

Seminar on Land Change Science

Fall 2012

GRG396T (Unique # 37545)

When: Tuesday: 4 – 7 pm, GRG 408

Dr. Eugenio Arima

Email: arima@austin.utexas.edu

Office Hours: M, W 3:00 – 4:00 pm or by appointment

Course description: This graduate level course will survey the current and past literature in the field of land change science. The course is divided into five major parts: part I) addresses the emergence of land change science as a fundamental component of environmental research; II) investigates the causes and drivers of land change and its theoretical foundations across certain social sciences' disciplines; III) provides a glimpse of the land cover monitoring & characterization and modeling literature; IV) looks into the synergies and impacts of land change on other systems. Finally, part V) investigates the recent literature on forest transition, indirect land change, and land sharing/sparing and future directions of the field.

Format: Seminar. Three to four journal articles will be assigned weekly. Students are expected to do all the assigned readings. Each week two students will be responsible for giving a 15 min summary of the articles and getting discussions started by providing a few questions or comments to the group. I will provide additional comments only if necessary.

Goals: like any other interdisciplinary field of inquiry, land change science is vast and impossible to be thoroughly covered in one semester. Therefore, I have specific learning objectives that I hope you will attain. One goal is to place the origins of LCS within geography's human-environment tradition. Second, although this is not a nature-society seminar, it is important to recognize the different paradigms and traditions within the discipline such as political ecology and critical theory. Bid-rent theory will comprise a week of readings because I consider it foundational to the field. I will also try to make a point about 'behavioral models' in our discussions and how they have been used to explain landscape patterns. A final goal is to expose you to the more recent literature and future directions of the field. I hope you will appreciate the depth and breadth of the discipline.

Grading: will be based on the following requirements:

- 1) Weekly reading journal (25%), two pages long, double-spaced due a week after the readings and discussions where you will summarize the major topics discussed, contribution of the articles to the field, and potential criticisms. Please use your own words when writing. Grades will be based on the system: check+, check, check-, zero (not submitted).
- 2) Lead discussion(s) once or twice, depending on class size (15%)
- 3) Attendance and participation (20%)

- 4) A research paper of approximately 20 pages in length (40%), double-space due on December 11th. A title, abstract, and short bibliography will be due a week before Thanksgiving week. A preliminary draft submission is not required but I will read and provide feedback if you so desire. Your final paper should be directly related to Land Change Science. A topic, region, or scale that is not adequately covered here would be a good place to start if you do not have ideas about your final paper... Please come to my office to discuss your topic as soon as you are ready.

+++++

TENTATIVE Weekly Readings (subject to change):

PART I - Introduction

Week 1: Antecedents

Sauer, C. O. 1944. A geographic sketch of early man in America. *Geographical Review*, 34(4), 529-573
 Allen, J. C. and Barnes, D. F. 1985. The causes of deforestation in developing countries. *Annals of the Association of American Geographers*, 75(2), 163-184.
 Myers, N. 1988. Threatened biotas: "hot spots" in tropical forests. *The Environmentalist*, 8(3), 187-208.

The ecological/cultural history literature is also worth reading, such as:

Cronon, W., 1983. *Changes in the land: Indians, colonists, and the ecology of New England*. Rev. Ed ed. New York: Hill and Wang.
 Denevan, W. M., 2001. *Cultivated landscapes of native Amazonia and Andes*. Oxford: Oxford University Press.

Week 2: What is LCS? Why LCS?

Turner, B., Meyer, W. B. and Skole, D. L. 1994. Global land-use/land-cover change: towards an integrated study. *AMBIO-STOCKHOLM*-, 23, 91-91.
 Ojima, D. S., Galvin, K. A. and Turner, B. L. I. 1994. The global impact of land-use change. *Bioscience*, 44(5), 300-304.
 Foley, J. A., et al. 2005. Global consequences of land use. *Science*, 309(5734), 570-574.
 Turner II, B. L., Lambin, E. F. and Reenberg, A. 2007. The emergence of land change science for global environmental change and sustainability. *Proceedings of the National Academy of Sciences of the United States of America*, 104(52), 20666-20671.

