

# ERTH 4303: Resources of a Finite Earth Winter 2021 Course Outline

**Lectures:** Live on Zoom Thursday 6:05 - 8:55 pm      **Office Hours:** please email me

## **Course objective:**

To learn about mineral, water, and food resources, in the context of economic and environmental consequences of their extraction and use; and the differences between concepts of sustainability of resource utilization in the short term (e.g., market cycles, electoral cycles), longer term (decades to centuries) and ultimate sustainability of industrial society.

**Instructor:** James Mungall  
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**TA:** Chris Jenkins [chrisjenkins@cmail.carleton.ca](mailto:chrisjenkins@cmail.carleton.ca)  
**TA:** Nabil Shawwa [nabilshawwa@cmail.carleton.ca](mailto:nabilshawwa@cmail.carleton.ca)

**Textbook and Supplementary readings:** There is no textbook required.

Stephen E Kesler and Adam C Simon, 2015, Mineral Resources, Economics and the Environment. Cambridge University Press ISBN 1107074910. Available on Amazon.

Vaclav Smil, 2017, Energy and Civilization. Available for free download from Carleton Library.

Vaclav Smil, 2014, Making the Modern World: Materials and Dematerialization. One print copy in the Carleton University Library. \$33.00 on Amazon.ca

Vaclav Smil, 2012, Harvesting the Biosphere: What We Have Taken From Nature. One print copy in the Carleton University Library.

Vaclav Smil, 2016, Still the Iron Age: Iron and Steel in the Modern World. One copy available for online reading through Carleton Library. \$75 on Amazon.ca

**Course notes:** I will put my .ppt lectures onto the course website for you before the class. I will deliver the lecture via Zoom at the scheduled time and plan to record every class. The recorded version of the lecture will be available on my Youtube channel. Come to class, listen and learn, put questions in the chat bar, and then if you want to take notes you can review the saved versions.

**Wikipedia assignment:** Your term work will consist of editing or writing a Wikipedia article. You must enroll on Wikipedia as a student editor for this course. Please bring a laptop to class.

## **Marking:**

Weekly quizzes after class through CuLearn	25%
Wikipedia assignment	75%
There is no midterm and no final examination	

**Brief course outline, by week and lecture date:**

*Items written in underlined italics are assignments for Wikipedia. Their grades total 100, which will be recalculated to make up the 75% weight of your course mark given to the Wikipedia assignment. Pay attention to the due dates. Items listed as 'no grade assigned' must be completed but will not be marked. The next assignment on your to do list will not be marked until the training exercise has been completed.*

**1. Jan 14.** Introduction to the course. Chapters 1 and 2.

Concepts of carrying capacity of Earth and sustainable use of resources.

*Get started on Wikipedia - everyone has a Wikipedia account*

Training – Wikipedia policies. Due Jan 21.

Training – Plagiarism. Due Jan 21.

Training – Sandboxes, talk pages, and watchlists. Due Jan 21.

Note: doing Training and getting an account are essential to get credit for all subsequent exercises. Marks will not be given until relevant Training is done.

**2. Jan 21.** Environmental geochemistry. Chapter 3.

Geochemical reservoirs, reactions, geochemical cycles, timescales, pollution and remediation.

*Evaluate Wikipedia.*

Class discussion: Thinking about sources and plagiarism

Training - Evaluating articles and sources

Training - How to edit: Wikicode vs Visual Editor.

Exercise: Evaluate an article due Jan 28. **5% mark**

**3. Jan 28.** Mineral exploration and production. Chapter 4.

Exploration methods, mining, beneficiation, smelting, refining, mining law in Canada.

*Choose your topic/Find your sources*

Class discussion: What's a content gap?

Training – Finding your article

Guides for writing articles in your topic area - Chemistry, Environmental Science

Exercise: Choose a topic **Due Feb 4**

**4. Feb 4.** Mineral economics. Chapters 5 and 6.

Resources and reserves, reporting requirements in Canada, elasticity in supply and demand, return on investment, present value, externalities, long term sustainability.

*Add to an article*

Training - adding citations

Exercise - copyedit an article and add a citation due Feb 11. **5% mark.**

**5. Feb 11.** Energy mineral resources. Chapter 7.

Fossil fuels, peak oil, carbon footprint and other externalities, enhanced recovery, nuclear power, renewable energy.

*Start drafting your contributions - Everyone has started writing*

Training - drafting in the sandbox

Exercise - Write a first draft of your contribution, with sources identified, and keep it in your Sandbox **25% mark**, due Feb 25.

## **6. Reading week no class Feb 18**

### **7. Feb 25.** Iron, steel and ferroalloys. Chapter 8.

History of iron production, manganese, nickel, chromium, silicon, cobalt, molybdenum, vanadium, tungsten, niobium; resources, markets, environmental impacts, and future supplies.

Peer review

Class discussion: Thinking about Wikipedia

Exercise – peer review two articles. **5% mark** due Mar 4.

### **8. Mar 4.** Aluminum, light elements and technological elements. Chapters 9 and 10.

Respond to your peer review and begin moving your work to Wikipedia.

