100 cm^2. The soil samples were irrigated with distilled water to approximate saturation followed by daily applications of 125 ml of distilled water, or the equivalent of 1.25 cm of rain. The funnels were kept at about 25 C. Soil extracts percolating through were collected in sterilized flasks standing in baths of ice water, and were tested for inhibition of *Pythium*, usually within an hour. In the tests, 4% "purified" (Bacto) or Ion (Oxoid) agar was autoclaved, cooled to 60 C, mixed with an equal amount of the extract in a petri dish, and allowed to solidify. Two or three inoculum pieces, 12 mm in diameter, from a 10-day old water agar culture of *Pythium ultimum* Trow, were then transferred to each dish. After incubation for 24 hr at 25 C the average linear extension of the colonies was measured and expressed as a percentage of the controls in which distilled water was used instead of soil extract.

In some tests bacteria and other fungi were especially studied. Their growth was usually negligible due to an inhibitory effect of the extract itself or the short duration of the test and lack of nutrients. In the tests shown in Table 1, bacteria were reduced by centrifuging the extract for 10 min at 1000 g, or were eliminated by heat or Millipore filtration. Care was exercised to avoid accidental interference of *Pythium* growth by rapid increases of bacteria in condensation water. Inhibition of *Pythium* was seen most clearly on Ion agar, which was found to be the most suitable among various media tested.

The test organism, culture (No. 9248), used was selected because of its small nutrient requirements, its rapid growth on water agar, and its sensitivity to inhibitory effects.

The results (Table 1) indicate that soils of different kinds generally contained solutions which inhibited *P. ultimum in vitro*. The degree of the inhibition varied greatly between the soils and between sampling times in one soil. Such variation was due to differences in the inhibition itself and not to experimental errors in the tests, as these were relatively small.

Decreased linear growth was the most obvious and useful expression of the inhibition; the mycelium was also less dense and autolysis took place earlier in tests with strongly inhibitory soil extracts. The sensitivity of the test organism probably facilitated the observation of the differences.

Because the rapidity with which the inhibitory activities of soil flora respond to changes in physical factors and the time needed to reach equilibria are not known, these results show only that there are differences among soil.—O. Vaartaja, Sault Ste. Marie, Ont.

Chronology of Pole Blight Lesions of Western White Pine in British Columbia.— Pole blight, a disease causing premature decline and death of immature western white pine [*Pinus monticola* Dougl.], appears to be linked with climatic change. Unfortunately no records indicate precisely when pole blight first occurred. It was well established in Idaho by 1938 (Erlich and Baker, Univ. Idaho, Sch. Forest., Typed Report. 1942). Buchanan et al. (Phytopathol. 41:199-208, 1951) believed it had been present from the late 1920's. In British Columbia, pole blight must have begun some time before it was recognized in 1949 because dead trees with pole blight symptoms were already evident (Parker et al., Can. Dep. Agri., Div. Botany Plant Pathol., Forest Pathol. Note No. 3, Victoria. Mimeo. 1950).

Pole blight lesions provide a useful index for dating disease incidence because they are sufficiently durable that their date of origin can be established many years later. These elongate, fusiform patches of dead bark and wood, are the most specific symptom of the disease (Buchanan et al. (*loc. cit.*).

The dates of origin of 189 pole blight lesions were determined from trunk sections collected from 127 white pine trees. Trees were sampled in 20 widely scattered stands in the Columbia Forest Region. The average age of trees in the stands sampled ranged from 55 to 130 years in 1967. Lesions were dated by subtracting the number of annual rings since lesion occurrence from the date of sampling, or in dead trees, from the date of death. If unknown, the date of death was estimated, in some cases, by comparing the state of the dead crown with the crowns of trees whose date of death was known from sample plot observations, and in other cases, from known dates of mountain pine beetle infestations. Most dates of lesions originating before the last three decades were from living trees, because sufficient accuracy in dating trees which had been dead for many years could not be assured. Omitting trees that had been dead for a long time undoubtedly resulted in underestimation of the incidence of old lesions. The frequency of lesions originating many years ago was also likely to be underestimated because some were completely overgrown and externally unrecognizable.

The incidence of trees which developed lesions each year from 1900 to 1967 was expressed as a percentage of the number of sample trees which were between 28 and 114 years old in any given year (Fig. 1). In 1912, for example, incidence was 3%—two lesions originated among the 68 sample trees which were between 28 and 114 years old. In 1942, 124 of the trees sampled fell within this range. Consequently, six trees with lesions originating in that year represented an incidence of 5% .By 1966, the number of living sample trees less than 114 years old had dropped to 52. Percent incidence was based on the number of sample trees between 28 and 114 years old, in each year, because no lesions had originated in the trees sampled when they were younger or older than these ages. A tree was counted as lesioned only once in any given year regardless of the number of lesions which had developed in that year. It was counted a second time if another lesion had occurred in a different year.

