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**GEO 3510 EARTH RESOURCES: Fall 2021**

Monday-Wednesday-Friday 12:00-12:50

Florida International University

Department of Earth and Environment

**Teaching Faculty:**

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**Required texts:**

Earth Resources and the Environment, 4<sup>th</sup> Edition, by Craig Vaughan and Skinner (CVS in the course schedule)

Essentials of Geology, 13<sup>th</sup> Edition, by Lutgens, Tarbuck, and Tasa (LTT in the course schedule)

Encounters with the Archdruid, by John McPhee

**Common Reading for Global Learning:**

The Case for Contamination, Kwame Anthony Appiah, New York Times, Jan. 1, 2006.

**Recommended and extra credit texts:**

Coal: A Human History, by Barbara Freese

**Other study materials:**

Additional study materials, including the powerpoint files used in class, may be found in the modules in Canvas. Canvas is available to you for this course mainly for the distribution of these materials.

**Course meeting location:**

As of the beginning of the semester, I am planning to have this class meet only in face-to-face mode, and I do not currently plan to have any of the course assessments online. If you have not, for some reason, been vaccinated against COVID-19, **I urge you in the strongest of terms to get vaccinated, as I have.** If I could require you to be vaccinated to attend my class I would.

However, as it pandemic continues to drag on and to become for transmissible, there is the possibility that we may be forced to go into remote mode. If that happens, I will post an announcement in Canvas and the class will continue in Zoom lectures at the regularly scheduled times. In this event, exams will be given in Canvas, rather than in person.

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### **Course Justification:**

GEO 3510 Earth Resources is a Global Learning Foundations course and fulfills the Physical Sciences requirement for the University Core Curriculum when taken with the accompanying lab (GEO 3510L).

Mineral and nonrenewable energy resources have been produced by geologic processes acting over much of Earth's history—consequently, they are erratically distributed over the Earth, and many resources are concentrated heavily in a small number of countries. Nevertheless, the demand and markets for these resources are global, and conflict over resources has often shaped the course of human events and will continue to do so. Discussion of each resource will include an overview of how the resources form geologically, what each resource is used for, which nations are the major resource holders and producers and which nations are most dependent on imports.

The use and impacts of earth resources are intrinsically global in scope and involve complex interrelationships among nations, government agencies, corporations, individuals and the local and global environment. Ownership, exploitation and scarcity of resources create tensions among nations, between the interests of corporations and individuals and between the interests of development and conservation.

Understanding the use of earth resources and their impacts on society and the environment also requires an understanding of their interdisciplinary dimensions. The geology of the resources creates technical and engineering challenges in their extraction, processing and refining. Their global distribution creates political and economic challenges including the formation of cartels, the support of oppressive regimes by resource companies, and the prosecution of wars which have changed the course of history on the largest scales. The impacts of resource extraction and use create political and scientific challenges as solutions to environmental problems are sought and political efforts are waged to implement these solutions. All of these scenarios play out in diverse ways in different countries with differing legal systems and cultural norms.

There are positive and negative aspects to the extraction and use of every resource, and a central emphasis of the course is to consider the uses of each resource together with the associated political, economic and environmental issues, rather than treating each of those topics separately. Because everyone living in industrialized society is involved in the use of mineral and energy resources, the relationships between individuals and the pros and cons of resource are emphasized.

### **Global Learning Course Outcomes:**

**Global Awareness**—Students will be able to demonstrate an understanding of the global sources of energy and mineral resources in their geologic, economic, political and environmental context.

Identify earth resources that are crucial to human society and their uses,

Demonstrate understanding of how these resources form geologically, which is the basis for the discovery of new resource deposits, the estimation of reserves and planning of resource use.

Demonstrate understanding of mining technologies, their various environmental impacts, and the economic and social factors that favor the use of one technology over another.

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Analyze global impacts of earth resource extraction and use, particularly global warming, and evaluate means for reducing those impacts.

**Global Perspective**—Students will be able to analyze the extraction and use of resources from local, national and multinational perspectives, including the effects of cartels.

Demonstrate understanding of the effects of heterogeneous resource distribution, resource scarcity and resource replacement.

Analyze and describe how the global distributions of earth resources and competition for them have affected international relations past and present.

**Global Engagement**—Students will collaborate in groups to devise solutions to problems involved in resource extraction and use.

Students will engage in an in-class debate of environmental/economic/social issues facing a large multinational mineral or energy resource company.

Students will reflect on the relationship between their own consumption of resources and consequent impacts.

Analyze the social and environmental impacts of extractive industries on local and national populations, including such examples as Nigeria, South Africa, and Andean South America.

