

**San José State University  
Department of Urban and Regional Planning  
Geog130: Natural Resources, Section 1**

**Spring 2021**



*January 13, 2020*

**Course and Contact Information**

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<b>Office Hours:</b>	Please contact me if you would like to set up an appointment.
<b>Class Days/Time:</b>	Weekly homework and announcements as scheduled.

## Course Format

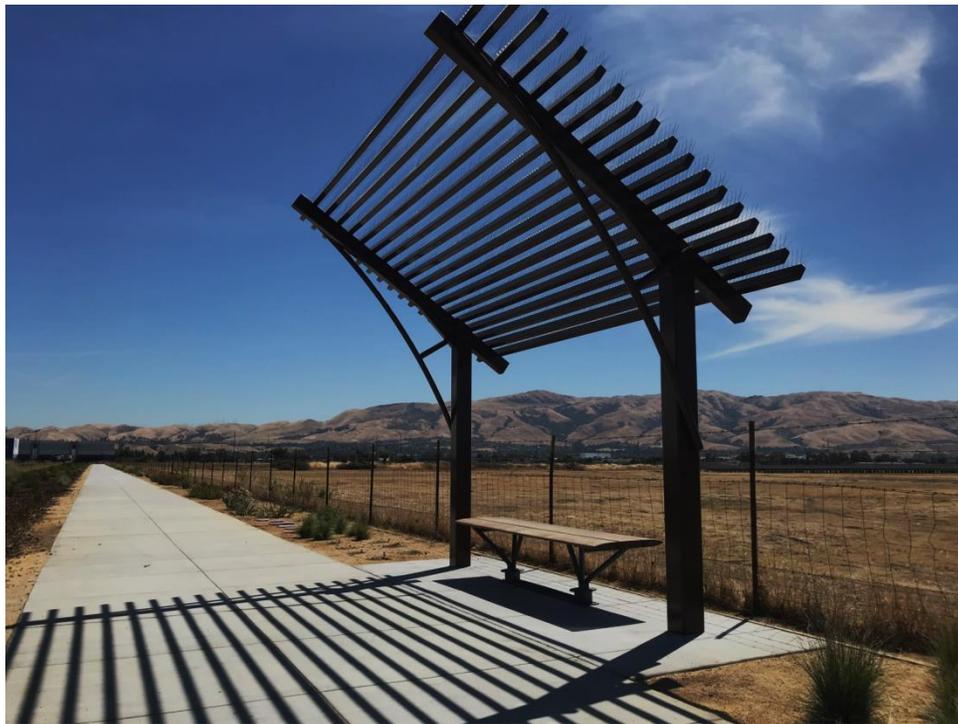
### Course Format

This is an online only course. Internet connectivity and computer are required. Many of the resources that we will use are from safe, reliable sources on the Internet. The course itself can be accessed through the Canvas Learning Management System course login website, primarily through the **Announcements** and **Assignments** for this class. Additional course materials (including this syllabus) can be found and uploaded from **Files**, as prompted in the schedule.

Students are required submit one homework assignment each week, as well as a final evaluation paper. Study material and assignments are listed and described under **Assignments**, but additional requirements or suggestions may be described within recent **Announcements**. Please check the Announcements at least once a week, particularly before submitting homework. Your grades may suffer if you repeatedly fail to address the questions that may have been posted there.

All homework must be submitted, even if late. Any work that has not been submitted by the end of the semester will receive a zero grade. Repeated lateness should be explained in a Canvas message or with one pinned to the submission itself. Comments may be pinned to particular submissions by either the instructor or student. I will try to get to each submission within a week after its due date, although I may run late. Check your submission for any comments I may have left, regardless of whether you have received a grade, and address any pressing requests expressed there. If you would like to respond to a pinned comment, please do so with an independent message, since I am unlikely to return to that particular submission once it has been graded unless I've been prompted to do so by you.

The photo below represents (with a little humor) my impression of some of the online educational technologies that we are often encouraged to use. If you look closely, you might notice something odd. The metal structure looming over the bench looks it might provide some sort of shade or shelter from rain, but in fact it does neither, at any time. Nevertheless, spikes are required to keep birds from perching on it.



You might take the bench in the photo to represent the parts of Canvas that we will use: **Files, Announcements, and Assignments**, communicating as necessary via messaging. The stylish structure looming over the bench might be taken to represent my impression of some of the less helpful parts of Canvas, as well as many of the published textbooks and resources that students are often required to buy. For this course, I have found that some carefully chosen Internet sources, as well as some of my own material, are sufficient.

The subject matter should be what makes a course engaging, not its structure. Let's not mistake the finger pointing at the moon, for the moon itself. The characteristics of the finger are not important. It just points the way. That's part of my role, but I can also provide feedback when appropriate and follow current events and recent discoveries wherever they might lead in real time. In order to allow for that kind of flexibility, it's often better to have less formal structure and superfluous interaction. Nor should we rely on the overpriced products of publishing houses that jazz up and help push a particular pundit's point of view. I would prefer to have us sample freely from any number of qualified sources of information, analysis, and wisdom that exist throughout the world. Conforming to the changing protocols of educational and social media is not the goal of any of my courses. I hope to keep that stuff to a minimum.

Within the **Announcements**, I might make some general observations and offer some general advice regarding earlier homework responses, but I will never identify students by name without prior permission. I further promise to keep any information we exchange via either messages or homework (other than your pointing out one or more of my many potential typos and simple errors that I need to tell the rest of the class about) **completely private**. Nevertheless, you may share any such exchanges or documents with anyone at any time.

Within **Canvas messaging**, conversations cannot be easily ignored, misplaced, tampered with, or shared with others. There are no such assurances with email, which has as a result become a tool for manipulation, power, confusion, and disrespect, even by people in authority. That is why I would prefer not to use email in my role as educator. Canvas messaging is sufficient. Text my private number if you have an emergency. Being late with your homework is not an emergency.

Please read and view the material at the beginning of each **Assignment**, as well as any new **Announcements**, every week. These are where the material that would otherwise be covered in lectures will be located. Homework questions are posed within each **Assignment**. If I pose an additional question for your homework in a recent **Announcement** and you have not addressed it, this may be reflected in your grade. I am not obsessive about the quality of your writing, since you have a very limited amount of time each week to proofread, but I do appreciate good organization and reasoning. I am looking mostly to see that you have actually accessed and examined the material in question. If you are uncertain, make adjustments based on prior grades and comments. You might want to ask someone to independently read and edit your homework before submission. However, your words and thoughts should be your own. You may quote extensively from material in the assigned or suggested texts or videos, but please provide complete attribution, by means of notes or references (a URL alone is not enough).

**The university expects that each student put at least nine hours of work per week into each three-credit course. Your homework assignments and final paper will be evaluated and graded primarily on the degree to which this expectation has been met, based on my impressions of your work.** The more detailed, organized, and thoughtful your responses are, relative to your classmates, the better your grades will be. You are not graded on the basis of any opinions or conclusions you may express on any issue, even when I might ask you to express one. I am more interested in whether you understand and appreciate the issues themselves. Further details are discussed below under Course Requirements and Assignments, in the Course Schedule, and in my introductory videos.

## Course Description

The course content is organized roughly into two parts, which are divided by the Spring Break. The first part concentrates on traditional means of deriving energy and materials from the Earth. Many of these activities have generally helped to lift the ever-increasing human population from poverty, but this often occurs at significant cost to the environment and to local populations.

The second part of this course samples current ideas in resource management and the sorts of resources required to supply some alternative means of meeting our energy and material needs. These of course include ecological and fresh water resources. Clearly, each of these topics deserves a semester or more of further study. This course is meant as a general introduction. Hopefully, the topics discussed in the second section will inspire you to connect these trends to your own lives and careers. The topics, described further in the schedule below, are as follows:

### Part 1:

- Introduction
- Resource extraction case study: diamond mining
- Coal and natural gas
- Oil and petrochemicals
- Metals
- Cobalt and rare earths
- Uranium, thorium, plutonium
- The seabed

### Part 2:

- Corruption, insecurity, and conflict
- Solar, wind, and tidal energy resources
- Hydro and geothermal energy resources
- Fresh water resources
- Ecological resources and wildlife
- Adaptive management

## Course Learning Outcomes (CLO)

Upon successful completion of this course, students will have become familiar with the most significant aspects of natural resource extraction and processing, and with the management of these activities. Students will have achieved a better understanding of the relationships between natural resource extraction and use, population growth, and urbanization. Students will have a better sense of the possibilities offered by cleaner energy and material resources. And finally, students will have understood the importance of ecosystem services and clean water as natural resources.

