LIMITS OF THE EARTH: ISSUES IN HUMAN ECOLOGY

ENVST-UA 333
Thursdays 5:00-7:30pm
Bobst Library, Room LL140

Syllabus: FALL 2017
(Draft March 2017)

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**General Description:**

What is the current state of Earth in terms of human well being and impact on Earth’s natural systems? Issues such as energy, CO\(_2\), climate, agriculture, water, and material fluxes are intricately connected as a global system that has been expanding for decades by about 3% per year (in economic terms). If continued, this growth rate will lead to a world before 2060 in which the average world citizen will have a lifestyle approximately equal to that of today’s average American (again, in terms of economic well-being). But that is a big “if.” Will such a trajectory be possible? What are the implications for the environmental issues just noted? Substantial portions of this inquiry-based course will require students to conduct independent research by locating, using, and sharing technical papers and data bases, synthesizing facts and viewpoints, and by making presentations and writing short technical papers that will have aspects peer-reviewed by the other “researchers” in the class.

This seminar course does not assume specific math abilities, but students should be willing to work with numbers and spreadsheets (the instructor will allow that some polishing of rusty skills might be necessary). Students also need to be enthused about a course in which each will forge ahead on his or her own during self-directed investigations that complement (but usually are not exactly the same as) what the other people in the class are doing. In this manner, for the semester we will form a community of thinkers.

Topics in the course can include population, economic indicators and well being, energy, land use, agriculture, water, forestry, fisheries, resource inputs such as metals, as well as wastes and technologies of recycling, and numerical indicators of sustainability and progress. Again, much of the course will be self-initiated and project-based, with presentations, discussions, and short papers. Class attendance and participation count and there will be short quizzes and several skill-building assignments, especially at the beginning. Alternative media for presentations of findings will also be considered as options.
**Learning Objectives:**

**Knowledge Objectives:**
- Gain an educated understanding of the global state of energy consumption, in various energy units and across various primary sources of energy.
- Gain an educated understanding of the global environmental status and consumption patterns with respect to water, agricultural production, forestry production, land use, metal and mineral consumption, and waste production. Primary focus will be on water, food, and forest products, but several students will look into the other topics as well, such as fisheries. As with energy, attention will be on comparing these patterns and projections to about year 2050 across various regions and nations.
- Gain an understanding of systems thinking and the general concepts of systems dynamics as interrelationships of parts and trade-offs. This involves getting insight into how recommendations and technological advances or regulatory shifts with respect to one item needed by humanity (say, food) impacts others (for example, energy or forestry).
- Gain an introductory understanding of the concept of indicators. The Gross Domestic Product used by economists is one example. Environmental scientists have been proposing others, such as the Ecological Footprint. From politics we have still others, such as Gross Happiness Index.
- Overall, we seek answers (or at least well-defined questions) to environmental issues posed by current trends that are taking the world to a situation in year 2050 in which the average per capita Gross World Product might be about equal to that of the per capita Gross Domestic Product of today’s developed nations. Is this going to be possible? Should we be optimistic or not? Let us investigate.

**Skill Objectives:**
- Gain skill in finding technical peer-reviewed papers in citation databases, such as Google Scholar and the Science Citation Index. In other words, be able to find, read, and interpret peer-reviewed research papers in several areas relevant to the course.
- Gain experience with entering and using global environmental databases. Databases include those for CO₂ emissions, Gross Domestic Product, energy consumption, water consumption, etc. We will be looking at databases most relevant to questions about national, regional, and global trends.
- Gain skills in using simple applied math and spreadsheets to manipulate data (change units, etc.) and create plots to examine trends and implications of numbers (what trends in improved yields in agriculture quantitatively mean for trends in land use, for example).
• Gain skill in conducting independently driven “research” in one or more specialized areas of the global situation described above.
• Gain facility in public presentations (to the class).
• Gain proficiency in writing and in reviewing the work of others in the class, in a “peer-review” process. Explore other media, such as web presentations and videos, for presenting findings.
• Learn to participate in discussions that involve public (classmate) comments on the technical findings of others, in ways that are helpful and intellectually rigorous.
• Gain knowledge of how to learn from and incorporate alternative approaches to data and analyze approaches taken by other students or student groups in the course.

Grading:

20 – 30 % quizzes and homework.
55 – 70 % projects, including presentations, small projects and final paper.
10 – 15 % class participation, enthusiasm, and initiative.

Course texts, recommended readings, instructional material and learning resources:

• 2052: A Global Forecast for the Next Forty Years (Required)
  by Jørgen Randers (2012)
  Chelsea Green Publishers
  This book will be read as soon as possible early in the course, so we gain an overview of the global situation. It will be available in the NYU bookstore.