An appreciable number of lesions originated in the early 1920's (Fig. 1), several years earlier than the date (1927 or 1928) suggested by Buchanan et al. (*loc. cit.*) as the time when pole blight was first evident. The development of lesions shortly after 1916 (the beginning of a succession of hot, dry summers that persisted for a number of years) provides better evidence of the congruence of pole blight with climatic change than was previously available.

Although the frequency of lesions shown for the 1920's is likely to be low due to the sampling constraints referred to, underestimates should decrease progressively in later years. Consequently if pole blight incidence were constant with time, a gradual increase in the frequency of lesion occurrences could be expected. The lack of such an increase in the 1930's (Fig. 1) suggests that a reduction in pole blight incidence may in fact have occurred during this period. On the other hand, the increase in lesion occurrences by the late 1940's is probably sufficiently great to indicate that pole blight had by then become more frequent than in previous period. A high incidence of pole blight may have occurred later in British Columbia than in Idaho, where the disease had already attracted attention in the 1930's (Erlich and Baker *loc.cit.*).

The continuance of lesions until 1967, the year that sampling was completed, shows that conditions for their development persisted despite a reduction in the frequency of hot, dry summers (McMinn and Molnar, Can. Dep. Agri., Forest Biol. Div., Bi-Mon. Progr. Rep. 15(1): 2-3, 1959). Perhaps when white pine has been exposed to moisture stress for many years, as seems to be the case in the Interior Wet Belt, pole blight eventually develops in susceptible trees even when drought conditions are only periodic. In a few recent cases, lesions occurred without pronounced crown symptoms of pole blight. The limited development of such symptoms on these trees may reflect the reduced frequency of moisture stress in recent years. The occurrence of lesions in 1912, in two trees which continued to live for more than 40 years, might also reflect a stress sufficient to cause lesions but insufficient to cause death of trees.

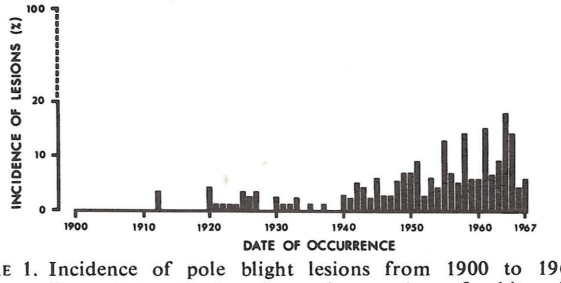

FIGURE 1. Incidence of pole blight lesions from 1900 to 1967. Percentages are based on the number of white pine sample trees which were between 28 and 114 years old in any given year.

Further analysis of the chronology of lesions and their relation to climatic events should provide more insight into the circumstances causing pole blight, and the significance of weather and decline diseases. — R. G. McMinn and M. A. Grismer, Forest Research Laboratory, Victoria, B.C.

SILVICULTURE

Conifer Reproduction in Old-Field Spruce Stands in the Maritimes.— Old-field spruce stands, so-called because they develop on abandoned agricultural lands, are a significant part of the forests of the Maritime Provinces. Drinkwater (Can., Dep. North. Aff. Natur. Resources, Tech. Note 65, 1957) estimated that such stands, usually white spruce with associated other conifers, occupied approximately 500,000 acres in Nova Scotia alone. Large areas of abandoned farmland in southeastern New Brunswick and on Prince Edward Island also support old-field spruce.

Many landowners and foresters believe that the advance growth of spruce and fir that is present in most mature old-field stands is sufficient to form new coniferous stands when the old material is clear felled. In 1957, however, Drinkwater observed the inadequacy of natural regeneration in old-field stands and suggested an objective survey. Whether cut-over old-field spruce stands reproduce to conifers or not, is of particular importance at present because thousands of acres of such stands are clear-cut annually for pulpwood.

A survey was conducted in 1962 and 1963 to obtain objective data on advance growth and regeneration in uncut and clear-cut mature stands of old-field spruce. Reproduction was assessed on 11 uncut areas in either pure white spruce [*Picea glauc* (Moench) Voss] or white spruce — balsam fir [*Abies balsamea* (L.) Mill.] stands (occasionally red spruce [*Picea rubens* Sarg.]), aged 40 to 75 years, and in eight clear-cut areas in similar stands located in southeastern New Brunswick, central Nova Scotia, and on Prince Edward Island (Fig. 1).

Individual stand descriptions and an interpretation of the results obtained in the survey have been described (Jablanczy, Can., Dep. Fish. Forest., Intern. Rep. M-44, 1969). Wide variations in stocking with spruce and balsam fir reproduction were evident for both uncut and clear-cut stands (Fig. 2). Of the 11 uncut stands, only one was well stocked and only two were moderately stocked with spruce advance growth: the remaining eight were either understocked or failures. Only one of the eight cut-overs was well stocked to spruce reproduction.

