Great Issues Sci 360: Natural Hazards - Science and Society
1:30 – 2:45 pm (T,Th)
Profs. Timothy Filley and Megan Sapp Nelson, organizers.

Course Overview
As future graduates of the College of Science, you will have the opportunity to contribute your knowledge and skills to finding solutions to the complex, multi-faceted problems facing the country and the world. However, even if your career path does not lead you to work on a daily basis in a scientific field, as a citizen, your informed approach to complex issues—whether the challenges are local, national, or global—will help promote high-quality decision making, and, ultimately, will help create strong, resilient communities.

This course will investigate the role of science in policy and decision-making as it relates to three types of natural disasters: hurricanes, earthquakes, and tornadoes. The scientific fundamentals of each of these hazards will be introduced first followed by an exploration of how various policies, programs, and real-time decisions can impact a community’s response and recovery from disasters. This course is not designed to arrive at particular consensus solutions to the specific case studies that we will cover, rather, the goal of this course is to explore the linked complexities between the science of the threat and the political and social response.

To deepen our understanding, we have invited guest speakers to give accounts of their role in specific disasters and in framing the policies and decisions made in the aftermath of the natural hazards. These guests include city managers, the mayor of Greenburg, Kansas, and faculty from the social and physical sciences. Their perspectives will help us to develop a better understanding of the connections across technological, political, and social systems, and the myriad of challenges that communities and management professionals face when confronted by these events. Many of these individuals are on the “front-line” and offer us a unique opportunity to engage in a two-way discussion of the short and long term consequences of policy and technological choices these communities have made.

Natural hazards and the intersection of science and policy is at the forefront of our national discussion. For example, The U.S. National Academies has commissioned leaders in this area to engage within committees such as the Committee on Increasing National Resilience to Hazards and Disasters and the Committee on Science, Engineering, and Public Policy to advise our policy makers. The following quote from the recent National Academy report on Disaster Resilience: A National Imperative (2012) Committee on Science, Engineering, and Public Policy (http://www.nap.edu/catalog.php?record_id=13457) aptly summarizes the need we hope to address with you in this course.

“Increasing disaster resilience is an imperative that requires the collective will of the nation and its communities. Although disasters will continue to occur, actions that move the nation from reactive approaches to disasters to a proactive stance where communities actively engage in enhancing resilience will reduce many of the broad societal and economic burdens that disasters can cause.” –NAS,

Learning Objectives
The course will foster the development of the skills necessary to make a critical evaluation of complex issues facing society. Issues will be examined from scientific, economic, political, and ethical viewpoints. Students will learn to examine the issues from these different perspectives and to draw conclusions based (in part) on scientific evidence.
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Students will enhance their information literacy skills. The science and economics pertaining to the issues examined in this course are subject to rapid change. In order to talk and write knowledgeably about these issues, one must be able to find current and reliable information, evaluate its validity and applicability, and integrate it into one's existing understanding of the issues.

This course strives to emphasize the interrelationship between the various issues examined. Students will leave this course with a greater understanding how and why the issues are linked and cannot be viewed as problems to be solved separately. Similarly, these problems are not the province of a single discipline, but rather all disciplines have to be involved to contribute to the solution of these issues.

Students will demonstrate the ability to write knowledgeably and persuasively about the issues.

Students will use statistics and data ethically in the discussion of great issues.

Students will work as an active and contributing member of a team.

**Academic Honesty**: Any effort to represent someone else’s work as your own or allowing your work to be represented as someone else’s is cheating (this includes work of your classmates as well as work you find on the Internet or in books or journals, i.e., plagiarism). If you are reproducing the work of others in your project, you must reference it as such through a proper citation.

Working with other students on your group project is NOT cheating. In fact, it is encouraged.

If a student is found cheating, he or she will receive an F for the course and be reported to the Dean of Students. In serious cases, the Dean may suspend or expel the student from the university.

**Changes to Course Due to Major Campus Emergency**: In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances. Course information will, in general, be disseminated via one or more of the following routes: lecture, course Blackboard web site, or email.

**REQUIRED MATERIALS**

During each class period, there must be at least one laptop or wireless enabled device per small group. Group participants are responsible for ensuring the presence of those devices. For a few class periods during the semester, a research project will be conducted during class. On those days, it is beneficial for each participant to bring a laptop or wireless enabled device so that the work load can be split between participants.

Readings will be posted to Blackboard. Check between each class to stay up to date on the assigned texts.
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COURSE OUTLINE

Week 1
Jan 8, 2013. Class one
Introduction to course and expectations for students. What is science and what is policy? How is science conducted? How do Science and Society intersect in a natural disaster?


