



Sustainability and Complexity Syllabus

Department of Biology

BIOL 4065, Fall 2023

Dalhousie University acknowledges that we are in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq People and pays respect to the Indigenous knowledges held by the Mi'kmaq People, and to the wisdom of their Elders past and present. The Mi'kmaq People signed Peace and Friendship Treaties with the Crown, and section 35 of the Constitution Act, 1982 recognizes and affirms Aboriginal and Treaty rights. We are all Treaty people.

Dalhousie University also acknowledges the histories, contributions, and legacies of African Nova Scotians, who have been here for over 400 years.

Course Instructor(s)

Name	Email	Office Hours
Ginno Martinez	gn524998@dal.ca	By appointment on Microsoft Teams

Course Description

Sustainability is a transdisciplinary area integrating equitable societies, protected environments, and robust economies. Achieving sustainability is a challenge that to date has had limited success in our complex world. Complexity studies offer new approaches for achieving sustainability beyond the traditional ones that have been mostly focused upon reducing unsustainability and using the machine model as a worldview. Simply reducing unsustainability has repeatedly fallen short of the goal of achieving sustainability.

Course Prerequisites

BIOL 2060.03 (or BIOA 3001.03) or EARTH 2410.03 or GEOG 2100X/Y.06 or GEOG 2201.03 or GEOG 2202.03 or INTD 2001.03 or INTD 2002.03 or OCEA 2001.03/2002.03 (or OCEA 2000X/Y.06) or SUST 2000.06 or SUST 2001.06

Course Exclusions

RESTRICTIONS: E1, E2, E3 Restricted to students in: Faculty of Science, College of Sustainability and International Development students in FASS

Student Resources and Support

Advising

- General Advising https://www.dal.ca/campus_life/academic-support/advising.html
- Science Program Advisors: <https://www.dal.ca/faculty/science/current-students/undergrad-students/degree-planning.html>
- Indigenous Student Centre: https://www.dal.ca/campus_life/communities/indigenous.html
- Black Students Advising Centre: https://www.dal.ca/campus_life/communities/black-student-advising.html
- International Centre: https://www.dal.ca/campus_life/international-centre/current-students.html

Academic supports

- Library: <https://libraries.dal.ca/>
- Writing Centre: https://www.dal.ca/campus_life/academic-support/writing-and-study-skills.html
- Studying for Success: https://www.dal.ca/campus_life/academic-support/study-skills-and-tutoring.html
- Copyright Office: <https://libraries.dal.ca/services/copyright-office.html>
- Fair Dealing Guidelines <https://libraries.dal.ca/services/copyright-office/fair-dealing.html>

Other supports and services

- Student Health & Wellness Centre: https://www.dal.ca/campus_life/health-and-wellness.html
- Student Advocacy: <https://dsu.ca/dsas>
- Ombudsperson: https://www.dal.ca/campus_life/safety-respect/student-rights-and-responsibilities/where-to-get-help/ombudsperson.html

Course Structure

- Course Delivery: asynchronous online
- Lectures: asynchronous, lecture and slides posted on Brightspace
- Tutorials: asynchronous, tutorials and activities posted on Brightspace

Course Materials and Procedures

- Required textbooks:
 1. *System Thinking Made Simple: New Hope for Solving Wicked Problems* by Derek and Laura Cabrera. 2nd Edition. 2015 [Available on Amazon.ca as paperback, or electronically downloaded to a Kindle or a Kindle app for your computer]
 2. *A New World System. From Chaos to Sustainability* by Donald G. Reid. Earthscan from Routledge. 2021. Available at DAL Bookstore.
 3. *What's the Worst that Could Happen? Existential Risk and Extreme Politics* by Andrew Leigh. 2021. The MIT Press. Available at DAL Bookstore.
- Online course delivery: You will need a computer to access website and course materials, and a camera and microphone for online meetings. There are no synchronous components and no ungraded components. No course components require on-campus attendance. Students connecting to online resources from outside Canada are responsible for ensuring awareness and compliance with any applicable laws in the country from which they are connecting.
- Course Brightspace website with captioned Panopto lectures.
- E-journal articles from Dalhousie Library.
- Online platform outside Brightspace: Microsoft Teams
- Email-class messages, reminders, and announcements will be sent to all students via Brightspace. Students are encouraged to post only to the discussion board to ask about class content or procedures.
- A student should request a virtual meeting with the class instructor by contacting the class instructor: gn524998@dal.ca
- A student should contact the class instructor about lateness and missed work.
- A student should email the Marker to ask a question about marking.

