SUSC PS 5040 - Spring 2024

Sustainability in the face of Natural Disasters

Thursdays, 6:10-8:00 PM - 3 Credits

Instructors:

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Course Overview

Natural hazards, naturally occurring phenomena that can lead to great damage and loss of life, pose a great challenge for the sustainability of communities around the world. This course aims to prepare students to tackle specific hazards relevant to their life and work by providing them the scientific background and knowledge of the environmental factors that combine to produce natural disasters. The course will also train students about the methods used to study certain aspects of natural hazards and strategies for assessing risk and preparing communities and businesses for natural disasters. The course will cover a range of natural hazards, including geological, hydro-meteorological, and biological. The course will emphasize the driving physical, chemical and biological processes controlling the various hazards, and the observation and modeling methods used by scientists to assess and monitor events. Many case examples, including hurricanes, earthquakes and volcanic eruptions that occurred in the last five years, will be given and analyzed for the characteristics of the event, the preparation and the response.

By providing students with a solid understanding of past natural disasters, the course prepares them to think more critically about creating more resilient communities that can resist catastrophic events. Students will be studying the underpinning scientific principles of natural disasters but will also learn specific strategies for planning, mitigation, and response. During the course, students will master cutting-edge tools and technologies that will prepare them to work in the complex and demanding field of disaster management. After completing the course, students will be able to understand past events, communicate risk, and make critical decision related to disaster and preparedness. In increasingly unpredictable times, there is a need for more resilient and connected communities, and this particular course will train students in both the knowledge and skills needed to lead and strengthen those communities and resilience efforts at scale.

Format: The course will meet once a week for two hours. In most weeks, the first hour will be dedicated to an overview of physical processes controlling a specific natural hazard, and the second hour will be devoted to a discussion of case studies of that phenomena and

group activities. The case examples will frequently be presented by students working in small groups. Towards the end of the semester, a role-playing exercise simulating a natural disaster scenario will let students reflect on the concepts and skills they have acquired.

This course is approved to satisfy the Area 4 – Scientific Tools for Responding to Sustainability Challenges curriculum area requirement for the M.S. in Sustainability Science.

Learning Objectives

By the end of this course, students will be able to:

L1: Identify and describe the scientific principles, both physical and social, entrenched in natural disasters

L2: Identify and collect valuable information from different types of natural disasters for policy and decision-making

L3: Provide insight into the methods and tools needed in the response and mitigation of natural hazards

L4: Analyze a natural hazard case study comprehensively from beginning to end to account for pre-hazard assessments, determine the tools needed for forecasting, and develop a relevant preparedness plan for a community

Readings

Primary text book:
Abbott, Patrick L. *Natural Disasters*, 9th edition. McGraw-Hill Education. New York, NY: 2014. pp 479.

Secondary books:

1. Abubakar, I. et al., *Infectious Disease Epidemiology*. Oxford University Press, Oxford UK: 2016.
2. Haddow, George, Jane Bullock, and Damon P. Coppola. *Introduction to emergency management*. Butterworth-Heinemann, 2017.
3. Raub, Robert M., John Walsh, and Donna Charlevoix. *Severe and Harzadous Weather: An introduction to high-impact meteorology*, 5th Edition. Kendall Hunt Publishing, 2017.

Course Requirements (Assignments) and Assessment

Analysis Assignments (L1, L2, L3)

Four homework assignments will ask students to review the subjects covered in class and serve to measure their ability to apply their knowledge. The assignments will be in the form of problem sets that present quantitative case-based challenges based on the materials that have been covered. The students will have to respond with a written solution that demonstrates their problem-solving abilities.

The first, second, and fourth assignments will focus on hydro-meteorological and biological processes. The students will search for and download data, perform mapping and data analysis, and will interpret the results (L2, L3).

The third assignment will focus on hazards related to the Solid Earth. Students will be asked to download information from online sources, analyze the data, and assess the level of community vulnerability and the expected risk (L1, L2).

Other Assignments and Case Study Discussions (L1, L2, L3, L4)

During the 8 hazard-specific weekly sessions, students will read papers and discuss case studies of that week's topic. Presentations by the students will discuss a variety of topics, such as the information available before the event and any forecasting and assessment that was or should have been done, a data-centric description of how the event unfolded and what processes were important to limit or enhance damage, as well as review the response efforts. These discussions will have a different format each week, for instance, presentations, in-depth discussions of papers, debates on possible solutions, and in-class activities on the topic.

Final project (L1, L2, L3, L4)

Students will submit a final project in small groups, in which they will decide to focus on a specific aspect of a disaster, such as preparing a mitigation plan for a company or city to prepare for a potential hazard that might impact these in the future, or have a specific suggestion on how to improve the communication of the hazard to the public. The students will select the site and hazard, discuss these with the instructors, present an outline by the 7th week of the semester, and submit a project plan by the 9th week. The groups will present the projects to the class in the two last weeks of the semester. The final project will be due during the university's final exam week. Projects will be limited to 10 pages of text including figures and references.

Evaluation/Grading

Problem Sets (4 x 8% each – total 32%):
All problem sets will be graded from 0-100. The weight of each problem on a problem set will be clearly stated. Calculation problems will be graded on the correctness of the answer, calculation procedure, and explanation of the procedure. Essay problems will be graded on relevance to asked material.

Other Assignments and Case Study Discussions (8 x 4% each – total 32%):
The Case Study discussions will be graded on a scale of 0-100. Presentations will be assessed for the thoroughness of the research and presentation (were all types of relevant information considered? did the student use a variety of information sources?), level of discussion (did the student exercise critical thinking when reporting the case, or simply stated the facts?) and level of class engagement in all class discussions.

Final Project (1st outline 8% + 2nd outline 8% + oral presentation 10% + paper 10% = total 36%):
Final projects will be graded from 0-100. Evaluation criteria will be similar to those of the case study presentation in terms of thoroughness (Were all types of relevant information considered? did the student use a variety of information sources?), quality of both written and oral presentations (level of writing, use of graphics, preparedness, quality of slides), and reasoning of the arguments. The grade will be given based on the timely submission of a first outline on week 5 (8%), a more complete outline on week 7 (8%), an oral presentation on week 13 or 14 – each group will be assigned go one of the weeks – (10%) and a paper on the final project due on the week of exams (10%).