

# ENVIRONMENTAL QUALITY

## Fall Semester 2011

**Instructor:** Dr. George F. Vance

**Office:** 1007 Agricultural Hall, 766-2297, gfv@uwyo.edu

**Office Hours:** Tuesday, Wednesday, Thursday 12:15-1:30, by appointment, or just come by my office.

**Course Text:** Soils and Environmental Quality, 3<sup>rd</sup> Edition. 2005. Pierzynski, Sims, and Vance. CRC Press, Taylor & Francis Group, Boca Raton, FL. Available at the University Campus Bookstore.

**Grading:**

Term Exams (3)	=	300	(100 pts per exam)
Assignments	=	260	(articles (@ 5 pts), homework (@15 pts))
Term Project	=	170	(poster (100), presentation (50), poster grading (20))
Final Exam	=	150	(comprehensive, mainly last part of semester)
Participation	=	120	(discussion groups, field trip, class involvement)
TOTAL	=	1000	

Course Grade A = 90-100% B = 80-89% C = 70-79% D = 60-69% F = <60%

**Preface:** Our soil, water, and air are both interfaces and environments that are impacted by human activities. Therefore, it is important to preserve, protect and sustain these ecosystems and their functions for future generations. An understanding of soil, aquatic and atmospheric properties and reactions is thus critical to the evaluation of how many contaminants and pollutants, as well as essential nutrients, behave in the environment. For example, soils play an important role in environmental quality as they can be a source, sink, or interacting medium for contaminants such as greenhouse gases, heavy metals, excess nutrients, and waste products. Consequently, proper soil management is an important step in maintaining and even improving our environment.

**Course Goals:** Students upon completion of *Environmental Quality* should:

- Understand the role of the atmosphere, hydrosphere, and soil systems in the cycling of nutrients and contaminants.
- Develop an appreciation of how ecosystems respond to natural and anthropogenic (i.e., human-generated) substances.
- **Know the Scientific Method.** Be able to assess methods for prevention and/or remediation of different types of contaminants under various environmental scenarios.

**Course Objectives:**

- Define and classify contaminants and pollutants.
- Review the basics of atmospheric, aquatic, and soil sciences.
- Examine the role of soils in the biogeochemical cycling of major elements and chemicals of environmental concern.
- Discuss various aspects of nitrogen, phosphorus, sulfur, trace elements, organic chemical, greenhouse gases, and acid precipitation.
- Study different methods of soil management and remediation to minimize or correct polluted ecosystems.
- Examine the interactions of potential pollutants with atmospheric, aquatic, and soil environments.
- Review the concept of risk assessment using contemporary examples.

**ENVIRONMENTAL QUALITY  
2011 TENTATIVE OUTLINE**

**Week 1**

**Part I - FUNDAMENTALS OF ENVIRONMENTAL QUALITY**

8/23 **Introduction - Syllabus and Course Content.**

**Chapter 1 “Introduction to Environmental Quality”**

Lecture (pp. 3-11) Environmentalism; Studying the Environment: The Scientific Method; *EQ Issue/Event*; Environmental Science and the General Public; Defining Pollution and Contamination.

8/25 **Introduction to Environmental Quality (cont.)**

Lecture (pp. 11-22) Classifying and Characterizing Pollutants; Human Exposure to Soil Contaminants; Federal Environmental Legislation; Major Environmental Issues in Soil Science; *Overview of Risk Assessment (review of Chapter 12)*.

**ASSIGNMENT - Turn in Article**

**Week 2**

8/30 **Chapter 2 “Our Environment: Atmosphere and Hydrosphere”**

Lecture (pp. 26-40) Atmosphere - Atmospheric Layers and Their Properties; Atmospheric Cycles; Characterizing the Atmosphere; Atmospheric Pollution; *EQ Issue/Event*

**ASSIGNMENT - Turn in SEQ BOOK Chapter 1 questions 1 (Bonus), 4, 8, 12**

9/1 **Atmosphere and Hydrosphere (cont.)**

Lecture (pp. 40-58) Hydrosphere - Properties of Water; Components of the Hydrologic Cycle; Water Use; *EQ Issue/Event*; Legislative Efforts Related to Water Quality Issues; Water Pollution; *EQ Issue/Event*