Assessment

Component	Weight	Date Due (all due 11:59 pm AST)
Module Assignments 1-10	10 modules @ 8 pts each = 80 pts	Sept 10, 17, 24; Oct 1, 8, 15, 22, 29; Nov 5, 19- all Sundays
Term Paper	20 pts	December 6 (Wednesday)
Total	100 pts.	

- There are no synchronous components and no ungraded components.
- 10 Module Assignments to be assessed (each one has a weight of 8 pts=80 pts or in total 80%)
- Assignments must be posted on Brightspace before the end of each week's module on Sundays 11:59 pm AST for originality checking. Points will be deducted for lateness (10% per day including weekends).
- The term paper has a weight of 20 pts (=20% of the total course assessment) and will be submitted (typed) online for originality checking by 11:59 pm on date due on Brightspace. Points will be deducted for lateness (10% per day including weekends)

Conversion of numerical grades to final letter grades follows the

Dalhousie Grade Scale

A+ (90-100)	B+ (77-79)	C+ (65-69)	D (50-54)
A (85-89)	B (73-76)	C (60-64)	F (0-49)
A- (80-84)	B- (70-72)	C- (55-59)	

Course Policies on Missed or Late Academic Requirements

Course Policies for Grading

You will not receive a letter grade lower than what is indicated for your final point value listed above, although the professor reserves the right to give you a higher grade. Because the scale is generous for A's and B's (30 points) as compared to C's and D's (20 points), individual marks will only be rounded up if the student has more than 0.50 above the maximum value for a particular letter grade. For instance, if you received 79.51 points, you would receive an A- in the class and not a B+. If you receive 79.49 points, you would receive a B+ and not an A-. A grade is something you earn. If you require a final grade at a particular level for an honours degree, job, graduate or professional school, or other purpose, you should ensure that you put the time and effort in during the term to earn the grade. The Professor is willing to give you extra help and study assignments if you believe that you are not achieving a satisfactory level of proficiency in the class. Please do not come at the end of the term requesting a higher grade because you need it to fulfill a requirement, enter graduate school, you worked hard, or

because you paid your tuition. These are not satisfactory reasons. It is unfair to the other students in the class who have done the work, and to the university, which needs to maintain fair and high standards of academic achievement. Although assignments will have a detailed point of distribution for marking, the Marker has a discretionary power to deduct additional points (up to 10%) for overall sloppy writing, poor grammar and spelling, messy format, inadequate referencing, and overall inferior quality of the assignment. All assignments are to be typed and spell & grammar-checked before submission.

Absences, Lateness, and Missed Work

Use the Student Declaration of Absence form for missed academic requirements in this course if you are ill for more than 3 consecutive days (not 3 class days) as per university policy. A submission site for your declaration is given on the class website on Brightspace. Two submissions are permitted per term. The possibility of making up late work is at the discretion of the professor. According to "Student Absence Declaration", "students experiencing recurring long-term absences are strongly encouraged to meet with a Faculty or Declared Major Advisor, or Faculty Program Coordinator and refer to the University's Student Accommodation Policy". We do not have the possibility of offering alternative assignments or changes in weighting of points per requirement. Any material submitted for evaluation after designated deadline will have marks deducted at the rate of 10% per day including weekends. Extensions without the mark penalty will be given only with a valid Student Declaration of Absence or other excuse as approved by the professor. If you file a Student Declaration for a short-term absence from class, you need to follow-up immediately with the Professor on when the missed work is due.

Course Policies related to Academic Integrity

Individual Work and Plagiarism

All work in this class is to be done individually. The 10 Module Assignments should be typed, and spell/grammar checked before being submitted to the originality evaluation on our website. Your term paper also will be checked for originality. All instances of suspected plagiarism will be reported promptly to the Academic Integrity Officer of the Faculty of Science.

We worry that using generative AI and large language models (e.g., ChatGPT) takes away the valuable thinking work that takes place when we reason things out, brainstorm, outline, refine bad ideas, etc. In that sense, students must be responsible learners by completing assignments on their own. All assignments must be considered a student's unique work, that means all ideas must be on their own and not influenced by AI tools. Students must acknowledge any sources of information or ideas when they are not their own.

