Spring 2009
Sustainability: Issues and Action, Near and Far

CEE 395 – 20
Wed., 4-7 pm

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Course Description

While there is general consensus on the definition of *sustainability*, there are many divergent views on what it means to scientists, social scientists and engineers, especially when considering what are appropriate activities in developed as compared to developing economies. The purpose of this course is to explore the issues that motivate the planning, policy, design and engineering of sustainable resource use and development. First we will consider the issues driving the need for sustainable design and development. Is it simply good practice (that few really apply. . .) or is there a more critical imperative? The principles of sustainability will be reviewed and then their application to energy, climate change, urban planning, transportation, water, ecosystem services, social equity and environmental justice will be considered. Case studies and examples from both developed and developing economies will be discussed and compared. Students will work on teams on short and long-term projects throughout the course. This course will serve students from a wide range of disciplines, who have a strong interest in environmental issues. Weekly readings will be assigned and periodic presentations will be made by students throughout the quarter.

Books:
- **Collapse**, Jared Diamond (Penguin, N.Y., 2005).
- **The End of Poverty,** Jeffrey D. Sachs (Penguin, N.Y., 2005).
- **Natural Capitalism,** P. Hawken, A. Lovins, L.H. Lovins (Little, Brown & Co., N.Y., 2000)
- Selected Reading packet (Quartet Copying, 825 N. Clark Evanston, IL, 60201 Phone: 847 328-0720)

Evaluation:
- Participation – 20%
- Group Work – 20%; select a lecture topic and supplement/augment what I provide class.
- Short Position Papers on Readings/Talks (7) – 20% - (The week you give a lecture, no position paper required)
- Final Proposal/Project – presentation 20% (10% peer evaluation); report 20% (10% peer evaluation)

Class Schedule

1. April 1 - Introduction, Discuss/organize projects

2. April 8 - The Case for Sustainability [No formal class meeting]

Readings:
- Garrett Hardin. 1968. "The Tragedy of the Commons," *Science*, 162: 1243-1248 (blackboard).
- Selected Chapters from **Collapse** (Prologue, Ch. 1, 2, 9, 10-13, 14-16).

Video – **Heat**, Martin Smith PBS Frontline Special
(http://www.pbs.org/wgbh/pages/frontline/heat/view/)

Assignment – Position paper 1

3. April 15 - Principles of Sustainability

Readings:
- G. Musser (2005). "The Climax of Humanity," *Scientific American*, Sept. 2005, 44-47. (course packet).
- P. Anastas, J.B. Zimmerman (2003). "Design Through the 12 Principles of Green Engineering," *Environ. Sci. Technol.* 37:95A-101A. (blackboard).
- W. McDonough, M. Braungart, P.T. Anastas, J.B. Zimmerman (2003). "Applying the Principles of Green Engineering," *Environ. Sci. Technol.,* 37:434A-441A. (blackboard).
- A.B. Lovins (2005). "More Profit with Less Carbon," *Scientific American*, Sept. 2005, 74-83. (blackboard).
- D.C. Esty & A.S. Winston (2006). **Green to Gold.** Intro, Ch. 1 & 2, p. 1-64. (course packet).

- Selected Chapters from **The End of Poverty** (Ch. 1-4).

Assignment – Position paper 2

4. April 22 - Energy (fossil fuels, biofuels, renewables, etc.)

Readings:
- P. Roberts, *The End of Oil*. (Houghton Mifflin Co. 2004) Chapters 2 (44-65) &13 (307-332) (course packet).
- A.E. Farrell, R.J. Plevin, B.T. Turner, A.D. Jones, M. O'Hare, D.M. Kammen (2006), Ethanol can contribute to energy and environmental goals, *Science*, 311:506-508. (blackboard)
- J.P.W. Scharlemann, W.F. Laurance. (2008). "How Green Are Biofuels?" *Science*, 319:43-44. (Blackboard)
- R. Zah et al. (2007) Life Cycle Assessment of Energy Products: Environmental Impact Assessment of Biofuels. Executive Summary. (Blackboard)
- D. M. Kammen, 2006. "The Rise of Renewable Energy," *Scientific American*, 295:84-93.(course packet).
- W. W. Gibbs, 2006. "Plan B for Energy," *Scientific American*, 295:102-114. (course packet).
- M. Svenvold (2007). "The Zero-Energy Solution, *NYT Magazine* (05/20/07, p.98) (http://www.nytimes.com/2007/05/20/magazine/20solar-t.html)

- Selected Chapters from **Natural Capitalism** (Ch. 1, 4).

