PROF. MERLE P. MEYER*
PROF. DAVID W. FRENCH
University of Minnesota
St. Paul, Minnesota

Forest Disease Spread

The rate-of-spread of dwarfmistletoe in black spruce forests can be assessed through sequential aerial photography.

ABSTRACT: *Dwarfmistletoe of black spruce is a slow-moving disease whose extent and change are difficult to assess on the ground. Glass plate positive transparencies made of a study area pictured on conventional 1:20,000 scale aerial photographs flown in 1940, 1951 and 1962, respectively, were projected onto a uniform map base. By means of area measurements from these maps, combined with use of local aerial stand volume tables, reliable estimates of infection area increase and timber volume losses were obtained.*

INTRODUCTION

THE FACT THAT dwarfmistletoe infection centers in black spruce are discernible on aerial photographs has been known to forest managers for a considerable number of years. Anderson (1949), for example, made use of 1940 aerial photography in his study of dwarfmistletoe. As is the case in much of the United States, the major black spruce growing area in northern Minnesota has been aerially photographed a number of times in the past quarter century (i.e., in 1940, 1951 and 1962). Since infection centers were clearly visible on all sets, it was reasoned that both the rate of spread and resultant timber losses, over a period of time, might be determined if a method of uniform comparison could be developed. This paper constitutes a description of the technique developed and the resulting assessment of a test area.

MEASURING DISEASE SPREAD

All three sets of photography were at a nominal scale of 1:20,000 but significant scale variations prohibited direct comparison. To overcome this, three ground-photo points which were well-distributed around the test area were selected, pinpricked and circled as illustrated in Figure 1. That portion of each photo containing the study area and the three control points was then photographically copied at the scale of the photo and printed on a glass plate.

The glass positive transparency for the 1940 photography was placed in a photographic enlarger and the image projected at about 3× enlargement (i.e., projected image was about 1:8,000 scale). Three layers of stable mapping paper were centered under the projected image and the three control points were pinpricked through all map sheets simultaneously at the projection scale.

Once the three control points had been pinpricked and circled on the map sheets, the 1940, 1951 and 1962 plates, respectively, were projected onto these maps in such a way as to have the plate control points coincide exactly with those on the base map. This insured that the boundaries of the infected areas would be traced off at precisely the same scale and, consequently, their respective areas could be measured and compared. The results of the comparison are tabulated in Table 1 and indicated an increase in the infection area of 88 per cent over the 22-year period.

TIMBER VOLUME LOSS

In order to relate the increase in size of the infection center to the timber losses incurred over the 22-year period, ten 1-acre aerial photo plots were established around the perimeter of the infected area on the 1951

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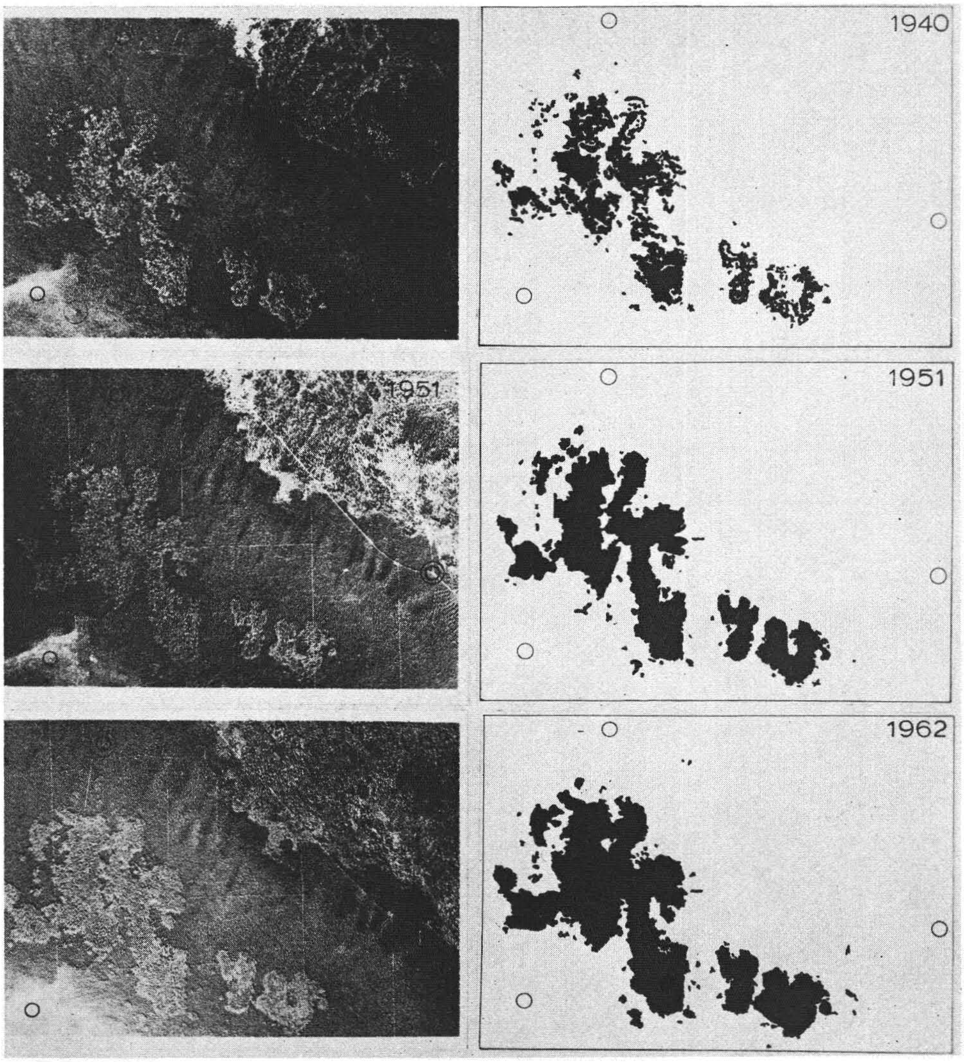

FIG. 1. Aerial photos and trace maps (1940, 1951 and 1962) of the same black spruce stand in northern Minnesota illustrating the increase in area of trees killed by dwarfmistletoe over a 22-year period.

photography. Using a local aerial stand volume table (Meyer, 1961) in conjunction with photo stand height measurements and crown closure estimates of the ten plots, an average

TABLE 1

AREA OF SPRUCE MORTALITY DUE TO DWARFMISTLETOE INFECTION

Year	*Size of infection center (acres)*	*Increase in area size since 1940*	
		Acreage	*Per cent*
1940	67.3	—	—
1951	103.0	35.7	53
1962	126.4	59.1	88

volume per acre of 579 cubic feet (7.2 cords /acre) was obtained.

Projections of the estimate of the volume of wood that might now be expected on this area, assuming no dwarfmistletoe, are as follows:

1. Approximate total merchantable volume lost to dwarfmistletoe in this infection center:

   126 acres $\times$ 7.2 cords = 907 cords.

2. Approximate loss in merchantable volume between 1940 and 1962:

   59 acres $\times$ 7.2 cords = 425 cords.

CONCLUSIONS

This study of dwarfmistletoe infection analysis, localized though it may be, illustrates the value of the time-sequence photographic library which conventional aerial photography is building. In those cases where it is applicable, relatively simple mensurational techniques and inexpensive methods will often suffice to provide valuable information with respect to change in vegetation (and other) features over time.

ACKNOWLEDGMENT

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