

# GRANDE PRAIRIE REGIONAL COLLEGE

## Bachelor of Applied Forest Resource Management

SEP. 10 2002

**FOREST ENTOMOLOGY: FO3380**

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

### **Calendar Description:**

Increasing importance of forest health in recent years. Identification of major insect pests and their symptoms. Life histories of selected insects. The pest in relation to its forest environment. Pest management through an understanding of pest biology. Long-term management strategies versus temporary short-term programs. Fibre management strategies and their effects on forest insects. Elements of a forest health 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**

Canadian Council of Forest Ministers. *Compendium of Canadian Forestry Statistics*. (1996).

Coulson, R.N. and J.A. Witter. (1984). *Forest Entomology: Ecology and Management*. John Wiley & Sons, Toronto.

Graham, S.A. and F.B. Knight. (1967). *Principles of Forest Entomology*. McGraw-Hill, Toronto.

Knight, F.B. and H.J. Heikkinen. (1980). *Principles of Forest Entomology*. 5<sup>th</sup> Ed. McGraw-Hill, Toronto.

Turgeon, J.J. and P. De Groot. (1992). *Management of Insect Pests of Cones in Seed Orchards in Eastern Canada*. Forest Pest Management Institute. Sault Ste. Marie, Ontario.

### **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'

### **Insect biology**

- General biology of insects
  - Anatomy
  - Physiology
  - Life cycle, growth
  - Ecology, population dynamics
  - Taxonomy, identification and classification

### **Categorising insects as damage agents**

- By the part of the tree affected
  - Roots
  - Stems
  - Foliage
  - Reproductive biology
- 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

### **Impact on forest trees**

- mortality (especially in regeneration)
- loss of height growth
- volume loss
- loss of stem and wood quality
- effect on reproductive biology

### **Field identification**

- Identification of the insect
- Identification by symptom (more usual)

OR

### **Detailed study of individual insect pests**

- 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

### **Surveys to ascertain endemic and epidemic levels of insect pests**

- 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
- Pheromone traps
- Timing of surveys
- Combining entomological surveys with other silvicultural surveys
- Aids to surveying
- Efficiencies in surveying

### **Management of insect pests**

- Three types of information needed before initiating a management program - frequency, impact, feasibility of control
- Use of decision Support Systems (DSS) in management planning
- 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

### **Insect management as part of the planning process**

- Obligations under Alberta Forest Care, B.C. Forest Practices Code, Certification procedures.
- The Alberta Critical Pest Management Strategy
- Regional Forest Health Integrated Management Committees – their responsibilities.
- The private companies – their role in detecting and managing insect problems.
- Long-term insect management as part of the silvicultural plan.
- The insect management component of forest management plans. PFMP; DFMP, GDP; AOP; PIP.

### **Threshold levels that trigger management**

- The need for reliable information on endemic levels of insect pests
- Investigation of the relationship between numbers of insects captured in pheromone traps and baited trees and damage inflicted will allow us to identify critical “threshold” levels
- Emphasise the need for reliable long-term data
- Use of computer models to forecast the possible outcome(s) of different management strategies (Decision Support Systems – DSS)

- The budworm DSS as an example
- Current efforts by Alberta L.F.S. to develop an Alberta model for *Dendroctonus ponderosae*
- Information from pre-harvest surveys as a guide to managing insect pests endemic to a site

#### **Enhanced forest management (EFM)**

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

#### **Exotic insect pests**

- Increased trade means greater chance of importing exotic pests
- Controls and the difficulty of implementing them

#### **Ecosystem management**

- Forest health vs individual tree health

**Note:** Although this is an entomology course, we will set aside some time for consideration of avian and mammalian pests. Chiefly, we will discuss their management/control.