Jan 10, 2013. Class two
The social (Source, Production, and Location) implications of information. Examples of how to choose appropriate sources of information and evaluate the quality and popularity of information sources.


Week 2
Jan 15, 2013. Class Three (Guest Lecture: Prof. Leigh Raymond)
“Wicked Problems” where science and society meet


Out-of-class student activity: Students will track down the source of these two quotes and write a paper addressing the following: What was the original context of each quote? How is the intersection of science and society reflected in the content of each quote? Cite your sources for the background information/quote in APA format.

1. "That 'perfect storm' of a combination of catastrophes exceeded the foresight of the planners, and maybe anybody's foresight," Michael Chertoff

2. “It would be impossible for any cyclone to create a storm wave which could materially injure the city”. Isaac Cline

Jan 17, 2013. Class Four.
Watch the PBS New Orleans (2002) ”City in a Bowl” ---“New Orleans in Peril”

Out-of-class student activity: Return to the Chertoff quote. Find one scientific paper published prior to Hurricane Katrina that investigates the likelihood of flooding in New Orleans in conjunction with a hurricane. Briefly synthesize the paper and use the major scientific findings to explain how the scientific
findings support or contradict the Chertoff quote. This should be no longer than 1 page, with APA citations for the scientific paper that you located.

Week 3
Jan 22, 2013, Class Five
Basic Science of Hurricanes - (cover Galveston, Katrina, mention Isabel)

**In-class student activity:** Students will be given a list of 15 scientific questions at the beginning of class that they expected to be able to answer at the conclusion of the lecture. Lecture limited to 55 minutes with open class discussion for the remainder of time.

**Out-of-class student activity:** Assign viewing of YouTUBE video on follow-up to PBS special, The NOVA special “The Storm That Drowned a City”.

Jan 24, 2013, Class Six (Guest Lecture: Prof. Eric Dietz –Homeland Security Institute- (http://www.purdue.edu/discoverypark/phsi/about/staff.php)

The role and powers of the Department of Homeland Security and the Federal Emergency Management Agency in a natural disaster (state and federal). When do they have a recovery role? When/if their duties supersede local authority? What is their role in preparedness?

**Out-of-class student activity:** Prepare a brief (no more than ½ page total) profile of a specific date/locale (modeled on http://www.fema.gov/disasters) natural disaster. See also http://www.fema.gov/pdf/hazard/map/declarationsmap1964_07.pdf. Using incidences not more recent than 12 months prior as paperwork for assistance may not have been processed. Using local newspapers, FEMA website, for any location of your choice, profile an event that happened representing normal life context, then profile an emergency that happened on the following day. Cite the newspaper or magazine article content that you used in APA format. In the report indicate the counties and state affected, disaster duration (incident period), declaration date, description of disaster, federal support provided (individual assistance, public assistance, SBA loans). Treat this as a report that you are giving to other CoS majors where you pay attention to grammar and spelling. Be succinct in your descriptions!

Week 4
Jan 29, 2013, Class Seven
Basic Science of Hurricanes - (cover Galveston, Katrina, mention Isabel)

**In-class student activity:** Students will be given a list of 15 scientific questions at the beginning of class that they expected to be able to answer at the conclusion of the lecture. Lecture limited to 55 minutes with open class discussion for the remainder of time.

**Out-of-class student activity** Use NOAA, FEMA, and other US government resources to discover the following information: When were the evacuation orders given relative to landfall for Annapolis, MD prior to Hurricane Isabel, for New York City prior to Hurricane Sandy, and New Orleans prior to Hurricane Katrina? How many people evacuated in each situation? How many people sheltered in place? Based on your research, what factors played a role in the decisions of those who chose to shelter in place? Cite the resources you found using APA citation style. No more than one page in length.
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Jan 31, 2013, Class Eight (Guest Lecture: Mr. Robert Agee –International City/County Management Association representative and former City Manager of Annapolis, MD).
Decision Making/Policy Issues Stemming from Hurricane Isabel

Week 5
Feb 5, 2013, Class Nine
(Guest SKYPE Interaction: Mr. Robert Agee –International City/County Management Association representative and former City Manager of Annapolis, MD).
Decision Making/Policy Issues Stemming from Hurricane Isabel

**In-class student activity:** Student lead discussion with R. Agee on comparisons between different city approaches (response and preparedness).

