ENVIRONMENTAL STUDIES 335

**Analysis and Management of the Aquatic Environment**

Prof. Candie C. Wilderman

Fall, 2011

This course will examine major freshwater ecosystems, with a focus on streams and estuaries. Interactions between the physical, chemical, and biological components of the systems will be examined, with a focus on field and laboratory research methods utilized to assess healthy and perturbed systems. Management strategies and techniques to protect and restore aquatic systems will be critically examined.

Laboratories will be mostly devoted to two field-based collaborative research projects on stream water quality, freshwater diatoms, and macroinvertebrate communities. There will be a weekend field trip to Smith Island on the Chesapeake Bay to study estuarine dynamics and the management of Chesapeake Bay socio-ecological systems.

My goals for this course are: (1) to build an understanding and appreciation of the dynamics of aquatic social-ecological systems, (2) to familiarize you with some important research, assessment and data analysis techniques used in the laboratory and in the field to probe aquatic ecosystems, (3) to allow you to utilize these techniques in original group research projects, (4) to help prepare you professionally by encouraging you to develop your listening, studying, note-taking, writing, and oral communication skills through practice, and (5) to have fun, that is, to share with you in the joy of intellectual discovery.

Most of the planned laboratories are weather-dependent, and so the schedule that follows will most likely to adjusted depending on both weather and stream flow conditions. So – please be prepared to go with the flow … both literally and figuratively! Readings will be on selected issues; some will be drawn from peer-reviewed scientific literature and others from studies by government agencies or private advocacy groups, and will range quite a bit in levels of sophistication. The focus in lectures will be to examine the dynamics of aquatic ecosystems and their responses to human-induced perturbations. Whenever possible, case studies will be used.

Attendance at all classes and labs is expected and will be necessary to keep up with the materials. Remember, lab meets from 1:30-5:30 PM. Much of the work will be done during laboratory periods, but some time outside of class will need to be devoted to background research, collection of samples, laboratory analysis of samples, and data analysis.

All materials will be posted and updated throughout the semester on Moodle. It is your responsibility to check Moodle on a regular basis, at least two times per week, to be sure that you are up to date on the requirements for the course.

***REQUIREMENTS***

Reading

The reading this semester will consist of selected chapters from books, papers from scientific journals, and web-based information. All of these materials will be posted on Moodle during the course of the semester. Most of these papers will be reports of scientific studies that were exceptionally important in advancing our knowledge of aquatic ecosystems. Many of these papers will be the “classics” of aquatic ecology; some are very difficult to understand, and although they may be only 10 pages long, they may require several hours to fully comprehend. This is one of our challenges this semester – to read, understand, and critique primary literature in the field – something that you will need to do should you ever engage in research, either at Dickinson, in graduate school, or in your professional careers.

Reading assignments will be posted on Moodle, at least one week before they are due. You will be asked to comment on selected readings on Moodle prior from time to time.

Exams (30% of your grade)

There will be two hour exams (@ 10%) on October 13 and on November 17 covering all reading, class, and field/laboratory work. There will a final exam on Wednesday, December 14 at 2 PM.

Field and Laboratory Research Projects and Reports (30% of your grade [2 papers; several lab exercises])

We will be conducting two (2) collaborative research projects this semester; you will be writing formal scientific reports on these projects. The reports will be in standard scientific format, and will allow you to practice and perfect your scientific writing skills. I have set tentative due dates for the reports, but the actual due date may change due to the fact that the field portions of the studies are so weather-dependent.

(1) Diatoms as environmental indicators: a focus on primary producers in aquatic systems

The question we are asking is: are diatoms good indicators of different environmental conditions in streams? We will spend 3-4 lab periods and some class time collecting, identifying to the genus level, and enumerating diatoms from different environmental regimes in different kinds of streams to assess their efficacy as environmental indicators. This will involve establishing artificial substrates for the colonization of diatoms, measuring physical and chemical parameters in the environments sampled, using light microscopy and scanning electron microscopy for identifying diatoms to the genus level, and using multivariate statistical techniques for analysis of the results. We will compile the data we have collectively amassed, and you will be writing a scientific report on the results. This report is tentatively due on Moodle on October 10, 5 PM.

