Interdisciplinary Honors Seminar: Global Environmental Change

Due to anthropogenic forcings, the acceleration of global environmental change has been increasing at a pace unknown to natural history. The goal of the course is to offer a science-based, interdisciplinary approach that provides students, regardless of their scientific or mathematical skills, the capability to develop an understanding of the changing global environment and the human relationship to the environment. Through lecture/discussions with experts (natural and social scientists and engineers and practitioners) and with an exploration and analysis of data, students will gain knowledge beyond the popular media of what the current environmental issues are and how personal choices can make impacts.

Environmental sciences and studies by their very nature are interdisciplinary. They involve the intersection of an array of natural and social sciences to understand how the Earth's systems function. This course uses a systems analysis approach to make connections among seemingly disparate academic disciplines (e.g., geology, climatology, ecology, political science, public policy). The interfaces of numerous traditional disciplines are being created to form exciting new disciplines (e.g., ecological economics, environmental psychology) that permit a fuller understanding of the complexities of environmental sciences.

In this class, we will explore the physical aspects of change from the early development of the planet to living organisms to current events, as related to physical, chemical, and biological cycles that contribute to global change. In concert, we will examine the human impacts, through the effects of economic and social systems on the dynamics of a changing planet. Change has always characterized Earth since its formation 4.5 billion years ago, but today's environmental changes are occurring at unprecedented rates which are creating a unique and potentially catastrophic challenge to humanity. Students will learn how seemingly small changes can have major impacts, such as the increase in large storms through only slight warming of the ocean-atmosphere interface, large coastal changes through only minor sea-level rise, the role of young people dominating non-western nations through new demographic trends, and water shortages from growing regional demands and hydrologic shifts. These and other topics will be investigated by taking a critical, hands-on approach to learning which is enabled with computer simulations using modeling software and spatial database visualizations and analyses using geographic information system (GIS) software.

Tentative Syllabus
Interdisciplinary Honors Seminar: Global Environmental Change (ISC 3XXX)

Class meetings: will be on Tuesday and Thursdays in the Collaborative Classroom. Tuesdays will largely consist of a lecture/discussion format. Thursdays will involve computer laboratory exercises using systems modeling and GIS software.

Weekly Topics of Study

Weeks 1-2 - Introduction to Concepts and Activities
Subtopic a. Introduction to Systems Dynamic Modeling with STELLA
Subtopic b. Introduction to Spatial Data Analysis with ArcGIS
Subtopic c. Introduction to Critical Reading & Discourse – The Challenges We Face

Group Assignment 1 due

Week 3 - Planet Earth: Origin and Evolution
Subtopic a. Modeling the Impact of Disasters
Subtopic b. Distribution and Economic Impact of Natural Disasters
Subtopic c. Averting Disasters

Potential Guest Lecture – Hurricane's, Tidal Surges – Scott Hagen (Civil & Environmental Engineering)

Week 4 - Life: From Building Blocks to Biomes
Subtopic a. Natural Selection and Mutation - The Case of the Peppered Moth
Subtopic b. Earth's Changing Biomes
Subtopic c. Ecological Footprint

Potential Guest Lecture – Evolution – Chris Parkinson (Biology)

Individual Assignment 1 due

Week 5 - Biodiversity: From Production to Conservation
Subtopic a. Biological Productivity and Trophic Systems
Subtopic b. Biodiversity and Protected Areas
Subtopic c. Threats to Biodiversity

Potential Guest Lecture – Conservation Biology – Reed Noss (Biology)

Individual or Group Project Proposal due

Week 6 - Human Evolution: Adaptation and Environmental Justice
Subtopic a. Population Dynamics: Predator-Prey Interactions
Subtopic b. Global Water Resources
Subtopic c. Environmental Justice

Potential Guest Lecture – Red Wolf Predator/Prey modeling – Jim Roth (Biology)

Group Assignment 2 due

Week 7 - Human Population: Trends, Appropriations and Health
Subtopic a. Population Dynamics
Subtopic b. Population Demographics: HIV/AIDS
Subtopic c. Population Growth and Global Society

Potential Guest Lecture – Population Explosion – Ronnie Hawkins (Philosophy)

Week 8 - Energy: Resources and Consumption

Subtopic a. Earth's Energy Balance Model
Subtopic b. Global Energy Resources - Population and Consumption
Subtopic c. Making Other Energy Choices

Potential Guest Lecture – Carbon Neutrality at UCF – David Norvell (UCF Center for Energy & Sustainability)

Individual Assignment 2 due

Week 9 - Climate: Atmosphere and Ocean

Subtopic a. Analysis of Vostok Ice Core Data
Subtopic b. Investigating Atmospheric Emissions
Subtopic c. Climate Change

Potential Guest Lecture – Global Carbon Project – Penelope Canan (Sociology)

Week 10 - Development and Urbanization: Pollution and Poverty

Subtopic a. Urbanization and Pollution
Subtopic b. Population Growth and Urbanization
Subtopic c. Urbanization and Inequality

Potential Guest Lecture – My Region.org – Linda Chapin (UCF Metropolitan Center)

Group Assignment 3 due

Week 11 - Global Biogeochemistry: Transformations and Cycles

Subtopic a. Creation of a Global Hydrologic Cycle
Subtopic b. Alteration of the Global Carbon Cycle
Subtopic c. Tropical Rainforest Ecosystem and Biogeochemistry

Weeks 12 & 13 Sustainability: Globalization, Equality and Security

Subtopic a. Linking Population, Gender, and Biodiversity
Subtopic b. Inequality and Civil Liberties
Subtopic c. Sustainability

Potential Guest Lecture – Sustainability – Peter Jacques (Political Science)

Individual Assignment 3 due

Weeks 14 & 15 Individual and Group Project Development

Finals Week Individual and Group Project Presentations

Individual/Group Project Write-up due

There will be two primary sources of readings. One will be the textbook *Inquiries in Global Change* by van der Pluijm and Sefcik (which is presently being developed at W.W. Norton & Company). The other will be the most current *State of the Planet* by the WorldWatch Institute. Additional readings will come from current science and mainstream media outlets. Expectations are that students come to class prepared to discuss the reading material.

