Modeling Fire Behavior, Smoke Emission and Forest Succession of Insect-killed White Spruce Stands on the Kenai Peninsula, Alaska

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Abstract
During the 1990’s a significant portion of the white spruce stands on the Kenai Peninsula, Alaska, were killed by infestation from the spruce bark beetle (Dendroctonus rufipennis). This analysis evaluates the effectiveness of several measures to mitigate the impacts of the die-back of white spruce (Picea glauca [Moench] Voss). The Fire Effects Tradeoff Model (FETM) was applied to model landscape succession, wildfire behavior, and smoke emissions for several management scenarios aimed at reducing the risk of large-scale wildfires, and decreasing the anticipated increase in grasslands on the landscape. The initial vegetation distribution, totaling about 1 million acres, was classified by species, successional stage, stand density, and fuel bed characteristics. Simulations included the effects of succession, wildfire, ungulate browsing, spruce bark beetle mortality, and several fuel treatment options, including salvage logging, replanting, and prescribed fire. In simulation, grass- and hardwood dominated vegetation increased in abundance over time. Mixed hardwood-white spruce and white spruce dominated stands increased greatly if replanted following salvage logging. However, application of fuel treatments had little impact on wildfire behavior in the study area. The results suggest that while fuel treatments do help in protecting local communities, the proposed treatment levels were insufficient to greatly affect fire behavior in more remote areas.