RES 542 – Integrated Assessment of Global Change: an introduction to quantitative systems model design and development.

Syllabus

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Office: AERL 442
Classes: Mondays from 9:30-12:30 at AERL 107 or 419 (depending on class size)
Office Hours: Mondays from 1 to 3 pm and by appointment

Course Overview

This course is about developing an appreciation of the broader context and dynamics of global change issues. In general, Integrated Assessments (a.k.a. systems modelling) are developed to address long-term multi-faceted public policy challenges.

Integrated Assessment approaches are suitable for such applications because the problems span many different disciplines – each with its own fortes and foibles. There are many insights leading to this approach to research:

- disciplinary knowledge will only provide insights for a small fraction of real problems;
- if the intention is to modify a "system" we need to focus effort on points of leverage in that system;
- traditional research approaches concentrate on deepening knowledge in a an ever narrower field, IA is about deepening knowledge iteratively and only where it can provide insights relevant to the intended outcomes.

In summary, Integrated Assessment is a trans-disciplinary (whatever that term may mean) approach to solving technically/scientifically complex real world challenges.

We will consider many different change processes as platforms for learning. The specific examples will be selected from discussions in class to ensure they are relevant to the class participants. For example, we can consider emergent new diseases (human, computer, etc.) We could consider the rise of unemployable graduate students. The key insights are that the dynamics of these change processes are identifiable and can be characterised in terms of aspects that are known, unknown and perhaps unknowable until it is too late to intervene effectively. This course is about understanding the complexity of the many interactions that shape the world we live in and identifying policy responses that are more likely to succeed in guiding us towards our objectives.

Learning Outcomes:

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

- Characterize a change process in terms of drivers, context and interactions
- Understand uncertainties in structural models describing above and their parameterizations
- Deal with uncertainty and decision-making under uncertainty
- Apply Value of Information based strategies to development of a systems model about real problems.

Course Format:

The course consists of one three-hour meeting per week. Each class will have two components:

- half of the class will be devoted to presentations on core concepts and discussing their implications;
- half of the class will be devoted to examining case studies to gain experience in applying the introduced concepts.

The class sessions are divided into five modules, each requiring readings and leading into a case study session developed and run by students. Students will work in groups to either develop a new case study or to modify an existing case, and then lead the class through an exercise. The cases will provide students with the opportunity to examine global issues in a very specific and local context and learn how to analyze these problems.

Course Requirements

This course is open to all UBC graduate and advanced undergraduates. students. Students should be willing to apply concepts from a variety of disciplines. The course is heavily biased towards evidence-based methods, hence, command of basic statistics and fearless application of scientific thinking, are advantageous. Auditing of this course is not advisable.

Evaluation Criteria and Grading

The course is graded on a numeric basis, and evaluation will be based on four factors of assessment:

1. Class Presentation (15 points)

Each student will be asked to review and present one or more of the suggested readings for the course. You are expected to summarize the paper and critique its findings. The presentation should take about 20 minutes, and will be followed by a 10-minute Q&A session. Resources for how to present papers are here and here.

2. Short writing assignments (total 40 points):

There are five short writing assignments (1000-1500 words) each worth 8 points. Topics are specified in the course outline. Papers should be well argued and well presented. They should try to include quantitative evidence where possible. Assignments are due on Mondays at noon. Please email them as a word document – using the following naming convention <surname>#<assignment number>.doc to: assignment to: climatecourse@gmail.com.

3. Final paper (20 points):

Each student is expected to write a high-quality final paper or project on the topic of their choosing or to an expansion of one of the two final short assignments. If you wish to write on a topic of your choosing, please provide me with a short write-up about your paper by November 10th. The paper will be due at noon on Monday December 5.

4. Participation (25 points):

The remainder of the course grade will be determined by each student's active and constructive participation in class sessions. Students are expected to attend each class, to prepare for each session by completing the weekly readings, and to participate actively and constructively in class discussions.

