

New Course Proposal
GEOL 420: Earth Science and Policy

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Catalog Description: Discusses earth science issues that have policy implications. Course uses a broad definition of earth science, from atmosphere to geosphere. Course taught seminar-style, with emphasis on discussion, reading, writing, critical analysis, and student oral presentations. Course may include field trips.

Objectives: This course will provide a basic understanding of the policy decision-making process and of policy issues related to the earth sciences. The course will integrate technical and social science knowledge. It will provide a clearer understanding of how technical information should be used in policy-making. It will also provide students with a clearer idea of what to question in technical analysis, and how to understand uncertainty or error in data presentation. We will focus on case studies within different earth systems including the geosphere, hydrosphere, and atmosphere. Students will be given an opportunity to test their understanding of uses and limits of technical information by application to case studies that will be interspersed with background technical information.

Necessity for a new course: Currently, the Department of Environmental Science and Policy (ESP) does not offer a permanent course that specifically addresses earth science policy, and thus, this new course would fill an existing gap in our curriculum. Moreover, this course would provide another option for students who need a required capstone course for our geology and earth science degrees.

Relationship to similar courses in the department: The proposed course has no similarities to any permanent course now offered as part of the geology and earth science program. The course Geol 406 (Seminar in Earth and Environmental Science) is a wide-open special topics course that deals with any subject in earth and environmental science (e.g., Origins of Life special topic course taught by Dr. Robert Hazen in spring 2006). Thus, Geol 406 would continue to be available for any timely special topics courses, whereas Geol 420 would focus on earth science policy.

Relationship to similar courses in other departments: There are no similar courses in other departments.

Anticipated audience and enrollment: The audience will be drawn mostly from existing geology and earth science majors, as well as new global and environmental change majors, though other students may attend if they fulfill the requirements.

List of Potential Instructors: Allison Macfarlane, Rick Diecchio, and other experts in earth science and policy.

Anticipated frequency at which course will be offered: This course will be offered once a year.

Additional resources necessary to offer the course: None; though at times we may take a field trip to Washington D.C.

Course is not expected to satisfy general education requirement.

GEOL 420: Earth Science and Policy

Instructor: Allison Macfarlane

Class Meeting: twice weekly for 1.5 hours each session

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Grading: Grades will be based on the following:

Class Participation	20 pts
Take-home mid-term	20 pts
Op-ed	20 pts
Long paper	25 pts
Presentation	15 pts

Requirements: Reading assignments must be completed before class, and the participation grade will be based partly on the student's relation of the readings to the class discussions. The op-ed will be 800 words long and written in the style of a New York Times or Washington Post op-ed. The long paper should be 15-20 pages in length and on a specific policy issue related to one of the larger headings in class (geosphere, hydrosphere, biosphere, and atmosphere), but not discussed in class. I will provide a list of possible paper topics in class. The presentation will present the argument of the long paper. Papers should be well referenced and should not rely too heavily on internet resources.

Schedule:

Week 1: Introduction to Science Policy

Jan 23:

Introduction

Jan 25:

Sheila Jasanoff, 2006, Biotechnology and Empire: The Global Power of Seeds and Science, in John Krige and Kai Henrik-Barth, editors, *Global Power Knowledge: Science and Technology in International Affairs*, Chicago, IL: University of Chicago Press, pp. 273-292

Week 2: Science Policy Issues

Jan 30

Science and Uncertainty

Herrick, Charles and Sarewitz, Daniel (2000) Ex Post Evaluation: A More Effective Role for Scientific Assessments in Environmental Policy. *Science, Technology & Human Values* **25**, pp.309-331.

Morgan, M. Granger and Henrion, Max (1992) *Uncertainty: A Guide to Dealing with Uncertainty in Quantitative Risk and Policy Analysis*, Cambridge: Cambridge University Press.

Feb 1

Decision-making under uncertainty

Daniel Sarewitz, 2004, How Science Makes Environmental Controversies Worse, *Environmental Science and Policy*, Issue 7 2004, pp 385-403

Sarewitz, D. and Pielke, R. Jr. (1999) Prediction in science and policy. *Technology in Society* **21**, pp. 121-133.

Week 3: Geosphere

Feb 6:

Energy Resource Issues;

Dara O'Rourke and Sarah Connolly (2003) Just Oil? The Distribution of Environmental and Social Impacts of Oil Production and Consumption, *Annual Review of Environmental Resources* 28, pp. 587-617.

