

University of Toronto at Scarborough  
Department of Physical and Environmental Science  
RISK (Environmental)  
(ESTD19HS)

**Course Instructor**

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**Teaching Assistant**

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Office Hours: TBD

**Prerequisite:** STAB22H3 (or equivalent) and at least 14.5 credits.

**Breadth Requirement** Natural Sciences

**Lectures:** Tuesdays, 7:00-9:00 PM  
UTSC Instructional Centre 204

**Course Description**

Risk and/or vulnerability assessment methodologies have come to dominate the environmental field, as notably evident in the IPCC assessment process. The wide scale adoption of such procedures across business sectors, government institutions, and civil society, is having a profound impact upon how modern society perceives its relationship to the environment. The huge uncertainties associated with ecosystems and socio-economic processes, the variability of access to knowledge and expertise, and the need to systematically assess a range of options in light of locally oriented social, cultural and economic values, has spurred this development.

Generally speaking, this trend has been received positively within the field, but the increasing proliferation of risk and vulnerability assessment procedures/protocols is also increasing the confusion regarding what constitutes the field's essential theoretical and methodological elements. Recently the *Environmental Action Lab* at UTSC has identified over twenty core knowledge domains within this literature, each with a slightly different interpretation of risk, and risk assessment procedures, as inclusive of scientific standards and protocols. Against this heterogeneous, methodological background this course is offered so that students are better able to interpret the results of such assessment procedures (e.g. IPCC assessment reports), as well as participate, and advance the development of, real-world risk assessments as environmental professionals.

This course is anchored in direct experience with the development, and implementation of risk and vulnerability assessment methods:

- 1) From the public sector, especially in the area of public transit;
- 2) From the private sector, as applied to energy generation, distribution and transmission.

At the core of all these methods are scientifically based modeling exercises as structured around a scenarios based, methodological framework. Drawing upon our experience, as well as an extensive review of the literature, we will introduce students to both the theoretical foundations of risk management, and its' actual application.

### **Course Objectives**

This course is intended to be a practical introduction to the concept of 'risk' as utilized in environmental decision-making, with an emphasis on climate change risks. Students will be introduced to risk analysis and assessment procedures as applied in business, government, and civil society. Students will receive a broad array of inter-related, transferable, problem solving, assessment, and analytical skills:

- Students will learn about the theoretical foundations of risk\ vulnerability theory, analysis and management tools, as they are applied at various spatial scales, sectors, and infrastructure assets.
- Students will become aware of the broad areas of uncertainty within the realm of climate science, climate vulnerability and impacts, the politics of climate change and the evolving regulatory context, and how this affects our concept of risk.
- Students will develop a greater appreciation of assessing the physical risks of climate change on critical infrastructure in face of uncertainty regarding future greenhouse gas emissions and projections in climate-related hazards and climatic parameters.
- Students be introduced to climate change data, both historical and future projections, that are available through national climate and weather data information portals.
- Students will be introduced to municipal climate adaptation plans, with a focus on southern Ontario communities.
- Students will learn about best practice in climate change risk assessment and adaptation planning for public transit.
- A major focus of the course though, will be to introduce students to the broad class of environmental risk\ vulnerability assessments and the procedures, through which knowledge is integrated across disciplines\sectors\fields\communities, and especially those that apply to climate change risk assessment:

*A climate change risk assessment is the cornerstone of broader risk management and, as such, should include the consideration of vulnerabilities, exposure and climate change hazards and the consideration of likelihoods and consequences. The results of the climate change risk assessment can then be used to identify the appropriate courses of action to respond to the identified risks.*

Canadian Council of Ministers of the Environment (CCME) (2021), p. 3

At the end of the course, students will be able to critically assess the results of major environmental risk analysis and assessment exercises. Equally important, they will gain hands-on experience with actual assessment processes that they can draw upon in their professional lives. The ultimate goal is for each student to develop a more informed appreciation and understanding of risk as it applies to the environment and climate on a personal and professional basis.

## RESOURCES

There are numerous texts and study guides associated with risk analysis, risk assessments and risk management. There is one required text for the course, which is accessible in electronic format via the University of Toronto Library. In addition, you will be responsible for key articles\reports associated with the Climate Change Risk literature; links will be provided for individual articles and reports on Quercus at the appropriate time.