#### **Active Learning Exercises:**

Students will participate in an in-class discussion session of the book “Encounters with the Archdruid.” Students will discuss resource and conservation issues raised in the book in small groups. Each group will make a brief oral presentation of its conclusions to the whole class and submit a written summary to me. Students will be evaluated on the basis of their participation in the discussions and presentation, which will depend on thoughtful consideration of the reading. There is no make up assignment for this activity.

Students will also participate in an in-class discussion exercise of the Common Reading: “The Case for Contamination” by Kwame Anthony Appiah. This discussion will be followed by a short essay quiz which will assess your analysis of the core concepts in the essay and your ability to synthesize them with the central themes of the course. A minimum score of 7/10 is required to pass the quiz.

#### **Co-curricular activities:**

Students will be able to participate in the Tuesday Times Roundtable discussions. Documented attendance of at least three of these activities and submission of a three-page summary of the activities (a minimum of one full, single-spaced page per activity) will count as extra credit in the course as described in the section on grading policy.

#### **Group learning exercise:**

Students will participate in an in-class debate/roleplaying exercise in which they debate and devise solutions to major problems facing extractive industries. Students will divide into groups representing different parties with distinct viewpoints on the problem, such as citizens groups, multinational corporations, government agencies and others as may be applicable.

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### Exam Attendance Policy:

You absolutely **MUST** attend the exams and the debate of the second text at the scheduled times. If you cannot attend, you must contact me **IN ADVANCE** to take the exam at a different time. **If you miss an exam without contacting me in advance, you will receive a zero for the exam no matter the circumstances.** To take an exam late, you **must** provide documentation that proves you could not be in attendance at the scheduled time, and arrangements will be made only in the case of serious emergencies, and only at my discretion. Attendance at athletic events, practices, family outings or trips, hangovers, sniffles, sick friends or family, car trouble, trips for other courses or forgetting the date of the exam, among many other excuses, are **NOT** acceptable and will **NOT** result in being allowed to take a make up exam. If you fail to attend an exam for any reason that does not in my opinion constitute an emergency, and if you do not contact me in advance, you will receive a zero for that exam. There will be no exceptions to this policy.

### Grading Policy:

Grades will be based the following scores:

Two midterm exams	20% each
Final exam	25%
In-class discussion of Encounters with the Archdruid	10%
In-class debate of challenges in resource use	10%
Discussion of the Common Reading	5%
Roll call attendance	10%

Assessment dates are indicated in **bold type** in the schedule below. Exams consist of a mixture of multiple choice (about 2/3 point total) and short essay type questions (about 1/3 of the point total). I will take roll call attendance at 5 random class meetings through the semester, and the attendance grade will make up the remaining 10% of your course grade. Attendance of 4 or 5 out of 5 = A, 3 out of 5 = B, 2 out of 5 = C, 1 out of 5 = D, 0 attendance = F. **If you are unable to attend on a roll call date because of COVID-19, you must bring documentation of that diagnosis and it's dates. There are no other excused absences from roll call attendance—that is why you are allowed to have one absence without it affecting your grade. Do not waste your time bringing me excuses for roll-call absences.** When I call roll, you are either in your seat or you are not—if you go out to the bathroom, to take a phone call, or if you walk in 2 minutes after I call roll, you are marked absent. If you get arrested, hit by a meteorite, married etc. more than once in the semester, you will be marked absent.

### Extra Credit exercises:

There will be two available extra credit assignments. First, the university hosts a series of roundtable discussions called the Tuesday Times Roundtables each Tuesday from 12:30-1:30. Most of the roundtables are at the University Park campus, but some are at Biscayne campus also. The schedule of discussions may be found at <https://goglobal.fiu.edu/ttr/>. Documented attendance at three of these sessions, accompanied by a full one page single spaced summary of the roundtable discussion, will earn you extra credit in the course. Writeups must have your name and the title of the roundtable on no more than two lines, and the text of your summary must occupy the rest of the page—submissions that are shorter than this will receive no credit. These writeups will be due on the last day of lecture (November 30). Second, a written quiz will be given on November 7, and students scoring a passing grade on that quiz (7/10 or better) will also receive extra credit.

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The quiz will cover the recommended text “Coal: A Human History.” In each case, extra credit consists of an increase to the overall semester grade by one fraction (e.g., from C- to C, B to B+).

