Ennis

THE EFFECTS OF TREE CROWN COVER AND FIRE ON GROUND COVER VEGETATION IN KIRTLAND'S WARBLER HABITAT

The habitat of the Kirtland's Warbler (a Federally-listed Endangered Species) is nearly pure Jack Pine (Pinus banksiana) stands on xeric sites in northern lower Michigan. A comprehensive census conducted annually from 1971 thru 1987 has averaged 207 male KW's concentrated into only 17-23 breeding areas each year. Dense Jack Pine crown cover between 1.3m to 5.0m in height is an important factor for KW habitat suitability (Probst MS). Jack Pine is regenerated naturally or by planting. Natural regeneration may occur with or without fire, but there is more potential to obtain dense stocking with prescribed fire because many Jack Pine cones are serotinous.

Kirtland's Warbler management has incorporated fire as a tool to promote Jack Pine regeneration and to create optimal ground cover. (Byelich et al. 1976). A certain ground cover species composition could be necessary for suitable nest locations (Walkinshaw 1983). Previously, it was shown that KW's were found in adequately-stocked stands on both burned and unburned stands within the appropriate height range (Probst MS) and site quality, so fire may not be necessary to create suitable ground cover for KW's. I report on two related studies on ground cover structural components in xeric jack pine stands in lower Michigan. First, I describe ranges of relative percent cover values for major ground vegetation species and components, and relate ground cover to tree cover in occupied Kirtland Warbler habitat. Second, I test the idea that

dissimilar ground covers under different histories of tree crown cover become more similar (convergent succession) after tree crown removal by wildfire. Thus, I will present evidence that ground cover composition in KW habitat is altered primarily by site quality and tree crown cover, and is less influenced by fire per se. Studies of jack pine communities over a greater range of sites describe the floristic composition of communities in more detail (Abrams and Dickmann 1982, 1984; Abrams et al. 1985).

METHODS

The first study was conducted in occupied KW habitat between August 10 and August 25, 1979-1986. Ground cover vegetation was measured once at five burned sites (three wildfire and one prescribed burn), and five unburned in Crawford and Oscoda Counties. The results of the first study led to a hypothesis, which was tested in the plant succession study following wildfire in three areas with contrasting pre-fire tree-stocking. The most densely-stocked area was regenerated naturally after a 1946 wildfire. The area with the least tree-stocking was harvested in 1964 and the intermediately-stocked area was harvested and prescribe-burned in 1966. All three areas were burned in the Mack Lake Fire of 1980. Vegetation was measured between August 10 and August 25 in the years 1981, 1983 and 1985. An unburned control area, harvested in 1966, was sampled in 1979 and 1986.In both studies, vegetation was measured on two 33m L-shaped line transects each of which was subdivided into two 16.5m segments perpendicular to each other. Ground cover was estimated by foliar cover along the line (Daubenmire 1963, Gregg Smith 1964). For the first study in occupied habitat, tree crown cover was estimated by the line-intercept method (Lindsay 1955). Because tree crowns were destroyed in the Mack Lake

Burn Area, an indirect index of tree crown cover was developed by measuring the height and density of live and dead trees and summing the tree heights (Buech 1980). This index integrates tree size and density, which are related to total tree crown cover. To develop the index, live or dead trees were counted and measured 33m to the outside of the transect to give two areal sample plot 33m and 33m. I attempted to correlate the tree-crown index developed from sum of the tree heights with tree-crown cover using data from the first study in occupied habitat.

Measurements of ground cover components included three non-vegetative elements: litter, patches of bare ground (>3cm), and pieces of dead wood (>3cm). Grass and sedge species were classified into two categories because of structural similarities and difficulty in identifying grasses by vegetative parts. Broad leafed grasses lumped as "coarse grass" were principally bluegrasses (Andropogon gerardii and A. scoparius), or less commonly, Indiangrass (Sorghastrum) or Brome grasses (Bromus sp.), "Fine grasses" included sedges (Carex pennsylvanica), poverty grass (Danthonia sp.), Hairgrass (Deschampsia), Koeleria cristata, and ricegrass (Oryzopsis sp.).

ANALYSIS

Foliar percent cover was converted to percent cover relative to all ground cover components, because relative percent cover is less sensitive to the specific methodology in a single study and allows comparison between past and future studies. Ground cover samples from all stands occupied by Kirtland's Warbler were combined for initial analysis of ground cover for all jack pine stands sampled. For each plot's subsample at each sampling period, the

relative cover of each component was computed. The values for the two subsamples were averaged to arrive at the value for the transect. The plot averages were transformed to stablize their variance using arc sin (relative cover proportion)1/2; this also improves normality of proportions.

The transformed data were then analyzed, when possible, using standard univariate and multivariate ANOVA for repeated measures on each component separately. This analysis provides two ways of looking at plant succession effects and at the History (before 1980) x Succession interaction in the second study. The first perspective is differences among means; the second is existence of linear and quadratic trends. When there was a significant History x Time interaction, further analysis separated what effects History has on successional trends, and what effects Succession has for each plot History. If there was no interaction independent results for History and Succession effects were presented. Multiple comparisons were done with t-tests.

RESULTS

For the initial analysis all transects from all study plots were treated as a composite group for calculations of frequency of occurrence. Ground cover components were ranked by their frequency (Fig. 1) in the following order: moss/lichen, fine grass, blueberry, deadwood, sand cherry, bare ground, sweet fern, coarse grass and bearberry. The ranking of components for percent cover or relative cover (Fig. 2) is somewhat different than for the frequency ranking, indicating some local dominance or a clumped distribution of some components. The 95% confidence intervals (Fig. 2) illustrate the common range of ground cover percentages measured in occupied Kirtland's Warbler habitat.