

Soils, Environmental Quality and Global Challenges
SSC 495/590, Section 002
Fall 2013

Instructor: Matt Polizzotto, Assistant Professor, Soil Science
3234 Williams Hall
Ph: 515-2040
matt_polizzotto@ncsu.edu

Prerequisites: General chemistry; SSC 200, ES 100, or permission of the instructor

Class Hours: TR 10:15-11:30; 2312 Williams Hall

Office Hours: TR 1:00-2:00 or by appointment

Readings: Selected primary literature, policy documents, and textbook chapters

Course Description:

As the world population grows to 9 billion people by 2050, we will be pressed to increase food security, respond to the consequences of a changing climate, and improve human health – while protecting the environment and maintaining natural resources. Soils play a critical role in many of these challenges, particularly in regulating environmental quality. The primary goal of this course is to teach you how soils mediate environmental impacts through a host of chemical, physical, and biological processes. We will examine a series of global challenges, assess their main related environmental issues, and analyze the roles of soils in each issue. Examples of the possible Global Challenges covered in the course include food security, drinking water and sanitation access, and climate change adaptation and mitigation. Key themes throughout the course will include the range of spatial scales over which processes occur, data sources used to understand soil processes and global challenges, the interconnections between (and among) various environmental issues and societal needs, the role of soil science in policy analyses, and the differences in challenges facing developed and low-income countries.

Course Objectives:

- Develop analytical skills of complex, integrated technical and policy issues
- Develop skills in communication of technical issues to a range of audiences
- Develop an understanding of the key chemical, physical, and biological processes by which soils regulate environmental quality
- Connect soil processes to global challenges
- Provide insights on how data are acquired and used in decision-making

Student Evaluation:

Paper discussion moderation	250 points	(25%)
Periodic assignments (4)	100 points	(10%)
Term Project		
1-min presentation	100 points	(10%)
1-page memo	100 points	(10%)
10-min presentation	100 points	(10%)
Final paper	200 points	(20%)
<u>Participation in paper discussions</u>	<u>150 points</u>	<u>(15%)</u>
Total	1000 points	

Projected Outline of Lecture Topics:

PART I - INTRODUCTION

Class Overview (1 Lecture)

- Syllabus
- The world in 2050: trends in population growth, resource availability, land use
- Global Challenges: food security, drinking water and sanitation, climate change adaptation and mitigation, energy production, waste disposal
- Millennium Development Goals
- Soil roles in global challenges

Background and syllabus analysis assignments

Soils and Environmental Quality (1-2 Lectures)

- Soil hydrobiogeochemical processes
- Fate of contaminants: soil, water, and air
- Scale: Over which spatial and temporal scales do relevant soil processes occur? Over which scales are policy decisions made?
- Data: What are data sources for understanding soil processes (and assessing global challenges)?

Paper discussion assignment description

Term project assignment description

Roles of Science Informing Policy (1 Lecture)

- Challenges for scientists
- Communication
- Resources

PART II - CONSUMPTION

Food Production, Food Safety, and Global Food Security (3 Lectures)

- Global food needs, nutrition, soil amendments
- Nutrient impairment of water quality
- Fate of pesticides
- Air quality
- Biosolids and animal waste as fertilizer

Term project topics due

Drinking Water and Water Security (3 Lectures)

- Global access to safe drinking water
- Use of groundwater as an improved water source
- Anthropogenic contamination of groundwater: pathogens
- Natural contamination of groundwater: arsenic, fluoride, manganese

Land Use and Land Development (2 Lectures)

- Erosion, sediment, and soil conservation
- Hydrological shifts
- Deforestation

Introduce 1-minute presentation and memo assignments

Energy Production (2 Lectures)

- Global energy needs and trends, global energy resources
- Coal mining
- Fracking
- Spills

PART III – EMISSIONS AND WASTE

Climate Change (4 Lectures)

- Mitigation of carbon emissions
- Adaptation to climate change
- Carbon storage in soil
- Greenhouse gas emissions

1-minute presentations and memos due

Sanitation (3 Lectures)

- Global sanitation access
- Effluent treatment by soil – pathogens, nutrients, and metal transport in groundwater

Final project outlines due

Waste Disposal (3 Lectures)

- Landfill leachate, methane release
- Energy waste management, coal fly ash
- Soil pollution

PART IV - CONCLUSIONS

Interconnections among Issues (2 Lectures)

Class exercise: flow diagram

10-minute presentations, final papers due

Projected Schedule of Assignments:

Aug. 27	Background and syllabus analysis assignments
Sep. 12	Term project topics due
Oct. 10	FALL BREAK – No class
Oct. 24	1-minute presentations and memos due
Nov. 5-7	SSSA MEETINGS – No class
Nov. 14	Final project outlines due
Dec. 5	10-minute presentations and final papers due

Readings and Paper Discussions:

Many class sessions will be composed of group paper discussions. Each reading will be provided at least 1-week ahead of the class in which it will be discussed. One student will be assigned to lead and moderate the discussion on each paper, providing background to the topic and focusing on target questions, which will be provided by the instructor in advance. All students are expected to read the assigned papers and participate in group discussions.

Term Project:

A term project on a topic of each student's choice will include two individual presentations, a 1-page persuasive memo, and a final paper (8-12 pages); the first presentation will be a 1-minute talk ("elevator speech") during the middle of the term and the second presentation will be a powerpoint-aided 10-minute presentation. In the papers and presentations, students will investigate an environmental issue related to soils, assess existing scientific questions and relevant policies, and provide recommendations for potential solutions or improvements to the issue.

Other Expectations:

- Positive group dynamics!
- Ask questions!
- Provide feedback to your instructor!

Attendance:

Attendance at all lectures is expected but will not be formally recorded. University-approved absences should be discussed in advance with the instructor. Emergency absences should be discussed as soon as possible after return to class. Examples of planned excused absences are: University duties or trips, recognized religious observances and required court attendance. Examples of emergency excused absences are: serious personal or family illness or injury, or the death of a family member. The university's official policy on attendance is found at this web site:

http://www.ncsu.edu/policies/academic_affairs/courses_undergrad/REG02.20.3.php

Academic Integrity:

The Code of Student Conduct at North Carolina State University clearly outlines expectations of academic integrity for all students. It is the responsibility of all members of the NCSU academic community to discourage cheating and plagiarism. Academic dishonesty cannot be tolerated at any institution that values individual achievement, truthfulness, and the free exchange of ideas. It is the University's expectation that all students will abide by its regulations concerning academic integrity. Failure to do so will jeopardize each individual's academic career and has the potential to negatively impact their vocational experiences as well. For a more detailed description of the Code of Student Conduct you may visit the following web site:

http://www.ncsu.edu/policies/student_services/student_discipline/POL11.35.1.php

(Appendix L, Chapter 5, Section 6.4, paragraphs 7-13)

Students with Disabilities:

Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantage of available accommodations, students must register with Disability Services for Students at 1900 Student Health Center, Campus Box 7509, 515-7653. For more information on NC State's policy on working with students with disabilities, please see the **Academic Accommodations for Students with Disabilities Regulation (REG02.20.1)**.