**Out-of-class student activity:** Examine the potential trajectories and range of surge presented to the cities of New York, New Orleans, and Annapolis, MD prior to Hurricanes Sandy, Katrina, and Isabel at 1 week, 5 days, 3 days, and 1 day prior to landfall. Select one Hurricane. Using census data, estimate the number of individuals impacted by each projection as the hurricane approached. Pretend that you are the emergency manager for your selected city. At what point would you order an evacuation, for what area, and for how many people? Take into consideration economics, social ties, and physical geography. Explain how you made your decision. Has hindsight played a role in your decision? Include APA citations for the sources of your information in a bibliography.

Feb 7, 2013, Class Ten
Open class discussion on Chertoff and other Hurricane Disaster related quotes and media responses.
**In-class student activity:** Class exercise on finding disaster preparedness and response instructions for Annapolis, New Orleans, New York.

**In-class student activity:** Discussion on levels of unknown science in each of the Hurricane trajectories and magnitude and what it meant for the damage/recovery.

**In-class student activity:** Examining these documents that you have found, and working as a team, identify specific instructions for hurricanes and earthquakes. What are the significant differences between the instructions? How does the nature of the event change the instructions given? Report out your findings via discussion in the last 15 minutes of class.

Week 6
Feb 12, 2013, Class Eleven
Basic science behind earthquakes (plate tectonics, margins, earth structure)

**In-class student activity:** Students will be given a list of 15 scientific questions at the beginning of class that they expected to be able to answer at the conclusion of the lecture. Lecture limited to 55 minutes with open class discussion for the remainder of time.

Feb 14, 2013, Class Twelve
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Basic science behind earthquakes (differences between Haiti and Peru quakes, intraplate earthquakes specifically New Madrid Zone)

**In-class student activity:** Students will be given a list of 15 scientific questions at the beginning of class that they expected to be able to answer at the conclusion of the lecture. Lecture limited to 55 minutes with open class discussion for the remainder of time.

**Out-of-class student activity:** Students are given quotes from the State Prosecutor and defending attorney/ the convicted/ supporters of the scientists related to the L’Aquila Italy quake incident and asked to investigate the science/policy/media connection

Students will track down the source of this quote(s) and write a paper addressing the following: What was the original context of the quote? How is the intersection of science, society and policy reflected in the content of each quote? Cite your sources for the background information/quote in APA format.—for open discussion on Feb 21.

**Week 7**
Feb 19, 2013, Class Fourteen (Guest Lecture: **Prof Zhenming Wang** – University of Kentucky).
Discussion of hazards/risk to cities along New Madrid Zone. How are different cities preparing and how does it vary between bordering states (IN, KY, TN, IL)? What comparisons can be made between US and China?

**Action item:** Pass out papers for Feb 26 in-class project.

Feb 21, 2013, Class Thirteen

**In-class Student activity:** Response of media (Italian vs World) and scientific community to L’Aquila Quake Incident. Open discussion/presentation of homework assigned Feb 5. Jigsaw of four articles on aftermath of L’Aquila ruling. How might this ruling influence future scientists ability to communicate/speculate hazard levels or serve on natural hazard/emergency management committees?

In class activity includes a list of stakeholders in the context of some science project and the student have to indicate challenges and methods of how to communicate.

**Week 8**
Feb 26, 2013, Class Fifteen (Guest Lecture, **Prof. Ayhan Irfanoglu**, Purdue’s Network for Earthquake Engineering Simulation (NEES)
Comparison of risk/response between Haiti and Istanbul to past and future events. Discuss L’Aquila aftermath.

**Out-of-class student activity:** Listen to NPR’s Science Friday podcast on predicting earthquakes. [http://sciencefriday.com/segment/04/10/2009/predicting-earthquakes.html](http://sciencefriday.com/segment/04/10/2009/predicting-earthquakes.html). Complete the quiz posted on Blackboard or reflective paper of statistical correlation or success in science.

Feb 28, 2013, Class Sixteen **Prof. Jeff Trap**
Basic science behind severe storms/tornadoes.
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**In-class student activity:** Students will be given a list of 15 scientific questions at the beginning of class that they expected to be able to answer at the conclusion of the lecture. Lecture limited to 55 minutes with open class discussion for the remainder of time.

**Out-of-class student activity:** Examine an emergency communication plan for a city (posted to Blackboard). What strategies are in place for communicating in the absence of electricity and stable topography/political geography (i.e. streets filled with rubble or buildings collapsed)? Apply the techniques that you have found in the document to create an emergency communication plan for an organization or social group that you are a part of. Submit a one – two page document via blackboard.

