

**THE PENNSYLVANIA STATE  
UNIVERSITY**

## GEOSC 402 NATURAL DISASTERS

TU: 10:10 - 12:05 - DEIKE 017  
THU: 10:10 - 12:05 - DEIKE 006

INST: KEVIN P. FURLONG  
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Is anywhere safe from natural disasters? Can we hide, or should we learn to live with the hazards around us? This course will explore the causes, effects, and societal response to disasters. By learning from previous disasters, we can develop strategies to avert the disasters or at a minimum mitigate their effects. We will look at a variety of natural hazards and related disasters including flooding, volcanoes, earthquakes, hurricanes, and tsunamis. By the use of laboratory exercises we will determine how damaging disasters can be, and what we can do to minimize their impact on society. 2 hrs lect. and disc., 2 hrs lab.

This course will provide an in-depth, hands-on study of natural hazards, their geography, and their impact on societies worldwide. We will focus on both the physical processes (e.g. underlying geology or geophysics) of selected natural hazards and the human systems that have developed to minimize the impact of natural disasters.

The course will place emphasis on laboratory exercises to investigate processes and responses to natural hazards, and will meet for one lecture and one lab period each week. Grading will be based on *laboratory reports* and a *term exercise/report*.

The course will use recent occurrences of Natural Disasters to investigate the causes and consequences of hazards including: FLOODING, EARTHQUAKES, VOLCANIC ERUPTIONS, LANDSLIDES, TSUNAMI, AND HURRICANES.

### ***Background***

This course will treat a branch of environmental science which is often forgotten - that of natural disasters. This topic is timely and important as the United Nations has designated the 1990's as the International Decade of Natural Disaster Reduction (IDNDR). The course will include a practicum which will allow students 'hands on' experience in evaluating the causes and consequences of natural events. This Practicum will cover the issues from both the scientific and societal sides. Not only will the underlying causes of natural hazards be discussed, but also through lecture and laboratory exercises the impact of such hazards on society (and the role of societal actions in enhancing or mitigating the hazards) will be developed.

Text: *EARTHSHOCK Climate, Complexity and the Forces of Nature*, Andrew Robinson

Course Grading:

Lab Reports (~ 6 reports)	50%
Term Report	30%
Final	20%

***Term Exercise/Report:***

- Natural Hazard Assessment Report for Major U.S. Metropolitan Area (Seattle - Tacoma, WA)

Preliminary Syllabus

WEEK	Chap.	TOPIC	PRACTICUM EXERCISE
1	1/2	Introduction to Course; Concepts of Natural Disasters; Geography of Disasters	
2,3	6	Flooding: Rainfall and Drainage; Susquehanna vs. Mississippi	Hurricane Agnes and the flooding of the Susquehanna River Basin - Harrisburg, PA
4,5	3	Earthquakes: Causes, locations, magnitudes, intensity, ground shaking and damage; role of bedrock; Losses (property and life)	Loma Prieta - magnitude, ground acceleration, bedrock geology, insurance claims
6,7	4	Volcanoes: Causes, locations, predicting eruptions, types of hazards; human activities	Predicting Volcanic Eruptions
8	8	Landslides, Land failure	Mount St. Helens - landslide, devastation, flooding, timber losses, environmental recovery
9,10	6 (review)	Tsunamis, Causes, Consequences	Global Tsunami Hazards; warning systems
10,11	5	Hurricanes: Causes, geography, rates of occurrence; Hazards: wind, rain, storm surge, flooding	Hurricane Andrew: Path, storm surge(?), damage. Impact on insurance industry
12,13		Barrier Islands, Coastal Processes	
14	7,9	Droughts, Global Climate Change	Term Report Due
15		Role of human activities; Course Wrap-Up	

Fall 1995

**Meteo 497B**

**NATURAL DISASTERS SEMINAR**

**2 Credits**

T 11:15-12:05; F 2:30-3:20, 413 Rider II Bldg.