Russell Lee (2002) Environmental Impacts of Energy Use, *In Energy: Science, Policy and the Pursuit of Sustainability*, R. Brent, L. Orr, and R. Baker, ed.s, Island Press, pp. 77-108.

Feb 8:

Uranium Mining and contamination: the case of the Navajo

Hall, "Impacts of the energy industry on the Navajo and Hopi", *Unequal Protection*, p. 130-154.

Week 4: Geosphere

Feb 13:

Geologic Hazards

Guest Lecture, David Applegate, USGS Hazards Division

Feb 15:

Living in earthquake zones

readings from: Mike Davis, 1998, *Ecology of Fear, Los Angeles and the Imagination of Disaster*, New York: Vintage Books

William Cronon, 1996, *Uncommon Ground: Rethinking the Human Place in Nature*, New York: W.W. Norton and Company.

Week 5: Hydrosphere

Feb 20:

Water cycle, groundwater and aquifers

John Sharp and Jay Banner, The Edwards Aquifer: Water for Thirsty Texans, In Jill Schneiderman, editor, 2000, *The Earth Around Us, Maintaining a Livable Planet*, New York: WH Freeman

Feb 22:

Use and abuse of aquifers

Cathryn Manduca, Living with Karst: Maintaining a Clean Water Supply in Olmsted County, Minnesota, In Jill Schneiderman, editor, 2000, *The Earth Around Us, Maintaining a Livable Planet*, New York: WH Freeman

Week 6: Hydrosphere

Feb 27:

Groundwater quality and contamination

CW Fetter, *Applied Hydrogeology*, Prentice Hall, 1994

Mar 1: Water and Nuclear Waste Disposal

Yucca Mountain – issues in siting a nuclear waste repository

Readings from: Allison Macfarlane and Rodney Ewing, 2006, *Uncertainty Underground: Yucca Mountain and the Nation's High-Level Nuclear Waste*, Cambridge, MA: MIT Press.

Field Trip to Nuclear Power Plant – tentative plan

Week 7: Hydrosphere

Mar 6:

Water and Nuclear Waste Disposal

Metlay, D. (2000) From Tin Roof to Torn Wet Blanket: Predicting and Observing Groundwater Movement at a Proposed Nuclear Waste Site. In *Prediction: Science, Decision Making, and the Future of Nature* (ed. Sarewitz, D., Roger Pielke, J. and Radford Byerly, J.), Washington, DC: Island Press. pp. 199-228.

Mar 8:

Flooding, flood cycles: should people live on flood plains?

Mike Davis, 1998, *Ecology of Fear, Los Angeles and the Imagination of Disaster*, New York: Vintage Books

Week 8: Hydrosphere

Mar 20:

Coastlines

Guest Lecture: Randy McBride, GMU

Orrin Pilkey in Jill Schneiderman, editor, 2000, *The Earth Around Us, Maintaining a Livable Planet*, New York: WH Freeman, Ch. 15-16, pp. 181-220.

Mar 22:

Coastlines – how much should man adapt to them and adapt them?

Cornelia Dean, 1999, *Against the Tide, the Battle for America's Beaches*, New York: Columbia University Press

Jill Schneiderman, editor, 2000, *The Earth Around Us, Maintaining a Livable Planet*, New York: WH Freeman

Week 9: Atmosphere

Mar 27:

Wind

Selected readings from Frank Press & Raymond Siever, *Understanding Earth*, WH Freeman, 1994

Mar 29:

Contaminant transport: Three Mile Island and Potential Nuclear Disasters

Kai Erikson, *A New Species of Trouble*, WW Norton & Co., 1994

Mark Monmonier, *Cartographies of Danger: Mapping Hazards in America*, University of Chicago Press, 1997

Week 10: Atmosphere

Apr 3:

General circulation in the upper atmosphere

Frederick Lutgens and Edward Tarbuck, 2002, *Foundations of Earth Science*, New York: Prentice Hall, 3rd Edition.

Apr 5:

Ozone Hole

David Doniger, "Politics of the Ozone Layer", *Issues in Science and Technology*, Spring 1988, 86-92.

Fahey, D.W. Twenty Questions and Answers About the Ozone Layer: Scientific Assessment of Ozone Depletion: 2002, 42 pp., World Meteorological Organization, Geneva, 2003. <http://www.al.noaa.gov/WWWHD/pubdocs/Assessment02/Q&As.pdf>

Week 11: Atmosphere/Science Policy Decision-Making

Apr 10:

Global Climate Change: some issues

J.D. Mahlman, 1997, Uncertainties in Projections of Human-Caused Climate Warming, *Science*, Vol. 278, November 1997, pp 1416-1417

John P. Holdren, 2003, US Climate Policy Post-Kyoto: Scientific Underpinnings, Policy History, and the Path Ahead.