The combined stocking of spruce and balsam fir indicates that only four of the uncut stands and three of the cut-overs were fully or well stocked to coniferous reproduction. In addition, two uncut stands and one cut-over had moderate stocking or reproduction. Coniferous reproduction was either low or a failure on the remaining nine.

Although both spruce and fir repeatedly seed in under the mature overstorey, the seedlings rarely live more than a few years. Therefore, when the old stand is cut, the advance growth either occurs in inadequate numbers or it lacks the necessary vigor to stock the area. Regeneration following logging is usually insufficient to compensate for the losses caused by logging damage and by subsequent drying of the forest floor. On the better sites, advance growth usually includes tolerant broad-leaved species, while intolerant broad-leaved species invade many cut-overs. Jablanczy (*loc. cit.*) reported that on four of the eight cut-overs a heavy invasion of maple, birch, and aspen occurred in the first 2 years after felling.

Conifers will form the next crop in only a portion of the clear-felled old-field spruce stands. Frequently mixed-woods, and occasionally broad-leaved species, will form the next crop. — A. Jablanczy, Forest Research Laboratory, Fredericton, N.B.

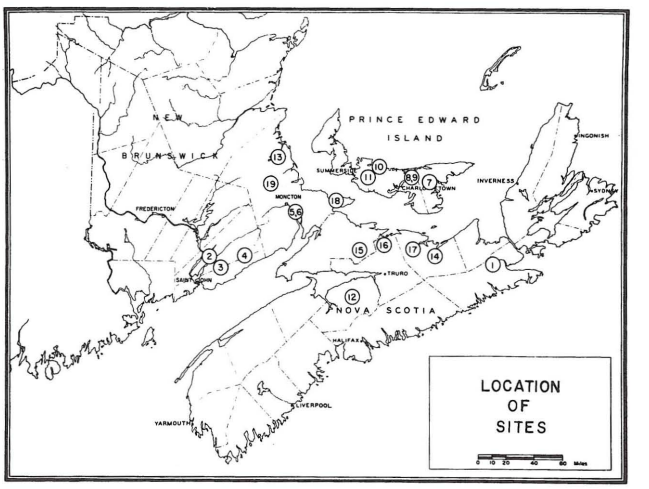

FIGURE 1. Location of sample areas.

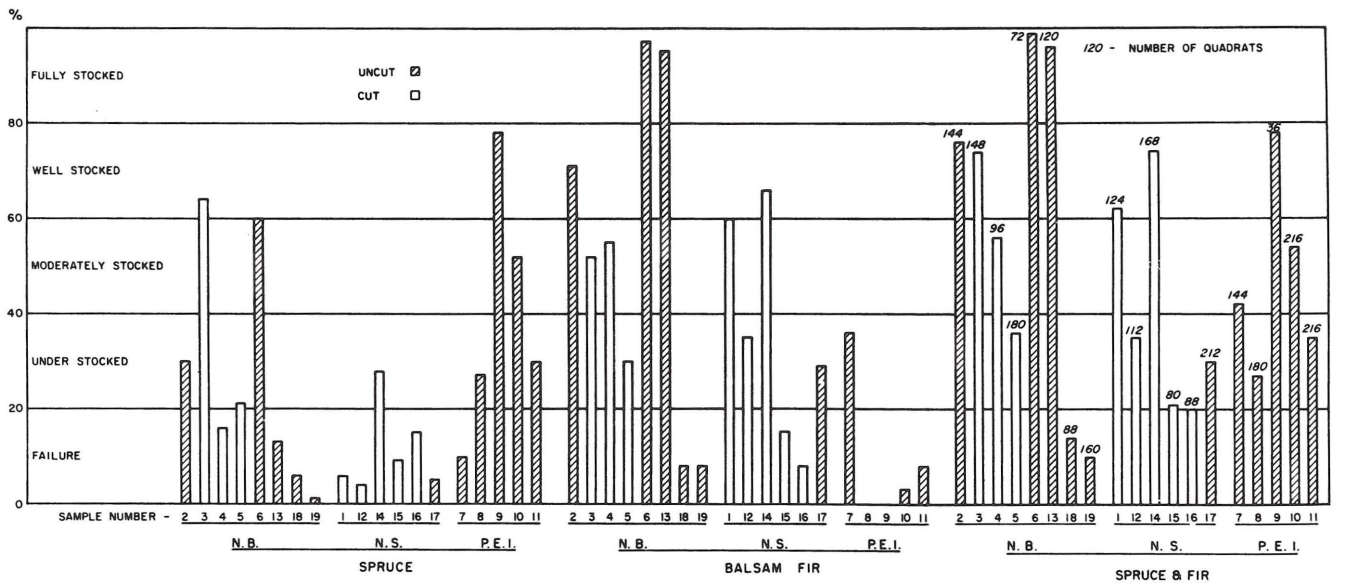

FIGURE 2. Stocking percentages for spruce, balsam fir, and spruce and balsam fir.