Instructor: Gregory S. Forbes  
415 Rider II  
863-2458

- Text:**
- (1) Bryant, E.A., 1991: *Natural Hazards*. Cambridge Univ. Press, 294pp, paperbound.
  - (2) Course note packet from ProCopy -- at Student Book Store.
  - (3) optional -- *Natural and-Technological Disasters*, S.K. Majumdar, G.S. Forbes, E.W. Miller, R. Schmalz, eds., Penna. Acad. Sci., Easton, PA, 561pp. Forbes has acquired a supply from PAS and is reselling them at cost: \$36.00.

**Course prerequisites.** Meteo 411 required; Meteo 414--Mesoscale Analysis and Forecasting, prerequisite or concurrent, or equivalent professional experience in mesoscale meteorology

**Philosophy of the Course.** Operational meteorologists--whether employed by the National Weather Service or other governmental agency, by private firms, by television stations, or in industrial positions--often must serve as the resource person to field questions by supervisors, colleagues, and the public concerning real-time natural disasters of all types. The course must provide the background of information needed to answer these questions. Some lectures and reading assignments, therefore, will cover a range of topics, intended to give meteorology students a survey-level knowledge of a variety of natural and technological disasters. To add depth to the course content, other lectures and student projects and presentations will seek to advance the students' advanced-level understanding of disasters of meteorological origin.

**Nature of the Course; Grading.** The course will consist of a mixture of (1) lectures by the instructor and invited guest speakers, (2) skill-building assignments; (3) student research projects, and (4) student presentations. Some class periods will be omitted in order to allow time for individual student-instructor consultation sessions concerning term projects. Each student will prepare an individual term project, consisting of a case study of a natural disaster. Cases must be approved by the instructor. The first person to sign up for a case gets it. Each student will give a short in-class summary of the project during the last few weeks of the semester, worth 14%. A written report will be due on the last day of classes, worth 30%. Case selection by the assigned deadline will be worth 3%. Quizzes covering the lectures, reading materials, and student presentations will be worth 30%. Assignments will be worth 15%. Participation will be worth 5%.

**Course objectives.** There are at least four objectives of the course: (1) to provide the students with a survey-level knowledge concerning a variety of disasters, sufficient to allow them to answer questions from the public; (2) to teach the students some specific techniques often used in investigating meteorological disasters; (3) to give the students experience in writing a disaster survey report; (4) to give the students experience in verbally presenting disaster information.

**DISASTER** -- a catastrophic event affecting a community or communities and causing damage of sufficient magnitude and extent that external assistance is required in the relief, cleanup, and rebuilding process. That is, the scope of the event is sufficiently broad that individual and community resources are insufficient to restore conditions to normal without help from the State and/or Federal government.

**RECIPE FOR DISASTER** (i.e., more than just a hazardous phenomenon is required):

Extreme natural event

Occurrence in densely populated area

Fatality rate accelerated by lack of preparedness planning or warning

**Topics and reading assignments.** (Schedule to be announced)

Disaster Overview

Tornadoes

Hurricanes

Flash Floods

River (Main Stem) Floods

Severe thunderstorms (wind, hail, lightning)

Meteorological Hazards to Aviation; Ships

Blizzards; Ice Storms; Cold Waves

Avalanches

Drought; Heat Waves

Wildfires

Volcanoes

Earthquakes

Tsunamis (tidal waves)

Landslides

Relief Infrastructure; Insurance

Rare phenomenon risk assessment

Governmental Agencies, Programs, Policies, Regulations

Preparedness Planning

Chase Teams; Spotter Networks

Damage Survey Techniques

Expert Legal Testimony

STUDENT PRESENTATIONS

## **Investigative Technique Assignments:**

F-scale assessment

Damage mapping using aerial photographs

Photogrammetric techniques: site location quantitative use of images in damage mapping

## **TOPICS WE PROBABLY WON'T HAVE TIME FOR**

Potential disasters due to climatic change:

- ozone depletion
- global warming, sea level rise
- global warming, world food production
- radioactive waste

Catastrophic extinction of the dinosaurs

Air pollution disasters

Technological disasters in which natural phenomenon was not primary cause (nuclear accidents; building failures; toxic spills; transport accidents) but played role in disaster