THE UNIVERSITY OF BRITISH COLUMBIA

# Geography 314
# Analysing Environmental Problems
# Generic Syllabus

**General Information:**

*Instructor:* Prof. Simon Donner, Department of Geography, Room 133

## 1. Course Description

This problem-based learning course for 3rd year Environment and Sustainability (Geography) majors introduces students to key concepts and techniques employed in environmental research. Students will develop a core set of qualitative and quantitative research and analytical skills, including data interpretation, life cycle analysis, literature assessments and risk assessment, through three modules focused on present-day challenges in the areas of climate change mitigation, agriculture, and coastal hazards. Through lectures, in-class activities and assignments, students will gain exposure to the relationships between data, information, knowledge and action in the environmental space. The students will also gain experience using a variety of analytical tools and techniques common in environmental work.

## 2. Course Format

The three-credit course offers three hours of lecture time per week separated into one-hour and two-hour blocks, plus one-hour labs most weeks. The course is an active learning environment in which students work on problems during labs and portions of the class time using their portable devices (laptops, tablets, etc.) using available software. The course is structured around three modules, each of which will be conducted over three to four weeks. In each module, students will report on their work in the form of a multi-step lab assignment on project, which students can complete in groups of two. Students will also individually complete a final exam on the core lecture material.

## 3. Readings

The course has required readings and reference materials for each of the modules as well as background readings from which the conceptual material for the lectures is drawn. Suggested readings for students wishing to learn more about a subject are also provided. All readings are available via Canvas. There is no textbook.

## 4. Schedule + Course Modules

The course schedule, including details on every class and lab section, is available on the Canvas page. After some introductory material on baselines and scales in environmental analysis, the course comprises of three modules:

***MODULE 1: Measuring the impact of transportation choices on greenhouse gas emissions***

In the first module, students will practice converting raw data into information and into knowledge and become acquainted with the tools and techniques used in environmental data analysis and throughout the course. The case study on the carbon footprint of different modes of transportation

*Activity outline*

- The module includes lectures on the history of transportation, assessing fuel use and greenhouse gas emissions from different transportation modes, life cycle analysis, and policy instruments
- Lab exercises include introductions to methods for computing fuel use and greenhouse gas emissions from different transportation modes, life cycle analysis software and conducting policy assessments
- Based on the lab exercises, students will complete a multi-stage assignment on greenhouse gas emissions generated from different modes of transportation and different transportation policy options, including personal transportation to campus. This will involve considering the units, the chemistry of different fuels, the efficiency of different modes, the source electricity for electric vehicles, the energy used to construct vehicles, and other factors.

*Specific learning goals and skills gained:*

- Interpreting raw data and assessing potential biases in data collection
- Gain experience with data collection and processing, including unit conversions
- Learn to appropriately present data in graphical form
- Introduction to footprint analysis and life cycle analysis

***MODULE 2: How do people share and receive environmental information?***

In the second module, students will learn about the role of bias in the assessment and presentation of environmental research, drawing from the latest research in psychology and communications. This module will include additional lecture time and assessment will be conducted via a midterm quiz combining the first two modules.

*Activity Outline*

- The module will begin by introducing students to the key factors and processes influencing the translation of scholarly research into public information and knowledge, including the science of cognitive or cultural biases ("cultural cognition"). This will draw examples from research on gaps in public between expert knowledge on climate change and in areas of medical research like vaccines, and on techniques commonly used in science "denial".
- The case study will involves students comparing separate in-class searches of original academic literature, grey literature and the media for information on the productivity and the nutritional value of organic vs. conventional crops. Students will then be asked to compare their findings to that of a provided (recent) academic reviews of the subject.
- Different case studies may be substituted in future years; the specific case study is selected because the subject is of public interest but the research findings are not widely known (i.e. in contrast to climate change)

*Specific learning goals and skills gained:*

- First-hand experience conducting an assessment of a topic disputed in the academic literature and the media
- Learn the science of how people receive information (i.e. cultural cognition)
- Practice methods for conducting effective literature searches and assessing the reliability of available environmental information,
- Become acquainted with common techniques used in science 'denial' (e.g. cherry-picking, appeals to authority, appeals to emotion) and learn methods for effectively debunking myths
- Learn how scientific results are translated to the media and practice 'elevator' pitches

***MODULE 3: Risk assessment: Sea-level rise and coastal hazards***

This module will introduce students to the concepts and skills involved in environmental risk assessment, through a group project on inundation hazards in the Lower Mainland. While climate change in general is firmly in the minds of many people thinking about the future social adaptations that are required, the specific changes to sea level pose particularly severe challenges to human development in coastal environments around the world. Flooding by the sea can be driven by individual events like tsunami, storm surges created by intense low pressure storm systems, or by the natural cycles of ocean tides. All of these events play out in the context of increasing mean sea level, which makes the impacts of any event more severe, and which increases the costs of the measures required to mitigate against these hazards.

