The University of Michigan's Global Change Curriculum, part of the Program in the Environment, offers an innovative approach in undergraduate science and social science education. In interdisciplinary, team-taught courses the topic of Global Change from physical and human perspectives are examined, and case studies are used to explore scenarios for sustainability. Complementary small-group sessions are used to promote students' critical thinking and analysis.

The courses are aimed at first and second year students who want to understand the historical and modern aspects of Global Change. These 4-credit courses include hands-on sections and carry NS or SS distribution credit. A Minor in Global Change can be completed in the first few years of study, with the three Global Change Courses at its core. Students learn further through the completion of 2 elective, campus-wide courses in bio-, geo- or sociosphere.

Read the UM Global Change leaflet
Meet our faculty and staff
Email us at globalchange@umich.edu

"A Technology-enhanced, Interdisciplinary Learning Environment"
View the NSF Case Study report on Global Change I

"Global Change Sequence: A different type of course"
Read the University Record Feature article by R. Doyle, 6 Nov. 2000

www.globalchange.umich.edu
CURRICULUM and ACADEMIC MINOR in GLOBAL CHANGE

Objectives
"To become better equipped to contribute to the important debates concerning global environmental change, resource management and societal adaptation strategies."

Current Faculty
- Vince Abreu, AOS
- David Allan, SNRE
- Eric Dey, Education
- Dick Ford, Anthropology
- Tom Gladwin, Business
- George Kling, EEB
- Maria Carmen Lemos, SNRE
- Perry Samson, AOS
- Ben van der Pluijm, Geology

Support Staff
Rachel Police, Ast. Coordinator
Peter Knoop, School of Information, IT development
and a team of Graduate Student Instructors

Funding (Current and Recent)
- University of Michigan, Office of the Provost
- The William and Flora Hewlett Foundation
- NASA's ESSE program
- National Science Foundation
- Michigan Space Grant Consortium

Program Characteristics and GCminor
- Three core courses and two electives (17+ credits)
- "Front loaded": core courses completed in the first two years of undergraduate study
- Web-supported lecture materials and activities
- Labs combine computer modeling, spatial analysis and discussion
- Web-based, group research projects
- UM CourseTools Development site

GLOBAL CHANGE 1
Physical Processes
- Evolution of the universe
- Early earth
- Evolution of atmosphere
- Natural hazards
- Evolution, tree of life
- Natural selection, speculation
- Ecosystems
- Cells and energy transformations
- Biogeochemical cycles
- Atmosphere-biosphere interactions
- Systems dynamics modeling (Stella)

GLOBAL CHANGE 2
Human Impacts
- Detecting global change
- Population growth
- Water resources
- Land resources
- Earth's biota
- Energy
- Sustainable development
- Environmental justice
- Economic indicators
- GIS spatial analysis (ArcGIS)

GLOBAL CHANGE 3
- Sustainability
- Case study modules
- Population growth
- Natural resource management
- Environmental law
- Economic incentives and regulation
- Ethics and remediation
- Human health

ELECTIVE COURSES

One course from two of three categories:

Biosphere
Ecology, Evolution, Ethnobotany, Limnology, Conservation, Resource management

Geosphere
Atmospheric chemistry, Biogeochemical cycles, Geography, Oceanography, Climatology, Geochemistry, Hydrology, Surficial processes

Sociosphere
Urban planning, Population, Sustainable environments, Globalization, Society and environment, Environmental justice

http://globalchange.umich.edu
globalchange@umich.edu
Objective

“To become better equipped to contribute to the important debates concerning global environmental change, resource management and societal adaptation strategies.”

Current Faculty

Vince Abreu, David Allan, Eric Dey, Dick Ford, Tom Gladwin, George Kling, Maria Carmen Lemos, Perry Samson, Ben van der Pluijm

Academic Programs

Anthropology, Atmospheric Science, Biology, Business, Ecology, Education, Geology

Support Staff

Rachel Police, Peter Knoop; team of GSIs

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The Global Change Curriculum
Objectives

- Improve understanding of natural and social science underpinnings of Global Change
- Study evolution of natural world and appreciate temporal and spatial scales of change
- Understand how human actions are contributing to global environmental change
- Become better equipped to contribute to debate on global environmental change and societal adaptation strategies; to become an informed citizen and decision maker
- Learn how to develop dynamical models of Earth processes, use spatial data analysis, utilize the internet to gather information
- Develop capacity to integrate information and technology to explore for solutions to interdisciplinary problems

