Some Aspects of Jack Pine Regeneration on Prescribed Burned Areas.—In 1964 a comprehensive program was begun in southeastern Manitoba to determine whether prescribed burning can be used in cut-over jack pine stands to prepare them for natural and artificial seeding and for planting. Other objectives are to determine optimum conditions for burning, to study fire behaviour, and to study the ecological effects of fire. Operational aspects of the 1964 and 1965 burning will be described elsewhere by J. L. Adams. This item presents preliminary results from various regeneration studies established on the burns.

Five 1-acre areas were burned in July 1964. Four more areas, ranging in size from 18 to 51 acres and totalling 116 acres, were burned in August 1965. All areas were on excessively and well-drained sands and had originally supported open jack pine stands averaging about 300 trees per acre with a basal area of about 50 sq. ft. Seed tree cutting, leaving 10 trees per acre, was carried out on one of the 1964 areas and on a 10-acre block of one of the 1965 areas. The remainder of the areas were clear cut. Logging was carried out 1 or 2 years prior to burning and slash was generally windrowed between skid roads.

Results of seed fall studies on the two areas cut by the seed-tree method indicate that total seed fall on the 1964 burn was 105,000 seeds per acre and on the 1965 burn, 87,600 per acre. Seeds from the 1964 and 1965 burns were 28.6 and 64.0% sound, respectively, and sound seed fall per acre was 30,000 (0.23 lb.) on the 1964 burn, and 56,200 (0.42 lb.) on the 1965 burn. On the 1965 burn, seed fall averaged 3,400 seeds per acre per day for the first 16 days after burning, 1,070 seeds during the next 25 days, and 200 seeds for the next 30 days.

A number of regeneration studies were established on the 1964 burned areas and were assessed at the end of the 1965 growing season. Natural regeneration, broadcast and spot seeding with Arasan- and Endrin-treated seed, and planting were the methods employed.

Stocking with natural regeneration on the seed-tree burn was 25% (1-milacre quadrats) with 500 stems per acre. No natural regeneration was found on burned areas that had been clear cut.

Broadcast seeding in the spring (1965) at a rate of 12 oz. of viable seed per acre resulted in 28% stocking with 310 stems per acre. Broadcast seeding in the fall (1964) resulted in 30% stocking with 1,300 stems per acre.

Spot seeding in the spring and fall with 15 to 20 seeds on spots located at 6-ft. spacing, and prepared by scuffing the ground with a foot and then covering seed with soil, gave better results than broadcast seeding. Spots seeded in the spring were 40% stocked with 1.6 germinants per spot and those seeded in the fall were 53% stocked with 2.1 germinants per spot. Initial germination was much higher but over 60% of the germinants died during August from drought and extremely high temperatures.

Survival of spring plantations averaged 85%, and of fall plantations, 58%. The average spring-planted seedling grew 3.8 inches and the average fall-planted seedling 2.6 inches.

Seed-spotting and planting have given the most promising results so far. However, considerable mortality has occurred in all treatments, and it is probable that better results would have been obtained had seeding and planting been delayed for perhaps a year. By that time the shade created by lesser vegetation and the leaching of surface ashes would have lessened the extreme environmental conditions prevailing on the burned areas.

It is believed that much seed was blown from the seed-tree and broadcast-seeded areas by strong winds which occurred after seed was on the ground. In fact, many germinants were observed in the furrows which were ploughed as firebreaks between the study areas. Such seed losses would not occur to the same extent on larger burned-over areas.

The burning program will be continued and extended to cover a variety of site, fuel and weather conditions. As the program progresses, additional studies will be initiated to determine the best means of restocking the various burned-over conditions created. Ten areas totalling about 1,000 acres have been selected for burning in 1966 and other areas have tentatively been chosen for burning in 1967.—J. H. Cayford, Directorate of Program Coordination, Ottawa.

SOILS

The Effect of Burning Logging Slash on Chemical Properties of Soil.—Much attention has been given to the effects of forest fires on soils and vegetation. However, the literature contains contradictions and divergence of views. This, according to Davis (Forest Fire, Control and Uses, 1959, McGraw Hill, New York), is the result of a failure to fully evaluate modifying factors such as topography, geography, climate, latitude, soil and forest cover type.

On the sandy loam soils of the Lumby area of British Columbia the burning of logging slash had a marked and immediate effect on some of the important chemical properties of soil. Exposure to weathering after burning caused further modification. Soil reaction or pH, organic carbon percentages, exchangeable cation values, and cation exchange capacities exhibited considerable change. Soluble nitrogen, phosphorus and salts, particularly in the duff layer, were also modified by burning. A tendency for pH values to revert to original levels was evident in the duff and Ae horizons.

There is an increase in water soluble constituents. However, this increase is soon removed from the upper 12 inches of the soil profile due to the increased rate of leaching resulting from the removal of the protective vegetative cover.

Increases in cation exchange capacities and exchangeable cation values (principally calcium, magnesium, and potassium) occurred after burning, especially in the duff and Ae horizons. Fuel materials, oxidized to varying degrees by burning, were deposited as charcoal on the unburned or partially burned duff layer. Released and mineralized constituents such as calcium, magnesium, and potassium, resulting from complete combustion of fuel materials, were re-adsorbed by the charcoal.

The pH-dependent charge of the duff layer was greatly reduced, and is one of the most marked and immediate effects of burning. Destruction or modification of the soil organic matter fraction probably was instrumental in this reduction. As observed in soil pH values, there is a tendency with time for the pH-dependent charge to revert to original values.

In the evaluation of the effects of slash burning on soil, consideration must be given to the length of time to which the soil was exposed to increased weathering as a result of tree removal.

Although it may seem that burning improved the soil chemically, this "apparent" improvement was not reflected in Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco) seedling growth. The most vigorous seedlings are those growing on unburned soil. On slash-burned areas, growth response decreased with time. This emphasizes that growth is not only related to the chemical, but also to the physical and biological properties of the soil. Although available nitrogen and phosphorus were initially increased by burning, these values are still well below those required for optimum growth. Water-soluble sulphate was not detected in either unburned or burned soil samples. Thus, it is likely that these soils would respond favourably to applications of nitrogen, phosphorus, and sulphur.—Joseph Baker, Forest Research Laboratory, Victoria, B.C.