## Required Texts/Readings

Several readings have been uploaded to Canvas, under the **Files** tab. These should be downloaded and read as directed in the homework assignments. With most of these readings, I suggest that you read the introduction, section titles, and the last section. Then you might want to read or study in more detail anything you find particularly interesting or relevant to the homework questions. There is no need to read every paper thoroughly from beginning to end, unless you care to do so.

## Videos

Videos are a big part of this course, and much of the homework will be judged on the basis of how closely you consider them in your discussions. If you are accessing each assignment directly through CANVAS **Assignments**, you can watch the videos coming from YouTube directly within CANVAS, but you also have the choice of running each video in a separate browser. Watching videos within separate browsers often provides you with additional textual information, as well to the author's channel. You might want to watch videos on a tablet as you write on a laptop. Use whatever method feels comfortable, but make sure you have a large enough screen to clearly see the details (including text) in the videos. You also obviously need sufficient bandwidth, which may change for you over the course of a typical day. Each video listed in the schedule is preceded by either Watch or Examine:

**Watch:** take the time to watch the video in its entirety, or at least most of it. You may find it helpful to 'pause' and watch key portions repeatedly, taking notes as you watch.

**Examine:** You may watch the video in its entirety if you like it, but there is no immediate need to do so. You might want to scrub through segments and watch only those portions that look particularly interesting or connect to the questions you need to address. Many of these videos have no narration, although they do convey a great deal of information. Some just provide a deeper sense of context. In any case, do NOT just skip over these videos, since they nearly always connect with the homework questions.

If you open YouTube videos in a separate browser, you will find that some of them contain ads. Usually, these can be cut short by clicking on 'Skip Ad' at the lower right of the browser, or by clicking on the X if it's a popup. There are never ads on my own videos, and I get no monetary benefit from YouTube. I do not often provide tags, and I do often disable comments. In addition, embedded Canvas views are not counted as views by YouTube. As a result, most of my videos get few views. However, you may share my videos with anyone at any time. YouTube, along with most other social media, is becoming increasingly censorious, and this is a problem, but it remains the principle depository of educational videos.

## Course Requirements and Assignments

### Homework:

Fourteen homework assignments should be completed on or before the due dates, as described in the course schedule below. They should all be submitted, even if late. Please submit all files via Canvas; never email them to me. If you are having difficulties, message me through Canvas. If Canvas goes down or if you are having difficulties communicating, just be patient, try again later or the next day, and let me know about it. No penalty, obviously, if you let me know. For each homework assignment, I would prefer that you use 10 (or 12) point font with 1½ line spacing. Put your name, the Assignment number, 'Pereira', 'geog12-2' or 'geog12-3', and 'Spring 2021', arranged at the upper right of the first page.

Text, figures, and images copied from documents or screenshots may be embedded within your homework, but these must all include full attribution (not just the URL). In other words, be honest about which words, figures and images are yours, and which are from other sources. You will need to be especially careful if you decide to publish or post your work in an online portfolio. Although it is often helpful to include external material in the form of extended quotes, graphs, and figures, these should be explicitly cited and referenced. They should be there for an important reason, otherwise leave them out. Most of the text in each homework submission should be your own.

Regarding the length in pages or word count expected for each assignment: this depends on the topic, and also on your writing style. **I'm looking for evidence of understanding, substance, and a willingness to sufficiently pursue each point you are making until you've made it properly.** I understand that you only have a few days for each one. It is also perfectly reasonable to be unsure about topics that you are just beginning to understand. The ability and willingness to openly express one's own doubts and uncertainties is a virtue, if it leads to further understanding. If your writing style is average, and you avoid redundancy, and you put in the time expected of you, each homework assignment should probably run at least three pages.

Don't expect an A+ (or even an A) just for being 'correct'. Each of your submissions is graded relative to those of your classmates in the current and former semesters. I often look through each week's submissions repeatedly before deciding on grades. I may offer comments or advice in Canvas for each assignment. Check back on each assignment a week or more after the deadline for any comments that I may have tagged to it, particularly if it hasn't been graded. I may be a few days late with grades on occasion. If you would like to begin or continue a conversation about an assignment, please do so with an independent Canvas message.

I encourage you all to go back and expand and polish up some of your most interesting essays and **publish them online**, in Portfolium at a minimum. In my opinion, the work you are doing for this class and others should be used in support of your professional career. Please read 'About your instructor', below.

### **Final Evaluation**

Instead of a comprehensive exam, I want you to write a thoughtful essay as described below in the Course Schedule.

I don't believe in having students review one another's work, but I do encourage you to make your best work available to the world, on your own terms. That is what **Portfolium** and similar online services are for. I advise you all to polish up and recombine some of the work you do for this class and others, create some graphical, illustrative material, and put it online. Portfolium is designed to be a one-stop shop for potential partners, employers, and clients who want to get an idea of just how bright you might be. As a reminder of what Portfolium looks like, here's the account I created in order to understand the system (I haven't touched it for years, so it's a bit out of date). You all should create and begin populating your own accounts, which you can constantly revise and over which you have total control. It's free.

## Determination of Grades

Fourteen homework assignments (6.5% each)	91%
Term paper	9%
<b>Total</b>	<b>100%</b>

98% and above	A+
94% - 97%	A
93% - 90%	A-
89% - 87%	B+
86% - 84%	B
83% - 80%	B-
79% - 77%	C+
76% - 74%	C
73% - 70%	C-
69% - 67%	D+
66% - 64%	D
63% - 60%	D-
<b>below 60%</b>	<b>F</b>

SJSU classes are designed such that in order to be successful, it is expected that students will spend a minimum of forty-five hours for each unit of credit (normally three hours per unit per week), including preparing for class, participating in course activities, completing assignments, and so on. More details about student workload can be found in University Policy S12-3 at <http://www.sjsu.edu/senate/docs/S12-3.pdf>.

Note that “All students have the right, within a reasonable time, to know their academic scores, to review their grade-dependent work, and to be provided with explanations for the determination of their course grades.” See University Policy F13-1 at <http://www.sjsu.edu/senate/docs/F13-1.pdf> for more details.

Per University Policy S16-9, university-wide policy information relevant to all courses, such as academic integrity, accommodations, etc. will be available on Office of Graduate and Undergraduate Programs’ Syllabus Information web page at <http://www.sjsu.edu/gup/syllabusinfo/>



## About your instructor, Gary Pereira



I grew up in New Jersey, in an industrial city near NYC. I had various jobs thereabouts, from working in the downtown single-screen movie theater to working as an untrained technician at a now decommissioned nuclear power plant.

I began working professionally as a technician with an associates' degree in electronics engineering. For six years, I helped to build and maintain the data acquisition and instrument control system for Princeton University's huge experimental nuclear fusion reactor. I got to know graduate students and townies at the university and in downtown Princeton, which is absolutely soaked in history and greatness. After TFTR was completed, I went to work as a technician for Brooklyn College, where I also earned a master's degree in computer science. I had the opportunity to meet some of the giants in computer science and Artificial Intelligence, at both Brooklyn College and at the Graduate Center on 42<sup>nd</sup> Street in Manhattan. I met and married Cheri while in Brooklyn. We had a child and moved to Bethlehem, PA, where I worked and studied at Lehigh University for another few years, later at Lockheed Martin. We moved again to Minnesota, where I worked with a small federal agency in Chanhassen that uses remote sensing, GIS, and hydrological modeling to produce online data products (often involving snow cover) for the US weather services and hydrological agencies and industries. I earned a PhD in Geography at the University of Minnesota, where I met or studied under some of the most outstanding scholars in the field and researched methods of modeling and reducing fire spread in Amazonia. We finally moved again to the Bay Area, and I've been teaching at SJSU for about 18 years.

