Effects of mechanical and prescribed fire treatments on jack pine regeneration and arthropod communities in the Baraga Plains

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Fire is an important part of jack pine (*Pinus banksiana*) life history. Under natural conditions, stand-replacing fire drives jack pine forest regeneration, but low intensity prescribed burning in harvested stands may also help promote natural regeneration. Jack pine barrens occur over a limited area and are highly fragmented due to fire suppression and land use changes. Common practice for jack pine management in the Baraga Plains region of Michigan's Upper Peninsula is 50-year rotation clearcutting, and natural fire occurs in 25-100 year intervals. A combination of mechanical and prescribed burning treatments is used to mimic some of the effects of wildfire for jack pine regeneration in the Northern Great Lakes Region, but little is known about the short- and long-term ecological impacts of these treatments. The objectives of this study by DeSantis & Storer (2000) were to evaluate how post-harvest prescribed fire, mechanical treatment and their combination (fire + mechanical) affect fuel loads, closed cone percentage, and percentage of the area burned, and to compare the biodiversity of ground-dwelling arthropods among these treatments. This study included a harvested but untreated control.

The study took place at the Michigan Technological University Ford Center Research Forest, in an area that was clearcut before the study began. Baseline inventory was conducted on site prior to clearcutting in 2003, and treatments began in 2004. Four treatments were assessed: control, anchor chaining (mechanical treatment), prescribed burning, and anchor chaining followed by prescribed burning (combined treatment). Arthropods were collected with pitfall traps, and species and abundance were recorded before the clearcut harvest, and

MANAGEMENT IMPLICATIONS

1. Prescribed fire and the combination of fire and mechanical treatments reduced slash, exposed mineral soil, and opened jack pine cones. These effects are likely to promote natural jack pine regeneration.

2. Prescribed fire and the combination treatment resulted in decreased arthropod richness and diversity one to two months post-treatment. This study did not evaluate long-term recovery.

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again after the post-harvest treatments. Fuel loading data was also collected pre- and post-fire, and included closed cone percentage. Percent burn coverage of prescribed fire treatment areas was also assessed.

Pre-treatment sites consisted of 97% jack pine, and the mean basal area and mean DBH were similar across the study area. Post-treatment surveys showed significant reductions in fuel loading for the <0.5, 0.5-1.0, and 1.0-3.0 cm (<0.2, 0.2-0.4, 0.4-1.2 in, respectively) fuel size classes for all treatments, and reductions in the 3.0-5.0 cm (1.2-2.0 in) size class in burned treatments. The fuel loading differed among treatments for the four smallest size classes, but not for total fuel loading. In the fire-only treatment, 94% of the area was burned, whereas only 61% of the area was burned in the combined treatment sites. The difference in percentage of area burned was likely influenced by more evenly distribute fuels in the fire-only area, and the compaction of fuels in the combined treatment sites caused by mechanical treatment. The percentage of closed cones was highest in control areas and lowest in the fire-only areas. The closed cone percentage decreased in mechanically treated sites over time, most likely due to exposure to sunlight. The fire intensity in fire-only and combined treatments was great enough to reduce slash, expose mineral soil, and open jack pine cones.

There were 22 arthropod taxa found in the study areas. The fire-only treatments yielded the lowest taxonomic richness (relative to the control and mechanical-only treatment) and lowest Shannon-Wiener diversity index, relative to all other treatments. The most common arthropod taxa pre-fire were ground beetles (*Carabidae*), leaf beetles (*Chrysomelidae*), true weevils (*Curculionidae*), ants (*Formicidae*), and spiders (*Arachnida*), whereas the most common taxa post-fire were ground beetles, ants, plant bugs (*Miridae*), grasshoppers (*Acrididae*), and spiders. The research showed that there was an initial decrease in arthropod taxonomic diversity in the burned sites; however, this study did not evaluate long-term effects or comparisons between treatments. The authors discuss other studies that show an increase in arthropod diversity one to two years post-burn in prairie, and they recommend a patchwork of burned and unburned areas to promote species recovery after fire. Arthropod responses to fire and mechanical treatments may differ among taxa or species, and are likely influenced by seasonal timing of the treatments. It is important to note that findings from this study provide insight on short-term effects only, and that additional evaluations are important for understanding long-term effects.

Reference

DeSantis RD, Storer AJ (2007) Characterizing mechanical and prescribed fire treatments following clear-cutting of jack pine and short-term treatment effects on insect communities. In: 23rd Tall Timbers Fire Ecology Conference: Fire in Grassland and Shrubland Ecosystems. Tall Timbers Research Station, Tallahassee, pp 129–139