Richard Wolfson and Stephen H. Schneider, 2002, Understanding Climate Science, in Stephen H. Schneider, Armin Rosencranz and John O. Niles, *Climate Change Policy Survey*, Washington D.C.: Island Press, pp 3-51

Apr 12:

Players: scientists, Government, NGOs, industry, public

Walter Rosenbaum, 2003, *Environmental Politics and Policy*, Washington, DC, CQ Press, Chapter 10.

Norman Vig, Michael Kraft, 2003, *Environmental Policy: New Directions for the Twenty-First Century*, 5th Edition, Washington, DC: CQ Press, Chapter 13.

Week 12: Other Ways of Knowing

Apr 17:

Understanding Nature

William Cronon, 1996, *Uncommon Ground: Rethinking the Human Place in Nature*, New York: W.W. Norton and Company.

Apr 19:

Sylvia Noble Tesh, 2000, *Uncertain Hazards, Environmental Activists and Scientific Proof*, Ithaca, NY: Cornell University Press, Ch. 5-6, pp. 81-119.

Week 13: Student Presentations

Apr 24:

Apr 26:

Week 14: Student Presentations

May 1:

May 3:

George Mason University General Education Course Approval Form, rev. 4/5/02
Office of the Provost

(Please Attach to GMU Standard Course Approval Form, Office of the Registrar, and submit via your College Office)

New_____ Modify_____ Existing__XX_____

Date: __18 Sept 2006__ Dept. __ESP__ Course Abbrev/Number __GEOL 420

Full Course Title: __GEOL 420 Earth Science and Policy

Credit Hours: __3_____ Lab/Non lab (circle one)

GE Area A. Foundation_____ B. Core _____ or C. Synthesis __XX_____

GE Category: _____ (If Synthesis, please also see Appendix 1, Checklist; all other categories see Appendix 2, 2002-03 Catalogue Descriptions)

1. Course Content (please attach SYLLABUS)

2. How does course specifically meet the specified General Education Goal/Category?

This course will be a senior seminar course and therefore a capstone course. It will integrate scientific and social science knowledge by examining technical issues, understanding the science behind the technical issues and then applying that knowledge to policy problems. Solutions to policy problems will be both technical and social science-based. Course prerequisites are that students must have completed or be concurrently enrolled in all other required general education courses. In addition, students must have completed at least 18 credit hours in their major or minor (geology, earth science, ocean and estuarine science, or global and environmental change), and one of the following social science-based courses: EVPP 361, ECON 103, ANTH 114, GEOG 103, GLOA 101, GOVT 132 or 133, HIST 125 or 130, SOCI 101, 102, or 120.

3. Expected Student Outcomes/Assessment plan summary:

Student assessment will be done via class participation (the course will be seminar-style), the writing of two papers and student presentations (using PowerPoint or similar software).

(Attach separate sheet if necessary)

Submitted by:

_____ Phone: _____ e-mail: _____

Signature:

_____ Dept. _____ Mail Stop _____

SIGNATURES

Department Chair _____ Date _____

College Council Chair(*if appropriate*) _____ Date _____

College Dean _____ Date _____

Provost _____ Date _____

General Education Curriculum files, Office of the Provost: File recorded: _____ Date: _____

Synthesis Course Proposal
GEOL 420: Earth Science and Policy

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I am proposing to teach GEOL 420, Earth Science Policy, as a synthesis course. To take the course, the prerequisite is that the students must have completed or be concurrently enrolled in all other required general education courses. In addition, students must have completed at least 18 credit hours in their major or minor (geology, earth science, ocean and estuarine science, or global and environmental change). Students will demonstrate competence in written communication by writing two papers of differing lengths and types as well as composing answers to questions on a take-home exam. They will demonstrate competence in oral communication by making a presentation to the class at the end of the semester (based on their research for their long paper). They will need to employ PowerPoint or other computer projection to software to make their presentations.

This course will ask students to use critical thinking in understanding different policy issues. They will use their knowledge of earth science as a basis to understand some of the technical issues involved in a particular policy problem (climate change, for example). If necessary, additional scientific information will be provided in class. They will then learn about the political, cultural, economic, and ethical issues involved in particular cases. They will also gain an understanding of different theoretical frameworks from the social sciences to analyze the science policy sciences issues.