

EVR 5705 Natural Resource Management and Innovation Systems Spring 2020

Course credits: 3

Instructor information:

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Office Hours: Tuesdays and Thursdays 10-noon, or by appointment

Course Description: Natural-resource science, technology, and the innovation process; cases in food, agriculture, forestry, water, urban environment, and energy, and their role in sustaining society.

Course Framing: This course addresses how human societies perceive, use, and change natural resources, by examining the drivers, feedbacks, and social impacts of the innovation process. The course connects the ecological and economic systems studied during the first semester of the Master's in Development Practice degree program with the social realm. Whereas innovation systems have traditionally taken the perspective of a market economy and how firms rely on and influence innovation, this course focuses on the materials and energy on which societies depend, the ecological- economic-social dynamics of change in materials/energy use, and the ways science, technology and society integrate to foster sustainable development. This course recognizes that industrial civilization relies upon natural resources for its support, development, and growth.

The course also will connect LAS 6238 (Ecological Principles for Development Professionals) to broader production and environmental concerns, applying theoretical as well as practical-managerial approaches to specific issues and cases where science, technology and society intersect and where sustainable development is paramount. The course will analyze which kinds of technologies can be called sustainable and which criteria we should employ to define them as such. It will also adopt the view that innovation does not only encompass the biophysical world, but that it can extend to the sphere of social institutions and organizations, which may have to change in order to make the search for and adoption of sustainable practices possible.

Course objectives:

- Identify and discuss the unresolved dilemmas in the fields of science, technology and innovation, with particular attention to the gaps in our understanding of their inter-connections and impacts upon social well-being.
- Conduct a critical survey of how the innovation process works: its drivers, its impacts, its feedbacks, with particular emphasis upon cases in agriculture, forestry, water management and energy alternatives.
- Address specific innovation cases from a sustainability perspective: new products, new processes and their impacts upon the scientific realm and social processes.
- Develop an understanding of the role that technology and innovation play in present-day concerns about the environment and sustainability.

Format

An initial reading list will be provided in CD form. During each class session individual students will present a summary and lead a discussion of the selected papers. Students will also add to the course content from the literature they are employing, case studies from their own background or experience, and group projects. An interactive mode of discussion will be pursued, through which particular points of interest, conflict, or suggestions for research will be addressed in a collective manner. To allow for ample discussion, we will meet for three consecutive periods, once a week, to

work through ideas and problems, inspect their soundness and perspective, and advance towards clarity and coherence.

The class will also undertake a research project. It will split into 4-5 groups (depending upon total enrollment); each group will choose –at the beginning of the semester- an ongoing existing sustainability initiative such as a wind-farm, a particular forest region being harvested sustainably, a poverty-mitigating effort (or similar) and will analyze it from three perspectives: its technological background, its governance structure, and its implementation and management. Each group will present advances in its research during weeks 5, 10 and 15.

Course materials:

Required Textbooks:

Stoneman, P. 2002. **The economics of technical diffusion**. Blackwell Publishers, Oxford.

Freeman, C. and F. Louca. 2001. **As time goes by: the information revolution and the industrial revolutions in historical perspective**. Oxford University Press.

Ronald, P.C. & R. W. Adamchak. 2008. **Tomorrow's Table: organic farming, genetics, and the future**. Oxford University Press.

Recommended Reference Book:

Fagerberg, J., Mowery, D., and Nelson, R. (Eds.). 2005. **The Oxford Handbook of Innovation**. Oxford University Press.

Required and recommended articles and book chapters as listed below in the Topical Outline: a reading list in CD form shall be distributed.

Prerequisites: There are no formal prerequisites.

