

# GEOGRAPHY 3310

## INTRODUCTION TO NATURAL HAZARDS

GEOG 3310 - 001

3 credit hours

FALL SEMESTER 2016 SYLLABUS

**Class Meetings:** 2:00 - 3:20 PM Tuesday, Thursday

- **Instructor:** Larry Coats
- **Office telephone number:** 587-9325
- **Office location:** Old Law Building (Building 73) Room 214
- **E-mail:** larry.coats@geog.utah.edu

**Office hours:** 9:00-10:00 AM Tuesday and 12:30-1:30 PM Thursday, or by appointment

**Required Text:** *Natural Hazards: Earth's Processes as Hazards, Disasters, and Catastrophes- Third Edition* by Edward Keller and Duane DeVecchio, Prentice Hall, 2012. ISBN: 9780321662644.

**SMARTPHONES OFF, PLEASE!**

### Catalog Description of Course

**Introduction to Natural Hazards** Fulfills Physical Life Science Exploration. Is your house on the Wasatch Fault? Is it likely to be flooded, or buried by a landslide? How likely are tornadoes in the Salt Lake Valley? This course examines the physical principles of naturally occurring geologic and weather processes, methods of investigating hazards, techniques for assessing risk, and methods of mitigation. Course focuses on earthquakes, landslides, floods, debris flows, and other hazards. Lectures will draw on Utah examples of these hazards whenever possible, and present current understanding of the magnitude of the hazard, areas at risk, recurrence intervals, and mitigation measures. Homework projects will be directed towards identifying global and local areas where hazards exist.

### Introduction

This course provides an introduction to the Earth's natural hazards by studying landforms and the processes that shape them. The emphasis will be on identifying stable and unstable landscapes, recognition and assessment of natural hazards, and ways to reduce or mitigate risk. Through 1) class lectures, 2) course readings, 3) and homework assignments, students will learn about hazards associated with earthquakes, landslides, climate change, severe weather, floods, and other natural hazards. At the end of the course the student should be able to recognize hazards and understand the physical processes that create these hazards. The student will also be familiar with procedures for conducting investigations, quantifying hazards, and implementing mitigative measures.

### Course Suggestions and Objectives

This class is intended as an introduction to Earth-system processes, specifically the study of natural hazards associated with these processes. In addition to learning discipline-specific information, I hope you will practice all your well-developed academic skills including the following: 1) using critical thinking skills to assess the validity of information, 2) taking good quality notes, 3) getting the most out of what you read in the textbook and assigned readings, 4) preparing well for tests, 5) finding information on your own, and possibly most importantly 6) how to think about the world with a geographic understanding. For many of you, this class may be your first (or only) science course, and studying for science may emphasize different skills than those with which you are most familiar. Geography is, for the most part, an observable discipline - it is with us and around us all the time. Because of this, you can often picture the various concepts. I believe that if you can draw or map the various concepts, etc., you will

automatically understand it too. If something is difficult to comprehend, remember, or convey, try drawing it. Draw it, label the various parts, and annotate it - this provides a picture of the subject that should be in your mind even during "exam blackout"!

A major objective of this course is to familiarize you with the methods and practices of Earth scientists to gain knowledge about natural processes that may operate on extremely long time scales. To do this we will not only study the processes themselves but also methods of collecting data, quantifying hazards, and assessing risks. At the end of the course you should have a solid understanding of the scientific method as practiced by Earth scientists.

In this course we will cover the major natural hazards that mankind must deal with, such as earthquakes, volcanoes, severe weather, floods, etc. by examining the following aspects of hazard analysis: 1) the fundamental principles of the Earth-system processes, 2) methods of investigation for hazard assessment, 3) quantitative assessment of hazard magnitudes, 4) predictive models for hazard behavior, and 5) methods for mitigating hazards.

