



ECON326 – McGill University

ECOLOGICAL (also called Biophysical) ECONOMICS
Winter 2024 Syllabus

Class Times: [REDACTED]
Room: [REDACTED]
Credits: 3

Instructor: Michael Babcock
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Office Hours: [REDACTED]

1) In accord with McGill University's Charter of Student Rights, students in this course have the right to submit in English or in French written work that is to be graded. This does not apply to courses in which acquiring proficiency in a language is one of the objectives. (Approved by Senate on 21 January 2009)

Conformément à la Charte des droits de l'étudiant de l'Université McGill, chaque étudiant a le droit de soumettre en français ou en anglais tout travail écrit devant être noté, sauf dans le cas des cours dont l'un des objets est la maîtrise d'une langue. (Énoncé approuvé par le Sénat le 21 janvier 2009)

2) McGill University values academic integrity. Therefore, all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the Code of Student Conduct and Disciplinary Procedures. (Approved by Senate on 29 January 2003) (See McGill's guide to academic honesty for more information.)

L'université McGill attache une haute importance à l'honnêteté académique. Il incombe par conséquent à tous les étudiants de comprendre ce que l'on entend par tricherie, plagiat et autres infractions académiques, ainsi que les conséquences que peuvent avoir de telles actions, selon le Code de conduite de l'étudiant et procédures disciplinaires. (Énoncé approuvé par le Sénat le 29 janvier 2003) (pour de plus amples renseignements, veuillez consulter le guide pour l'honnêteté académique de McGill.)

3) Lecture and associated material for this course are not to be reproduced or placed in the public domain. Each of you are permitted to use these materials for your own purposes, but you cannot allow others to use it by posting it online or giving it or selling it to others who may copy it and make it available. Instructor-generated course materials (e.g., handouts, notes, summaries, exam questions) may not be copied or distributed in any form or in any medium without explicit permission

of the instructor. Note that copyright infringements can be subject to follow-up by the University under the Code of Student Conduct and Disciplinary Procedures.

4) The University and your course instructor are committed to maintaining teaching and learning spaces that are respectful and inclusive for all. To this end, offensive or harmful language arising in course contexts may be cause for disciplinary action.

5) In the event of circumstances beyond the University's control, the content and/or evaluation scheme in this course is subject to change. Additionally, portions of the course may be offered remotely, if conditions lead to this being necessitated.

6) No audio or video recording of any kind is permitted during lectures.

7) It is important that students take care of both mental and physical health during their studies. Please consult McGill's Student Wellness Hub website if you feel you need professional assistance or health care. Here will be found a wide-range of services offered for students, including dietitians, sexologists, nurses, doctors, wellness advisors, counsellors, and psychiatrists. I encourage all students to acquaint themselves with the website and the services on offer prior to the Winter semester.

Course Overview

Macroeconomic and structural aspects of the ecological crisis. A course in which subjects discussed include the conflict between economic growth and the laws of thermodynamics; the search for alternative economic indicators; the fossil fuels crisis; and "green" fiscal policy.

Ecological (AKA biophysical) economics differs in intent, perspective, and analytical method from mainstream economics. Environmental economics, for example, focuses on micro level optimization; while macroeconomics concerns itself in understanding, maintaining, and if possible accelerating growth at the economy-wide level. By contrast biophysical economics studies economic activity in terms of not just resources or markets but in terms of the economic and environmental consequences of economic activity for the biosphere as a whole; its main concern is not production or distribution at the micro or macro levels, but the use and flows of energy and matter on both local and global scales, as well as the depletion of stocks of resources and waste/pollution in and of environmental sinks.

Put simply, the biophysical/ecological perspective used in this course attempts to understand material and energy flows through the ecosystems human economies and societies depend upon; it attempts to adjudicate how much material and energy individual ecosystems can produce and have flow through their porous boundaries; and it attempts to link these to macroeconomic agendas, institutions, and, potentially, transitions. To these inquiries there are no simple responses, however, and this course offers tools and concepts, such as *ecologically open vs. ecologically closed* systems, and a multi-disciplinary perspective to find partial answers.

To do well in this course students must come to understand the forces, human and natural, acting on the globe, their trajectories over time and space, and their implications for the future. The lectures and associated materials elucidate these by describing the foundations of biophysical and

biogeochemical processes, their importance for human life, and, by extension, their centrality in human economies and societies.

Required Course Materials

Core course material is available in lectures plus in individual modules on mycourses. This is not a textbook-based course, but we make use of several resources, of which the lectures and lecture material are the most important. Consequently, for top grades in the course, attendance at lectures is essential. The “slides” (updated year by year), and also posted on mycourses after lecture, are the essential guide to more technical and complex material found on mycourses. However, reviewing the slides alone is not sufficient for grasping the course material; serious learning requires activating your eyes, ears, hands, and brain: you need to see material on the screen, listen to it being explained, take careful notes, and think about what you heard and saw. Additionally, in pursuit of this goal of serious learning, the assignments in this course give students practice in thinking through and writing out – clearly, lucidly, and, it is hoped, beautifully – what they have learned in lecture.