### Advice on Course Strategy

I have taught this class many times, and my advice on how to prepare yourself to succeed is as follows:

- 1) Print out outlines of the powerpoint files for each lecture, and use them as a template for your in-class notetaking. Notice, this implies that I expect you to take notes in class. Many things I expect you to know are not found in bullet lists in the powerpoints, and simply studying them alone will not result in a passing grade.
- 2) Print out and make many copies of the resource data sheet (available in Canvas). Fill out one copy of the form for each resource we discuss after the introductory part of the semester (e.g., natural gas, copper, iron, diamonds, etc.) and use it to organize your information about each resource. These forms will be a crucial resource in preparing for the exams, especially the final exam.
- 3) Take advantage of the extra credit opportunities, especially the Tuesday Times Roundtable, early in the semester. Later in the semester the series will have ended and it will be too late to earn that extra credit. Asking for extra credit in the last week of the semester, like asking for an incomplete because your grade is too low, will not get you anywhere.

### Course behavior:

Students will arrive on time, ready to participate in the day’s activities. Electronic devices may be used only for participation in class activities. Cell phones must be turned off or muted at all times. Any violations of the university honor code (available at <http://www2.fiu.edu/~daiglerr/code.htm>) will result in charges of academic misconduct. This includes any form of cheating such as use of unauthorized materials or communication during exams, plagiarism and so on. Students will behave in a respectful manner toward one another even during heated debates, regardless of how strongly you disagree.

### Class Schedule (Subject to Modification)

Date	Topic	Reading
August 23	Course ground rules and introduction. Distribution of resources shaped the world we live in.	Syllabus
August 25	Introduction to the Earth	LTT 1.4-1.9
August 27	Plate tectonics	LTT 2
August 29	Minerals and rocks	LTT 1.8, 3
September 1	Igneous rocks—how and where they form	LTT 4
September 3	Surface processes: weathering	LTT 6.1-6.7
September 6	No class meeting, Labor Day Holiday	
September 8	Sedimentary Rocks	LTT 7.1-7.7
September 10	Deformation of rocks	LTT 11.1-11.3

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September 13	Geologic Time	LTT 1.2, 18.5
<b>September 15</b>	<b>In-class discussion--Encounters with the Archdruid</b>	<b>Encounters</b>
	Weighing development and conservation	
<b>September 17</b>	<b>Encounters discussion, continued: Summaries</b>	
<b>September 20</b>	<b>Midterm 1</b>	
September 22	Midterm 1 review	
September 24	Basic mineral economics, cartels	CVS 3
September 27	Mining law	PPT only
September 29	Mining methods, part. 1 (overview and surface)	CVS 4
October 1	Mining methods, part. 2 (underground)	CVS 4
October 4	Energy resources—global overview of current use	CVS 5
October 6	Fossil fuels—formation of coal and petroleum,	CVS 5, LTT 7.9
October 8	Petroleum, worldwide distribution and future trends	CVS 5, LTT 7.9
October 11	Global environmental impact of fossil fuels	PPT, LTT 20
	Glaciers and climate change	
October 13	Glaciers and climate change	PPT, LTT 20
October 15	Energy alternatives: Renewables	CVS 6
October 18	Energy alternatives: nuclear power—sources, technology and impacts	CVS 6
<b>October 20</b>	<b>Midterm 2</b>	
October 22	Midterm 2 review	
<b>October 25</b>	<b>Discussion of the Common Reading and quiz</b>	<b>Common Reading</b>
October 27	Iron deposits and the evolution of the modern global atmosphere	CVS 7
October 29	Aluminum, manganese and titanium	CVS 7, LTT 6.10
November 1	Platinum and the ferroalloy metals vanadium and Chromium: Extreme examples of heterogenous global distribution.	CVS 8
November 3	Nickel, cobalt and other ferroalloys	CVS 8
<b>November 5</b>	<b>Class group discussion of challenges in resource use</b>	
November 7	Copper and the base metals: their uses and roles in the rise of modern society	CVS 8, LTT 4.9
November 10	Gold and silver: Formation and uses, roles in imperialism and conquest.	CVS 8
November 12	Gold and silver, continued	
<b>November 15</b>	<b>Extra credit quiz—Coal: A Human History</b>	
November 17	Formation of diamonds, the DeBeers international	CVS 10

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November 19	diamond cartel Chemical minerals	CVS 10
November 22	Fertilizers: nitrogen, phosphorous and potassium Nitrates and the War of the Pacific	CVS 9
November 24	Water resources	CVS 11
November 26	No class meeting, Thanksgiving Holiday	
November 29	Water resources continued	CVS 11
December 1	Water resources part 3	CVS 11
December 3	Catch up, final exam review, TTR writeups due	
<b>Final Exam</b>	<b>December 12, 9:45-11:45 AM</b>	

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