### Required:

Arnell, N. (2015) *A Short Guide to Climate Change Risk (1 edition)* (Farnham, Surrey, England; Burlington, VT: Routledge), 206 pages.

### General Introduction to, and Tools for, Climate Change Risk Assessment:

UK CIP: <https://www.ukcip.org.uk/>

PIEVC Protocol: <https://pievc.ca/protocol/>

PIEVC Analyses: <https://www.pievcanalysis.ca/>

ICLEI BARC: <https://icleicanada.org/barc-program/>

CCME Guidance: <https://ccme.ca/en/res/riskassessmentguidancesecured.pdf>

### Climate Change Science and Policy:

Intergovernmental Panel on Climate Change (IPCC):

Special Report on the Ocean and Cryosphere in a Changing Climate; <https://www.ipcc.ch/srocc/>

Special Report: Global Warming of 1.5°C; <https://www.ipcc.ch/sr15/>

Climate Change 2021: The Physical Science Basis, the Working Group I contribution to the Sixth Assessment Report; <https://www.ipcc.ch/report/sixth-assessment-report-working-group-i/>

UN Climate Change Conference in Sharm el-Sheikh, Egypt 2022:

November 6<sup>th</sup> – November 20<sup>th</sup>, 2022 <https://unfccc.int/cop27>

### Climate Change in Canada:

Bush, E. and Lemmen, D.S. (eds) (2019) *Canada's Changing Climate Report* (Ottawa: Government of Canada), 444 pages;

[https://changingclimate.ca/site/assets/uploads/sites/2/2020/06/CCCR\\_FULLREPORT-EN-FINAL.pdf](https://changingclimate.ca/site/assets/uploads/sites/2/2020/06/CCCR_FULLREPORT-EN-FINAL.pdf)

Warren, F. and Lulham, N. (eds) (2021) *Canada in a Changing Climate: National Issues Report* (Ottawa: Government of Canada), 734 pages;

[https://changingclimate.ca/site/assets/uploads/sites/3/2021/05/National-Issues-Report\\_Final\\_EN.pdf](https://changingclimate.ca/site/assets/uploads/sites/3/2021/05/National-Issues-Report_Final_EN.pdf)

Douglas, A.G. and Pearson, D. (2022). "Ontario"; Chapter 4 in *Canada in a Changing Climate: Regional Perspectives Report*, (ed.) F.J. Warren, N. Lulham, D.L. Dupuis and D.S. Lemmen; Government of Canada, Ottawa, Ontario.

[https://ftp.maps.canada.ca/pub/nrcan\\_rncan/publications/STPublications\\_PublicationsST/330/330561/gid\\_330561.pdf](https://ftp.maps.canada.ca/pub/nrcan_rncan/publications/STPublications_PublicationsST/330/330561/gid_330561.pdf)

Prairie Climate Centre (2019) *Heat Waves and Health: A Special Report on Climate Change in Canada* (Winnipeg, Manitoba: University – Version 5.0 of Winnipeg), 14 pages;

<https://climateatlas.ca/sites/default/files/PCC%20-%20Heat%20Waves%20and%20Health%20-%20Nov%202019.pdf>

#### Canada's National Adaptation Strategy and Action Plan:

Environment and Climate Change Canada (2022) *Canada's National Adaptation Strategy: Building Resilient Communities and a Strong Economy* (Gatineau, QC: ECCC), 56 p.

<https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/national-adaptation-strategy/full-strategy.html>

Environment and Climate Change Canada (2022) *Government of Canada Adaptation Action Plan* (Gatineau, QC: ECCC), 108 p.