Possible group presentation ideas – Clean coal & carbon sequestration (IGCC & current facilities)

Assignment – Position paper 3

5. April 29 – Climate Change
Guest Speaker – Professor David Dana, Law School

Readings:
- R.H. Socolow, St. W. Pacala, 2006. "A Plan to Keep Carbon in Check," *Scientific American*, 295:50-59. (blackboard)
- J. Broome (2008) "The Ethics of Climate Change," *Scientific American*, 298:6:97-102. (blackboard)

- M. Specter, "Big Foot," *New Yorker,* Feb. 25, 2008 (http://www.newyorker.com/reporting/2008/02/25/080225fa_fact_specter)
- C. R. Sunstein, D. A. Weisbach (2008). Climate Change and Discounting the Future: A Guide for the Perplexed. ***Harvard Law School, Program on Risk Regulation,*** RESEARCH PAPER NO. 08-12; ***Harvard Law School;*** PUBLIC LAW & Legal THEORY RESEARCH PAPER NO. 08-20; ***Reg-Markets Center;*** WORKING PAPER NO. 08-19 (blackboard).
- Daniel H. Cole (2007). The *Stern Review* and Its Critics: Implications for the Theory and Practice of Benefit-Cost Analysis; draft.
- Selected Chapter from **Natural Capitalism** (Ch. 12)

Possible group presentation ideas - IPCC AR4, http://www.ipcc.ch/ - Working Group I-III - Group presentations; Shifting positioning of climate change uncertainty vs. cost of mitigation efforts

Assignment – Position paper 4

6. May 5, 6, 7 - Buildings, Materials & Cities
Guest Speaker - Doug Farr, Architect

Readings:
- **"**Borrowing from Nature," *The Economist*, 09/06/07. (blackboard)
- "Eco-tecture: Designing and building with the environmental in mind," *NYT Magazine*, 05/20/07. (http://www.nytimes.com/indexes/2007/05/20/magazine/index.html)
  1. Why are they greener than we are? (Nicolai Ouroussoff);
  2. The Accidental Environmentalist (Michael Kimmerlman);
  3. The Road to Curitiba (Arthur Lubow).
- Case study – "A Green Dream in Texas," Texas Instrument green chip factory," T. L. Friedman,NYT, 01/18/06. (blackboard)
- U.S. Green Building Council - Leadership in Energy and Environmental Design (LEED) (http://www.usgbc.org/)

- Selected Chapters from **Natural Capitalism** (Ch. 5, 6, 7, 9)

Assignment – Position paper 5

7. May 13 - Ecosystem services, Biodiversity, & Fisheries

Readings:
- P.D. Raskin (2005). "Global Scenarios: Background Review for the Millennium Ecosystem Assessment," *Ecosystems*, 8:133-142. (course packet).
- M. Gunther (2006). "Saving seafood," *Fortune*, July 31, 2006. (course packet).
- F. Lichtman (2006). "A fish grows in Brooklyn," *Seed*, Sept. 2006. (course packet).
- D. Pauly, J. Alder, E. Bennett, V. Christensen, P. Tyedmers, R. Watson (2003). "The Future of Fisheries," *Science*, 302:1359-1361. (blackboard).
- C. Pauly, R. Watson, J. Alder (2005). "Global trends in world fisheries: impacts on marine ecosystems and food security," *Phil. Trans R. Soc. B*, 360:5-12. (course packet).
- S.L. Pimm, C. Jenkins (2005). "Sustaining the Variety of Life," *Scientific American*, Sept. 2005, 66-73. (course packet).

- Selected Chapter from **Natural Capitalism** (Ch. 8).

