

ENVIRONMENTAL SOIL SCIENCE
“SOILS AND LAND USE”
Geology 340
Fall, 2019

Course Information:

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Office Hours:	<i>M, W: 11:00-13:15, F: 12:15-13:15, or by arrangement</i>	
Class Time:	<i>M W: 10:10–11:00; F: 10:10-12:00</i>	
Room:	<i>EnGeo Building 3009/3011</i>	
Course Web Site:	http://csmgeo.csm.jmu.edu/geollab/eaton/web/eaton.htm	

Texts: *Soils and Land Use*, by W.C. Sherwood

Nature of the Course Content:

This three credit course is designed to introduce you to the origin, distribution, and use of soils through lecture, laboratory, field, and computer-based activities. Human demands on the earth's ecosystem are increasing exponentially. Among the most severely impacted resources are the world's soils. If we are to minimize the adverse impacts and optimize the beneficial utilization of soils, a minimum level of understanding of soil science is necessary. For professions such as agriculture and civil engineering the need for knowledge of soils is long standing. Additionally, numerous other professions are finding soils information to be of value. These include biology, geology, archeology, geography, environmental health, landscape architecture, environmental science, geohydrology, and others. Upon completion of this course, the student will have a strong underpinning, appreciation, and applications of the broad topic of soils.

Requirements and Policies:

Attendance/Participation:

What you derive from this course will depend on your investment in this endeavor. Attendance in lecture, laboratory, and field trips is expected; and unexcused absences for laboratory or field trips will result in a penalty of your grade. Excessive absences in the course will be reflected in your final grade.

Grading Structure:

	<u>%</u>
Exam #1	25
Exam #2	25
Exam #3	25
Laboratory Exercises and Field Books	22
Seminar Attendance and Write ups	3

Exam Dates (Tentative):

Exam 1: Friday, October 4
Exam 2: Friday, November 8
Exam 3: Friday, December 13 @8:00 a.m.

Overview of Grading:

Each of the Reports and Tests will be announced at least one week prior to the due date. A ten-point grading scale will apply, i.e. 90-100=A; 80-89=B; etc. The three exams will cover a specific part of the course. Test questions will be drawn upon material covered in class, from assigned readings, from field trips, and from laboratory exercises. A standard format for the laboratory reports will be discussed in class. Students will work in teams in the laboratory, but data manipulation, interpretation, and report preparation is to be done individually. Assignments are expected to demonstrate professionalism, and to be completed on time **Unexcused late laboratories and problem sets will be marked down 10 points per day and will not be accepted 5 days beyond due date.**

Academic Honesty:

All incoming JMU students sign a pledge to abide by the JMU honor code, which includes, but not limited to, not presenting others' work as your own without proper acknowledgement. **This honesty also includes not accessing/borrowing/incorporating past course assignments, laboratories, tests, or other materials. In short, you are expected to do your own work unless otherwise instructed.** The spirit of this honor pledge will be implicit in all assignments. Violation of this pledge will be prosecuted vigorously by the instructor and the honor council; penalties in the past have included receiving a failing grade on assignments, the course, and expulsion from the University. For more information, see the link <http://www.jmu.edu/honor/code.shtml>.

Inclement Weather:

JMU's cancelation policy will apply for our lecture and laboratory meetings. Please check your email before coming to class in the morning in the event that the instructor has cancelled class due to unforeseen events. With regards to our field trips, the instructor will make a decision on whether or not the event will proceed no later than two hours from the planned meeting time. However, you should be prepared for (and dress appropriately for), inclement weather for ALL field trips. For more information, see the link <http://www.jmu.edu/JMUpolicy/1309.shtml>.

Religious Observation Accommodations:

All faculty are required to give reasonable and appropriate accommodations to students requesting them on grounds of religious observation. The faculty member determines what accommodations are appropriate for his/her course. Students should notify the faculty by no later than the end of the Drop-Add period the first week of the semester of potential scheduled absences and determine with the instructor if mutually acceptable alternative methods exist for completing the missed classroom time, lab or activity.