**ASSIGNMENT - Turn in Article**

**Week 3**

9/6 **Chapter 3 “Our Environment: Soil Ecosystems”**

Lecture (pp. 64-87) The Soil Environment - Soil Physical Attributes; Particle Size, Texture, Structure, Density, Solids, Carbon, Water, Climate; Soil Physical Processes; Gas Transfer, Water Movement, Erosion; Soil Chemical Attributes; Clay Minerals, Organic Matter, Acidity, Salinity, Sodicity, Redox; Soil Chemical Processes; Weathering, Exchange, Sorption

**ASSIGNMENT - Turn in SEQ BOOK Chapter 2 questions 4, 7, 14 (Bonus), 16**

9/8 **Soil Ecosystems (cont.)**

Lecture (pp. 87-102) Soil Biological Attributes; Plants, Animals, Microorganisms; Soil Biological Processes; Factors, Pathogens; Soil Development and Land Use; Soil Quality; *EQ Issue/Event*

**ASSIGNMENT - Turn in Article**

#### Week 4

- 9/13 **Chapter 4 “Environmental Testing: Soils, Waters, Plants, Wastes, Organics”**  
Lecture (pp. 105-127) Agronomic and Environmental Testing Practices for Soils; Environmental Testing Practices for Waters; Plant and Organic By-Product Analysis; Environmental Testing Practices for Air and Atmospheric Deposition  
**ASSIGNMENT - Turn in SEQ Chapter 3 questions 1, 5 (Bonus), 8, 11**
- 9/15 **DISCUSSION SESSION I**  
**ASSIGNMENT - Turn in SEQ BOOK Chapter 4 questions 1, 3, 6, 9 (Bonus)**  
**ASSIGNMENT - Turn in Article**

#### Week 5 **Part II - NUTRIENTS, MANAGEMENT AND ENVIRONMENTAL QUALITY**

- 9/20 **Chapter 5 “Soil Nitrogen and Environmental Quality”**  
Lecture (pp. 133-140) Nitrogen in the Environment - Origin and Distribution; Effects on Human and Animal Health; *EQ Issue/Event*.
- 9/22 **FIRST EXAM (Chapters 1 through 4)**  
**ASSIGNMENT - Turn in Article**

#### Week 6

- 9/27 **Soil Nitrogen and Environmental Quality (cont.)**  
Lecture (pp. 141-180) Eutrophication; Atmospheric Effects; Risk Assessment; Soil Nitrogen Cycle - Mineralization; Nitrification, and Immobilization; Gaseous Losses; Leaching and Erosion Losses; Biological N Fixation; N Additions to Soils.
- 9/29 **Chapter 6 “Soil Phosphorus and Environmental Quality”**  
Lecture (pp. 185-207) Phosphorus and the Environment - Eutrophication; Impacts; The Soil Phosphorus Cycle - Inorganic and Organic Soil Phosphorus; Additions to Soils.  
**ASSIGNMENT - Turn in SEQ BOOK Chapter 5 questions 1, 2, 9, 12 (Bonus)**  
**ASSIGNMENT - Turn in Article**

#### Week 7

- 10/4 **Soil Phosphorus and Environmental Quality (cont.)**  
Lecture (pp. 207-230) Phosphorus Transformation - Mineral Equilibria; Sorption and Desorption; Phosphorus Transport in Soils - Surface and Subsurface (Leaching) Flow; *EQ Issue/Event*
- 10/6 **Chapter 7 “Soil Sulfur and Environmental Quality”**  
Lecture (pp. 236-253) Importance - Nutrition, Impacts; Global Sulfur Cycle - Inorganic, Organic, Fractionation; Sulfur Retention and Transformations - Sorption, Desorption, Redox; Transformations.  
**ASSIGNMENT - Turn in SEQ BOOK Chapter 6 questions 4 (Bonus), 7, 12, 14**  
**ASSIGNMENT - Turn in Article**

## Week 8

### 10/11 **Soil Sulfur and Environmental Quality (cont.)**

Lecture (pp. 253-268) Effects on Plants - Plant Nutrition, Availability Index; Management in Cultivated Cropping Systems, Grazed Systems, Forested Ecosystems; Problem Soils and Surface Waters - Acid Soils and Mine Spoils, Acid Mine Drainage, Sodic Soils, Coal Bed Methane Waters.

