The role of ecology and culture in determining the trajectory of tropical forest recovery

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Comparative analysis within regions or landscapes have shown that prior land use type, intensity, and frequency fundamentally control the rate and trajectory of tropical forest recovery. However, little work has addressed differences in recovery across geographic regions for a given land use type. Thus, we are left wondering why certain land use systems seem sustainable in some places and unsustainable in others. Without a rigorous comparative framework across political, economic, and ecological regions, we cannot understand the emergent characteristics of land use change in the tropics. In this paper, I argue that to move forward in land change science, we need not only comparative, in depth studies, but comparative, interdisciplinary, in depth studies. To illustrate my point, I ask why shifting cultivation seems to work better in West Kalimantan, Indonesia than in the Southern Yucatan Peninsula of Mexico. Soil phosphorus availability and the rate of biomass accumulation in secondary forests decline dramatically during the first few cycles of shifting cultivation in southeastern Mexico. In contrast, phosphorus availability and secondary forest biomass accumulation in Indonesia show no systematic decline during the first four cycles. Negative effects occur after six to ten cycles, but they are relatively mild compared to the early impact in Mexico. Several ecological factors may explain the differences: fallow period, cropping intensity, crop species, annual rainfall. However, other ecological factors contradict the differences: soil organic matter, soil pH, potential losses to erosion. The question is to what extent are the ecological differences mediated by cultural differences? The agents of change in Mexico are largely recent immigrants (20-30 years) from other parts of the country. The Indonesian farmers have occupied the same landscape for 250 years; most likely their ancestors occupied similar landscapes before that. Is local knowledge the key? Does an emphasis on local knowledge have implications for our view of human agency and the dynamics of land use change? Are we assuming humans are rational, or not? If we assume they are rational, what are the decisions they are making in Mexico? If they are learning but acting ‘irrationally’, is the ecological feedback loop too slow for farmers to adapt? Interdisciplinary research efforts are key to unraveling the logic of ecologically ‘bad’ decisions, to understanding how ecological factors can be mediated by cultural influences, and ultimately to defining the critical constraints on successful adaptive management during land use change.