Why do I encourage you all to join professional organizations as students and participate in whatever online learning opportunities they offer? Why do I encourage you at the very least to put your best work online, within something that potential employers can access, like Portfolium? I can think of plenty of reasons, involving everything from the state of the world to my own lived experience. For example, while I was working as a technician at Lehigh University, I took all of the classes that were required for a PhD in Computer Science, but we moved to Minnesota before I could make much progress on a dissertation. Oh well. It didn't really matter. None of that learning was wasted. Since I was interested in pattern recognition, simulation, modeling, and visualization, as well as the natural sciences, I independently developed a software system using principles from pattern recognition, remote sensing, GIS, and AI that I presented at a conference in Vancouver. I had no financial support. I paid for the travel, lodging and registration myself. A couple of weeks after the conference, I got a call from someone at Lockheed Martin Corporation who'd seen me there. They had a GIS project within commuting distance of my home that might interest me. They gave me an interview, and they offered me a job as a systems engineer, which I accepted.

Shine a light.

<https://portfolium.com/garympereira/portfolio>

# Geog130-1: Natural Resources

Please submit your homework responses as Word or pdf files by the due date indicated. I would prefer that you use 10 point font, with 1 ½ line spacing and normal margins. Put your name, the homework #, geog130-1, Pereira, Spring 2021 at upper right of the first page.

## Course Schedule

Week	Due Date	Topics, Videos, Readings, Assignments
1		<p><b>Topic: Introduction</b></p> <p>If you haven't already done so, please  <b>Watch:</b> General notes for my online classes [Gary Pereira]  <a href="https://youtu.be/_AN8k0OgwI0">https://youtu.be/_AN8k0OgwI0</a></p> <p>'Natural Resources' can be taken as a distinct field of study. Undergraduate and advanced degrees are offered in natural resources management. I will ask you to view some example videos of this kind below, but in this course we will try to take a broader geographical view, examining the role of a much wider variety of resources in socio-cultural-geological-ecological systems throughout the world. I don't know of any single career that would require professional competence in all aspects of this wider view, but a working knowledge of some of the major material and social players and processes may be helpful for many of you in your personal and professional lives.</p> <p>No single source provides everything that I would like to include for this course. It is my impression that there are too many facets to the topic of 'natural resources' for any single author or organization to adequately cover them properly. The approach I've taken here is to search out some of the more informative and reliable educational videos and texts from a variety of sources and ask you to either examine them informally or watch and read them more carefully, most often for the immediate purpose of addressing particular questions in the homework.</p> <p>Spurred on partly by global events, I have begun introducing more experiences from my own life and those of others. The PRC appears from time to time in the material for this course, primarily as an extractor and processor of mineral and fossil resources. Although I have no connection to the Chinese government, the US/China relationship is something personal for me, and it is so for many others as well. There are many people in China whom I care about both personally and professionally, and people there also care about me. I want to be able to continue to visit them and their beautiful country, and. I want them to be able to visit, collaborate and study in our beautiful country as well.</p> <p>Much of what you will see in the videos here regarding working and living conditions in places where mineral resources in particular are being mined and processed is likely to be disturbing. I ask you to look carefully at these videos nonetheless, but to please to refrain (in this course at least) from immediately connecting such conditions to any recommendations you may have with regard to broader ideological or political movements. Political corruption and poverty are certainly core concerns that I will ask you to examine in this course, but it is my opinion that neither you nor I have enough information about each situation, particularly on the basis of a video or two, to know how other people should govern themselves, or what precisely they should be doing to change their situation.</p> <p>After taking a brief look at some graduate programs, I'd like us to begin to understand the scope of the problem with a short documentary program about mineral extraction in the Congo. We will return to this region when we discuss cobalt, but I wanted us to look first into those extraction processes that allow us to have the very technologies that define modern life, but which very few people know about.</p>

Week	Due Date	Topics, Videos, Readings, Assignments
	02/03/21	<p>(See the syllabus section on <b>Videos</b> for a definition of ‘Examine’ and ‘Watch’).</p> <p><b>Examine:</b> Becoming a Natural Resources and Environmental Science Student [UK College of Agriculture, Food, and Environment]  <a href="https://youtu.be/zv8I-Yc6yec">https://youtu.be/zv8I-Yc6yec</a></p> <p><b>Examine:</b> Natural Resource Management Major at Colorado State University [naturalresourcescu]  <a href="https://youtu.be/rHyYaAj9f6c">https://youtu.be/rHyYaAj9f6c</a></p> <p><b>Examine:</b> Master of Natural Resources -- Online Degree Program [Oregon State University Ecampus]  <a href="https://youtu.be/DjHi1rrupBk">https://youtu.be/DjHi1rrupBk</a></p> <p><b>Watch:</b> Conflicted: The Fight Over Congo's Minerals [Al Jazeera English]  <a href="https://youtu.be/27BZgQ5ln0w">https://youtu.be/27BZgQ5ln0w</a></p> <p><b>Homework 1:</b></p> <p>1. Part of the second half of the course will focus on the issues, technologies, and decision processes involved in the kinds of natural resources management that are described to some extent in the first three videos above. In order to better understand your interests and goals, and to help with my discussions over the second half of this course, please tell me whether any of the topics that are briefly described in these or any other descriptions in natural resources or resource management programs interest you. More generally, after looking through this schedule, tell me which topics or facets that I’ve listed here seem most interesting to you at first glance, and whether there are any important ones I’ve missed.</p> <p>2. Describe the scramble for minerals that are being extracted from the Congo. What are these minerals, what are they used for, who mines them, who controls the mines, etc.?</p>
2		<p><b>Topic: Resource extraction case study: diamond mining</b></p> <p>Mining processes are some of the most significant and environmentally consequential methods of extracting natural resources from within the Earth. The materials that are mined are often non-renewable and geographically specific; as a result, mines and quarries have for thousands of years been treated as treasured source of riches for kingdoms, and as spoils of war. We will concentrate over the next few weeks on the mining of fossil fuels and minerals, and of the expansion of this activity onto the seabed and into the Arctic.</p> <p>This week we look specifically at diamond mining in two different settings. Together they illustrate some important factors that are common to many other sorts of mining operations as well, although they do not fall neatly into the main categories we will discuss. Diamonds and other rare gems that are valued and are therefore mined for their beauty; industrial diamonds can be manufactured. I suggest that you keep the homework questions (below) in mind when viewing the videos.</p> <p><b>Watch:</b> Diamond Mining: Inside Earth's Gigantic Holes [Bloomberg]  <a href="https://youtu.be/8uLuecS_PTk">https://youtu.be/8uLuecS_PTk</a></p> <p><b>Watch:</b> Diamond Mining 1/4 - The Promised Land [Paul Glynn]  <a href="https://youtu.be/u0855HBj31s">https://youtu.be/u0855HBj31s</a></p>

