

**San José State University**  
**Department of Environmental Studies**  
**Department of Geography and Urban and Regional Planning**  
**ENVS 121-80 / GEOG 121-80: Population and Global Change**

**Fall 2020**



**Course and Contact Information**

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**Office Hours:** Please contact me if you would like to set up an appointment.

## Course Format

This is an online course. Internet connectivity and a computer are required. Course materials (including this syllabus) can be found on the Canvas Learning Management System course login website at <http://sjsu.instructure.com>, under **Files**.

For this course, 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 discussed within recent **Announcements**. Please check **Announcements** at least once a week, and before submitting homework. All homework must be submitted, even if late. Repeated lateness should be explained in a message. As each assignment is viewed and graded, comments may be pinned to particular submissions. Check for such comments, regardless of whether you have received a grade, and address any concerns expressed there. If you would like to respond to a comment, please do so with an independent message. A final evaluation paper must also be submitted. That's it in a nutshell.

The photo above was intended to represent (with a little humor) how my courses might relate to some of the available online educational technologies that we are often encouraged to use. Look closely; you should notice something. The metal structure over the bench looks like something that might provide shade or shelter from rain, but in fact *it does neither, at any time*. Nevertheless, its oddly aligned slats need spikes to keep the birds away.

Imagine the bench in the photo as representing the three Canvas tabs that we will be using: **Assignments**, **Announcements**, and **Files**, communicating individually if necessary with Canvas **messaging**.

Imagine the metal structure in the photo as the rest of Canvas, which you may safely ignore for my classes. I don't mind it being there, but all we really need is the bench, from which you can metaphorically watch golden eagles, hawks, meadowlarks, gulls, waterfowl, songbirds, jackrabbits and colonies of ground squirrels just beyond the fence.

From the videos and texts I will ask you to examine, you can explore a great many things in great depth. The subject matter is what (hopefully) makes the course engaging, not its structure. Don't mistake the finger pointing at the moon for the moon itself. The finger is not important. Obeying the elaborate structures of educational and social media is not the goal of my courses. I hope to keep that stuff to a minimum.

You should all be working and writing as individuals, so there is no need in my classes for group communication via skype, zoom, or whatever the latest platform may be. I will point out any interesting observations or advice that I might have generally about your homework responses in the **Announcements**, but I will never identify individual student publicly. If I send you a message, you may rest assured that I will keep any information we exchange private. Nevertheless, you may release any conversations that you have with me publicly at any time.

Within Canvas, conversations cannot be tampered with, overlooked, ignored, or shared with others. There are no such assurances with email. That is why I would prefer never to use email. You may text my private phone number if you ever need to reach me in a hurry or in an emergency. Being late with homework is not an emergency.

Please read and view the material at the beginning of each homework assignment, as well as any new **Announcements**, every week. These are where my 'lectures' are located. If I suspect that you are not paying attention (by, for example, not addressing an additional question that I may have posed in a recent **Announcement**), this will be reflected in your grade. I encourage you to get someone to read and edit your homework before submission if you are uncertain, but 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 attribution, by means of notes or references.

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 are 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. I do not grade on the basis of the opinions or conclusions you

may express on any issue, even when I may ask you to express one. Further details are discussed below under Course Requirements and Assignments and in the Course Schedule.

## **Course Description**

This course was formulated without any guidance from textbook publishers or educational committees. The topics were chosen to reflect the realities of our times, particularly in light of the COVID-19 crisis. My goal is to help each of you to make informed, appropriate personal and professional choices and contributions as we navigate through this rapidly changing world. The topics are arranged into four general groups:

1. Complex systems, networks, and related topics
2. Social trends (population growth, urbanization, and globalization)
3. Individual and social well-being; pathogens and disease
4. Coastal and other vulnerable regions under rapid biospheric change
5. Water, energy, food, and resource security

## **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 considered them in your discussions. If you are accessing each assignment through CANVAS **Assignments**, you might be given the choice of opening a video in a separate browser or of watching it embedded within CANVAS. Whichever method you use, feel free to scrub and pause each video frequently and watch portions repeatedly, taking notes as you watch. Watching videos within separate browsers often provides you with additional information, as well as access to other material on the author's channel. You might want to pull up videos on your phone or tablet as you write on a laptop. Do whatever feels comfortable, but make sure you have a large enough screen and sufficient bandwidth to see the details (including text) that are important to most of these videos, including mine. I encourage you to explore the work of any YouTube contributor whose work you appreciate.

When viewed in a separate browser, many YouTube videos are preceded by ads. Usually, these ads can be cut short by clicking on 'Skip Ad' at the lower right of the screen, or by clicking on the x at the upper right of a popup ad. There are never ads on my own videos, and I get no monetary benefit from YouTube. I also provide no tags on my videos. If you view a video within Canvas (by clicking on the image rather than the link), this is not counted as a 'view' by YouTube. For these reasons, my videos (intentionally) get few views. However, you may share my videos at any time.

## **Course Requirements and Assignments**

### **Homework**

Fourteen homework assignments should be completed on or before the due dates, as described in the course schedule below. Each must be submitted in any case, even if late. Please submit these responses via Canvas. For each homework assignment, I would prefer you use primarily 10pt font with 1½ line spacing. Put your name, the homework number,

‘Pereira’, ‘geog120-80’ and ‘Fall 2018’, arranged at the upper right of the first page. Text, figures, and images lifted from documents or screenshots may be embedded in your homework, but these should include attribution.

## Announcements

Please check the **Announcements** tab every week. Discussions of homework results and expectations, current events, and other issues of interest to this class will be posted there. Additional homework questions may also be posted, due more than a week after posting.

## Final Evaluation

A term paper will serve as the final evaluation. The term paper should be at least five pages long (10 point font, 1 ½ spaced) and contain a formal list of references. The resulting document should qualify for publication in your undergraduate portfolio, if you have one.

You all should create and begin populating your own Portfolium accounts, which you can constantly revise and over which you have total control. It’s free. Here is one I made a few years ago:

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

## 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.

# EnvS121-80 / Geog121-80: Population and Global Change, Fall 2020

Please submit your homework responses as Word or pdf files by the due date indicated. Use 10 point font, with ~1 ½ line spacing and normal margins. Put at upper right on the first page of each submission your name, the homework #, geog121 or envs121, Fall 2020.

