Term Information

Effective Term	Autumn 2022

General Information

Course Bulletin Listing/Subject Area	Earth Sciences
Fiscal Unit/Academic Org	School of Earth Sciences - D0656
College/Academic Group	Arts and Sciences
Level/Career	Undergraduate
Course Number/Catalog	2540
Course Title	Learning from disasters: Extreme events and their impact on infrastructure, engineering and society
Transcript Abbreviation	Learn from disast
Course Description	Introduction to six dimensions of sustainability while learning the main impacts and threats caused by various extreme events through the study of academic publications and reports covering six major extreme events. Long term impacts and recovery from extreme events, how historical decisions in planning, engineering and/or urban development, legislation play important roles.
Semester Credit Hours/Units	Fixed: 4

Offering Information

Length Of Course	14 Week
Flexibly Scheduled Course	Never
Does any section of this course have a distance education component?	Yes
Is any section of the course offered	100% at a distance
Grading Basis	Letter Grade
Repeatable	No
Course Components	Lecture
Grade Roster Component	Lecture
Credit Available by Exam	No
Admission Condition Course	No
Off Campus	Never
Campus of Offering	Columbus, Lima, Mansfield, Marion, Newark, Wooster

Prerequisites and Exclusions

Prerequisites/Corequisites	None
Exclusions	Not open to students with credit for CivilEn 2540
Electronically Enforced	Yes

Cross-Listings

Cross-Listings	Cross-listed in CivilEn

Subject/CIP Code

Subject/CIP Code	40.0601
Subsidy Level	General Studies Course
Intended Rank	Freshman, Sophomore, Junior, Senior

Requirement/Elective Designation

Sustainability

Course Details

Course goals or learning objectives/outcomes

- Successful students will recognize and explain the multifaceted impacts that disasters resulting from extreme events have on people, communities, infrastructure, society, and nature.
- Successful students will apply multidisciplinary approaches from science and engineering to preparedness and hazard mitigation associated with of extreme events, including community preparedness, vulnerability, infrastructure robustness, resilience.
- Successful students will analyze and explain how social and natural systems function, interact, and evolve over time; how human wellbeing and sustainability depends on these interactions;
- how actions have impacts on subsequent generations and societies globally; and how human values, behaviors, and institutions impact multi-faceted, viable solutions across time.

Content Topic List

- Examples and introduction to sustainability's six dimensions framework

  Hurricanes (wind and precipitation)

  Hurricanes (rescue and recovery)

  Lasting effects of extreme events and measures to increase resilience

  Global warming and sustainability
- Dam failures and flooding

  Wildfires, landslides and debris flows

  Earthquakes and tsunamis (hazard and effects)

  Extreme event disasters in developing countries

Sought Concurrence

Yes

Attachments

- CurriculumChairLetter-newGE-hazards.pdf

  (Concurrence. Owner: Griffith,Elizabeth M)
- GE Learning from Disasters - Submission-sustainability 2021-12-15.pdf: Sustainability submission application

  (Other Supporting Documentation. Owner: Griffith,Elizabeth M)
- CIVILEN_EARTHSC_2540_interdisciplinary-team-taught-inventory.pdf: Team taught inventory

  (Other Supporting Documentation. Owner: Griffith,Elizabeth M)
- response to Jeremie Smith's recommendations.pdf: Response to ODE recommendations

  (Other Supporting Documentation. Owner: Griffith,Elizabeth M)
- CE2540+ES2540 - asc-distance-approval-cover-sheet.pdf: ASC Distance Approval Cover Sheet signed

  (Other Supporting Documentation. Owner: Griffith,Elizabeth M)
- Proposed syllabus of CE course - 2021-12-16.docx: revised syllabus

  (Syllabus. Owner: Griffith,Elizabeth M)

Comments

- CIVILEN 2540 is already submitted - pending approval with ASCCAO 1/27/22

  05/02/22 - This course does not count in one of our major programs, so no curriculum map was included.

  The ASC ODE reviewed the course and the signed ASC Distance Approval Cover Sheet is attached along with responses to recommendations from ODE. A revised syllabus was uploaded following these recommendations. *(by Griffith,Elizabeth M on 05/02/2022 08:35 AM)*

- - If this course can count in one of your majors, please upload an updated curriculum map.
  - It does not appear that this course has been reviewed by ASC ODE(?). Please follow instructions here https://asccas.osu.edu/curriculum/distance-courses *(by Vankeerbergen,Bernadette Chantal on 04/19/2022 12:41 PM)*

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Griffith,Elizabeth M	03/09/2022 08:54 AM	Submitted for Approval
Approved	Griffith,Elizabeth M	03/09/2022 08:54 AM	Unit Approval
Revision Requested	Vankeerbergen,Bernadette Chantal	04/19/2022 12:41 PM	College Approval
Submitted	Griffith,Elizabeth M	05/02/2022 11:23 AM	Submitted for Approval
Approved	Griffith,Elizabeth M	05/02/2022 11:24 AM	Unit Approval
Approved	Vankeerbergen,Bernadette Chantal	05/02/2022 12:00 PM	College Approval
Pending Approval	Cody,Emily Kathryn Jenkins,Mary Ellen Bigler Hanlin,Deborah Kay Hilty,Michael Vankeerbergen,Bernadette Chantal Steele,Rachel Lea	05/02/2022 12:00 PM	ASCCAO Approval

New distance learning, high impact interdisciplinary team taught Civil Engineering/Earth Sciences GE Sustainability Theme 4-units course:

"CivilEng 2540/EarthSc 2540: Learning from disasters: Extreme events and their impact on infrastructure, engineering and society"

INSTRUCTORS

CEGE (Civil Engineering): Dr. Daniel Pradel
Email address: pradel.1@osu.edu
Zoom Meeting Room: https://osu.zoom.us/my/pradel (password: geo)

SES (School of Earth Sciences: Dr. Ashley Griffith and Dr. Derek Sawyer
Email address: griffith.233@osu.edu and sawyer.144@osu.edu

Course credit hours: 4

COURSE PREREQUISITES

None.

INTRODUCTION

This document contains a joint proposal for a 4-unit Integrative Practice course in Sustainability. The proposed course will be taught by faculty from both, the School of Earth Sciences (SES) of the College of Arts and Sciences, and the Department of Civil, Environmental and Geodetic Engineering (CEGE). The course was designed to fulfill one of the approved Thematic Pathways of our University's new General Education Program Structure and is aligned with the goals and outcomes in Re-envisioning of General Education at Ohio State[1].

[1] https://oaa.osu.edu/general-education

The proposed course is an expanded version of a course that was previously taught as a 1 credit hour freshman seminar (ARTSCI-1137.24-010) between AU2019 and AU2020 by Prof. Daniel Pradel. It is noteworthy to mention that in 2020, the course was selected by the American Council on Education (ACE) to be part of the U.S.-Japan Rapid Response Virtual Exchange/Collaborative Online International Learning (COIL) Transformational Lab[2] and that the course was taught remotely, which allowed OSU students to work in teams with students in Japan from Tsukuba University.

In October, 2021, an expanded proposal of the course (3-units) was prepared and reviewed by OSU's Sustainability Education and Learning Committee (SELC). Additional modifications to the course proposal were made based on the feedback received by SELC including an emphasis aimed at fulfilling the *"Sustainability Thematic Pathway" requirement, as well as requirements for a 4-credit Interdisciplinary Team-Taught Course as defined in our University GE Program Structure[3].*

The proposed course will be taught by instructors from both Civil, Environmental, and Geodetic Engineering in the College of Engineering, and the School of Earth Sciences in the College of Arts and Science that have extensive knowledge and experience with extreme events, including:

- Dr. Pradel has participated in numerous extreme event reconnaissance missions after earthquakes, tsunamis, hurricanes, floods, dam and levee failures, landslides, and debris flows funded by NSF, ASCE…
- Dr. Sawyer led an NSF-funded Rapid Response data collection mission in St. John, U.S. Virgin Islands in 2017 immediately after the island experienced disasters from consecutive Category 5 hurricanes (Irma and Maria). Dr. Sawyer´s research also includes extreme events caused by underwater landslides, earthquakes, and tsunamis in locations around the world.
- Dr. Griffith conducts research on the physics of earthquakes and landslides, as well as how megathrust earthquakes interact with volcanic eruptions in the southern Andes. His work on these topics has been funded by the NSF, Southern California Earthquake Center (SCEC), National Earthquake Hazard Reduction Program (NEHRP), and FONDECYT (the Chilean National Fund for Scientific and Technological Development). Dr. Griffith also serves as the co-lead for Earthquake Geology on the Science Planning Committee for SCEC.