Week	Due Date	Topics, Videos, Readings, Assignments
	<b>02/10/21</b>	<p><b>Watch:</b> Diamond Mining 2/4 - The Promised Land [Paul Glynn]  <a href="https://youtu.be/6htaddGYp3k">https://youtu.be/6htaddGYp3k</a></p> <p><b>Watch:</b> Diamond Mining 3/4 - The Promised Land [Paul Glynn]  <a href="https://youtu.be/SXlu8Oi5OxU">https://youtu.be/SXlu8Oi5OxU</a></p> <p><b>Watch:</b> Diamond Mining 4/4 - The Promised Land [Paul Glynn]  <a href="https://youtu.be/Vv9JmltivU">https://youtu.be/Vv9JmltivU</a></p> <p><b>Examine:</b> World's Top Diamond Producing Countries 1970 to 2018 [Animated Stats]  <a href="https://youtu.be/XduChfWC0iE">https://youtu.be/XduChfWC0iE</a></p> <p><b>Homework 2:</b></p> <p>1. How much money, per year, is generated by the newer diamond mine in Siberia, portrayed in the first video? How powerful is the mining company locally, in terms of politics and media? Do you think that the remoteness of this location might have anything to do with the acceptability of the social situation and damage done to the environment? Is it important that people of a region become aware of the existence of open pit mines of this type?</p> <p>2. The documentary Promised Land (in four parts) portrays a sort of diamond mining that is clearly very different from the mines shown in the previous video. Technologically, it's primitive. Using the diamond as an example, discuss ways in which the availability of cheap labor, government, climate, and relative remoteness of mining operations might affect the ways in which mines are operated. After watching all four parts, please discuss the topic generally, focusing on anything you may have found to be particularly surprising or instructional about this sort of operation.</p>
<b>3</b>		<p><b>Topic: Coal and natural gas</b></p> <p>You will examine several videos this semester that use animated bar graphs to portray important trends in natural resource extraction, production, and use. These come from different channels, so they may differ somewhat in style. Pay close attention to the time period covered, which varies between videos, and keep in mind that the x axis may be self-adjusting. This can help with making comparisons between countries, but it can be misleading in terms of actual numbers (unless you watch closely).</p> <p><b>Examine:</b> Top 10 Countries by Coal Productions 1981-2018 [Stats Media]  <a href="https://youtu.be/qmIS138WgzE">https://youtu.be/qmIS138WgzE</a></p> <p><b>Watch:</b> Coal Mining's Environmental Impact   From The Ashes [National Geographic]  <a href="https://youtu.be/ynN39sfqT8w">https://youtu.be/ynN39sfqT8w</a></p> <p>The host of the 'Just Have a Think' channel describes current research in sustainable technologies. I highly recommend this channel to anyone who is interested in getting more substance and more useful leads for both career and investment decisions. I will usually list these to <b>Examine</b> because they often do get into the weeds, but I highly recommend you watch them in their entirety. For all of the 'Just Have a Think' videos, transcripts available at the website <a href="http://www.justhaveathink.com">http://www.justhaveathink.com</a>.</p> <p><b>Examine:</b> Coal: Can we kick our addiction? [Just Have a Think]  <a href="https://youtu.be/OYgTyYYUxkw">https://youtu.be/OYgTyYYUxkw</a></p>

Week	Due Date	Topics, Videos, Readings, Assignments
	02/17/21	<p><b>Examine:</b> World's Top Countries by Proven Natural Gas Reserves 1960 to 2018 [Animated Stats]  <a href="https://youtu.be/mRZiq67OgCg">https://youtu.be/mRZiq67OgCg</a></p> <p><b>Examine:</b> Top 20 Natural Gas Producing Countries 1970 to 2018  <a href="https://youtu.be/DSGK26TKEKs">https://youtu.be/DSGK26TKEKs</a></p> <p>Fracking has served to significantly increase the production of natural gas in recent years in the US.</p> <p><b>Watch:</b> Fracking explained: opportunity or danger [Kurzgesagt – In a Nutshell]  <a href="https://youtu.be/Uti2niW2BRA">https://youtu.be/Uti2niW2BRA</a></p> <p>Liquid fuels will remain in demand for transport (of goods and materials) and transportation on land, on the seas, and in the air for the foreseeable future. Biofuels and hydrogen are relevant options, but liquefied natural gas (LNG) is on the rise as well. A few technical videos from Shell and others to educate ourselves on some of these issues won't hurt.</p> <p><b>Watch:</b> What is LNG? Turning natural gas into liquid   Natural Gas [Shell]  <a href="https://youtu.be/QgtSoEJD9HE">https://youtu.be/QgtSoEJD9HE</a></p> <p>Natural gas is on the rise, and coal is on the decline, worldwide. Changes and innovations are taking place with the fossil fuels industry.</p> <p><b>Watch:</b> An Introduction to Natural Gas from Coal [UnconventionalGas]  <a href="https://youtu.be/jSTGDBkMeRY">https://youtu.be/jSTGDBkMeRY</a></p> <p><b>Watch:</b> China switch from coal to natural gas [CGTN America]  <a href="https://youtu.be/fyYnlh8veNg">https://youtu.be/fyYnlh8veNg</a></p> <p><b>Homework 3:</b></p> <ol style="list-style-type: none"> <li>1. How has coal production shifted between countries in recent years? Which nations currently produce the most coal?</li> <li>2. What are some of the environmental and social consequences of coal extraction and consumption? Can we kick our addiction to coal?</li> <li>3. How has natural gas production shifted between countries in recent years? Which nations currently produce the most natural gas? What is LNG, and why is it important?</li> <li>4. Discuss the extraction of natural gas from shale in the US and from coal in China.</li> <li>5. Compare the environmental consequences of natural gas extraction with the extraction of coal. The unintentional release of natural gas adds significant amounts of methane and other gases to the atmosphere. Why is methane specifically so worrisome?</li> </ol>

Week	Due Date	Topics, Videos, Readings, Assignments
4	02/24/21	<p><b>Topic: Oil for fuel and petrochemicals</b></p> <p><b>Watch:</b> Oil promises – how oil changed a country [DW Documentary]  <a href="https://youtu.be/b58b-BvWEpo">https://youtu.be/b58b-BvWEpo</a></p> <p><b>Watch:</b> Drilling 101: How a deep water well is drilled [Shell]  <a href="https://youtu.be/Do9dz6ypD7w">https://youtu.be/Do9dz6ypD7w</a></p> <p><b>Watch:</b> Tapping into Oil Over 30,000 Feet Deep [Shell]  <a href="https://youtu.be/V2Ubd-ZEGeY">https://youtu.be/V2Ubd-ZEGeY</a></p> <p><b>Watch:</b> Deepwater Horizon Blowout Animation [USCSB]  <a href="https://youtu.be/FCVCOWejlag">https://youtu.be/FCVCOWejlag</a></p> <p><b>Watch:</b> Animation of 2015 Explosion at ExxonMobil Refinery in Torrance, CA  <a href="https://youtu.be/JplAKJrgyew">https://youtu.be/JplAKJrgyew</a></p> <p><b>Examine:</b> Top 20 Crude Oil Producing Countries 1965 to 2018 [Animated Stats]  <a href="https://youtu.be/2gzBMmGk41g">https://youtu.be/2gzBMmGk41g</a></p> <p><b>Examine:</b> Top 15 countries by Oil Consumption   The Richest [Stats Media]  <a href="https://youtu.be/FLhNtM3B8ec">https://youtu.be/FLhNtM3B8ec</a></p> <p><b>Watch:</b> Cold Rush. Drilling For Oil Amid Arctic Ice [RT Documentary]  <a href="https://youtu.be/mxN1yc_DiKU">https://youtu.be/mxN1yc_DiKU</a></p> <p><b>Watch:</b> Plastics 101 [National Geographic]  <a href="https://youtu.be/ggh0Ptk3VGE">https://youtu.be/ggh0Ptk3VGE</a></p> <p><b>Examine (or Watch):</b> Can we survive without Petrochemicals? [Just Have a Think]  <a href="https://youtu.be/xPVEyYlgDq8">https://youtu.be/xPVEyYlgDq8</a></p> <p><b>Homework 4:</b></p> <ol style="list-style-type: none"> <li>1. Discuss the process of extracting oil from beneath the seabed. What exactly happened with the Deepwater Horizon? What have been some of the consequences of that disaster?</li> <li>2. Compare changes over time in which countries produce the most oil, with countries that have the largest proven reserves.</li> <li>3. Discuss the timeline of top oil consuming countries in the world, in recent years. Compare this history with the timeline of countries producing the most oil in recent years. You can choose your focus, but be specific. How might this relationship between oil producing and consuming nations have played a role in international relations?</li> <li>4. Discuss some of the challenges of extracting oil from Arctic seas, and how that might be changing.</li> <li>5. Discuss the production of plastics and petrochemicals from oil, and what some alternative sources may be.</li> </ol>

