LIMITS OF THE EARTH: ISSUES IN HUMAN ECOLOGY

ENVST-UA 333

DRAFT SYLLABUS

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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 tied together 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 in 2050 in which the average world citizen will have a lifestyle approximately equal to that of today’s average European or Japanese (again, in terms of economic well-being). But that is a big “if.” Will this 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.

The course does not assume specific math abilities, but students should be willing to work with numbers. 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, wastes and technologies of recycling, and numerical indicators of sustainability. Again, much of the course will be self-initiated and project-based, with presentations, discussions, and short papers or material for the web. It would be terrific if some of what we (or you) do could find an outlet somewhere. Class attendance and participation count and there will be short quizzes and several skill-building assignments, especially at the beginning of the course. 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 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 advancements 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?

Skill Objectives:
• Gain skill in finding technical peer-reviewed papers in citation databases, such as 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 and global trends toward year 2050.
• 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 reviewing the writings 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, contributions to Classes web sites, short papers, and reviews.
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). This book will also be on reserve. The book contains detailed technical information, of direct relevance to this course and your possible projects (water, agriculture, energy, etc.). It is also 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 *CO₂ Rising*, which will be provided to you. The full book should be on reserve at Bobst (see below).

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 book (the Randers book above). These include, as two examples, about agriculture (J.A. Foley, et al., 2011, “Solutions for a cultivated planet,” *Nature* 478, 337–342), and energy (M.I. Hoffert, et al., 2002, Advanced Technology Paths to Global Climate Stability: Energy for a Greenhouse Planet, *Science*, 298, 981-987. This is mostly during week 2.

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)

**Big-picture videos to start with:**

Peter Diamandis: Abundance is our future
http://www.ted.com/talks/peter_diamandis_abundance_is_our_future.html

Paul Gilding: The Earth is full
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
You can also find interesting lecture videos by Jørgen Randers, the author of our 2052 required reading.

Tyler Volk’s videos on CO₂:
“Where in the world is the CO₂ increasing?”.
www.youtube.com/watch?v=MRtRdrdQwig.
“Does my exhaled CO2 go into a leaf I can hold?”,
www.youtube.com/watch?v=2T7LSbyQ3bs.

Online places to watch for articles:
http://dotearth.blogs.nytimes.com/
http://www.thesolutionsjournal.com/
**Books on Reserve at Bobst:**

Item 1
Graedel, T. E.
Linkages of sustainability
MIT Press

Item 2
Volk, Tyler
CO₂ rising : the world's greatest environmental challenge
MIT Press

Item 3
Diamandis, Peter H
Abundance : the future is better than you think
Free Press

Item 4
Meadows, Donella H
The limits to growth : the 30-year update
Chelsea Green Pub.

Item 5
Dahlem Workshop on Earth System Analysis for Sustainability (91st : 2003 : Berlin, Germany) .:
TITLE: Earth system analysis for sustainability /edited by Hans Joachim Schellnhuber ... [et al.].
Cambridge, Mass. ; London : MIT Press in cooperation with Dahlem University Press, c2004..

Item 6
Cohen, Joel E.:
How many people can the earth support? /Joel E. Cohen..

Item 7
Bardi, Ugo
The limits to growth revisited (might be eBook only)
Springer
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.

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 LISTS OF RESOURCES
(I will hand these out 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