In addition, the course will feature speakers from different disciplines that address hazards/disasters. A list of potential speakers (including topics) is presented at the end of this document.

[2] https://oia.osu.edu/news/ohio-state-and-university-of-tsukuba-awarded-coil-partnership/ and https://ceg.osu.edu/news/2020/07/geotechnical-engineering-faculty-develop-course-japanese-colleagues

[3] https://oaa.osu.edu/sites/default/files/uploads/general-education-review/implementation/New-GE-Structure-Aug-2020.pdf

COURSE DESCRIPTION:

Extreme events, such as hurricanes, heat waves, flooding, earthquakes, landslides, volcanic eruptions, and tsunamis, are of great importance because of their potential to cause extensive damage and impacts on people, infrastructure, and nature. Although extreme events are widely reported by the news media, news reporters generally concentrate on aspects that are visually or emotionally appealing and rarely cover the topic after a few weeks or months. The study of extreme events is multidisciplinary and many disciplines are engaged in research, mitigation, and management of these events, e.g., climatology, earth sciences, engineering, hydrology, ecology, and social sciences. Furthermore, studying the effects from extreme events, their consequences and response to these events, requires lengthy research; thus, authoritative academic studies and government reports often appear a considerable time after an extreme event. In this course, students will be introduced to six dimensions of sustainability while learning the main impacts and threats caused by various extreme events through the study of academic publications and reports covering six major extreme events.

The course is structured in a seminar type format, where students will first perform individual scholarly research about a specific case history, then work with other students on a thematically organized presentation, and lastly participate in class discussions. Through the study of case histories, students will research and gain in-depth multidisciplinary knowledge about extreme events, their relation with our environment, and the different approaches that societies have implemented to mitigate disasters and their consequences. During class discussions, students will discuss the case histories in terms of preparedness, vulnerability, effects, robustness, flexibility, and resilience, which are important from a sustainability perspective. Students will also examine the impact of local legislation, wealth/poverty, political decisions, local characteristics, and the major impacts that various engineering design methods/concepts had on damage. The case histories, will include extreme weather events that had devastating environmental effects and long lasting economic as well as social consequences, e.g., hurricanes Katrina (2005)and Maria, Irma and/or Harvey in 2017. Other natural extreme events may include the 2011 Tohoku earthquake and ssunami in Japan, the 2010 Haiti earthquake, and/or the 2015 Gorkha earthquake in Nepal. The case histories will also include man-made disasters, such as dam and levee failures, the damage to the powergrid in Puerto Rico in 2017, and/or the tsunami related melt-down of the Dai-Ichi nuclear plant in Japan in 2011.

Through the study of case histories, students will gain an understanding of the long term impacts and recovery from extreme events, which are important from a sustainability perspective. Recovery from extreme events is long and very costly, as exemplified in New Orleans after hurricane Katrina in 2005, and in Puerto Rico after hurricane Maria in 2017 (both events with estimated total costs in excess of $160B). Students will also examine the effects of extreme events in developing countries, where limited resources often result in medical threats from infectious diseases due to lack of clean water and emergency medical services (e.g., 2010 Haiti and 2015 Nepal earthquakes); similarly, how historical

decisions in planning, engineering and/or urban development, as well as legislation play important roles that often magnify the destructive effects of extreme events (e.g., the levee construction/design methods and urban planning used in New Orleans, the urban planning in the center of Kobe in Japan, the Jones Act that restricts the boats and crews that could deliver emergency supplies to Puerto Rico).

Since most global warming models predict a sharp increase in the number, as well as severity, of extreme events it is important to learn from past disasters, in order to reduce their potential for destruction and improve resilience.

OSU GENERAL EDUCATION PROGRAM STRUCTURE

Course Goals:

GOAL 1: Successful students will recognize and explain the multifaceted impacts that disasters resulting from extreme events have on people, communities, infrastructure, society, and nature.

GOAL 2: Successful students will apply multidisciplinary approaches from science and engineering to preparedness and hazard mitigation associated with of extreme events, including community preparedness, vulnerability, infrastructure robustness and resilience.

GOAL 3 (SUSTAINABILITY): Successful students will analyze and explain how social and natural systems function, interact, and evolve over time; how human wellbeing and sustainability depends on these interactions; how actions have impacts on subsequent generations and societies globally; and how human values, behaviors, and institutions impact multi-faceted, viable solutions across time.

Expected learning outcomes:

Successful students are able to:

GE ELOs:

GE 1.1 Locate and select information sources that are credible, relevant and appropriate to the context.

GE 1.2 Demonstrate critical and logical thinking by analyzing and integrating information from multiple sources and disciplines.

GE 1.3 Read, listen, compose and speak in a variety of genres and modalities for a range of purposes and audiences.

GE 1.4 Apply learned concepts and skills to new situations.

GE 2.2 Use methods of research, inquiry, creativity and discovery across disparate disciplines to generate and respond to socially and ethically important topics.

GE 3.3 Describe, analyze and critique the roles and impacts of human activity on both human society and the natural world.

GE 4.1 Describe and apply skills needed to maintain resiliency and personal well-being in contemporary society.

GE 4.3 Employ technology effectively and ethically to enhance academic, professional and personal life.

GE 4.4 Appreciate and participate in a culture of engagement and service.

GE 4.5 Work collaboratively with others to achieve shared goals.

Sustainability Theme ELOs:

ELO 1.1: Engage in critical and logical thinking about extreme events.

ELO 1.2: Engage in an advanced, in-depth, scholarly exploration of extreme events.

ELO 2.1: Identify, describe, and synthesize approaches or experiences as they apply to extreme events.

ELO 2.2: Demonstrate a developing sense of self as a learner through reflection, self-assessment, and creative work, building on prior experiences to respond to new and challenging contexts

ELO 3.1: Describe, analyze and critique the roles and impacts of human activity on both human society and the natural world currently and in the future.

ELO 3.2: Devise informed and meaningful responses to problems and arguments in the area of sustainability based on the interpretation of appropriate evidence and an explicit statement of values.

Sustainability Six Dimensions Framework

1) **Systems:** coupled human-natural systems, integrating environmental, economic & social factors, systems thinking, resilience
2) **Environment:** environmental, earth, and natural resource systems; knowledge of planetary/natural systems, e.g., climate, aquatics, soils, forests, wildlife, geology, ecology, agriculture; understanding of how these systems impact human well-being (e.g., health, economy, social justice, future generations)

3) **Economic-political:** economic and political factors of sustainability (economy/consumption/ production; laws/policy/governance/institutions; business/strategy/management; costs/benefits/tradeoffs)
4) **Social-cultural:** social/cultural factors of sustainability (justice, equity, values, ethics, history, religion, the arts, citizenship, power, behavior and decision making, cultural critique...)
5) **Technology & design:** engineering; technological innovation; systems design; human-machine interface; manufacturing processes; life cycle; product design (design of technology and infrastructure to promote sustainability and human well-being)
6) **Well-being:** human health, safety, risk, sustainable livelihoods, social welfare and well-being

COLLEGE OF ENGINEERING ASSESSMENT

ABET Accreditation Program Learning Outcomes:

None

Engineering learning outcomes:

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

- Identify the main impacts and threats caused by extreme events.
- Identify methods used to prevent and/or mitigate extreme events, and their immediate as well as long-term consequences.
- Identify how regulations, building codes and mitigation methods change following extreme events, and evolve through time.
- Understand how managers, designers and engineers apply mitigation and design procedures intended to reduce the impacts caused by extreme events
- Understand the importance of resilience in the development of infrastructure.

Earth Science learning outcomes:

- By the end of this course, students should successfully be able to: Describe the physical, chemical, and/or biological processes that drive extreme events
- Understand feedback loops between natural and anthropogenic factors that cause extreme events
- Identify precursory phenomena that allow scientists and engineers to monitor and/or predict extreme events
- Describe monitoring methods for extreme phenomena

HOW THIS COURSE WORKS

Mode of delivery:

The lectures are 100% online and will be conducted on Zoom at their scheduled time.

Participating in online activities for attendance:

Instructor will hold Zoom live lectures, where students are expected to attend and participate (e.g., make group presentations). There will be Top Hat quizzes on a regular basis during these lectures and students must be connected in order to answer them. The live lectures will be recorded and links to lectures will be available shortly thereafter.