### Learning Outcomes

By the end of *GEOG/ENVST 3310 Introduction to Natural Hazards* students will be able to explain the role of science in understanding, forecasting, predicting, and mitigating natural hazards. Concerning seismic hazards, students will be able to evaluate the scientific evidence for plate tectonics, and integrate the concept of plate boundaries with natural processes such as earthquakes, tsunami, volcanic activity, and mass movements. Students will be able to estimate the severity of earthquake-generated ground movement based on quantitative and qualitative scales, and describe and map the risk of seismic hazards in North America. Concerning gravity-driven hazard processes, students will be able to classify mass wasting movement styles based on velocity, internal structure and deformation, hydrologic aspects, and the shape, size, and composition of the material involved. Concerning hydrologic and atmospheric processes, students will be able to describe, explain, and illustrate the natural and artificial causes of river flooding, and the connection of flooding to atmospheric phenomena, as well as describing and explaining other weather phenomena such as hurricanes, tornadoes, and drought. Students will also be able to describe and explain the causes and possible effects of climate changes. Students will finally evaluate the roles of scientists, educators, public officials, and individuals in addressing the ethical and social responsibilities of natural hazards information, and devise strategies that the individual or institutions could adopt to reduce the risks of natural hazards. Students will demonstrate the accomplishment of these outcomes by correctly answering quiz and test questions that require definitions for key concepts (recalling information), explanations for important processes (restating in your own words), interpretations of hazard datasets (analysis of scientific data), and evaluation of multiple lines of evidence to synthesize unique viewpoints on hazard solutions (problem solving). In addition, students will complete two homework assignments that will require them to evaluate potential hazards (both globally and locally), rank those hazards from most to least likely to occur, and propose mitigation strategies that could reduce or eliminate the hazards for local populations. The overall goal of this class is produce a group of citizens well-educated about natural hazards and hazard processes in order to promote rational decision making about development and risk in an increasingly more populated world.

### RECOMMENDATIONS FOR SUCCESS IN THIS CLASS:

1. Take notes!
2. Study figures carefully, annotate them, make your own.
3. Don't multi-task!

### Grading

Final grades are earned on the basis of the overall accumulated points. There will be unannounced quizzes, two equally weighted exams, and two homework assignments: *Global Hazards* and *Hazard Assessment*. These assignments are intended for you to gain experience in identifying natural hazards that threaten diverse urban environments. Details on these assignments will be provided in the weeks to come.

Quizzes (best 5 count)	50 points
Exam #1	150 points
Global hazards assignment	50 points
Hazard assessment assignment	50 points
Final exam	<u>150 points</u>
Total	450 points

A (4.0 points)= 94% (450-423 points) A- (3.7 points)= 90% (422-405 points)	Excellent performance, superior achievement
B+ (3.3 points) 85% (404-382 points) B (3.0 points) 82% (381-369 points) B- (2.7 points) 80% (368-360 points)	Good performance, substantial achievement
C+ (2.3 points) 75% (359-337 points) C (2.0 points) 72% (336-324 points) C- (1.7 points) 70% (323-315 points)	Standard performance and achievement
D+ (1.3 points) 65% (314-292 points) D (1.0 points) 62% (291-279 points) D- (0.7 points) 60% (278-270 points)	Substandard performance, marginal achievement
E (0.0 points) below 60% (<270 points)	Unsatisfactory performance and achievement

NO EXTRA CREDIT is offered in this course, with the possible exception of bonus questions on exams. I DO NOT accept late work, unless prior arrangements have been made.

If you ever have questions or problems relating to this course (or other classes for that matter!), please see me at your earliest convenience. Most of these situations can be positively handled if discussed early!

\*\* The instructor reserves the right to make additions, deletions, and modifications to the syllabus and course requirements with notification to the students enrolled in the class.

*“So it is perhaps appropriate that at 5:12 A.M. on that Wednesday morning the earthquake that was born out under the ocean beyond the Golden Gate seemed to come roaring into the city, as eyewitnesses like to remember, along the four switchback miles of Washington Street.*

*It made its entrance in a spectacular, horrifying, unforgettable way. It came thundering in on what looked like huge undulating waves, with the entire surface of the earth and everything that stood upon it seeming to lift up and then roll in forward from the direction of the ocean. The whole street and all its great buildings rose and fell, rose and fell, in what looked like an enormous tidal bore, an unstoppable tsunami of rock and brick and cement and stone.”*

\*Account of the beginning of the Great California Earthquake of 1906 in Simon Winchester’s book *A Crack in the Edge of the World* (2005).

