

ERS 410: CAPSTONE COURSE OUTLINE

Transforming Eco-Social Systems: Sustainability for ‘the Long Now’

PLEASE NOTE:

THIS IS DRAFT ONLY. THE SUBSTANTIVE CONTENT WILL REMAIN THE SAME. THE LECTURE SCHEDULE, STRUCTURE OF THE TUTORIALS AND THE DETAIL OF THE ASSIGNMENTS MAY CHANGE.

Imagine that you could look at the Earth and the universe from a vantage point outside space and time. Imagine that you could press a re-wind button ... and go all the way back? What would you see? What would be the most significant features of cosmic history in reverse? Great episodes such as World War I or the French Revolution would disappear into a blur. A series of more significant punctuations would come into view: modernity and the connecting up of a global human culture; agriculture and the emergence of the first cities; fire culture and language; the Cambrian explosion and multicellular organisms; the evolution of life; the creation of planets and solar systems; the birth of stars...the big bang.

That is a lot of history and seemingly an impossibly large canvas. How can such a big picture help us to navigate the social and ecological problems of the twenty-first century?

Although all species eventually become extinct, most manage to stay the course for around two million years. In the long view, sustainability is about whether humanity manages to live out this evolutionary potential. For this reason it should not be measured in decades or even centuries, but rather millennia and aeons. Longer than recorded history, such a time-scale is difficult to conceive, let alone to operationalize at the level of politics. But this is the task facing the current generation and their great grandchildren. The problem is made more difficult by the fragmentation and increasing specialization of scientific knowledge that makes it difficult see the big picture. At the same time, without a shared, taken-for-granted religious worldview it is also difficult to find meaning and significance in the world.

Using Big History as a point of departure, this capstone course is designed to ‘join the dots. Reflecting and synthesising learning from across the full breadth of ERS courses, students will focus on the big picture of humanity’s relationship with non-human nature. At the same time, students will contribute to the development of a ‘legacy course’ for the Department. Rooted in this shared orientation to the big questions, the legacy course will consolidate an identity and shared mission among successive cohorts of ERS students and develop practical projects within the wider UW and KW communities.

1. COURSE INFORMATION

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Teaching Assistants	Alyssa Roth. Email: aproth 'AT' uwaterloo DOT ca Kaitlyn Rathwell. Email: kaitlynDOTrathwell'AT'uwaterloo DOTca Isabel Urrutia. Email: ihurruti'AT'uwaterlooDOTca
Lecture:	Monday 12:30-2.20 EV3 1408
Tutorials:	Tues 10.30-11:20 EV2 2022 Tues 11.30-12.20 EV2 2022 Tues 2.30-3.20 EV2 2006 Tues 3:30-4:20 EV2 2006 Tues 2:30-3.20 EV1 354
	YOU MUST ATTEND TUTORIALS (PLEASE CONFIRM TIME, VENUE AND REGISRATION YOURSELF)
Readings:	Books will be in the reserve collection. Students are advised to photocopy (obeying copyright laws), and share as appropriate. Readings will also be posted on LEARN. There is no course fee for 'Courseware.' Users can login to LEARN via: http://learn.uwaterloo.ca/ (use your WatiAM/Quest username and password) Documentation is available at: http://av.uwaterloo.ca/uwace/training_documentation/index.html
Communications:	I will communicate using emails through LEARN. Emails will go to your UWaterloo account (see IT services on how to forward UWaterloo emails to other accounts).
Dates: TBC	There will be a lecture and a tutorial in the first week of the semester.

Advice: Please enter the dates of the various assignments into your calendar now. Give yourself a long lead-time and start working on each assignment weeks in advance.

2. COURSE OVERVIEW

ERS410 is the capstone course in the Department of Environment and Resource Studies. The course will provide a vehicle for reflection and synthesis, allowing students to integrate themes, bodies of knowledge and learning experiences accumulated over course of the degree programme. This will be achieved in four ways.