## Course Schedule

Week	Due Date	Topics, Videos, Readings, Assignments
1		<p>Topic: <b>Complexity and human dynamics</b></p> <p><b>Watch:</b> General notes for my online classes [Gary Pereira]  <a href="https://youtu.be/_AN8k0OgwI0">https://youtu.be/_AN8k0OgwI0</a></p> <p>I was introduced to some of the topics in this course when I was about 15 years old. The working class New Jersey public schools that I attended had a woodshop, metal shop, print shop, and auto shop, as well as drafting, chemistry, physics, biology, and electronics labs. Mr. Saltzer was our chemistry teacher. He was a middle aged man whose family had perished in the Holocaust. One day, he introduced us to a book called <i>Brave New World Revisited</i>, by Aldous Huxley</p> <p><i>Brave New World Revisited</i> (not to be confused with the novel, <i>Brave New World</i>) is a short book of essays that was first published in 1958. The chapters are titled: Over-Population; Quantity, Quality, Morality; Over-Organization; Propaganda in a Democratic Society; Propaganda Under a Dictatorship; The Arts of Selling; Brainwashing; Chemical Persuasion; Subconscious Persuasion; Hypnopedia; Education for Freedom; and What Can Be Done?. Still very interesting. But it’s just another one of those old books the libraries are likely to trash because it hasn’t been checked out in years. Another one of Huxley’s books, <i>Doors of Perception</i>, was to interest me a few years later.</p> <p><b>Topic 1. The individual and the collective</b></p> <p><b>Optional:</b> Humanity [Gary Pereira]  <a href="https://youtu.be/IeT2AOBkKJM">https://youtu.be/IeT2AOBkKJM</a></p> <p>(Videos of ambient scenes without narration do not need to be watched very closely, but try to watch enough to absorb their atmosphere.)</p> <p>I personally do not take a collectivist approach to the study of human society. The actual validity of collective claims that are often made in the social sciences is debatable; in any case I believe that it is important for many reasons to ascribe to individual human beings their fully individualized identities in our thoughts and imaginations. Putting our trust in theories involving societal categories is dangerous, regardless of whether they seem to be natural or intuitive. If we focus, at least part of the time, on individual human beings and the households they create, we can pursue important insights that categorical analyses will either miss or misinterpret. For many reasons, some of which we shall explore, the natural and human world is ever changing. Even apparently natural categories will pop in and out of existence here and there at different times, acting as rogue variables in historical or cross-cultural analyses. These categories are often ascribed causative agency that they do not possess.</p>



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		<p>To repeat: human societies, no matter how large or homogeneous or apparently tribal, are comprised of uniquely individualized human beings. This should be transparently obvious, but it is often overlooked. In a couple of weeks, when we discuss demography, do not lose sight of the fact that we are still always talking about people, each of whose lives are as important to each of them as mine is to me and yours is to you. Behind those windows facing the Yangtze river early one morning in the video above, thousands of people are waking up to a new day, each of them with their own particularized dreams and ambitions, disappointments and successes, joys and sufferings.</p> <p>To be clear: this course focuses on human ecosystems in the aggregate, global, and biological sense, but it is also very much about individual human beings. Intermediate categories based on nationality, party, income, race, ethnicity, religious belief, age, and gender or sexual identities or preferences, et cetera, are not necessarily either fundamental, significant, or universally applicable. Their relevance is contingent on the particularities of each situation. In my view, basing one's broad worldview on fluid categories is dangerous. Categorical relationships that seem so clear and significant to you now may not be justified in other contexts. All too often, arguments based on categorical social worldviews have proven to be wrong. They have often served to balkanize communities and isolate people who disagree with one another from one another. That is a sad and dangerous trend. And it is a trend that has become increasingly dangerous to oppose, particularly in the universities. I am well aware of that, from bitter experience.</p> <p>I will at times ask or invite you to discuss such categories in your homework. They might be valid, in context. But I would discourage you from being too ready to extrapolate your conclusions to other places or other times, or to the Earth as a whole. You will find me to be a skeptical audience. Remember, you are writing for someone who read <i>Brave New World Revisited</i> and <i>1984</i> before he was 15 years old. That was fifty years ago. I would prefer that you focus on and educate yourselves in the use of the ideas and tools coming from the complexity sciences, honestly, than from the fashionable nonsense that often passes for truth in the social sciences.</p> <p><b>Topic 2. Complex systems</b></p> <p>Understanding the topics in this course requires an appreciation of conceptual tools that are used in professional settings to represent and analyze them. The sciences and mathematics of complexity are increasingly being used to describe and to generate many of these tools. We only have time to consider some of the important concepts in that have arisen in recent years. We begin with the characteristics of distributed dynamical networks.</p> <p><b>Watch:</b> What is a Complex System? [Systems Innovation]  <a href="https://youtu.be/vp8v2Udd_PM">https://youtu.be/vp8v2Udd_PM</a></p> <p><b>Watch:</b> Network Paradigm [Systems Innovation]  <a href="https://youtu.be/9XEvXNrc-dg">https://youtu.be/9XEvXNrc-dg</a></p> <p><b>Watch:</b> Network Theory Overview [Systems Innovation]  <a href="https://youtu.be/qFcuovfgPTc">https://youtu.be/qFcuovfgPTc</a></p> <p><b>Optional:</b> Network Clustering &amp; Connectedness [Systems Innovation]  <a href="https://youtu.be/2Oa7mef77nM">https://youtu.be/2Oa7mef77nM</a></p>