Learning Objectives

- Interpret Sustainable Development (SD) as a trans-disciplinary requiring complex systems thinking.
- Contrast some of the major controversies in SD especially over what is to be sustained.
- Understand complexity as an emerging worldview and its potential applications for human development.
- Contrast North and South SD approaches regarding how can complexity theory help bridge the gap.
- Explain how reducing unsustainability is not the same as achieving sustainability.
- Undertake critical thinking about sustainability and flourishing.
- Make use of a variety of sustainability tools, methodologies, and models.
- Construct and analyze systems models featuring SD and complexity theory.
- Map SD systems using Plectica systems software.
- Interpret global sustainability indices for your study country.
- Understand wicked problems in SD from a systems point of view.
- Produce a creative, insightful final paper that integrates the course information to answer a relevant question.

Course Content

All Module Assignments are due at 11:59pm Atlantic Standard Time (AST) on first Sunday following last day (Saturday) of end of the week as listed below. Term paper due date is Dec 6. Modules contain detailed reading assignments not listed here. Readings #1-10.

Week	Date	Lesson Topic(s)	Reading/Assessment
1	Sep 6-10	Module 1. Introduction to Sustainability, Complexity, Systems Thinking, Wicked Problems, and Flourishing	Reading Week 1. -System Thinking Made Simple (Book). Chapter 1, 2 -A New World-System (Book). Preface, 1 Introduction -What's the Worst the Could Happen? (Book). Chapter 1, 2 Assignment 1. Your Twin and his/her Country
2	Sep 11-17	Module 2. The World is Complex and Unsustainable with Global Situation-Connected but Fragmented	Reading Week 2. -System Thinking Made Simple (Book). Chapter 3 -A New World-System (Book). 5 Globalization -What's the Worst The Could Happen? (Book). Chapter 3 Assignment 2. Country Statistics & Human Development Index
3	Sep 18-24	Module 3. Complexity Theory and Paradigm Shift. Changing	Reading Week 3. -System Thinking Made Simple (Book). Chapter 4

		an Approach that is Not Working/The Ecological Foot Print	<p>-A New World-System (Book). 2 Climate Change</p> <p>-What's the Worst The Could Happen? (Book). Chapter 4, 5.</p> <p>-Article: Excerpts on Rosennean: Complexity</p> <p>-Article: Leach, Melissa, Kate Raworth, Johan Rockström (2013), "Between social and planetary boundaries: Navigating pathways in the safe and just space for humanity", in International Social Science Council/United Nations Educational, Scientific and Cultural Organization, World Social Science Report 2013: Changing Global Environments, OECD Publishing, Paris/UNESCO Publishing, Paris. 10.1787/9789264203419-10-en</p> <p>-Article: Fang, K., R. Heijungs, and G.R. De Snoo. (2015). Understanding the Complementary linkages between ecological footprints and planetary boundaries in a footprint-boundary environmental, sustainability assessment framework. <i>Ecological Economics</i> 114, 2128-226. 10.1016/j.ecolecon.2015.04.008</p> <p>Assignment 3. The Ecological Footprint</p>
4	Sep 25-Oct 1	Module 4. Systems Thinking in Sustainability and Complexity in Environmental Systems. Are Resilient Ecosystems Possible?	<p>Reading Week 4.</p> <p>-System Thinking Made Simple (Book). Chapter 5</p> <p>-A New World-System (Book). 3 Technology</p> <p>-What's the Worst The Could Happen? (Book). Chapter 6.</p> <p>-Article: Reid, A., L. Eckert, J-F Lane, et al. (2021) "Two-Eyed Seeing": An Indigenous framework to transform fisheries research and management. <i>Fish and Fisheries</i> 22(2): 243-261. https://doi.org/10.1111/faf.12516</p> <p>Assignment 4. Case Study-SWOT (Note: Sep 30 is National Day for Truth and Reconciliation-University Holiday)</p>
5	Oct 2-8	Module 5. How can societies be sustainable with Social and Environmental Justice?	<p>Reading Week 5.</p> <p>-System Thinking Made Simple (Book). Chapter 6,7</p> <p>-A New World-System (Book). 4 Poverty</p> <p>-What's the Worst The Could Happen? (Book). Chapter 7</p> <p>-Article: Hickel, Jason (2019). "Is it possible to achieve a good life for all within planetary boundaries?" <i>Third World Quarterly</i>, 40(1): 18-35. 10.1080/01436597.2018.1535895</p> <p>Assignment 5. Comparing Development & SD Indicators</p>
6	Oct 9-15	Module 6. Sustainability and Complexity in Human Development. The Cuban	<p>Reading Week 6.</p> <p>-System Thinking Made Simple (Book). Chapter 8</p>