- i. **BIG HISTORY:** The lectures will focus on really big questions, placing human endeavours and problems into the overarching context of cosmic evolution. This framework, which David Christian (2005) calls 'big history', is presented as a scientific 'origin myth. Such a myth is necessary to anchor meaning and provide a sense of the significance of human endeavour, which might otherwise seem fleeting and meaningless when seen against the infinite universe. Big History makes sense of both ecological and social complexity as dimensions of a much broader thermodynamic order, which is evident in the unfolding universe at every spatial and temporal scale. Understanding our place in the universe in this way allows us to recognise as fellow travellers, not only our immediate kith and kin in the natural world (mice, monkeys, blue-green algae and viruses et al.), with whom we share a common genetic inheritance, biochemical machinery and an ecological household – but also in more unlikely entities such as quarks, quasars and stars. Narrowing the timeframe to the 'Long Now' of human development, this relationship between energy throughput and complexity is applied to what Elias called 'the process of civilisation' (1939): the interweaving co-development of controls over the self (psychology and personality structure), over others (social complexity and the division of labour) and over nature (ecological transformation). On this basis, the problem of sustainability is reframed in terms of (a) complexity as a locus for signification and ontological meaning (b) a tension between complexity in economy and society and complexity in natural systems, and (c) the internalisation of very long time horizons into human 'steering systems' (including culture, religion, spirituality governance, politics, policy, institutions).
- ii. **ECOLOGY, ECONOMY, TIME:** All of the environmental problems, with which students have become very familiar, can be understood in terms of energy and material **throughput** and as a problem of **scale** (the ratio of economy/ecology) i.e. a mismatch between the scale and temporality of human activities and those of non-human ecological systems. The lectures will consolidate student understanding of this tension and draw attention to the practical consequences for any truly long term vision for a sustainable relationship between economy and ecology, the 'anthroposphere' and the biosphere.

iii. **DIVERGENT FUTURES AND DISRUPTIVE TECHNICS:** The twenty first century will be a bottleneck in human development. The long-term future of any kind of science-based, globally connected civilisation is far from certain. Resource and energy strain could certainly lead to a significant process of collapse and consolidation at much lower level of technological and social complexity. Climate change could even result in the eventual extinction of the human species, along with the countless others whose fate is already (sadly) guaranteed. On the other hand, if we manage to secure into 'the long now', the future of a complex, globally-connected, science-based civilisation – then humanity could flourish for millennia to come. In flourishing, our species might also come to play the sentient, organising brain for a reflexive and self-aware biosphere. But to achieve what James Lovelock has referred to as a 'Gaian civilisation', humanity has to solve one very difficult problem: how is it possible to sustain a complex material culture involving high rates of technological innovation and an extensive social and technical division of labour, whilst at the same time radically reducing the underlying flows of energy and materials upon which all human activities depend. Exploring this problem, the lectures will juxtapose different scenarios for human development over the next century. Focusing on the 'wicked' problem of consumer society and consumerism as a resilient and expanding social-ecological system, the lectures will outline possibilities for radical techno-social innovation.

iv. **LEGACY PROGRAMME**

As the ERS capstone, ERS 410 is designed to function as a legacy course. The legacy we are attempting to create involves creating a pedagogical dynamic and community of practice that will pass down from one cohort of students to the next, each generation taking the opportunity to modify and improve the course. Over time, the legacy will consolidate the ERS collegiate experience, embody a distinctive intellectual and pedagogical ethos and give shape to a characteristic outlook and esprit de corps among ERS graduates. The course will help to create a wider community of ERS graduates who identify with each other and with the Department. Ideally the legacy will also involve on-going projects in the KW community. As well as a focus for the ERS community and 'brand', these projects will make a contribution to the problem of sustainability in 'the Long Now.'

One implication of this course design is that the programme will change every year. Each cohort will in effect help to design the programme for the subsequent year. This year students will use tutorials in the final third of the semester to examine possible legacy projects and to identify problems and opportunities with regard to their implementation in a university environment.

3. **READING LIST**

The reading list is to be confirmed by January. A separate document will be loaded on the LEARN site.

Students wishing to prepare for the class over Xmas should start by looking at the following texts.

