

ERTH 4815: Natural Hazards in Canada

Canada is the second largest country by area in the world, so it enjoys a wide range of landscapes across the nation. These unique landscapes offer a diverse setting within the country. However, with this diverse setting comes a wide range of natural hazards with potentially many different impacts. The Calgary Flood of 2013 caused damages estimated at above \$5 billion. On January 27th, 1700, an estimated **M9** earthquake offshore of Vancouver Island caused an unknown amount of destruction to local First Nations settlements in British Columbia and even resulted in a tsunami in Japan. A solar flare in 1989 caused a widespread blackout to the province of Quebec. In 2016, a wildfire originating near Fort McMurray and encompassing the town causing severe damage at a cost estimated to be \$9.9 billion.

These natural hazards are caused by geological, solar, and meteorological process that many of us may experience for time to time. The aim of this course is to identify the processes causing these hazards, estimate their frequency and impacts, and understand the best mitigation and response strategies. Learning directly from the a wide range of experts at Natural Resources Canada and other Canadian Governmental departments, students will gain an understanding of the current work in preparing, monitoring, and responding to natural hazards. During the course, students will be given the opportunity to work directly with governmental representatives. At the end of this course, students will be able to identify the best practices for mitigating and responding to the risk posed by natural hazards in Canada.

Objectives:

Identify Natural Hazards in Canada, and for each one:

- Explain what causes it.
- Describe the characteristics of the hazard.
- Analyze the potential impact on society and infrastructure.
- Identify the mitigation strategies applied to minimize its impact.
- Identify the role of the different stakeholders involved.

Prerequisites:

Third-year standing in earth science programs or permission of the department.

Important Information:

Professor: Stephen Crane (Stephen.Crane@Canada.ca), Office Hours are by email appointment

Lectures: 3 hours, once a week, Mondays, 18:05-20:55, HP3120. These lectures will usually be given by a specialist in the field of that week's topic. Attendance at the lectures is mandatory.

Assignments: 2 assignments will be graded throughout the term. More details will be provided through CULearn.

Examinations: 1 Midterm exam on October 28th 18:05-20:55, HP3120 and 1 Final Examination TBA.

Course Project, including presentation and paper: Presentations will be on December 6th, 18:05-20:55, HP3120. The paper will be due at the start of class on December 6th.

Lecture Schedule (Tentative):

Date	Lecture #	Topic
Week 1: Sept 9 th	1	Introduction
	2	Global and Universal Processes
Week 2: Sept 16 th	3	Natural Hazard Considerations
	4	Response operations case study:
Week 3: Sept 23 rd	5	Seismic Hazards: Earthquakes
	6	Tsunami
Week 4: Sept 30 th	7	Seismic Hazards close to home
	8	Volcanoes
Week 5: Oct 7 nd	9	Mass Movements I: landslides
	10	Mass Movements II: snow avalanches
Statutory Holiday: October 14th		
Reading Week: October 21th		
Week 6: Oct 28 th		Midterm
Week 7: Nov 4 th	11	Meteorological Processes: Floods.
	12	Floods case study:
Week 8: Nov 11 th	13	Severe weather: hurricanes
	14	Severe weather: tornadoes, thunderstorms, ice storms
Week 9: Nov 18 th	15	Wildfires
	16	Wildfires case study:
Week 10: Nov 25 th	17	Space Weather I
	18	Science-Policy Integration
Week 11: Dec 2 nd	19	Climate Change
	20	Impacts of Climate Change
Week 12: Dec 6 th		In-class presentations
		Exam Review

Course Evaluation:

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Assignments	1. Briefing Note	7.5%
	2. Hazard calculations	7.5%
Course Project	Presentation	10%
	Paper	35%
Lecture Attendance	Weekly, Mondays 18:05-20:55, HP3120	5%
Midterm Examination	October 28 th 18:05-20:55, HP3120	10%
Final Examination	TBA	25%
Total		100%

Briefing Note (7.5% of final grade): 1-2 page briefing intended for a Minister or Senior Government Official. Due September 23rd, 18:05.

Hazard Calculations (7.5% of final grade): Up to 10 questions of calculations related to natural hazards. Due November 18th, 18:05.

Course Project Presentation (10% of final grade): 15-20 minute presentation (per group) on a natural disaster. December 6th, 18:05-20:55, HP3120.

Course Project Paper (35% of final grade): Contribute one chapter (10-15 pages) to a project report. Due December 6th, 18:05.

Appropriate use of Technology in the Classroom:

- Cell phones must be turned OFF at all times.
- Laptops and tablets are to be used only to look and annotate the lecture notes

Academic Integrity:

It is your responsibility to review Carleton's policy on Academic Integrity -Section 14 of the Calendar. <http://calendar.carleton.ca/undergrad/regulations/academicregulationsoftheuniversity/acadregsuniv1>

Requests for Academic Accommodation

You may need special arrangements to meet your academic obligations during the term. For an accommodation request, the processes are as follows:

Pregnancy obligation

Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website: carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf

Religious obligation

Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website: carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf

Academic Accommodations for Students with Disabilities

If you have a documented disability requiring academic accommodations in this course, please contact the Paul Menton Centre for Students with Disabilities (PMC) at 613-520-6608 or pmc@carleton.ca for a formal evaluation or contact your PMC coordinator to send your instructor your Letter of Accommodation at the beginning of the term. You must also contact the PMC no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with your instructor as soon as possible to ensure accommodation arrangements are made. carleton.ca/pmc

Survivors of Sexual Violence

As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and its survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit: carleton.ca/sexual-violence-support

Accommodation for Student Activities

Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. <https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf>

For more information on academic accommodation, please contact the departmental administrator or visit: students.carleton.ca/course-outline