Course Requirements:

- **Participation = 40%** (20% for presentation of assigned readings, 20% for class discussion). Getting each class or topic started effectively depends on leadership by the day's presenters. Attendance and informed discussion are essential; students should do very well if they are present, have read the assignments, and participate. This is a discussion-based and project-driven course. Students should participate voluntarily and assertively; the small class size will enable the instructor to call on reticent students for their input. The substance of students' comments will show whether each has read and thought about the assigned material.
- **Essays = 40%** (20% each for a midterm and a final essay). For each essay, students will select one of three topics distributed by the instructor, selected from any subject dealt with during class presentations and discussions. The assignment is to synthesize material presented in the classroom along with a more complete and up-to-date literature review, and discuss the current issues this subject presents to society, proposed solutions, and their prospects. Each essay should be about 5,000 well-edited words, plus tables and figures (if appropriate) and complete literature citations.
- **Group Project = 20%**. As described above, the class will divide into 4-5 groups who will research a project designed and operating as a "sustainable" solution to a defined problem; it should contemplate sustainability constraints in terms of growth, inputs, waste, ecological footprint, etc. Students will present on weeks 5, 10, and 15. They will be peer and instructor-graded.

Grading:

Students' individual class presentations and discussion will be evaluated according to the following criteria: a) strength of their participation in class, including presentations and discussion; b) writing skills in their written submissions, especially in their midterm and final essays; and c) performance

and ability to function as members of a student team in selecting, studying and analyzing a particular case from reality. Priority will be given to the clear presentation and discussion of new insights and evidence, as well as to the linkages made between the issues under study and to both their theoretical underpinnings and their practical implications. Students are expected to argue correctly their points of view—verbally and in writing— with precision, using evidence from substantial sources and be able to express their ideas with a clear structure, pointing out conclusions, uncertainties and possible avenues of research.

Criteria for grading Essays and Group Projects will be: thesis clearly stated, essay structure clear and easy to follow, well formatted and edited, word usage and grammar correct, written in an engaging and compelling style, concepts presented in your own words, argument factually correct and complete, peer-reviewed articles and other references cited appropriately, essay contains original conclusions, conclusion backed by substantial evidence, and substance of the specific argument. An essay not handed in will receive zero credit.

Grading Scale:

A	93.4-100 %	4.0
A-	90-93.3 %	3.67
B+	86.7-89.9 %	3.33
B	83.4-86.6 %	3.0
B-	80-83.3 %	2.67
C+	76.7-79.9 %	2.33
C	73.4-76.6 %	2.0
C-	70-73.3 %	1.67
D+	66.7-69.9 %	1.33
D	63.4-66.6 %	1.0
D-	60-63.3 %	0.67
E	<60.0 %	0.0

Topical Outline:

Fifteen weeks of course work presentations and discussion of readings. The last week is devoted to a final summing-up and summary of the course.

**papers in bold letters are required reading. The other papers are recommended reading.*

Week 1: Introduction to the course: a review of ecological principles and sustainability.

Cash, D.W., W.C. Clark, F. Alcock et al. 2003. Knowledge systems for sustainable development. PNAS 100(14): 8086-8091.

Duffy, J.E. 2009. Why biodiversity is important to the functioning of real-world ecosystems. Front Ecol Environ 7(8): 437-444.

Karlsson, R. 2009. A global Fordian compromise?-And what it would mean for the transition to sustainability. Environmental Science & Policy 12: 190-197.

Norvig, P., D.A. Relman, D.B. Goldstein et al. 2010. 2020 Visions. Nature 463: 26-32. [An overview of what some experts have to say about the future of their disciplines].

Suding, K.N. and R. Hobbs. 2008. Threshold models in restoration and conservation: a developing framework. Trends in Ecology and Evolution 24(5): 271-279.

Graham, M.H. and P.K. Dayton. 2002. On the evolution of ecological ideas: paradigms and scientific progress. Ecology 83(6): 1481-1489.

- Hooper, D.U., F.S. Chapin III, J.J. Ewel et al. 2005. Effects of biodiversity on ecosystem functioning: a consensus of current knowledge. *Ecological Monographs* 75(1): 3-35.
- Hughes, B.B. and P.D. Johnston. 2005. Sustainable futures: policies for global development. *Futures* 37: 813-831.
- Kates, R.W., T.M. Parris, and A.A. Leiserowitz. 2005. What is sustainable development? Goals, Indicators, values, and practice. *Environment: Science and Policy for sustainable development* 47(3): 8-21.
- Likens, G.E. 1985. An experimental approach for the study of ecosystems. *Journal of Ecology* 73: 381-396.
- Martín-López, B., C. Montes, L. Ramírez et al. 2009. What drives policy decision-making related to species conservation? *Biological Conservation* 142: 1370-1380.
- Poorter, L., S.J. Wright, H. Paz et al. 2008. Are functional traits good predictors of demographic rates? Evidence from five neotropical forests. *Ecology* 89(7): 1908-1920.