Goals of the course:

The overall goal of this course is to impart a basic understanding of the origin and distribution of soils; and to examine the physical, chemical, and biological nature and processes of soils. The specifics of each goal and respective objects are:

Goal 1: Provide students in geology and related fields with an understanding soil-forming processes, soil morphology and Soil classification.

Objective 1: Identify the origin and evolution of parent material which is subjected to chemical, physical, and biological processes to produce true soil.

Objective 2: Develop the concepts of soil horization, soil profile development, and the integration of soils into the “rock cycle.”

Objective 3: Investigate the role of water in soil formation, drainage, translocation of cations and colloids, and plant growth.

Objective 4: Provide an understanding of soil classification systems and the philosophical basis for classifying soils.

Objective 5: Learn the formative elements of modern Soil Taxonomy, and use the system to identify and evaluate soils in the field.

Goal 2: Investigate soil genesis through the processes of rock weathering and the geochemistry, mineralogy, and organic constituents which form the solid phases in soil.

Objective 1: Understand the role of equilibrium chemistry in the weathering environment.

Objective 2: Differentiate the effects of oxidation, hydrolysis, and solution in the mineralogy of affected minerals.

Objective 3: Identify the common clay minerals in soils using x-ray diffraction methods.

Objective 4: Learn the major biota which live in soil and which affect the formation and evolution of soils.

Objective 5: Investigate the origin and importance of organic matter in soils in a relationship of climate and vegetation to the amounts and vertical distribution of humus in soils.

Goal 3: Introduce the fundamentals of soil mechanics and geotechnical engineering practice.

Objective 1: Study stress strained relations in a heterogeneous system such as soil.

Objective 2: Investigate soil foundations and soil as an engineering material.

Objective 3: Run a Proctor Test to determine the optimal moisture and maximum density of a specific soil and relate these properties to soil texture.

Objective 4: Use the Universal Soil Loss Equation to predict soil losses due to accelerated erosion and evaluate methods for erosion control.

Goal 4: Identify the major soils-related factors which must be considered in formulating sound land use decisions.

Objective 1: Evaluate the roles of geology and soils in the development of historic patterns of land use in Virginia.

Objective 2: Utilize specific case studies to develop a rational approach to optimal land use.

Objective 3: Evaluate soils as receptacles for liquid and solid waste. Identify the soil properties required for the containment and assimilation of various types of waste.

Objective 4: Discuss the role of soils and geology on human health. Include major and trace element biogeochemistry in the distribution of selected diseases.

ORDER OF TOPICS

READINGS

Classification and Distribution of Soils

What Is Soil?

Chapter 1

Knowing Your Backyard: Geology of Virginia

Soil Origins and Profiles

Chapter 2

Principle Factors of Soil Formation

Chapter 4

Soil Water

Chapter 3

Classification of Soils

Chapter 5

 Climate and Regional Trends

 Zonal Soils

 Soil Taxonomy

Soils Series, Associations, and Maps

Chapter 6

What's In Soil and Why Does It Matter?

Rock Weathering and Soil Mineralogy

Chapter 7

Clay Minerals

Soil Biology

Chapter 8

Soil Organic Matter

Soil Fertility and Productivity

Chapter 9

Engineering Properties of Soils

Erosion and Sediment Control

Chapter 10

Drainage and Storm Water Management

Mechanics of Deformation

Chapter 11

Soil as an Engineering Material

Land Use and Misuse

Land Use Trends in Virginia

Land Use – Selected Case Histories

Guidelines for Course Work

Lab Reports:

Most laboratory exercises will be conducted by teams of two or three students. These teams will work together until all of the raw data is complete. Raw data will include, for example, weights for moisture contents, weights for sieve analyses, etc. At this point, each student is to take the data and work alone on the lab report.

The following guidelines apply:

Allowed:

- Working together to generate raw data.
- General discussion of material presented in class, in laboratory, or in the textbook. Examples include the use of flow charts, tables, and figures.

Not Allowed:

- Working together to process raw data (example: using sample weight to determine moisture content).
- Sharing or working together to generate spreadsheets or other tables, graphs, and figures. All tables, figures, and spreadsheets should be generated individually.
- Working together to interpret the data.
- Working together to formulate conclusions.