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	<b>08/25/20</b>	<p><b>Optional:</b> Network Degree Distribution [Systems Innovation]  <a href="https://youtu.be/oCHTuTq_EOI">https://youtu.be/oCHTuTq_EOI</a></p> <p><b>Optional:</b> Network Dynamics [Systems Innovation]  <a href="https://youtu.be/Mp-ddvQ1mRE">https://youtu.be/Mp-ddvQ1mRE</a></p> <p><b>Optional:</b> Network Diffusion &amp; Contagion [Systems Innovation]  <a href="https://youtu.be/bTXUJQhEqL0">https://youtu.be/bTXUJQhEqL0</a></p> <p><b>Homework 1:</b></p> <ol style="list-style-type: none"> <li>1. If we have a diversity of parts without organization, but with lots of random activity, is that set of parts complex? Why are the relationships between parts important in defining a working model of a complex system?</li> <li>2. Describe why network theory is an important basis for the comprehension of geographic phenomena. What are some of the most important characteristics of networks? How do these networks emerge? Use examples to illustrate your points.</li> </ol>
<b>2</b>		<p>Topic: <b>Emergence, resilience, and antifragility</b></p> <p><b>Watch:</b> Rupert Sheldrake - The Science Delusion [revolutionloveevolve]  <a href="https://youtu.be/JKHUaNAxsTg">https://youtu.be/JKHUaNAxsTg</a></p> <p>Sheldrake's views may appear controversial, but his physics is accurate, and he brings up a number of interesting points. I've asked you to watch this in order to disabuse you of the notion that you have to be a materialist in order to be a scientist. Nonlinearities (in the mathematical sense) yield all sorts of weird and wonderful things. Nature itself is almost entirely nonlinear in form and function. As we begin to look ever more closely at astronomical objects, from stars to galaxies and beyond, they appear to be as complex in their own way as living things here on Earth. The universe itself, as we see it more closely, reveals its own evolution. It actually resembles something far more interesting than the mechanical caricature we've ascribed to it.</p> <p>As an example of the sorts of things that come out of a relatively simple nonlinear relationship, consider the Mandelbrot Set. As you zoom into the boundary of solutions to an iterative equation on the complex number plane, it reveals itself in astonishing complexity. Again, these fractal patterns that come out of pure mathematics appear to be more biological than mechanical.</p> <p><b>Optional:</b> Sapphires - Mandelbrot Fractal Zoom [Maths Town]  <a href="https://youtu.be/8cgp2WNNKmQ">https://youtu.be/8cgp2WNNKmQ</a></p> <p>The forms you can see emerging from the background and dissolving into the foreground as we zoom in are actually emerging from the calculations as they are performed. As with chaotic phenomena, as with evolutionary phenomena, we cannot predict very far ahead what sorts of forms will appear. Emergence seems to be of fundamental significance in both the mathematical and observable world, even if we cannot fully conceptualize it. The concept is difficult to formalize in words. Again, Systems Innovation</p>

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		<p>provides a series of videos that together present enough of a background for you to be able to more realistically imagine the sorts of social and natural dynamics that drive the topics we will be covering. We've looked briefly at Emergence last week; let's continue.</p> <p><b>Watch:</b> Emergence [Systems Innovation]  <a href="https://youtu.be/QIfTWZc7hKs">https://youtu.be/QIfTWZc7hKs</a></p> <p><b>Watch:</b> The Science of Patterns [Systems Innovation]  <a href="https://youtu.be/kh6KMW8J3RQ">https://youtu.be/kh6KMW8J3RQ</a></p> <p><b>Watch:</b> Synergies [Systems Innovation]  <a href="https://youtu.be/rsn5EQoAhUc">https://youtu.be/rsn5EQoAhUc</a></p> <p><b>Watch:</b> Long Tail Distributions [Systems Innovation]  <a href="https://youtu.be/vIp1kYOH0yw">https://youtu.be/vIp1kYOH0yw</a></p> <p>Despite their relative simplicity, nonlinear equations must contain operations beyond simple addition and subtraction. Similarly, the significance of nonlinear phenomena (that is, most things) cannot be determined by addition and subtraction alone.</p> <p>Imagine bumping into a wall at 1 mile per hour. No big deal. Now imagine doing it fifty times. Kind of silly but again, no big deal. Now imagine bumping into the wall just once at fifty miles per hour. Obviously, a very different result from doing it fifty times at 1 mph. In the real world, the sorts of events that carry the most significance (possibly the only significance) are often very those rare events that are strung out along the long tail of the frequency distribution. These are the events that actually change lives, nations, and civilizations.</p> <p>We need look no further than the past few months for a perfect example of a highly multiplicative, nonlinear process involving evolution, viral reproduction, and spreading, whose effects touch on every one of the topics we will be discussing here, possibly for the rest of our lives. We need to recognize that Nature allows for a submicron random mutation of some benign virus at some particular point in time and space to rapidly infect and sicken much of the world's human population, possibly remaining with us as yet another potential threat in perpetuity.</p> <p>So how do you respond to such potentially malevolent nonlinear phenomena? We should try at least to understand them, and we should try to develop and promote healing processes that thrive and grow stronger under adverse conditions. This characteristic has recently been termed 'antifragile'; Nassim Taleb has written a book on the topic. As he points out, antifragility is a very old idea, based on close observation of living things, including human beings.</p> <p>Let's introduce another Systems Innovation video, on network robustness and resilience. These are important characteristics that are often confused with antifragility. There is a difference. Resilience allows something to bounce back from adversity. Antifragility allows something to grow stronger. But robustness and resilience remain very important concepts and goals, which we shall return to later.</p> <p><b>Watch:</b> Network Robustness &amp; Resilience [Systems Innovation]  <a href="https://youtu.be/zNkmDg0mw">https://youtu.be/zNkmDg0mw</a></p>



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	09/01/20	<p><b>Watch:</b> Nassim Taleb Explains Antifragility in Under 5 Minutes  <a href="https://youtu.be/C40zwpdc_yo">https://youtu.be/C40zwpdc_yo</a></p> <p><a href="https://en.wikipedia.org/wiki/Antifragile">https://en.wikipedia.org/wiki/Antifragile</a></p> <p><b>Homework 2:</b></p> <ol style="list-style-type: none"> <li>1. Describe the concepts of emergence, synergies, and pattern formation, and try to illustrate them with a few examples.</li> <li>2. What are long-tailed statistical distributions? How might events following a power-law or long-tailed distribution make assumptions of long-term normality nonsensical? In other words, are common statistical terms always meaningful? For example, can the mean of a power-law distribution ever be determined?</li> <li>3. What is antifragility? Explain how it is different from resilience or robustness.</li> </ol>
3		<p><b>Topic: Demographic change</b></p> <p>The population of any bounded region ultimately reflects the sum of four processes: birth, death, in-migration, and out-migration. This sounds simple, but it depends of course on where you draw the boundaries in space and time, and it can become difficult to disentangle when it plays out in the real world. This week we explore the demographic transition and particular demographic situations around the world, primarily with the aid of population pyramids.</p> <p><b>Watch:</b> 7 Billion: How Did We Get So Big So Fast? [NPR]  <a href="https://youtu.be/VcSX4ytEfcE">https://youtu.be/VcSX4ytEfcE</a></p> <p>The 7 Billion video physically simulates world population with flasks of liquid categorized by continental. Did you notice at the end of the video that the water is on the verge of spilling out over the top of the flask? Besides neglecting the effects of migration, this model suggests an upper limit (where liquid spills out) somewhere above 10 billion. It doesn't explain what they mean by this, although it apparently deserved a close-up. The video is clever, but emotionally manipulative. The "Population pyramids" video is far more informative, but it also doesn't discuss the influence of in-migration and out-migration on the pyramids themselves. For small countries in particular, these can be significant factors. Nevertheless, this video might help you to visualize these processes.</p> <p><b>Watch:</b> How will population change transform our world? [Oxford Academic]  <a href="https://youtu.be/hDoGq3BaR8M">https://youtu.be/hDoGq3BaR8M</a></p> <p>All of what Professor Harper says in this four minute video is relevant to our course. If you would like to hear more, I recommend that you watch the following lecture.</p> <p><b>Optional:</b> How population change will transform our world, w/ Prof Harper [Oxford Martin School]  <a href="https://youtu.be/el7_v86HQcc">https://youtu.be/el7_v86HQcc</a></p>

