

An aerial photograph showing a large, blue body of water, possibly a reservoir or lake, with a prominent curved peninsula. The surrounding land is a mix of green fields, some with distinct patterns, and a few small buildings or structures. The overall scene is a rural or agricultural landscape.

APBI 402 / SOIL 502
Summary

Course objective

- To apply fundamental soil science principles in sustainable management of forested, agricultural, and urban / constructed ecosystems

Approach

- To simulate a real-life approach in evaluating soil properties to establish the most appropriate management practice
- Describe the soil chemical, biological, and physical environment

Learning outcome no. 1

- Describe processes of soil genesis, recognize diagnostic features of soils, and relate management practices to info available in soil surveys

Example – Bose soil

- Duric Humo-Ferric Podzol
- Formed on glaciofluvial deposits overlying glacial till
- Texture - gravelly SL to LS
- 2-8% org. matter (in Bf)
- CEC ~ 10 cmol_c/kg soil (in Bf)
- Base saturation <50% (in Bf)
- Strongly to moderately acidic

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LFH, Ae, Bf, BCc, C

Drainage might be impeded in lower parts of soil profile

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Good water infiltration

Good aeration

Poor water holding capacity

Good trafficability

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Low ability to supply nutrients

Low buffering capacity

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Soil fungi

Potential problems for Mo and B, but OK for Fe, Mn, Zn, Cu, Co

Learning outcome no. 2

- Utilize physical, chemical and biological soil quality indicators to assess sustainability of management practices

Framework for evaluating soil quality

| Function | Process | Attribute (property) | Indicator | Method |
|---|--|---|---|-------------------------------------|
| Soil supports plant growth | Accept, hold and release nutrients | Soil texture | Clay | hydrometer |
| | | Total soil organic matter | Soil organic C | Dry combustion |
| | | | C/N ratio | Dry combustion (C and N) |
| | | Labile organic matter | Microbial biomass | Chloroform fumigation |
| | | | Carbohydrates | Acid hydrolysis |
| | | Cation exchange capacity | | NH ₄ -acetate extraction |
| | | Available form of a nutrient (e.g., P, K, S, B) | | Corresponding extraction methods |
| Soil function deals with “what the soil does”. | Soil process supports the function being imposed upon on a particular soil. | Soil attribute is a measurable critical property involved with the process or processes underlying the function. | Soil indicator is an indirect, practical measure of the attribute. | |

Learning outcome no. 3

- Characterize the soil physical environment
 - What characteristics of soil physical parameters make this challenging?

**Soil properties range from dynamic to stable
(e.g. soil water content vs texture)**
 - How is the soil physical environment impacted by land use?

**Similar issues regardless of land use
(e.g. compaction)**
 - Can we measure what we are interested in directly?

**Attribute and proxy indicators
(e.g. compaction vs relative bulk density)**

Learning outcome no. 4

- Characterize the soil chemical environment

- What characteristics of soil chemical parameters make this challenging?

**Direct measures vs proxies
(e.g. available P vs C:N ratio)**

- How do we interpret our results?

**Soil fertility (bioavailability indices) vs.
contaminated sites (OMRR)**

- What information do we need to know?

Sustainable management requires long term data

Learning outcome no. 5

- Characterize the soil biological environment
 - What characteristics of soil biological indicators make this challenging?
 - What information do we want to know?
 - What can we measure?

Direct measurement is often costly, time consuming, highly specialized training required....

(research vs. practice)

Highly interactive with physical and chemical properties

Process products NO_3 , CO_2 → indicators

Social, economic, policy context for sustainable management

- Legislative framework
 - BC Forest & Range Practices Act
 - BC Forest Planning & Practices Regulation
 - BC Min. Agric. & Lands Environmental Farm Plan:
voluntary, encourages adoption of BMPs
 - CGSB (Canadian General Standards Board): set
standards for organic agriculture
 - Organic Matter Recycling Regulations

Summary of the Summary

- **Managing land = complex task**
- **Understanding of soil quality; physical, chemical and biological processes; and indicators → sustainable soil management**