Week	Due Date	Topics, Videos, Readings, Assignments
5	03/03/21	<p><b>Topic: Metals</b></p> <p>Shifting away from fossil fuels, our next big category of materials of tremendous importance in world development are metals: iron, steel, aluminum, copper, titanium, the list is actually quite long. We'll just pick a couple of the major ones.</p> <p><b>Watch:</b> Fossil free steel. Another giant step towards net carbon zero? [Just Have a Think]  <a href="https://youtu.be/ywHJt88H5YQ">https://youtu.be/ywHJt88H5YQ</a></p> <p><b>Examine:</b> How It Works - Steel Production [Extreme World]  <a href="https://youtu.be/tlNg4205Tpc">https://youtu.be/tlNg4205Tpc</a></p> <p><b>Examine:</b> Top Iron Ore Producing Countries in The World 1900 to 2017 [Animated Stats]  <a href="https://youtu.be/emm5aHAifMg">https://youtu.be/emm5aHAifMg</a></p> <p><b>Examine:</b> Top 20 Steel Producing Countries 1967 to 2018 [Animated Stats]  <a href="https://youtu.be/yqF5pYDEpRM">https://youtu.be/yqF5pYDEpRM</a></p> <p>The electrical conductor in those high voltage power lines is not copper; it's aluminum. Why? Because of aluminum's lighter weight. The raw material is bauxite. Bauxite is mined most often in tropical regions, so it is precisely the sort of mineral the developed nations would want from developing nations. Some of the former include China, the US, Europe and Russia. The latter include the PRC, Guinea, Ghana...</p> <p><b>Watch:</b> Bauxite: Guinea's mineral wealth [DW News]  <a href="https://youtu.be/K_WkvtBW1x0">https://youtu.be/K_WkvtBW1x0</a></p> <p><b>Watch:</b> China bets big on Guinea's bauxite - 08 Nov 09 [Al Jazeera English]  <a href="https://youtu.be/p89OE8oJAQk">https://youtu.be/p89OE8oJAQk</a></p> <p>We will return to questions of insecurity, corruption, and conflict after the break, but keep the following video in mind:</p> <p><b>Watch:</b> Guinea: Mining Companies Exploit Rural Communities [Human Rights Watch]  <a href="https://youtu.be/XdnrFdrOG9I">https://youtu.be/XdnrFdrOG9I</a></p> <p><b>Watch:</b> How It's Made – Aluminum [How It's Made Archive]  <a href="https://youtu.be/1u8gzoT-seg">https://youtu.be/1u8gzoT-seg</a></p> <p><b>Examine:</b> Top 20 Largest Aluminum Producing Countries in the World [Animated Stats]  <a href="https://youtu.be/BEmO8lKxwq8">https://youtu.be/BEmO8lKxwq8</a></p> <p><b>Examine:</b> Top Copper Producing Countries in The World 1970 to 2017 [Animated Stats]  <a href="https://youtu.be/2u1ufq21Oh4">https://youtu.be/2u1ufq21Oh4</a></p> <p><b>Homework 5:</b></p> <p>1. Describe the production and recycling of steel, including its energy requirements. How has the mining of iron ore and the production of steel shifted internationally in recent years? Describe the prospects of fossil free steel.</p>

Week	Due Date	Topics, Videos, Readings, Assignments
		<p>2. Discuss issues around the mining of bauxite. Describe the production of aluminum from bauxite.</p> <p>3. Discuss the international shift in the production of aluminum and copper in recent years.</p>
6		<p><b>Topic: Lithium, cobalt, and rare earths</b></p> <p>Lithium, cobalt, and the so-called rare earths are critical ingredients in batteries for cars and electronics. The demand for these resources is therefore anticipated to outgrow the demand for pretty much any other resources over the short to near term future. And they are being mined from some of the poorest, most insecure places on Earth. In some ways, this week's topics represent the crux of the 'natural resources' problem, and very few people are aware of them. If you take anything away from this course so far that is worth telling others about, it may be this week's topics.</p> <p>Most of the demand for lithium and cobalt comes from manufacturers of batteries like those that power electronic devices and cars. Lithium seems the less problematic of the two.</p> <p><b>Watch:</b> Companies race to mine lithium, a battery essential [PBS NewsHour]  <a href="https://youtu.be/su_UC9ZCD-0">https://youtu.be/su_UC9ZCD-0</a></p> <p><b>Watch:</b> Here's Where the Juice That Powers Batteries Comes From [Bloomberg Quicktakes]  <a href="https://youtu.be/50rXYrFCQMw">https://youtu.be/50rXYrFCQMw</a></p> <p><b>Watch:</b> Lithium Recycling FINALLY goes global! [Just Have a Think]  <a href="https://youtu.be/mbkhXAP1EQE">https://youtu.be/mbkhXAP1EQE</a></p> <p>Cobalt seems to be the more problematic substance, in human and environmental terms.</p> <p><b>Watch:</b> Whose Wealth? Cobalt from Congo [SOMO Researcher]  <a href="https://youtu.be/37iLD41vfdI">https://youtu.be/37iLD41vfdI</a></p> <p><b>Watch:</b> How do we solve the Cobalt problem? [Just Have a Think]  <a href="https://youtu.be/-WOOZYILyXI">https://youtu.be/-WOOZYILyXI</a></p> <p>Rare earths have unique electromagnetic properties. There are several of them, but they are usually found in the same deposits, which are found at various locations, including the sea floor, which we'll be looking at in a couple of weeks.</p> <p><b>Watch:</b> How These Rare-Earth Elements Could Change Our Future [Spark]  <a href="https://youtu.be/88jpgxSRVZU">https://youtu.be/88jpgxSRVZU</a></p> <p><b>Watch:</b> Rare Earth: How the US plans on rivaling China in the production of critical earths [CNBC]  <a href="https://youtu.be/CW4TnJDIQUw">https://youtu.be/CW4TnJDIQUw</a></p> <p><b>Watch:</b> Impact of Materials on Society (IMOS) - Rare Earth Elements [Materials Research Society]  <a href="https://youtu.be/C-b1NacN31Y">https://youtu.be/C-b1NacN31Y</a></p>

Week	Due Date	Topics, Videos, Readings, Assignments
	03/10/21	<p><b>Homework 6:</b></p> <ol style="list-style-type: none"> <li>Describe the mining and processing of lithium, its uses and opportunities for recycling.</li> <li>What are some of the current social and environmental issues associated with the mining of cobalt? According to the narrator of the ‘Just Have a Think’ video, is the cobalt problem bring solved?</li> <li>How might rare earth elements change our future? Which are most sought-after? What are they used for? Where are they found? Are they really that rare; i.e., are there likely to be undiscovered deposits? Which nations are most involved in increasing the production of rare earth minerals?</li> </ol>
7		<p><b>Topic: Uranium, thorium, and plutonium</b></p> <p>I’m probably one of the few people who worked as a technician on projects in both a commercial Nuclear Fission reactor and an advanced Nuclear Fusion project (many engineers and physicists must have worked in both domains, but I just played a minor role). Those years left me with some lasting memories, some of which I’ll briefly mention here. In the late 1970’s, I was hired to fill out a work team from Rhode Island at the Oyster Creek Nuclear Generating Station, in Forked River, New Jersey:  <a href="https://en.wikipedia.org/wiki/Oyster_Creek_Nuclear_Generating_Station">https://en.wikipedia.org/wiki/Oyster_Creek_Nuclear_Generating_Station</a></p> <p>The reactor is in the cube-shaped building in the center of this picture:  <a href="https://en.wikipedia.org/wiki/File:Oyster_Creek_Nuclear_Generating_Station_-_1998.jpg">https://en.wikipedia.org/wiki/File:Oyster_Creek_Nuclear_Generating_Station_-_1998.jpg</a></p> <p>The upper portion with the cladding around it is one large room, with the reactor embedded in the center and pools full of water to either side. Above on girders, a large industrial crane can lift the lid off the reactor, and remove the ‘spent’ fuel rods. These fuel rods are described in detail in the [How It’s Made] videos below. The crane immediately lowers each rod into one of the refrigerated pools, where it continues to emit heat (and more dangerous forms of radiation) for many years. They are left there at least until they are sufficiently cooled. After the spent rods are removed, the crane can reload the reactor with new rods. The problem then was (and this continues to be a problem for the nuclear industry), where to then put the spent fuel (and any other contaminated material) more permanently. Since there is no reprocessing industry in the US, and since federal storage proposals are challenged by states, for many reactors the rods remain in sealed casks somewhere on the grounds.</p> <p>What would happen? Not required viewing.  <a href="https://youtu.be/mM-5DhIhYmQ">https://youtu.be/mM-5DhIhYmQ</a></p> <p>Our team worked in that big room above the operating reactor. Our job was to rearrange brackets that had been installed on the floor of the pool in order to accommodate a higher density of fuel rods. Even in the 1970s, storage had become a problem. The technology we used was very basic: wrenches on long poles handled by technicians at the edge of the pool, as guided by other technicians with binoculars to screw and unscrew brackets that were deep underwater. You would not otherwise want to get anywhere near that water. Anything coming out of the pool would need to be wiped down with acetone to reduce their potential toxicity. Since I was the lowest man on the totem pole (and admittedly totally untrained), that was my job.</p> <p>The plant that I worked in is now shut down, but when I was there, the room was physically quite warm, regardless of the season, as the result of its proximity to the reactor itself. The disposable clothing and booties that we wore were similar in style and effectiveness to the disposable clothing that is used in clean rooms today, but in a nuclear reactor these clothes were there for the opposite reason: to keep contaminants away from your clothing and body. At the time, there was one guard near the entrance to the</p>

