A spatially explicit model to predict future landscape composition of aspen woodlands under various management scenarios

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Abstract

Quaking aspen (*Populus tremuloides*) is declining across the western United States. Aspen habitats are among the most diverse plant communities in this region and loss of these habitats can result in shifts in biodiversity, productivity, and hydrology across a range of spatial scales. Western aspen occurs on the majority of sites seral to conifer species, and long-term maintenance of these aspen woodlands requires periodic fire. Over the past century, fire intervals, extents, and intensities have been insufficient to regenerate aspen stands at historic rates; however the effects of various fire regimes and management scenarios on aspen vegetation dynamics at broad spatial and temporal scales are unexplored. Here we use field data, remotely sensed data, and fire atlas information to develop a spatially explicit landscape simulation model to assess the effects of current and historic wildfire regimes and prescribed burning programs on landscape vegetation composition across two mountain ranges in the Owyhee Plateau, Idaho. Model outputs depict the future structural makeup and species composition of the landscape at selected time steps under simulated management scenarios. We found that under current fire regimes and in the absence of management activities, loss of seral aspen stands will continue to occur over the next two centuries. However, a return to historic fire regimes (burning 12–14% of the modeled landscape per decade) would maintain the majority of aspen stands in early and mid seral woodland stages and minimizes the loss of aspen. A fire rotation of 70–80 years was estimated for the historic fire regime while the current fire regime resulted in a fire rotation of 340–450 years, underscoring the fact that fire is currently lacking in the system. Implementation of prescribed burning programs, treating aspen and young conifer woodlands according to historic fire occurrence probabilities, are predicted to prevent conifer dominance and loss of aspen stands.

Keywords: Successional model; Landscape dynamics; TELSA; VDDT; Fire regimes; Prescribed fire; Western aspen

Article Outline