Office Hours and Live Sessions:

Office hours will be held at their scheduled time via Zoom. For students on the Columbus campus, in-person office hours are optional.

Credit hours and work expectations:

According to Ohio State policy, students should expect for each 4 hours per week of time spent on direct instruction (instructor content and Carmen activities, for example) about 12 hours of time of homework (reading and assignment preparation, for example) to receive a grade of (C) average.

Prerequisites:

None.

Required Activities and Deliverables:

- Students are expected to attend all Zoom sessions (live lectures) and participate in seminar discussions.
- Weekly readings, student presentations, and individual research are expected.
- We expect that students will have the opportunity of working with peers from foreign universities (e.g., the University of Tsukuba[4], in Japan, where a similar course is approved). The type, format and extent of the participation will depend on the respective enrollment in the universities and will be detailed once the semester has begun.
- Prior to each student presentation session, students will submit a research report regarding an aspect (assigned by instructor) of a case history and their group PowerPoint presentation (examples of previous assignments are attached). The text portion of the research reports should be about ~500 words long (title and references excluded). There is no limit to the number of figures and/or photos that can be attached in a separate appendix.
- Student presentations will be in groups of two to four students (depending on course enrollment) and will focus on a particular impact (assigned by instructor) of an extreme event (e.g., economic impact, flooding, transportation, power generation, clean water, impact of legislation, political setting, economics, medical needs, etc.). Depending on the topic assigned by the instructor, student presentations will address some or all of the following:
    - A brief description of the assigned topic and its main effects (e.g., type of devastation, health threats, economic impacts);
    - Preparedness of the city/region/country prior to the extreme event;
    - Remedial measures implemented after the extreme event;
    - Short vs. long term consequences of the extreme event;
    - Prevalence of the impact and increased risks following the event;
    - Societal and behavioral impacts;

[4] http://www.tsukuba.ac.jp/en/

- Inequalities in disaster preparedness, data collection, emergency response and allocated ressources;
- Impact of local legislation and/or political setting;
- News coverage, what is commonly remembered, and urban myths associated with the events;
- Strategies for reducing similar threats (e.g., implemented elsewhere).
- All student Presentations should have:
  - A "title" slide that identifies team members;
  - A slide where the main sources/references are listed;
  - A "summary of findings" slide(s) at the end of the presentation.

COURSE MATERIALS AND TECHNOLOGY

Required textbooks:

None

Suggested Readings/Resources

To research a topic the preferred source of information for students' research papers are academic/scholarly publications, professional societies reports, government reports. Examples of such publications are presented below:

2015 Gorkha Earthquake (Nepal)

Tiwari B., Pradel D., et al. (2018), "Landslide Movement at Lokanthali, during the 2015 Earthquake in Gorkha, Nepal ASCE Journal of Geotechnical and GeoEnvironmental Engineering, 10.1061/(ASCE) GT.1943-5606.0001842

GEER/NSF reports from:

http://www.geerassociation.org/administrator/components/com_geer_reports/geerfiles/Nepal_GEER_Report_V1_15.pdf

2011 Tohoku earthquake and tsunami (Japan)

Pradel D., Tiwari B., and Wartman J. (2011), "Landslides Triggered by 2011 Tohoku Pacific Earthquake: Preliminary Observations", Geo-Strata (ASCE's Geo-Institute) Sept./Oct. 2011, 28-32

Pradel D., Wartman J., and Tiwari B. (2014), "Impact of anthropogenic changes on liquefaction along the Tone River during the 2011 Tohoku Earthquake", ASCE Natural Hazards Review. Vol.15, 13-26.

Pradel D., Wartman J., and Tiwari B. (2013), "Failure of the Fujinuma Dams during the 2011 Tohoku Earthquake", ASCE Geo-Congress 2013: Stability and Performance of Slopes and Embankments III, GSP 231, 1566-1580.

2005 Hurricane Katrina (New Orleans only)

FEMA (2006) "Hurricane Katrina in the Gulf Coast Mitigation Assessment Team Report Building Performance Observations, Recommendations, and Technical Guidance" FEMA 549 report

NIST (2006) "Performance of Physical Structures in Hurricane Katrina and Hurricane Rita: A Reconnaissance Report" NIST Technical Note 1476

2005 La Conchita landslide (California)

Pradel D. (2014), "The Progressive Failure Reactivation of La Conchita Landslide in 2005", ASCE Geo-Congress 2014: Geo-Characterization and Modeling for Sustainability, GSP 234, 3209-3222.

2017 Hurricane Irma & Maria (Puerto Rico only)

GEER/NSF report from http://www.geerassociation.org/administrator/components/com_geer_reports/geerfiles/180629_GEER_PR_Report_No_GEER-057.pdf

1928 St Francis Dam Failure (California)

Rogers, J. D. (2006, 6:2). Lessons Learned from the St. Francis Dam Failure. Geo-Strata, 14-17.

Rogers, J. D. & Hasselmann, K. F. (2013). The St. Francis Dam Failure: Worst American Engineering Disaster of the 20th Century. AEG Shlemon Specialty Conference: Dam Failures and Incidents. Denver: Association of Environmental and Engineering Geologists.

VandenBerge, D. R., Duncan, J.M., & Brandon, T. (2011). Lessons Learned From Dam Failures. Virginia Polytechnic Institute and State University.

2020 Edenville and Sanford Dam Failures (Michigan)

Pradel D. and Lobbestael A.. (2021) Edenville and Sanford Dam Failures, Field Reconnaissance Report. ASCE GSP327[5].

COURSE TECHNOLOGY:

General

For help with your password, university email, Carmen, or any other technology issues, questions, or requests, contact the Ohio State IT Service Desk. Standard support hours are available at ocio.osu.edu/help/hours, and support for urgent issues is available 24/7.

- Self-Service and Chat support: ocio.osu.edu/help
- Phone: 614-688-4357(HELP)
- Email: servicedesk@osu.edu
- TDD: 614-688-8743

Proctoring:

During lectures, some questions (e.g., Top Hat quizzes) may be graded using automatic proctoring tools.

Baseline technical skills for online courses:

- Basic computer and web-browsing skills
- Navigating Carmen: for questions about specific functionality, see the Canvas Student Guide

Required technology skills specific to this course:

- Zoom virtual meetings
- Microsoft Office 365, especially Excel for graphs and PowerPoint for drawings

[5] Book was accepted for publication and should appear in August, 2021. A copy of the cover provided by the publisher is attached.

Required equipment:

- Computer: current Mac (OS X) or PC (Windows 7+) with high-speed internet connection
- Other: a mobile device (smartphone or tablet) or landline to use for BuckeyePass authentication, as well as Top Hat quizzes.
- Webcam: built-in or external webcam, fully installed and tested
- Microphone: built-in laptop or tablet mic or external microphone

Required software:

- Microsoft Office 365: All Ohio State students are now eligible for free Microsoft Office 365 ProPlus through Microsoft's Student Advantage program. Full instructions for downloading and installation can be found at go.osu.edu/office365help.

Carmen access:

You will need to use BuckeyePass multi-factor authentication to access your courses in Carmen. To ensure that you are able to connect to Carmen at all times, it is recommended that you take the following steps:

- Register multiple devices in case something happens to your primary device. Visit the BuckeyePass - Adding a Device help article for step-by-step instructions.
- Request passcodes to keep as a backup authentication option. When you see the Duo login screen on your computer, click "Enter a Passcode" and then click the "Text me new codes" button that appears. This will text you ten passcodes good for 365 days that can each be used once.
- Download the Duo Mobile application to all of your registered devices for the ability to generate one-time codes in the event that you lose cell, data, or Wi-Fi service.

If none of these options will meet the needs of your situation, you can contact the IT Service Desk at 614-688-4357 (HELP) and IT support staff will work out a solution with you.

Carmen Website:

All course material will be posted on the Carmen site at http://www.carmen.osu.edu.

Material and submissions:

Lectures: Instructor's PowerPoint slides will be posted ahead of the CarmenZoom live lectures. In advance of each lecture, students are expected to have researched the subject topic and read the slides.

Assignments: A total of 6 research reports are anticipated, that require constant and continuous effort throughout the semester. Hence, students should plan ahead, and it is their responsibility to budget their time appropriately.

Presentations: A total of 6 group presentations are anticipated. Students' PowerPoint slides will be posted on Carmen ahead of the lecture, and students are expected to have researched the case history in advance of the lecture.

GRADING AND FACULTY RESPONSE

Grading:

Boundaries between grades are firm (there will be no rounding).

