Course: GEOL 420: Earth Science & Policy (3.0 credits)

Instructor: Dr. David J. Verardo

Office Hours: By appointment (email: dverardo@gmu.edu)

Class Meeting: GEOL 420 meets Tuesday evenings from 6:30 P.M.- 9:00 P.M. in Exploratory Hall
                       Room 1005

Course Description
This course discusses Earth science issues and their policy implications; uses a broad definition of earth science; is taught seminar-style, with an emphasis on discussion, reading, writing, critical analysis, and student oral presentations; and fulfills the University general education requirement in synthesis.

Course Objectives
As a **MASON APEX** experience, our emphasis will be on **QUANTITATIVE REASONING, ORAL COMMUNICATION, CRITICAL THINKING, SYNTHESIS, CLASS ENGAGEMENT AND INVOLVEMENT** because this course exists to share perspectives on how science and policy have interacted in the past and how they could interact in the future. We will use a combination of class discussions, assigned readings, individual and group exercises to accomplish our educational goals. Our emphasis will be on class engagement and involvement because this course exists to share perspectives on how science and policy have interacted in the past and how they could interact in the future. This means we will explore pragmatic aspects of scientific practice and policy implementation. As such, our course will begin by laying the foundation of skills and approaches that will help us understand and critically analyze historical case studies in science policy and explore new opportunities and challenges in integrating science and policy. These foundational skills will be practiced throughout the course.

Course Learning Outcomes
Upon completing George Mason University Natural Science courses, students will be able to: 1) Understand how scientific inquiry is based on investigation of evidence from the natural world, and that scientific knowledge and understanding: a) evolves based on new evidence and b) differs from personal and cultural beliefs; 2) Recognize the scope and limits of science; 3) Recognize and articulate the relationship between the natural sciences and society and the application of science to societal challenges (e.g., health, conservation, sustainability, energy, natural disasters, etc.); and 4) Evaluate scientific information (e.g., distinguish primary and secondary sources, assess credibility and validity of information).

Course Materials: No textbooks are required; any necessary materials will be provided. Reading assignments must be completed before the class for which they are assigned. This will enhance the discussion during each session. Reading assignments and resources will be updated during the course, as necessary.

Grading Policy
Attendance & Active Participation: 50%
Individual & Team Projects: 50%
Class attendance is mandatory, as is completion of projects and presentations, since class participation and discussion, as part of active learning, is essential to meeting our course objectives.

GMU POLICY GUIDELINES

These university and class policies are important to understand:

➢ Integrity: GMU has an Honor Code with guidelines regarding academic integrity; please see http://oai.gmu.edu for more information.

➢ Disability: If you are a student with a disability and you need academic accommodations, please see me and also contact the Office of Disability Services (ODS) at 703-993-2474 or http://ods.gmu.edu. All academic accommodations must be arranged through the ODS.

➢ Privacy: Students must use their MasonLive email account to receive important University information, including messages related to this class. Please see http://masonlive.gmu.edu for more information.

➢ Electronics: Please be respectful of our time together and do not engage in activities that are unrelated to class. Cell phones may be left on but muted and used for emergencies only.

➢ Use of Artificial Intelligence Tools: The judicious use of AI tools is permitted for class work as an aid in learning but not as a replacement for original independent work.

CLASS SCHEDULE & OVERVIEW OF TOPICS

Foundational Skills
1) Introduction & Origin of Federal Policy Power
2) Science as Evidence in Public Policy
3) Argumentation as a Policy Skill
4) Conflict Management as a Policy Skill
5) Interest-Based Negotiating as a Policy Skill
6) Ethically Communicating Scientific Uncertainty

Case Studies & Applications
7) The L'Aquila Earthquake
8) Natural Hazards – The Stafford Act
9) Hydraulic Fracturing
10) National Environmental Policy Act (NEPA) & Endangered Species Act (ESA)
11) Genetically Modified Organisms (GMO)
12) Team Project w/ Individual Writing Assignments
13) Team Project w/ Individual Writing Assignments
14) Final Session

DETAILED CLASS OUTLINE

Foundational Skills

1) **Introduction and Origin of Federal Policy Power**
   Précis: We will begin our exploration of science and policy with some fundamental questions such as: What is policy? Where does authority for federal policy power originate? How is federal policy developed? How is federal policy implemented? What are the roles of the Legislative, Executive, and Judicial branches? What is the role of the public (including individuals, organizations, corporations) in policy making?
   Reading Assignment & Resources:
   a) U.S. Declaration of Independence
   b) U.S. Constitution
   Exercise: In-class exercise using U.S. CIS Naturalization Test.