Week 2: Natural capital and ecosystem services

- Costanza, R., R. d'Arge, R. de Groot, et al. 1997. The value of the world's ecosystem services and natural capital. *Nature* 387: 253-260.**
- Garnett, S.T., J. Sayer, and J. du Toit. 2007. Improving the effectiveness of interventions to balance conservation and development: a conceptual framework. *Ecology and Society* 12(1) art 2. www.ecologyandsociety.org/vol12/art2/**
- Heinzerling, L. and F. Ackerman. 2002. Pricing the priceless: Cost Benefit Analysis of environmental protection. Georgetown Environmental Law & Policy Institute and Georgetown University Law Center.**
- Pejchar, L. and H.A. Mooney. 2009. Invasive species, ecosystem services and human well-being. *Trends in Ecology and Evolution* 24(9): 497-504.**
- UN Millenium Project 2005. Innovation: Applying Knowledge in Development. Task Force on Science, Technology, and Innovation.**
- Färe, R., S. Grosskopf, M. Norris et al. 1994. Productivity growth, technical progress, and efficiency change in industrialized countries. *The American Economic Review* 84(1): 66-83.
- Forrest, J.L., E.W. Sanderson, R. Wallace et al. 2008. Patterns of land cover in and around Madidi National Park, Bolivia. *Biotropica* 40(3): 285-294.
- Hughes, R. and F. Flintan. 2001. Integrating conservation and development experience: a review and bibliography of the ICDP literature. London: International Institute for Environment and Development.
- Kullander, S. 2010. Food security: crops for people not for cars. *Ambio* 39: 249-256.
- Lovins, A. 2010. Profitable solutions to climate, oil, and proliferation. *Ambio* 39: 236-248.
- Max-Neef, M. 2010. The world on a collision course and the need for a new economy. *Ambio* 39: 200-210.
- Ranganathan, J., F. Irwin, and C. Pricopé Ripinski. 2009. Banking on Nature's Assets. How multilateral development banks can strengthen development by using ecosystem services. www.wri.org
- Reich, R.B. 2009. Government in your Business. *Harvard Business Review* 87(7/8): 94-99.

Week 3: Man and nature, natural resources. An overview of issues related to hunger, shelter, nutrition, health and survival.

- Harris, J.M. and N.R. Goodwin. March 2003. Reconciling growth and the environment. Global Development and Environment Institute Working Paper No. 03-03.**
- Kim, W. Chan and R. Mauborgne. 2004. Blue Ocean Strategy. *Harvard Business Review* 82(10): 76-84.**

- Leach, M., I. Scoones, and A. Stirling. 2010. Governing epidemics in an age of complexity: Narratives, politics and pathways to sustainability. *Global Environmental Change* 20: 369-377.**
- Rammohan, S. 2010. Fueling growth. *Stanford Social Innovation Review* 8(3): 68-71.**
- Akçomak, I.S., and ter Weel. 2009. Social capital, innovation and growth: evidence from Europe. *European Economic Review* 53: 544-567.
- Chapin, F.S. III, S.R. Carpenter, G.P. Kofinas et al. 2009. Ecosystem stewardship: sustainability strategies for a rapidly changing planet. *Trends in Ecology and Evolution* 25(4): 241-249.
- Charles J. Godfray, H., J.R. Beddington, I.R. Crute et al. 2010. Food security: the challenge of feeding 9 billion people. *Science* 327: 812-817. Or: www.sciencemag.org/cgi/content/full/327/5967/812
- Loorbach, D. and J. Rotmans. 2010. The practice of transition management: Examples and lessons from four distinct cases. *Futures*: 42: 237-246.
- Nambisan, S. 2008. Transforming government through collaborative innovation. IBM Center for The Business of Government.
- Rowe, G. and L.J. Frewer. 2000. Public participation methods: a framework for evaluation. *Science, Technology, & Human Values* 25(1): 3-29.
- Wilkinson, P., K.R. Smith, M. Davies et al. 2009. Public health benefits of strategies to reduce greenhouse-gas emissions: household energy. *Lancet* 374(9705): 1917-1929.
- Woodcock, J., P. Edwards, C. Tonne et al. 2009. Public health benefits of strategies to reduce greenhouse-gas emissions: urban land transport. *Lancet* 374: 1930-1943.

