

# Conceptual strengths of ABM/LUCC models as integrative tools

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## **Abstract**

Agent-based models of land-use and land-cover change have often been developed with the express purpose of integrating the drivers of land manager decisions with their biophysical consequences. Several previously identified factors that favor ABM as a tool for integration include the ability of ABM to operate at the scale of LUCC decision making, and thus the opportunity to link local LUCC decisions to spatially explicit biophysical models through spatial identifiers; representation of diverse agent types; and representation of agent-and-environmental heterogeneity. ABM/LUCC were also viewed as a means of both knowledge discovery and knowledge synthesis, through the process of model building (potentially including stakeholder participation) and through analysis of model results. As the field has matured, these general conceptual advantages can be articulated more concretely through examples of successful completed projects and ongoing work. I will present several examples that illustrate how ABM can be used to explore the drivers of land-use change and land manager behavior, how both factors interact to affect land cover and ecosystem services, and how the heterogeneity of land manager resources, demographic profiles, and individual characteristics may affect environmental outcomes. I will also discuss the role that qualitative analysis can play in model development, drawing on ongoing work in Uganda with Berger and colleagues. Finally, I stress that integrative agent-based models are almost always hybrid models that draw on many other standard LUCC modeling tools (statistics, cellular automata, mathematical programming), and thus are beginning to be viewed as an integrative simulation modeling framework, rather than a distinct modeling method that is a pure substitute for other methods.