Note: GC interdisciplinary model used in new Program in the Environment major at UMich (starting Fall02), which is new home of the GC Curriculum
Global Change 1
- Evolution of the Universe
- Early Earth
- Evolution of the atmosphere
- Natural hazards
- Evolution and tree of life
- Natural selection and speciation
- Cells and energy transformations
- Ecosystems
- Biogeochemical cycles
- Atmosphere-Biosphere interactions
- System Dynamics Modeling (Stella)
- Enrollment: up to 160 (classroom)

Global Change 2
- Population growth
- Detecting global change
- Human impact on resources
- Water and land resources
- Earth’s biota
- Global Energy
- Governance
- Sustainable development
- Common future
- Spatial data analysis (ArcGIS)
- Enrollment: up to 120 (classroom)

Global Change 3: Studies
- Integrated regional studies
- data analysis and modeling
- Enrollment: up to 25 (seminar setting)
The Interdisciplinary Global Change Minor

Philosophy and Goals

- highly interdisciplinary, seamlessly crossing disciplinary boundaries
- provide a broad understanding of complex issues involved in global change and global sustainability (Earth as a system)
- enable students to use quantitative tools in approaching global change issues, including Stella (dynamic modeling), ArcView (spatial analysis) and Excel (data)
- offer a “front-loaded” minor, to engage students in their first years of study
- Offer an alternative approach to classical Liberal Arts education by offering early interdisciplinarity: “Interdisciplinarity before disciplinarity”
**IT in the Curriculum**

Real-time, in-class polling

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On election day, to what degree will a candidate’s environmental stand influence your vote?

A. I’m definitely most influenced by this issue.
B. The issue is important and will determine some of my votes.
C. The issue is important but will not influence my vote.
D. I don’t consider it an issue.
E. I’m from Florida, I’ll let the courts decide.

Total: 123

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<th>A</th>
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<th>C</th>
<th>D</th>
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<tr>
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<td>79</td>
<td>31</td>
<td>4</td>
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Slide: 2
Students investigate physical nature of changes from Big Bang to events of today, dealing with issues relating to natural physical, chemical, and biological cycles contributing to Global Change.

Students apply learned knowledge by using graphically based, dynamic modeling software program (STELLA) and Excel data analysis in computer laboratory setting, to investigate dynamics and effects on natural systems in global change issues such as Earth energy balance, paleoclimate, ozone, and greenhouse warming.
Global Deforestation

In this lecture period, we wish to learn:

- What do we mean by "deforestation"?
- How have the old-growth forests been affected by humans?
- What are the consequences of loss of forest habitats and ecosystems?
- What management strategies are in place to preserve, manage and restore forests?

1. Introduction

It is impossible to overstate the importance of humankind's clearing of the forests. The transformation of forested lands by human actions represents one of the great forces in global environmental change and one of the great drivers of biodiversity loss. The impact of people has been and continues to be profound. Forests are cleared, degraded and fragmented by timber harvest, conversion to agriculture, road-building, human-caused fire, and in myriad other ways. The effort to use and subdue the forest has been a constant theme in the transformation of the earth, in many societies, in many lands, and at most times. Deforestation has important implications for life on this planet.

Suggested Readings and Links

- 'Tropical Forests and Grasslands' World Resources Institute
- Extent of tropical deforestation
- Tropical Forests in Decline (Canadian International Development Agency)
- GCI Lecture: The Tropical Rain Forest

M-Lessons Self Tests

Click here to take a short self test on this lecture's materials.
GC1 - Laboratories

The Global Carbon Cycle

LAB EXERCISE 11

02/13/02

Background Material for this Lab: 11/19 Carbon Cycle Lecture

Introduction

Precise records of past and present atmospheric CO₂ concentrations are critical to studies attempting to model and understand the global carbon cycle and possible CO₂ -induced climate change. Researchers have attempted to determine past levels of atmospheric CO₂ concentrations by a variety of techniques, including direct measurements of trapped air in polar ice cores, and indirect determinations from carbon isotopes in tree rings, analysis of spectroscopic data, and measurements of carbon and oxygen isotopic changes in deep-ocean sediments. The modern period of precise atmospheric CO₂ measurements began during the International Geophysical Year (1957) with Keeling's (Scripps Institution of Oceanography) pioneering determinations at Mauna Loa, Hawaii, and at the South Pole. The Mauna Loa record remains the single most valuable CO₂ time series.

In this lab exercise we will do the following:

1. Import the Mauna Loa CO₂ data and graph them against time using Microsoft Excel.
2. Build a STELLA model of the global carbon cycle in order to understand natural and anthropogenic processes in this cycle.
3. Develop future carbon cycle scenarios and analyze them to determine possible effects on global climate change.

