

Grande Prairie Regional College

Department of Science and Technology

Bachelor of Applied Forest Resource Management

Forest Soils and Hydrology: FO 2130

Pre-requisite: FO1220

Calendar Description:

Explore the chemical and biological processes occurring in forest floors and forest soils. Advance the understanding of nutrient cycles in forest ecological systems. Tree nutrition and its relationship with fertilization. Examine in detail the water cycles in forest systems. Introduce systematically the concept and system of land capability classification and site description. Emphasize soil management for silviculture, nursery and problem soils. Investigate the impacts of forest fire and harvest on soil and water quality.

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Required Text:

Fisher, Richard F., and Dan Binkley. 2000. **Ecology and Management of Forest Soils**. John Wiley & Sons, New York, N.Y.

Recommended Texts (available in library)

Prichett, William L., and Richard F. Fisher. 1987. **Properties and Management of Forest Soils, 2nd Edition**. John Wiley & Sons, New York.

Hewlett, J.D. 1982. **Principles of Forest Hydrology**. The University of Georgia Press, Athens, Ga.

Beckingham, J.D. and J.H. Archibald. 1996. **Field Guide to Ecosites of Northern Alberta**. Canadian Forest Service, Northwest Region.

Perry, David A. 1994. **Forest Ecosystems**. The John Hopkins University Press, Baltimore, Maryland.

Manning, John C. 1997. **Applied Principles of Hydrology**. Prentice Hall Canada, Inc., Toronto.

Lee, Richard. 1980. **Forest Hydrology**. Columbia University Press, New York.

Brooks, K.N. et al. 1997. **Hydrology and the Management of Watersheds**. Iowa State University Press, Ames, Iowa.

Websites: <http://res.agr.ca/CANSIS/>
<http://www.soils.rr.uAlberta.ca/soils330/class.html>

COURSE EVALUATION

Assignments	20%
Lab Reports	25%
Mid-term exam	20%
Final exam	35%

COURSE OUTLINE

PART 1. Formation of Forest Soils and Ecological Classification

1. Forest floor and forest soils Jan 6 - 9
 - 1.1 Forest floor classification
 - 1.2 Formation of forest floor (litter fall and decomposition)
 - 1.3 Overview on organic matter study methods
 - 1.4 Podzollization and Podzolic soils
 - 1.5 Forest soils in Alberta

2. Ecological classification and land capacity Jan 13 - 16
 - 2.1 Land capacity classification
 - 2.2 Site description
 - 2.3 Ecological classification of forest soils

PART 2. Chemical and Biological Processes

3. Chemical process Jan 20 - 23
 - 3.1 Acidity and acidification in forest soils
 - 3.2 Diffuse-double-layer (DDL) theory and cation retention
 - 3.3 Anion sorption, phosphate fixation and the fate of phosphate fertilizers

4. Ecology of organisms in forest soils Jan 27 - 30
 - 4.1 Overview on organism world in forests
 - 4.2 Biochemical pathways of forest litter decomposition
 - 4.3 Microbial-plant interactions

PART 3. Tree Nutrition and Soil Fertility

5. Tree nutrition and nutrient cycling Feb 3 - 6
 - 5.1 Root systems
 - 5.2 Movement of nutrients to plant roots
 - 5.3 Nutrient uptake by trees
 - 5.4 Geochemical nutrient cycling
 - 5.5 Biological nutrient cycling

6. Fertilization Feb 10 - 13
 - 6.1 Forest nutrition assessment
 - 6.2 Principles of fertilization
 - 6.3 Fertilizers and fertilizer application
 - 6.4 Effects of fertilizers
 - 6.5 Use of wastewater and sludge as fertilizers
 - 6.6 Economics analyses

PART 4. Forest Soil Management

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| 7. | Soils and Silviculture | Feb 17 - 20 |
| | 7.1 Harvesting and nutrient cycling | |
| | 7.2 Effects of land cleaning and site preparation | |
| | 7.3 Soils and species selection | |
| | 7.4 Nutrition management (including symbiotic N-fixation) | |
| 8. | Management of nursery soils | Mar 4 |
| | 8.1 Site selection | |
| | 8.2 Soil management for nursery | |
| | 8.3 Christmas trees and seed orchards | |
| 9. | Fire-affected soils and management | Mar 6 |
| | 9.1 Effects of fire on soil properties | |
| | 9.2 Effects of fire on water quality | |
| | 9.3 Management implications | |
| 10. | Management of problem soils and land reclamation | Mar 11 |
| | 10.1 Aforestation and reforestation sites | |
| | 10.2 Reclamation of land to forest (reforestation) | |
| 11. | Soil erosion and control | Mar 13 |
| | 11.1 Definitions | |
| | 11.2 Factors affecting soil erosion | |
| | 11.3 Prediction (USLE) and measurement of soil erosion | |
| | 11.4 Control and prevention | |
| 12. | Environmental problems in forest ecosystems | Mar 18 |
| | 12.1 Water quality (definition and parameters) | |
| | 12.2 Soil quality | |
| | 12.3 Effects of land management practices on soil and water quality | |
| 13. | Engineering properties of soils | |

PART 5. Forest Hydrology

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| 14. | Introduction to hydrology | Mar 19 - 27 |
| | 14.1 Definitions | |
| | 14.2 Water and energy balance | |
| | 14.3 Drainage basin morphology | |
| 15. | Water budget | Mar 31 - Apr 10 |
| | 15.1 Atmospheric water and precipitation | |
| | 15.2 Subsurface water | |
| | 15.3 Evaporation and evapotranspiration | |
| | 15.4 Surface water and water yield | |