Course Schedule

Week	Part 1 (9:30 -~10:50)	Part 2 (~11:00-12:20)	Homework and readings
	Module 1: Basic philosophy of IA		
#1	Course organization	What are models for?	Develop a simple model of the human footprint on the earth
#2	Discussion of the assignment: Indicators	Discussion of the assignment: Drivers	What are the key uncertainties? How would you characterize them?
#3	Technical change	Preferences	Homework: develop the simplest model that generates useful insights
	Module 2: A simple energy model		
#4	Supply	Demand	Grübler, Arnulf, Nebojša Nakićenović, and David G. Victor. "Dynamics of energy technologies and global change." *Energy policy* 27.5 (1999): 247-280.
#5	Exogenous variables	Endogenous variables	Wilson, Charlie, and Hadi Dowlatabadi. "Models of decision making and residential energy use." *Annu. Rev. Environ. Resour.* 32 (2007): 169-203.
#6	Accounting for heterogeneity	Models of decision-making	Grubler, Arnulf. "Energy transitions research: Insights and cautionary tales." *Energy Policy* 50 (2012): 8-16. Dowlatabadi, H. (1998). Sensitivity of Climate Change Mitigation Estimates to Assumptions About Technical Change. *Energy Economics*, *20*, 473–493.
	Module 3: A simple demographic model		
#7	Malthus and other pioneers of Systems models & Sustainability Science	Demographic transitions (ie, attitudes, religion, politics and choice)	Galor, Oded, and David N. Weil. "Population, technology, and growth: From Malthusian stagnation to the demographic transition and beyond." *American economic review* (2000): 806-828. https://projects.fivethirtyeight.com/mortality-rates-united-states/
#8	Demographics and economic growth	Implications of living longer lives	Oeppen, Jim, and James W. Vaupel. "Broken limits to life expectancy." *Science* 296.5570 (2002): 1029-1031.
#9	Life expectancy and income	Exploring implications for policy analysis	Stern, David I. "The rise and fall of the environmental Kuznets curve." *World development* 32.8 (2004): 1419-1439.
	Module 4: Using IA thinking in everyday research		
#10	Climate change & agriculture	Climate change & vector-borne diseases	Develop a one page proposal about how to use IA to better understand a complex multi-dimensional challenge
#11	Air pollution	HIV AIDS	Gather key input information and characterize uncertainties
#12	Aging	Skynet	Develop scenarios of possible futures and potentially successful / futile interventions

Academic Integrity

The academic enterprise is founded on honesty, civility, and integrity. As members of this enterprise, all students are expected to know, understand, and follow the codes of conduct regarding academic integrity. At the most basic level, this means submitting only original work done by you and acknowledging all sources of information or ideas and attributing them to others as required. This also means you should not cheat, copy, or mislead others about what is your work. Violations of academic integrity (i.e., misconduct) lead to the breakdown of the academic enterprise, and therefore serious consequences arise and harsh sanctions are imposed. For example, incidences of plagiarism or cheating may result in a mark of zero on the assignment or exam and more serious consequences may apply if the matter is referred to the President's Advisory Committee on Student Discipline. Careful records are kept to monitor and prevent recurrences.

A more detailed description of academic integrity, including the University's policies and procedures, may be found in the Academic Calendar.

Access & Diversity:

Access & Diversity works with the university to create an inclusive living and learning environment in which all students can thrive. The university accommodates students with disabilities who have registered with the Access & Diversity unit.

Students must register with the Disability Resource Centre to be granted special accommodations for any on-going conditions.

Religious Accommodation:

The university accommodates students whose religious obligations conflict with attendance, submitting assignments, or completing scheduled tests and examinations. Students should let their instructor know in advance, preferably in the first week of class, if they will require any accommodation on these grounds. Students who plan to be absent for varsity athletics, family obligations, or other similar commitments, cannot assume they will be accommodated, and should discuss their commitments with the instructor before the course drop date. UBC policy on Religious Holidays can be found here.

UBC Statement on Respectful Environment for Students, Faculty and Staff

The University of British Columbia envisions a climate in which students, faculty and staff are provided with the best possible conditions for learning, researching and working, including an environment that is dedicated to excellence, equity and mutual respect. The University of British Columbia strives to realize this vision by establishing employment and educational practices that respect the dignity of individuals and make it possible for everyone to live, work, and study in a positive and supportive environment, free from harmful behaviours such as bullying and harassment.