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	09/08/20	<p><b>Watch:</b> Population pyramids: Powerful predictors of the future [TedEd]  <a href="https://youtu.be/RLmKfXwWQtE">https://youtu.be/RLmKfXwWQtE</a></p> <p><b>Homework 3:</b></p> <p>1. Briefly describe some of the ways population change will transform our world, according to Professor Harper.</p> <p><b>Access:</b> Current World Population  <a href="http://www.worldometers.info/world-population/">http://www.worldometers.info/world-population/</a></p> <p>2. What is the world’s current population, to the nearest 100,000?</p> <p>3. Access the following website: Population Pyramids of the World from 1950 to 2100  <a href="https://www.populationpyramid.net/world/">https://www.populationpyramid.net/world/</a></p> <p>Choose a country somewhere in the world whose recent history may have affected its demographic distribution, possibly through war, policy change, etc. Find that country from the alphabetical list to the right of your screen and click. The population pyramid for that country for the year 2020 is portrayed.</p> <p>Click on ‘Download’ below the bottom left corner of the pyramid; a PNG image should appear in a separate window. Copy this image and paste it into your homework document.</p> <p>If you change the year in the original window by clicking on -5, the year and corresponding pyramid should change to 2015. Click on -5 again, and the year and pyramid change to 2010.</p> <p>Capture population pyramid images for at least three different years for the country you chose in order to reflect the historical realities of that country. Discuss the effects of war and famine, recovery and boom, family size, etc. These pyramids should be separated from one another by at least fifteen years; you can go back to 1950 if you want.</p> <p>You choose which years to image. You can also explore the possible future by clicking on +5, but be aware that these numbers are speculative. Discuss the historical developments that helped shape that particular nation’s pyramids.</p> <p>Now do the same thing for another country. Two countries total. As with the first include a pyramid for 2020, and a couple periods that show interesting changes in demographics. Please adjust the size and placement of the images so that each country’s set of pyramids fills no more than 1/3 of a page. Describe in detail why each country’s demographics changed as it did: war, family planning policies, etc.</p>
4		<p><b>Topic: Urbanization</b></p> <p>The most significant trend currently influencing human demographics nearly everywhere is urbanization: migrations and land use changes that are concentrating people and transforming regions around the world. This has been accompanied by enormous changes in culture, economy, resource use, and human life in</p>

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	09/15/20	<p>general. A primary factor enabling such radical urbanization has of course been the rather recent ability to grow vast amounts of food using relatively few people (but often at the cost of huge energy expenditures, soil depletion, pollution, etc.). We will return to this topic in a few weeks.</p> <p><b>Watch:</b> Harnessing Urbanization for Growth and Poverty Alleviation [World Bank]  <a href="https://youtu.be/nTAIOxqKYNo">https://youtu.be/nTAIOxqKYNo</a></p> <p><b>Watch:</b> Megacities Reflect Growing Urbanization Trend [PBS Newshour]  <a href="https://youtu.be/eFboV2m1yuw">https://youtu.be/eFboV2m1yuw</a></p> <p>The World Bank video claims that urbanization drives growth, creates jobs, and reduces poverty. The PBS video on Dhaka, Bangladesh paints a more complex picture. Dye points out that urban life may actually widen the gap in quality of life between the rich and the poor, and it places a greater responsibility and new challenges to governance.</p> <p>Taking a step back to the personal scale, I'd like us to begin with what most of us would consider to be a pleasant example of what urbanization can be, by having you take a couple of video walks through the Shinjuku neighborhood of Tokyo. Many videos of this kind are appearing now. I picked this location because Tokyo has a population of about 14million and the greater metro area has 40 million, making it currently the world's most populous metropolitan area. In the following two videos, you may of course skip around, but I do encourage you to just relax for a few minutes and let the sights (and the sounds) take you away.</p> <p><b>Optional:</b> Nightlife Streets In Tokyo Shinjuku [Nippon Wandering TV]  <a href="https://youtu.be/1YXmdSVhA3M">https://youtu.be/1YXmdSVhA3M</a></p> <p>This second video is from a different source and has a different style. Pay attention after minute 7 or so.</p> <p><b>Optional:</b> Night videowalk in East Shinjuku, Tokyo [Rambalac]  <a href="https://youtu.be/vHr4qSQ-5XU">https://youtu.be/vHr4qSQ-5XU</a></p> <p>The following two videos present an extraordinary, detailed view of where the world's largest cities will be found by 2030 and 2100.</p> <p><b>Watch:</b> Top 10 Largest Cities by 2030 [The B1M]  <a href="https://youtu.be/N-a0TCWb6E">https://youtu.be/N-a0TCWb6E</a></p> <p><b>Watch:</b> Top 10 Largest Cities by 2100 [The B1M]  <a href="https://youtu.be/9OulEjWI-bE">https://youtu.be/9OulEjWI-bE</a></p> <p><b>Homework 4:</b></p> <ol style="list-style-type: none"> <li>1. It may be true that in many cases, economic growth and poverty reduction are positively correlated with urbanization. But is urbanization the causative factor? Is modernization possible urbanization, and in particular without such extremely large cities? Why or why not? (I realize this is a speculative question.)</li> <li>2. Describe the situation in Dhaka.</li> </ol>

