

**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

Labs: 3 hours per week

**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. 2<sup>nd</sup> Ed. Academic Press, Toronto.  
Canadian Council of Forest Ministers. Compendium of Canadian Forestry Statistics. (1996).  
Knight, F.B. and H.J. Heikkinen. (1980). Principles of Forest Entomology. 5<sup>th</sup> 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, non-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

<b>Overview of the course</b>	week 1
➤ Forest health in the year 2001	
➤ Reasons for increasing importance	
<b>Etiology – the causes of disease</b>	week 2
<b>The disease cycle, the disease triangle, disease square</b>	
<b>Symptomatology</b>	week 3
<b>Epidemiology</b>	
➤ Measurement	
➤ Temporal epidemic	
➤ Spatial epidemic	
➤ Role of environmental and cultural factors	
<b>Epidemiology</b>	week 4
➤ Geophytopathology	
➤ Quantitative analysis of epidemics	
➤ Regression	
➤ Simulation	
➤ Hazard evaluation	
➤ Yield losses	
<b>Principles of management</b>	
➤ Incidence	
➤ Impact	
<b>Principles of management</b>	week 5
➤ Control	
<b>Consideration of individual pathogens</b>	
<b>Fungal characteristics</b>	
➤ Basic structure and biology	
➤ Reproduction	
<b>Fungal characteristics</b>	week 6
➤ Classification	
<b>Review</b>	
<b>Detailed review of important pathogens</b>	weeks 7 - 9
<b>Fungi</b>	
➤ Important in Alberta	
➤ Ubiquitous in Alberta	
➤ Potentially important in Alberta	
<b>Lodgepole pine dwarf mistletoe</b>	week 10
<b>Wilts, declines, bacteria, viruses</b>	week 11
<b>Abiotic pathogens</b>	week 12
➤ Climate	
➤ Pollution	

**Exotic pathogens**

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

**Forest management in Alberta, re pathogens**

- Information from pre-harvest assessment allows us to prescribe treatments, e.g. Harvest sequencing; block layout; harvesting method; site prep; species choice; stand tending
- Pathogen management as an input to forest management plans; PFMP, DFMP, GDP, AOP, PIP.

**Enhanced forest management**

- 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

**The role of pathogens in the ecosystem**

- 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 6 <sup>th</sup> , 2002.
Week 2 (indoor)	.....	Slide/video run-through of Alberta pathogens.
Week 3 (outdoor)	.....	Survey of a selected pathogen, probably in the Hualien Seed Orchard Complex.
Week 4 (indoor)	.....	Analysis of the results of week 3 survey. Things to look for in reviewing survey results, from the operational perspective and from the research perspective.
Week 5 (indoor)	.....	Fungal structure, somatic and reproductive structures.
Week 6 (outdoor)	.....	Best-guess diagnosis of the cause of tree mortality on a small-holding near Grande Prairie.
Week 7 (indoor)	.....	<ul style="list-style-type: none"><li>• Write up project from week 6.</li><li>• Set up "salt" experiment.</li></ul>
Week 8	.....	Spring Break
Week 9 (outdoor)	.....	Field trip to review: <ul style="list-style-type: none"><li>• Hardwood pathogens in the field.</li><li>• Conifer pathogens in the field.</li></ul>
Week 10 (outdoor)	.....	Lodgepole pine dwarf mistletoe – recognition in the field. The six-point grading system.
Week 11 (indoor)	.....	Lab review of available pathogen material.
Week 12 (indoors)	.....	<ul style="list-style-type: none"><li>• Results of the "salt" experiment.</li><li>• Impromptu talk session.</li></ul>
Week 13 (indoor)	.....	Lab exam

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

## Examinations

Mid-term examination	.....	30% of term marks
Assignments, lab reports etc.	.....	25% of term marks
Lab exam	.....	10% of term marks
Final exam	.....	35% of term marks