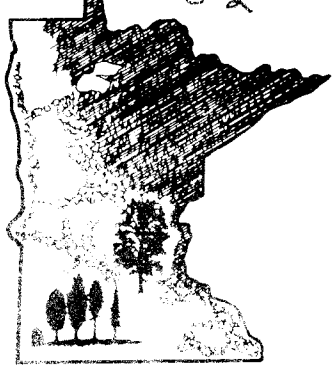

Minnesota Forestry Research Notes

No. 211
January 15, 1970

AERIAL PHOTOGRAPHY APPEARS INADVISABLE FOR SARATOGA SPITTLEBUG DAMAGE DETECTION

Robert P. Latham and Imants Millers[1]/

The Saratoga spittlebug (Aphrophora saratogensis (Fitch)) is a major pest of young red pine plantations in the Lake States. The adult bug feeds on the twigs of pine by sucking juices from the phloem and the newly-formed xylem and creates scars at the feeding site. An abundance of scars apparently interferes with water conduction and results in growth reduction or tree mortality, depending upon severity of attack (Ewan, 1961).

The spittlebug is widely distributed in the Lake States and annual ground surveys are necessary to detect damage before tree mortality occurs. The ground survey involves examination of selected sample twigs for an abundance of feeding scars. Each plantation is visited every four years, or more frequently when outbreaks are detected, until the trees are about 15 feet tall.

A cooperative study between Forest Pest Control, U. S. Forest Service and the School of Forestry, University of Minnesota, was initiated to determine if an aerial photography system could be substituted for ground surveys and the cost of surveys thereby reduced. Since stressed vegetation may lose a significant amount of spectral reflectance in the near infrared before visual symptoms occur, it occasionally has been possible to obtain pre-visual detection of stress using Ektachrome Infrared Aero film, Type 8443 (e.g., Norman and Fritz, 1965). Therefore, initial investigation sought to determine whether or not plantations with known infestations could be detected. A literature search was conducted, as well as discussions with involved field personnel.

Types of aerial photography obtained in the course of this study included:

1. Winter photography with 70 mm Ektachrome Infrared film, Type 8443, of a moderately damaged red pine plantation near Drummond, Wisconsin. Six different scales (1:1584 to 1:17,000) were obtained with the University of Minnesota School of Forestry's Quadricamera (Ulliman, et al., 1969), equipped with Wratten 12 filters.

2. June photography with 70 mm Ektachrome Infrared film, Type 8443, of a severely damaged red pine plantation near Drummond, Wisconsin. Photography was similar to the winter photography except that Wratten 12 and Wratten 21 filters were used.

---

[1]/ Research Fellow, School of Forestry, University of Minnesota, and Forest Entomologist, State and Private Forestry, U. S. Forest Service, respectively.

Published by the School of Forestry, University of Minnesota, St. Paul, Minnesota 55101, cooperating with the Division of Forestry, Minnesota Conservation Department, and Forest Industries of Minnesota

The number of white pine seedlings taller than one foot (Figure 2-4) indicates a satisfactory height growth only in the jack pine-bearberry type. White pine seedlings in the maple-basswood-leatherwood type with dense tree cover and strong competition of hardwood reproduction, although relatively numerous, have not reached a foot of height even at the age of 15 years. The lack of white pine and other pine seedlings in height classes over one foot in most of the forest types, except jack pine-bearberry type, is striking. This indicates that although there is some initial seedling establishment, further development is a critical problem, particularly with white pine. Red and jack pine seedlings do not establish even initially except for a scattered occurrence in the jack pine-bearberry type. In general, white pine is an invading species becoming initially established over a wide range of site and stand conditions. However, it does not survive under strong shrub or tolerant hardwood competition. Total shrub density and the pr-portion of beaked hazel (Corylus cornuta Marsch.) is shown by forest types in Figure 2-2.

Red Pine and Jack Pine Reproduction. The distribution pattern of red pine and jack pine seedlings in the edaphic field differs considerably from that of white pine seedlings (Figure 1). The distribution range of these seedlings is narrower than that of mature red pine and jack pine trees. Scattered red pine and jack pine seedlings in all age groups are largely confined to dry, nutrient-poor sites, mainly in the jack pine-bearberry type. Even in this type ground cover species, mainly halfshrubs, grasses, and invading shrubs appear to be serious competitors of pine seedlings for soil moisture. Furthermore, forest communities of the jack pine-bearberry type constitute only a small fraction of the total area of upland forests in the park. Without some disturbance such as fire even this forest type is unsuitable for new pine establishment. The complete lack of one to two-year old red and white pine seedlings on dry, nutrient-poor sites (Figure 1) is probably a result of an inadequate seed supply and severe drought in July, 1965 preceding data collection. The total number of red pine and jack pine seedlings per acre has some significance only in the jack pine-bearberry type. There are about 300 red pine seedlings per acre in this type (Figure 2-3). Jack pine seedlings are more abundant than red pine; however, jack pine seedlings were heavily browsed and their survival questionable.

Red and jack pine seedlings can be found on roadsides, old gravel pits, and in openings along trails. However, the area occupied is minute compared to the acreage of mature red pine and jack pine stands.

Perpetuation of Present Pine Stands. It seems clear that without major disturbances or special silvicultural measure the present area of pine dominated stands will continue to decline. While white pine seedlings establish initially, they do not survive the competition of dense shrub canopies or tolerant hardwood trees. By contrast, red and jack pine seedlings do not even establish initially under present stand and site conditions.

Literature Cited

Bakuzis, E. V. 1959. Synecological coordinates in forest classification and in reproduction studies. Ph.D. thesis, Univ. Minnesota. 244 pp.

Kurmis, V. and H. L. Hansen. 1969. Reproduction characteristics of upland forest communities in Itasca State Park, Minnesota. Minn. For. Res. Notes No. 209. 4 pp.

Published as Sci. Jour. Ser. Paper No. 7079 of the Univ. of Minn. Agr. Expt. Sta.