SOIL/WATR 462/662: Environmental Biogeochemistry
Spring 2018 Syllabus

Course Information

Class Times: Wednesday 2:00 – 3:50pm
Friday 2:00 – 3:50pm
Location: Discussion/Lecture in D216 Science Building, Lab in TNR 260/261
Credits: 3.0

Instructors Information

Dr. Kyle Herrman
Email: Kyle.Herrman@uwsp.edu (preferred method)
Office: 263 Trainer Natural Resources Building
Office Phone: 715-346-4832
Office Hours: By appointment

Dr. Rob Michitsch
Email: rmichits@uwsp.edu (preferred method)
Office: 276 Trainer Natural Resources Building
Office Phone: 715-346-4190
Office Hours: By appointment

Course Objective

The goal of this course is to expose students to the theory, concepts, and methods available to quantify biogeochemical cycles in terrestrial and aquatic ecosystems. Students will use the theory they learn in the beginning of class to conduct an independent research project that will explore some aspect of biogeochemistry. Using common methods in soil/water analysis and advanced analytical chemistry techniques students will plan, develop, and conduct an in-depth research project. At the end of the semester students will give a scientific-style oral presentation that discusses the rationale behind their project and explores the significance of the data collected.

Learning Outcomes

By the end of the semester a student will be able to:

1. Demonstrate how air, soil, and water are unique mediums for biogeochemical cycles
2. Identify biotic and abiotic interactions and potential feedback loops involved in biogeochemical cycles
3. Apply knowledge gained in the class to examine if biogeochemical cycles are impacted by either an anthropogenic or natural forcing factor
4. Apply your understanding of elements that shape successful oral communications such as topic, purpose, genre, and audience to critique your own and others' delivery and provide effective and useful feedback to improve your communication
5. Apply discipline-specific standards of oral communication to compose an articulate, grammatically correct, and organized presentation of your research project with properly documented and supported ideas, evidence, and information suitable for the topic, purpose, and audience
6. Complete a research project that integrates knowledge, skills, and experiences that allows students to determine how the physical, chemical, and biological environment is connected in soil and water resources
7. Demonstrate the skills needed to conduct applied research in soil and water resources that would be required for graduate school or agency positions where adaptive management is being utilized

Textbooks

1. *Biogeochemistry: An Analysis of Global Change, 3rd Ed.* Schlesinger and Bernhardt. Elsevier (text rental).
2. Other readings/sources will be assigned and provided to you. You will be expected to have read the material and be prepared to discuss the material in class.
3. *The Bedford Handbook: 6th Ed*. Hacker. Bedford/ St. Martin's (suggested/text rental).

Attendance

This class is a capstone course and thus attendance is mandatory. Missing lectures at this level is not only detrimental to your learning of material but also impinges on your group ability to complete your project. Therefore, if attendance becomes an issue by students then the midterm exam will be assigned. If, however, students attend all lectures, then we will not have to assign a midterm exam.

Assignments

Exam (potentially optional)

The exam in this class, if necessary, will be a take-home exam. Because it is a take-home exam you may be required to conduct reading comprehension, essay response, graph making, and data analysis. The exam will be based on lecture material we cover during the first half of class. You will be given approximately one week to complete the exam and are not allowed to discuss specific responses to questions with any other students. You are allowed to discuss general approaches to questions with other students, but you and you alone are responsible for the material you turn in. If any of the writing, graphs, figures, or calculations are too similar to another student's exam, then all individuals involved will be brought up on charges of academic misconduct according to Chapter 14 in the University Handbook (http://www.uwsp.edu/admin/stuaffairs/rights/rightsChap14.pdf).

> **Cheating and/or plagiarism** will not be tolerated. You may consult and discuss the assignments with one another, but you must complete the assignments and exams independently. Aside from the lecture material, you must properly reference work that is not your own. Your final exam answers must be uploaded to D2L.

Proposal

In approximately the 5th week of class (***Feb. 21***), groups will present their proposal for the research project. This will consist of a 10 minute PowerPoint presentation in which all members of the group will present. You will need to work with either Dr. Herrman or Dr. Michitsch to figure out the specific details regarding methodology. The more details you can provide the better the feedback you will receive. During the proposal you must use the following format:

- Title – this needs to be a simple representation of your project (i.e., not overly wordy)
- Significance – why the project is important to the average citizen (i.e., human health or ecological effect
- Rationale – why is your study necessary
- Objectives – identify the major goals you will accomplish
- Hypothesis(es) – provide specific statements that clearly indicate what you expect to observe
- Methods – provide the specific methods you will use to achieve your objectives (be sure to provide some details into how the method works)
- Data analysis – what statistical tests will you use to analyze the data
- Expected results – provide a general idea of what you expect the data to look like

Literature Review
During the 7th and 8th weeks of class (***March 7 and 14***), each group will present a 30-minute presentation related to the theory behind their topic. This will ultimately require you to dig into the literature of the topic you have selected. The presentation should follow a typical classroom lecture format and will provide both the fundamentals of the science and provide specific details related to the research that has been published related to their topic. Each group is required to provide a reference section in their presentation and a paper copy of their references. For this assignment, we are requiring a minimum of 10 peer-reviewed articles per group.