Spiers, F. (2010) *Big History and the Future of Humanity* (Oxford: Wiley Blackwell)

Christian, D. (2004) *Maps of Time: An Introduction to Big History* (Berkeley, CA, University of California Press)

4. LEARNING AIMS AND OBJECTIVES

By the end of this course, you will be able to:

- Apply the time horizons of Big History to the problem of sustainability
- Demonstrate your understanding of the relationship between energy and complexity
- Demonstrate a conceptual understanding of the relationship between human institutions and the kind of steering implied by the 'the Long Now'
- Frame humanity's long-term ecological dilemma as a problem of metabolic scale
- Recognize and articulate the issue of (over)consumption as a 'wicked' (paradoxical, not 'bad') problem.
- Articulate an overview of the big picture implicit across the breadth of ERS courses.
- Describe the role and function of a 'legacy course' in a university environment.
- Identify the potential, impact and possible content of a legacy course in ERS.
- Imagine a completely new relationship between humanity and the biosphere, recognize kinship and complicity with a much wider array of entities, biophysical processes and phenomena and conceive of the human project within the extended time horizons of 'the Long Now.'

5. TUTORIALS

As well as conventional discussions of set readings, tutorials will include student Powerpoint presentations and a variety of exercises. Some of the exercises will be reproduced in a more polished form and submitted as part of the PORTFOLIO, and in one case as a separate POSTER assignment (see below).

In seminars students will be divided into 4 teams (A,B,C and D). The administration of this process is up to the Teaching Assistant. In most cases a team will work together throughout. Many of the sessions will involve working first of all in teams, reporting back to the group and then a final group discussion or exercise.

6. LECTURE AND TUTORIAL SCHEDULE

ERS-410 Course at a Glance			
<p>PLEASE NOTE:</p> <p>ASSESSMENT SUMMARY</p> <ul style="list-style-type: none"> • Term paper [50%] (ELECTRONIC SUBMISSION VIA LEARN, by midnight Friday in week 12). • Poster [15%] (based on tutorial 2, hand in at tutorial 5) • Portfolio: [35%] 5 exercises (A-E, indicated below) and handed in to the tutorial in week 9. <p>READING</p> <ul style="list-style-type: none"> • <i>Lecture reading</i> = what you need to really get to grips with the topic, get the most from the lecture and achieve good marks in the term paper. • <i>Tutorial reading</i> (where indicated) = minimum reading necessary for students to be able to participate in the tutorial effectively. 			
Week	Lecture	Lecture Reading	Tutorial
1	<p><u>Preface:</u> The idea of a legacy course (15 min lecture)</p>	1 page notes from lecturer, with examples	
	<p>Myth, Meaning and Enlightenment</p> <ul style="list-style-type: none"> • The role of origin myths • Instrumental and substantive rationality • Individuation, freedom and meaning • Killing God,' detraditionalisation and failures of ecological restraint 	<p>Segal</p> <p>Berman</p>	<p><u>Tutorial Question:</u> <i>Is progress incompatible with ecological restraint?</i></p> <p>Tutorial reading: Berman – Intro + Ch1</p> <p><u>Assessment:</u> PORTFOLIO EXERCISE A: SHORT ANSWERS.</p>
2	<p>Individuation and Ecological Restraint</p> <ul style="list-style-type: none"> • The Land Ethic and 'ecological civilising processes' • Ontological insecurity and 'terror management' 	<p>Callicott</p> <p>Leopold</p> <p>Giddens</p> <p>Quilley</p> <p>Dickinson</p> <p>Becker</p>	<p><u>Tutorial Exercise:</u> <i>'Hero Projects' and 'Symbolic Selves'</i></p> <p>Tutorial reading: Dickinson & Becker</p>