(2) Macroinvertebrates and the stream continuum: a focus on the critical carbon processers in the stream ecosystem

The question we are asking is do the macroinvertebrate communities found in different stream orders in Cumberland Valley, PA follow the theoretical distribution in the river continuum concept? We will spend 3-4 lab periods and some class time collecting, identifying to the family level, and enumerating macroinvertebrates from different locations along the stream continuum in the Yellow Breeches watershed. We will explore how the communities vary downstream and how that relates to the stream continuum concept. We will also use an advanced (DEP) protocol for evaluating the stream health based on macroinvertebrate communities, building on what most of you have done in the introductory course. This report is tentatively due on Moodle on November 14, 5 PM.

The Chesapeake Bay Field Trip (Sep 30-Oct2)

We will be taking an extended field trip to Smith Island, leaving 6 AM on Friday, September 30 and returning 9 PM on Sunday, October 2. This field trip is a critical core experience of this course, and it promises to be a highlight of your experiences this fall. During this trip we will travel to Smith Island and stay at a Chesapeake Bay Foundation (CBF) facility. The educators at the facility will lead us through a weekend of exploration and discovery, which will include interactions with residents, discussions among ourselves, and exploration of the estuarine system, using CBF boats and equipment. You will keep a journal and field notebook while on the island which will be due on Tuesday, October 4, 10:30 AM (in class) and is worth 10% of your grade.

Estuary or River Profile (15% of your grade)

To expand our knowledge of the extent and importance of the estuarine and river ecosystems in the world, each of you will do library research on an estuary or river of your choice, and make a short powerpoint presentation to the class, profiling that system, in terms of its unique geographic and human context, its history, and environmental issues. You will also submit a one-page written profile to accompany the powerpoint. Examples of estuaries that might be discussed include (but are certainly not limited to): San Francisco Bay, Bay of Fundy, Severn Estuary, St Lucia Estuary System, Barataria-Terrebonne Estuary, MD Coastal Bays, Gulf of Nicoya, Bahia Magdalena, Bay of Bengal, and Mekong Delta. Examples of rivers include (but are certainly not limited to): Ausable, Madison, Colorado, Green, Tennessee, Columbia, Rhine, Thames, Amazon, Yangtze, Yellow, Lena, Niger, Congo (Zaire), Indus, Volga and Nile. You will submit your proposed choice on September 1, 5 PM on Moodle. Presentations will be on Thursdays during the semester and will each be limited to 15 minutes for the presentation and 5 minutes for questions.

Class and Lab Engagement (15% of your grade)

Participation and engagement are crucial prerequisites to learning. Participation involves many styles – taking initiative to complete lab and field tasks, asking questions, making suggestions, facilitating, challenging, and listening. It is the quality of participation that is important, not the quantity. Attendance in class and lab is expected; remember, you cannot participate if you do not attend class!

Since we will be collaboratively learning this semester, it is critical that you take responsibility to carry your share of the work, and that you cooperate with your co-workers by carrying out your commitments, being willing to take a leadership role as well as being a team player, and communicating effectively with your colleagues. Your success in this course will mirror your level of engagement.

