LINKING LAND-USE INTENSIFICATION, PLANT COMMUNITIES, AND ECOSYSTEM PROCESSES IN LOWLAND BOLIVIA

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Summary

Land-use intensification (LUI) is one of the main global drivers of biodiversity loss with negative impact on ecosystem processes and the services that societies derive from the ecosystems. The effect of LUI on ecosystem processes can be direct through changes in environmental conditions and indirect through changes in plant community. In this dissertation I explored the mechanisms through which land-use intensification affects plant community assembly and ecosystem processes in the Bolivian lowland tropics. Specifically I evaluated: 1) how plant communities respond to LUI via plant *response* traits, 2) the effects of plant communities on decomposition via their *effect* traits, and 3) the relative importance of direct and indirect pathways in explaining LUI effects on ecosystem processes.

I used two gradients of LUI, a long gradient, including five common and contrasting land use types (mature forest, logged forest, secondary forest, agricultural land, and pastureland), and a short gradient of disturbance intensity represented by four experimental treatments in managed forest (unlogged forest, and forest subject to one of three levels of logging intensity and application of silvicultural treatments). Plant community response and effect were evaluated based on species diversity and functional properties. I measured for the most dominant species 12 functional traits and 14 litter traits.

Both gradients of LUI affected functional properties of the plant communities. An increase in LUI shifted plant communities from species characterized by slow growth and slow returns on resource investment (conservative species), toward species characterized by fast growth and fast returns on resources investment (acquisitive species). However, communities with an intermediate position along the LUI gradient (i.e., secondary forests) showed dominance of conservative species mainly due to land use management (abundance of palm species due to frequent burning). Along the short gradient of LUI demographic processes mediated the changes plant communities. With and increase in disturbance caused by logging and silvicultural treatments, there was an increased recruitment of individuals with more acquisitive trait values. Moreover, the response of functional diversity differed between both LUI gradients. Whereas functional diversity decreased along the long LUI gradient, it did not change along the short LUI gradient. Communities with an intermediate position along the long LUI gradient showed higher functional diversity than communities at the extremes of the gradient. Whereas both environmental and management filters drove changes in plant

communities along a long LUI gradient, changes along a short LUI gradient were mainly driven by environmental filters.

LUI affected litter decomposition through changes in environmental conditions and through changes in plant communities. With an increase in LUI decomposition *potential* (measured as mass loss of standard litter incubated in all land use types) decreased. Since soil properties only weakly affected decomposition, other factors were probably the main drivers of the direct effects of LUI on decomposition potential. With increasing LUI the litter decomposability increased due to changes in litter quality produced by plant communities; litter from mature- and logged forest had low decomposability, litter from secondary forest had an intermediate decomposability, and litter from agricultural land and pastureland had high decomposability. Functional traits, such as leaf N concentration, specific leaf area and leaf chlorophyll content, were good and positive predictors of decomposition rate. Although experimentally litter quality explained more variation in decomposition rate across the long LUI gradient (48%) than environmental site characteristics (17%), the *actual* decomposition rate (*in-situ* decomposition of litter community into its own land use type) was site-dependent, and determined by both drivers that partly compensated each other. Thus, litter with high decomposability (litter from pastureland) incubated in the land use type with low decomposition potential (pastureland plot) had generally a similar decomposition rate as litter with low decomposability (litter from mature forest) incubated in the land use type with high decomposition potential (mature forest plot).

Tropical ecosystems are not only very diverse in species, they are also diverse in their responses to human disturbance. I concluded that LUI has important effects on plant community properties and ecosystem processes. These effects, however, contrast with some predictions of current ecological theory. High intensification of land use does *not necessarily* lead to low plant functional diversity, and less favourable environmental conditions for decomposition do *not necessarily* lead to low decomposition rates. Instead, the multiple factors related with management decisions at local scales cause a large heterogeneity of ecosystem responses. Consequently, depending on the management decisions taken, the negative effect of LUI could be mitigated.