Global Change 1: Physical Processes

Environ 110, Biol 110, Geosci 171, AOSS 171, ENSCEN 171

www.globalchange.umich.edu/globalchange1

Global Change 1: Introductions

Professors

David Allan
School of Natural Resources and Environment; *dallan@umich.edu*

George Kling
Department of Ecology and Evolutionary Biology; Course Coordinator.
gwk@umich.edu

Ben van der Pluijm
Department of Geological Sciences, Program in the Environment.
Program Director for Academic Minor in Global Change; *vdpluijm@umich.edu*

Chris Poulsen
Department of Geological Sciences, *poulsen@umich.edu*

GSI team

Sarah Barbrow, Biology	sbarbrow@umich.edu
Dan Horton, Geology	danethan@umich.edu
Mose Jones-Yellin, SNRE	mosejy@umich.edu
Menan Jangu, Anthro/SNRE	mjangu@umich.edu

Support

Haley Cureton; globalchange@umich.edu

Email: globalchange@umich.edu

Interdisciplinary, Team-taught Natural and Social Science Curriculum

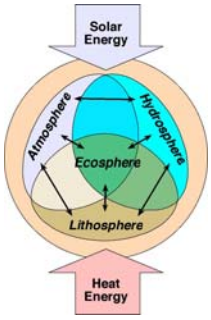
"To become better equipped to contribute to the important debates concerning global environmental change, resource management and societal adaptation strategies."

Science and understanding changes, we have to keep up!

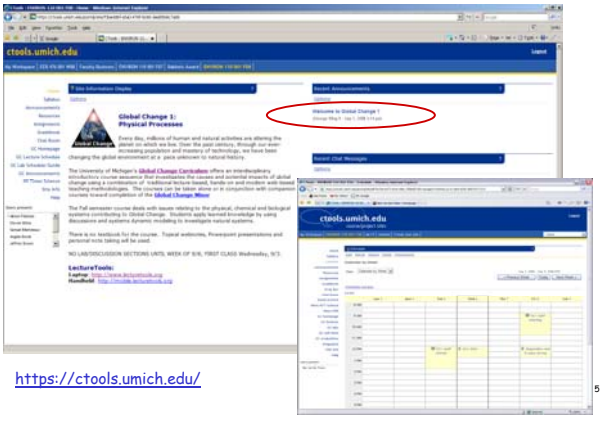
GC1 - Course Objectives

Understand Earth as an "integrated system":

- Change and evolution (stars, solar systems, atmosphere, soils and life evolve from precursors)
- Underlying physical and natural processes, how they work and how they are integrated
- Variability and uncertainty (climate has always varied, prediction is difficult in complex systems)
- Human alteration of Earth's physical and biological systems (rates are key)