- Research reports 40%
- Group presentations 40%
- Class participation 15%
- Top Hat quizzes 5%

Grade	Point %
A	100% - 93%
A-	90% - 92%
B+	87% - 89%
B	83% - 86%
B-	80% - 82%
C+	77% - 79%
C	73% - 76%
C-	70% - 72%
D+	67% - 69%
D	60% - 66%
E	0% - 59%

Attendance:

Attendance is expected to all CarmenZoom live lectures, so that students can obtain the information necessary to comprehend the course material, make relevant presentations, participate in group discussions, etc. Attendance should enable students to successfully complete assignments and/or improve performance. Instead of taking attendance, there will be multiple-choice quizzes administered through ***Top Hat*** during most live lectures. The Top Hat quizzes will contribute to the grade and help instructor assess students' learning.

Assignments

- Students will have a week to complete their assignments, and all submissions will be due 3 hours before the relevant discussion session or lecture (e.g., if student presentations are assigned during lectures on a Monday, all Carmen submissions will be due 3 hours ahead of the meeting on the following Monday).
- Late submission will not be accepted (grade = zero). In case of severe illness, the student shall notify the instructor as soon as possible and submit a doctor's note, and/or other properly documented similar extenuating circumstance.
- Handwritten submissions are not allowed, and all assignments are to be submitted electronically in CARMEN. Students shall submit their reports and presentations as a single PDF file. Emailed assignments and/or different formats will not be accepted, nor receive points (grade = zero).

Grading and feedback:

- Feedback on homework and lab reports will be provided on Carmen, typically within a week.
- Instructor typically replies to emails within 24 hours
- Excused absences from quizzes and exams include illnesses for which you have a doctor's note, and/or other properly documented similar extenuating circumstance.

Tone and civility:

Let's maintain a supportive learning community where everyone feels safe and where people can disagree amicably. The instructors are committed to making the classroom a comfortable space for all of us, and we ask that we all work toward this goal in all of the course's online spaces. We will respect each other and practice civility at all times. Disrespectful language will not be tolerated.

Academic integrity policy:

Quizzes and exams: You must complete the midterm and final exams yourself, without any external help or communication.

Written assignments: Your written assignments, should be your own original work.

Reusing past work: In general, you are prohibited in university courses from turning in work from a past class to your current class, even if you modify it. If you want to build on previous work or revisit a topic you've explored in previous courses, please discuss the situation with instructor.

Falsifying data or results: All the analyses you will conduct in this course are intended to be a learning experience; you should never feel tempted to adjust or modify data/results.

Collaboration and informal peer-review: The course includes many opportunities for formal collaboration with your classmates. While study groups and peer-review of written projects is encouraged, remember that written reports you submit must be your own work.

Ohio State's Academic Integrity Policy: Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, The Ohio State University and the Committee on Academic Misconduct (COAM) expect that all students have read and understand the university's *Code of Student Conduct*, and that all students will complete all academic and scholarly assignments with fairness and honesty. Students must recognize that failure to follow the rules and guidelines established in the university's *Code of Student Conduct* and this syllabus may constitute "Academic Misconduct."

The Ohio State University's *Code of Student Conduct* (Section 3335-23-04) defines academic misconduct as: "Any activity that tends to compromise the academic integrity of the university or subvert the educational process." Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Ignorance of the university's *Code of Student Conduct* is never considered an excuse for academic misconduct, so I recommend that you review the *Code of Student Conduct* and, specifically, the sections dealing with academic misconduct.

If we suspect that a student has committed academic misconduct in this course, we are obligated by university rules to report our suspicions to the Committee on Academic Misconduct. If COAM determines that you have violated the university's *Code of Student Conduct* (i.e., committed academic misconduct), the sanctions for the misconduct could include a failing grade in this course and suspension or dismissal from the university.

If you have any questions about the above policy or what constitutes academic misconduct in this course, please contact me.

Other sources of information on academic misconduct (integrity) to which you can refer include:

- The Committee on Academic Misconduct web pages (COAM Home)
- *Ten Suggestions for Preserving Academic Integrity (Ten Suggestions)*
- *Eight Cardinal Rules of Academic Integrity* (www.northwestern.edu/uacc/8cards.htm)

Copyright disclaimer

The materials used in connection with this course may be subject to copyright protection and are only for the use of students officially enrolled in the course for the educational purposes associated with the

course. Copyright law must be considered before copying, retaining, or disseminating materials outside of the course.

Statement on Title IX

All students and employees at Ohio State have the right to work and learn in an environment free from harassment and discrimination based on sex or gender, and the university can arrange interim measures, provide support resources, and explain investigation options, including referral to confidential resources.

If you or someone you know has been harassed or discriminated against based on your sex or gender, including sexual harassment, sexual assault, relationship violence, stalking, or sexual exploitation, you may find information about your rights and options at titleix.osu.edu or by contacting the Ohio State Title IX Coordinator at titleix@osu.edu. Title IX is part of the Office of Institutional Equity (OIE) at Ohio State, which responds to all bias-motivated incidents of harassment and discrimination, such as race, religion, national origin and disability. For more information on OIE, visit equity.osu.edu or email equity@osu.edu.

Your mental health

A source available at s a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing. If you find yourself feeling isolated, anxious or overwhelmed, please know that there are resources to help: ccs.osu.edu. You can reach an on-call counselor when CCS is closed at (614) 292-5766 and 24 hour emergency help is also available through the 24/7 National Prevention Hotline at 1-(800)-273-TALK or at suicidepreventionlifeline.org. The Ohio State Wellness app is also a great resource go.osu.edu/wellnessapp.

Accessibility accommodations for students with disabilities

Requesting accommodations

The university strives to make all learning experiences as accessible as possible. If you anticipate or experience academic barriers based on your disability including mental health, chronic or temporary medical conditions, please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, we may request that you register with Student Life Disability Services (SLDS). After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion.

SLDS contact information: slds@osu.edu; 614-292-3307; 098 Baker Hall, 113 W. 12th Avenue.

Accessibility of course technology

This online course requires use of Carmen (Ohio State's learning management system) and other online communication and multimedia tools. If you need additional services to use these technologies, please request accommodations with your instructor.

- CarmenCanvas accessibility
- Streaming audio and video
- CarmenZoom accessibility
- Collaborative course tools

Classroom Safety and Respect

CEGE Buckeyes take pride in masking up and physically distancing to protect others in public spaces. As members of the Ohio State University community, these actions are part of our personal and ethical responsibility to protect public health and safety.

HOW WILL MULTIPLE PERSPECTIVES BE PRESENTED AND DISCUSSED IN THIS ONLINE FORMAT?

Ensuring this Online Course will be Interdisciplinary and Interactive

The course centers on a number of specific case studies of natural hazards, each of which include inquiry into the fundamental scientific principles involved for each hazard, and feedbacks between societal, political, and engineering challenges; hence, is interdisciplinary in nature.

In this online course, the instructors will keep the content interactive and interdisciplinary in the following ways:

1. The engineering challenges, including impacts on structures, infrastructure, disaster assistance, economy, recovery, public policy, society and ramifications of political policy, will be presented by the instructor from Civil Engineering. The scientific aspect of each hazard, including the natural processes involved and methods of monitoring and hazard analysis will be presented by the instructor from the School of Earth Sciences.
2. Each case study will culminate in sessions where students will make thematic presentations, participate in interactive synthesis discussions (see section below), and submit reports where they synthesize information across and between disciplines covered in this interdisciplinary course.
3. Students will benefit from additional perspectives provided by external speakers from government agencies, private industry, and other universities who will discuss their real-world experience studying and mitigating effects of natural hazards covered in the course. A list of prospective speakers is provided at the end of this document. These visits will also be interactive with Q&A time built int the visit for students and speaker to engage directly.

Thematic student presentations and Discussions

For each thematic topic, students will be divided into groups and assigned a specific topic of research (a sample assignment with a list of topics is provided below). During student presentations instructors will act as moderators and encourage questions form other teams and group discussions. The format of the sessions will be similar to that of a graduate student seminar where challenging each other opinions is encouraged. The instuctors will moderate sessions according to their area of expertise (e.g., disaster assistance and recovery will be moderated by the instructor from Civil Engineering), and/or their field reconnaissance experience.