<https://www.canada.ca/content/dam/eccc/documents/pdf/climate-change/climate-plan/national-adaptation-strategy/GCAAP-Report-EN.pdf>

#### Climate Change Data and Weather Portals:

Environment and Climate Change Canada:

[https://climate.weather.gc.ca/index\\_e.html](https://climate.weather.gc.ca/index_e.html)

[https://climate.weather.gc.ca/historical\\_data/search\\_historic\\_data\\_e.html](https://climate.weather.gc.ca/historical_data/search_historic_data_e.html)

Canadian Centre for Climate Services:

Climate Data for a Resilient Canada: <https://climatedata.ca/>

Climate Atlas of Canada: <https://climateatlas.ca/>

Western University and the Institute for Catastrophic Loss Reduction:

Computerized Tool for the Development of Intensity-Duration-Frequency Curves under Climate Change – Version 5.0; <https://www.idf-cc-uwo.ca/>

#### Best Practice Case Studies:

##### 1. Metrolinx:

*Metrolinx (2018) Metrolinx Climate Adaptation Strategy (Toronto: Metrolinx), 36 p. Retrieved December 15, 2022 from*

[https://assets.metrolinx.com/image/upload/v1663237659/Documents/Metrolinx/MX\\_Climat\\_Adapt\\_Str\\_May8\\_vs4.pdf](https://assets.metrolinx.com/image/upload/v1663237659/Documents/Metrolinx/MX_Climat_Adapt_Str_May8_vs4.pdf)

*Chiotti, Q., Chan, K., Gulecoglu, E., Belaieff, A. and G. Noxon (2017) Planning for Resiliency: Toward a Corporate Climate Adaptation Plan (Toronto: Metrolinx), 69 p. Retrieved December 15, 2022 from*

[https://assets.metrolinx.com/image/upload/v1663237658/Documents/Metrolinx/Planning\\_for\\_Resiliency\\_2017\\_EN\\_final.pdf](https://assets.metrolinx.com/image/upload/v1663237658/Documents/Metrolinx/Planning_for_Resiliency_2017_EN_final.pdf)

2. United Kingdom Network Rail:

<https://www.networkrail.co.uk/who-we-are/publications-and-resources/our-delivery-plan-for-2019-2024/>

<https://www.networkrail.co.uk/communities/environment/climate-change-and-weather-resilience/climate-change-adaptation/>

<https://www.networkrail.co.uk/communities/environment/climate-change-and-weather-resilience/weather-impacts-on-performance/>

<https://safety.networkrail.co.uk/wp-content/uploads/2017/02/NR-WRCCA-Strategy-2017-2019.pdf>

3. Los Angeles County Metropolitan Transportation Authority (LA Metro):

[https://www.transit.dot.gov/sites/fta.dot.gov/files/FTA\\_Report\\_No.\\_0073.pdf](https://www.transit.dot.gov/sites/fta.dot.gov/files/FTA_Report_No._0073.pdf)

[http://media.metro.net/projects\\_studies/sustainability/images/resiliency\\_indicator\\_framework.pdf](http://media.metro.net/projects_studies/sustainability/images/resiliency_indicator_framework.pdf)

[https://media.metro.net/projects\\_studies/sustainability/images/Climate\\_Action\\_Plan.pdf](https://media.metro.net/projects_studies/sustainability/images/Climate_Action_Plan.pdf)

### **Class Attendance**

Lectures will be provided online via Zoom, presented live in real time or when necessary taped and posted in advance of the scheduled class. Videos of the lectures will be available until the end of term. Because of the practical nature of the material covered in class, class participation during real time lectures is highly recommended.

Students are required to do readings before class and come prepared with questions about the readings to discuss in class. Additional readings may be recommended on a weekly basis, at least a week prior to the lecture.

### **Grading Scheme**

There will be three assignments and a final exam. The assignments will progressively build upon each other provides students first-hand experience with climate change risk assessment, starting with an introduction to climate data (historical and future climate change projections), and then progressing towards more complex environmental, social and economic considerations via the application of the Public Infrastructure Engineering Vulnerability Committee (PIEVC) Protocol to a hypothetical case study.

As this course is intended to provide both a theoretical basis for final year courses, as well as expose students to practical application, it will require assessing both writing and communication skills, as well as problem solving and analytical capabilities. The exam will cover the theoretical aspects of the course, while the assignments will demonstrate the student's ability to apply their analytical and problem-solving skills. Simplified impact models will be used within the assignments as a foundation for broader participatory methods.

Assignment #1:	25% (due Friday February 10 <sup>th</sup> )
Assignment #2	20% (due Friday March 3 <sup>rd</sup> )
Assignment #3:	20% (due Friday March 24 <sup>th</sup> )
Final Examination:	35% (Scheduled in regular winter exam period)

### **Missed Term Work**

Late assignments will be subject to a late penalty of 5% (of the total marks for the assignment) for the first day late (including weekends), and 10% every day after that. All assignments are due before the EOD Friday, midnight EST. Assignments must be uploaded (see below).

