

Spring 2003
Geography 308: Seminar in Physical Geography

Course Emphasis :
Land Use/Land Cover Dynamics and Human-Environment Interactions
Tuesdays 3:30-6:00 pm; 215 Saunders Hall
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In 2001, the National Academy Press published *Grand Challenges in Environmental Sciences*. In it the National Research Council identified a set of environmental research agenda items for the next decade that would have the greatest bearing on science and policy. Central to their recommendations was human-environment interactions and land use dynamics. Also cited was the importance of the continued development of a suite of spatial digital technologies that have become to be known as GIScience – the integration of scientific theory and information systems.

Increasingly, policymakers and researchers are confronted with problems at multiple spatial and temporal scales or extents, such as global climate change, land use/land cover change at regional to local settings, and the introduction of new land use policies that have implications across socio-economic, biophysical, and geographical domains. The interchanges between humans and the environment are played out through land development scenarios and land transformation activities that often create feedbacks and thresholds among people, place, and policy. Yet a lack of adequate tools and theoretical understanding across the social, natural, and spatial sciences has traditionally led researchers to focus on relatively coarse grains of analysis where aggregate data are available. But it is at the finer social, biophysical, or spatial scales where spatially explicit information may be more appropriately collected, derived, and applied because decision-making about the use of the land is often local. Furthermore, even where adequate data have been collected at an appropriate spatial scale and in a spatially explicit manner, data analyses have tended to focus on either people or the environment, without suitable integration.

This course is a step along the path of integration by assimilating thematic domains and space-time scales in the study of land use and land cover dynamics and the drivers of change within the context of population-environment interactions. What is needed is the viewing of the landscape within a spatially explicit perspective, where people are viewed as agents of landscape change that shape and are shaped by the landscape, and where landscape form and function are assessed within a space-time context. This framework requires the integrative training of students who can initially enter the discourse from the social or natural sciences, but, through training and experiences can navigate the human-environment continuum and see the landscape through the lens of a social or natural scientist, both empowered through a spatially-explicit approach framed within GISc concepts and methodologies.

Some challenges and opportunities specific to population-environment interactions includes, for instance, work linking specific households and associated demographics with local land use decision-making as well as satellite-based measures of LULC dynamics. Experimenting on how best to link disparate data types has become an integral part of the larger question of forces driving land use decision-making, and at what levels those forces are more or less understandable and associated with different explanatory factors. The question is not if the processes themselves are scale dependent, but if the ability to detect patterns representing those processes is scale dependent. Are forces driving LULC decisions different at household versus community versus regional levels? How can “exogenous” effects operating at more macro spatial and temporal scales be explicitly incorporated into the understanding of those forces and concomitant changes? What are the spatio-temporal relationships between endogenous and exogenous effects on the linkages between people and the environment?

From a methodological standpoint, what are the techniques for not only conducting these analyses, but moreover, for validating analyses conducted with varying availability of fieldwork and remotely sensed information? How do those techniques change with the advancement of sensor systems? And what mechanisms exist (or should be developed) to ease comparison of studies conducted across scales, geographic areas and cultures, and methodological approaches to distill and diffuse findings and policy relevant information among the stakeholder communities?

Rindfuss et al. (2002) describe a pervasive challenge facing the population-environment community -- to link people to the lands so that social behavior can be studied meaningfully in relation to changes in land use and land cover types, landscape conditions, and associated ecosystem processes. One aspect of the challenge is that the linking must take place at appropriate spatial and temporal scales. Another aspect of the challenge is that social data are typically discrete, referring to point locations, where data on land cover and land use are typically continuous. Increasingly, however, the broad scientific and policy communities concerned with global and environmental change have been requesting more data to obtain a better understanding of land use dynamics. As soon as land use is considered, as opposed to land cover, consideration of human behavior necessarily enters the discourse. It is only by considering the role of human decision-makers that we can begin to consider likely future changes in land use and land cover.

Theoretical Perspectives

A number of theoretical approaches offer context to this course that seeks to integrate population-environment interactions as drivers of land use and land cover dynamics. For instance, *Complexity Theory* examines systems that contain more possibilities than can be actualized, where descriptions are not constrained by an *a priori* definition. The goal of is to understand how simple, fundamental processes can be combined to produce complex holistic systems. Non-equilibrium systems with *feedbacks* can lead to *non-linearity* and may evolve into systems that exhibit *criticality*. Complex systems generally embody hierarchical linkages that operate at different spatial and temporal scales. *Hierarchy Theory*, developed in general systems theory and now incorporated into ecology, is used to describe the structure of ecological systems through their spatial and temporal organizations. Spatial and temporal grains and extents frame the studies, and scale, pattern, process interrelationships are fundamental. Hierarchies can change with time thereby making issues of resilience and adaptability of critical importance. *Political Ecology Theory* involves the nesting of local decision-making at finer scales framed within a broader set of issues operating at coarser scales. Interactions between local *endogenous* factors and regional, national, global *exogenous* factors are considered, often within a land science context where *time-lags* are examined and directional flows between direct and indirect consumers and producers are considered. *Human Ecology* Theory sees people as active agents on the landscape that shape and are shaped by the environment. *Feedback mechanisms* with possible *thresholds* or triggers may be observed where human behavior shifts in relation to real or perceived environmental and/or land use/land cover patterns and dynamics.

Course Requirements

Active involvement in the course is central. Students will serve as (a) discussants on assigned literature, (b) must participate in class discussions, (c) will prepare critiques of assigned papers, (d) develop an annotated bibliography and examine their general contribution to population-environment research; and (e) generate three major course papers on the following general themes – (1) theoretical, disciplinary perspectives on the study of LULC dynamics and population and environment interactions; (2) practical issues on linking people and environment, and in characterizing land use /land cover dynamics; and (3) description of the challenges and opportunities for population and environment research in a selected application and case study site.