Training: Moving work out of the sandbox

Exercise – move your work from the sandbox to Wikipedia due Mar 11.

### **9. Mar 11.** Precious metals and gems. Chapter 11.

Gold, silver, platinum-group elements, diamonds, gems; resources, markets, environmental impacts, and future supplies.

Continue improving your article.

Training: contributing images and media files

Exercise: add links to your article **5% mark** due Mar 18 – it must be out of the sandbox by now.

### **10. Mar 18.** Food. Chapter 12. Construction, chemical, and industrial minerals. Chapter 13.

History and current state of food production; potash, phosphate, nitrate supplies, arable land as a resource; environmental risk and food security.

Polish your work. **5% mark** due Mar 25. We must see substantial editing since last week.

### **11. Mar 25.** Water. Uses of water, types and amounts of water resources, water resource management and conflict, effects of climate change, consequences of overuse and degradation of water resources.

Reflection on Wikipedia

Exercise - Reflective essay **10% mark** Due Apr 1.

### **12. Apr 1.** Global mineral reserves, resources, and sustainability. Chapter 14.

Resource estimation; recycling, substitution, energy cost of declining grade; environmental impact; future prospects for industrial society.

All edits complete: remarking of entire project is worth **40%** due Friday April 9.

**Academic offences:**

**<https://carleton.ca/senate/wp-content/uploads/Academic-Integrity-Policy1.pdf>**

I have vigorously pursued academic offenses in the past and intend to continue to when circumstances warrant it. The following passages have been excerpted from the calendar of Carleton University, and will be applied in this course to ensure that students get credit where credit is due.

Excerpt from the Academic Integrity Policy:

"Students are responsible for being aware of and demonstrating behaviour that is honest and ethical in their academic work. Such behaviour includes:

- Following the expectations articulated by instructors for referencing sources of information and for group work.
- Submitting original work, citing sources fully, and respecting the authorship of others.
- Asking for clarification of expectations as necessary. Students who are in any doubt as to whether an action on their part may be viewed as a violation of the standards of academic integrity should ask for clarification.
- Identifying situations that may reasonably lead to a violation of this policy.
- Preventing their work from being used by others, e.g. protecting access to computer files, etc.
- Adhering to the principles of academic integrity when conducting and reporting research."

"Examples of plagiarism include, but are not limited to:

- submitting a take-home examination, essay, laboratory report or other assignment written, in whole or in part, by someone else;
- using ideas or direct, verbatim quotations, paraphrased material, algorithms, formulae, scientific or mathematical concepts, or ideas without appropriate acknowledgement in any academic assignment;
- using another's data or research findings
- submitting a computer program developed in whole or in part by someone else, with or without modifications, as one's own'
- failing to acknowledge sources through the use of proper citations when using another's work and/or failing to use quotation marks"

**This means: don't copy and don't cheat.**

## **LEARNING OUTCOMES**

By the end of the course, each successful student will acquire the knowledge in the lecture allowing them to understand and critically evaluate historical, contemporary, and projected:

- sources and material flows of the key mineral resources used in contemporary society.
- economic and environmental constraints on mineral resource utilization.
- global supplies of food from agriculture and from natural sources.

In the context of Earth Science Learning Outcomes, this course will contribute to the following:

4. Explain the origin, consumption and impacts of humans on natural resources (e.g., energy, mineral, water, atmosphere) – Outcome Mastered
6. Critically evaluate geoscience data and their uncertainty to produce a scientific report – Outcome Reinforced
8. Produce independent research – Outcome Mastered
9. Demonstrate initiative, problem solving skills, teamwork and appreciation of knowledge limitations – Outcome Mastered

## **STUDENT ACCOMMODATIONS**

### **Requests for Academic Accommodation**

You may need special arrangements to meet your academic obligations during the term. For an accommodation request, the processes are as follows:

#### **Pregnancy obligation**

Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website: [carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf](https://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf)

#### **Religious obligation**

Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website: [carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf](https://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf)

#### **Academic Accommodations for Students with Disabilities**

If you have a documented disability requiring academic accommodations in this course, please contact the Paul Menton Centre for Students with Disabilities (PMC) at 613-520-6608 or [pmc@carleton.ca](mailto:pmc@carleton.ca) for a formal evaluation or contact your PMC coordinator to send your instructor your Letter of Accommodation at the beginning of the term. You must also contact

the PMC no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with your instructor as soon as possible to ensure accommodation arrangements are made.

[carleton.ca/pmc](http://carleton.ca/pmc)

### **Survivors of Sexual Violence**

As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and its survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit: [carleton.ca/sexual-violence-support](http://carleton.ca/sexual-violence-support)

### **Accommodation for Student Activities**

Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. <https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf>

For more information on academic accommodation, please contact the departmental administrator or visit: [students.carleton.ca/course-outline](http://students.carleton.ca/course-outline)

### **Missed tests or late assignments:**

I will be more forgiving of late work than in other years, however, if you get behind on the course work it will come back to haunt you later. Your TA needs to have all the work in a timely manner so he can focus his attention on marking one item at a time, so if your