

MPA in Environmental Science and Policy

ENV U6110: Ecology & Biodiversity

Summer Semester 2007

Lectures: Fri 9:00am-12pm; Room 407 IAB

Labs: SIPA computer room 510A IAB

Session A: 1-3:30 PM

Session B: 3:30-6 PM;

Instructor:

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Course Outline

Objective

This course will serve as an introduction to the applied science of maintaining the earth's biological diversity, its landscapes, and wilderness. The course will focus on the biological principles relevant to the conservation of biodiversity at the genetic, population, community, and landscape levels. Due to the cross-disciplinary nature of ecology and biological conservation, some of the social, philosophical, and economic dimensions of biological conservation will also be addressed. Our focus will be on applications and problem-solving in both ecology and conservation biology. Basic and advanced ecology and evolutionary processes will be a major focus. The one technique to which we will give particular attention is geographic information systems (GIS). Students will gain a basic, practical understanding of GIS applications using ArcView GIS 9.1.

The specific objectives of the course are:

- To define an interdisciplinary approach to address environmental problems and conservation issues.
- An understanding of the ways in which biology can contribute to the solution of the kinds of conservation and ecological problems now (or soon to be) facing human society.
- To develop skills needed to recognize and analyze the relationships among the scientific, technological, societal and economic issues that shape environmental research and decision-making.

- To prepare environmental management and policy professionals to use research in a data based decision-making process that is firmly grounded in current scientific knowledge and methodology.

Course Structure

Each section of the course includes the examination of key questions and concepts that will be illustrated by lectures, class discussion, required and supplemental readings, and associated websites.

Course lectures intend to present a broad overview of the issues in ecology and conservation biology affecting individuals, populations and the landscape. I encourage individuals in class to contribute to discussions in the lecture period. Students will be expected to do the assigned reading before class (excluding the synthesis notes which will be available online at Courseworks after each lecture) and be prepared to discuss the articles in class.

The class will meet for one lecture period (3 hrs) and one lab (2.5 hrs) per week. Attendance to lecture is highly recommended, but not mandatory. Attendance to lab is required.

Readings and Text:

Students will be expected to do a significant amount of reading for the course and to contribute to discussions on readings. The principal texts for this course are:

- "Principles of Conservation Biology" by Meffe and Carroll, 3rd edition (Sinauer, 2005).
- "Ecosystems and Human Well Being" by Millennium Ecosystem Assessment. 2005.
- "Introduction to ArcGIS" by North Carolina State University GIS Research and Teaching Program and the National Park Service. Available for purchase from SIPA printing office (4th Floor IAB). Also available on Courseworks.

You can purchase textbooks online or in the Columbia bookstore. Scientific articles are available either online (if they are not copyright protected) or on the CourseWorks website, or the citation is listed and you may download them individually. Synthesis notes which summarize all lecture material, and often contain supplemental material, are available after all lectures online at Courseworks. However, it should be noted that the synthesis notes do not contain all information presented during lectures and so should not be relied upon entirely for course content.

Grades:

Homework & Writing Assignments: 17.5%

GIS Exam/Special Assignments: 17.5%

Lab Exercises- 45%

Final Exam- 20%

Homework Assignments (17.5%): Approximately 3-4 homework assignments make up this portion of your grade. These assignments are individual assignments, not group work. You will have one week to complete most of these assignments and they should be turned in during the following week's lecture. Many of these assignments will require you to do research on the web or use current scientific literature. Occasionally, you may be asked to write a summary of one or more articles that are assigned as reading for the course.

GIS Homework/Exams (17.5%): Approximately 3 GIS homework assignments to be completed outside of lab time will be given throughout the semester. These assignments should be completed individually and will be assigned at the end of lab. These assignments will require you to synthesize the skills you have learned in GIS labs into a project you complete on your own. Due dates for each assignment will be announced.

Labs Assignments (45%): Approximately a third of the labs are ecology based lab exercises while the remainders are GIS related computer exercises. The majority of lab activities should be completed during lab time. Attendance to labs is considered mandatory except under extreme circumstances since complementary material in addition to the lab assignments will be presented and included in exams or assignments. Please bring a calculator to all labs.

Final Exam (20%): A cumulative final exam will be given on **Friday August 17th 9-12pm**. The exam will be short answer and true/false, and focus on material covered from homework assignments (non-GIS HW), and from lectures and readings from the textbook "Principles of Conservation Biology" and "Ecosystems and Human Well-Being".

Classroom Policies:

Class Participation: Each week we will discuss the assigned reading articles at the beginning of class. You should come to class every Friday having read the material to be discussed and be prepared to contribute to the discussion of it. Although class participation is not a formal part of your overall grade, participation in class will be used in cases of borderline grades (example: if a student has a 89.2 grade average but is an active discussion participant, I reserve the right to bump up the grade from a B+ to an A-).