*Activity outline*

- Lectures will review literature and risk analysis, frequency and probability analysis, the drivers of sea-level rise and methods for assessing the effect of low probability events
- Student will participate in a self-guided field trip to assess the potential effects of sea-level rise in Vancouver, and the associate risks to communities and infrastructure
- Using provided data, the students will assess the potential areas of inundation associated with different peak water levels (e.g., 1 m vs. 2 m higher than at present)
- The students will evaluate the potential effects on the transportation system, emergency response scenarios, the project number of people displaced and the value of land lost
- Students will develop an appropriate hazard mitigation plan for dealing with a high water event in Vancouver, drawing on the lessons learned from previous events

*Specific learning goals and skills gained:*

- Students will gain confidence in risk assessment and computing probabilities and frequency distributions
- Using published literature and available news reports, the students will be able to identify the key hazards associated with rising sea levels that are likely to be a concern for the lower mainland

## 5. Learning Outcomes:

At the end of this course students will be able to:

1. Interpret environmental data, including understanding probability, uncertainty, sampling, signal detection and data scaling

2. Apply analytical methods used in environmental research (e.g. footprint analysis, life cycle analysis, literature review, risk assessment)
3. Create, use and manipulate data in spreadsheets
4. Conduct searches of the scholarly literature and read scholarly publications
5. Assess the reliability of information sources and detect biases in the presentation of environmental information in the media and elsewhere

## 6. Assessment Criteria and Grading:

The course will be graded on a numeric (%) basis. Students will be graded based on the assignments for the modules, a final exam and participation and collaboration throughout the course.

**Marking Scheme and Criteria**

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|---|---|
| Module assignments (3) | 60% |
| Weekly quizzes and participation* | 10% |
| Final Exam | 30% |

*Module Assignments*: Each of the three module involves a multi-part assignment. The assignments can be conducted individually or in groups of two. All assignment information including due dates and times are available on Canvas. Late assignments are not accepted, outside of medical issues or students who notify the instructor in advance about representing UBC, the province, etc. at an official event (sport, academic events).

*Weekly quizzes and participation:* This grade is based half on in-class participation and half on take-home quizzes. Participation is evaluated based on use of i-Clickers during class and participation in lab activities. Brief weekly quizzes (~10 minutes) on the lecture material will be posted on Canvas after class on Monday, to be completed by Friday at noon. The answers will then be reviewed in Friday's class. The quizzes are designed to help students assess knowledge and understanding of material: grades are based half on participation (did you complete the quiz!) and half based on performance.

*Final Exam*: The final exam, based on the lecture material will be held during the exam period. A review of key material for the exam and an exam guide will be made available during the last week of class. The final exam is scheduled by UBC; there can be no makeup final exam.

***Marking rubric for assignments and exams***

All assignments and exams will be graded against prepared answer keys. The following general rubric will be applied in all cases.

| **Criteria** | ***Excellent (85-100%)*** | ***Good (70-84%)*** | ***Fair (55-69%)*** | ***Poor (0-54%)*** |
|---|---|---|---|---|
| Calculation accuracy | Accurate calculations | Minor inaccuracies due to methods, | Some inaccuracies in calculations | Mostly inaccurate or incomplete calculations |

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|---|---|---|---|---|
| | | assumptions | | |
| Methods | Most appropriate approach to solving the problem | Effective approach, but better alternatives available | Suitable approach but led to problems with aspects of the analysis | Mostly inappropriate methods |
| Statement of assumptions | Assumptions are well stated and justified | Assumptions are stated but not justified | Assumptions are not well stated and not well justified | Assumptions are poorly or not stated or justified |
| Quality of explanation of results | Accurately and clearly explains results | Results explained but with minor inaccuracies | Results explained but with a few inaccuracies | Results poorly or not explained |
| Quality of conclusions | Appropriate and novel conclusions | Appropriate but not novel conclusions | Appropriate but not well justified conclusions | Inaccurate and/or poorly justified conclusions |
| Quality of figures | Excellent figures charts that display results | Good figures, minor errors | Figures display results but are unclear | No charts, or charts that do not adequately portray the results |
| Quality of writing | Excellent grammar and clarity | Well-written, with minor errors | Well-written but with some errors | Poorly written |