### **Handing in Your Assignment:**

PDF (Portable Document Format) hardcopy files of the assignments must be uploaded to QUERCUS on the day that it is due. If you do not know how to create a pdf please search online for a tutorial (<https://support.office.com/en-us/article/Save-or-convert-to-PDF-d85416c5-7d77-4fd6-a216-6f4bf7c7c110> ). Assignments sent by email are not acceptable.

Please follow University of Toronto procedures to be completed in order to be considered for academic accommodation for any course work such as missed tests or late assignments. Verification of Student Illness or Injury forms can be found on the Office of the Registrar's webpage (<http://www.illnessverification.utoronto.ca/getattachment/index/Verification-of-Illness-or-Injury-form-Jan-22-2013.pdf.aspx> ).

### **Extension of Time**

Students MUST submit a request for extension in ADVANCE of the deadline in order to receive a decision. For extensions of time beyond the examination period you must submit a petition through the Office of the Registrar. <http://www.erin.utoronto.ca/index.php?id=6988>

Verification of Student Illness or Injury forms can be found on the Office of the Registrar's webpage (<http://www.illnessverification.utoronto.ca/getattachment/index/Verification-of-Illness-or-Injury-form-Jan-22-2013.pdf.aspx>).

### **A Note on Marking**

Feel free to contact Dr. Chiotti at any time to discuss the requirements of this course. If you are unhappy with the mark you received on an assignment\exam\project please arrange to speak to Dr. Chiotti with a written response to the comments provided for your assignment\exam\project.

### **Academic Integrity**

The University treats cases of cheating and plagiarism very seriously. The University of Toronto's Code of Behaviour on Academic Matters (<http://www.governingcouncil/utoronto.ca/policies/behaveac.htm>) outlines the behaviours that constitute academic dishonesty and the processes for addressing academic offences.

Potential offences in papers and assignments include using someone else's ideas or words without appropriate acknowledgement, submitting your own work in more than one course without the permission of the instructor, making up sources or facts, obtaining or providing unauthorized assistance on any assignment. On tests and exams cheating includes using or possessing unauthorized aids, looking at someone else's answers during an exam or test, misrepresenting your identity, or falsifying or altering any documentation required by the University, including (but not limited to) doctor's notes. Please avoid academic dishonesty, have confidence in your own ability to learn and grow academically by doing your own thinking and writing!

### **Accessibility**

Students with diverse learning styles and needs are welcome in this course! In particular, if you have a disability/health consideration that may require accommodations, please feel free to approach Dr. Chiotti and/or the AccessAbility Services Office as soon as possible. Dr. Chiotti will work with you and AccessAbility Services to ensure you can achieve your learning goals in this course. Enquiries are confidential. The UTSC AccessAbility Services staff (located in SW302) are available by appointment to assess specific needs, provide referrals and arrange appropriate accommodations (416) 287-7560 or [ability@utsc.utoronnto.ca](mailto:ability@utsc.utoronnto.ca)

### **Communicating With You**

This is a very 'hands-on' course; by far the best way to communicate with Dr. Chiotti is immediately after class and during office hours. If you send Dr. Chiotti an email to [drq.chiotti@utoronto.ca](mailto:drq.chiotti@utoronto.ca) and do not receive a response within 48 hours, please follow it up by sending an email to either of his other addresses. The subject line of your email must contain the course number and course title or Dr. Chiotti will not be able to differentiate your email from the numerous other emails he receives. You can also send emails to the teaching assistant Taylor Tabobondung [Taylor.Tabobondung@mail.utoronto.ca](mailto:Taylor.Tabobondung@mail.utoronto.ca)

From time-to-time Dr. Chiotti will send email messages or post messages on Quercus to notify you of changes in schedule and opportunities that you may want to take advantage of. Dr. Chiotti can only send messages to your U of T e-mail address. If you use another account (gmail, hotmail, yahoo, etc.) make sure that your U of T email is sent to your alternate email account. Dr. Chiotti will set office hours after consulting students, but can be reached at the EOD (after 5:00 PM) on weekdays and mornings on weekends.