Attendance: Attendance of lectures is strongly encouraged since complementary material, in addition to required readings, will be presented in lectures and included in examinations/discussions. Discussion periods will also require in-class participation from all students and so failure to attend lectures may affect your final grade (see above).

Late Policy: Ten percent (10%) of the grade will be deducted per day if the lab reports or papers are submitted past the due date. Materials that are submitted more than one week late will not be accepted.

Plagiarism or Cheating: *I am extremely strict on plagiarism. DO NOT PLAGIARIZE. YOU RECEIVE AN AUTOMATIC "F" IN THE COURSE IF YOU ARE CAUGHT PLAGIARIZING IN ANY WAY.* Columbia has always believed that learning to write effectively and think critically are some of the most important goals a college student can achieve. Your assignments and papers play a major role in course performance, but more important, they play a major role in intellectual development. Every year there are instances in which students attempt to submit the work of other people as their own. Because intellectual integrity is the hallmark of educational institutions, academic dishonesty is one of the most serious offenses that a student can commit at Columbia. It is also punishable by suspension or dismissal from the University.

Logistical Issues:

Labs: We select students to be in Lab Session A and B completely at random. Your assignment to the A or B lab is considered final. Due to the large number of students in the course (and the undesirable nature of Lab B on a Friday afternoon!) we do not allow switching from Lab A to B, or vice versa, except under extreme circumstances. Although we do not take attendance during labs we do consider attendance mandatory. This is because we often change lab assignments or instructions as circumstances arise in lab (ex. a time constraint, a glitch in software, bonus questions). We also provide additional lecture material in labs that you will not be able to receive except by attending the labs. If you must miss a lab, you are responsible for all lab work and this must be submitted at the same time as other students or they will be considered late (see policy above). Labs begin at 1:30 (Lab A) and 3:30 (Lab B). Please do not show up to the computer room at 12pm expecting to begin your lab early.

Courseworks: Assigned reading in the form of pdf's are available under the shared file folder of Class Files under courseworks. If you choose to view the pdf version of the material on courseworks, please be aware that at times, courseworks will give you an error indicating that the file you are trying to open either does not exist, or is corrupt. This often happens during heavy computer usage times and is a known bug in Courseworks. We recommend logging out of Courseworks and trying again at another time. 99% of the time, the file is actually fine and will properly open if you attempt to open it at another time.

Classroom Etiquette:

This program is meant to train you to become professionals in the field of public administration. As such, we present you with both academic and practical training. Much of the practical training focuses on how to effectively communicate, public speaking, writing memo's, how to present yourself, selling ideas, etc. In addition, we aim to give you guidance on professional etiquette that is expected of senior management officials. This means that we expect you will conduct yourself as a professional during class time. Just as you would not come to a professional meeting late, I expect that you will also come to class on time. Professionalism also extends to how you behave in front of your peers or boss. It is for this reason that I ask that you refrain from using electronic devices, including laptops, palm pilots, etc., during class, much as professionals in the real world refrain from routinely using them during professional meetings. I discourage bringing these devices to class. The only exception to this rule is for those who use their laptops to take class notes (however, class notes are generally not extensively needed in this class since I provide lecture notes). It is **very** clear from those attending a meeting, or those attending lecture, when someone is taking notes (i.e. they are typing, not reading the screen) and when one is reading the web or email (scrolling, staring at the screen). Therefore, in the rare instances that your laptop is open during class, I expect you will be typing. If you are not typing, it should be closed, or partially closed. Checking email, surfing the web, or writing papers for other classes during lecture time is distracting to other students and is also discourteous. If you are seen doing this then you will be asked not to bring a laptop to class for the remainder of the semester.

Course Outline

Class 1: June 1 - Introduction – What is Biodiversity and Why is it Important?

Read:

- 1) Chapter 2 & 4 in Conservation Biology (Meffe and Carroll, Sinauer 2005).
- 2) Pages 18-59 in Ecosystems and Human Well-Being-Biodiversity Synthesis (pdf located in Courseworks shared files folder).

Homework: Biodiversity: The Diversity of Life. Due in Lecture 2

Lab: GIS Lab 1

Class 2: June 8–Threats to Biodiversity & Ecosystem Services

Read:

- 1) Chapter 5 in Principles of Conservation Biology text (Meffe and Carroll, Sinauer 1997).
- 2) Pages 60-81 in Ecosystems and Human Well-Being-Biodiversity Synthesis (pdf located in Courseworks Lecture 1 Readings Folder under Shared Files).
- 3) Costanza et al. 1997. The value of the world's ecosystem services and natural capital. Nature 387:253-260.

