



SUBJECT AND COURSE No.

Environmental Change and the Evolution of Ecosystems

ENVIRON 510K; Spring 2018

Dates / contact hours: 300 contact minutes per week for seven weeks

Academic Credit: 1 course

Course format: lecture and discussion sections; learning modules based on text excerpts, field trip, short individual student project written summaries, highlighting process controls in selected ecosystems currently important in China

Instructor's Information

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Prerequisite(s)

No requirements but a background in the biological, environmental, or earth sciences is recommended; without this background, one must obtain permission of instructor.

Course Description

The processes that control ecosystem production, the carbon cycle, and delivery of ecosystem services as well as the resilience of ecosystems exposed to environmental stress have been molded by millions of years of evolution under Global Change. This perspective of deep time is sometimes lost in the teaching and learning of environmental sciences, when Global Change can be misleadingly construed as something new that has materialized during recent decades. In fact, our developing understanding of earth system processes and current Global Change depends strongly on looking to the past and considering evolution of the climate system, plant and ecosystem processes, biological feedbacks, soils development, and all of these with respect to ecosystem (biosphere) carbon, water, and nutrient cycles.

The proposed course combines information from climate research and geological studies of earth system development with information on the structural and ecophysiological adaptations of organisms that determine characteristics of ecosystems encountered today, i.e., the functioning of the biosphere. This course is intended to provide a new perspective on, and appreciation of, the role and importance of ecological processes and ecosystem science as basic information needed for the understanding of

environmental and resource management. While the material is broad, and the interrelationships discussed are complex, the course focuses on the important principles rather than on details. As such, the content is appropriate for study at undergraduate or Master's level.

Course Goals and Objectives

The objectives of this course are to develop students' abilities to:

- Understand interactions among atmospheric, biological, and soils processes that determine the health and productivity of ecosystems
- Understand ecosystem responses that determine carbon, water, and nutrient balances at different scales (vegetation stand, landscape, regional to continental, and global scales)
- View atmosphere-biosphere-geosphere (A-B-G) processes in the context of long-term global change and evolution of the earth system, thereby gaining insight into the history and evolution of the biosphere
- Understand the importance of carbon bonds as a universal currency with respect to energy supporting life on earth, but also as the critical link between A-B-G
- Obtain a working knowledge at ecosystem stand level of the factors controlling water and carbon balances and, thereby, understand current carbon balance research carried out in global network projects

Students must understand basic concepts from lectures and assigned text readings; must carry out an individual project analyzing function within a currently important Chinese ecosystem; and must discuss material from their project clearly in a short oral free format presentation.

Required Text Resources

Reading assignments and discussion materials will be selected from the following books and related documents:

Ruddiman, W. 2013. *Earth's Climate: Past and Future*, 2013, Third Edition. New York, New York: W.H. Freeman & Co Ltd, pp. 465.

Willis, K.J., & J.C. McElwain 2014. *The Evolution of Plants*, Second Edition. Oxford: Oxford University Press, pp. 398.

All selected readings are compiled in a course "Reader" provided to the students in pdf form.

Needed Materials

Laptops with Word and Adobe Reader are needed for internet access and preparation of the semester projects.

Course Requirements

1. On time attendance at all lectures, discussions and course field trip.
2. Active participation in discussions that review weekly material and prepare students for quizzes. Quizzes will focus on short answers or definitions that demonstrate knowledge of concepts and terminology discussed in lectures.
3. Oral presentation of the individual student semester project on function within a currently important Chinese ecosystem

Detailed rubrics for the individual projects explaining the expectations and technical considerations will be provided to students in agreement with the time schedule. Explanation of the assigned readings and quiz procedures will be provided in weekly sessions.

Technology Considerations

Lecture slides and additional pdf materials will be distributed to students via Sakai.

Assessment Information and Grading

Grading will be based on a 100 point scale, where points are accumulated based on performance with respect to the following items:

Participation in Class Discussions	20%
Quizzes on Evolution of Ecosystems (3 Quizzes each 20%)	60%
Written summary and presentation of project on selected Chinese ecosystem	20%

Diversity and Intercultural Learning

From the global perspective, the course examines development and functioning of ecosystems in diverse environmental settings and can be of interest to persons from all backgrounds. Guidance on group work and class participation will be provided for students not accustomed to open discussion style of pedagogy.

Course Policies and Guidelines

Attendance is required at all sessions. Failure to attend must be justified with documentation.

Use of laptops for note taking and following the materials provided is encouraged. Surfing and use of cell phones during sessions is prohibited.

Duke University holds its students to the highest standards of academic integrity and honesty. Academic dishonesty of any kind is not tolerated and might result in failure of the assignment, and/or course, and/or

expulsion from the university. Plagiarism on written assignments will result in a zero for the assignment and might result in further disciplinary action through the university. As a Duke student you pledge to uphold the Duke Community Standard:

- I will not lie, cheat, or steal in my academic endeavors;
- I will conduct myself honorably in all my endeavors; and
- I will act if the Standard is compromised.

For more information on academic integrity and the Duke Community Standard see:
http://judicial.studentaffairs.duke.edu/resources/community_standard/cs_more.html

Course Outline and Time Schedule

Course readings are compiled as a separate “Reader” document and provided to students, based on the two books listed under Required Text Resources. For additional reading, copies of the books will be on reserve in the library. The readings support the material covered in lectures.

Week 1: Earth History, Global Processes, the Origin of Life

Week 2: Invasion of the Land

Week 3: Formation of Tropical Forests

Week 4: Gymnosperm Evolution, Dry Climate Ecosystem Adaptations

Week 5: Expansion of the Angiosperms, Evolution of Current Floristic Kingdoms, Mountain Floras, and Grazing Ecosystems

Week 6: Pleistocene Glaciations and the Holocene

Week 7: The Anthropocene