

ABSTRACT OF THE THESIS

The effects of fire on hardwood tree species
in New Jersey

by JOHN DEAN CHRISTIANSON

Thesis director: Professor Murray F. Buell

This research consisted of three separate studies, each designed to collect evidence to test whether certain hardwood species are more fire tolerant than others. The study strengthened the hypothesis that past fires had a role in establishment of the floristics of the trees of New Jersey.

The first study was of the effects of fire on three species of tree seedlings: white ash (Fraxinus americana), sugar maple (Acer saccharum), and red oak (Quercus rubra). This study showed white ash seedlings were the most fire intolerant and also possessed limited ability to resprout following fire. Red oak seedlings were the most fire tolerant, primarily due to their ability to resprout following fire. Sugar maple seedlings were intermediate in fire tolerance.

The second study was of the effects of fire on a hardwood forest in central New Jersey. A spring fire was set on sixteen plots and the effects of the fire were studied during the first growing season. Red oak seedlings were found to have a significantly higher resprouting ability than the average for the species investigated. Sugar maple seedlings were found to have a significantly lower survival and resprouting rate than this average. There were significant less seedlings under 0.5" d.b.h. following fire, but larger trees were not killed.

Both of the above studies were used in collecting data on the time-temperature relationships of surface fires. There was found to be much variability in the actual temperatures and their durations within fires on the same plots.

The third study was an investigation of the tolerance of the cambium of hardwood tree seedlings to heat. White ash, sugar maple, and red oak seedlings were exposed to various time-temperature treatments following which the tissues were tested for viability, using tetrazolium chloride. During the summer treatments red oak seedlings showed a significantly greater tolerance to heat than the other two species investigated. Treatments during dormant conditions showed red oak and sugar maple seedlings to both be more tolerant to heat than white ash seedlings.

During the three investigations differences were found in the fire tolerance of hardwood tree species. Red oak, because of its tolerance to heat and its ability to resprout following fire, presumably endured fire better than the other species. Sugar maple and other fire intolerant species were reduced in importance following fire. The evidence supported the original hypothesis that fires in pre-settlement periods played an important role in determining the floristics of New Jersey. Cessation of fires caused an increase in the shrub and understory strata, thus limiting the amount of light reaching the forest floor. At present the shade tolerant species appear to be the tree species which, if the area remains free from disturbance, will become the dominants of the future. The shade intolerant oak and hickory species will probably continue to decrease in importance in the hardwood forest in New Jersey.