PROPOSED SCHEDULE

Week No.	Class No. / Title
1	**Introduction:** Scope and organization of the course, discussion of Syllabus and student deliverables; group assignments. Examples and introduction to sustainability's six dimensions framework: 1) Systems: coupled human-natural systems, integrating environmental, economic and social factors, systems thinking, resilience 2) Environment: environmental, earth, and natural resource systems; knowledge of planetary/natural systems, e.g., climate, geology, ecology; understanding of how these systems impact human well-being (e.g., health, and economy) 3) Economic-political: economic and political factors of sustainability (economy/consumption/production; laws/policy/governance/institutions; business/strategy/management; costs/benefits/tradeoffs) 4) Social-cultural: social/cultural factors of sustainability (justice, equity, values, ethics, history, religion, citizenship, power, behavior and decision making, cultural critique...) 5) Technology & design: engineering; technological innovation; systems design; human-machine interface; manufacturing processes; life cycle; product design (design of technology and infrastructure to promote sustainability and human well-being) 6) Well-being: human health, safety, risk, sustainable livelihoods, social welfare and well-being Highlighred numbers below indicate which dimensions of sustainability are covered primarily.
2	**Hurricanes (wind and precipitation):** Instructor presentation on the effects of Hurricanes Irma and Maria in Puerto Rico and US Virgin Islands (#1, 2 and 3). Assignment of specific topics related to hurricanes for student presentations **Hurricanes (rescue and recovery):** Instructor presentation on rescue efforts and recovery after a major hurricane and Puerto Rico's recovery after Hurricane Maria (#4 and 6). **Lasting effects of extreme events and measures to increase resilience:** Instructor presentation on the short and long term effects of Hurricane Katrina in New Orleans, and measures taken at the local and federal level to decrease New Orleans vulnerability of levees and buildings (#5).. Assignment of specific topics related to global warming for student presentations
3	**Thematic student presentations No.1 (hurricanes) / submission of report No.1**
4	**Global warming and sustainability:** Recent experience along the Gulf Coast, from Katrina in 2005 to the historical 2020 season (which ran out of hurricane names and had to use Greek letters); increased number of devastating hurricanes in recent decades and predictions from global warming models (#2)..

5	**Thematic student presentations No.2 (rescue, recovery and global warming) / submission of report No.2**
6	**Dam failures and flooding:** Instructor presentation on the causes and effects of the 1928 St Francis Dam Failure (California), 1976 Teton Dam Failure (Idaho) and 2020 Edenville Dam Failure (Michigan) (#1, 3 and 5).. Assignment of specific topics related to dam failures for student presentations
7	**Thematic student presentations No.3 (dam failures and flooding) / submission of report No.3**
8	**Wildfires, landslides and debris flows:** Instructor presentation on the 2005 landslide at La Conchita in California and 2014 Oso Landslide in Washington; deforestation caused by wildfires followed by erosion and debris flows (#2, 3, 4 and 6).. Assignment of specific topics for student presentations regarding landslides and mudflow disasters.
9	**Thematic student presentations No.4 (wildfires, landslides and mudflows) / submission of report No.4**
10	**Earthquakes and tsunamis (hazard and effects):** Instructor presentation on the effects of the 2011 Tohoku Earthquake and tsunami in Japan and on the geological record of past Eartquakes and tsunami events offshore of Japan (#1, 2, 3, 5 and 6).. Assignment of specific topics related to earthquakes for student presentations
11	**Thematic student presentations No.5 (Earthquakes and Tsunamis) / submission of report No.5**
12	**Extreme event disasters in developing countries:** Instructor presentation on the effects of the 2010 Haiti Earthquake and 2015 Gorkha Earthquake in Nepal (#2, 3, and 6). Assignment of specific topics for student presentations
13	**Thematic student presentations No.6 (disaters in developing countries) / submission of report No.6**
14-15	**Discussions and conclusions:** In-class discussions on topics including: vulnerability to extreme events, effects of global warming, lessons learned from case histories, preparedness, infrastructure robustness, and measures to enhance flexibility and resilience. Students suggestions to enhance resilience and reflections on sustainability (#1 to 6).

Sample Assignment

Report on Puerto Rico's Recovery from the 2017 Hurricane Maria

Individual reports (single bullet) and thematic group presentations shall concentrate on the 2018-2021 recovery period from Hurricane Maria in Puerto Rico. Hence, submissions should only discuss briefly emergency actions taken between October and December 2017.

Group 1: Infrastructure topics (#2, 5 and 6).

- Power generation and electric distribution (electric grid, hydroelectric dams, renewable sources, etc.)
- Water treatment and distribution of drinkable water.
- Transportation (airports, bridges, freeways, traffic lights, etc.)
- Short vs. long-term building repairs (e.g., blue roofs), differences between residential and commercial building repairs, etc.
- Emergency and long-term repairs of hospitals and other public buildings; impact on services

Group 2: Effects of federal legislation and political setting (#3 and 4).

- Impact of the "1920 Jones Act" legislation
- Political representation in Washington (impact of US territory vs. state)
- FEMA's funding, warehouses and asset allocation
- Distribution of federal funds between Texas, Florida and Puerto Rico after the 2017 hurricanes (Harvey, Irma and Maria)

Group 3: Economic topics (#1 and 3).

- Destruction of sources of income (e.g., tourism before vs. after Maria)
- Effect on manufacturing (e.g., pharmaceutical industry) both in Puerto Rico and on the mainland
- Impact of laws such as the "1920 Jones Act" on recovery in Puerto Rico
- Impact of public debt, fiscal policies and corresponding austerity measures of Puerto Rico's government during the decade prior to Maria

Group 4: Public health/wellbeing (#2, 4 and 6).

- Impact of damaged schools, hospitals, pharmacies on Puerto Ricans
- Estimated vs total death toll, and suicide rate
- Environmental impacts from mold and fungi on Puerto Ricans living in damaged buildings
- Impact on the island of residents' migration to the continental USA

Guest Speakers and Presentation Topics[6]

Topic: Sustainability assessment tools to assess or optimize sustainability
Speaker: Krishna Reddy, ASCE Committee on Sustainability

Topic: Reversing the Resilience Divide,
Speaker: William Craig Fugate, former administrator of the Federal Emergency Management Agency (FEMA)

Topic: US Army Corps of Engineers' Research & Development for Tackling the Climate Crisis,
Speaker: David Pittman, U.S. Army Engineer Research and Development Center (ERDC)

Topic: Creation and goals of "Resilient Los Angeles",
Speaker: Craig A. Davis, Water System Resilience Program Manager for the Los Angeles Department of Water and Power

Topic: Realizing Resilience: Living with Extreme Events,
Speaker: Lauren Alexander Augustine, Gulf Research

Topic: Inequalities in Disaster Risk,
Speaker: Susan Cutter, University of South Carolina

Topic: Earthquake flow slide investigation in Indonesia
Speaker: Joseph Whartman, Director of the Natural Hazards Reconnaissance (RAPID) Facility at the University of Washington

Topic: Mitigating climate change effects in coastal communities
Speaker: Navid Jaffari, Mississippi State University

Topic: Lessons from Hurricane Katrina, Lessons and Design Issues revelaed by post-Katrina Studies
Speaker: J. David Rogers, Missouri Science and Technology

Topic: Climate science and what to do about it: The confluence of science, risk management, economics, and policy
Speaker: Kelly Hereid, Director of Catastrophe Research and Development at Liberty Mutual

[6] Tentative list

Liz and Daniel,
I have completed and signed off on the preliminary distance learning review for the **Ear *CivilEng 2540/EarthSc 2540: Learning from disasters: Extreme events and their impact on infrastructure, engineering, and society*** course approval proposal (see signed Cover Sheet attached). This syllabus includes all required syllabus elements and provides a comprehensive overview of the course expectations.

I have a few *recommendations* to improve your syllabus that I hope will be helpful:

- Though ASC DL courses are typically required to use the ASC Syllabus Template, this syllabus was created by the Engineering DL syllabus template that shares the same source as the ASC template (ODEE Online Syllabus Model). For this reason, I do not think it necessary to change the cross-listed team-taught syllabus for the Earth Science listing.

  No change was made following this recommendation. Thank you for the confirmation.

- Under Credit Hours and Work Expectations (page 7 of syllabus) and workload estimation (page 3 of cover sheet), the language for a 1 credit course is still there, the two numbers for time spent per week should be multiplied by 4 for this 4-credit course. I strongly recommend making these consistent to prevent a longer faculty panel course approval process to address confusions.

  Changes (highlighted in red) were made in the syllabus, so it reads on page 7:
  - According to Ohio State policy, students should expect for each 4 hours per week of time spent on direct instruction (instructor content and Carmen activities, for example) about 12 hours of time of homework (reading and assignment preparation, for example) to receive a grade of (C) average.

