CRITIQUE #5 Wear et al. (1996)

Wear, D.N., M.G. Turner, R.O. Flamm. 1996. Ecosystem management with multiple owners: Landscape dynamics in a Southern Appalachian watershed. Ecological Applications 6(4):1173-1188.

Introduction

The recent trend toward ecosystem management may change dramatically the way landscapes are managed. In landscapes with multiple ownerships, ecosystem management has the potential to change long standing social norms about property rights and land tenure (Wear et al. 1996). In 1996, relatively few studies focused on the effects of land-tenure and ownership on landscape patterns (see Turner et al. 1996 for a brief review of these studies), and a current search shows that relatively few more studies (such as Lovett-Doust and Kuntz 2001) could be added to Turner et al.'s (1996) list. Landscape change is a reality within which ecosystem managers must make policy and decisions. Incorporating the social and economic differences between land ownership classes with their influence on the landscape is critical to the robust understanding and practice of ecosystem management and conservation planning. Wear et al. (1996) keenly reveal their awareness of this need in the introduction to their publication on landscape dynamics in southern Appalachia; the study models changes in landscape patterns as a function of public or private ownership in various historical and hypothetical anthropogenic land-cover transition scenarios.

General Strengths and Weaknesses

Wear et al. (1996) begin with an excellent depiction of the interwoven nature of socioeconomic factors and landscape change, and the necessity for ecosystem management rather than reactionary species management policies. Although the concept of ecosystem management has been criticized in the past for being vague in its definition and policy implications (see Corbin 1999), Wear et al. (1996) succinctly define ecosystem management and describe how land-use regulations might be effected by the implementation of ecosystem management. With this in mind Wear et al. (1996) develop a spatial model of landscape change in the Little Tennessee River Basin (LTRB) based on binomial choice in ownership type, historical trends in land-cover change, and hypothetical regulations to future land-cover change. Given their acknowledgement of the complexity of landscape change, I was somewhat disappointed by the simplicity of their model, which allowed for either public or private landownership, 1975-1980 or 1986-1991 land-cover transitions, and a no timber harvest or stream buffer regulations. Even though this model designs allows for 16 separate scenarios, it is clear from the authors' opening discussion that landscape change is substantially more complex than these scenarios. This substantive weakness is addressed toward the end of the article in an honest description of the study's limitations. Given this concession, the research is a considerable contribution to the understanding of how current and historical trends and possible regulations might affect landscape change.

The methods used to describe the formulation and rules of the model and the analyses of the simulations' outcomes are clearly written and concisely justified. With little exception, Wear et al. (1996) provide a solid base from which results can be explained. Unfortunately, the results are abstract in their presentation. The study's

results could be strengthened in two ways: 1) increasing the interpretation of the raw results; and 2) restricting the number of scenarios for which results are offered to those that are most salient for the discussion. This second recommendations holds true for the figures and tables included as well. The authors provide the reader with such a number of figures and tables that their importance is diminished. Furthermore, out of a total of 9 figures, only one is spatial; the others can be characterized as distributional landscape models using Baker's (1989) taxonomy of models of landscape change. Wear et al. (1996) do supplement the results with a number of tables describing patch and class characteristics; however, without publishing the statistical comparisons of these results it is difficult to determine whether the degree of significance of the differences in the simulations, let alone whether there are ecologically significant differences.

Wear et al. (1996) provide a well organized and interesting discussion. The discussion describes the major limitations of the study, the results of other similar studies, and some key findings. Perhaps most important is the assertion that, "spatially targeted" policies may be more efficient in achieving desired ecosystem management goals than "blanket restrictions" (Wear et al. 1996, p.1186). Finally, Wear et al. (1996) conclude with a concise summary of their results as well as call for more depth in research of the effects of land cover change on natural resource stock, local income, regulation costs, and ecologically significant variation in within land cover categories (disaggregating simplified land cover classes). The authors also make methodological recommendations for future studies, such as using finer scale remotely sensed imagery. The conclusion provides the reader with an excellent overview of the problems and questions surrounding ecosystem management.