Week	Due Date	Topics, Videos, Readings, Assignments
		<p>3. Compare the urban environment in Shinjuku, Tokyo, to any city of similar density that you may have experienced or know about (for example, some big city here in the US). Describe similarities and differences in both the physical layout and condition, as well as social and cultural differences. I expect you to describe a few obvious differences from typical US cities, as well as some less obvious ones.</p> <p>Hint: watching ambient videos like this is not everyone's cup of tea. I find them relaxing and entertaining, particularly since we've been cooped up for so long. You might be surprised by how absorbed you become in noticing things if you give yourself the chance.</p> <p>4. List the projected numbers of people that will be living in each of the ten cities listed for 2030, and comment on at least five of them. Do you find this trend surprising in any way? Compare them to the numbers living in the world's largest cities today.</p> <p>5. List the projected numbers of people that will be living in each of the ten cities listed for 2100. How have things changed since 2030? Do you think that these cities of the future will be anything like today's cities?</p>
5	09/22/20	<p><b>Topic: Economic Globalization</b></p> <p><b>Watch:</b> Globalization - Rise of Networks [Systems Innovation]  <a href="https://youtu.be/x1wLbJoSmR0">https://youtu.be/x1wLbJoSmR0</a></p> <p><b>Watch:</b> Global Cities: Globalization [Systems Innovation]  <a href="https://youtu.be/B76KE1IFVj4">https://youtu.be/B76KE1IFVj4</a></p> <p>We'll be looking at infectious diseases later in the course, but the effects of COVID-19 on the world economy cannot be overlooked at this point. There are obviously still a great many unknowns, some of which are eventually resolved, but there are certainly a great many opinions. The OECD video makes clear the vulnerability of the world economy to a viral pandemic. The Economist video provides a selection of typical neoliberal opinions on the matter. Thus far, there has been little discussion of resilience, antifragility, etc., although I believe we are beginning to see these characteristics of local economies begin to play out.</p> <p><b>Watch:</b> Living with Covid-19: Two scenarios for the world economy [OECD]  <a href="https://youtu.be/QYFG_u1D0dM">https://youtu.be/QYFG_u1D0dM</a></p> <p><b>Watch:</b> Covid-19: what will happen to the global economy? [The Economist]  <a href="https://youtu.be/pnKsrKuUfBc">https://youtu.be/pnKsrKuUfBc</a></p> <p><b>Homework 5:</b></p> <p>1. Describe how economic globalization could only reach the scale it has once certain thresholds in technology, innovation, and cooperation were achieved. What might some of these thresholds have involved, and given the reversible nature of thresholds, how stable is the basis for economic globalization today?</p>

Week	Due Date	Topics, Videos, Readings, Assignments
		<p>2. How is it possible that the global economy can shift from one “dominated by agriculture and industry, to being predominantly based on services and information” (3:15 in the Global Cities: Globalization video)? Don’t people still have the same material needs? You may explore reasons both for and against this idea.</p> <p>3. Try tackling some harsh questions, in terms of searching for what might be required to answer them. To what degree is economic globalization responsible for the pandemic nature of COVID-19? Is urbanization involved? Might this pandemic be responsible for some long term injury to the global economy? Might some as-yet little understood self-healing processes be at work?</p>
6		<p><b>Topic: Climate change</b></p> <p>Regardless of the relative validity of various assessments and projections of the state of the global climate system, the importance of climate and associated systems to human well-being is self-evident. Their association with both the rise and the fall of past civilizations are undeniable. There is abundant historical evidence, from all parts of the inhabited world, of people working with and against nature, for better or worse. People have left behind ruins and deserts where great forests once had grown, and people have also created garden ecosystems where once there had only been stone or sand. No divorce from nature is ever possible. We can expect this relationship to continue and to grow more difficult in the near future. But divorce is impossible. What emerges will depend largely on what we do.</p> <p>Viewed from outside of ourselves, it should be clear that human beings are an exceptional species and that we have huge responsibilities. These responsibilities have been neglected for a very long time. We find ourselves in a precarious position. In order to make the right decisions and act on them, we need at the very least to open our eyes and to look around carefully and with intelligence at the situation that we are in. That means using all the technology and human talent that are available to us. It means supporting science and science education. It means losing no time in forming an understanding that recognize and represents the complexity of the systems involved. It means communicating effectively with everyone involved and in making important decisions in a timely manner.</p> <p>I’d like to concentrate our discussion on a topic that proceeds directly from our study of complexity and nonlinear phenomena: tipping points. This idea has risen to the top of US political discussion (regarding for example the claim that an irreversible climatic tipping point will occur in less than ten years’ time). Unfortunately, few people seem to be looking at the original scientific research and theories that form the basis for any such claims.</p> <p>Tipping points obviously exist at all scales, even in everyday life. But it can be difficult to extrapolate the idea to much longer time scales. Sea level rise is one of those topics. People will generally assume that a slow rise in sea level might be something relatively easy to adapt to, since it is occurring relatively slowly. Empirically, of course, we can see that this is just not so. Often, the effects can be quite sudden, as when they are triggered by a storm. New York City and adjacent coastal regions discovered this with Superstorm Sandy.</p> <p>One of the leading scientists in the field of climatic nonlinearities and tipping points is Professor Tim Lenton. I want you to watch the following lecture. You should be able to understand all or most of it.</p>