### 10/13 **Chapter 8 “Nutrient Management Planning”**

Lecture (pp. 271-321) Nutrient Management Planning - Definition, Basic Components, Other Land Uses; Nutrient Management Practices for N - Principles, Availability, Sources, Application Methods, Conservation, Nonagricultural Settings; Nutrient Management Practices for P - Principles, Testing, Sources, Application Methods, Conservation.

**ASSIGNMENT** - Turn in SEQ BOOK Chapter 7 questions 1, 5, 8, 13 (Bonus)

**ASSIGNMENT** - Turn in Article

## Week 9

### 10/18 **DISCUSSION SESSION II**

**ASSIGNMENT** - Turn in SEQ BOOK Chapter 8 questions 8 (Bonus), 10, 14, 17

### 10/20 **SECOND EXAM (Chapters 5 through 8)**

**ASSIGNMENT** - Turn in Article

## Week 10 **Part III - INORGANIC AND ORGANIC CONTAMINANTS**

### 10/25 **Chapter 9 “Trace Elements”**

Lecture (332-359) Trace Element Categories and Importance; Sources of Trace Elements for the Terrestrial Environment; Adverse Effects. Trace Element Cycles in Soils; Bioavailability of Trace Elements in Soils; Radionuclides; *EQ Issue/Event*

### 10/27 **Chapter 10 “Organic Chemicals in the Environment”**

Lecture (364-394) Organic Chemicals - Sources, Categories; *EQ Issue/Event*; Adverse Effects - Human, Animal and Wildlife, Aquatic Organisms, Groundwaters, Plants, Microorganisms; Predicting Organic Chemical Fate - Uptake, Solubility, Half-life, Hydrolysis, Volatilization, Photolysis, Sorption-Desorption, Abiotic and Biotic.

**ASSIGNMENT** - Turn in SEQ BOOK Chapter 9 questions 2, 4, 8, 11 (Bonus)

**ASSIGNMENT** - Turn in Article

## Week 11

### 11/1 **Organic Chemicals in the Environment (cont.)**

Lecture (pp. 395-409) Response of Organic Chemicals in the Environment; *EQ Issue/Event*; Organic Chemical Analysis - Sample Collection and Preparation, Identification and Quantification; Alternative Pest Management and Plant Breeding Strategies - Integrated Pest Management, Biological Control, Genetically Modified Crops.

11/3 **Chapter 11 – “Union Pacific Tie Plant Presentation”**

**“The Atmosphere: Global Climate Change and Acidic Deposition”**

Lecture (pp. 413-448) The Climate and Global Climate Change - Greenhouse Effect and Evidence of Greenhouse Gases, Carbon Dioxide, Methane, Nitrous Oxide, Uncertainties and Complexities; Acidic deposition - Legislative Acts and Programs, Sources and Distribution; Human Health, Material and Cultural Resources, Ecosystems, Reversing the Effects of Acidic Deposition

**ASSIGNMENT** - Turn in SEQ BOOK Chapter 10 questions 3, 10 (Bonus), 14, 15

**ASSIGNMENT** - Turn in Article

**Week 12**

11/8 **UP Railroad Field Trip (2:45-4:00 pm). TENTATIVE**

11/10 **DISCUSSION SESSION III**

**ASSIGNMENT** - Turn in SEQ BOOK Chapter 11 questions 1, 4 (Bonus), 8, 14

**ASSIGNMENT** - Turn in Article

**Week 13 Part IV - CONTAMINANT ASSESSMENT AND REMEDIATION**

11/15

**Chapter 12 “Remediation of Soil and Groundwater”**

Lecture (pp. 453-471) Inorganic Contaminants - Soil and Water; Organic Contaminants - Soil and Water; *EQ Issue/Event*.

11/17 **Chapter 13 “Risk Assessment”**

Lecture (pp. 475-495) Risk Perception; Carcinogenicity; Risk Assessment - Exposure Assessment, Dose-Response Assessment, Risk Characterization; Ecological Risk Assessment; Uncertainty; *EQ Issue/Event*.

**ASSIGNMENT** - Turn in SEQ BOOK Chapter 12 questions 1, 3, 5, 10 (Bonus)

**ASSIGNMENT** - Turn in Article

**Week 14**

11/22 **THIRD EXAM (Chapters 9 through 11)**

11/24 **THANKSGIVING - NO CLASS**

**Week 15**

11/29 **Student Presentations**

**ASSIGNMENT** - Turn in SEQ BOOK Chapter 13 questions 3, 5, 6 (Bonus), 8

12/1 **Student Presentations.** Wrap-up and discussion of Final Exam.