		Model as a Sustainable Society?	<p>-Article: Cabello, J.J., Garcia, D., Sagastume, A. et al. (2012). An approach to sustainable development: the case of Cuba. <i>Environ Dev Sustain</i> 14, 573–591 https://doi.org/10.1007/s10668-012-9338-8</p> <p>Article: Lane, P. (2012). Cuba's future as a sustainable society: Real option or impossible utopia? <i>Journal of Cuban Studies</i> 4(2), 154-178. https://doi.org/10.2307/41945974</p> <p>Assignment 6. Comparing Development & SD Indicators Assignment 6. UN SD Goals/SD Index/Sustainability Toolbox</p>
7	Oct 16-22	<p>Module 7. Sustainability and Complexity in the Economy. Three Models of Economy-Environment Relationship. How well does Environmental Economics (Model B) promote sustainability?</p>	<p>Reading Week 7.</p> <p>-System Thinking Made Simple (Book). Chapter 9</p> <p>-A New World-System (Book). Chapter 7, 8</p> <p>-What's the Worst The Could Happen? (Book). Chapter 8</p> <p>-Article: Lane, P. undated note. Understanding the links between economy and environment (on Brightspace)</p> <p>-Article: De Groot, R., L. Brander, S. van der Ploeg, et al. (2012). Global estimates of the value of ecosystems and their services in monetary units. <i>Ecosystem Services</i> 1, 50-61. https://doi.org/10.1016/j.ecoser.2012.07.005</p> <p>Assignment 7. Valuing Cuban biodiversity</p>
8	Oct 23-29	<p>Module 8. Sustainability and Complexity in the Economy. Ecological Economics (Model A) VS. Neoclassical Economics (Model C)</p>	<p>Reading Week 8.</p> <p>-System Thinking Made Simple (Book). Chapter 10, 11</p> <p>-A New World-System (Book). Chapter 9, 10</p> <p>-What's the Worst The Could Happen? (Book). Chapter 9</p> <p>-Article: Ramos, T.B. (2019). Sustainability Assessment: Exploring the Frontiers and Paradigms of Indicator Approaches. <i>Sustainability</i> 2019, 11(3), 824-838. https://doi.org/10.3390/su11030824</p> <p>Assignment 8: Sustainability Assessment</p>
9	Oct 30-Nov 5	<p>Module 9. Wicked Problems and Neoliberal Globalization. Does it possible a Model D? Degrowth as an alternative</p>	<p>Reading Week 9.</p> <p>-System Thinking Made Simple (Book). Chapter 12</p> <p>-A New World-System (Book). Chapter 11</p> <p>-What's the Worst The Could Happen? (Book). Chapter 10.</p> <p>-Article: Kish, K. and S. Quilley. (2017). Wicked dilemmas of scale and complexity in the politics of the growth. <i>Ecological Economics</i> 142, 306-317. https://doi.org/10.1016/j.ecolecon.2017.08.008</p> <p>-Article: Kothari, A., Demaria, F. & Acosta, A. (2014) Buen Vivir, degrowth and ecological Swaraj: Alternatives to sustainable development and the</p>

			green economy. <i>Development</i> , 57(3-4): 362-375. https://doi.org/10.1057/dev.2015.24 Assignment 9. Wicked problems in your country thwarting sustainability
10	Nov 6-12	Module 10. Sustainability after Pandemic: lessons and future	Reading Week 10. Article: Morrisey, S., & Heidkamp, P. (2022). Sustainability after COVID-19: pillars for just transition. <i>Environmental Sustainability</i> 5, 261-269. https://doi.org/10.1007/s42398-022-00231-y Assignment 10. pandemic impacts on your country
Study Week: Nov 13-17			
11	Nov 20-26	Work on Term Paper: Sustainability Transition: challenges, alternatives, envisions	Work on Term Paper
12	Nov 27-30	Review and Feedback	Term paper due Dec 6 by 11:59pm AST

