Title: A streamlined approach to agent-based state-and-transition simulation modeling

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Abstract (300 word limit):
Simulation modeling can help us better understand complex, dynamic ecosystems and evaluate practical questions about how ecosystems will respond to different scenarios of global change and management actions. Two popular simulation modeling approaches, agent-based modeling (ABM) and state-and-transition simulation modeling (STSM), can be used to track a wide range of characteristics of landscape pattern and process. ABMs can simulate many types of agents (i.e., autonomous units, such as wildlife, people, or viruses), and are advantageous because they can capture agent characteristics, decision-making, adaptive behavior, mobility, interactions, and feedbacks between agents and their environment. STSMs are flexible and intuitive models of landscape dynamics that can track landscape attributes and management scenarios, and integrate diverse data types (e.g., output from correlative and mechanistic models). Despite recent advances in combining these approaches, prior approaches required considerable time and expertise to implement multiple model runs and visualize data across three software programs. We report on tools that we have developed to streamline this process, specifically using the SyncroSim software platform. This approach facilitates 1) handling of model inputs and outputs; 2) running multiple scenarios, including sensitivity analyses; 3) creating a record of model modifications; and 4) visualizing and exploring output, all within a single platform. With the approach presented here, modelers can now more easily use output from an ABM to dictate landscape changes within an STSM that in turn influence agents, and thereby produce more realistic and management-relevant projections.

Keywords: Agent-based model, resource management, simulation modeling, state-and-transition simulation model

Topics: Modeling, Landscape Change, Wildlife Ecology