Week 4: Agricultural Systems I: origins, and the evolution of different types of systems.

- Fairweather, J.R. and L.M. Hunt. 2009. Can farmers map their farm systems? Causal mapping and the sustainability of sheep/beef farms in New Zealand. *Agriculture and Human Values*, DOI: 10.1007/s10460-009-9252-3**
- Galt, R.E. 2009. "It just goes to kill Ticos": natural market regulation and political ecology of farmers' pesticide use in Costa Rica. *Journal of Political Ecology* 16: 1-33.**
- Krugman, P. 1999. The role of geography in development. *International Regional Science Review* 22(2): 142-161.**
- Mehra, K. 2001. Indian system of innovation in biotechnology –a case study of cardamon. *Technovation* 21: 15-23.**
- Ruttan, V.W. 1977. Induced innovation and agricultural development. *Food Policy* 2(3): 196-216.**
- Blanche, S.B., H.S. Utomo, I. Wenefrida et al. 2009. Genotype X Environment interactions of hybrid and varietal rice cultivars for grain yield and milling quality. *Crop Science* 49: 2011-2018.
- Gepts, P. 2002. A comparison between crop domestication, classical plant breeding, and genetic engineering. *Crop Science* 42: 1780-1790.
- Greiner, R., L. Patterson, and O. Miller. 2009. Motivations, risk perceptions and adoption of conservation practices by farmers. *Agricultural Systems* 99: 86-104.
- Griliches, Z. 1957. An exploration in the economics of technological change. *Econometrica* 25(4): 501-522.
- Thompson, J. and I. Scoones. 2009. Addressing the dynamics of agri-food systems: an emerging agenda for social science research. *Environmental Science and Policy* 12: 386-397.

Week 5: Agricultural Systems II: the scale of agricultural systems, industrial agriculture and the food system; local economies, organic farming and the question of inputs. First Presentation of Group Projects –Technological Background.

Chiffolleau, Y. 2005. Learning about innovation through networks: the development of environment-friendly viticulture. *Technovation* 25: 1193-1204.

Giombolini, K.J., K.J. Chambers, S.A. Schlegel et al. 2010. Testing the local reality: does the Willamette Valley growing region produce enough to meet the needs of the local population? A comparison of agriculture production and recommended dietary requirements. *Agriculture and Human Values* July 10 (in print).

Hubert, B., M. Rosegrant, M.A.J.S. van Boekel et al. 2010. The future of food: scenarios for 2050. *Crop Science* 50: S33-S50 .

Pretty, J.N., A.S. Ball, T. Lang et al. 2005. Farm costs and food miles: an assessment of the full cost of the UK weekly food basket. *Food Policy* 30: 1-19.

Arias-Aranda, D. and M.M. Romerosa-Martínez. 2010. Innovation in the functional foods industry in a peripheral region of the European Union: Andalusia (Spain). *Food Policy* 35: 240-246.

Conrad, J. 2007. The role of public policy in promoting technical innovations. The case of the regional innovation network InnoPlanta. *Science, Technology and Innovation Studies* 3: 67-85.

Isserman, A.M., E. Feser, and D.E. Warren. 2009. Why some rural places prosper and others do not. *International Regional Science Review* 32(3): 300-342.

Geiger, F., J. Bengtsson, F. Berendse et al. 2010. Persistent negative effects of pesticides on biodiversity and biological control potential on European farmland. *Basic and applied ecology* 11: 97-105.

Puente-Rodríguez, D. 2009. Biotechnologizing *Jatropha* for local sustainable development. *Agriculture and Human Values* 27(3): 351-363.