University Policies and Statements

Recognition of Mi'kmaq Territory

Dalhousie University would like to acknowledge that the University is on Traditional Mi'kmaq Territory. The Elders in Residence program provides students with access to First Nations elders for guidance, counsel, and support. Visit or e-mail the Indigenous Student Centre at 1321 Edward St or elders@dal.ca. Additional information regarding the Indigenous Student Centre can be found at: https://www.dal.ca/campus_life/communities/indigenous.html

Internationalization

At Dalhousie, 'thinking and acting globally' enhances the quality and impact of education, supporting learning that is "interdisciplinary, cross-cultural, global in reach, and orientated toward solving problems that extend across national borders." Additional internationalization information can be found at: <https://www.dal.ca/about-dal/internationalization.html>

Academic Integrity

At Dalhousie University, we are guided in all our work by the values of academic integrity: honesty, trust, fairness, responsibility, and respect. As a student, you are required to demonstrate these values in all the work you do. The University provides policies and procedures that every member of the university community is required to follow to ensure academic integrity. Additional academic integrity information can be found at: https://www.dal.ca/dept/university_secretariat/academic-integrity.html

Accessibility

The Student Accessibility Centre is Dalhousie's centre of expertise for matters related to student accessibility and accommodation. If there are aspects of the design, instruction, and/or experiences within this course (online or in-person) that result in barriers to your inclusion, please contact the Student Accessibility Centre (https://www.dal.ca/campus_life/academic-support/accessibility.html) for all courses offered by Dalhousie with the exception of Truro. For courses offered by the Faculty of Agriculture, please contact the Student Success Centre in Truro (<https://www.dal.ca/about-dal/agricultural-campus/student-success-centre.html>)

Conduct in the Classroom – Culture of Respect

Substantial and constructive dialogue on challenging issues is an important part of academic inquiry and exchange. It requires willingness to listen and tolerance of opposing points of view. Consideration of individual differences and alternative viewpoints is required of all class members, towards each other, towards instructors, and towards guest speakers. While expressions of differing perspectives are welcome and encouraged, the words and language used should remain within acceptable bounds of civility and respect.

Diversity and Inclusion – Culture of Respect

Every person at Dalhousie has a right to be respected and safe. We believe inclusiveness is fundamental to education. We stand for equality. Dalhousie is strengthened in our diversity. We are a respectful and inclusive community. We are committed to being a place where everyone feels welcome and supported, which is why our Strategic Direction prioritizes fostering a culture of diversity and inclusiveness (Strategic Priority 5.2). Additional diversity and inclusion information can be found at: <http://www.dal.ca/cultureofrespect.html>

Student Code of Conduct

Everyone at Dalhousie is expected to treat others with dignity and respect. The Code of Student Conduct allows Dalhousie to take disciplinary action if students don't follow this community expectation. When appropriate, violations of the code can be resolved in a reasonable and informal manner - perhaps through a restorative justice process. If an informal resolution can't be reached, or would be inappropriate, procedures exist for formal dispute resolution. The full Code of Student Conduct can be found at: https://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html

Fair Dealing Policy

The Dalhousie University Fair Dealing Policy provides guidance for the limited use of copyright protected material without the risk of infringement and without having to seek the permission of copyright owners. It is intended to provide a balance between the rights of creators and the rights of users at Dalhousie. Additional information regarding the Fair Dealing Policy can be found at: https://www.dal.ca/dept/university_secretariat/policies/academic/fair-dealing-policy-.html

Originality Checking Software

The course instructor may use Dalhousie's approved originality checking software and Google to check the originality of any work submitted for credit, in accordance with the Student Submission of Assignments and Use of Originality Checking Software Policy. Students are free, without penalty of grade, to choose an alternative method of attesting to the authenticity of their work and must inform the instructor no later than the last day to add/drop classes of their intent to choose an alternate method. Additional information regarding Originality Checking Software can be found at:

https://www.dal.ca/dept/university_secretariat/policies/academic/student-submission-of-assignments-and-use-of-originality-checking-software-policy-.html

Student Use of Course Materials

Course materials are designed for use as part of this course at Dalhousie University and are the property of the instructor unless otherwise stated. Third party copyrighted materials (such as books, journal articles, music, videos, etc.) have either been licensed for use in this course or fall under an exception or limitation in Canadian Copyright law. Copying this course material for distribution (e.g. uploading to a commercial third-party website) may lead to a violation of Copyright law.