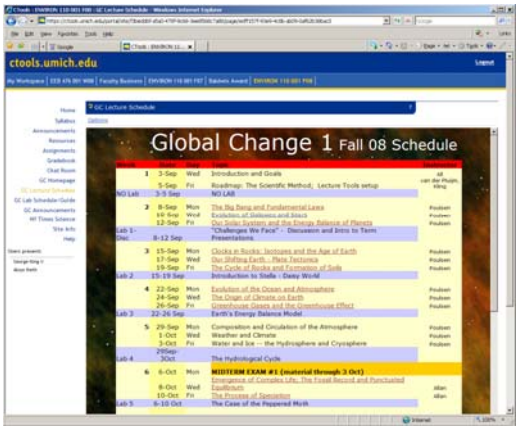


Course Management: U-M's Ctools

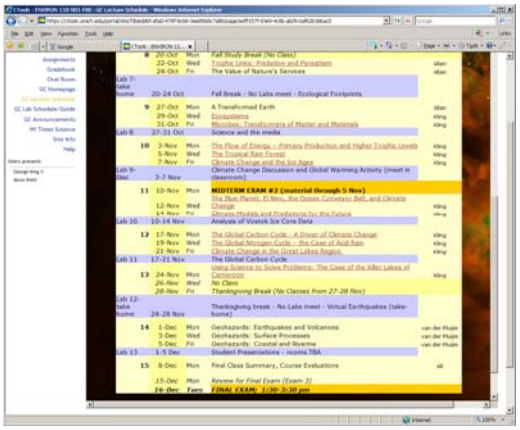


https://ctools.umich.edu/

Lectures



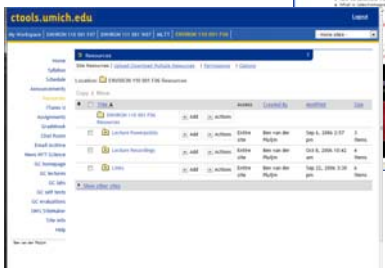
Lectures, cont.



Lecture Notes and PowerPoint files

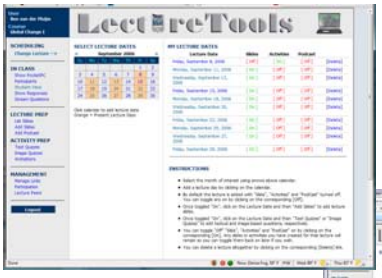
1. Your own class notes. Be here, so you learn more and won't be surprised.

2. Supporting notes on-line (but they do not replace lectures).



3. PowerPoint slides through Ctools and LectureTools (updated prior to lectures)

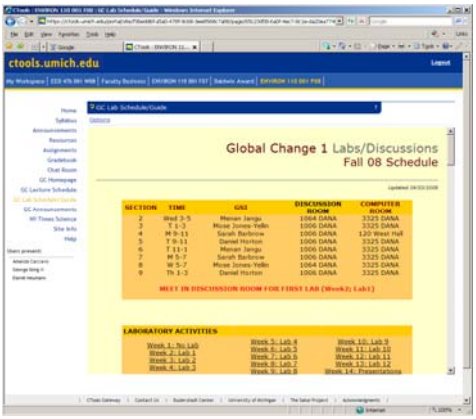
Information Environment (LectureTools)



Bring your wireless-enabled laptop to class for lecture notes, web access, and real-time searches

Details on Friday …

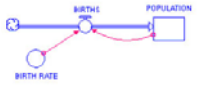
Labs: Discussions and Analysis

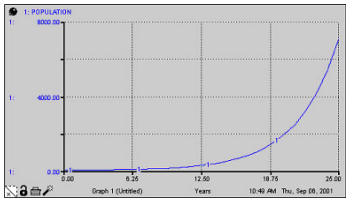


- Before lab, read articles
- In class, discuss questions and activities related to the articles to explore our role in global change.

System Dynamics Modeling (Stella)

Population Example:
BIRTHS = (BIRTH RATE)*(POPULATION)





Stocks are variables of interest

Flows change stocks. Flows go into or out of stocks

Converters change relationships between stocks and flows

Connectors allow information to be passed between variables

Next Week's Lab Reading

Before coming to lab, read:

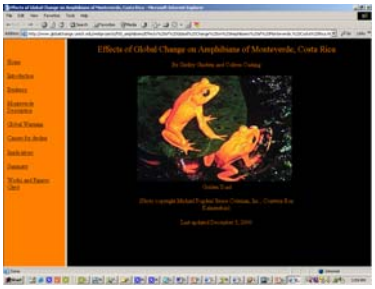
The Challenges We Face – A History of our Future

2003 State of the World p. 3-13

"We have only one or perhaps two generations in which to reinvent ourselves."

Group Term Project

The term project is a group research activity that will be presented in a PowerPoint class presentation and posted as a website.



Students organize into teams of 3 to develop a plan and implement the project related to the course material.

Suggestions for project topics and sample projects are offered, but the choice will be left to each team with guidance from your lab instructor.

Grades

The class uses a **point system** for determining final grades:

- Midterms (2): 100 points each
- Final: 150 points
- Lab/Discussion: 13 points each (hand-in by next lab)
- Lecture Homework: 5 points each (hand-in by next lab)
- Term Project: 100 points total
- Surveys/Assessments: 1 point each (excluding UM's E&E)

Optional, non-graded self-tests for lectures available as a link on the CTools site.

