied Forest Resource Management

FOREST PATHOLOGY: FO4080

Pre-requisite: FO1200 (Dendrology); BT2400 (Plant Physiology)

Calender Description:

Increasing importance of forest health in recent years. Identification of major disease pests and their symptoms. The pathogen in relation to its forest environment. Management through understanding the biology of the pathogen. Long-term management strategies versus temporary short-term programs. Fibre management strategies and their effects on forest pathogens. Elements of a control program.

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Lectures:	3 hours per week.	Tues. and Thurs.	10:30 – 11:20.
Labs:	3 hours per week	Wednesday	14:30 – !7:30

Recommended textbook:

Hiratsuka, Y., Langor, D.W. and P.E. Crane. (1995). A Field Guide to the Forest Insects and Diseases of the Prairie Provinces. UBC Press, Vancouver.

Textbooks Available in the Library

Agrios, G.N. (1997). Plant Pathology. Academic Press. San Diego.
Allen, E., Morrison, D and G. Wallis. (1996). Common Tree Diseases of British Columbia. Canadian Forest Service, Pacific Forestry Centre, Victoria, B.C.
Blanchard, R. O. and T.A. Tattar. (1997). Field and Laboratory Guide to Tree Pathology. 2nd Ed. Academic Press, Toronto.
Canadian Council of Forest Ministers. Compendium of Canadian Forestry Statistics. (1996).
Knight, F.B. and H.J. Heikkenen. (1980). Principles of Forest Entomology, 5th Ed. McGraw-Hill, Toronto.
Tainter, F.H. and F.A.Baker. (1996) Principles of Forest Pathology. John Wiley and Sons. Toronto.

Scientific Journals and Periodicals available in the library

Bugs and Diseases. Alberta Forest Service, Edmonton.
Canadian Journal of Forest Research
Forestry Chronicle
Northern Journal of Applied Forestry
Silviculture

Course Description

General introduction, overview of forest health

- Factors contributing to the current high profile of forest health:
  - Forest industry expansion of the late 1980's has led to:
    - lack of a timber reserve
    - an increasing area of young regenerating stands
  - Development of new regeneration standards.
  - Increasing use of Enhanced Forest Management (EFM) techniques.
  - Annual Allowable Cut (AAC) implications.
  - Reduced impact of fire.
  - The push for company certification, Forest Care to ISO, CSA, FSC etc.
  - Higher profile of forest health in Alta Govt LFS revised 'ground rules'.

The range of forest pathogens

- Fungi
- Flowering plants
- Roundworms
- Bacteria
- Viruses
- Abiotic

The pathogen life style

- Parasites
  - Obligate and facultative
- Saprophytes
  - Obligate and facultative

The disease triangle and the disease square

- Importance of the environment

Overview of control strategies

- The control triangle
- Importance of ecological considerations
- General control strategies
  - exclusion, eradication, protection, resistance

Generalised study of fungal biology

- Structure
- Classification
- Life history
- Taxonomy and classification
- Their role in the ecosystem

Categorising fungal pathogens (three methods)

- Signs and symptoms
  - Symptoms in four categories
    - Necrosis
    - Hypertrophy
    - Atrophy
    - Physiological response
- By the crop-type affected
  - Young pine stands
  - Young spruce stands
  - Young deciduous stands
  - Mature/over-mature pine stands
  - Mature/over-mature spruce stands
  - Mature/over-mature deciduous stands
- By the part of the tree affected
  - Roots
    - Stems
    - Foliage
    - Reproductive biology

Impact

- Mortality (especially in regeneration)
- Loss of height growth
- Volume loss
- Loss of stem and wood quality
- Effect on reproductive biology

Field identification of pathogens

- Identification by sign and
- Identification by symptom

Lab identification of pathogens

- Isolating
- Plating
- Identification
- Preservation and storage

Detailed study of fungi

- Currently important in Alberta
- Currently important in Alberta but expected to become less important
- Important elsewhere and potentially important in Alberta
- Important elsewhere but not potentially important in Alberta

Detailed study of other pathogens

- Flowering plants
  - Lodgepole pine dwarf mistletoe
- Round worms
  - *Bursaphelenchus xylophilus* (pine wilt disease)

- Bacteria
  - Fire blight
- Viruses
  - Leaf mosaic of various deciduous species
- Abiotic
  - Climate
  - Pollution

Detection and evaluation of endemic and epidemic levels of pathogens

- Aerial survey
  - Helicopter vs fixed-wing
  - Use of Global Positioning System (GPS)
- Ground surveys
  - one-dimensional, two-dimensional, pixel etc.
- Temporary and permanent sample plots
- Timing of surveys
- Combining pathogen surveys with other silvicultural surveys
- Aids to surveying
- Efficiencies in surveying