3	<p>Big History as a Scientific Origin Myth</p> <ul style="list-style-type: none"> • Thermodynamic, order and complexity • Fellow travellers in the cosmic caravan • Bringing back God? (Does she want to come back? Maybe? Maybe not. What about cosmic meaning more generally?) 	<p>Spiers</p> <p>Quilley</p> <p>Christian</p>	<p><u>Tutorial Question:</u> <i>What is the ‘big picture’ that emerges from the courses that you have taken in ERS (and in other departments) at U. Waterloo?</i></p> <p><u>Assessment:</u> POSTER (Submit week 5)</p>
4	<p>The Long Now:</p> <ul style="list-style-type: none"> • Playing with time • The meaning of ‘success’ for a species • Human institutions and the long now 	<p>Stewart Brand</p>	<p><u>Tutorial problem:</u> <i>Human interventions in natural cycles /processes.</i></p> <p><u>Assessment:</u> PORTFOLIO EXERCISE B: 7 Generations (or Granny’s Granny’s Great⁵ Grand-daughter)</p>
5	<p>Fire and Civilization</p> <ul style="list-style-type: none"> • The triad of basic controls: psychological, social and ecological transformations in tandem • Human ecology=trophic expansion (that is what we do!) 	<p>Goudsblom</p> <p>Elias,</p> <p>Quilley</p>	<p><u>Tutorial Problem:</u> <i>Human steering systems and means of orientation.</i></p> <p><u>Assessment:</u> PORTFOLIO EXERCISE C – In 300 words make an argument for ‘knowledge’ or ‘meaning’ as more important for steering human society over the next two centuries.</p> <p><u>‘POSTER’ ASSIGNMENT DUE: HAND IN DURING THE TUTORIAL</u></p>
6	<p>Transformity: energy and civilisation</p> <ul style="list-style-type: none"> • Thermodynamic zero sums • The energetic cost of complexity • What is the thermodynamic throughput associated with democracy, Gay Pride, international football or Led Zeppelin? 	<p>Odum</p> <p>Quilley</p>	<p><u>Tutorial Problem:</u> <i>Entropy and ‘rock & roll’</i></p> <p><u>Tutorial reading:</u> Quilley (Anthroposphere article) + Odum</p> <p><u>Tutorial homework:</u> Watch a live performance of Led Zeppelin playing between 1969 and 1975.</p>

7	Nature, Culture and Symbiosis	Nash Coppinger Budiansky Margulis Sapp Lovelock (on 'Gaian civilisation')	<u>Tutorial Problem:</u> <i>Feeding civilisation and the earth biosphere A.D.2500</i> (Pan-galactic Comparative Biosphere Project: Final Report to the Sentient Species Research Council) <u>Assessment:</u> PORTFOLO EXERCISE D: Provide a 500 word synopsis of Professor Joop Depthort's Final Report.
8	Consumerism and civilisation	Botson Gansky Adam Curtis - BBC film	<u>Tutorial Exercise:</u> 'Education for consumption' TRIZ exercise
9	Future gazing: Escape Velocity versus 'The Road'	Constanza	<u>Tutorial exercise:</u> 'A day in the life of...' Kitchener -Waterloo A.D. 2099 <u>Assessment:</u> PORTFOLIO EXERCISE E: Book review
10	Ecocities and 'arcologies'	Register Soleri	<u>Tutorial exercise:</u> TBC
DESIGNING A LEGACY COURSE			
11	Intro: What is a legacy course? Possible topics, avenues and strategies <ul style="list-style-type: none"> • Open source ecology/3D Printing/flexible fabrication- • Hacker spaces and community fabrication • MIT – Build Just about Anything 	Gershenfeld	<u>Tutorial exercise:</u> HAND & BRAIN + LEGACY TRIZ EXERCISE <u>PORTFOLIO ASSIGNMENT DUE: HAND IN TO THE TA DURING TUTORIAL</u>
12	Vertical Farming and/or (Transition) Permaculture Garden		<u>Tutorial exercise:</u> Designing an ERS legacy programme around food and fabrication

7. ASSESSMENT

Full details of the assignments will be made available on the LEARN site at the start of the semester. Assignments consist of:

- **TERM PAPER (50%):** Students will submit a 2500 word paper, with a title chosen from a list provided by the instructor and available on the LEARN site. This assignment is due (TBC – end of Semester). PLEASE NOTE: THIS PAPER SHOULD BE SUBMITTED ELECTRONICALLY THROUGH LEARN BY MIDNIGHT ON THE FINAL FRIDAY IN WEEK 12 (the last week of the course).
- **POSTER (15%):** Based on the tutorial exercise in week 2, the poster is to be submitted to your TA at the tutorial in Week 5.
- **(Individual) Portfolio for legacy project? (35%):** The Portfolio will consist of 5 exercises (A-E) from the tutorials, written up and handed in together, to the TA at the tutorial in Week 11. The relevant exercises will be indicated in the Tutorial Schedule. PLEASE NOTE: *The final component, a book review is indicated in week 9 but you are strongly advised to start on this element by week 3.*