**Summary of grading for this course:**

Chesapeake Bay Field Journals and Notebooks 10%

River/Estuary Profile Presentation 15%

Hour exams (2 @ 10%) 20%

Final exam (10%) 10%

Lab research reports and exercises 30%

Engagement and Participation 15%

College Statement on Accommodations for Disabilities

The Department of Environmental Studies is committed to making reasonable academic accommodations for students with disabilities. In compliance with Dickinson College policy and equal access laws, every professor is available to discuss the implementation of academic accommodations for students with documented disabilities.  Students requesting accommodations are required to first register with Disability Services to verify their eligibility for reasonable and appropriate accommodations. Once documentation has been reviewed by Marni Jones, the Director of Learning Skills and Disability Services, she will provide eligible students with signed accommodation letters for their professors. Students are to obtain a new letter every semester and to schedule an accommodations discussion meeting with each relevant professor prior to any accommodations being implemented. To ensure adequate time for any necessary arrangements to be made, accommodation discussion meetings should be scheduled during the first three weeks of the semester (except for unusual circumstances), and one week before any needed testing accommodations. The Office of Disability Services is a part of Academic Advising, located on first floor of Biddle House. Appointments with Marni Jones can be made by calling Jennifer Minnich at 717-245-1080. For more information, go to the Disability Services website at[http://www.dickinson.edu/student-life/resources/disability-services/](https://exmail.dickinson.edu/owa/redir.aspx?C=6b589412013e4094a9c1931c29e34871&URL=http%3a%2f%2fwww.dickinson.edu%2fstudent-life%2fresources%2fdisability-services%2f)  or email [disabilityservices@dickinson.edu](https://exmail.dickinson.edu/owa/redir.aspx?C=6b589412013e4094a9c1931c29e34871&URL=mailto%3adisabilityservices%40dickinson.edu) .

Academic Honesty Policy

Students are expected to uphold the Community Standards and Procedures for Academic Conduct (beginning on page 2 of the pamphlet Dickinson College Community Standards 2010-11, <http://www.dickinson.edu/uploadedFiles/student_life/resources/dean_of_students/content/commstand0910.pdf>). These standards explain what is considered cheating and plagiarism.

Office Hours

My office hours are: Wednesday 9:30-11:30 AM and Thursday 1:00-3:00 PM, and by appointment. My office phone extension (complete with voice mail) is 1573. I do not always read my e-mail over the weekend or if I am out of town. In an emergency, I can be reached on my cell at 717-319-1429.

What follows is a proposed schedule for the semester. The intention of this schedule is to give you a sense of the flow of the semester. Details will change based on student feedback and interest, as well as weather and stream conditions.