Week	Due Date	Topics, Videos, Readings, Assignments
	03/17/21	<p>room above the reactor, sitting at a desk, with a handgun. There seemed to be no additional armed security at the time. It was in the 1970's; things were very different pre-9/11. When I left the plant for the last time, I was given a full body scan in a trailer that the NRC kept on site. I had absorbed some radioactive iodine in my few weeks on the job. I learned later that if had taken iodine supplements prior to working there, my thyroid would have been pre-saturated and may not have absorbed any on the job. Iodine pills had been distributed throughout the US during the Cold War in the event of a nuclear strike.</p> <p><b>Examine:</b> How It's Made Uranium Part 1 [How it's Made]  <a href="https://youtu.be/TSza2XH28hs">https://youtu.be/TSza2XH28hs</a></p> <p><b>Examine:</b> How It's Made Uranium Part 2 [How it's Made]  <a href="https://youtu.be/n2f7kEeSXYg">https://youtu.be/n2f7kEeSXYg</a></p> <p><b>Examine:</b> World's Top Uranium-Producing Countries 1970 to 2018 [Animated Stats]  <a href="https://youtu.be/K6zL9N81NzI">https://youtu.be/K6zL9N81NzI</a></p> <p>I'm darkly fascinated by these sorts of legacy facilities:</p> <p><b>Examine:</b> Hanford B Reactor: Making plutonium for nuclear weapons [Studio McGraw]  <a href="https://youtu.be/8rIVHEY7BF0">https://youtu.be/8rIVHEY7BF0</a></p> <p><b>Watch:</b> Thorium and the Future of Nuclear Energy [PBS Space Time]  <a href="https://youtu.be/EluIEJruhRQ">https://youtu.be/EluIEJruhRQ</a></p> <p><b>Watch:</b> Could Advanced Nuclear Power Replace Fossil Fuels? [Journe]  <a href="https://youtu.be/eg613DFBR8s">https://youtu.be/eg613DFBR8s</a></p> <p><b>Examine (or watch):</b> Small Modular Reactors. Are they now unavoidable? [Just Have a Think]  <a href="https://youtu.be/yofGtxEgpI8">https://youtu.be/yofGtxEgpI8</a></p> <p><b>Watch:</b> Understanding the accident of Fukushima Daiichi [IRSN]  <a href="https://youtu.be/YBNFvZ6Vr2U">https://youtu.be/YBNFvZ6Vr2U</a></p> <p><b>Watch:</b> Fukushima's ghost towns  <a href="https://youtu.be/xKfnsYzQWjw">https://youtu.be/xKfnsYzQWjw</a></p> <p><b>Homework 7:</b></p> <ol style="list-style-type: none"> <li>1. Describe some of the prospects for the nuclear power industry around the world. Be region-specific if you can. What are some of the differences between traditional reactor designs and fuels and current generation designs, including 'small nuclear reactors' and those that use thorium?</li> <li>2. For years now, I've been asking students how much they know about Fukushima. For most of them, not much, it turns out, until they do my homework. So bear with me if you've seen this before. For this course in particular, I think it is important to think very carefully about Fukushima and what it says about human risk-taking. Describe the circumstances leading up to the Fukushima Daiichi disaster. You might begin with the wisdom of the decision to site nuclear plants on Japan's eastern shore. What precisely is the situation now? Why did Japan decide to go so strongly with nuclear energy? Has anything changed?</li> </ol>

Week	Due Date	Topics, Videos, Readings, Assignments
8	03/24/21	<p><b>Topic: The seabed</b></p> <p>This week we shift our focus from resource types to resource locations. We've already looked at drilling for oil beneath the seabed, but the seabed itself is becoming a source of metals, minerals, and other resources. You may be surprised by what you see.</p> <p><b>Watch:</b> TechKnow - Deep sea gold rush [Al Jazeera English]  <a href="https://youtu.be/s1b4xVTAKcl">https://youtu.be/s1b4xVTAKcl</a></p> <p><b>Watch:</b> Mining the Deep Sea [Massachusetts Institute of Technology (MIT)]  <a href="https://youtu.be/MWvCtF1itQM">https://youtu.be/MWvCtF1itQM</a></p> <p><b>Watch:</b> Deep Sea Mining: Searching for the Next Mineral Boom [Roundtable]  <a href="https://youtu.be/-UPjsuuyvD4">https://youtu.be/-UPjsuuyvD4</a></p> <p><b>Watch:</b> Seabed Mining in the Deep Sea [University of California Television (UCTV)]  <a href="https://youtu.be/ePm3Wbw2tyc">https://youtu.be/ePm3Wbw2tyc</a></p> <p><b>Watch:</b> Introduction to the International Seabed Authority and Seabed Mining part 1 [dyaguilfoyle]  <a href="https://youtu.be/TlumflivuPg">https://youtu.be/TlumflivuPg</a></p> <p><b>Homework 8:</b></p> <ol style="list-style-type: none"> <li>1. Discuss advances in the technology of seabed mining, and current activities. What are the possible positive and negative consequences of seabed mining, including its potential impact on deep sea ecosystems?</li> <li>2. Discuss the legal and regulatory status of seabed mining, and future plans.</li> </ol>
9	03/31/21	<p><b>Recess</b></p>
10		<p><b>Topic: Corruption, insecurity, and conflict</b></p> <p>I want to take this week to focus on social issues that came up repeatedly in videos over the first half of this course. I don't want to burden you with the academic discussion regarding what has come to be known as the 'resource curse', with some arguing for and some against. I find most of that discussion to be derivative and boring; I think we can all learn more at this point by looking at each individual case. Nevertheless, we need to recognize the terms and reality of that discussion.</p> <p>It should not be surprising that human beings are capable of mismanaging wealth. Human beings are capable of cheating one another, and they are capable of being cheated. I don't think social scientists, educators, administrators, or politicians will ever put an end to such tendencies through coercion, particularly since they engage in just these sorts of practices so often themselves. But I do think that bringing greater awareness to each case of this kind will eventually elicit justice and security.</p>

Week	Due Date	Topics, Videos, Readings, Assignments
	04/07/21	<p><b>Watch:</b> The Resource Curse [BakerInstitute]  <a href="https://youtu.be/qNUuIA1Pam8">https://youtu.be/qNUuIA1Pam8</a></p> <p><b>Watch:</b> Profits Over People: Mining Ruins Lives in Malawi [Human Rights Watch]  <a href="https://youtu.be/qD4WlqL5fwg">https://youtu.be/qD4WlqL5fwg</a></p> <p><b>Watch:</b> Nigeria: Poverty despite oil wealth   DW Business [DW News]  <a href="https://youtu.be/PZXH2LJN3ZY">https://youtu.be/PZXH2LJN3ZY</a></p> <p><b>Watch:</b> South Sudan's 'oil curse' [Al Jazeera English]  <a href="https://youtu.be/Y2Y6XmPZATY">https://youtu.be/Y2Y6XmPZATY</a></p> <p><b>Watch</b> (start at minute 1 or 2):  Counting the Cost - Is Mongolia over-reliant on its resources? [Al Jazeera English]  <a href="https://youtu.be/ol_zp6ZnU">https://youtu.be/ol_zp6ZnU</a></p> <p>We first began looking at the DRC on week one, and again with regard to cobalt and rare earths. You may want to go back and watch some those videos; here is another one of particular relevance:</p> <p><b>Watch:</b> Why Isn't Congo as Rich as Saudi Arabia? Massive Tax Evasion [Vocativ]  <a href="https://youtu.be/UADiQhjjzWs">https://youtu.be/UADiQhjjzWs</a></p> <p><b>Watch:</b> Botswana proves Africa can avoid the 'resource curse' [Devex]  <a href="https://youtu.be/QgfgsGAHmnk">https://youtu.be/QgfgsGAHmnk</a></p> <p><b>Homework 9:</b></p> <p>1. What is the 'resource curse'? Would poverty and conflict exist to the same extent or with the same characteristics in some of these regions if they were not rich in particular resources? You might want to discuss similarities and differences between the resource-related social situations in Malawi, Nigeria, South Sudan, or other regions or nations for which resources pose social challenges. How might Botswana's experience provide a solution to some of these conditions?</p> <p>3. About a minute into the Mongolia video, we discover their mineral wealth: coal, copper and gold. What about Mongolia's reputation for corruption? How has Mongolian life been changing? What is the government response?</p>
11		<p><b>Topic: Solar and wind resources</b></p> <p>Sunlight and wind are not ordinarily considered resources, except in a general sense. But in recent years they have become important as direct sources of energy and often must compete with other land uses.</p> <p><b>Watch:</b> Impact of Materials on Society (IMOS) – Photovoltaics [Materials Research Society]  <a href="https://youtu.be/efMKfHUIw3s">https://youtu.be/efMKfHUIw3s</a></p> <p><b>Examine:</b> Top Solar Energy Producing Country   Solar Energy Data [Stats Media]  <a href="https://youtu.be/xTrd3SxqhdS">https://youtu.be/xTrd3SxqhdS</a></p> <p><b>Watch:</b> The thrilling potential for off-grid solar energy   Amar Inamdar [TED]</p>