Other general articles/chapters you might want to take a look:

Houghton, R. 1994. The worldwide extent of land-use change. *Bioscience*, 44(5), 305-313.
 Skole, D. L., Turner, B. L. and Moran, E. F. 2004. The Development of the International Land Use and Land Cover Change (LUCC) Research Program and Its Links to Nasa's Land-Cover and Land-use Change (LCLUC) Initiative. In: *Land change science: observing, monitoring and understanding trajectories of change on the earth's surface*. Springer London, p. 1-15.
 Gutman, G., et al. 2004. The NASA Land Cover and Land Use Change Program. In: *Land change science: observing, monitoring and understanding trajectories of change on the earth's surface*. Springer London, p. 17-29.

PART II – Causes and drivers of land use and change

Week 3: Drivers of land change: a-theoretical or too many theories?

- VanWey, L. K., et al. 2005. Theories underlying the study of human-environment interactions. In: *Seeing the forest and the trees: human-environment interactions in forest ecosystems*, 23-56.
- Lambin, E. F., Geist, H. J. and Lepers, E. 2003. Dynamics of land-use and land-cover change in tropical regions. *Annual Review of Environment and Resources*, 28, 205-241.
- Hersperger, A. M., et al. 2010. Linking land change with driving forces and actors: four conceptual models. *Ecology and Society*, 15(4), 1.

Week 4: Bid-rent theory and the von Thünen model.

Lecture: What is rent? How are rents 'created'? The bidding process and optimal land use allocation. Rent-seeking behavior.

- Chomitz, K. and Gray, D. 1996. Roads, land use, and deforestation: a spatial model applied to Belize. *The World Bank Economic Review*, 10(3), 487-512.
- Arima, E. Y., et al. 2007. Fire in the Brazilian Amazon: a spatially explicit model for policy impact analysis. *Journal of Regional Sciences*, 47(3), 541-567.
- Walker, R., et al. 2009. Ranching and the new global range: Amazônia in the 21st century. *Geoforum*, 40(5), 732-745.
- Walker, R. and Solecki, W. 2004. Theorizing land-cover and land-use change: The case of the Florida Everglades and its degradation. *Annals of the Association of American Geographers*, 94(2), 311-328.

Recommended reading of original theoretical development (requires some background in calculus of optimization):

- Alonso, W., 1964. *Location and land use*. Cambridge, MA: Harvard University Press.
- Fujita, M., 1989. *Urban economic theory: land use and city size*. Cambridge: Cambridge University Press.
- Walker, R. T. 2001. Urban sprawl and natural areas encroachment: linking land cover change and economic development in the Florida Everglades. *Ecological Economics*, 37(3), 357-369.

Week 5: A few paradigms/traditions

Political Ecology:

- Blaikie, P. 1995. Changing environments or changing views? A political ecology for developing countries. *Geography*, 203-214.
- Carney, J. 1993. Converting the wetlands, engendering the environment: the intersection of gender with agrarian change in The Gambia. *Economic Geography*, 69(4), 329-348.

Critical Theory:

- Harvey, D. 1981. The spatial fix – Hagel, Von Thünen, and Marx. *Antipode*, 13(3), 1-12.

Behavioral theory:

- Walker, R. T. 2003. Mapping process to pattern in the landscape change of the Amazonian frontier. *Annals of the Association of American Geographers*, 93(2), 376-398.

Sociological/demographic:

- De Sherbinin, A., et al. 2008. Rural household demographics, livelihoods and the environment. *Global Environmental Change*, 18(1), 38-53.

Math-based utilitarian household models were originally developed in the agricultural economics, development microeconomics, and regional science fields. The book below laid out the foundation.

- Singh, I., et al., 1986. *Agricultural household models: extensions, applications, and policy*. Baltimore: Johns Hopkins University Press.

PART III – Monitoring, characterization, and modeling

Week 6: Observation, Monitoring LULC – A glimpse of the remote sensing literature.

- Defries, R. and Townshend, J. 1999. Global land cover characterization from satellite data: from research to operational implementation? *Global Ecology and Biogeography*, 8(5), 367-379.

