Climate Change Adaptation and Natural Hazards

1015 Schermerhorn Extension, 6:10-8:10 PM

Instructor: Nada Petrovic, PhD – Postdoctoral Research Scientist at the Center for Research on Environmental Decisions

Email: np2122@columbia.edu (alternative: petrovic@columbia.edu)

Course Description: As the devastating impact of recent natural disasters, such as Hurricane Sandy and the F4 Oklahoma Tornado, indicate, our planet is vulnerable to erratic and extreme weather events. Although no specific natural disaster can be directly attributed to climate change, statistical trends of many types of disasters are likely to shift in upcoming decades. The first half of this course provides an overview of the underlying physical science of climate-related natural disasters, and reviews predicted impacts, if any, of climate change on the frequency and severity of these events (topics covered: hurricanes, tornadoes, floods, drought, wildfires). The second half of the course introduces an economic framework for assessing disaster impacts and an overview of US climate change adaptation policy, with an eye towards disaster risk management. This broad perspective is then applied to New York City and storm adaptation in the wake of Hurricane Sandy as a case study.

Course Goals: Provide students with basic understanding of the physical science underlying natural disasters and their relationship to global climate change. Familiarize students with disaster risk conceptualized as a combination of physical as well as economic factors. Provide a general overview of basic federal policy related to natural disasters and tools to critically examine examples of local adaptation efforts, using NYC as a case study.

Course Assignment: 5-7 page paper, due at the beginning of class on December 23

Each student will complete a case study of a specific natural disaster that occurred in the last 10 years selected from a list of options (or selected on his/her own with instructor’s approval). Please cite all of your sources and try to use a variety. Suggested sources: government reports, scientific papers, class readings. Please do not cite Wikipedia.

The paper should cover the following:

- Summary of the basic physical science of this disaster type (paraphrased from class to show understanding), and an assessment of how extreme this disaster was from the physical perspective.
- Explanation of how (if at all) occurrences of this type of natural disaster will be impacted by climate change (paraphrased from class to show understanding). Is this specific geographic region from the case study likely to be affected again?
- Summary of human and economic losses due to this specific disaster
- Assessment of whether physical strength of disaster, economic context, or policy failures were the primary cause of loss. You may choose to use the vulnerability framework to discuss this section.
- Summary of climate change adaptation or disaster adaptation measures that were or should have been in existence at the time of this disaster and assessment of their adequacy.
- Recommendation of adaptation measures that should be implemented in the future to avoid a reoccurrence
- Identification of policies (federal, state, local) that can help with or hinder implementation of recommendations

Day 1 (Nov 25th): Course overview, introduction to climate change, natural disasters and climate change (Part 1: hurricanes)

Readings:
- *IPCC Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation: Summary for Policy Makers*
- *Tropical Cyclones and Climate Change* Knutson et al
- *IPCC 4th Assessment Report Working Group 1, Summary for Policymakers* (optional)

Lecture:
- Brief introduction to the course and specifically to disaster risk as a confluence of vulnerability, exposure, and climate (as framed in IPCC reading).
- *Climate Change*: Brief overview of the underlying physical science and the major predicted effects.
- *Hurricanes*: Physical science of hurricanes and projected impact of climate change on future trends (and effects we may be seeing already).

Day 2 (Dec 3): Effects of climate change on natural disasters (Part 2: tornadoes, floods, droughts, wildfire)

Readings:
- *Anthropogenic greenhouse gas contribution to flood risk in England and Wales in autumn 2000* Pall et al
- *Drought under global warming, a review* Dai
- *Climate change and disruptions to global fire activity* Moritz et al
- *Does Global Warming Influence Tornado Activity* Diffenbaugh, Trapp & Brooks (optional)

**Lecture:**
- *Tornadoes, floods, drought, wildfires:* Physical science of phenomena, projected impact of climate change on future trends (and effects we may be seeing already).

### Day 3 (Dec 9): Economics of disaster impacts, vulnerability framework

**Readings:**
- *The Economics of Natural Disasters: A Survey* Cavallo and Noy
- *The Death Toll From Natural Disasters: The Role of Income, Geography and Institutions* Kahn
- *The determinants of vulnerability and adaptive capacity at the national level and the implications for adaptation* Brooks, Adger and Kelly
- *Natural Hazards UnNatural Disasters* UN & the World Bank pgs 23-32, 41-63

**Lecture:**
- Overview of the economics of disaster loss. Introduction to basic cost statistics and drivers of cost for various natural disasters in the world and US.
- Vulnerability framework: Disaster risk conceptualized as a combination of physical, economic, and political factors
- Case studies: Illustration of disasters with similar physical characteristics resulting in starkly different outcomes, due to economic and political context.

**Assignment (due next week):**
Each student will select the case study they will be analyzing and research potential adaptation methods for that disaster type. Bring in or email a 200 word summary of findings and also be prepared to speak informally about them in class next week.

### Day 4 (Dec 16): Federal and state policy related to climate change and natural disasters, guest lecture by Courtney St. John (previously Climate Change Affairs Officer for the United States Navy’s Task Force Climate Change)

**Readings:**
- *The President’s Climate Action Plan*
• Optional: Watch President Obama’s speech on Climate Action Plan
• Executive order: “Preparing the United States for the Impacts of Climate”
• Please choose any 2 of the following:
  o Federal Actions for a Climate Resilient Nation: Progress Report of the Interagency Climate Change Adaptation Task Force
  o Encouraging Adaptation to Climate Change: Long-Term Flood Insurance Kunreuther and Michel-Kerjan
  o Fire and sustainability: considerations for California’s altered future climate Moritz and Stephens
  o Agricultural Adaptation to a Changing Climate Malcolm et al

Lecture:
• Overview of adaptation options for US-based disasters.
• Overview of federal and state climate change adaptation policy with special focus on planning for natural disasters.
• Courtney St. John will speak about her policy-making experience at the United States Navy’s Task Force Climate Change as it relates to natural disasters and security issues as well as climate change adaptation.

Day 5, Dec 23: Cities as leaders in climate change adaptation, NYC as a case study with focus on Hurricane Sandy

Readings: TBA

Lecture:
• Overview of the role of cities in climate adaptation.
• Summary of natural hazards relevant for NYC and their role in the current climate adaptation plan.
• Case study of Hurricane Sandy with focus on lessons learned and future adaptation.