The total points are normalized on a scale from 0-100, using a straight scale for letter grades. The grades are:

- 0-59 = E
- 60-62, 63-65, 66-69 = D-, D, D+
- 70-72, 73-75, 76-79 = C-, C, C+
- 80-82, 83-85, 86-89 = B-, B, B+
- 90-92, 93-95, 96 and up = A-, A, A+

George Kling

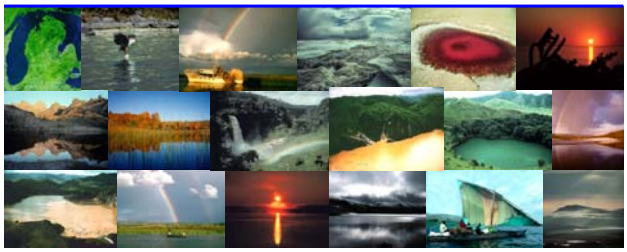
Department of Ecology & Evolutionary Biology
1041 Natural Sciences Bldg
Office hours, F 3-4
gwk@umich.edu

Teaching:

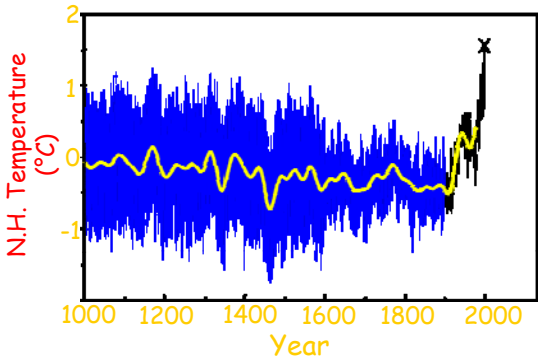
Global Change (Bio 110)
Ecosystem Ecology (EEB 476)
Limnology (study of lakes; EEB 483)

Research:

Aquatic Ecosystems
Impacts of Climate Change
Biogeochemistry
- Arctic, Africa, Michigan



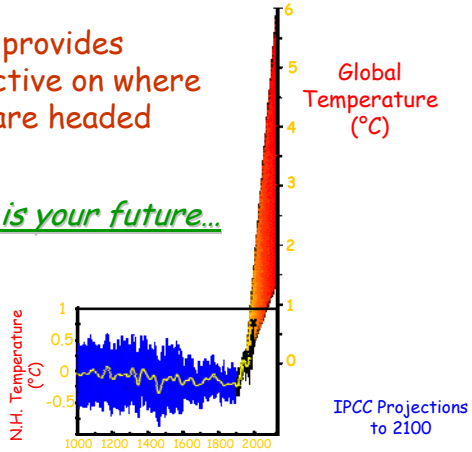
"Recent" climate change and variability...



Mann et al. (1999) GRL 26:759-762

...provides perspective on where we are headed

This is your future...



IPCC Projections to 2100

My Themes

- Global change on our planet can only be understood by combining "abiotic" and "biotic" components – *must look at the whole Ecosystem*
- *A combination of facts and scientific concepts* can help us understand even the most complicated problems
- Science is *NOT* hard, and everyone can and MUST learn enough to make rational decisions about our world's future

Possible Projects

- The "missing sink" - Where did all the CO_2 go?
- Microbes rule, Humans drool
- Does the rainforest *really* matter?
- The day the Earth turned brown and blue – The limits to food production
- Who's doing who? Climate skeptics and the use and misuse of Science facts
- Who needs more ice? Melting the Earth's glaciers *(a.k.a. "Water World 2050", starring B. van der Pluijm as K. Costner…)*
- WWF Climate 2008 "rage in the cage" – People vs. Nature
- Abrupt climate change – can El Nino's run wild?
- Whatcha gonna do when the rain don't come – Shifts in the Global water cycle

Me -- Chris Poulsen

• Associate Professor in Dept. of Geological Sciences and Dept. of Atmospheric, Oceanic and Space Sciences

• Paleo/climatologist

• Ancient ice ages
• Times of extreme warmth
• Climate impacts -- water resource
• South American climate and tectonics

• GS114 - Global Warming
• GS116 - Introductory Geology in the Field
• GS151 - Ice Ages Past and Present
• AOSS321 - Earth System Dynamics
• AOSS410 - Earth System Modeling

Our Place in Space

• How did 'IT' all start?

