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Responses of insect diversity and function to landscape change in the Amazon

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Land use change has been shown to cause potentially irreversible alterations in the distribution and abundance of biodiversity across Amazonian landscapes. These impacts have provoked intense debate regarding optimal strategies for reconciling economic development and biodiversity conservation objectives in the region. Traditional strategies for biodiversity protection, such as strict protected areas, have resulted in clear trade-offs between conservation and human landscape exploitation that do not account for potential disruption to the underlying linkages between biodiversity and ecosystem functioning. Where such connections are recognized it is assumed that any change in biodiversity necessarily has negative consequences for ecosystem functioning and associated service production. We evaluated four scenarios of anthropogenic impacts in the Brazilian Amazon in order to test the general hypothesis that intensity of use leads to a joint loss of biodiversity and ecosystem function. The scenarios were representative of four common types of human-impact found in the Brazilian Amazon: vertebrate hunting and selective logging in forest ecosystems, and traditional (small-holder agroforestry mosaics) and mechanized agriculture. We used dung beetles as a model study group and the ecological functions performed by these insects (secondary seed dispersal, dung removal and soil removal) as indicators of change in ecosystem functioning. Across all four gradients dung beetle communities were negatively affected by increases in the intensity of human use. However, in contrast the ecological functions performed by dung beetles did not exhibit a uniform response in relation to changes in the insect community. Rates of change in ecological functions were associated more closely to changes in total insect biomass than to species richness, although the magnitude of the observed effects were context-dependent. Although further work is needed, our results demonstrate the importance of considering changes in both biodiversity and biodiversity mediated functions when developing conservation and management strategies for human-modified landscapes in the Amazon.