## TENTATIVE SEMESTER SCHEDULE

DAY	DATE	DISCUSSION TOPIC	READINGS
T	8/23	Introduction to natural hazards	Chapter 1
Th	8/25	Scientific method/ Earth structure	Chapter 2
T	8/30	Earth structure & Plate Tectonics	Chapter 2
Th	9/1	Earthquakes & their causes	Chapter 3
<i>F</i>	<i>9/2</i>	<i>Last day to drop/delete</i>	
<i>M</i>	<i>9/5</i>	<i>LABOR DAY HOLIDAY</i>	
T	9/6	Earthquakes (continued)	Chapter 3
Th	9/8	Earthquakes (continued)	Chapter 3
T	9/13	Earthquake prediction & mitigation	Chapter 3
Th	9/15	Tsunamis	Chapter 4
T	9/20	Tsunamis	Chapter 4
Th	9/22	Volcanoes	Chapter 5
T	9/27	Volcanoes (continued)	Chapter 5
Th	9/29	Volcanoes (continued)	Chapter 5
T	10/4	Mass wasting	Chapter 7
Th	10/6	Mass wasting (continued)	Chapter 7
<i>M-F</i>	<i>10/8-10/16</i>	<i>-----FALL BREAK-----</i>	
T	10/18	Mass wasting (continued)	Chapter 7
Th	10/20	<b>**MIDTERM EXAM**</b>	Chapter 8
<i>F</i>	<i>10/21</i>	<i>Last day to withdraw</i>	
T	10/25	Climate change & weather hazards	Chapter 12
Th	10/27	Climate change (continued)	Chapter 12
T	11/1	Climate change (continued)	Chapter 12
Th	11/3	Streams & floods	Chapter 6
		<b><i>World Hazards assignment due</i></b>	
T	11/8	Streams & floods (continued)	Chapter 6
Th	11/10	Streams & floods (continued)	Chapter 6
T	11/15	Hurricanes	Chapter 10
Th	11/17	Hurricanes (continued)	Chapter 10
T	11/22	Tornadoes	Chapter 9
<i>T/F</i>	<i>11/24-27</i>	<i>-----THANKSGIVING HOLIDAY----</i>	
T	11/29	Tornadoes (continued)	Chapter 9
Th	12/1	Wildfires	Chapter 13
T	12/6	Extra-terrestrial hazards	Chapter 14
		<b><i>Hazard Assessment assignment due</i></b>	
Th	12/8	Course wrap-up	
<i>F</i>	<i>12/9</i>	<i>UU READING DAY</i>	

**FINAL EXAM:** THURSDAY, DECEMBER 15, 1:00 PM in this classroom.

### University of Utah Attendance Policy

The University expects regular attendance at all class meetings. **You are not automatically dropped from your classes if you do not attend.** You must officially drop your classes by the published deadline to avoid a "W" on your record.

You are responsible for satisfying the entire range of academic objectives, requirements and prerequisites as defined by the instructor. If you miss the first 2 class meetings, or if you have not taken the appropriate requisites, you may be required to withdraw from the course.

If you are absent from class to participate in officially sanctioned University activities (e.g. band, debate, student government, intercollegiate athletics), religious obligations, or with instructors approval, you will be permitted to make up both assignments and examinations.

### **University of Utah Standards of Academic Conduct**

All students are expected to maintain professional behavior in the classroom setting, according to the Student Code, spelled out in the Student Handbook. Students have specific rights in the classroom as detailed in Article III of the Code. The Code also specifies proscribed conduct (Article XI) that involves cheating on tests, plagiarism, and/or collusion, as well as fraud, theft, etc. Students should read the Code carefully and know they are responsible for the content. According to Faculty Rules and Regulations, it is the faculty responsibility to enforce responsible classroom behaviors, beginning with verbal warnings and progressing to dismissal from and class and a failing grade. Students have the right to appeal such action to the Student Behavior Committee.

### **University of Utah Center for Disability Services**

The University of Utah seeks to provide equal access to its programs, services and activities for people with disabilities. If you will need accommodations in the class, reasonable prior notice needs to be given to the Center for Disability Services, 162 Union Building, 581-5020 (V/TDD). CDS will work with you and the instructor to make arrangements for accommodations.