Part 1: Graphing Mauna Loa Data using Excel

- Log into the Global Change Course Tools page.
- Download the carbon dataset from "selected course resources" on the main page. Open this data in the full Excel program (not the browser plugin) by saving the data to your H:\ drive first and then opening the file in Excel as delimited and tab separated data.
Global Change 2: Human Impacts

- Students study the effect of economic and social systems on natural physical, chemical, and biological dynamics of our planet.
- Students use hands-on simulations using ArcGIS Geographic Information System to investigate spatial impacts. What natural processes are of importance? What are key forcing functions? What are human impacts? What national and international initiatives mitigate effects of global change? Solutions?
- The course places activities and discoveries of student's discipline in context of human experience and role of humans in managing Earth. For non-science concentrators, this course places role and activities of science in context of what we know about world around us and how we can develop plans for managing our world.

www.globalchange.umich.edu/globalchange2
Global Change 2 Labs
Lab 6: Global Water Resources

This exercise will provide a spatial examination of global water resources, withdrawals and predicted future water needs, using ArcView GIS. You may need to refer your Guide to Basic ArcView Features.


Answer questions 1-7 in CourseTools and submit it to your GSI by the next lab session (seven points). Submit your final map layout by saving it to your GC2 Web Workspace (three points).

- Map your I drive at the atlas account a \atlases.ccs.umd.edu\class-data and start ArcView GIS for Windows NT.
- Before you begin, save your project to your GC2 directory on the mapped Atlas drive (\GC2\<username>\saved_work\). Save intermittently as you are working.

1. Create a new view and name it Global Water Resources (change the name field in View Properties). Then add the theme entitled wtrland.shp from the Load the legend found in I:\<username>\lab_data\lab6 directory. This specially prepared theme includes the standard water.shp (water resources) and (landuse) in one theme. The water resources theme contains data on freshwater resources and withdrawals for each country, which is of primary interest for this lab exercise. Detailed explanations of these data may be found in the Summary of Available WRI Data on the winter labs web page.

2. Create a graduated color legend, using Wresource (total km^3 of annual internal renewable
Course Management (C-tools)

Global Change

- Recent Announcements
  - "Sudden jump" in greenhouse gases
  - CNN report: "The Guardian and the Independent newspapers said on Monday the finding was the first t...
  - (Jerry Ramsey - Oct 11, 2004 6:41 pm)

- Evaluation Posted
  - The second GC evaluation has been posted and opens Wednesday, October 6th at 1 pm. Please complete...
  - (Rachel Palazzo - Oct 6, 2004 11:33 am)

- Undergraduate Research Opportunities
  - Consider a research project in Global Change that is specifically tailored for undergraduates: Conta...
  - (Ben Van Der Plujm - Oct 1, 2004 8:53 am)

- SFAM Messages
  - Sorry, but I am not sending the spam messages you may be receiving with my name in the "From" box (s...
  - (Ben Van Der Plujm - Sep 29, 2004 9:54 am)

- Assignments: New Open Date for Virtual earthquake
  - New open date for assignment Virtual earthquake is Oct 1, 2004 1:00 pm.
  - (Ben Van Der Plujm - Sep 29, 2004 1:26 pm)

- Recent Main Chat Room Messages
  - Where are the exam dates posted?
    - (Heather Pejo - Oct 7, 2004 2:22 pm)
  - will someone please be my friend?
    - (John Budai - Oct 6, 2004 11:33 am)
  - nevermind, oct 20th
    - (Alexander Siren - Oct 4, 2004 10:34 pm)
  - when is our midterm?
    - (Alexander Siren - Oct 4, 2004 10:33 pm)
GCevaluation
In-term Evaluation of Lectures and Labs
Global Change I
Final Course Survey
December 2001

As you know, the Global Change instructors have been engaged in a continuing effort to enhance the effectiveness of this course. As part of this effort, the instructional staff is interested in learning more about your overall reactions to the course and its many components.

This survey should only take a few minutes to complete. We would appreciate your honest answers to the questions, and you should feel free to skip any question that you feel uncomfortable answering. Your individual responses will be kept in the strictest professional confidence by the evaluation coordinator (Prof. Eric Dey of the UM School of Education), and your name and e-mail address will be removed from your responses before the results are shared with the course instructors.

Questions or concerns? Please feel free to contact:

Eric Dey -- dev@umich.edu
Associate Professor
Center for the Study of Higher and Postsecondary Education

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Lab information

Who is the GS of your lab section?  please choose

What is your lab section number?  please choose

General Reactions to Global Change I

1. Overall, this was an excellent course.
2. Overall, Even van der Pluij was an excellent teacher.
3. Overall, David Allen was an excellent teacher.
4. Overall, Jim Toet was an excellent teacher.