ever, while biological considerations might favor the use of 2-inch diameter containers, economic constraints, such as available greenhouse and nursery space, increased costs of transportation and handling, etc., are likely to limit the size of container used operationally. Consequently, for the production of white spruce and jack pine container planting stock with a shoot length of 4–5 inches (10–12 cm), the best compromise would be a container of approximately 1¼-inch diameter.—J.B. Scarratt, Great Lakes Forest Research Centre, Sault Ste. Marie, Ont.

The Effects of Site Preparation on Summer Soil Temperatures in Spruce-Fir Cutovers in the British Columbia Interior.— Few studies have mentioned the potentially beneficial effects of site preparation on soil temperature regimes. However, indirect evidence suggests that, in northerly or high elevation areas where soil temperatures are relatively low and moisutre is usually adequate, increases in soil temperature may be beneficial to forest regeneration. For example, Babalola *et al.* (Plant Physiol. 43: 515–521, 1968) found that net photosynthesis of *Pinus radiata* seedlings increased with soil temperature up to 26.7°C. Bowen (Aust. J. Soil Res. 8: 31–42, 1970) also observed beneficial effects to *P. radiata* seedlings from increasing soil temperature. He reported that total root length of 3-week-old seedlings was doubled and phosphate uptake was considerably increased by raising the soil tsmperature from 15 to 25°C. Chalupa and Fraser (Can. J. Bot. 46: 65–69, 1968) found that white spruce seedlings produced a finer, more fibrous root system and a lower shoot-root ratio at higher soil temperature than at lower ones, although total seedling weight was inversely correlated to soil temperature. The present study examines the effects of site preparation on summer soil temperatures within the rooting zone of planted seedlings.

The study was carried out in white spruce [*Picea glauca* (Moench) Voss]/alpine fir [*Abies lasiocarpa* (Hook) Nutt.] cutovers in the Montane Transition Section (Rowe, Can. Dept. North. Affairs and Nat'l. Res., For., Br., Bull. 123, 1959) 40 miles (1.6 kilometers) northeast of Prince George, British Columbia at Lat. 54°10′. Plots were established on each of three typical sites characterized by differences in soil texture: fine sand, silt loam and clay loam.

Three treatments were applied to the study sites: scalping (brush and duff removed), clearing (brush removed, duff left intact) and control (brush and duff left intact). Heavy slash was manually removed from all plots. Scalping was done by a bulldozer with an angled blade, and clearing was accomplished with a brush cutter, followed by herbicide treatment.

Three temperature sensors (germanium diodes) were installed at a depth of 5 cm (2 inches) in each treatment plot on each of the three study sites. Sensors were located at points judged to be representative of the plot. Since duff thickness was generally less than 5 cm on all sites, all sensors were located in mineral soil, regardless of surface treatment. Temperatures were monitored at additional depths on the silt loam sites where sensors were also installed at depths of 2 cm (.86 inch) (in the humus layer), 11 and 23 cm (4.9 and 10.0 inches). Temperature readings were taken with a meter at approximately weekly intervals from 6 July to 23 September. Readings were taken between 1400 and 1600 hr and, on one occasion (29 July), every 2 hr for a 24-hr period. The diurnal trend indicated that the readings taken at 5 cm between 1400 and 1600 hr closely approximated daily temperature maxima for that depth. Comparisons among means were tested for significance by Tukey's HSD procedure.

Soil temperature on all sites, regardless of treatment, increased rapidly through the first half of July, remained fairly constant to mid-August, then decreased for the duration of the study period. On the silt loam site, the daily maximum temperature at 5 cm on the control plot remained at about 17°C from 20 July to 10 August (Fig. 1). An almost identical seasonal trend and mid-summer temperature plateau was recorded on the control plot on the clay loam site. The control plot on the drier and less brushy sand site reached a mid-summer plateau of about 20°C at the 5 cm depth.

Brush removal (clearing) resulted in a 1– to 2–deg increase for most of the study period at the 5 cm depth on the silt loam site (Fig. 1). This difference, although consistent, is not statistically significant (5% level). The same treatment led to temperature increases of as much as 4 deg on the clay loam site (critical difference at the 5% level = 2.97 deg), while the removal of the sparse brush on the sand site had virtually no effect on soil temperature at the 5 cm depth.