Management of pathogens

- Three types of information needed before initiating a management program - frequency, impact, feasibility of control
- Modelling – the DSS (Decision Support System) as an aid to management
- Control methods
  - Silvicultural – building control plans into the silvicultural prescription
  - Mechanical – of limited use in operational forestry
  - Biological – undertake with caution
  - Chemical – last resort
  - Genetic
  - Integrated
- Treatment prescriptions may call for changes in: sequencing of harvest schedule; block layout; species selection; site prep; stand tending
- Broad overview of management philosophy offered as part of long-term planning: PFMP; DFMP; GDP

Enhanced forest management (EFM)

- How various EFM techniques interact with the biology and frequency of pathogens
  - Thinning, spacing, release from overstorey
  - Planting vs seeding
  - Fertilizing
  - Use of genetically-improved stock
  - Use of exotics

Exotic diseases

- Increased trade means greater chance of importing exotic diseases
- Problems also with exporting forest products, e.g. pine wilt
- Controls and the difficulty of implementing them

The role of pathogens in the ecosystem

- Their role in:
  - Succession
  - Providers of food
  - Providers of habitat
- Forest health vs individual tree health

LECTURE SCHEDULE

Overview of the course **week 1**

- Forest health in the year 2004
  - Reasons for increasing importance

Development of a forest health program

- Distribution, impact and management

The range of pathogens **week 2**

- The fungi
- Dwarf mistletoe, an Angiosperm pathogen
- Roundworms
- Bacterial pathogens
- Viral pathogens
- Abiotic pathogens
  - Climate
  - Pollution

Detailed review of important pathogens

- Fungal biology and taxonomy **week 3**
  - Fungal pathogens of:
    - Seedlings **weeks 4, 5**
    - Young stands
    - Mature/over-mature stands **weeks 6, 7**
    - Reproductive structures
- Dwarf mistletoe, an Angiosperm pathogen **week 8**
- Roundworms **week 9**
- Bacteria
- Viruses

Pathogens potentially important in Alberta **week 10**

- Not yet occurring in Alberta
- In Alberta, but not currently important

Surveying for pathogens **week 11**

- Ground surveys, aerial surveys
- Statistical validity of different types of surveys
- GPS, digital mapping, satellite surveys
- Other non-photographic imagery

Pathogen management **week 12**

- Modelling as an aid to management
- The control triangle
  - General strategies
    - Exclusion, eradication, protection, resistance
    - Ways to implement strategies
    - Silvicultural, mechanical, biological, genetic, chemical, integrated
- Information from pre-harvest assessment allows us to make Treatment prescriptions. These can may centre on:
  - Harvest sequencing; block layout; harvesting method; Site prep; species choice; stand tending
- Pathogen management as input to forest management plans; PFMP, DFMP, GDP, AOP, PIP.

Enhanced forest management **week 13**

- Interaction of EFM techniques with the biology and population dynamics of pathogens
  - Site prep
  - Stand tending
  - Planting vs seeding
  - Genetically improved stock
  - Use of exotics

Exotic pathogens **week 14**

- Why we should be concerned about the introduction of exotic pathogens
  - Historical examples of introductions
  - The problem of exporting our pathogens

The role of pathogens in the ecosystem **week 15**

- Their role in:
  - Succession
  - Providers of food
  - Providers of habitat
- Forest health vs individual tree health
- Enhanced management vs ecosystem management

Lab schedule

Week 1 (indoor)	**……...**	**Five specimens, with documentation, to be handed, in not later than April 6th, 2002.**
Week 2 (indoor)	**……...**	**Slide/video run-through of Alberta pathogens.**
Week 3 (indoor)	**……...**	**Fungal structure, somatic and reproductive structures.**
Week 4 (indoor)	**……...**	**Set up "damping-off" and salt experiments.**
Week 5 (outdoor)	**……...**	**Survey of western gall rust in the lodgepole pine (B1) seed orchard of the Huallen Seed Orchard Complex.**
Week 6 (outdoor)	**……...**	**Analysis of the results of week 5 survey. Things to look for in reviewing survey results, from the operational perspective and from the research perspective.**
Week 7	**……...**	**Reading week - no lab**
Week 8 (outdoor)	**……...**	**Collect and write up results of the "damping-off" and salt experiments.**
Week 9 (outdoor)	**……...**	• **Impromptu talk session.** • **Review of specimens**
Week 10 (indoor)	**……...**	**Lodgepole pine dwarf mistletoe – recognition in the field. The six-point grading system.**
Week 11 (indoors)	**……...**	**Case study of disease in aspen on an acreage near Sexsmith.**
Week 12 (indoor)	**……...**	**Lab review of available pathogen material.**
Week 13 (indoor)	**……...**	**Final Lab exam.**

Note: Labs slated for outdoors will be conducted, unless conditions are totally unsuitable.

Examinations

Mid-term examination	…….	30% of term marks
Final lab exam	…….	20% of term marks
Reports from week 6 and week 8	…….	15% of term marks
Final exam	…….	35% of term marks