

# Putting White Pine in Its Place on the Hiawatha National Forest

Allen D. Saberniak<sup>1</sup>

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**Abstract**—White pine was once a very important part of the ecosystem in the northern lake states. Turn of the century logging and wildfires removed white pine from many of the ecosystems of which it was an integral part. Early reforestation efforts were largely unsuccessful. The native white pine weevil and the exotic white pine blister rust made white pine establishment difficult at best. Both of these pests pose management challenges. However silvicultural practices can give white pine a distinct advantage over the pests. These practices include regenerating white pine under the shelter of overhead canopy, using genetically selected seed source, dense stocking, pathological and corrective pruning. Careful management is helping white pine once again return as a major component of the ecosystem.

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## INTRODUCTION

White pine invaded the lake states shortly after the retreat of the glaciers from the Lake Superior region. Paleoecological evidence suggests that white pine was extremely abundant during the mid-holocene era when climate was warmer and drier (Jacobson 1992). White pine may play a more important role in lake states forests if global warming and greenhouse effects are a reality.

A search of government land office survey notes indicates that white pine was a major forest component and often the largest trees on a site during the land surveys which took place in the 1840's and 50's. The first assessment of the nation's timber supply published in 1909 estimated the area of northern forests of which white pine was a principal member, as nearly 150 million acres supporting "not less than 1,000 billion board feet" of all species (Kellogg 1909). Many of these forests had their origin during the little ice age dating from 1450 to 1850, a period of highly variable climatic condi-

tions and frequent disturbance which favored white pine (Stern 1992). Many stands were subjected to light or moderate ground fires on a 20 to 40 year frequency. Fires kept the stands from succeeding to more tolerant species (Heinselman 1981).

## HISTORY

Lake states forests were used by a growing nation which had and still has a tremendous appetite for wood products. Logging and post logging fires significantly changed the northern forests. Vast areas remained open until the 1930's when establishment of the national forests (including the Hiawatha), fire control and the Civilian Conservation Corps led to reforestation efforts. At least 2000 acres of white pine were planted during the CCC's on the Hiawatha. Most of these stands were managed exactly like red pine in that they were planted in open fields or in stands where all overstory trees were removed. Attempts at managing these white pine plantations during the 40's and 50's left forest managers frustrated by the problems associated with the species. Today white pine maintains only a fraction of its original impor-

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<sup>1</sup>Assistant Ranger for Ecosystem Management, Munising Ranger District, Hiawatha National Forest, U.S. Department of Agriculture, Forest Service, Munising, MI.

tance. In fact the 1993 Michigan inventory of the Hiawatha shows all conifers except tamarack are more common than white pine. This is true both as a type and as individual trees.

### Silvical Review

Before discussing management strategies for white pine, it would be appropriate to quickly review white pine's silvical characteristics. Eastern or northern white pine (*Pinus strobus*) is the only 5-needled pine growing in eastern North America (Stearns 1992). It is the largest of eastern conifers capable of growing to 150 feet or more in height and in excess of 3 feet in diameter (Harlow). It is capable of growing on a wide range of sites, from dry rocky ridges to wet bogs. It grows best on moist sandy loam soils. White pine is intermediate in shade tolerance and produces good seed crops every 3 to 5 years, but some seed is produced almost every year (Harlow 1968). It also has a wide genetic variability lending itself to a successful tree improvement program (Meier 1992).

### Importance

White pine has played a major role in northern forests both ecologically and economically. Many wildlife species utilize white pine throughout its life cycle. Young white pine are often fed upon by hares and deer. Old trees are sought as refuge sites for bear or nest sites for many birds, especially eagle and osprey (Rogers 1992). History has proven the economic significance of white pine. Even today logs cut in the 1800's are being salvaged from the bottom of Lake Superior (Swerkstom 1994).

### PROBLEM

Many insects and diseases are associated with white pine (Jones 1992). Unquestionably the most serious problems associated with white pine are white pine blister rust and the white pine weevil (Katovich 1992). White pine blister rust, *Cronartium ribicola*, is a stem disease believed to have been brought to North America on seedlings transplanted from Europe. It is a fungus which uses, gooseberry, *ribes* spp., as an alternate host (Hepting

1971). In the white pine it causes cankers on the stem which will eventually girdle the stem. Growth loss results if the infection involves only a lateral branch. Mortality results if the main stem is involved. Infection on to a host white pine requires exacting conditions of temperature and moisture when the wind born spores are transmitted from the ribes to the white pine needles. Silvicultural practices can reduce the risk of blister rust to acceptable levels (Jones 1992). These practices include: careful site selection, avoiding openings and high ribes populations, underplanting, and pathological pruning. White pine weevil, *Pissodes strobi*, unlike blister rust, is not capable of directly killing the white pine. This native pest deforms trees by laying eggs in the terminals. Hatching larva feed under the bark of the previous year's terminal, killing the terminal. Usually one or more of the laterals take over causing noticeable crook or forking in the stem (Katovich 1992). The dead terminal will persist for many years often serving as an entry point for red rot. The weevil problem too, can be controlled by careful attention to management practices. These practices include: planting under overhead shade, corrective pruning and insecticide application.