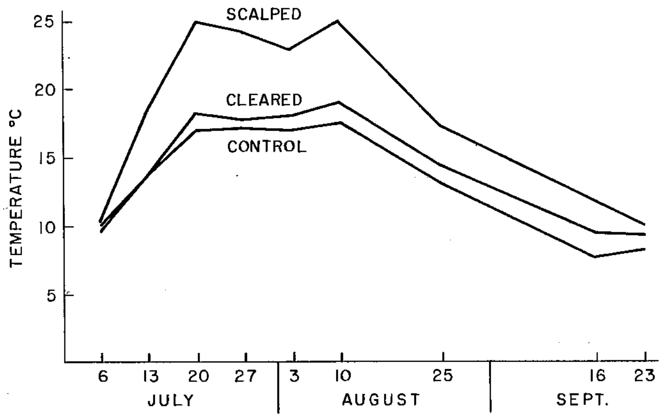

Figure 1. Seasonal march of maximum soil temperature at the 5 cm depth on the silt loam site.

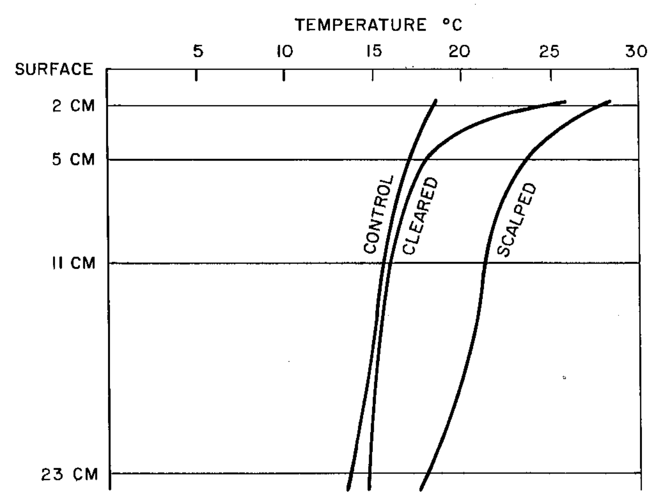

Figure 2. Profile of the average maximum soil temperature from 30 July to 10 August on the silt loam site.

A marked increase in daily maximum temperature at 5 cm was noted on all scalped plots. The 5 cm maximum temperature for the mid-summer period was raised about 5 deg on the sand site and 6–8 deg on the silt loam (Fig. 1) and clay loam sites, bringing all plots to a plateau of 24–25°C. These temperature increases were statistically significant in all cases.

Data obtained over a 24-hr period on the silt loam site indicate, at least for the 5 cm depth, that temperature increases brought about by scalping prevail throughout the diurnal cycle.

The maximum temperature on the scalped plot was 7 deg over that on the control plot, and the minimum on the scalped plot remained 2 deg above that on the control plot.

Temperatures obtained between 1400 and 1600 hrs on the four sampling dates from 20 July to 10 August on the silt loam site were averaged for each depth. These data are presented in Fig. 2 which shows that the soil temperature increase effected by site preparation, particularly by scalping, was manifested at least as deep as 23 cm on this site.

Results of this study show that increased soil temperatures within the rooting zone for forest regeneration follow mechanical site preparation and persist at least through the subsequent summer. The fact that, under conditions of the study, more of the increase is due to duff removal than brush removal, suggests that the increased summer soil temperatures will prevail for several seasons. Work done elsewhere on the effect of soil temperature on seedling physiology and development suggests the temperature changes observed in this study are biologically significant—R.C. Dobbs and R.G. McMinn, Pacific Forest Research Centre, Victoria, B.C.

Height Growth of White Spruce Transplanted from BC/CFS Styroblocks.—At the Petawawa Forest Experiment Station, seedlings are being raised in BC/CFS Styroblocks (Matthews, Dep. Environ. Inf. Rep. BC-X-58, 1971) in conditions which provide accelerated rates of growth. The system is used to provide experimental stock for tree improvement research (Pollard and Teich, Bi-Mon. Res. Notes 28:19-20, 1972). In this program, seedlings are often transplanted from Styroblock plug moulds to plastic pots or nursery beds. In the research reported here, it was found that seedlings could be kept in Styroblocks to ages 3–13 weeks before transplanting without affecting subsequent height growth in the same season. However, height growth declined slightly if the seedlings were kept in the moulds beyond age 13 weeks.