Week	Due Date	Topics, Videos, Readings, Assignments
	09/29/20	<p><b>Watch:</b> Early Warning of Climate Tipping Points [Understanding Climate Change]  <a href="https://youtu.be/5yTJZzQzdYI">https://youtu.be/5yTJZzQzdYI</a></p> <p>Here's a pdf of the slides from the lecture.  <a href="http://www.to.isac.cnr.it/aosta/LecturesSeminars/Lenton_3.pdf">http://www.to.isac.cnr.it/aosta/LecturesSeminars/Lenton_3.pdf</a></p> <p><b>Homework 6:</b></p> <ol style="list-style-type: none"> <li>1. Explain the importance of nonlinearities, thresholds, tipping points, and surprises in the relationship of humanity with the Earth's natural systems. What are some of the challenges we face in trying to avoid unpleasant surprises? Include in your discussion anything else you have found to be interesting or surprising about Dr. Lenton's lecture.</li> <li>2. In the face of such nonlinearities, thresholds, tipping points, and surprises in the relationship between humanity and the Earth's natural systems, do you think that governance is generally up to the task, here or elsewhere? How might government become more responsive to such changes? Do you think that popular understanding of these issues matches their known realities? How might these issues be addressed?</li> <li>3. Do you think that urbanization will have any influence, positive or negative) on the ability of human societies to cope with the sort of shocks that climate and complexity sciences are warning us about?</li> </ol>
7	10/06/20	<p>Topic: <b>Human well-being</b></p> <p><b>Watch:</b> What is Human Development? [UNDP Kosovo]  <a href="https://youtu.be/HwgZQ1DqG3w">https://youtu.be/HwgZQ1DqG3w</a></p> <p><b>Watch:</b> How can countries measure the well-being of their citizens? [TED Institute]  <a href="https://youtu.be/4PkD4JebMAY">https://youtu.be/4PkD4JebMAY</a></p> <p><b>Watch:</b> The economics of human well-being   Jan-Emmanuel De Neve [TEDxINSEAD]  <a href="https://youtu.be/DV1ks-TLYoM">https://youtu.be/DV1ks-TLYoM</a></p> <p>Human Development Index (HDI)  <a href="http://hdr.undp.org/en/content/human-development-index-hdi">http://hdr.undp.org/en/content/human-development-index-hdi</a></p> <p><b>Homework 7:</b></p> <ol style="list-style-type: none"> <li>1. What is human development? What is human well-being? What are the different ways in which these social characteristics have been or might be measured? Can countries measure the well-being of their citizens more accurately and with better validity than through GDP? If so, how?</li> <li>2. This is more of an introspective question; I don't expect you to fully justify your response. Given the evolving nature of human society, and given the never-ending challenges of nature, is it ever really possible to fully define human well-being? Could it be that an over-emphasis on well-being, particularly</li> </ol>



Week	Due Date	Topics, Videos, Readings, Assignments
		short-term well-being, might lead eventually to corruption, immorality and decline (see for example Huxley's <i>Brave New World</i> and similar speculative literature)? Does this question make sense to you?
8	10/13/20	<p><b>Topic: Infectious diseases</b></p> <p>We now get to what has been on everyone's mind. Although I feel fairly competent to talk about the mathematics and modeling of epidemics and pandemics, I think it best to leave it to the experts to educate us on the basics. That is why there is so much lecture material to watch this week.</p> <p>Don't worry if you don't grasp it all. I'd eventually like to make this into a semester's worth of material, but for now, we will be discussing infectious diseases next week as well, so try to watch all of these at least once by the end of next week.</p> <p><b>Watch:</b> How Pandemics Spread [TED-Ed]  <a href="https://youtu.be/UG8YbNbdaco">https://youtu.be/UG8YbNbdaco</a></p> <p><b>Watch:</b> Spatial Epidemiology &amp; Geography of Disease [The Great Courses Plus]  <a href="https://youtu.be/-T4VUZmohAo">https://youtu.be/-T4VUZmohAo</a></p> <p><b>Watch:</b> How Math Predicts the Coronavirus Curve [The Great Courses Plus]  <a href="https://youtu.be/POmuHKzt7HA">https://youtu.be/POmuHKzt7HA</a></p> <p>I intend to send out an Announcement at about this time discussing agent-based modeling of diseases and other spatial spreading phenomena. The video above is particularly pertinent, at this point.</p> <p><b>Watch:</b> Viral Intelligence: What Is Coronavirus? [The Great Courses Plus]  <a href="https://youtu.be/P2AueO_pcAU">https://youtu.be/P2AueO_pcAU</a></p> <p><b>Watch:</b> Introduction to Infectious Diseases: Travel, War, and Natural Disasters [The Great Courses Plus]  <a href="https://youtu.be/sghMinCXX4Y">https://youtu.be/sghMinCXX4Y</a></p> <p><b>Watch:</b> Why are outbreaks of infectious diseases on the rise? [DW News]  <a href="https://youtu.be/4J1AqK0ayTE">https://youtu.be/4J1AqK0ayTE</a></p> <p><b>Watch:</b> How we conquered the deadly smallpox virus [TED-Ed]  <a href="https://youtu.be/yqUFy-t4MIQ">https://youtu.be/yqUFy-t4MIQ</a></p> <p>I took an early morning walk once on Emei (or Omei) Mountain, in Sichuan Province, China. This area is sacred to, and populated by, Taoists and other seekers, and it feels like a truly mystical place of extraordinary natural beauty. Anyway, it was a surprise to find in the smallpox video (at 1:20) the story of a nun on Emei who invented an anti-smallpox procedure called variolation, in 1022 BC! The video identifies her as a Buddhist nun, but that's impossible. Buddhism would not arrive there for well over a thousand years. She was an adept of a much more ancient system of science and belief.</p> <p><b>Homework 8:</b></p>

Week	Due Date	Topics, Videos, Readings, Assignments
		<p>1. What is the difference between an epidemic and a pandemic?</p> <p>2. Based on what you've seen so far, what geographical, climatic, and social factors might be involved in the spread of an infectious disease? How have these factors changed through time? Try to be as comprehensive as you can.</p> <p>3. What was the significance of smallpox, historically? How was the smallpox vaccination developed?</p>
9	10/20/20	<p><b>Topic: Infectious diseases and human migration</b></p> <p>Shortly after COVID-19 appeared, the potential sources, enablers, and downstream effects of COVID-19 and other infectious diseases are too numerous to discuss comprehensively in one or two weeks. The following are videos and articles that I believe may contribute significantly to our understanding.</p> <p><b>Watch:</b> How Will COVID-19 Impact Global Migration? [Center for Strategic &amp; International Studies]  <a href="https://youtu.be/Kkh5hGTJsaQ">https://youtu.be/Kkh5hGTJsaQ</a></p> <p><b>Watch:</b> Closed Border: How COVID-19 is Changing Global Migration [Center for Strategic &amp; International Studies]  <a href="https://youtu.be/fGJ_Nr907P0">https://youtu.be/fGJ_Nr907P0</a></p> <p><b>Watch:</b> Coronavirus India: Death and despair as migrant workers flee cities [BBC News]  <a href="https://youtu.be/GIe8ZbQgTow">https://youtu.be/GIe8ZbQgTow</a></p> <p><b>Homework 9:</b></p> <ol style="list-style-type: none"> <li>1. According to the Center for Strategic &amp; International Studies, the COVID-19 pandemic “could be changing the long term face of global migration”. What are their five scenarios?</li> <li>2. Discuss developments at the Greek/Turkish border and their wider implications.</li> <li>3. Why is COVID-19 causing migrant workers to flee the cities in India?</li> <li>4. How are deforestation and climate change contributing to rising incidence of old and new infectious diseases?</li> </ol>
10		<p><b>Topic: Wildlife and infectious diseases</b></p> <p><b>Watch:</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>Watch:</b> How wildlife trade is linked to coronavirus [Vox]</p>