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**Week 9**
March 5, 2013, Class Seventeen
Basic Science behind severe storms/tornadoes

**In-class student activity:** Students will be given a list of 15 scientific questions at the beginning of class that they expected to be able to answer at the conclusion of the lecture. Lecture limited to 55 minutes with open class discussion for the remainder of time.

**Out-of-class student activity:** Jigsaw of four articles describing the tornado/ destruction of Greensburg. Students should be prepared to discuss the major events of May 4, 2007 and the weeks after.


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March 7, 2013, Class Eighteen (Guest Lecturer: Mayor Bob Dixson – Greensburg, Kansas).
Discussion of the event, aftermath, decision to rebuild sustainably. Lessons for small towns, big towns, large cities? Has their effort influenced other communities in their recovery effort? What was the role of federal, state, local emergency responders and finances in the immediate and long-term recovery?

**Out-of-class student activity:** Use appropriate sources to compare/contrast the damage from major tornadoes to Greensburg, KS in 2007 and Joplin, MO in 2011. What essential services existed prior to the tornado? What essential services were still viable in the hours just after the tornado?

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**Week 11**
March 19, 2013, Class Nineteen.
Scales of Impact and Preparedness.

**In-class student activity:** In class discussion of homework from March 7.

**In-class student activity:** Frame conversation about timelines of recovery. Have students search on what relationships there are between tornado characteristics and destructive force (width, wind speed, hail). Search on what basic social/municipal functions/services (electricity, medical, water, radio) are most vulnerable at the different tornado conditions and how, if any, of these scale with the size of the town. This will start the students to think about scales of impact and preparedness.

**Out-of-class student activity:** Timeline of recovery. Create a timeline based upon news articles or other appropriate resources for either Greensburg or Joplin, documenting the recovery of the town. Be sure to include the point when essential services resumed. Create a bibliography of the resources that you used in APA format.
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March 21, 2013, Class Twenty (Guest Lecturer: City Manager Ed. Truelove – Greensburg Kansas)
Discussion of the subsequent recovery effort in Greensburg and the outlook for the future of recovery (opportunities/roadblocks). Role of Public and Private sector in sustainable recovery. His recommendations for other Cities---Joplin?

In-class student activity: Engage Mr Truelove on how he is addressing timelines of recovery in the redesign of the Greensburg, KS. Draw from in-class discussions and homework begun on March 19.

Week 12
March 26, 2013, Class Fifteen. Greensburg Recovery
In-class student activity: Jigsaw reading and minute paper assignment

1. Opportunities and challenges in rebuilding tornado-impacted Greensburg, Kansas as “stronger, better, and greener”
Paul, Bimal ; Che, Deborah

2. From Tragedy to Triumph Rebuilding Greensburg, Kansas To Be a 100% Renewable Energy City;
Preprint
2010

3. Disaster reconstruction and business geography following the 2007 Greensburg, Kansas Tornado
Hagelman, Ronald R. ; Connolly, Matthew H. ; Zavar, Elyse M. ; Dahal, Khila R.

Out-of-class student activity: Discussion of the Family Tree analogy in scientific citations. Scientific articles are related in much the same way that a family is. An article is related to other articles via the citations at the end of the article. Those citations generally connect the articles and form a topical relation between the two. The students will create a “Family tree” for the following article:


Using Scopus or Web of Science, create a bibliography of both articles where White (2010) was cited, and articles that White (2010) cites. Skim the articles. Investigate if other cities, state or Federal agencies use Greensburg as an “example” for green recovery. Write a brief (under 1 page) paper describing what you have discovered. Submit along with an APA formatted bibliography of the citing and cited references.

March 28, 2013, Class Sixteen (Guest Lecturer, Prof. Steve Cain. Purdue Extension Disaster Communication Specialist and the Indiana Point of Contact for the Extension Disaster Education Network (EDEN)).
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The March 2, 2012 Tornado—The “Henryville, IN” Tornado. Discuss the organization of the response. How did it vary with county, city? What is the role of private and public funds? How is it different than Greensburg?

Week 13
April 2, 2013, Class Fifteen
**Tentative student activity:** Henryville site

April 4, 2013, Class Sixteen (Mayor’s Office Greensburg, KS)
Open class discussion and consultation with Mayor Dixson and City Manager Ed Truelove of Greensburg about projects for weeks 14-16. Create response/recovery forecasting for medical, utilities, transportation for tornadoes of different size.

Weeks 14-16
Greensburg group projects and presentations. Disaster-Decisions Game Development. VACCINE Project Labs