BIOL 138/EARS 128: Introduction to Polar Systems

Fall 2010
Class location - 028 Haldeman Center
3A: M 3-5 and Th 4-6

Instructor: Ross A. Virginia
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Office Phone: 646-0192
Office Hours: by appointment

ORC Description

Introduction to Polar Systems

Polar regions are increasingly under threat from human accelerated climate and environmental change. This course will examine current polar science that has relevance to critical environmental issues and policies for the high latitude regions. Topics will be viewed through the lens of individual disciplines and then as crosscutting interdisciplinary problems. The courses will provide a foundation on topics such as ice core interpretation, declining sea ice and changes in ice sheet dynamics, alterations in the terrestrial and marine carbon cycles, and climate change impacts on polar biodiversity. The later portion of the course will focus on the development of a group interdisciplinary research project. This is a core course in the IGERT Polar Environmental Change curriculum.

In keeping with the interdisciplinary theme of this course, several faculty will lecture or lead discussions. Prof. Virginia is responsible for organizing the course, administration, and assigning final grades.

Course Objectives:

• provide an introduction to the major physical, biological, and human systems of the Earth's high latitudes,
• introduce techniques for pooling the resources of a number of distinct disciplines to reach multidisciplinary and interdisciplinary modes of inquiry in order to understand the science of polar environmental change,
• introduce members of the Dartmouth polar community working on high-latitude concerns and some of the “tools” and facilities available at Dartmouth and CRREL for polar work, and
• develop skills in team learning and science communication through a class project on climate change science and policy.

Academic Honor Principle: Fundamental to the principle of independent learning are the requirements of honesty and integrity in the performance of academic assignments, in the
classroom, in the laboratory, and in daily interactions with others. Dartmouth operates on the principle of academic honor, without proctoring of examinations. Students who submit work which is not their own or who commit other acts of academic dishonesty in the classroom or in the research laboratory, etc. forfeit the opportunity to continue at Dartmouth. You should consult with the instructor if you are not clear about your responsibilities or expected conduct during any assignment or activity in this course. Visit the Dartmouth WEB site to be sure that you understand the proper use of Sources in preparing assignments and papers.  
http://www.dartmouth.edu/~sources/  
Also be aware of the Graduate Academic and Conduct Regulations  
http://www.dartmouth.edu/~gradstdy/students/regulations.html

**Students with Disabilities:** I encourage students with disabilities, including “invisible” disabilities like chronic diseases, learning disabilities and psychiatric disabilities to discuss with me after class or during office hours appropriate accommodations that might be helpful to you. If you have a documented disability needing academic adjustments or accommodations please see me by the end of the second week of the term. All discussions will remain confidential.

**Religious Observances:** I realize that some students may wish to take part in religious observances that fall during this academic term. Should you have a religious observance that conflicts with your participation in the course, please come speak with me before the end of the second week of the term to discuss appropriate accommodations.

**Blackboard:** The course [Blackboard site](http://www.dartmouth.edu/~sources/) will be used to post assigned papers to read, links to useful sites and as a location to communicate information about assignments. Please check this site on a regular basis.

**Useful Links**

- COP 15, UN Climate Conference, Dec. 7-18, 2009  
- IPCC 4th Assessment 2007  
  WG 1  
  Summary for Policymakers  
  Chapter 4 Observations: Changes in Snow, Ice and Frozen Ground  
  Chapter 7 Couplings Between Changes in the Climate System and Biogeochemistry  
  Chapter 8 Climate Models and their Evaluation
- IPCC Climate Change 2007: Impacts, Adaptation and Vulnerability  
  Chapter 15: Polar Regions (Arctic and Antarctic)
- Millennium Ecosystem Assessment 2005  
  Chapter 25, Polar systems  
Arctic Climate Impact Assessment 2004
http://www.svs.is/AHDR/AHDR chapters/English version/Chapters PDF.htm

Global Climate Change Impacts in the United States 2009
http://www.globalchange.gov/

Additional Activities (TBA): As interest and time permit we will arrange visits to investigator laboratories and Dartmouth core facilities to introduce some of the methods and instrumentation used in polar research. Likely candidates include:

