SOILS 4150/5150, FALL 2011

FOREST AND RANGE SOILS:
THE SCIENCE AND CULTURE OF WILDLAND SOILS.

The objective of this course is to provide an overview of extensively managed environments and the soils under them. Attention will be paid to what they are, what importance these soils have and why they are worthy of study. To this end, the class will go to these natural bodies, soils, on and in the landscape: to touch and immerse.

Location: Room 2070 in the Engineering Building..
Lecture: Tuesdays and Thursdays 11:00 AM to 12:15 PM
Lab and Field Trips: Thursdays 1:20 PM to 5:10 PM. Most sessions will be in the field, although we will start in the Lab, Room 30 in the Old Agriculture Building.
Text: None, although readings will be assigned.
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Establishing Paradigms: What are forest and range soils? Are they productive from an economic perspective? Are there aesthetic features of these forest and range landscapes that transcend economics? Are forest and range soils merely wild land soils? How does one separate forest and range environments and soils, by definition and by management, from other environments and associated soils? What products come from forest and range environments? Who owns the forestlands and range lands? How are these lands classified? How do soils vary across forest and range landscapes? How do soil properties of forest and range landscapes impact above ground plant and animal growth? What are the energy and nutrient flow dynamics of forest and range soils? How resilient are forest and range ecosystems? Can these systems be restored if they are disturbed?

Labs, Quizzes, Examination: During the semester there will be 12 quizzes, each worth ten points (only the ten highest grades will be counted towards your grade). There will be ten Thursday lab write ups, each worth thirty points; personal project worth 100 points and one 100 point take-home final examination. In summary, the total possible points for this class are:

Ten quizzes (each worth ten points)	100 points
Ten lab write ups (each at 30 points)	300 points
Your personal project	100 points
One take home final examination	100 points

Total Possible Points: 600.
Grades: Grading scale:

Total Points	Percentage	Grade
540 to 600	90 & above	A
480 to 539	80 to 89	B
420 to 479	70 to 79	C
360 to 419	60 to 69	D

359 and below	59 and below	F

General Laboratory Template: For each laboratory (in this case, field trips) you will be required to hand in a brief report. The following is the very general outline that you will use for each write up.

A. Objectives—There are central questions for each lab that will need to be stated here.
B. Methods—these, in brief, are detailed in the handout entitled "Field Methodology for Soils 4150/5150." There may be some methodology changes or additions and you should make note of those here. It is unnecessary to repeat methodology from the handout.
C. Description—This is essentially the completed Soils Data Template (SDT), one for each soil examined, that we examine during the lab or expedition. In each write up there will be at least one SDT for each lab and perhaps as many as six.
    a. In the description and in the conclusions it will be very important to keep in mind the soil state equation and its components when addressing the objectives and in coming to conclusions.
    b. The Soil State equation: $S=f(PM, Cl, Topo, Org)_T$. This equation reads:

       Soil (S) is a function (f) of
        i. Parent Material (PM)
        ii. Climate (Cl)
        iii. Topography (Topo) which includes aspect and slope
        iv. Organisms (Org), plants, animals, microbiota,
        v. All integrated across time (T).
D. Results and Conclusions: In this section you should unambiguously address and answer the questions posed in the objectives.
E. References: If in writing your report you used any references, including internet addresses, these should be listed here.

Supplies and Safety

A. Personal Items Highly Recommended-each person should provide these for themselves
    a. Adequate shoes—boots, walking shoes, extra socks.
    b. Jacket, hat, work gloves, rain gear.
    c. Insect repellant, sun-screen, sun glasses.
    d. Water, snacks, and on expeditions, bring a portable lunch.
    e. Pack
B. Items Provided
    a. Extra water
    b. First Aid Kit
    c. Vehicle(s) for transportation.
C. Safety Training
    a. Tool usage.
    b. Walking and hiking, especially in the woods.
    c. The group and the "buddy" system.

THE SYLLABUS

Forest and Range Soils

Chapter I: Forest and Range Environments: Objective to provide an over view of extensively manage environments, what they are, what importance they have, why they are worthy of study.

A. The Soil State Equation and variation in climate, topography, parent materials and organisms across extensively managed environments.
B. Introduction to uses of Forest and Range Environments.
C. Differentiation between Extensive Management and Intensive management.

Chapter II: Historical Perspectives of Land and Soil Management: Extensively managed environments have been important to humans for much of their existence: For food, fuel, shelter. However, there is also an attachment through literature, poetry and song; attachments culturally and traditionally. In modern times all of these remain, but they are also a source of recreation.