Data Analysis and Graph Creation
During the 11th week of class, Dr. Herrman will instruct you about stats and preparing your tables and graphs (Dr. Michitsch will contribute). On Monday of the week before your presentations, each group will turn in the tables and figures they will be presenting during the final presentation. We will focus on the format of data presentation, use of appropriate statistics to analyze the data, and the correct use of units, figure legends, etc. in order to prepare your final presentations.

Final Presentation
In the last week of class each group will give their final presentation. This will consist of a 15 minute PowerPoint presentation with 5 minutes of question and answer. Each member of the group is required to present. During the presentation each group is required to discuss the significance of the project, what their data suggests regarding their hypotheses, and how their data fit with other studies conducted in similar systems. Slides should have limited amounts of text, all figures and tables should have correct units and be easily seen in a large room, and the presentation should have good continuity. A general outline should be:

- Title slide
- Introduction
  - Significance
  - Objective and Hypothesis(es)
- Methods
- Results with statistical analyses
- Discussion/Conclusion
- Acknowledgements

Project Status Reports
What: Each project team will develop a brief (maximum 1 page) summary of activities completed by the Team over the past week and/or status of activities initiated in prior weeks.

When: Due at 12:00 noon each Monday (beginning March 19th) unless instructed otherwise.

How: Each Team's Project Leader will send one email to Drs. Herrman and Michitsch. While the Project Leader will send the email, this does not imply that the Project Leader is solely responsible for creating the Status Report. Status Reports should be developed as a Team effort. Please remember that this is a formal email and should be presented in complete sentences and in paragraph form. If necessary feel free to use Word to create the reports and send them as an attachment.

Graduate Students
One expectation of graduate students in this class will be to write a technical paper on the project they work on during the semester. This will follow a typical scientific paper format (Introduction, Methods, Results, Discussion, and Conclusion) and will be due either during week 15 or 16 of the semester.

Points

Undergraduate Student		Graduate Student	
Assignment	Points	Assignment	Points
Exam (if necessary)	*50*	*Exam (if necessary)*	*50*
Proposal	15	Proposal	15
In class presentation	20	In class presentation	20
Data Analysis, Graphs	15	Data Analysis, Graphs	15
Final Presentation	50	Final Presentation	50
		Technical Paper	50
Total	**100 (or 150 if exam)**	**Total**	**150 (or 200 if exam)**

Grading Scale

A	>92	B	83-86	C	73-76	D	60-66
A-	90-92	B-	80-82	C-	70-72	F	<60
B+	87-89	C+	77-79	D+	67-69		

Tentative Schedule (subject to change as semester progresses)

Week	**Date**	**Topic**	**Assignments**	**Instructor**
1	Jan 24	Syllabus, History, Study Design		Herrman
2	Jan 31	Water		Herrman
3	Feb 7	Atmosphere, Microbial Communities	Topic Due	Michitsch
4	Feb 14	Soils		Prater
5	Feb 21	Proposals		
6	Feb 28	Week off to prepare for presentations		
7	Mar 7	Group Presentations		
8	Mar 14	Group Presentations		
9	Mar 21	Sampling, Sample Prep	Exam Assigned (if needed)	
10	Mar 28	**Spring Break**		
11	Apr 4	Statistics and Data Analysis	Exam Due	Herrman
12	Apr 11	Experiments		
13	Apr 18	Data Analysis, Graphs		
14	Apr 25	Experiments		
15	May 2	Experiments	Graphs due 4-30-18	
16	May 9	Presentations on Friday		
Finals				

Available Analyses (list subject to change)

Soil Pool	**Water Pool**	**Flux/Rate/Biomass Estimate**
Organic Matter	Carbon Constituents	Labile Carbon
Total Nitrogen	Total Nitrogen	Methanogenesis
Total Carbon	Total Phosphorus	Nitrification
Extractable Nutrients	Nutrients	Denitrification
	Various Anions and Cations (Fl, Cl, Br, SO_4, Mg, Ca, K, etc.)	Mineralization
		Microbial Biomass
Soil Chem/Phys Properties	**Water Chem/Phys Properties**	Phosphorus Sorption Capacity
pH	pH	Chlorophyll a
CEC	Alkalinity	Transient Storage/Solute Transport
EC	Redox Potential	
Bulk Density	Specific Conductance	Bacterial and Fungal Analyses
Soil Moisture	Turbidity/TSS	

Laboratory Safety

Safety procedures must be followed at all times to avoid danger to yourself and those you share laboratory with. If you ever have a safety question, **ASK!!!**

General – Basic safety equipment in the laboratory includes: eye wash station, safety showers, gloves, aprons, fire extinguishers, chemical absorbents, etc. You should be aware of the location of all these items

Chemical Spills – In the event of a spill:
1. Alert others in area.
2. Determine chemical type.
3. Put on necessary protective equipment.
4. Contain spill with absorbent.
5. Call **×3456** or **9-911** or **911** if necessary.

> Chemical absorbent is located by the door in room 260.
> Note: not all chemicals can be contained with paper towels, in fact some chemicals are flammable in contact with organic materials such as paper.

Fire – In the event of a fire:
1. Turn off gas, remove flammables.
2. Alert others in area.
3. Determine chemical type.
4. Contain with appropriate material.

Attire – Chemical spills do happen. To avoid damage to your clothes or person we recommend: laboratory coats, old clothes, closed toe shoes, and (when necessary) use of PPE.

Sharps – Needles, etc. are to be disposed of in “Sharps” containers, not the trash.