Aerial Spraying Operations Against the Swaine Jack-Pine Sawfly in Quebec, 1965.—In August of 1965, approximately 150,000 acres of jack pine forest infested by the Swaine jack-pine sawfly (*Neodiprion swainei* Midd.) were sprayed from the air utilizing the insecticide Phosphamidon. This was the first large scale commercial aerial spraying programme against the insect in Canada. The infestations were centered in a 5,000 square mile area west of La Tuque, Quebec, on the limits of the Consolidated Paper Corporation and the Canadian International Paper Company. Costs of the operation were shared equally by the Federal and Quebec Governments and the companies. The spraying operation was conducted by Quebec Forest Industries Limited with supervisory personnel and staff supplied by Forest Protection Limited, Campbellton, New Brunswick. Biological assessment was supervised by scientists of the Department of Forestry of Canada with assistance and personnel supplied by the Department of Lands and Forests, Quebec.

The Swaine jack-pine sawfly is a defoliator specific to jack pine, *Pinus banksiana* Lamb. Populations of the insect periodically reach epidemic levels, sometimes at rather short intervals (6 to 7 years) and tree mortality may result if natural control agents do not arrest the infestations. Tree mortality is usually initiated 4 to 5 years after the start of an epidemic and trees may die if they are completely stripped of foliage as a result of one summer's feeding.

Preliminary ground surveys carried out in the fall of 1965 indicated a significant resurgence of sawfly populations in the St. Maurice River watershed. To appraise the extent of these infestations, an aerial survey of approximately 5,000 square miles west of La Tuque, Quebec, between the St. Maurice and Mattawin Rivers was carried out in late March of 1965. Maps showing the distribution of jack pine were supplied by the companies concerned. Sawfly infestation centres were plotted directly on these maps by flying east-west flight lines at 2 mile intervals at an altitude varying from 500 to 1,000 ft, depending upon the terrain, and at considerably lower altitudes once infestation epicentres had been located.

The infestations were classified in two categories: severe and moderate. In severely infested areas, many of the trees had a distinctive reddish appearance owing to feeding on

Bi-monthly progress report. 22(1), 1966.

the current foliage; numerous bare crowns could be observed and some trees were completely or almost completely stripped of foliage. some tree mortality (ca. 10%) had already occurred or was imminent. In moderately infested areas, some crown tops, notably on dominant trees, showed the distinctive reddish colour, there were also a few bare tops but the majority of trees were not visibly affected. Some tree mortality was noted.

On completion of the survey, four-mile-to-the-inch reference maps and 1:50,000″ working maps were prepared, showing the distribution of jack pine and extent of sawfly infestations. The 1:50,000″ maps were used for calculating the size of areas to be sprayed and also served as flight maps for the spray pilots.

Most of the affected jack pine stands were about 40 years of age, and had originated from extensive fires in the early 1920's. These stands are only marginally exploitable at present and could not be salvaged profitably in the event of tree mortality. It was therefore recommended that an attempt be made to control the sawfly infestations in the St. Maurice valley.

The operation was carried out between August 10 and 20, 1965, when the majority of larvae had reached the second instar. The objective was to kill the larvae while they were still young to keep current defoliation at a minimum and thereby save trees.

Two 1,500-ft airstrips were constructed within the sprayed area. Seven aircraft were based at each airstrip: four Stearman spray aircraft and three Cessna 172's, which were used for navigating the spray aircraft. The aircraft flew in groups of four along rectangular spray blocks, mean swath width approximately 660 ft. Spray was applied at ¼ pound of technical Phosphamidon (Dimecron 90) per 0.2 gallons of water per acre, except in one experimental spray block where the concentration was reduced to ⅛ pound per 0.2 gallons per acre.

Fifty-six sampling points were selected prior to the operation, 17 from unsprayed localities and 39 from sprayed localities. Those from unsprayed areas were sampled 1 or 2 days before, or during the operation, and those from sprayed areas, not less than 4 or more than 7 days following application of the spray. At each point, the trees were selected at 1-chain intervals at right angles to predetermined localities along roadsides. All sawfly colonies were counted and each was classified as follows: all larvae living, all dead, dead and living, absent, or not hatched. In addition, 50 individual sawfly colonies, when available, were selected at random from each locality and counts made of the number of eggs deposited and the number of surviving larvae in each colony.

The total egg complement of one female Swaine jack-pine sawfly is laid on a single current shoot of jack pine and young larvae that hatch from these eggs feed as compact colonies on old foliage in the immediate vicinity of the egg cluster. Thus it is possible by counting the number of eggs deposited and the number of surviving larvae, to calculate generation mortality to the time a given sample is selected. Therefore, generation mortality from both sprayed and unsprayed areas, as calculated from samples selected a few days after spray application, may be compared to determine the direct mortality resulting from the insecticide (Table I). Generation mortality in sprayed areas to the time the samples were collected was 99.2%, whereas in unsprayed areas it was 37.4%. The interval mortality directly attributable to the action of the spray, that is the difference in mortality between sprayed and unsprayed areas, was 98.1%. These figures are meaningful only if compared with the total generation mortality for the sawfly which would result in a population trend index of 0. A population trend index equals 0 when the egg population of a given generation is equal to that of the next generation. For the Swaine jack-pine sawfly, total generation mortality for a population trend index of 0 is usually of the order of 97.2% (assuming a mean fecundity of 65 eggs per female sawfly and a sex ratio of 0.63 in favour of females). Therefore, since the interval mortality directly attributable to the action of the spray (98.7%) and generation mortality in sprayed areas to the time the samples were selected (99.2%) exceed the normal total generation mortality for trend index 0, it follows that sawfly populations should be reduced to very low levels in the sprayed areas in 1966. Also, owing to the quick action of the insecticide, feeding on the previous years' foliage was kept to a minimum and the current foliage remained virtually untouched. Thus, trees which were in danger of dying from sawfly defoliation in 1965 were saved.

The experimental block sprayed at ⅛ pound per acre gave results almost equally as good as the ¼ pound dosage. Mean sawfly mortality for the six plots sampled was 92.8%. Mortality in one of these sample points, situated near the edge of the experimental block, was disproportionately low (68%) and consequently may have received poor spray coverage. If this sample is edited from the data, the average mortality for the five remaining samples is 98.6%. This would suggest that in future operations against the Swaine jack-pine sawfly, ⅛ pound of Phosphamidon per 0.2 gallons per acre might suffice to produce adequate interval mortality.—J. M. McLeod.