Possible group presentation ideas – Success of marine reserves, case studies,

Assignment – Position paper 6

8. May 19, 20, 21 - Transportation & Cities (automobiles, mass transit, urban planning)
Guest Speaker – Dr. Nancy Kete, WRI, Embark Project

Readings:
- S.M. Wheeler & T. Beatley (2004). **The Sustainable Urban Development Reader** (Routledge, NY); "The Next American Metropolis," (Peter Calthorpe, 1993); "Transit and the Metropolis: Finding Harmony" (Robert Cervero, 1998); "Traffic Calming," (Peter Newman & Jeffrey Kenworthy, 1999). (course packet)
- J.H. Kunstler (1993). **The Geography of Nowhere** (Simon & Schuster, NY), Ch. 11 (Three Cities) 189-216). (course packet)

- Selected Chapters from **Natural Capitalism** (Ch. 2)

Assignment – Position Paper 7

9. May 27 - Water – Quality, Quantity & Technology; Public Health

Readings:
- P. Polak (2005). "The Big Potential of Small Farms," *Scientific American*, Sept. 2005, 84-90. (course packet)
- World Water Council, Water at a Glance (Water Crisis, Water & Nature, Water Supply & Sanitation, Water on the International Agenda) http://www.worldwatercouncil.org/index.php?id=5&L=0
- P. Rogers, (2008) "Facing the Freshwater Crisis," *Scientific American,* 299:2:46-53. (blackboard).
- G. Bergkamp, C.W. Sadoff, "Water in a Sustainable Economy," in **2008 State of the World, Innovations for a Sustainable Economy**, The Worldwatch Institute (W.W. Norton & Co., New York, 2008) p. 107-122. (blackboard)
- R. Dominguez-Faus, S. E. Powers, J.G. Burken, P.J. Alvarez (2008) "The Water Footprint of Biofuels: A Drink or Drive Issue?" Draft, *Environmental Science & Technology,* in review. (blackboard)

- Selected Chapters from **Natural Capitalism** (Ch. 3, 10, 11)
- Selected Chapters from **The End of Poverty** (Ch. 10)

Possible group presentation ideas – Case studies about water limits, explore potential for water and conflict, water as next oil, water use in agriculture, particularly beef industry, water reuse/recycling in industry.

Assignment – Position Paper 8

10. June 3- Social Equity/Social Justice/Social Policy

Readings:
- H. Daly (2005). "Economics in a Full World," *Scientific American*, Sept. 2005, 100-107. (course packet)
- W. Waytgibbs (2005). "How should we set priorities?" *Scientific American*, Sept. 2005, 108-115. (course packet)
- P. Steyn (2006). "Shell International, the Ogoni People, and Environmental Injustice in the Niger Delta, Nigeria," in **Echoes from the Poisoned Well**, S.H. Washington, P.C. Rosier, H. Goodall (Lexington Books, N.Y.), 371-388. (course packet)
- T. Homer-Dixon (2000). **The Ingenuity Gap**, Ch. 1 (Careening into the Future) p. 11-42. (course packet)

- Selected Chapters from **The End of Poverty** (8, 9, 11 – 17)
- Selected Chapters from **Natural Capitalism** (Ch. 13-15)

Assignment – Position Paper 9

11. June 10 – Project Presentations

Group Projects

1. Divide into 4 student teams for quarter.
2. Select 1 weekly topic, prepare class presentation providing greater depth (20-30 minutes)
3. Quarter Project – 2 objectives (Sustainability requires system view (many parameters) & what is metric to show improvement over BAU).
    - Choose topic, strategy, market sector, etc. – What is the sustainability challenge?
    - What change is required to make sustainable?
    - Analyze the impact, feasibility (technical & economic), & time horizon of proposed action to improve sustainability. Can you work within system (evolution) or do you recommend revolution.
    - Case study, research to provide evidence or scientific/engineering/theoretical underpinnings of proposal. How economically viable is the idea?
    - What will it take to make proposed actions happen (driver, voluntary, policy needs, regulations, etc.)
    - How will you measure effects (metric) so you can show action produces more sustainable outcome than present practice.
4. Oral presentation & Written report.
5. Peer and Instructor Evaluation