• Linkages of Sustainability  (Parts required)
  by Thomas E. Graedel, T. E.
  (available online through Bobst). The book contains detailed technical information, of direct relevance to this course and your possible projects (water, agriculture, energy, etc.). It is available to read online, by going to the book through BobCat and making the proper clicks and user identification.
  Bobst call number: GE195 .L555 2010
  I will assign particular readings from the book, or request that you read chapters relevant to your projects.

• Chapter 7 of Volk’s book $CO_2$ Rising; the chapter will be provided.
In addition, the instructor will supply key technical papers (or citations to them) for additional global and regional analysis, to supplement material from the main core reading (the Randers book above). These include, as examples, mostly during the first third or so of the course:


Examples of data bases that students will use to compare the situation and challenges in specific world regions to the world average include “Statistics on World Population, GDP and Per Capita GDP,” by Angus Maddison (www.ggdc.net/maddison); the CIA World Factbook (www.cia.gov); the Carbon Dioxide Information and Analysis Center, the BP Statistical Review of World Energy (www.bp.com); the Food and Agricultural Organization (FAO) of the United Nations; others.

NOTE: It is assumed that students will have laptops with standard word-processing software and spreadsheet software. At times we will use laptops during classroom time.

Weekly syllabus:

The week-to-week schedule will be determined as we make progress, with handouts each week for the next week (and I will post those handouts in Classes website for the course). Here is the currently anticipated plan:

1. Introduction to the course. Outline of the course. Expectations for short and long assignments, use of spreadsheets, quantitative goals, “big picture” goals, systems thinking, videos to prompt discussion. Introduction to energy and other aspects of the world situation.
   • Assignment handed out, due Sept. XX.

2. Readings due for this session:
   • Chapter 7 of Volk’s CO₂ Rising (“Wealth, Energy, and CO₂”), which has been provided to you.
   • Chapter 1, pages 1-8 of Linkages of Sustainability, by Thomas E. Graedel) (online through Bobst; see above).
   • Chapters 1-2, pages 1-49 of 2052: A Global Forecast for the Next Forty Years. What are Randers’ “five big issues” going to 2052?
   • Assignment due from Sept. XX. New assignment handed out, due Sept. XX.
   • Quiz

   • Readings due for this session: (and be ready to answer basic questions on a quiz, as well as discuss in class): Chapters 3-5, pages 53-129 of 2052: A Global Forecast for the Next Forty Years. Pay special attention to: Randers’ forecast
for global population. His distinction between “consumption” and “investment” as components of GDP (gross domestic product) and what he thinks will happen to their relative fractions in the economy and why. How does Randers’ forecast of the GDP increase for the 40 years from 2012 to 2052 differ from the forecast one would make using the world GDP growth rate of 3.1% from recent decades? What are his forecasts for CO₂ emissions and energy consumption?

• Assignment due from Sept. XX. New assignment handed out, due Sept. XX.

• Quiz

4.
We examine the following material: To make his forecasts, Jorgen Randers used trends of various kinds. Two of his important trends are what he calls “energy intensity” and “climate intensity.” You can see graphs of these and discussion in his Chapter 5. Definitions are in the captions of the graphs in Chapter 5 (Figure 5-1, page 101; and Figure 5-3, page 115). Other brief definitions are on page 59 (see inside items 8 and 10 on page 59). On page 59, his energy intensity is also called the “energy intensity of production.” It is energy consumption per unit GDP. On page 59, his climate intensity is called “CO₂ intensity of energy use.” ALERT: It looks he is not consistent with terms, because on page 59 he does not use the term “climate intensity,” however the units are the same and I know his “CO₂ intensity” is the same as his “climate intensity.”

• Assignment due from Sept. XX. New assignment handed out, due Oct. XX. Be prepared to discuss: Are your data consistent with Randers?

5.
Material: Discuss and compare the findings of J. Foley and Randers about the future of global food production.


• Assignment due from Sept. XX. New assignment handed out, due Oct. XX (one graph chosen from a figure in the reading by end of class).

6.

Presentation: By the end of class on Oct. XX, you chose one of the graphs to try and replicate from Figure 3 of the paper. Please do that. Come to class on
October XX with a short powerpoint (1-3 slides), for a 5-minute talk on your data verification. You can make other points, and go beyond what the graph show (on other words, make other calculations, especially if the verification was quick and easy). We will all speak in a mini-seminar next week. You can send me the ppt by noon that day, or come to class with a data stick, or bring your laptop to use (or I will pass around a data stick for you to put your ppt on). (These presentations might extend into the following week, if necessary.)