White spruce [*Picea glauca* (Moench) Voss] seed of local origin was sown in the BC/CFS Styroblock 2 (40 cc per cavity, 2.7 cm spacing — 2.44 cubic inches, 1.1 inches). At weekly intervals (seedling age 3–15 weeks) 20 seedlings were transplanted to 300 ml plastic pots. A 3:1 mixture of peat and vermiculite was used in both Styroblocks and pots. The seedlings were grown in a greenhouse (16 hr photoperiod, 20–30°C) and were watered four times daily by an automatic nutrient feed system (Pollard, Can. Forest. Serv. Inf. Rep. PS-X-28, 1971). Height of all seedlings was measured weekly until they were 18 weeks old, at which time most of the seedlings had set terminal buds.

Table 1 shows the mean height for every second week of transplanting and measuring. Under these conditions, the seedlings may be transplanted between ages 3–13 weeks with no appreciable effect on subsequent height growth. Even those seedlings which were removed from the Styroblock in their first 6 weeks – before their root systems had formed a compact plug in the mould – were unaffected by transplanting. When 13 weeks old, shoots and roots of seedlings in the Styroblocks were very crowded and their branch and leader growth declined. Poor form and reduced growth of seedlings transplanted after this time are apparent (Fig. 1). Seedlings could probably be held in Styroblocks for longer periods in environments which do not provide accelerated rates of growth.

TABLE 1

Mean height (cm) of seedlings transplanted at ages 3–15 weeks. Standard deviation at 18 weeks = $< \pm 3.5$ cm.

Age when measured (weeks)	Age when transplanted (weeks)						
	3	5	7	9	11	13	15
3	2						
5	2	2					
7	3	4	4				
9	4	5	5	5			
11	7	7	7	6	8		
13	10	10	10	10	11	11	
15	14	14	15	14	14	14	13
17	17	17	18	18	18	17	15
18	18	18	19	19	19	18	16

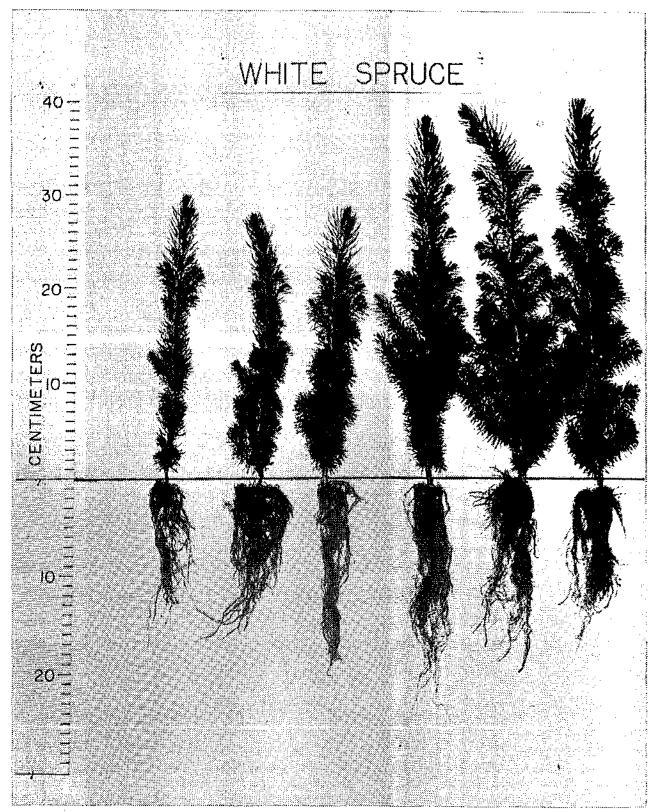

Figure 1. Seedlings transplanted at age 15 weeks (left) and age 9 weeks (right) showing poor branch development on former. Age when photographed: 22 weeks.

The wide latitude of age at which seedlings may be transplanted provides flexibility in designing experiments and constitutes a further advantage to this system of growing research stock. Although this system is used at Petawawa on a research scale, the results may have a broader interest to those growing seedlings in Styroblocks for reforestation purposes.—K.T. Logan, Petawawa Forest Experiment Station, Chalk River, Ont.

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