Week 6: Biotechnologies and GMOs, a study in the application and outcomes of technical change, innovation and their consequences.

Azadi, H. and P. Ho. 2010. Genetically modified and organic crops in developing countries: a review of options for food security. *Biotechnology Advances* 28: 160-168.

Batista, R. and M.M. Oliveira. 2009. Facts and fiction of genetically engineered food. *Trends in Biotechnology* 27(5): 277-286.

Lu, B-R, and C. Huang. 2009. Gene flow from genetically modified rice to its wild relatives: potential ecological consequences. *Biotechnology Advances* 27: 1083-1091.

Tamis, W.L.M., A. van Dommelen, and G.R. de Snoo. 2009. Lack of transparency on environmental risks of genetically modified micro-organisms in industrial biotechnology. *Journal of Cleaner Production* 17: 581-592.

Ahrweiler, P., N. Gilbert and A. Pyka. 2006. Institutions matter but... Organisational alignment in knowledge-based industries. *Science, Technology and Innovation Studies* 2: 3-18.

Arechavala-Vargas, R., C. Díaz-Perez, and J. Huerta-Ruvalcaba. 2007. Genetically modified maize in Mexico: varied responses to technology. *Atlanta Conference on Science, Technology and Innovation Policy*: 1-7.

Drucker, P.F. 2002. The discipline of innovation. *Harvard Business Review* 80(8): 95-103.

Kuzma, J., A. Kuzhabekova, and K.M. Wilder. 2009. Improving oversight of genetically engineered organisms. *Policy and Society* 28: 279-299.

Parrott, W. 2010. Genetically modified myths and realities. *New Biotechnology*, doi:10.1016/j.nbt.2010.05.016.

Week 7: Crop rotations, recycling, restoration. Nutrient cycles and energy flows.

Bennett, E.M. and P. Balvanera. 2007. The future of production systems in a globalized world. *Frontiers in Ecology and the Environment* 5(4): 191-198.

Castanheira, E.G., A.C. Dias, L. Arroja et al. 2010. The environmental performance of milk production on a typical Portuguese dairy farm. *Agricultural Systems* 103: 498-507.

Lahsen, M. and C. Nobre. 2007. Challenges of connecting international science and local level sustainability efforts: the case of the Large-Scale Biosphere-Atmosphere experiment in Amazonia. *Environmental Science & Policy* 10: 62-74.

Plassmann, K., A. Norton, N. Attarzadeh et al. 2010. Methodological complexities of product carbon footprinting: a sensitivity analysis of key variables in a developing country context. *Environmental Science & Policy* 13: 393-404.

Byrne, F., M.J. Robertson, A. Bathgate et al. 2010. Factors influencing potential scale of adoption of a perennial pasture in a mixed crop-livestock farming system. *Agricultural Systems* 103: 453-462.

Klerkx, L. and C. Leeuwis. 2008. Matching demand and supply in the agricultural knowledge infrastructure: experiences with innovation intermediaries. *Food Policy* 33: 260-276.

Pielke Jr., R.A. 1997. Asking the right questions: atmospheric sciences research and societal needs. *Bulletin of the American Meteorological Society* 78(2): 255-264.

Week 8: Forests, forestry, deforestation and GHG emissions: a study in the relationship between science, technology and policy at various scales.

Alencar, A., D. Nepstad, and M. del C. Vera Diaz. 2006. Forest understory fire in the Brazilian Amazon in ENSO and non-ENSO years: area burned and committed carbon emissions. *Earth Interactions* 10, paper 6.

Al-Juaied, M.A. and A. Whitmore. 2009. Realistic costs of carbon capture. Discussion Paper 2009-08. Cambridge, MA: Belfer Center for Science and International Affairs, Harvard Kennedy School.

Dilling, L. 2007. Towards science in support of decision making: characterizing the supply of carbon cycle science. *Environmental Science & Policy* 10: 48-61.