• What are the origins of our solar system and planet Earth?

Evolution of a Habitable Earth

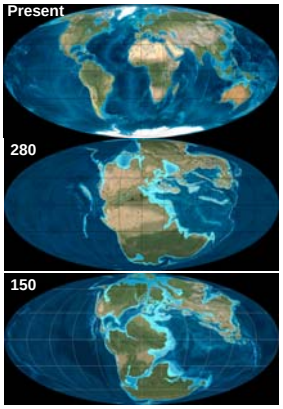
• Why is Earth the only habitable planet in our solar system?

• What were the steps in making a habitable Earth?

Our Solid Earth: Plate Tectonics

• What is the age of the Earth, and how do we know?

• Plate what?



Our Fluid Earth: Ice, Atmosphere & Ocean

• From fiery hell to icy rock. What controls Earth's climate?

• Why do the winds blow?

• Global warming? How, why, and so what?

Evolution and Ecology Roadmap

We wish to know:

- Where we are going
- Why we should care
- How the pieces fit together

• And, maybe… Who is this guy?

http://tolweb.org/tree/phylogeny.html

David Allan

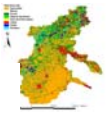
dallan@umich.edu

My Research

Watersheds, Land Use, and River Ecosystems

Environmental Flows

River Restoration

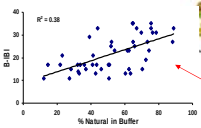


My Courses

Environ 110 Earth and Ecosystems (fall)

Environ 111 Human Impacts (winter)

Environ 520 Fluvial Ecosystems (fall)



River health improves with increasing natural land near the stream

My Interests

Travel

Camping

Reading

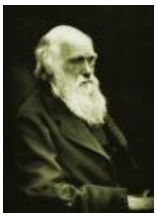
Allan family safari, Serenghetti

My themes

- Human-induced changes to the planet need to be understood within the context of natural processes and evolutionary change
- Not just climate change: global deforestation and desertification, over-harvested resources, global homogenization of species, altered mineral cycles
- Life diversity and life processes are at risk

Efforts to Reconcile God and Nature

Jacopo Tintoretto's *Creation of the Animals* (c. 1550).



Charles Darwin
1809 - 1882

Threats to Biodiversity

Human actions now threaten species and ecosystems to an extent rarely seen in earth history.

Over-harvest

Exotic species

Climate change

Why should we care about biodiversity?

- The wonder of nature
- Ecosystem goods and services
  - Clean water, productive soils, the recycling of nutrients, food and fiber, recreation, spiritual renewal
- The accelerating rate of species loss
- Emerging diseases

The March of the Penguins, narrated by Morgan Freeman

http://www.divegallery.com/Leafy_Sea_Dragon.htm

Ben van der Pluijm

Professor of Geological Sciences
Professor of the Environment
Director Global Change Program
www.globalchange.umich.edu/Ben
vdpluijm@umich.edu or globalchange@umich.edu

Research: Structural Geology

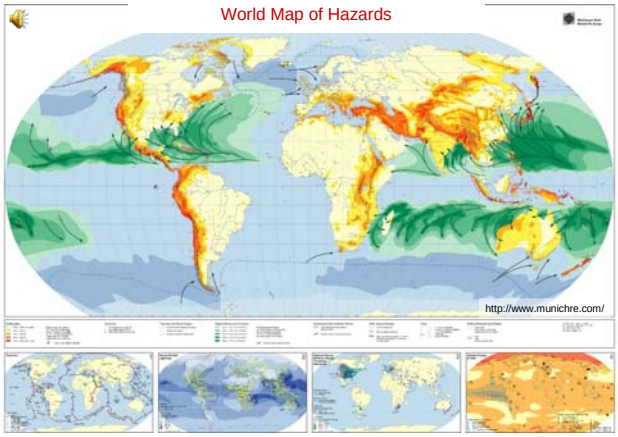
field areas: the northern Appalachians, the USA continental interior, North and South America's Grenville, northern Spain's Cantabria, East African Rift, US-Canadian Rockies, San Andreas (CA) and Alpine (NZ) faults.