- On page 13 of the syllabus, there is a section on grading that shows the 4 categories of graded work. I recommend providing a brief description of these assignments in this section of the syllabus to clarify expectations (for students and the faculty committees reviewing the course).

  Thank you for the recommendation, at this time no revision was made to the syllabus following this point because the assignments are expanded elsewhere in the syllabus. However, the instructors will consider adding more details here in future revisions of the syllabus.

The ASC Office of Distance Education strives to be a valuable resource to instructors and departments in the College of Arts and Sciences. In addition to managing the DL course review process, hosting ASC Teaching Forums, and developing an ever-expanding catalog of instructor support resources, we also provide one-on-one instructional design consultation to ASC instructors interested in redesigning any aspect of their online course. If your department or any of your individual instructors wish to meet with one of our instructional designers to discuss how we can provide advice, assistance, and support, please do let me know.

Kindly,

Jeremie Smith
Distance Education Coordinator
ASC Office of Distance Education
The Ohio State University
1775 College Road, 458 Hagerty Hall
Columbus, OH 43210-1340, U.S.A.
smith.12199@osu.edu

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www.earthsciences.osu.edu

15 November 2021

Dear Daniel,

Cc: Steven Lower, Ashley Griffith, Derek Sawyer

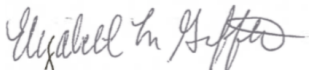
I am writing to express our support for a course proposal for a jointly-offered integrative and high impact 4 credit, online, Interdisciplinary Team-Taught (Civil Engineering/Earth Science) course in the Sustainability Theme of the new GE on the topic of "Learning from disasters: Extreme events and their impact on infrastructure, engineering and society". My understanding is this course will be team-taught by you (Civil Engineering), Derek Sawyer (SES), and Ashley Griffith (SES), and that the course is intended to be targeted at the 2000-level. The course topics and learning objectives are complementary to our Natural Hazards (EARTHSC 1151) course which has been approved in the new GE as a Foundations course in Natural Sciences. Specifically, EARTHSC 1151 focuses on understanding fundamental Earth processes responsible for hazards. Course objectives for EARTHSC 1151 are listed below:

1) Introduce the basic concepts of the Earth Sciences, using natural hazards as examples.
2) Develop an understanding of Earth processes, and an appreciation of the rates and scales at which those processes work.
3) Examine the details of geologic hazards (earthquakes, volcanic eruptions, landslides, tsunamis, flooding, hurricanes, climate change, and meteorite impacts).
4) To examine the influences of geologic hazards on humans, and how humans attempt to mitigate those influences.
5) To understand geologic hazards in Ohio.
6) To apply the scientific method to collect and interpret earth science data.

In contrast, the proposed 2000-level Interdisciplinary Team-Taught course will expand these topics to an advanced study of the engineering and policy dimensions of natural hazards.

Once the proposed course is approved in the new GE, we also intend to propose a new certificate in Natural Hazards which includes both EARTHSC 1151 and the proposed course as core courses, grouped with upper-level electives in Earth Sciences and Civil Engineering. We hope to submit that proposal early in the 2022-2023 academic year. This certificate will complement other popular certificates already offered in the School of Earth Sciences.

Sincerely,



Elizabeth M. Griffith
Associate Director of Administration & Chair of the Curriculum Committee
School of Earth Sciences, griffith.906@osu.edu

GE THEME COURSES

Overview

Courses that are accepted into the General Education (GE) Themes must meet two sets of Expected Learning Outcomes (ELOs): those common for all GE Themes and one set specific to the content of the Theme. This form begins with the criteria common to all themes and has expandable sections relating to each specific theme.

A course may be accepted into more than one Theme if the ELOs for each theme are met. Courses seeing approval for multiple Themes will complete a submission document for each theme. Courses seeking approval as a 4-credit, Integrative Practices course need to complete a similar submission form for the chosen practice. It may be helpful to consult your Director of Undergraduate Studies or appropriate support staff person as you develop and submit your course.

Please enter text in the boxes to describe how your class will meet the ELOs of the Theme to which it applies. Please use language that is clear and concise and that colleagues outside of your discipline will be able to follow. You are encouraged to refer specifically to the syllabus submitted for the course, since the reviewers will also have that document Because this document will be used in the course review and approval process, you should be *as specific as possible*, listing concrete activities, specific theories, names of scholars, titles of textbooks etc.

CivilEng/EarthSc 2540

Course subject & number

General Expectations of All Themes

GOAL 1: Successful students will analyze an important topic or idea at a more advanced and in-depth level than the foundations.

Please briefly identify the ways in which this course represents an advanced study of the focal theme. In this context, "advanced" refers to courses that are e.g., synthetic, rely on research or cutting-edge findings, or deeply engage with the subject matter, among other possibilities. *(50-500 words)*

INTRODUCTION: The proposed course focuses on the interaction of humans and their environment through the study of recent disasters caused by extreme events. The study of extreme events is not only very complex but multidisciplinary in nature, involving fields such as: public health, economics, engineering, urban planning, public policy, law, politics, climate studies, seismology, hazard mitigation, etc. The course is entitled "Learning from disasters: extreme events and their impact on infrastructure, engineering and society" and through the study of case histories concentrates on advanced topics of sustainability, including vulnerability, preparedness, robustness, flexibility, and resilience.

SIGNIFICANCE: During the 2017 hurricane season alone, three storms were responsible for over 4000 deaths and $265 billion in damages in the U.S. Southeast and Caribbean. Climate change projections indicate that extreme events such as droughts, wild fires, floods, hurricanes and typhoons are increasing in number, and importantly also in severity. Hence, it is extremely important from a sustainability perspective, to understand the hazards resulting from extreme events on our societies and the specific vulnerabilities of our various communities, in order to develop measures that improve disaster preparedness, emergency response and resiliency.

COURSE FORMAT: Using major disasters caused by extreme events as context, students will research the nature and effects of specific extreme events, and present in-depth studies of the disasters' emergency response and recovery. For each disaster, students' individual studies will examine the impact of federal and local legislation, wealth/poverty, sociopolitical conditions, climate and geography, and the interconnection of these impacts as well as their larger societal implications; they will also study and discuss the impacts that policies and engineering design methods/concepts have on disaster damages, as well as their effects on recovery. The course is structured as a graduate seminar, in which students are first introduced to a topic through one or more case histories of disasters caused by an extreme event, where the instructor was a member of the reconnaissance mission (e.g., NSF sponsored mission to Puerto Rico after hurricane Maria, ASCE missions to Nepal and Japan after major earthquakes) and provides first-hand account of the conditions immediately after the event. Students are then assigned to groups where they work individually on an assigned specific topic belonging to a theme (see example in syllabus). Students prepare a research report on their specific topic and work with their group on a thematic class presentation. In-class discussions follow the student presentations. At the end of the semester, the course culminates with instructor led discussions, where students evaluate the preparedness of the USA to extreme events, propose solutions, discuss the applicability of foreign approaches, etc.

Course subject & number CivilEng/EarthSc 2540

ELO 1.1 Engage in critical and logical thinking about the topic or idea of the theme. Please link this ELO to the course goals and topics and indicate *specific* activities/assignments through which it will be met. (50-700 words)

PRECONCEIVED IDEAS: Through the news, students are regularly exposed to disasters caused by extreme events such as tsunamis, hurricanes, wild fires, etc. Unfortunately, news reporters concentrate on aspects that are visually or emotionally appealing and rarely cover disasters more than a few weeks after an event. Long term impacts, as well as, topics related to preparedness and recovery, which are important from a sustainability perspective, are rarely considered newsworthy and thus not covered adequately by journalists. Additionally, because journalists are generally not specialized in covering extreme events, their news articles often contain substantial inaccuracies.

CRITICAL THINKING: Through their individual research, group work and in-class discussions, students will reevaluate preconceived ideas as they gain in-depth multidisciplinary knowledge about natural disasters and our environment, the consequences on man-made decisions, and the various actions that different societies have implemented to mitigate extreme events. For example, during the course student will discover country specific measures by which building codes have been incrementally modified to reduce loss of life, how laws have been enacted in some seismically vulnerable countries that mandate earthquake insurance prior to obtaining a home mortgage, how man-made decisions taken immediately after the 2011 Tohoku earthquake resulted in saving the Dai-Ni Nuclear Plant instead of the melt-down experienced by the Dai-Ichi Nuclear Plant a few miles away.