Interpretation of the Data

Wear et al. (1996) use patch and class metrics such as patch size, number of patches, and edge to area ratio to analyze the results of each simulation. The interpretations of the authors are intuitively sound given the trends in each simulation's data. The article could, however, be strengthened by including the actual statistical test results. Wear et al. (1996) find that there are differences between public and private ownership outcomes in their simulations. This finding is supported by other studies that come to similar conclusions, albeit through different methods. For instance, Spies et al. (1994) found that in the Oregon Cascades significant differences were observed in the historical rates of fragmentation between public and private forestland. Similarly, Turner et al. (1996) examine land cover change in both the Olympic Peninsula, Washington and the Little Tennessee River Basin with respect to land ownership between 1975 and 1991. This study also corroborates the finding that publicly and privately owned forest land experience different rates of land cover change. Lovett-Doust and Kuntz (2001) demonstrate differences in biodiversity change over time between public and mixed public-private, and private ownership dominated landscapes in southern Ontario, Canada. Finally, Wear and Bolstad (1998) examined land use change in southern Appalachia from the perspective of human density over a 40 year time period. This study confirms the assertion made by Wear et al. (1996) that modeling land cover change in anthropogenically modified landscapes is highly complex, and must take into account a number of human processes to be useful. In the context of these studies it appears that Wear et al.'s (1996) findings are reliable given the parameters of the simulations.

However, it is difficult to compare simulations of the future with empirical findings from the past. In this sense, Wear et al. (1996) acknowledge this as a limitation and appropriately note that their findings should not be taken as potential future outcomes, but rather as benchmarks with which to measure expected changes, instability, and stochasticity.

Extrapolation of the Results

The highly user defined nature of rules in simulation modeling makes extrapolation of results a difficult task. The case study characteristic of this research further compounds the difficulty of extrapolating the results from the Little Tennessee River Basin to other basins. However, one general finding by Wear et al. (1996) that is likely to be true in other similar landscapes is that, landscapes dominated by private ownership must include conservation strategies that address private lands. The authors cite both Franklin (1993) and Pimentel et al. (1992) who both note that a necessary condition for successful conservation management strategies is attendance to conservation on both public and private lands. However, Lovett-Doust and Kuntz's (2001) does indirectly contest this assertion about biodiversity conservation in their study landscape of southern Ontario. Wear et al. (1996) do provide a useful approach to simulating future landscape scenarios that can be used by researchers in other locations.

Overview and Further Questions

The approach taken by Wear et al. (1996) to model future land cover change based on a number of scenarios is useful to determine possible landscape changes modeled with simulated or current conditions. Of course results should not be considered as forecasts, but rather potential trends. Furthermore, Wear et al. (1996) can be considered as an extension of Franklin and Foreman's (1987) classic model of forest cutting and landscape patterns. Wear et al. (1996) begs for more complex modeling of social factors as they relate to landscape change. The reader is compelled to ask how changes in residential development and other population pressures may affect land cover change in the rural – urban interface, such as in the Little Tennessee River Basin. Furthermore, I am left wondering how social and economic stochasticity should be modeled to make landscape change simulations more realistic. Overall, I found the article to be an important step toward understanding the dynamics of landscape change.

Literature Cited

Baker, W. 1989. A review of models of landscape change. Landscape Ecology 2(2):111-133.

Corbin, G.D. 1999. The United States Forest Service's response to biodiversity science. Environmental Law, 29(2):377-413.

Franklin, J.F. 1993. Preserving biodiversity: species, ecosystems, or landscapes? Ecological Applications 3:202-205.

Franklin, J.F., and R.T.T. Foreman. 1987. Creating landscape patterns by forest cutting: Ecological consequences and principles. Landscape Ecology 1(1):5-18.

Lovett-Doust, J., and K. Kuntz. 2001. Land ownership and other landscape-level effects on biodiversity in Southern Ontario's Niagara Escarpment Biosphere Reserve, Canada. Landscape Ecology 16(8):743-755.

Pimentel, D., U. Stachow, D.A. Takacs, et al. 1992. Conserving biological diversity in agricultural/forestry systems. BioScience 42:354-362.

Spies, T.A., W.J. Ripple, G.A. Bradshaw. 1994. Dynamics and pattern of a managed forest landscape in Oregon. Ecological Applications 4(3):555-568.

Turner, M.G., D.N. Wear, R.O. Flamm. 1996. Land ownership and land-cover change in the Southern Appalachian Highlands and the Olympic Peninsula. Ecological Applications 6(4):1150-1172.

Wear, D.N., and P. Bolstad. 1998. Land-use changes in Southern Appalachian landscapes: Spatial analysis and forecast evaluation. Ecosystems 1:575-594.

Wear, D.N., M.G. Turner, R.O. Flamm. 1996. Ecosystem management with multiple owners: Landscape dynamics in a Southern Appalachian watershed. Ecological Applications 6(4):1173-1188.