### MANAGEMENT OPPORTUNITIES

These two pests, white pine weevil and blister rust, create management challenges. Fortunately there is some common ground in the techniques that allow for successful management of white pine. First sites should be selected which are not high risk areas for blister rust. This would include: avoiding the base of slopes, avoiding small openings and avoiding areas that have a large amount of ribes. These areas have cooler temperatures, higher relative humidities, and higher inoculum source, all of which increases blister rust incidence.

Secondly, an overstory should be maintained at 40 to 50% crown closure. This overstory makes unfavorable conditions for both blister rust and the weevil. The shade retards both evening cooling and subsequent increases in relative humidity, conditions needed for blister rust inoculation. Shade also causes smaller terminal diameters which are unfavorable to the weevil. Excessive shade on the other hand will retard the growth of

the white pine seedlings. Growth on 8 year old seedlings should be at least 15 inches per year. Shorter growth suggests too much shade (Katovich 1993). There is a fine line between having enough shade and too much. The forest manager needs to be observant on white pine sites to learn where that balance is and what kind of growth rates to expect.

Thirdly, white pine stocking should be maintained at between 800 (7x8) and 1200 (6x6) trees per acre (Katovich & Mielke 1993). This stocking level allows for some loss to blister rust, forces self correction after weevil attack, and increases natural self pruning. These stocking recommendations assume that the objective is for a pure stand of white pine. These numbers can be reduced if other natural regeneration will be coming on the site. On some sites on the Hiawatha we are planting as few as 10 seedlings per acre where our objective is strictly restoring a small component of white pine to a stand.

A fourth and final management recommendation is to prune up to 350 trees per acre. This pruning needs to fill two purposes. Pathological pruning will remove any branch anywhere on the tree which shows incidence of rust formation plus removes all branches in the lower third of the tree. This eliminates potential deadly cankers and significantly reduces the risk of additional infections. Research has shown that 99% of all blister rust infections occur within 9 feet of the ground (Katovich/Mielke 1993). The second function that pruning needs to fulfill is to correct any deformations caused by weevil attacks. This is done by removing the destroyed leader and all but one lateral directly below the destroyed terminal. This forces the tree to develop a new terminal and increases the chances of developing a single straight stem. Corrective pruning is most effective if done in late July or early August with removed dead terminals being burned or removed from the site. This removal destroys some of the next year's egg laying weevils (Katovich, 1993).

## **HIAWATHA'S APPROACH**

After the CCC era and up to the 1980's, very little white pine was planted on the Hiawatha

National Forest. Managers felt the risk from rust and weevil were too high. In the early 80's white pine seedlings from Region 9's Tree Improvement Program began to be available from the Oconto River Seed Orchard. We also started looking at the forest with an eye for improving natural biodiversity and restoring some of the missing components to our ecosystems. One of the first operational white pine plantings undertaken on the Hiawatha was underplanting a low quality hardwood stand on a sandy outwash plain near Munising (Wetmore outwash LTA). The site index for northern hardwoods was measured at 36 feet with a corresponding site index of 56 feet for white pine (Saberniak 1983). This would be an ELTP of 40. The stand was non-commercially thinned to a crown closure of 50%. The following spring 700 3-0 genetically selected white pine were planted per acre. A year and half later the trees were spot released using glyphosate. Several hand releases using prison labor have also taken place to keep the trees growing free of hardwood sprout competition. At age 7 we did a pathological pruning though little rust was evident. During 1993 and 1994 growing seasons we began to notice some weevil damage in the stand. We plan an additional pathological and corrective pruning within the next two summers. It appears that this stand is well on its way to again having white pine as a major component.

Since the first planting in 1984 we have planted 500 acres on the district to white pine, approximately 2000 acres forest wide. Our most successful attempts have been in underplanting poor quality low site index northern hardwoods especially red maple. We have found the lowest cost treatments to involve whole tree chipping to set up the initial shelterwood. These have been done by describing the objective then issuing a timber sale contract to "designate by description" the timber to be removed or left. A recent timber sale will prepare in excess of 400 acres for underplanting. Efforts have been concentrated on sites without white pine seed trees. The objective of these plantings has never been to create a pure stand of white pine but rather to manage stands of white pine mixed with northern hardwoods.