GOALS AND ELOs: The preparation of six individual research papers, group presentations by students, and discussions is best aligned with OSU's “Goal 1 Intellectual and Cognitive Skills” and is linked to the following GE and Sustainability Theme ELOs:
• GE 1.1 Locate and select information sources that are credible, relevant and appropriate to the context.
• GE 1.2 Demonstrate critical and logical thinking by analyzing and integrating information from multiple sources and disciplines.
• GE 3.3 Describe, analyze and critique the roles and impacts of human activity on both human society and the natural world.
• GE 4.5 Work collaboratively with others to achieve shared goals.
• ELO 1.1: Engage in critical and logical thinking about extreme events.
• ELO 1.2: Engage in an advanced, in-depth, scholarly exploration of extreme events.
• ELO 2.1: Identify, describe, and synthesize approaches or experiences as they apply to extreme events.

ELO 1.2 Engage in an advanced, in-depth, scholarly exploration of the topic or idea of the theme. Please link this ELO to the course goals and topics and indicate *specific* activities/assignments through which it will be met. *(50-700 words)*

ACTIVITIES/ASSIGNMENTS: Students will research and prepare six individual research papers on a specific topic related to extreme events (as exemplified in the syllabus). Their research will be multidisciplinary and involve fields such as: public health, economics, engineering, urban planning, public policy, law, politics, climate studies, seismology, hazard mitigation, etc. In groups, students will also prepare thematic class presentations that will be followed by in-class discussions. The course is structured as a graduate seminar which culminates, during the last two weeks of the semester, in instructor led discussions, where students use what they have previously learned to evaluate and discuss the overall preparedness of our country to extreme events; during these last meetings, students are encouraged to use their research to critique constructively the structure of our emergency response system (FEMA, USACE, etc.), the effectiveness of programs such as the National Flood Insurance Programs), mitigation needs, and challenge damage expectations from historical global warming models. During these final meetings, students are highly encouraged to suggests solutions at the federal and local levels, propose mitigation measures, discuss their benefits, costs and/or need for taxation, and challenge each other opinions.

GOALS AND ELOs: The activities/assignments described above are best aligned with the goal: "Successful students will apply multidisciplinary approaches to the study of extreme events, including community preparedness, vulnerability, infrastructure robustness and resilience", and are linked to the following GE and Sustainability Theme ELOs:
• GE 1.2 Demonstrate critical and logical thinking by analyzing and integrating information from multiple sources and disciplines.
• GE 1.3 Read, listen, compose and speak in a variety of genres and modalities for a range of purposes and audiences.
• GE 2.2 Use methods of research, inquiry, creativity and discovery across disparate disciplines to generate and respond to socially and ethically important topics.
• GE 3.3 Describe, analyze and critique the roles and impacts of human activity on both human society and the natural world.
• ELO 2.2: Demonstrate a developing sense of self as a learner through reflection, self-assessment, and creative work, building on prior experiences to respond to new and challenging contexts
• ELO 3.1: Describe, analyze and critique the roles and impacts of human activity on both human society and the natural world currently and in the future.

Course subject & number CivilEng/EarthSc 2540

GOAL 2: Successful students will integrate approaches to the theme by making connections to out-of-classroom experiences with academic knowledge or across disciplines and/or to work they have done in previous classes and that they anticipate doing in future.

ELO 2.1 Identify, describe, and synthesize approaches or experiences as they apply to the theme. Please link this ELO to the course goals and topics and indicate *specific* activities/assignments through which it will be met. *(50-700 words)*

OUT-OF-CLASSROOM EXPERIENCE: The typical out-of-classroom experience that our students have about extreme events is through the news, as they report disasters such as tornadoes, droughts, wild fires, flash floods, dam/levee failures, tsunamis, and hurricanes. Unfortunately, journalists generally concentrate on aspects that are visually or emotionally appealing and rarely cover the topic beyond a few days or weeks. Furthermore, long term impacts, as well as, topics related to preparedness and recovery, which are important from a sustainability perspective are rarely covered by the news media adequately. Additionally, because journalists are generally not specialized in covering extreme events, news articles often contain substantial inaccuracies and/or report poorly supported estimates without quantifying and discussing the uncertainties of the supporting data.

RESEARCH AND SYNTHESIS: Collecting and analyzing data after a natural disaster is resource intensive and time consuming (as shown by the example, below); hence, governmental agencies reports, scholarly articles and comprehensive academic studies, often appear months or years after a major extreme event. During the course, students are encouraged to review authoritative/scholarly sources and compare them with early news reports and announcements by government officials. EXAMPLE: the death toll in Puerto Rico from hurricane Maria in 2017 was originally reported by the government at 13, two weeks later the official number was revised to 16, and revised again two months later to 64. Independent investigations reported the likely number of deaths between 499 (CNN) and 1,052 (NY Times); meanwhile, universities developed statistical models which predicted between 793 and 8,498 deaths. Ten months after hurricane Maria a comprehensive study by researchers from George Washington University indicated 2,975 as the most-likely number of deaths in Puerto Rico, i.e., a number that is very different from governmental and news sources.

IN-CLASS EXPERIENCE: Through in-class discussions students will gain in-depth multidisciplinary knowledge about extreme events, our relationship with the environment, and different approaches that societies have implemented to mitigate disasters. Students will be encouraged to reflect on what was reported in the news and use critical thinking when examining the reported data. During discussions, students will share points of view, and suggest solutions and mitigation measures individually as well as in groups. For example, during the course student will discover and discuss specific measures by which building codes have been modified after each major effort to reduce loss of life in certain communities, how laws were passed in certain seismically vulnerable countries that mandate earthquake insurance prior to obtaining a home mortgage, how man-made decisions taken immediately after the 2011 Tohoku earthquake resulted in saving the Dai-Ni Nuclear Plant instead of the melt-down experienced by the Dai-Ichi Nuclear Plant a few miles away.

GOALS AND ELOs: The activities/assignments described above are best aligned with OSU's "Goal 1 Intellectual and Cognitive Skills" and is linked to the following GE and Sustainability Theme ELOs:
- GE 1.1 Locate and select information sources that are credible, relevant and appropriate to the context.
- GE 1.2 Demonstrate critical and logical thinking by analyzing and integrating information from multiple sources and disciplines.
- GE 2.2 Use methods of research, inquiry, creativity and discovery across disparate disciplines to generate and respond to socially and ethically important topics.
- GE 3.3 Describe, analyze and critique the roles and impacts of human activity on both human society and the natural world.
- GE 4.1 Describe and apply skills needed to maintain resiliency and personal well-being in contemporary society.
- ELO 1.2: Engage in an advanced, in-depth, scholarly exploration of extreme events.
- ELO 2.2: Demonstrate a developing sense of self as a learner through reflection, self-assessment, and creative work, building on prior experiences to respond to new and challenging contexts
- ELO 3.1: Describe, analyze and critique the roles and impacts of human activity on both human society and the natural world currently and in the future.

ELO 2.2 Demonstrate a developing sense of self as a learner through reflection, self-assessment, and creative work, building on prior experiences to respond to new and challenging contexts. Please link this ELO to the course goals and topics and indicate *specific* activities/assignments through which it will be met. *(50-700 words)*

ACTIVITIES/ASSIGNMENTS: The course is structured as a seminar which culminates, during the last two weeks of the semester, in instructor led discussions, where students use what they have previously learned in their research to evaluate and discuss the preparedness of our country to extreme events; students are encouraged to reflect on preconceived ideas (often based on news reports), self-assess their research reports based on information from peer presentations and in-class discussions, as well as critique constructively the government's disaster response, and prevention/mitigation programs. During these concluding meetings, students are highly encouraged to suggests solutions and/or mitigation measures, discuss their benefits, costs and/or need for taxation, share different points of view, and challenge each other opinions.

GOALS AND ELOs: The activities/assignments described above are best aligned with the goal: "Successful students will apply multidisciplinary approaches to the study of extreme events, including community preparedness, vulnerability, infrastructure robustness and resilience", and are linked to the following GE and Sustainability Theme ELOs:
- GE 1.1 Locate and select information sources that are credible, relevant and appropriate to the context.
- GE 1.2 Demonstrate critical and logical thinking by analyzing and integrating information from multiple sources and disciplines.
- GE 2.2 Use methods of research, inquiry, creativity and discovery across disparate disciplines to generate and respond to socially and ethically important topics.
- GE 3.3 Describe, analyze and critique the roles and impacts of human activity on both human society and the natural world.
- GE 4.1 Describe and apply skills needed to maintain resiliency and personal well-being in contemporary society.
- ELO 1.2: Engage in an advanced, in-depth, scholarly exploration of extreme events.
- ELO 2.2: Demonstrate a developing sense of self as a learner through reflection, self-assessment, and creative work, building on prior experiences to respond to new and challenging contexts
- ELO 3.1: Describe, analyze and critique the roles and impacts of human activity on both human society and the natural world currently and in the future.