The many readings accumulated on mycourses are clearly marked into the categories of mandatory and supplementary. There are a select few readings that students will need to familiarize themselves with for the mid-term examinations, but these are provided to the students via links to the McGill library on mycourses. More details on readings will be discussed during lectures. Each module in mycourses is coupled to a particular class and contains the necessary items selected by the professor to complement lectures. These modules are where students will find all readings and slides.

While basic knowledge of economics is presupposed for all students, some basics of ecology are important. Students can read any introductory ecology book or (better still) follow the 12 unit (10-12 minutes each) crash course provided here that explains core ecological concepts: https://www.youtube.com/results?app=desktop&search_query=crash+course+ecology. *It is also fun!*

Other Readings

There are sort-of textbooks available for ecological (or biophysical) economics, but we are still awaiting that which sets out a/the “grand unifying theory” of ecological processes and economic systems. None are required reading for the course, but if students are interested in pursuing these ideas independently they are available from the McGill library and for purchase.

- **Juan Martínez-Alier: *Ecological Economics: Energy, Environment and Society*** (looks at some precursors of the thinking embodied in the subject of ecological economics).
- **Stanislav Shmelev: *Ecological Economics: Sustainability in Practice*** (the most accessible of more technical recent works).

- **Blair Fix: *Rethinking Economic Growth Theory From a Biophysical Perspective*** (requires reasonable knowledge of calculus and macroeconomic theory).
- **Nicholas Georgescu-Roegen: *The Entropy Law and the Economic Process*** (the most important book in the emergence of biophysical economics; the book's math and physics can be complicated and its grammar and sentence structure sometimes hard to parse. Some of Georgescu-Roegen's more comprehensible articles are made available in the Appendix module on mycourses).
- **Charles Hall and Kent Klitgaard: *Energy and the Wealth of Nations: Understanding the Biophysical Economy*** (while important to the field of biophysical economics the text has a strong US-focus, detracting Canadian and International readers somewhat; available at the McGill library as a e-book for free download).
- **Vaclav Smil** is perhaps the most learned person on the interface of energy, economy, and environment, and has written many books for various audiences. Some are short and easy to read, for example *Energy* or *Oil*, both written as *Beginner's Guides*. His most scientific is *Energy in Nature and Society* while *Cycles of Life: Civilization and the Biosphere* is his most fascinating. If you thought learning about ecology was fun, wait until you read some of these!!

Key Course Concepts

It is useful to keep a file of unfamiliar concepts so you can find them quickly and correctly.

Biogeochemical cycles
 Carrying capacity
 Bioaccumulation
 Ecosystem services
 Limiting factors
 Environmental footprint
 Energy carriers, conversions, efficiencies etc.
 Closed-loop versus linear-throughput systems
 Entropy
 Dissipative Structures
 Dynamic systems thinking
 Path dependent behavior

Grading Scheme

All assignments are to be uploaded to mycourses – email attachments to the professor will not be accepted, unless there are exceptional circumstances. Please see separate word documents in the Syllabus section of mycourses for complete instructions for the Case Study and the Reflection Essay.

All late submissions will be subjected to a loss of one (1) mark per day up to a maximum of five (5) days. After this period your mark will be zero. This course is out of 100 marks and your grade is the accumulation of marks accrued across the assignments and with course participation. Late submissions and overall class participation can therefore be the fine line between getting an A or an A- or a B- or a C+.

Part of a university education is teaching students how to be proper functioning adults in our complex and diverse societies. This course will help teach students how to think through complex and sophisticated issues like an educated adult, as well as how to meet deadlines such as an educated adult must. Once you leave university the bank that is going to give you a loan will not care that your roommate has broken up with their partner and your home is crisis central, nor that you do not know how to work a word processor, etc. etc. They just want you to pay your bill on time, and if you don't there are penalties. I'm not a bank, but I like their logic.

Without a document from a medical professional excusing a late submission there are no exceptions, familiar, or otherwise. The above rubric is designed so that students may make their own decisions regarding course assignments. If you think your written work could benefit from another 24 or 48 hours, and are willing to lose 1-2 grades, perhaps this would be an intelligent decision. Economics, remember, is all about trade-offs, and this rubric gives you the opportunity to decide on such a trade-off, if necessary (really, however, you should pay your bills on time and you should hand your assignments in on time, but my lecturing you doesn't technically start until the first class).

1. *Mid-term Exam I (in-class)* 20% **Feb. 7**

This exam will test students' knowledge of lecture and other mandatory course material on the first eight (8) units of the course. The exam will consist of multiple choice, fill-in-the-blank, and short answer questions.

Students are not permitted to bring any electronic devices out during the examination. This includes tablets, smart phones, and laptops. If a student is found with their phone out during the exam their mark will be zero. Any attempt to photograph or otherwise duplicate examination material could result in further disciplinary action. There is zero tolerance on this policy.