Week	Due Date	Topics, Videos, Readings, Assignments
	10/27/20	<p><a href="https://youtu.be/TPpoJGYIW54">https://youtu.be/TPpoJGYIW54</a></p> <p><b>Watch:</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>Read:</b> How deforestation helps deadly viruses jump from animals to humans  <a href="https://theconversation.com/how-deforestation-helps-deadly-viruses-jump-from-animals-to-humans-139645">https://theconversation.com/how-deforestation-helps-deadly-viruses-jump-from-animals-to-humans-139645</a></p> <p><b>Read:</b> How Climate Change Is Contributing to Skyrocketing Rates of Infectious Disease [ProPublica]  <a href="https://www.propublica.org/article/climate-infectious-diseases">https://www.propublica.org/article/climate-infectious-diseases</a></p> <p><b>Homework 10:</b></p> <ol style="list-style-type: none"> <li>1. Discuss the connections between wildlife and the emergence of new viruses.</li> <li>2. How might the COVID-19 epidemic be causing a crisis in wildlife conservation?</li> <li>4. How are deforestation and climate change contributing to rising incidence of old and new infectious diseases?</li> </ol>
11		<p>Topic: <b>Regional vulnerabilities and climate refugees</b></p> <p>Tackling the issues of regional vulnerabilities and climate refugees before considering water , resources, and agriculture might be putting the cart before the horse, and it is, but I think it is important that we underscore what is actually at stake when we look at those domains more closely. This week, it is sufficient that you base your responses on the videos presented here.</p> <p>Climate Refugees: Nations under threat [CBS News]  <a href="https://youtu.be/4MXoUbsswHY">https://youtu.be/4MXoUbsswHY</a></p> <p>Fleeing climate change — the real environmental disaster [DW Documentary]  <a href="https://youtu.be/cl4Uv9_7KJE">https://youtu.be/cl4Uv9_7KJE</a></p> <p>Here’s an interesting report from Elizabeth White of the University of San Francisco’s Geospatial Analysis Lab:</p> <p><b>Watch:</b> Exploring the relationship between Climate Change and Human Migration in Africa [USFGsAL]  <a href="https://youtu.be/HtUw_jvv3GU">https://youtu.be/HtUw_jvv3GU</a></p> <p><b>Watch:</b> Climate Change: Rising Sea Levels + Coastal Megacities = Forced Migration [Big Think]  <a href="https://youtu.be/s4UgekcYg2o">https://youtu.be/s4UgekcYg2o</a></p> <p>(The transcript of Dr. Khanna’s talk is available in the notes below the video if you open it in a separate</p>

Week	Due Date	Topics, Videos, Readings, Assignments
	11/03/20	<p>browser.)</p> <p><b>Watch:</b> Climate change and migration: How do they connect? [DIEnewsflash]  <a href="https://youtu.be/t5SytZCFzo">https://youtu.be/t5SytZCFzo</a></p> <p><b>Watch:</b> Climate Change Impacts in Bangladesh [World Bank]  <a href="https://youtu.be/V3IL6Y1TDHo">https://youtu.be/V3IL6Y1TDHo</a></p> <p>Climate refugees in Bangladesh [DW Documentary]  <a href="https://youtu.be/co5uywe-1Z8">https://youtu.be/co5uywe-1Z8</a></p> <p>Within the next 30 years, up to 20% of Bangladesh will disappear beneath the water as rivers and sea levels rise. This will put as many as 30 million people on the move.</p> <p>Changing Climate, Moving People: A film on climate stress related migration [TERI]  <a href="https://youtu.be/NjYR3LohMM0">https://youtu.be/NjYR3LohMM0</a></p> <p>This video for UNESCO looks at disaster or climate stress related migration from three different regions in India that are already amongst the leading sources for internal migration and have been hit by extreme weather events: floods (Uttarakhand), drought (Bundelkhand region) and cyclones (Odisha),</p> <p><b>Homework 11:</b></p> <ol style="list-style-type: none"> <li>1. What are some of the climate-related migration issues that are likely to increase in the near future?</li> <li>2. Where and why are we likely to find large numbers of climate refugees now and in the future? Where precisely are the source regions? Is most of the migration currently taking place within national borders? Where and when migration becomes international, which other states are or might become involved? What if those states have their own internally displaced populations to deal with? I'm thinking for example of Bangladesh and India, but there are several potential examples of difficult political situations arising from climate migration.</li> </ol>
12		<p><b>Topic: Water security</b></p> <p>The promotion of water security is precisely the sort of activity that can benefit tremendously from scientific observation and modeling. Since that is my own background,</p> <p>I worked for a couple of years for the National Operational Hydrologic Remote Sensing Center (NOHRSC) (<a href="https://www.nohrsc.noaa.gov">https://www.nohrsc.noaa.gov</a>) which is NOAA's "source for snow information" and other hydrological data products and models. Every winter day, several satellite datasets are downloaded to this facility and analyzed, and by evening a variety of maps and graphs are generated and uploaded onto the Internet for use by regional hydrological agencies, businesses, and others to inform their own work and decisions. One important variable that has to be mapped and used to forecast springtime flooding is called 'snow water equivalent', or SWE, which gauges the volume of liquid water that would result from melting a given area of snow cover. This can be checked manually on the ground at various points using automated 'snow pillows' and other devices, but it can also be checked from above. NOAA pilots run low</p>