Course subject & number CivilEng/EarthSc 2540

Specific Expectations of Courses in Sustainability

GOAL 1: Students analyze and explain how social and natural systems function, interact, and evolve over time; how human wellbeing depends on these interactions; how actions have impacts on subsequent generations and societies globally; and how human values, behaviors, and institutions impact multi-faceted, potential solutions across time.

1.1 Describe elements of the fundamental dependence of humans on Earth and environmental systems and on the resilience of these systems. Please link this ELO to the course goals and topics and indicate *specific* activities/assignments through which it will be met. *(50-700 words)*

INTRODUCTION: Disasters caused by extreme events and the impact of anthropogenic changes to our environment are challenging communities worldwide. The proposed course addresses the interaction of humans and the environment through the study of recent disasters caused by extreme events; it focuses on various aspects of sustainability, including vulnerability, preparedness, robustness, flexibility, and resilience. The study of extreme events is not only very complex but multidisciplinary in nature, involving fields such as public health, economics, engineering, urban planning, public policy, law, politics, climate studies, seismology, and hazard mitigation.

Using case histories of hurricanes, wild fires, dam/levee failures, floods, earthquakes, and tsunamis, as context, students will research using academic and scholarly publications the nature and effects of specific extreme events, and present in-depth studies of the disasters' emergency response and recovery. For each disaster, students will examine the impact of local legislation, wealth/poverty, political decisions, laws, climate and geography, and the interconnection of these impacts as well as their larger societal implications. They will study the impacts that certain policies and engineering design methods/concepts had on damage, as well as their effects on recovery.

The course will introduce and incorporate the Sustainability Six Dimensions Framework, i.e.:
1) Systems: coupled human-natural systems, integrating environmental, economic & social factors, systems thinking, resilience;
2) Environment: environmental, earth, and natural resource systems; knowledge of planetary/natural systems, e.g., climate, aquatics, soils, forests, wildlife, geology, ecology, agriculture; understanding of how these systems impact human well-being (e.g., health, economy, social justice, future generations)
3) Economic-political: economic and political factors of sustainability (economy/consumption/ production; laws/policy/governance/institutions; business/strategy/management; costs/benefits/tradeoffs)
4) Social-cultural: social/cultural factors of sustainability (justice, equity, values, ethics, history, religion, the arts, citizenship, power, behavior and decision making, cultural critique...)
5) Technology & design: engineering; technological innovation; systems design; human-machine interface; manufacturing processes; life cycle; product design (design of technology and infrastructure to promote sustainability and human well-being)
6) Well-being: human health, safety, risk, sustainable livelihoods, social welfare and well-being

ACTIVITIES/ASSIGNMENTS: The format of the course will be that of a traditional seminar type course, where students are first introduced into the topic by the instructor, then research specific topics (individually and in groups), write six papers, make group presentations, and finally have in-class discussions moderated by the instructor. Examples of topics discussed in class will include:
• The impact of the 1920's Jones Act on the Puerto Rico's recovery after hurricane Maria in 2017 (the Jones Act is a federal law that requires all goods transported by water between U.S. ports to be carried on U.S.-flag ships, constructed in the United States, owned by U.S. citizens, and crewed by U.S. citizens and U.S. permanent residents).
• Impact of urban planning on the fires that followed the 1995 Kobe Earthquake in Japan.
• Medical threats from infectious diseases in developing countries (e.g., after the 2010 Haiti and 2015 Nepal earthquakes and the 2020 super typhoon Goni in Philippines).
• FEMA's response after the hurricane Katrina in 2005 and the long term mitigation measures around New Orleans implemented by the US Army Corps of Engineers.

GOALS AND ELOs: The preparation of six individual research papers and group presentations by students is best aligned with "Goal 3: Students analyze and explain how social and natural systems function, interact, and evolve over time; how human wellbeing depends on these interactions; how actions have impacts on subsequent generations and societies globally; and how human values, behaviors, and institutions impact multi-faceted, potential solutions across time." and is linked to the following Sustainability Theme ELOs:
• ELO 1.2: Engage in an advanced, in-depth, scholarly exploration of extreme events.
• ELO 3.1: Describe, analyze and critique the roles and impacts of human activity on both human society and the natural world currently and in the future.
• ELO 3.2: Devise informed and meaningful responses to problems and arguments in the area of sustainability based on the interpretation of appropriate evidence and an explicit statement of values.

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1.2 Describe, analyze and critique the roles and impacts of human activity and technology on both human society and the natural world, in the past, currently, and in the future. Please link this ELO to the course goals and topics and indicate *specific* activities/assignments through which it will be met. *(50-700 words)*

INTRODUCTION: Human activities, such as the burning of fossil fuels, have resulted in global warming, and as a result, we have seen an increase in the number and severity of extreme events such as droughts, wild fires, flash floods, hurricanes and typhoons. Anthropogenic changes to our environment (e.g., the channeling of the Mississippi River and the construction of levees in New Orleans) to protect communities also result in significant man-made hazards from extreme events and long term challenges to human societies. The effect of extreme events on lifelines often present significant challenges in affected communities, as exemplified by the power grid destruction in Puerto Rico by hurricane Maria in 2017, and polar vortex winter storms that resulted in the Texas power crisis of February 2021.

ACTIVITIES/ASSIGNMENTS: Through individual research (reports), group presentations and in-class discussions, students will gain in-depth multidisciplinary knowledge about extreme events, human relation with the environment, and different approaches that leaders, engineers, urban planners and societies have implemented to mitigate disasters. For example, during the course student will discover and discuss specific measures by which building codes have been incrementally modified after each major effort to reduce loss of life in certain countries, how laws were passed in certain seismically vulnerable countries that mandate earthquake insurance prior to obtaining a home mortgage, how man-made decisions taken immediately after the 2011 Tohoku earthquake resulted in saving the Dai-Ni Nuclear Plant instead of the melt-down experienced by the Dai-Ichi Nuclear Plant a few miles away.

GOALS AND ELOs: The activities/assignments described above are best aligned with OSU's “Goal 1 Intellectual and Cognitive Skills” and is linked to the following Sustainability Theme ELOs:
• ELO 1.2: Engage in an advanced, in-depth, scholarly exploration of extreme events.
• ELO 2.2: Demonstrate a developing sense of self as a learner through reflection, self-assessment, and creative work, building on prior experiences to respond to new and challenging contexts
• ELO 3.1: Describe, analyze and critique the roles and impacts of human activity on both human society and the natural world currently and in the future.

1.3 Devise informed and meaningful responses to problems and arguments in the area of sustainability based on the interpretation of appropriate evidence and an explicit statement of values. Please link this ELO to the course goals and topics and indicate *specific* activities/assignments through which it will be met. *(50-700 words)*

ACTIVITIES/ASSIGNMENTS: The course is structured as a seminar which culminates, during the last two weeks of the semester, in instructor led discussions, where students use what they have previously learned to evaluate and discuss the preparedness of the USA to extreme events; students are encouraged to reflect on preconceived ideas (often based on news reports), self-assess their previous reports (e.g., based on information from peer’s presentations and in-class discussions), as well as critique constructively the government response structure and programs. During these concluding meetings, students are highly encouraged to share points of view, suggests local/federal solutions and/or mitigation measures, discuss their benefits, costs and/or need for taxation, and challenge each other opinions.

GOALS AND ELOs: The activities/assignments described above are best aligned with the goal: "Successful students will apply multidisciplinary approaches to the study of extreme events, including community preparedness, vulnerability, infrastructure robustness and resilience", and are linked to the following Sustainability Theme ELOs:
• ELO 2.2: Demonstrate a developing sense of self as a learner through reflection, self-assessment, and creative work, building on prior experiences to respond to new and challenging contexts
• ELO 3.1: Describe, analyze and critique the roles and impacts of human activity on both human society and the natural world currently and in the future.
• ELO 3.2: Devise informed and meaningful responses to problems and arguments in the area of sustainability based on the interpretation of appropriate evidence and an explicit statement of values.