ESSAY & PORTFOLIO MARKING RUBRIC

EXCELLENT A+ to -A-	A+ 90-100	<p>Demonstrates significant understanding and knowledge of theories and concepts.</p> <p>Demonstrates critical awareness and capacity to compare, contrast and critique theoretical positions.</p> <p>Broad knowledge of literature.</p>
	A 85-89	<p>Demonstrates capacity to apply theories and concepts.</p> <p>Recognition of the limits of choses position/recommendation/perspective.</p> <p>Well written without significant grammatical or spelling errors.</p>
	A- 80-84	<p>Appropriate referencing and citations and a properly formatted bibliography.</p>

GOOD B+ - B-	<p>B+ 77-79</p> <p>B 73-76</p> <p>B- 70-72</p>	<p>Follows general outline of the assignment.</p> <p>Demonstrates reasonable knowledge of the literature</p> <p>Signals good understanding of theories and concepts.</p> <p>Makes interesting and insightful observations about issues but not effectively or clearly linked to course content and materials</p> <p>Applies concepts and theories but with less creativity and precision.</p> <p>Demonstrates good communication skills.</p> <p>Cites sources appropriately and fully.</p>
ADEQUATE C+ to C-	<p>C+ 67-69</p> <p>C 63-66</p> <p>C- 60-62</p>	<p>Writing is largely descriptive with little or no probing, analysis or critique..</p> <p>Poor or partial understanding of concepts and theories along with significant errors.</p> <p>Evidence of only limited reading.</p> <p>Poor writing skills (lack of structure, poor composition, poor sentence structure, problems with paragraphing etc.)</p> <p>Frequent spelling and grammatical errors</p> <p>Some problems with citation, referencing and the presentation of a bibliography.</p>
INADEQUATE D+ to F		<p>Little or no understanding of the concepts and theories.</p> <p>Evidence of little or no reading.</p> <p>Poor writing skills with systemic grammatical and spelling errors.</p>

POSTER MARKING RUBRIC

	EXCELLENT					INADEQUATE
QUALITY OF ARGUMENT/ PRESENTATION						
Question/problem clearly stated						
Poster 'stands alone' and needs no additional explanation						
Logical and adequate explanation of topic						
EVIDENCE						
Adequate supporting evidence and examples						
APPEARANCE						
Use of figures or tables (if any) is effective						
Graphics and illustrations eye-catching and effective						
SOURCES AND REFERENCING						
Sources adequately acknowledged with accurate citations						

8. COURSE POLICIES

- **REFERENCING:** All written work should use the standard APA/Harvard referencing system.
- **SPELLING, STYLE, GRAMMAR, COMPOSITION:** I take this seriously and so should you.

- **ELECTRONIC SUBMISSIONS:** When submitting files, please use user-friendly and descriptive file names (e.g. Quilley– 410-ESSAY2.doc).

9. NOTES FOR PERSONS WITH RELIGIOUS BELIEFS AND /OR DISABILITIES

Note for students with disabilities: The Office for Persons with Disabilities (OPD), located in Needles Hall, Room 1132, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with the OPD at the beginning of each academic term.

Religious Observances: Please inform the instructor at the beginning of term if special accommodation needs to be made for religious observances that are not otherwise accounted for in the scheduling of classes and assignments.

10. PLAGIARISM, STUDENT CONDUCT AND ACADEMIC INTEGRITY

Academic Integrity: In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility. www.uwaterloo.ca/academicintegrity/. Students who are unsure what constitutes an academic offence are requested to visit the on-line tutorial at: <http://www.lib.uwaterloo.ca/ait/>

Research Ethics: Please also note that the 'University of Waterloo requires all research conducted by its students, staff, and faculty which involves humans as participants to undergo prior ethics review and clearance through the Director, Office of Human Research and Animal Care (Office). The ethics review and clearance processes are intended to ensure that projects comply with the Office's Guidelines for Research with Human Participants (Guidelines) as well as those of provincial and federal agencies, and that the safety, rights and welfare of participants are adequately protected. The Guidelines inform researchers about ethical issues and procedures which are of concern when conducting research with humans (e.g. confidentiality, risks and benefits, informed consent process, etc.).

If the development of your research proposal consists of research that involves humans as participants, the please contact the course instructor for guidance and see: www.research.uwaterloo.ca/ethics/human/