

Simulation tools for exploring multi-scale vegetation response to climate change

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Simulation models can help us explore vegetation response to climate change. Two simulation models are presented that explore potential consequences of climate change on (1) local processes of competition and facilitation and (2) landscape-scale processes (i.e. fire spread and seed dispersal). The role of competition and facilitation in shaping community structure could change in association with altered precipitation and temperature. An individual-based model was developed that includes local processes of growth, competition, facilitation, reproduction and establishment. At landscape scales, changing climate may affect fire regime thus species traits important to post-fire re-colonization such as seed dispersal mechanisms will be important considerations in exploring potential landscape composition. An aggregated grid-based simulation model was developed to explore the interaction of fire regime scenarios and seed dispersal on landscape composition. The models are parameterized for mountain big sagebrush (*Artemisia tridentata* Nutt. ssp. *vaseyana* [Rydb.] Beetle), but could be adapted to include different species. The simulation models were developed in the NetLogo programming environment and include a user-friendly graphical user interface that is intended for both research and education purposes.