- Stable and radiogenic isotope laboratories, Earth Sciences
- CRREL, Thayer Ice lab
- Environmental Measurements Lab, Environmental Studies
- Trace Element Analysis Core Facility (http://www.dartmouth.edu/~toxmetal/resources/cores/analysis/index.html)
- Laboratory for GIS and Applied Spatial Analysis (http://www.dartmouth.edu/~gis/)
- Stefansson Special Collection in Polar Exploration, Rauner Library (http://ead.dartmouth.edu/html/stem169.html)

Integrating Course Project: COP 15 Climate Change Conference

The UN Climate Conference (COP 15) will be held in Copenhagen during December. The goal of this international meeting under the UNFCCC is to implement a comprehensive international agreement to replace the Kyoto Protocol. This process brings together developed, developing, and lesser-developed nations, environmental NGO’s, and indigenous groups to sort through the science, politics, economics, and ethics behind managing the earth’s atmosphere to reduce global climate change.

We will focus on the complex interplay between science and climate policy by dividing the class into teams that will prepare hypothetical cases for Denmark, Greenland, and the United States. Greenland has recently achieved self-rule from Denmark, but Greenland cannot negotiate for itself in international agreements. How are Greenland and Denmark climate interests the same or different? The US has complicated relations with Greenland and Denmark around issues related to security and environment. The project will evolve as we progress through the term. Students will be assigned to a case by the instructor to provide a balance of disciplines within each group. The final scope of the project will be shaped by the interests of the class and the limited time we have available. We will devote time throughout the term to set benchmarks and discuss progress. The project will culminate in a mini COP 15 session where the three groups will present their findings and summarize the scientific basis behind their positions. Each group will also prepare a written document along the lines of the IPCC Summary Reports for Policy Makers.

Grading: This course relies on your active participation in class discussions and projects. Please contact Prof. Virginia if you have missed class for illness or if you need to miss class for academic reasons.
Grading will be based on graduate division criteria i.e., HP, P, LP, NC.

Participating faculty members are responsible for the academic content of their subject matter unit and for assignments and/or in class assessments of student participation. Your final grade in the course will be based on the following breakdown:

- 1/3 Class participation
- 1/3 Assignments
- 1/3 Group Project

Class Schedule- subject to revision as the term progresses

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<th>Week 1</th>
<th>Introductions and overview, Polar environmental change</th>
<th>Ross Virginia</th>
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<tr>
<td>Week 2</td>
<td>Coupled natural/human systems, Climate assessment process</td>
<td>Ross Virginia</td>
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<td>Climate assessment presentations</td>
<td>Ross Virginia</td>
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<td>Week 3</td>
<td>Terrestrial and aquatic ecosystems</td>
<td>Matt Ayres</td>
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<td>Matt Ayres</td>
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<td>Week 4</td>
<td>Microbial systems</td>
<td>Jill Mikucki</td>
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<td>Carbon cycling</td>
<td>Xiahong Feng/ Ross Virginia</td>
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<td>Week 5</td>
<td>Stefansson Collection (3-4 PM)</td>
<td>Jay Satterfield, Rauner Library</td>
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<td>Stable isotopes</td>
<td>Xiahong Feng</td>
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<td>Stable isotope applications</td>
<td>Xiahong Feng</td>
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<td>Week 6</td>
<td>Ice as a material</td>
<td>Ian Baker, Rachel Obbard</td>
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<td>Week 7</td>
<td>Climate and sea ice dynamics</td>
<td>Don Perovich</td>
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<td>Week 8</td>
<td>Landscape change, glacial history</td>
<td>Meredith Kelly</td>
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<td>Week 9</td>
<td>Snow and ice dynamics; polar ice sheets; ice core records of climate</td>
<td>Mary Albert, Bob Hawley</td>
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<td>Week 10</td>
<td>COP 15, international law and agreements, indigenous rights</td>
<td>Bruce Duthu, Michael Dorsey</td>
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<td>Thanksgiving Break</td>
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<td>Week 11</td>
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<td>COP 15 Presentations</td>
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<td>COP 15 reports due</td>
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