Until 1990 the Oconto River seed orchard was not able to produce all the genetically improved seed

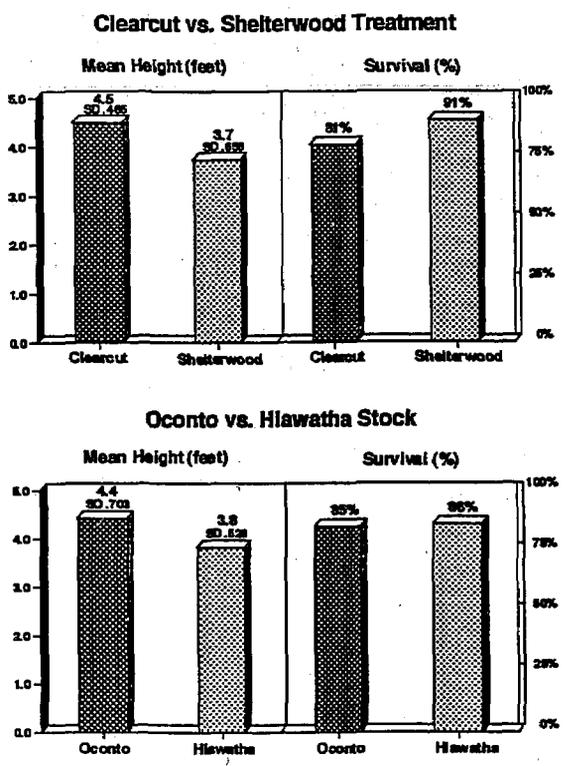
we needed. As a result seed was collected from selected individual trees on the forest. Outplantings have been done with this Hiawatha woods run seed source. In 1989 the Hiawatha, in conjunction with North Central Forest Experiment Station and Northeastern Area State and Private Forestry, established an administrative study to compare: Hiawatha vs. Oconto Seed Orchard stock, pruned vs. unpruned, and planting in clearcut vs. planting in shelterwood. After six growing seasons trends in survival and growth among treatments continue. Tree survival was nearly identical between Oconto and Hiawatha stock, and similar among treatments. Trees from the Oconto River seed orchard stock are slightly taller than from the Hiawatha stock and trees in the clearcut continue to outgrow trees in the shelterwood plots (fig. 1). Weevil damage was present only on trees within the clearcut plots with an average incidence of 6 percent (Ostry 1994). If weevil damage increases in

the future, growth on the shelterwood plots will likely catch or surpass the clearcut plots. Blister rust is also an unknown at this time. Meier estimates the Oconto River seed source to be about 30 percent superior in terms of rust resistance; however, this is not yet proven.

Active management of white pine continues through shelterwood cutting and planting. However there are many more areas where a white pine component is coming in naturally. The 1993 forest inventory shows that there are in excess of 35 thousand acres on the Hiawatha which have an adequate white pine understory. As mentioned earlier white pine is the second least common overstory conifer; however, it is the second most common understory conifer. Most of this regeneration is under 20 years old. Several factors are likely contributing to this surge of regeneration. First, while pine blister rust has probably run its initial most devastating course having taken out the most susceptible population members. Also attempts at ribies irradiation while not total were effective at reducing alternate host populations. Second, scattered residual white pine seed trees have grown to large size and are of an age that seed production is more prolific. Finally and perhaps most importantly our forests have made significant ecological recovery since the cut and burn days of the 19th century. Moderate level disturbances brought on by thinnings and selection harvests in hardwoods or age and stand break up in aspen and jack pine are again opening canopy gaps in the extremely dense second growth stands which came back after clearcutting. These naturally regenerating white pine are capable of hanging on under dense competition and show good growth response within one to five years after release (Kelty & Entcheoa 1993). This certainly opens a door of opportunity for silvicultural treatments like selection harvests to further aid in returning white pine to the main canopy.

**SUMMARY**

White pine was once a very important component of Lake States forests. Turn of the century logging and catastrophic fires greatly reduced white pine abundance. Hampered by insect, disease, reduced seed sources and a lack of manage-



OSTRY, 1994

Figure 1.—Six-year survival and height growth of white pine, Hiawatha NF, October 1994.

ment, white pine is making a slow comeback. White pine can be successfully managed and returned to the ecosystems it has been removed from, thereby benefiting diversity. Regenerating it under a shelterwood system or perhaps even a multi-aged system will strengthen its place in the ecosystem. The role of fire in these systems needs to be investigated and better understood. A choice needs to be made, we as managers can either use the silvicultural tools available to us and return white pine to its natural place in our northern ecosystems, or we can do nothing and take our chances that white pine may be missing from future generations of forests.

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