Lab: GIS Lab 2

Class 3: June 15- Ecosystem Loss and Fragmentation

Read:

- 1) Chapters 9-10 in Principles of Conservation Biology
- 2) Fahrig, L. and Merriam, G. 1993. Conservation of Fragmented Populations. Conservation Biology 8:50-59.
- 3) Pages 64-83 in Ecosystems and Human Well-Being- Synthesis (textbook)

Lab: GIS Lab 3

Class 4: June 22 – Urbanization and Land Use

Read:

- 1) Pages 1-24 in Ecosystems and Human Well-Being- Synthesis (textbook)
- 2) Wackernagel, M. et al. 2006. The Ecological Footprint of cities and regions: comparing resource availability with resource demand. Environment and Urbanization 18: 103-112.
- 3) McManus and Haughton. 2006. Planning with Ecological Footprints: a sympathetic critique of theory and practice. Environment & Urbanization 18:113-127.

Homework: Ecofootprint Exercise: Due in Lecture 5

Lab: GIS Lab 4

Class 5: June 29- Ecosystem Approach to Management

Read:

- 1) Guery, A. 2005. Icarus and Daedalus: conceptual and tactical lessons for marine ecosystem-based management. Frontiers in Ecology and the Environment 3:202-211.
- 2) Grumbine, R. 1994. What is Ecosystem Management? Conservation Biology 8:27-38.

Lab: GIS Lab 5

Class 6: July 6- The Science Behind Environmental Policy Acts (ESA, CBD, Magnusson-Stevens Fisheries Conservation Act, etc.)

Read:

- 1) Prato, T. 2005. Accounting for Uncertainty in Making Species Protection Decisions. Conservation Biology 19:806-814.
- 2) Male, T. & M. Bean. 2005. Measuring progress in the endangered species conservation. Ecology Letters 8: 986-992.
- 3) Loreau et al. 2006. Diversity without Representation. Nature 442:245-246.

Lab: GIS Lab 6

Class 7: July 13- Conservation Genetics

Review Material: This website is a great place to review the basics of genetics and conservation genetics:

<http://gslc.genetics.utah.edu/units/basics/tour/>

<http://www.ncbi.nlm.nih.gov/About/primer/genetics.html>

<http://www.science.org.au/nova/044/044print.htm>

Read:

- 1) Hedrick, P. and Miller, P. 1992. Conservation Genetics: Techniques and Fundamentals 2:30-46
- 2) DeSalle, R., Amato, G. 2004. The expansion of conservation genetics. Nature Review Genetics 5:702-713
- 3) Chapter 6 in Principles of Conservation Biology text.

Lab: GIS Lab 7

Class 8: July 20- Applied Demography

Read:

- 1) Ch 7 in Principles of Conservation Biology.
- 2) TBD

Lab: Ecology Exercise: Meet in Classroom-Parrots and palms: Estimating the vital statistics of populations to determine best management strategies and sustainable harvest levels. Work in groups and turn in exercise at end of lab.

Class 9: July 27- Metapopulations and Small Populations

Read:

- 1) Owen, L. et al. 1997. Three ways of assessing metapopulation structure in the butterfly (*Plebejus argus*). Ecological entomology 22:283-293.
- 2) Berger, J. 1990. Persistence of different sized populations: An empirical assessment of rapid extinctions in bighorn sheep. Conservation Biology 4:91-98.

Lab: Ecology Exercise: Meet in Classroom-PVA exercise.

Class 10: Aug 3- Threat Assessment in Conservation Planning

Read:

- 1) Gardenfors, U. 2001. Classifying threatened species at a national versus global level. Trends in Ecology and Evolution 16: 511-516.
- 2) Pereira, H. and H. Cooper. 2006. Towards the global monitoring of biodiversity change. TREE 21:123-129.

Lab: Ecology Exercise: Meet in classroom- Conservation Planning and Management Exercise for Kabini Biosphere Reserve. Work in groups and hand in exercise following week in lab.

Class 11: Aug 10-Climate Change

Read:

- 1) Parmesan, C. and G. Yohe. 2003. A globally coherent fingerprint of climate change impacts across natural systems. Nature 421: 37-42.
- 2) Schroter D. et al. 2005. Ecosystem Service Supply and Vulnerability to Global Change in Europe. Science 310: 1333-1337
- 3) Thomas, C. et al. 2004. Extinction risk from climate change. Nature 427:145-148.

Homework: Write a 5 page paper on any aspect of climate change and ecology. You must use at least 5 journal articles as reference (no web references at all). Citations should be in the format used in the journal Conservation Biology. Use papers other than those assigned for reading.

Lab: Optional Exam Review- This review will be an opportunity for you to ask questions about any material and have the TAs answer them. No formal review of the material will be given, but rather this will serve as a time to clarify topics of concern for the final exam.

Class 12: Aug 17- Final Exam (9-12pm)