**ASSIGNMENT** - Turn in Article

**TENTATIVE FINAL EXAM, Thursday (12/8), 10:15 – 12:15**

## ENVIRONMENTAL QUALITY

### TERM PROJECT

The term project will include both:

#### **A GROUP POSTER AND PRESENTATION**

Two or more students will be responsible for developing a poster display and giving a short 10 minute presentation at the end of the semester. Poster themes are to be on one of the current environmental quality topics listed below or a topic related to the students interest that is agreed upon by the group and Dr. Vance.

Current topics for group posters and presentations include the following.

1. Waste Water Treatment
2. Endocrine Disruptors
3. Noxious and Invasive Organisms
4. Global Warming
5. Urbanization
6. Habitat Displacement
7. Water in the West
8. Current Environmental Quality Issue or Event
9. Other topic agreed upon between group and instructor

#### **EACH GROUP MUST SELECT A TOPIC BY SEPTEMBER 29!!!**

Poster displays will be exhibited for one week in the showcase next to AG room 1024. The poster must be displayed by 2:00 p.m. Monday and taken down before 5:00 pm Friday of the same week.

#### **Each display must include:**

- 1) **Your name(s)**
- 2) **Title**
- 3) **Objectives (i.e., what you want to present)**
- 4) **Materials (data, photos, graphs, etc.) use your imagination and be creative**
- 5) **Discussion**
- 6) **Summary**
- 7) **References (minimum of 6 with maximum of 2 from internet sources)**

**Note that all references must be cited in the poster where appropriate. Also material that is not referenced to its original sources will result in points deducted from the group poster score.**

Grading of posters will be based on composite evaluations by three to four classmates, Dr. Peter Stahl and me.

**I HIGHLY ADVISE ALL GROUPS USE THE GRADING SHEET TO EVALUATE HOW WELL YOU'RE POSTERS FOLLOW THE SPECIFIC GRADING QUESTIONS, HOW WELL EACH OF THE QUESTIONS ARE ADDRESSED, AND WHAT YOU BELIEVE WOULD BE YOUR TOTAL SCORE. IF IT IS NOT CLOSE TO 50 POINTS, REEVALUATE YOUR POSTER AND MAKE CHANGES TO INCREASE THE POINT TOTAL.**

Presentations will be given during the last week of the semester. Some of the poster and presentation information may appear on the final examination.

## GRADING OF POSTER TERM PROJECT

The display projects will be evaluated by me as well as three to four students and Dr. Peter Stahl.

REMEMBER - students responsible for the display will each receive the same grade unless one fails to actively participate in the project. **Poster displays will be exhibited for one week in the show case next to room 1024 in the Agricultural building. The display must be in place by 2:00 Monday and taken down during Friday afternoon.**

The evaluation will be based on a rating system from 0 to 5 (0 meaning that item is not addressed in the poster, 1 being poor and 5 being excellent) and the reviews of the different evaluators. The evaluation will include the following:

Title \_\_\_\_\_

Authors \_\_\_\_\_

	<u>Circle one number for each question</u>					
	NA	poor				excellent
<u>Title</u>						
Is the title self explanatory?	0	1	2	3	4	5
Does the title cover the material presented in the poster?	0	1	2	3	4	5
<u>Objectives</u>						
Are the objectives clearly stated?	0	1	2	3	4	5
<u>Materials</u>						
Is the information presented clearly?	0	1	2	3	4	5
How is the quality of the materials?	0	1	2	3	4	5
<u>Discussion</u>						
Was there adequate discussion?	0	1	2	3	4	5
Were both sides of the issue presented?	0	1	2	3	4	5
<u>Summary</u>						
Was the summary informative?	0	1	2	3	4	5
Did the summary include all the main points?	0	1	2	3	4	5
Rate the poster on overall creativity and imagination.	0	1	2	3	4	5

**EVALUATORS COMMENTS:** (what are some of the strengths and/or weaknesses of the poster?)

**Note that the evaluation is not complete without comments!**

EVALUATOR \_\_\_\_\_ DATE \_\_\_\_\_