

Earth Resources, Sustainability and Society Syllabus

Department of **Earth and Environmental Sciences**

ERTH/ENVS 3700 Winter 2025

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

Name	Email	Office Hours
Prof. Grant Wach	grant.wach@dal.ca	Upon request (email)

Course Description

This course addresses the question: what do we need to know and understand about the nature and distribution of Earth's resources to optimally reconcile exploration and extraction processes with society's needs, environmental considerations, and the sustainable development goals, in a more geoethical and balanced approach, through the 21st Century?

Course Prerequisites

ERTH 1080, ERTH 1090

Course Exclusions

ERTH 4153, restricted to senior students in 3rd and 4th year.

Student Resources

No official office hours, if you wish to meet with Dr. Wach please send him an email with suggested meeting times and the purpose of your inquiry.

Additional resources are provided at the end of this document.

Course Structure

Course Delivery

Course delivery is in person, synchronous learning. Students are expected to attend 3 hours of in-person lectures per week, with in-class assignments given each week during the lecture period.

Lectures

Tuesdays and Thursdays, 8:35-9:55AM, Milligan Room 8007 8th floor LSC

Course Materials

ERTH/ENVS 3700 course materials will be provided for your review on the course Brightspace page. Review the course Brightspace and carefully read any emails and announcements you receive through email regarding this course.

Assessment

COMPONENT	WEIGHT (% OF FINAL GRADE)	DUE DATE
Participation	5%	Throughout the semester
Debate	15%	April 1 st (in class)
In-Class Assignments	20%	Throughout the semester
Final Exam	20%	April 3 rd (in class)
Term Paper	40%	February 27 th @ 8:35 AM

In-Class Assignments

There will be a total of 8 in-class assignments given throughout the semester - 4 exercises and 4 quizzes. Each exercise will be worth 3%, each quiz will be worth 2%, adding up to a total of 20% of your final grade. Each assignment will be directly related to the material presented during class that week. There will be no in-class assignment the week the term paper is due. The

debate will serve as the final in-class assignment, being worth 15% of your final grade, and will be held during the last Tuesday class period of the year.

These quizzes MUST be completed in class and accommodations will be considered if required. If you are unable to attend a class in which there is an assignment, alternate arrangements must be made ASAP to ensure fairness. If you are unable to attend a class, please email Dr. Wach with your reasoning prior to the beginning of the scheduled lecture period.

You can waive one in-class assignment during the semester.

Term Paper

The term paper will be due directly after reading week, by the start of class time 8:35AM on Thursday February 27th. The theme/topic for the paper will be introduced and discussed at length during the second week of classes. There is a 10% per day penalty for late submissions, no exceptions.

The term paper will have you select a specific resource project of your choosing (Muskrat Falls hydroelectric, Bay of Fundy tidal, Alberta oil sands, Saskatchewan uranium, etc.) and provide a detailed overview of the project and analyze its components based on the UN Framework Classification of Resources.

You will be asked to provide your chosen topic by Tuesday January 21st. You will be given the chance to provide an outline of your paper for review and comments from Dr. Wach. This is not mandatory, but it is highly suggested for you to get feedback on your paper. The due date for this will be January 30th, to help encourage you to stay on track and work on the paper prior to the last few days before it is due.

Final exam

The final exam will be worth 20% of your course grade and will take place during the last scheduled class of the semester. You will have one hour to complete it. The exam will include questions on material presented throughout the semester in both long- and short-answer format. If you require any accommodations for the final exam, please be sure to arrange through the Accommodations team at the start of the semester.

Other course requirements

Attendance in the scheduled lecture periods is mandatory. In-class assignments will be given each week and will make up a total of 20% of your final grade. If you are unable to attend a class for any reason, please reach out to Dr. Wach prior to the beginning of the scheduled class period detailing your absence in order to work out alternate arrangements for any in-class assignments you may miss.

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

If you are unable to attend a class in which there is an in-class assignment, please provide your reason for absence to Dr. Wach prior to the scheduled class period. All in-class quizzes must be completed during class (cannot be completed at home), and rescheduling must be done during the week of the assignment to count towards your grade.

There are no exceptions for the submission date for the term paper – this date is set at the beginning of the semester, and you are given nearly two months to complete it. For every day or part of the day that your submission is late, you will receive a 10% penalty on your term paper grade. We highly recommend not leaving this to the last minute.

Course Policies related to Academic Integrity

*All data will be your own work. Ask questions of both your classmates, TAs, and the instructor but **do not copy others' work**. Plagiarism will result in direct referral to the University Senate Committee on Academic Discipline & Integrity. For any assignment completed in a group, please provide a brief breakdown of the work between team members. The Term Paper is to be a completely independent assignment subject to additional scrutiny.*

We strongly discourage the use of AI and large language models in the completion of course work. The purpose of this course is to enhance your understanding of certain topics, which cannot be assisted by AI generated material. If you feel that the use of AI models in the course would improve your comprehension, please discuss with the professor to determine potential while encouraging critical thinking and veering away from plagiarism. Keep in mind AI models are not reliable sources, and anything created or found in such programs would need to be cross referenced for accuracy.

Learning Objectives

1. Demonstrate knowledge and understanding of the concepts of the earth resources including processes of mineral formation, energy systems including fossil fuels and renewables, and the processes of resource exploration, evaluation, and extraction.