2) **Science as Evidence in Public Policy**
   Précis: We will explore how science is used as evidence in public policy formulation (i.e., evidence-based policy). We will investigate what science is admissible and what science is not admissible in legal setting where science is used to inform policy as well as the role of scientific experts in legal settings.
   Reading Assignment & Resources:
   a) *Using Science as Evidence in Public Policy*; Prewitt, K.P., T.A. Schwandt, M.L. Straf, (ed.), 2012; National Acad. Sci.
   b) *Scientific Epistemology: How Scientists Know What They Know*; Wenning, C.J., 2009; J. Phys. Tchr. Educ. Online, 5(2).
   Exercise: In-class exercise on Interpreting Statutes and Regulations.

3) **Argumentation as a Policy Skill**
   Précis: We will discuss the field of argumentation in terms of communication that aims to persuade through reasoned judgment. This skill is essential for scientists in the policy arena, and elsewhere in their professional life, but this critical skill is noticeably in decline in scientific circles where it is often presumed that given enough data, a conclusion is obvious and unassailable.
   Exercise: In class exercise on Argumentation. [Playing God in the Laboratory]

4) **Conflict Management as a Policy Skill**
   Précis: Conflict is everywhere and unavoidable given differing assumptions, expectations, and values among people. This is particularly evident in the public policy arena where values and agenda collide. Handled badly, conflict can do real harm and cripple our communities and relationships. Handled well, however, conflict can be a powerful personal and professional ally.
   Exercise: In class exercise on Conflict Management. [Fisheries Resources]

5) **Interest-Based Negotiating as a Policy Skill**
   Précis: We will discuss negotiation based on interests versus position. This conflict management strategy focuses on developing mutually beneficial agreements based on the interests of the disputants such as the needs, desires, concerns, and fears important to each side. Interest-based bargaining is premised on the understanding that all sides to the bargaining process have legitimate interests to be protected and advanced.
   Exercise: In class exercise on Interest-Based Negotiating. [Public Sector Funding Priorities]

6) **Ethically Communicating Scientific Uncertainty**
Précis: We will discuss how scientific uncertainty is ethically communicated from the perspective of three policy relevant groups - scientists, lawyers, and journalists.
Exercise: In class webinar bringing scientists, journalists, and attorneys together to discuss ethically dealing with uncertainty in each professional field.

Case Studies & Applications

7) **The L'Aquila Earthquake**
Précis: Seven of Italy's top scientists were charged, tried, and convicted of involuntary manslaughter following a severe earthquake that resulted in the loss of life and destruction of property. The scientists were members of a commission whose responsibilities were to advise on matters of public safety. An Italian judge found the scientists guilty of involuntary manslaughter on the basis of delivering "inexact, incomplete, and contradictory information." We will discuss this case in terms of public policy, the responsibility of scientists in professional practice, the limits of scientific certainty, and ethically communicating scientific uncertainty.
Reading Assignment & Resources:
a) *The Aftershocks.* David Wolman, 2014
b) Earthquake Conviction
c) Earthquakes Acquittals
d) Exoneration Discussion

8) **Natural Hazards – The Stafford Act**
Précis: We will examine the Robert T. Stafford Disaster Relief and Emergency Assistance Act, Public Law 93-288, as amended, 42 U.S.C. 5121 et. seq. Located in United States Code, Title 42. The Public Health and Welfare, Chapter 68. Disaster Relief.
Reading Assignment & Resources:
stafford_act_booklet_042213_508e(1)
Exercise: In-class exercise on Natural Hazards. [Federal Response to Hurricane Katrina]

9) **Hydraulic Fracturing**
Précis: What is the science of hydraulic fracking? Why is it used? How long has it been around? Is it safe? These and other questions surrounding this technology will be explored and discussed.

10) **National Environmental Policy Act (NEPA) & Endangered Species Act (ESA)**
Précis: We will discuss how NEPA and ESA came about and what each law covers.

11) **Genetically Modified Organisms (GMO)**
Précis: What is the science behind GMOs? How are they used? What are the arguments for and against their use? These and other questions surrounding GMOs will be explored and discussed.

12) **Team Project w/ Individual Writing Assignments**

13) **Team Project w/ Individual Writing Assignments**

14) **Final Session**