A. Prehistoric Considerations
    a. Nomadic Man
    b. Early Civilizations
    c. Ancient Agriculture—Case Studies
B. Historical Considerations
    a. Discovery of man's relationship with nature
    b. Defining a philosophical basis for Land and Soil Use
    c. The Political structure for land and soil management
C. Land Management after World War II

Chapter III: Description, Management and Geography (Microgeography to Macrogeography) of Soils along Climatic, Vegetal And Topographic Gradients: This chapter presents the basic generalized soil unit, and the state equation factors that are their basis.

A. Alpine/Tundra Soils
B. Forest Soils
    a. Coniferous Forests
    b. Deciduous Forest
    c. Tropical Forests
    d. Forest-grassland Ecotones
C. Transition Soils
    a. General Environment
    b. Pine to Shrub Transition
    c. Pinon-Juniper Woodlands
    d. Chaparral
D. Arid Rangeland Soils
    a. Environments
    b. Precipitation

c. General soil Properties
d. Plants
e. Aspect
f. Typical soils

E. Upland Range Soils
    a. Environment
    b. Straton Sagebrush Study

F. Grassland Soils, Tropical Savannahs
    a. State Equation
    b. Geography
    c. Mollic Epipedon
    d. Mollisols

G. Bog Soils (Histosols) and other riparian soils
H. Volcanic Soils Including properties.

Chapter IV: Descriptive Techniques for Soils: This essentially focuses on taking the soil members from Chapter V and working them into levels of maps, levels of utilization, and levels of sustainability (soil health).

A. Variability of soils
    a. Determination of Soil Variability
    b. Soil Variability as a factor in the quality of soil surveys
    c. How variability affects plant growth
B. Mapping Techniques
C. References
    a. Soil Surveys
    b. Other Published Literature
D. Soil Health Criteria

Chapter V: Nutrient Management in Forest and Range Soils—Biological Diversity and Productivity.

A. Fertilization: General Nature
B. Forest Fertilization
C. Range Fertilization
D. Management of Biological Nitrogen Fixation
E. Role of other soils microorganisms in nutrient management
F. Soil Organic Matter and Productivity
    a. In Rangeland Ecosystems including below ground carbon dynamics and assimilation by grassland soils
    b. Management in Forested Systems
    c. Decomposition of macro-sized organic materials (Tree Trunks)
G. Mycorrhizae
H. Fire
I. Summary of the Soils State Equation
    a. Abiotic factors domination of the landscape
    b. Biotic factor domination of the landscape

Chapter VI. Water in forest and Range Soils

- A. General Soil Water
- B. Water Regimes
- C. Water Conservation
- D. Soil water in forested systems
    - a. Interaction of cutting strategies and water production
- E. Soil Water in Range Systems
- F. Water Repellent Soils
- G. Impacts of Soil Properties (especially chemical on Water
    - a. Quantity and quality
    - b. Variations in Hydraulic conductivity

Chapter VII: Soils of Extreme pH and Salt content

- A. Saline Sodic Soils and their management
    - a. Indicator Vegetation
    - b. Description and Properties
    - c. Management
- B. Highly leached, acid soils and their management
    - a. Indicator Vegetation
    - b. Description and properties
    - c. Management

Chapter VIII: Impact of Soil on Biota

- A. Soil Plant Relations.
    - a. State factors
    - b. Distribution and diversity
- B. Biological Crusts
    - a. State factors
    - b. Distribution and diversity
- C. Soil Wildlife Relations
    - a. State factors
    - b. Habitat and nutrition
    - c. Distribution and diversity
- D. Other Biota.

Chapter IX: Desertification and Reclamation of Desertified Areas

- A. Global Deserts
- B. Deforestation
- C. Use and abuse by Grazing animals
    - a. Effects of animal Wastes
    - b. Compaction and Erosion
    - c. Germination of Seeds
    - d. Soil structure impacts
    - e. General Function
- D. Atmospheric toxicants

E. Aqueous and non-aqueous toxicants
F. Mining
    a. Topsoil conservation and erosion
    b. Connection between soil characteristics and reclamation
    c. Reestablishment of shrubs
    d. Man's impact on soil properties
    e. Interface between human occupied soils and Natural Systems (the boundary between intensive management and extensive management).

Chapter X. Forest and Range Classification and Use

A. Forest Service
B. Bureau of Land Management
C. Soils conservation Service
D. National Park Service
E. Private Land
    a. Estates (e.g. the Scottish Estate)
    b. Ranches, Cattle Stations, Etc.
    c. Timber Magnets (Crown-Zellerbach, Weyerhouser, Georgia- Pacific, etc.
    d. Small acreages
F. Other Governmental Agencies

Chapter XI: Future uses of these lands.