7. Readings due for this session: Possibly read my “Draft” of the working paper I wrote to coordinate with an interdisciplinary think tank in Bilbao, Spain; to be handed out if we do this. Regarding the challenge of reaching global prosperity, think about the following: what should a research program be? What do we need to know to make judgments about the possibility for global prosperity? At this point, we are getting into the nitty-gritty of data, and the hope is that this very general question will get more refined itself as the data and our understanding unfolds. Students will be assigned specific topics to discuss.

8. Readings due for this session: Read the rest of the Randers book, carefully and attend to the regional projections at the end. Also, for the bulk of the book you are getting into what Randers calls “non-material” concerns, many of which you likely have thought about or had discussed in other courses. But perhaps not with the density of “future concerns” as Randers has put together using guest experts for sections of his book. Be prepared to discuss.


10. To be determined; possible global metrics.

11. Presentations on projects, open workshop format in the classroom.

12. Presentations on projects, open workshop format in the classroom.
PLUS: YOUR PRELIMINARY PAPERS ARE DUE, with introduction to the problem, core calculations, and preliminary conclusions, which you want 2 others in the class to review. (See more below). About 3-5 pages. 3 PAPER COPIES, 1 TO ME AND 2 WILL GO TO REVIEWERS.

13. Presentations, open workshop.
PLUS: YOUR REVIEWS ARE DUE TO ME VIA EMAIL (NOON, PLEASE). I will send those reviews (you will be anonymous, see below) out to the writers and you will receive your reviews as well, presumably the next day. You can start working on final calculations/presentations and final papers. Your reviews of the 2 papers assigned to you are due. Send as simple text in an email to tyler.volk@nyu.edu. I will send out only the review itself to the paper’s author. If you have marked up the paper and want to scan it or photograph it and send to me as a pdf attachment, as well as your text review, please do so. I will pass that marked up paper on to the writer as well. This is anonymous peer review, as used by most high-end scholarly journals. See below for review guidelines.

14. (Last class session) Last day of class. Last class day. Probably: we will have short, final presentations from everyone (10 minutes each).

Deadline for papers. Thursday, December XX. Last day to submit final papers. Your final papers are due to me (10 page maximum, see below). They can be put in my mailbox (mail room of Biology Dept., 1009 Silver) or sent to me by email. Anytime after the last day of class or even before!

**Big-picture videos and a few other resources:**

Peter Diamandis: Abundance is our future (16+ minutes)
http://www.ted.com/talks/peter_diamandis_abundance_is_our_future.html

Paul Gilding: The Earth is full (16+ minutes)
http://www.ted.com/talks/paul_gilding_the_earth_is_full.html

Exclusive Q&A from the TED stage: Paul Gilding and Peter Diamandis debate (6+ minutes)
You can also find interesting lecture videos by Jørgen Randers, the author of our 2052 required reading.

Tyler Volk’s videos on CO_2:
“Where in the world is the CO_2 increasing?”. www.youtube.com/watch?v=MRtRdrdQwig.
“Does my exhaled CO_2 go into a leaf I can hold?”, www.youtube.com/watch?v=2T7LsbyQ3bs.

Online places to watch for articles:
http://dotearthblogs.nytimes.com/
http://www.thesolutionsjournal.com/

Also, good for systems thinking: Donella Meadows. “Leverage Points: Places to Intervene in a System.”

The work of The Breakthrough Institute is worth checking out:
http://thebreakthrough.org

**List of texts, software, and supplies**

Readings will be assigned as we make progress and as the semester moves along will largely (but not always) be self-determined, based on need. Main text and a number of probable papers have been listed above.

**Software:** I will assume that students will have laptops with standard word-processing software and spreadsheet software. We will often need to use laptops during classroom time (particularly early in the course).

**Classes website:** We can use Classes as a group common working space. We might post records of material that was “spontaneously” written on the classroom whiteboard, and class session powerpoints, and links and reviews of crucial articles, and your papers at different stages of progress, and comments on the work of various groups around the world (see “people and organizations” below), and other categories of relevant materials and work.

**Expanded list of resources in databases**
I will direct these to you as needed, but examples include:
• BP Statistical Review of World Energy. www.bp.com
There is an annual update available.


• International Energy Agency (IEA) http://www.iea.org


• The World Bank http://data.worldbank.org

**Course policy about absences for quizzes and presentations:**
In general, excused absences for quizzes and presentations will mean that other materials and accomplishments in the course will be weighted more in figuring the final grade.

Disability Disclosure Statement

Academic accommodations are available to any student with a chronic, psychological, visual, mobility, learning disability, or who is deaf or hard of hearing. Students should please register with the Moses Center for Students with Disabilities at 212-998-4980.

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