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# Coupling biophysical and socioeconomic models: assessing the consequences of conservation policies on smallholder livelihoods in the Atlantic rainforest (Brazil)

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# Coupling biophysical and socioeconomic models: assessing the consequences of conservation policies on smallholder livelihoods in the Atlantic rainforest (Brazil)

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**Abstract:** Shifting cultivation is among the most typical agricultural practices of smallholders in the forest-agriculture frontiers around the tropics. Shifting cultivation depends on long fallow periods to recover vegetation, soil structure and fertility. However, different socioeconomic, geographic and political drivers are transforming the system in many places, inducing land use/land cover changes. In the Ribeira River Valley (southeastern Brazil), nature conservation policies have additionally constrained shifting cultivation, claiming it is a major driver of deforestation on one of the most important Atlantic Rainforest remnants. Smallholders practicing shifting cultivation there have intensified commercial relations, have become increasingly dependent on the market for food and have declined participation in reciprocal labor sharing arrangements. As a consequence, land use has transformed towards shortened fallow periods, smaller agricultural plots and decreased plot rotation. This study aims to disentangle the impacts of conservation policies and ongoing agricultural intensification in the community of Pedro Cubas. We capture the interrelationships within this socio-environmental system in an integrated simulation approach coupling a socio-economic multi-agent model (MPMAS) with a biophysical landscape model (LUCIA). We simulate farm households' land use decisions and biophysical responses over twenty years, comparing scenarios with and without the application of nature conservation policies and with and without market access. In this way, we are able to analyze effects of conservation policies and agricultural intensification on farm household incomes, local forest landscape heterogeneity and soil organic matter contents on the agricultural patches. Finally, our modeling application can contribute to build a land use plan that focus on more sustainable practices, helping to improve local livelihoods, wealth, food security and ecosystem conservation.

**Keywords:** Atlantic rainforest, shifting cultivation, smallholders agriculture, nature conservation policies, land use modeling.