Davis, C., A. Williams, L. Goers et al. 2010. Getting ready with forest governance: a review of the World Bank Forest Carbon Partnership Facility readiness preparation proposals (version 1.4). Working Paper, World Resources Institute. Online at: <http://www.wri.org/gfi>

Catalan, P., C. Moreno, and S. Cozzens. 2008. Exploring R&D evolution in the forestry industry: the cases of Chile and Finland. Atlanta Conference on Science, Technology and Innovation Policy: 1-12.

Foley, J.A., G.P. Asner, M.H. Costa et al. 2007. Amazonia revealed: forest degradation and loss of ecosystem goods and services in the Amazon Basin. *Frontiers in Ecology and the Environment* 5(1): 25-32.

Keller, M., G.P. Asner, G. Blate et al. 2007. Timber production in selectively logged tropical forests in South America. *Frontiers in Ecology and the Environment* 5(4): 213-216.

Week 9: The urban landscape, social and environmental opportunities, constraints, dilemmas.

Burris, S., T. Hancock, V. Lin et al. 2007. Emerging strategies for healthy urban governance. *Journal of Urban Health: Bulletin of the New York Academy of Medicine* 84(1): i154-i163.

Feldman, M.P. and D.B. Audretsch. 1999. Innovation in cities: science-based diversity, specialization and localized competition. *European Economic Review* 43: 409-429.

Grimm, N.B., S.H. Faeth, N.E. Golubiewski et al. 2008. Global Change and the Ecology of Cities. *Science* 319: 756-760.

Osolen, R. and N-M. Lister. 2004. Social capital, urban sprawl, and smart growth: a preliminary investigation into sustainable communities in Canada. Discussion Paper Series No. 3. Community Research Connections at www.crcresearch.org

Raco, M. 2007. Securing sustainable communities. Citizenship, safety and sustainability in the new urban planning. *European Urban and Regional Studies* 14(4): 305-320.

Boardman, B. 2007. Home truths: a low-carbon strategy to reduce UK housing emissions by 80% by 2050. <http://www.eci.ox.ac.uk/research/energy/downloads/boardman07-hometruths.pdf>

Coleman, J.S. 1988. Social capital in the creation of human capital. *The American Journal of Sociology* 94 Supplement: Organizations and Institutions pp: S95-S120.

Fernández-Maldonado, A.M., and J. Bredenoord. 2010. Progressive approaches in the current Peruvian policies. *Habitat International* 34: 342-350.

Jansen, E.G. 2009. Does aid work? Reflections on a natural resource programme in Tanzania. www.U4.no/document/publications.cfm

Potter, C. 2010. The carbon budget of California. *Environmental Science & Policy* 13: 373-383.

Tunas, D. and A. Peresthu. 2010. The self-help housing in Indonesia: the only option for the poor? *Habitat International* 34: 315-322.

Zabala-Iturriagoitia, J.M., A. Gutiérrez-Gracia, and F. Jiménez-Sáez. 2008. Benchmarking innovation in the Valencian Community. *European Urban and Regional Studies* 15: 333-347.

Week 10: Practical project and water issues. Second Presentation of Group Projects – Governance Structures.

Bencala, K.R. and G. D. Dabelko. 2008. Water wars: obscuring opportunities. *Journal of International Affairs* 61(2): 21-33.

Calow, R.C., A.M. MacDonald, A.L. Nicol et al. 2010. Ground water security and drought in Africa: linking availability, access, and demand. *Ground Water* 48(2): 246-256.

Pahl-Wostl, C., M. Craps, A. Dewulf et al. 2007. Social learning and water resources management. *Ecology & Society* 12(2) art 5.

Chappin, M.M.H., W.J.V. Vermeulen, M.T.H. Meeus et al. 2009. Enhancing our understanding of the role of environmental policy in environmental innovation: adoption explained by the accumulation of policy instruments and agent-based factors. *Environmental Science & Policy* 12: 934-947.

Gupta, J., C. Termeer, J. Klosterman et al. The Adaptive Capacity Wheel: a method to assess the inherent characteristics of institutions to enable the adaptive capacity of society. *Environmental Science & Policy* 13: 459-471.

Lal, H., J.A. Delgado, C.M. Gross et al. 2009. Market-based approaches and tools for improving water and air quality. *Environmental Science & Policy* 12: 1028-1039.