2. Organize ideas, summarize teachings, and describe findings appropriate for academic writing and oral defense of ideas in the Earth and Environmental Sciences.
3. Demonstrate in-depth knowledge and understanding of resource assessment and terminology through analysis, classification, and identification of earth resources.
4. Synthesize and summarize social, geoethical, and environmental considerations as they relate to development of earth resources.

Course Content

- *Introduction: the historical context; the sustainability dilemma; international standards; the exploration and development cycle*
- *UN SDGs, UNRMS, UN Framework Classification of Resources (term paper topic assignment), UNCLOS*
- *Introduction to the economics and business aspect of earth resources; CRM (critical raw materials)*
- *Geology of earth resources: mineral deposits and plate tectonics; classification of mineral deposits; processes of formation – magmatic, metamorphic, sedimentary, and hydrothermal; hydrocarbon development; groundwater and tidal*
- *Geothermal systems; carbon capture, usage, and storage (CCUS)*
- *Environmental considerations and sustainability: mining and the environment; mining and sustainable development; environmental impact and reduction of harm to the environment*
- *Social license to operate; social impacts of mining and reduction of harm; mining in relation to the sustainable development goals*
- *Resource exploration (minerals, hydrocarbons, water, tidal, wind): key aspects, stages, models, and methods; environmental and societal implications*
- *Resource evaluation: sampling and assessment; project evaluation principles; environmental and societal implications; extraction and processing stages; site closure and reclamation*
- *Overview of geoethical considerations; geo-communication considerations (transparency)*
- *Case studies of controversial exploration and extraction (Mining in the ocean? Critical minerals mining? Mining waste? The future of resource extraction?)*

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/about/leadership-governance/academic-integrity/faculty-resources/ouriginal-plagiarism-detection.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.

Student Resources and Support

University Policies and Programs

Important Dates in the Academic Year (including add/drop dates):

http://www.dal.ca/academics/important_dates.html

Classroom Recording Protocol:

https://www.dal.ca/dept/university_secretariat/policies/academic/classroom-recording-protocol.html

Dalhousie Grading Practices Policies:

https://www.dal.ca/dept/university_secretariat/policies/academic/grading-practices-policy.html

Grade Appeal Process: https://www.dal.ca/campus_life/academic-support/grades-and-student-records/appealing-a-grade.html

Sexualized Violence Policy: https://www.dal.ca/dept/university_secretariat/policies/health-and-safety/sexualized-violence-policy.html

Scent-Free Program: <https://www.dal.ca/dept/safety/programs-services/occupational-safety/scent-free.html>

Learning and Support Resources

General Academic Support – Advising (Halifax): https://www.dal.ca/campus_life/academic-support/advising.html

General Academic Support – Advising (Truro): <https://www.dal.ca/about-dal/agricultural-campus/ssc/academic-support/advising.html>

Student Health & Wellness Centre: https://www.dal.ca/campus_life/health-and-wellness.html

On Track (helps you transition into university, and supports you through your first year at Dalhousie and beyond): https://www.dal.ca/campus_life/academic-support/On-track.html

Indigenous Student Centre: https://www.dal.ca/campus_life/communities/indigenous.html

Indigenous Connection: <https://www.dal.ca/about-dal/indigenous-connection.html>

Elders-in-Residence (The Elders in Residence program provides students with access to First Nations elders for guidance, counsel, and support. Visit the office in the Indigenous Student Centre or contact the program at elders@dal.ca or 902-494-6803:

<https://cdn.dal.ca/content/dam/dalhousie/pdf/academics/UG/indigenous-studies/Elder-Protocol-July2018.pdf>

Black Student Advising Centre: https://www.dal.ca/campus_life/communities/black-student-advising.html

International Centre: https://www.dal.ca/campus_life/international-centre.html

LGBTQ2SIA+ Collaborative: <https://www.dal.ca/dept/vpei/edia/education/community-specific-spaces/LGBTQ2SIA-collaborative.html>

Dalhousie Libraries: <http://libraries.dal.ca/>

Copyright Office: <https://libraries.dal.ca/services/copyright-office.html>

Dalhousie Student Advocacy Services: <https://www.dsu.ca/dsas?rq=student%20advocacy>

Dalhousie Ombudsperson: https://www.dal.ca/campus_life/safety-respect/student-rights-and-responsibilities/where-to-get-help/ombudsperson.html

Human Rights and Equity Services: <https://www.dal.ca/dept/hres.html>

Writing Centre: https://www.dal.ca/campus_life/academic-support/writing-and-study-skills.html

Study Skills/Tutoring: http://www.dal.ca/campus_life/academic-support/study-skills-and-tutoring.html

Faculty of Science Advising Support: <https://www.dal.ca/faculty/science/current-students/undergrad-students/degree-planning.html>

Safety

Biosafety: <http://www.dal.ca/dept/safety/programs-services/biosafety.html>

Chemical Safety: <https://www.dal.ca/dept/safety/programs-services/chemical-safety.html>

Radiation Safety: <http://www.dal.ca/dept/safety/programs-services/radiation-safety.html>

Laser Safety: <https://www.dal.ca/dept/safety/programs-services/radiation-safety/laser-safety.html>