Week	Due Date	Topics, Videos, Readings, Assignments
	11/10/20	<p>altitude flight-lines over snow with instruments that estimate SWE by measuring the degree to which the natural radioactivity of the ground beneath is dampened, or attenuated. These NOAA Corps pilots travel all over the world gathering data and assisting researchers; one in our office had once overwintered at the South Pole.</p> <p><b>Watch:</b> The Water Planet: Managing Earth’s Most Precious Resource [WoodrowWilsonCenter]  <a href="https://youtu.be/hPRhstZ-Xas">https://youtu.be/hPRhstZ-Xas</a></p> <p><b>Watch:</b> Is the world’s fresh water supply running out? [PBS Newshour]  <a href="https://youtu.be/iVcTQdOJMMw">https://youtu.be/iVcTQdOJMMw</a></p> <p><b>Watch:</b> For 15 Years, GRACE Tracked Freshwater Movements Around the World [NASA Goddard]  <a href="https://youtu.be/MaxBOvQ2a_o">https://youtu.be/MaxBOvQ2a_o</a></p> <p><b>Watch:</b> Water Resource Management [ThinkTVPBS]  <a href="https://youtu.be/odngssDFMrU">https://youtu.be/odngssDFMrU</a></p> <p><b>Homework 12:</b></p> <ol style="list-style-type: none"> <li>1. What are some of the points and recommendations regarding water planning in the federal climate assessment as discussed in the first video?</li> <li>2. What is the general state of the world’s freshwater supplies? Which regions are most vulnerable? What important source of fresh water worldwide do we know the least about?</li> <li>3. How do GRACE and other innovative remote sensing technologies help in the search for sustainable freshwater supplies?</li> <li>4. Water resource management is something that needs to be done well everywhere in the world. I wanted to include a video on these sorts of careers and occupations because they are among the unsung heroes driving civilized life, to the same degree as emergency workers, health care workers, peace officers, etc. What are some of the tasks and concerns of water resource managers?</li> </ol>
13		<p>Topic: <b>Energy and resources</b></p> <p>Clearly, the relationships between energy, resources, population, and global change are numerous and complex; I suggest taking my course on natural resources, geog130, or educate yourself on the issues. At this time, I’d like you to work seriously on your term paper, so I’ll limit this week’s discussion and expectations. We’ll look at an issue that very few people seem to even be aware of.</p> <p><b>Watch:</b> Deep-sea mining could transform the globe  <a href="https://youtu.be/IYKaKeJv2dQ">https://youtu.be/IYKaKeJv2dQ</a></p> <p><b>Watch:</b> The Next Frontier in Mining: Deep Sea Exploitation in the Pacific</p>

Week	Due Date	Topics, Videos, Readings, Assignments
	11/17/20	<p><a href="https://youtu.be/PuEXmFQeJpw">https://youtu.be/PuEXmFQeJpw</a></p> <p><a href="https://en.wikipedia.org/wiki/Deep_sea_mining">https://en.wikipedia.org/wiki/Deep_sea_mining</a></p> <p><a href="https://www.nature.com/articles/d41586-019-02242-y">https://www.nature.com/articles/d41586-019-02242-y</a></p> <p><a href="https://en.wikipedia.org/wiki/International_Seabed_Authority">https://en.wikipedia.org/wiki/International_Seabed_Authority</a></p> <p><a href="https://en.wikipedia.org/wiki/United_Nations_Convention_on_the_Law_of_the_Sea">https://en.wikipedia.org/wiki/United_Nations_Convention_on_the_Law_of_the_Sea</a></p> <p>Countries bordering oceans claim an exclusive economic control over the oceans that extends far out to sea. Many of these waters are disputed among various nations (e.g., the South China Sea). Fissures along plate boundaries bring minerals up from deep beneath the crust. Hotspots in the deep ocean that are often associated with islands and seamounts have abundant minerals in their seabed. Unknown forms of life, that we have barely begun to understand, exist in these places as well.</p> <p><b>Homework 13:</b></p> <p>1. What (if anything) is being done to regulate the exploitation of the seabed for minerals? Discuss the history and significance of national claims of exclusive rights over offshore resources.</p>
14		<p>Topic: <b>Agriculture and food security</b></p> <p><b>Watch:</b> The Future of Agriculture [OECD Trade and Agriculture]  <a href="https://youtu.be/uAM4Si_WhDk">https://youtu.be/uAM4Si_WhDk</a></p> <p><b>Watch:</b> How to feed the world in 2050: actions in a changing climate  <a href="https://youtu.be/gjtII5B1zXI">https://youtu.be/gjtII5B1zXI</a></p> <p><b>Watch:</b> The Future of Farming [The Daily Conversation]  <a href="https://youtu.be/Qmla9NLFBvU">https://youtu.be/Qmla9NLFBvU</a></p> <p><b>Optional</b> Agriculture, Population Growth, and the Challenge of Climate Change  <a href="https://youtu.be/gWORvA_p9i0">https://youtu.be/gWORvA_p9i0</a></p> <p>The OECD video briefly describes a rather optimistic globalist vision of the future. The second video, from the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), provides a more sanguine and far more detailed analysis of the path ahead.</p> <p>The video from the Daily Conversation described some of the innovations that will be require to double production in the near future. Finally, I include an optional lecture from Lincoln Taiz of UCSC tying together several of the threads we've been pulling on this semester.</p>



Week	Due Date	Topics, Videos, Readings, Assignments
	<b>11/24/20</b>	<p><b>Homework 14:</b></p> <p>The Haber process (for the production of nitrogen fertilizer) and the green revolution are the reason agricultural production has not constrained global population growth – yet. There seems to be a diversity of opinions regarding the ease with which we can achieve ever greater yields and nutrition through, for example, genetic manipulation and crop intensification.</p> <ol style="list-style-type: none"> <li>1. Judging from this week’s material, do you think it will be necessary to continue to intensify agriculture artificially by chemical and industrial means in order to continue to feed the world?</li> <li>2. Would a move toward more organically grown food and sustainable agricultural practices necessarily involve shortages, higher prices, or an expansion of farmland?</li> <li>3. Do you think it might be useful to distinguish food (and fuel) production from nutrition? Should farmland be used to produce carbon-based fuels given the projections we’ve seen here?</li> </ol>
<b>15</b>	<b>12/01/20</b>	<b>No work due. Please work on your term paper.</b>
<b>16</b>	<b>12/09/20</b>	<p><b>Term paper (Final Evaluation)</b></p> <p>Choose one of the topics we’ve covered (or something directly related) and write a thoughtful term paper. This will serve as your final evaluation. Provide at least four citations. It doesn’t matter what format you use, so long as you are consistent. I suggest that you choose a serious topic that is aligned with your interests or career plans. The resulting paper’s text should be at least four pages long, easily more. Use the same font and spacing as for the homework, please. You may also include graphics and extended quotations, if you provide citations. I encourage you to produce some of your own graphics if you are so inclined. You will find these to be useful if you upload your work to Portfolium. There is no upper limit to the length of the paper, but please don’t lengthen it with unnecessary repetition. I expect all of you to produce a paper that you can publish online without further editing.</p>