Basis for Student Evaluation

There will be six computer lab assignments based on STELLA and ArcGIS activities related to specific topics. Three of these will be individual efforts; three of these will be small group activities. These will consist of brief write-ups (~3 pages each) and extensions of computer laboratory exercises.

There will also be an individual or small group projects where students use STELLA to model and environmental system and/or ArcGIS to explore spatial aspects of global environmental change. These projects are designed for students to take a scientific approach to address an environmental question. Individuals and groups will be responsible to develop a research topic over the course of the semester and take a systems approach to analyze it and/or collect spatial data and perform an innovative analysis to explore the factors influencing environmental change. Each group will provide a short presentation of their research to the class during finals week and a paper will be produced to summarize this effort. The final two weeks of the class will be largely dedicated to the development of this project.

Lastly, associated with readings there will be class discussions. Students will be scored weekly based on their contributions to the discussions of the topics.

Distribution of Assessment Points

Unit Assignments	6 x 10	=	60
Individual/Group Project	1 x 30	=	30
Class Participation	1 x 10	=	10

			100

Grades will be based on the standard: A = 90-100; B = 80-89, C = 70-79, etc. Pluses and minuses will be used to represent upper and lower parts of the grade ranges.

Course Innovations

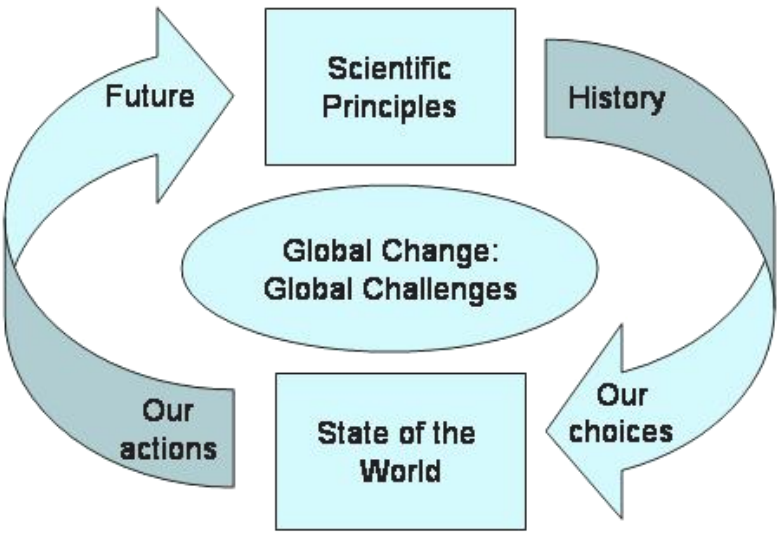
Units for this course will be introduced using an inquiry-based approach. Students will explore fundamentals by answering a series of key questions followed by personal examinations with a variety of hands-on activities. The activities in each unit include systems modeling using the ISEE program STELLA (www.iseesystems.com), spatial data analysis using the ESRI GIS program ArcGIS (www.esri.com) and critical reading using essays in the *State of the World* by the WorldWatch Institute. These computer programs have wide applications beyond the environmental sciences.

The systems analysis program STELLA is an easy-to-use software package that permits students, educators, and researchers to ask and answer "what if" questions for a broad variety of topics. It is a visual tool that enables active learning through simulation and has been used to study social and natural sciences from K-12 through advanced research communities. It enables the ready exploration of theory to application in real world situations.

Geographic information systems (GIS) permit users to visualize, explore, and analyze spatial data, revealing underlying patterns, relationships, and trends. Students will explore the state of the world using datasets, which includes information on the social and political climate that a population experiences, as well as the environmental and geologic factors that shape their region. Students will examine patterns such as the level of civil liberties countries possess, to rates of urbanization, to the distribution of geologic hazards such as volcanoes and earthquakes.

I have taught two graduate courses (Models in Ecology and Landscape Ecology) that use these software programs. Thus, they are both available on campus computer labs. We will use the collaborative classroom in Classroom Building I. This computer lab is organized around small tables to maximize student interaction. Through modeling, students try to understand the connections of a system to simulate past dynamics and predict future scenarios. Using spatial data, students explore global patterns of the past and present in an attempt to find meaningful correlations and connections.

The goal of the course is that students understand how their choices and their ability to influence the choices of others have broad ramifications.



Statement regarding Information Fluency

The media floods us with environmental doomsday scenarios. This course provides a means to critically analyze the premises on which some of these futures are based. Students will develop skills to synthesize information, develop relationships, organize and interpret geospatial data. Because this course is coupled with a computer lab, students will be manipulating data to learn new connections. The students will receive an introduction to digital, georeferenced data. They will learn to use it gain new insights into how the changing environment functions.

Global Environmental Change – Course Summary

This course deals with issues relating to the physical, chemical and biological cycles contributing to Global Environmental Change. Students will study the recent, explosive growth of the human population and its institutions and their consequences on land, air, water, and biological resources. Students apply learned knowledge in discussions coupled with hands-on systems modeling and Geographic Information Systems (GIS) software to investigate the dynamics and spatial impacts of human-influenced natural systems.