## LECTURE SCHEDULE

### Current views on forest health

- reasons for increasing importance of forest health

week 1

### Three pillars of a forest health program

- distribution, impact and management

### Insect biology

- General biology and taxonomy of insects
  - Anatomy
  - Physiology
  - Life cycle, growth
  - Ecology
  - Taxonomy, identification and classification

weeks 2, 3

### Population dynamics

- Carrying capacity of a site
- Life tables
- 'k' and 'r' strategists
- Relationship between predator and prey
- Population fluctuations, stable, cyclic, eruptive

weeks 4, 5

### Detailed review of major insect pests in :

- Canada
  - Alberta
    - Nurseries
    - Young stands
    - Mature stands
    - Seed orchards
    - Landing decks and log yards

weeks 6

weeks 7, 8

week 8, 9

week 10

Always emphasising the importance of the relationship between insect biology and management

### Damage agent surveys

- ground surveys, aerial surveys, pheromone traps
- Surveys designed for specific pests
- statistical validity of different types of surveys
- Use of GPS, digital mapping, satellite surveys.
- Other non-photographic imagery

week 11

### Management of insect pests

week 12

- The need for information on frequency, impact, feasibility of control (referring back to the 'three pillars' from week 1)
- Using a Decision Support System to aid in management decisions
  - Control methods
    - Silvicultural – building control plans into the silvicultural prescription
    - Mechanical – of limited use in operational forestry
    - Biological – undertake with caution
    - Chemical – short term solution
    - Genetic – possibly difficulties in the long term
    - Integrated
  - Public concerns over the effects of management on the environment

### Insect management as part of the planning process

week 13

- Obligations under Alberta Forest Care; B.C. Forest Practices Practices Code; Certification procedures.
- The Alberta Critical Pest Management Strategy
- Regional Forest Health Integrated Management Committees – their responsibilities.
- The private companies – their role in detecting and managing insect problems.
- Long-term insect management as part of the silvicultural plan.
- The insect management component of forest management plans; PFMP; DFMP; GDP; AOP; PIP.

### Threshold levels that trigger management

week 14

- The need for reliable information on endemic levels of insect pests
- Investigation of the relationship between numbers of insects captured in pheromone traps and baited trees and damage inflicted will allow us to identify critical "threshold" levels
- Emphasise the need for reliable long-term data
- Use of computer models to forecast the possible outcome(s) of different management strategies (Decision Support Systems – DSS)
  - The budworm DSS as an example
  - Current efforts by Alberta L.F.S. to develop an Alberta model for *Dendroctonus ponderosae*
- Information from pre-harvest surveys as a guide to managing insect pests endemic to a site, e.g. *Hyllobius warreni*

### Enhanced forest management

week 15

- Impact of EFM techniques on the stand environment
- How the changed environment affects the biology and population dynamics of insects
  - site prep
  - planting vs seeding
  - stand tending
  - genetically improved stock
  - use of exotics

### **Current concerns in forest entomology**

- Ecosystem management vs traditional management for fibre production
- Possible introduction of exotic pests
  - Historical examples of introductions
  - Impact of globalization

### **Mammal and bird pests**

- Chiefly rodent pests, how to manage or how to live with

## Lab Schedule

<b><u>Week 1</u></b>	Field lab	.....	Walk-through mature stands, naturally regenerated stands and artificially regenerated stands, noting different environments of each.
<b><u>Week 2</u></b>	Field lab	.....	Insect pests of deciduous stands
<b><u>Week 3</u></b>	Field lab	.....	Insect pests of conifer stands
<b><u>Week 4</u></b>	Field lab	.....	Pests of log yards
<b><u>Week 5</u></b>	Indoor lab	.....	Using a key to identify insects
<b><u>Week 6</u></b>	Field lab	.....	Case study. Diagnosis of a problem called in by a member of the public
<b><u>Week 7</u></b>	Field lab	.....	Planning and conducting an Insect survey in Huallen S.O
<b><u>Week 8</u></b>	Indoor lab	.....	Analysis of data collected in week 7
<b><u>Week 9</u></b>	Indoor lab	.....	Mid-term lab exam
<b><u>Week 10</u></b>	Indoor lab	.....	Alberta's spruce budworm program – planning and implementation (Mike Maximchuk, Peace River I.F.S.)
<b><u>Week 11</u></b>	Indoor lab	.....	Students prepare written and verbal presentations on forest entomology topics
<b><u>Week 12</u></b>	Indoor lab	.....	Presentation of week 11 papers
<b><u>Week 13</u></b>	Indoor lab	.....	Insect collection, preservation and mounting
<b><u>Week 14</u></b>	Indoor lab	.....	Revision lab; video and slides of important insect pests
<b><u>Week 15</u></b>	Indoor lab	.....	review lab

## Examinations

Mid-term examination	.....	30% of term marks
Mid-term lab exam	.....	25% of term marks
Papers from lab XII	.....	10% of term marks
Final exam	.....	35% of term marks