Week	Due Date	Topics, Videos, Readings, Assignments
	04/14/21	<p><a href="https://youtu.be/20adDr7Felw">https://youtu.be/20adDr7Felw</a></p> <p><b>Watch:</b> Puerto Rico's solar energy insurrection [Quartz]  <a href="https://youtu.be/7ekFQ0xOwDw">https://youtu.be/7ekFQ0xOwDw</a></p> <p><b>Watch:</b> Morocco turns the Sahara desert into a solar energy oasis [PBS NewsHour]  <a href="https://youtu.be/ZSDo67E1k3s">https://youtu.be/ZSDo67E1k3s</a></p> <p><b>Examine:</b> Top 15 Countries by wind power production [Stats Media]  <a href="https://youtu.be/HSNmkJVYdlk">https://youtu.be/HSNmkJVYdlk</a></p> <p><b>Homework 10:</b></p> <ol style="list-style-type: none"> <li>1. Discuss the material requirements of photovoltaics, in terms of natural resources. How easily are these substances acquired? What sort of processing is required?</li> <li>2. Briefly describe the history of nations with the largest power generation from photovoltaics. For example, describe the situation every five years since 1995.</li> <li>3. Why is off-grid power generation and storage a valuable goal?</li> <li>4. How are deserts in places like Morocco and California becoming important for the large-scale centralized production and distribution of solar energy? What sorts of technologies are being considered?</li> <li>5. Briefly describe the history of nations with the largest power generation from wind turbines. For example, describe the situation every five years since 1995.</li> </ol>
12		<p>Topic: <b>Hydro, tidal, and geothermal resources; biofuels</b></p> <p>Finally, as sources of energy, we shall look at hydroelectric and geothermal facilities, biofuels, and the possibilities for tidal energy. This does not sufficiently cover the range of energy resources that are currently in use</p> <p><b>Watch:</b> Could Earth's Heat Solve Our Energy Problems? [Real Engineering]  <a href="https://youtu.be/vZLo0-lwK1k">https://youtu.be/vZLo0-lwK1k</a></p> <p><b>Watch:</b> How a Geothermal Plant Works [alternativeenergycom]  <a href="https://youtu.be/kjpp2MQffnw">https://youtu.be/kjpp2MQffnw</a></p> <p><b>Examine:</b> Top 5 Geothermal Energy Producing Countries   2017 [Present Tech]  <a href="https://youtu.be/QEC83nW5_Jo">https://youtu.be/QEC83nW5_Jo</a></p> <p><b>Watch:</b> Kenya joins world leaders in geothermal energy production [africanews]  <a href="https://youtu.be/XcMN-C4GoKA">https://youtu.be/XcMN-C4GoKA</a></p> <p>Hydropower can be generated at small scales, but it is most often discussed in the context of massive projects. China and the developing countries are proceeding apace with such projects, which are also required for flood control over increasingly populated regions. The US has been among the leaders in such massive projects for nearly a century.</p>

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	04/21/21	<p><b>Examine:</b> Top 20 Country by Hydropower Electricity Generation (1965-2019) [Wawamustats]  <a href="https://youtu.be/wcwryKJiozU">https://youtu.be/wcwryKJiozU</a></p> <p><b>Watch:</b> Hydropower: China's world "business card" [CGTN]  <a href="https://youtu.be/fhPNRpuPZEA">https://youtu.be/fhPNRpuPZEA</a></p> <p>I recently spent a day at the Three Gorges Dam, and a week on the river behind it. You can clearly see the high water mark on the riverbank in the second video below. Hope you enjoy.</p> <p><b>Examine:</b> The Three Gorges Dam [Gary Pereira]  <a href="https://youtu.be/pPKV GTI4gk">https://youtu.be/pPKV GTI4gk</a></p> <p><b>Examine:</b> The Three Gorges [Gary Pereira]  <a href="https://youtu.be/kNk0BJwheh4">https://youtu.be/kNk0BJwheh4</a></p> <p><b>Watch:</b> Can Underwater Turbines Solve Our Energy Problems? [Real Engineering]  <a href="https://youtu.be/CIYA6Jwwp4s">https://youtu.be/CIYA6Jwwp4s</a></p> <p>Biofuels are the final category of carbon-based energy resources we shall cover here. There are many living sources of biofuels, from forests to agricultural fields to algae, so their connections to natural resources are diverse. They release atmospheric carbon, but if that carbon was originally absorbed from the atmosphere, such fuels are potentially carbon-neutral.</p> <p><b>Watch:</b> Biofuel and Ethanol [Iken Edu]  <a href="https://youtu.be/xAms3Q 3pXg">https://youtu.be/xAms3Q 3pXg</a></p> <p><b>Watch:</b> Biofuels: Renewable Jet Fuel [Boeing]  <a href="https://youtu.be/kKO6TuH OeQ">https://youtu.be/kKO6TuH OeQ</a></p> <p><b>Watch:</b> How the Technology Works - algae to biofuels [Algaetec biofuels]  <a href="https://youtu.be/OP HbQ5cWSk">https://youtu.be/OP HbQ5cWSk</a></p> <p><b>Homework 11:</b></p> <ol style="list-style-type: none"> <li>1. How is geothermal energy utilized? What are the prospects for its increased use? Where is it being utilized most at present, and where is it likely to grow in importance?</li> <li>2. Which nations have been most active in developing hydropower historically, which dominate now, and which are on the rise? Where are older dams being dismantled? What are some of the unintended consequences of dam construction? You may need to do some research.</li> <li>3. Discuss the use of underwater turbines and/or other means of utilizing tidal resources. Where are such methods likely to be most useful?</li> <li>4. Discuss the importance of ethanol, and its production methods. What substances are required?</li> <li>5. Can jet fuel and other liquid fuels be economically generated from biological sources? What would be the advantages of doing so?</li> <li>6. Discuss the production of biofuels from algae. Why are algae potentially an important source of fuel?</li> </ol>