topical areas: brittle and ductile faults, deep-crustal architecture, fault gouge and pseudotachylyte, intraplate stresses, oroclines, clay microstructures and textures, magnetic anisotropy, X-ray goniometry, paleomagnetism, geochronology, physical oceanography

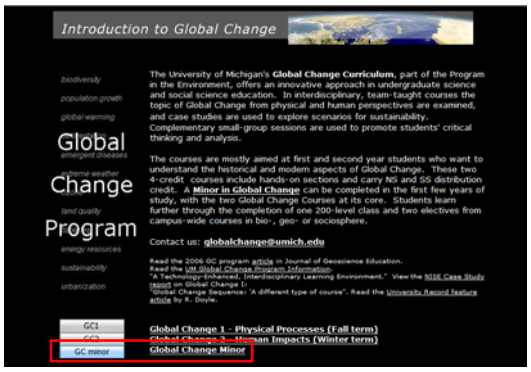
Teaching

Interdisciplinary undergraduate teaching (Global Change), Environmental Geology, concentrator and graduate level specialty classes, IT-supported classroom education (GeoPocket), IT-supported field-based education (GeoPad).

World Map of Hazards



Global Change Curriculum and Minor



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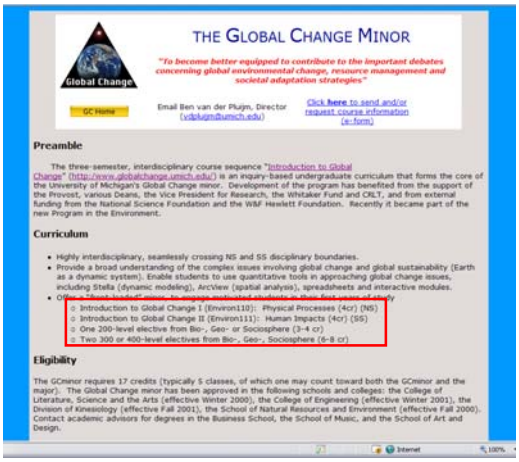


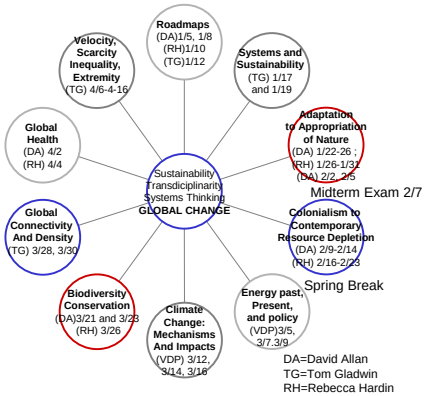
The GC2 Wheel of Lectures (Winter Semester)

How to read this slide: Clockwise from the "midnight" position:

1) First three basic Conceptual & Chronological Units preparing us to think about broad issues of past, present and future

2) The heart of the course is four theme-driven modules on relatively recent past and present issues: colonialism, energy, climate, and conservation

3) We conclude with a future-oriented series of lectures on global trends, including health



DA=David Allan
TG=Tom Gladwin
RH=Rebecca Hardin
VDP=Ben van der Pluijm

Interdisciplinary, Natural and Social Science Curriculum examining Dimensions of Global Change

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

Wrapping up

- Global Change encompasses all the ways that our planet has been changing since its formation ~4.5 billion years ago to today, and looking toward the future.
- Humans are affecting Earth and its life support systems at an unprecedented rate, which poses new challenges to humankind and our planet.
- Decisions and good policy require good science.

…. that is why you are in Global Change !