| **DATE** | **LECTURE TOPIC** | **LAB TOPIC** | **ASSIGNMENTS DUE** |
| --- | --- | --- | --- |
| Aug 30 | GOALS AND EXPECTATIONS  INTRO TO COURSE  INTRO TO CLASS PARTICIPANTS |  |  |
| Aug 30 |  | MAPS: THE LOCAL CONTEXT |  |
| Sep 1 | I. RESEARCH IN THE ENVIRONMENTAL SCIENCES |  | WEEK 1 READINGS  Proposal for river/estuary profile presentation due on Moodle, Friday, Sep 2, 5 PM |
| Sep 6 |  |  | Map exercise due in class  WEEK 2 READINGS, Part I |
| Sep 6 |  | FIELD RECONNAISSANCE FOR DIATOM RESEARCH PROJECT  DIATOMETER PLACEMENT |  |
| Sep 8 | II. WATER AND THE HYDROLOGIC CYCLE; GROUNDWATER HYDROLOGY |  | WEEK 2 READINGS, Part II |
| Sep 13 |  |  |  |
| Sep 13 |  | WATER POLLUTION discovery exercise  BOTTLE PREPARATION  UNITS practice and exercise |  |
| Sep 15 | III. CONCEPTS IN WATER POLLUTION CHEMISTRY |  | WEEK 3 READINGS |
| Sep 20 | IV. ESTUARINE SYSTEMS AND THE CHESAPEAKE BAY |  | WEEK 4/5 READINGS, Part I.  Units exercise due in class |
| Sep 20 |  | DIATOMETER PICK UP  HABITAT ASSESSMENTS  WATER COLLECTION |  |
| Sep 22 |  |  | WEEK 4/5 READINGS, Part II. |
| Sep 27 |  |  | WEEK 4/5 READINGS, Part III. |
| Sep 27 |  | DIATOM ID (Light microscopy and SEM)  WATER CHEMISTRY ANALYSIS |  |
| Sep 29 |  |  | WEEK 4/5 READINGS, Part IV. |
| Sep 30- Oct 2 | **FIELD TRIP TO SMITH ISLAND, CHESAPEAKE BAY** | **Leave Friday 6 AM**  **Return Sunday, 9 PM** |  |
| Oct 4 | Field Trip Debriefing |  | Chesapeake Bay field notebook and journal due in class |
| Oct 4 |  | DIATOM DATA ANALYSIS  WRITE UP OF REPORT |  |
| Oct 6 | V. MARCELLUS SHALE GAS EXTRACTION  VOLUNTEER MONITORING |  |  |
| Oct 11 |  |  | WEEK 7 READINGS  Diatom research report due Monday, Oct 10, (5 PM on Moodle) |
| Oct 11 |  | MONITORING MARCELLUS: GRASSROOTS TRAINING AND THE PHILOSOPHY OF PUBLIC INVOLVEMENT |  |
| Oct 13 | **HOUR EXAM 1** |  |  |
| Oct 18 | *NO LECTURE – FALL PAUSE* |  |  |
| Oct 18 |  | *NO LAB – FALL PAUSE* |  |
| Oct 20 | VI. ECOLOGY OF STREAMS |  | WEEK 8-9 READINGS |
| Oct 25 |  |  | WEEK 8-9 READINGS |
| Oct 25 |  | MACROINVERTEBRATE COLLECTION  WATER COLLECTION  HABITAT ASSESSMENTS |  |
| Oct 27 |  |  |  |
| Nov 1 |  |  |  |
| Nov 1 |  | MACROINVERTEBRATE ID  WATER CHEMISTRY ANALYSIS |  |
| Nov 3 |  |  | WEEK 10 READINGS |
| Nov 8 | VII. SURFACE WATER HYDROLOGY/HUMAN HYDROLOGIC MODIFICATIONS |  | WEEEK 11 READINGS |
| Nov 8 |  | MACROINVERTEBRATE DATA ANALYSIS WRITE UP OF REPORT |  |
| Nov 10 |  |  |  |
| Nov 15 |  |  | Nov 14: Macroinvertebrate report due (5 PM on Moodle)  WEEK 12 READINGS |
| Nov 15 |  | HYDROLOGIC CONSULTANT LAB or MULLY GRUB/LETORT TOUR LAB |  |
| Nov 17 | **HOUR EXAM 2** |  |  |
| Nov 22 | *NO CLASS (COMP TIME)* |  |  |
| Nov 22 |  | *NO LAB – THANKSGIVING BREAK* |  |
| Nov 24 | *NO CLASS --THANKSGIVING BREAK* |  |  |
| Nov 29 | VIII. AQUATIC ECOSYSTEM  RISKS AND RESTORATION |  | WEEK 13 READINGS |
| Nov 29 |  | MULLY GRUB/LETORT TOUR or HYDROLOGIC CONSULTANT LAB |  |
| Dec 1 |  |  |  |
| Dec 6 |  |  | WEEK 14 READINGS |
| Dec 6 |  | COMPUTER SIMULATIONS OF RESTORATION TECHNIQUES |  |
| Dec 8 |  |  |  |

Below is a summary of intended due dates for major assignments, for your convenience. Remember, things may change as the semester proceeds. Also, there will be some smaller lab exercises due throughout the semester (e.g. map exercise, hydrologic consultant exercise, etc.). Also, remember to add the date of your river/estuary profile presentation.

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| **Due date** | **Assignment** |
| Sep 2 | Proposal for river/estuary profile presentation due (5 PM on Moodle) |
| Sep 30- Oct 2 | Field trip to Smith Island, Chesapeake Bay |
| Oct 4 | Chesapeake Bay field notebook and journal due (in class) |
| Oct 10 | Diatom lab research report due (5 PM on Moodle) |
| Oct 13 | Hour Exam |
| Nov 14 | Macroinvertebrate lab research report due (5 PM on Moodle) |
| Nov 17 | Hour exam |
| Dec 14 | Final exam, 2 PM |

Schedule Escape Clause

The preceding schedule is my best estimate of how the semester might proceed in a meaningful way. However, I wish to maintain maximum flexibility for two reasons: 1) Weather conditions may dictate changes in the labs scheduled, and 2) I would like to allow the interests of students to drive the agenda to a certain extent. That means we may decide to add materials, delete materials, spend more time than allocated on certain issues, spend less time on others, etc. These revisions will be largely a result of student feedback, so please feel a responsibility to let me know when changes need to be made.

You will need to pay close attention to these changes, and, therefore, will not be able to rely entirely on this schedule. The secret is to stay involved by coming to all classes.