Leach, W.D., N.W. Pelkey, and P.A. Sabatier. 2002. Stakeholder partnerships as collaborative policymaking: evaluation criteria applied to watershed management in California and Washington.

Tortajada, C. 2008. Challenges and realities of water management of megacities: the case of Mexico City metropolitan area. *Journal of International Affairs* 61(2): 147-166.

Week 11: Knowledge systems and research needs for sustainability; policy and technology constraints. Implications of climate change science.

Acs, Z.J. and A. Varga. 2002. Geography, endogenous growth, and innovation. *International Regional Science Review* 25(1): 132-148.

Amable, B. 2000. Institutional complementarity and diversity of social systems of innovation and production. *Review of International Political Economy* 7(4): 645-687.

Fichman, R.G. and C. Kemerer. 1999. The illusory diffusion of innovation: an examination of assimilation gaps. *Information Systems Research* 10(3): 255-275.

Nabel, G.J. 2009. The coordinates of truth. *Science* 326: 53-54.

Wonglimpiyarat, J. 2010. Innovation index and innovative capacity of nations. Futures 42: 247-253.

Acs, Z.J. and D.B. Audretsch. Innovation in large and small firms: an empirical analysis. *The American Economic Review* 78(4): 678-690.

Berkes, F. 2009. Evolution of co-management: role of knowledge generation, bridging organizations and social learning. *Journal of Environmental Management* 90: 1692-1702.

Björk, J. and M. Magnusson. 2009. Where do good innovation ideas come from? Exploring the influence of network connectivity on innovation idea quality. *Journal of Production Innovation and Management* 26: 662-670.

Backer, T.E., J. Dearing, A. Singhai et al. 2005. Writing with Ev –words to transform science into action. *Journal of Health Communication* 10: 289-302.

Gilbert, R. 2006. Looking for Mr. Schumpeter: where are we in the competition-innovation debate? *Innovation Policy and the Economy* 6: 159-215.

Heilbroner, R.L. 1967. Do machines make History? *Technology and Culture* 8(3): 335-345.

Lerner, J. 2002. 150 Years of patent protection. *American Economic Review* 92(2): 221-225.

Week 12: Energy and fuels. A look at the economic and environmental costs and efficiencies of various sources and technologies.

Blackman, A. 1999. The economics of technology diffusion: implications for climate policy in developing countries. Resources for the Future Discussion Paper 99-42, Washington DC.

Boardman, B. 2004. Achieving energy efficiency through product policy: the UK experience. Environmental Science & Policy 7: 165-176.

Gallagher, K.S. and J.P. Holdren. 2004. U.S. Government policies relating to international cooperation on energy. Belfer Center for Science and International Affairs, John. F. Kennedy School of Government, Harvard University.

Jaffe, A.B., R.G. Newell and R.N. Stavins. Technology policy for energy and the environment. Innovation Policy and the Economy 4: 35-68.

Schubert, C. 2006. Can biofuels finally take center stage? Nature Biotechnology 24(7): 777-784.

Smith, V.H., B.S.M. Sturm, F.J. deNoyelles et al. 2009. The ecology of algal biodiesel production. Trends in Ecology and Evolution 25(5): 301-309.

Cairns, S. and C. Newson. 2006. Predict and decide. Aviation, climate change and UK policy. Environmental Change Institute, University of Oxford. Final Report.

Fuchs, G. and S. Wassermann. 2008. Picking a winner? Innovation in photovoltaics and the political creation of niche markets. *Science, Technology & Innovation Studies* 4(2): 93-113.

Kempton, W., F.M. Pimenta, D.E. Veron et al. 2010. Electric power from offshore wind via synoptic-scale interconnection. *Proceedings of the National Academy of Sciences* 107(16): 7240-7245.

Kok, R.A.W. and W.B. Biemans. 2009. Creating a market-oriented product innovation process: a contingency approach. *Technovation* 29: 517-526.

Mautz, R. 2007. The expansion of renewable energies in Germany between niche dynamics and system integration –opportunities and restraints. *Science, Technology & Innovation Studies* 3(2): 113-131.