Ramankutty, N. and Foley, J. A. 1999. Estimating historical changes in global land cover: Croplands from 1700 to 1992. *Global Biogeochemical Cycles*, 13(4), 997-1027.

Plus two of your choice (we will vote in class)

Week 7: Modeling land cover change – yet another glimpse on spatially explicit model

Parker, D. C., et al. 2003. Multi-agent systems for the simulation of land-use and land-cover change: a review. *Annals of the Association of American Geographers*, 93(2), 314-337.

Verburg, P. H., et al. 2004. Land use change modelling: current practice and research priorities. *GeoJournal*, 61(4), 309-324.

Soares-Filho, B. S., et al. 2004. Simulating the response of land-cover changes to road paving and governance along a major Amazon highway: the Santarém-Cuiabá corridor. *Global Change Biology*, 10, 745-764.

Arima, E. Y., et al. 2008. The fragmentation of space in the Amazon basin: emergent road networks. *Photogrammetric Engineering & Remote Sensing*, 74(6), 699-709.

PART IV – Synergies and Impacts of land cover change

Week 8: LULCC, biodiversity, and climate change

Gardner, T. A., et al. 2009. Prospects for tropical forest biodiversity in a human-modified world. *Ecology Letters*, 12(6), 561-582.

Pielke Sr, R. A., et al. 2002. The influence of land-use change and landscape dynamics on the climate system: relevance to climate-change policy beyond the radiative effect of greenhouse gases. *Philosophical Transactions of the Royal Society of London. Series A: Mathematical, Physical and Engineering Sciences*, 360(1797), 1705-1719.

Plus two of your choice (we will vote in class)

Week 9: LULCC and soil, hydrology, water.

Geist, H. J. and Lambin, E. F. 2004. Dynamic causal patterns of desertification. *Bioscience*, 54(9), 817-829.

Latrubesse, E., et al. 2009. The geomorphologic response of a large pristine alluvial river to tremendous deforestation in the South American tropics: the case of the Araguaia River. *Geomorphology*, 113(3-4), 239-252.

van Noordwijk, M., Poulsen, J. G. and Ericksen, P. J. 2004. Quantifying off-site effects of land use change: filters, flows and fallacies. *Agriculture, Ecosystems & Environment*, 104(1), 19-34.

PART V. Recent developments and future directions

Week 10: Land dynamics: forest transition, indirect land use change.

Meyfroidt, P., Rudel, T. K. and Lambin, E. F. 2010. Forest transitions, trade, and the global displacement of land use. *Proceedings of the National Academy of Sciences*, 107(49), 20917-20922.

Pfaff, A. and Walker, R. 2010. Regional interdependence and forest “transitions”: Substitute deforestation limits the relevance of local reversals. *Land Use Policy*, 27(2), 119-129.

Lapola, D. M., et al. 2010. Indirect land-use changes can overcome carbon savings from biofuels in Brazil. *Proceedings of the National Academy of Sciences*, 107(8), 3388-3393.

Arima, E., et al. 2011. Statistical confirmation of indirect land use change in the Brazilian Amazon. *Environmental Research Letters*, 6(DOI:10.1088/1748-9326/6/2/024010.).

Week 11: Land sharing, land sparing

Ewers, R. M., et al. 2009. Do increases in agricultural yield spare land for nature? *Global Change Biology*, 15(7), 1716-1726.

- Macedo, M. N., et al. 2012. Decoupling of deforestation and soy production in the southern Amazon during the late 2000s. *Proceedings of the National Academy of Sciences*, 109(4), 1341-1346.
- Gutiérrez-Vélez, V. H., et al. 2011. High-yield oil palm expansion spares land at the expense of forests in the Peruvian Amazon. *Environmental Research Letters*, 6, 044029.
- Phalan, B., et al. 2011. Reconciling food production and biodiversity conservation: land sharing and land sparing compared. *Science*, 333(6047), 1289-1291.

Week 12: Recent Literature
Class will select articles for discussion

Week 13: Future directions?

(E)Merging paradigms?

Turner, B. and Robbins, P. 2008. Land-change science and political ecology: Similarities, differences, and implications for sustainability science. *Annual Review of Environment and Resources*, 33, 295-316.

TBD