Week	Due Date	Topics, Videos, Readings, Assignments
13	04/28/21	<p><b>Topic: Fresh water resources</b></p> <p>The presence or absence, availability or unavailability of fresh water (or at least, water that can be made fresh) is and has always been a resource over which wars have been fought and civilizations made and destroyed. It is no wonder that, with the increasing population the world now faces, that the availability of this resource should continue to be important.</p> <p><b>Watch:</b> Water Scarcity in Yemen [Mario Alemi]  <a href="https://youtu.be/OtQypN8ODH4">https://youtu.be/OtQypN8ODH4</a></p> <p><b>Watch:</b> Mexico City faces growing water crisis [PBS NewsHour]  <a href="https://youtu.be/0E_VpTjx-y0">https://youtu.be/0E_VpTjx-y0</a></p> <p><b>Watch:</b> Inside Story - What can be done to stop global water scarcity? [Al Jazeera English]  <a href="https://youtu.be/JIIBBWSQMds">https://youtu.be/JIIBBWSQMds</a></p> <p><b>Watch:</b> Our Freshwater Future   Rosemary Knight   TEDxStanford [TEDx Talks]  <a href="https://youtu.be/AFO77hDGbII">https://youtu.be/AFO77hDGbII</a></p> <p>In two weeks, we will be looking into adaptive management strategies. Water management is one of the oldest tasks of government. As you might expect, a great deal has been learned and shaped through the successful management of fresh water resources. Much of what has been learned regarding conservation, purity, availability, and reuse applies to other resources as well.</p> <p><b>Watch:</b> Water &amp; Governance [sesync annapolis]  <a href="https://youtu.be/tHAzFVrZtUM">https://youtu.be/tHAzFVrZtUM</a></p> <p>Dujiangyan is an ancient irrigation system in Sichuan, China. Originally constructed around 256 BC as an irrigation and flood control project, it is still in use today. It is a really beautiful part of China, highly recommended. Here's a re-creation of some of that early work:</p> <p><b>Watch:</b> See an Ancient Wonder of China that Transforms a River [National Geographic]  <a href="https://youtu.be/arfV94Y9tKE">https://youtu.be/arfV94Y9tKE</a></p> <p><b>Homework 12:</b></p> <ol style="list-style-type: none"> <li>1. Why, in many developing (or even developed) countries, do the poor pay more for water than do the rich? What is being done, if anything, to address this concern?</li> <li>2. Much of Yemen's and Mexico City's water is extracted from non-renewable groundwater. This is the case in many locations throughout the world. According to Gleeson, which regions have the greatest challenge regarding the water balance of their associated aquifers?</li> <li>2 According to some of the people interviewed in the Al Jazeera video, what can be done to stop global water scarcity?</li> <li>4. Discuss the use of remote sensing in assessing groundwater reserves in the talk by Rosemary Knight.</li> </ol>

Week	Due Date	Topics, Videos, Readings, Assignments
14	05/05/21	<p><b>Topic: Ecological resources and wildlife</b></p> <p>Biological and ecological resources are often kept separate from discussions of mineral resources. Wilderness and wildlife conservation are often considered to be distinct in some way from other sorts of natural resources management, although they clearly intersect in the real world. This week, we'll explore some terms; next week we'll try to connect these to our earlier discussions through ideas like adaptive management and Complex Adaptive Systems. Ecological resources are often discussed in terms of the 'ecosystem services' that offer benefits to human societies.</p> <p><b>Watch:</b> Ecosystem services [California Academy of Sciences]  <a href="https://youtu.be/BCH1Gre3Mg0">https://youtu.be/BCH1Gre3Mg0</a></p> <p>It is often with regard to ecological resources that individual human beings have a powerful personal influence. Through the actions of specific people, entire species have escaped extinction thus far. Careers acting on behalf of wildlife and naturally diverse ecosystems may be some of the most challenging, time-critical, but personally fulfilling domains of natural resource management that we have seen and will continue to see in the near future. Even part-time volunteer work can be quite meaningful.</p> <p><b>Watch:</b> Top 5 Inspirational Animal Conservation Stories [BBC Earth]  <a href="https://youtu.be/zQZndqa2bIw">https://youtu.be/zQZndqa2bIw</a></p> <p><b>Examine (or Watch):</b> Modern day wildlife conservation   Nick Bubb [TEDx Talks]  <a href="https://youtu.be/BTzm6RKmaXs">https://youtu.be/BTzm6RKmaXs</a></p> <p>We cannot neglect the enormous significance that ecological and wildlife resources may have with regard to the pandemic we now face.</p> <p><b>Examine:</b> COVID-19: Where It Starts and Stops [Wildlife Conservation Society]  <a href="https://youtu.be/_D_6a56zI_U">https://youtu.be/_D_6a56zI_U</a></p> <p><b>Examine:</b> How wildlife trade is linked to coronavirus [Vox]  <a href="https://youtu.be/TPpoJGY1W54">https://youtu.be/TPpoJGY1W54</a></p> <p><b>Examine:</b> Covid 19 is causing a conservation crisis. Endangered species at risk [Evening Standard]  <a href="https://youtu.be/CGJ9X2MGzxw">https://youtu.be/CGJ9X2MGzxw</a></p> <p><b>Homework 13:</b></p> <ol style="list-style-type: none"> <li>1. What are ecosystem services? What services are most important in sustaining the human population of a given region? How might they be different from one region to another?</li> <li>2. Consider how gentle animal stories so successfully capture the imaginations of children. Do you think that being around animals or early immersion in nature may help to shape a generation better able to understand and deal with resource issues more generally?</li> <li>3. Describe how wildlife trade is not a good idea, whether it involves ivory or virus-carrying species.</li> </ol>

Week	Due Date	Topics, Videos, Readings, Assignments
15	05/12/21	<p><b>Topic: Adaptive management</b></p> <p>Obviously, in an ever-changing world, management strategies must be adaptive; if management breaks down or offers no valid solution to a new problem, then it is simply in the way. I'd love to go more deeply into aspects of complexity science that I believe are relevant here, but one (oversimplified) discussion that you may have heard of involves top-down vs bottom-up strategies.</p> <p>This first video explains the sustainable management of natural resources from the point of view of a commission of the European Parliament. I would characterize this as a top-down strategy. Pretty much anything coming from the EU, the Davos conference, the PRC, or the UN, for example, involves top-down thinking, even when their graphics portray ordinary people.</p> <p><b>Watch:</b> Sustainable management of natural resources [MySTOA]  <a href="https://youtu.be/4qA3KBFrB2o">https://youtu.be/4qA3KBFrB2o</a></p> <p>Contrast that with the idea of community-based adaptive management, a bottom-up approach.</p> <p><b>Watch:</b> Community-based adaptive learning in management of Conflicts and Natural Resources  <a href="https://youtu.be/EMxe2a2VyOg">https://youtu.be/EMxe2a2VyOg</a></p> <p>A short introduction to the idea of adaptive management in conservation:</p> <p><b>Watch:</b> Adaptive Management for Conservation [Blue Mountain World Heritage Institute]  <a href="https://youtu.be/4BNN5RsDITQ">https://youtu.be/4BNN5RsDITQ</a></p> <p>A good introduction to the concept of Complex Adaptive Systems</p> <p><b>Watch:</b> Complex Adaptive Systems introduction video [Wageningen University]  <a href="https://youtu.be/nGxeinvr1I4">https://youtu.be/nGxeinvr1I4</a></p> <p><b>Watch:</b> Unleashing innovation in a resource limited world [Australian National University]  <a href="https://youtu.be/maUkJza9Ct8">https://youtu.be/maUkJza9Ct8</a></p> <p><b>Homework 14:</b></p> <ol style="list-style-type: none"> <li>1. How might innovations in communication (enabled by the Internet) help to reduce the rate of consumption of goods tied to resource extraction? Consider the numbers of people now working from home due to the pandemic.</li> <li>2. Contrast what might be called a top-down, macroeconomic, globalist approach to natural resources management, with bottom-up, community-based regional approaches. Can these two general ways of looking at the problem coexist, particularly if the practitioners of a top-down approach severely restrict what can be done at the local level?</li> <li>3. Why is fundamental and applied scientific research important for the future of resource management?</li> <li>4. What are Complex Adaptive Systems, and how is this concept applicable to the management of natural resources in light of social concerns?</li> </ol>

Week	Due Date	Topics, Videos, Readings, Assignments
16	05/19/21	<p><b>Term paper (Final Evaluation)</b></p> <p>In place of a final exam, I want you to submit a paper on a topic of your choice, possibly expanding on one of the topics we've already covered, or introducing something new. Provide at least three citations, including at least one that you have found yourself. Choose a topic that you are genuinely interested in educating yourself further about. The resulting paper should be at least five pages long, easily more. There is no upper limit on length. Please do not just resubmit portions of earlier homework assignments with minor modifications. There should be substantive improvement and discussion. In other words, this is a warning: resubmitted homework responses for which you may have received A's can easily earn you a B or less here if there are no substantive additions.</p> <p>This should be something that you would consider submitting to a newspaper or journal, post online, and add to your undergraduate portfolio. You should create such a portfolio, if you haven't already done so, in Portfolio.</p>