Melillo, J.M., J.M. Reilly, D.W. Kicklighter et al. 2009. Indirect emissions from biofuels: how important? *Science* 326: 1397-1399.

Searchinger, T.D., S.P. Hamburg, J. Melillo et al. 2009. Fixing a critical climate accounting error. *Science* 326: 527-528.

Week 13: Establishing relationships among knowledge, science, technology and innovation systems. Which stakeholders are involved? Uncertainty and risk.

- Amabile, T.M., C.N. Hadley, and S.J. Kramer. 2002. Creativity under the gun. *Harvard Business Review* 80(2): 52-61.
- Aghion, P., N. Bloom, R. Blundell et al. 2005. Competition and innovation: an inverted-U relationship. *The Quarterly Journal of Economics* 120(2): 701-728.
- Almeida, M. 2008. Innovation entrepreneurship in Brazilian universities. *International Journal of Technology Management and Sustainable Development* 7(1): 39-58.
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Academic Honesty, Software Use, UF Counseling Services, Services for Students with Disabilities

In 1995 the UF student body enacted a new honor code and voluntarily committed itself to the highest standards of honesty and integrity. When students enroll at the university, they commit themselves to the standard drafted and enacted by students.

In adopting this honor code, the students of the University of Florida recognize that academic honesty and integrity are fundamental values of the university community. Students who enroll at the university commit to holding themselves and their peers to the high standard of honor required by the honor code. Any individual who becomes aware of a violation of the honor code is bound by honor to take corrective action. The quality of a University of Florida education is dependent upon community acceptance and enforcement of the honor code.

The Honor Code: We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity.

On all work submitted for credit by students at the university, the following pledge is either required or implied: **“On my honor, I have neither given nor received unauthorized aid in doing this assignment.”**

The university requires all members of its community to be honest in all endeavors. A fundamental principle is that the whole process of learning and pursuit of knowledge is diminished by cheating, plagiarism and other acts of academic dishonesty. In addition, every dishonest act in the academic environment affects other students adversely, from the skewing of the grading curve to giving unfair advantage for honors or for professional or graduate school admission. Therefore, the university will take severe action against dishonest students. Similarly, measures will be taken against faculty, staff and administrators who practice dishonest or demeaning behavior.

Students should report any condition that facilitates dishonesty to the instructor, department chair, college dean or Student Honor Court. (*Source: 2008-2009 Undergraduate Catalog.*)

It is assumed all work will be completed independently unless the assignment is defined as a group project, in writing by the instructor. This policy will be vigorously upheld at all times in this course.

Software Use:

All faculty, staff and students of the university are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against university policies and rules, disciplinary action will be taken as appropriate.

Campus Helping Resources

Students experiencing crises or personal problems that interfere with their general well-being are encouraged to utilize the university's counseling resources. Both the Counseling Center and Student Mental Health Services provide confidential counseling services at no cost for currently enrolled students. Resources are available on campus for students having personal problems or lacking clear career or academic goals, which interfere with their academic performance. The Counseling Center is located at 301

Peabody Hall (next to Criser Hall). Student Mental Health Services is located on the second floor of the Student Health Care Center in the Infirmary.

Students experiencing crises or personal problems that interfere with their general well-being are encouraged to utilize the university's counseling resources. The Counseling & Wellness Center provides confidential counseling services at no cost for currently enrolled students. Resources are available on campus for students having personal problems or lacking clear career or academic goals, which interfere with their academic performance.

- *University Counseling & Wellness Center, 3190 Radio Road, 352-392-1575, www.counseling.ufl.edu/cwc/*

Counseling Services

Groups and Workshops

Outreach and Consultation

Self-Help Library

Training Programs

Community Provider Database

- *Career Resource Center, First Floor JWRU, 392-1601, www.crc.ufl.edu/*

Students with Disabilities

The Disability Resource Center coordinates the needed accommodations of students with disabilities. This includes registering disabilities, recommending academic accommodations within the classroom, accessing special adaptive computer equipment, providing interpretation services and mediating faculty-student disability related issues.

0001 Reid Hall, 392-8565, www.dso.ufl.edu/drc/