Any student who is absent for the mid-term will receive a grade of zero, unless documentation is provided showing a significant medical emergency. In case of alternative situations students may request a deferred exam by emailing Babcock, but this will only be considered if the request is for legitimate reasons and is received at least 2 weeks prior to the scheduled exam.

2. *Case Study (40%).* Submission date: 11:59pm EST **Feb. 29 **Five-page maximum formatted in Word 12 point, 1.5 spacing.****

Each student will prepare a five-page analytical text, plus no more than two pages for charts, figures, or diagrams, to discuss an environmental/ecological/economic issue of the student's own

choosing. This case study uses the frameworks taught in class, e.g. flows of matter and energy, cycles of life, and how throughput (low entropy to high entropy transformations) manifests itself in time and space, to examine a particular entity in the world. A properly written case study boils down to a clear picture of the costs of human engineered energy and material flows into and out of the economy of nature.

Your analysis should be systemically driven with careful regard for both long and short term, yet proximal to the point of impact of the issue under investigation. Consider your topic from several distinct angles – economic, political, sociological, but certainly biophysical and ecological – to produce a well-rounded viewpoint. A specific subject could be a metallic ore, a type of plant, a particular species of insect facing new problems because of human exploitation, and so forth. The world is wide open for case study choices: animal, vegetable, mineral, exploring the resulting impact by *human interventions* in and on the natural world, including residual ecological and environmental effects.

Especially important is that you consider the scalability of both your topic of investigation and its consequences: pay attention to habitat (natural or synthetic), material stocks, energy flows, toxin production, waste accumulation, that affect not simply energy and material at a given stage of production, but beyond this in that similar processes in different locations are liable to have similar impacts. In other words: think and research local, but if done right, you give us global.

A warning: every semester several students write standard form essays which read like political commentary – this is not what I want as you can see from the case study examples on mycourses. This is a *data-driven* analysis the form of which is liable to be unfamiliar to some students. Therefore, there will be one class dedicated to case studies where I will offer a tutorial and answer any questions. I am also always available during my office hours.

Lastly, please do not try to submit some monstrosity generated by ChatGPT or similar platforms. Not only can this platform not perform the type of data-driven analysis I am asking for, but if you do this please note that this is the one thing worse than submitting political commentary: this is plagiarism. Any student caught using such platforms for submitted assignments will be subject to any and all disciplinary measures at the University's discretion.

Beyond this, however, and here from a friend and not your professor, you are paying to be at university, not just in tuition, but also in terms of the opportunity cost of your entire student life. Not only could you be spending this time and money in another, more profitable, venture, but if you chose to try and get through university using ChatGPT and other platforms of this nature you're not getting educated. You are, in other words, potentially wasting a lot of time and money. So please don't do yourself this disservice. It is an honour and privilege to spend years of our lives learning and studying – make the most of it, *carpe diem*, and the like. For when it comes to education there really is no substitute for actually getting engaged with and in the material and thus *learning*, and this could be the one chance you get in your life to devote yourself almost exclusively to this pursuit and begin to truly educate yourself – something very much worth both the time and the money, if done properly.

Marking Criteria for the Case Study (10 marks each)

1. Systematic analysis with multiple perspectives
2. Correct use of core course concepts
3. Quality, clarity, and depth of exposition
4. References and data sources

3. Mid-term Exam II (in-class) 20%. March 20

This exam will take place during class on March 20th and will consist of reviewing an article that I will share with students later in the term. Students must write their review in class, with pen or pencil, on lined paper that I will provide for the purpose. More instruction on this exam will be provided later in the semester.

Students are not permitted to bring any electronic devices out during the examination. This includes tablets, smart phones, and laptops. If a student is found with their phone out during the exam their mark will be zero. Any attempt to photograph or otherwise duplicate examination material could result in further disciplinary action. There is ZERO tolerance on this policy.

Any student who is absent for the mid-term will receive a grade of zero, unless documentation is provided showing a significant medical emergency. In case of alternative situations students may request a deferred exam by emailing Babcock, but this will only be considered if the request is for legitimate reasons and is received at least 2 weeks prior to the scheduled exam.

4. Reflection Essay Units 13-15: Four Pathways to Future (15%) and Class Participation (5%) **Submission date: 11:59pm EST April 18** **500 word max formatted in WORD 12 point, 1.5 spacing.**

Participation in the final four lectures is essential for writing the final assignment. Here central ideas and themes will be explored and expanded upon in lecture which will give students the necessary concepts and language to write the final assignment. The participation mark comes from engaging with material on mycourses throughout the semester, as well as attendance at course lectures.

This assignment consists of 500-word reflection essay asking for students' input/opinion regarding material covered throughout the course and into the future given our current social, economic, and environmental situation. This is like an exam in that I will give you material in lecture that you will then need to reproduce in your own words and provide a reflection on this material.

Marking Criteria for Reflection (5 marks max each)

1. Demonstrated knowledge of core course themes/concepts
2. Developed position on which of the four pathways you deem applicable/possible to the future
3. Creativity and originality