viously. Temperatures were measured with unshielded thermocouples (40-gauge wires) at 0.1 and 90 cm above the ground at hourly intervals between 9 a.m. and 4 p.m. on seven sunny days between June 11 and August 4, 1965. For simplicity, data presented in Fig. 1 show only three representative times: 9 a.m., noon, and 3 p.m.

The temperature data for all seven days and for paired plots were combined because of their close similarities. The arithmetic averages illustrate four differences between plots in the open without grass cover and plots under forest shade with grass: The forest shade alone reduced the average air temperature (at 0.1 and 90 cm) by 2.6° C between 9 a.m. and 3 p.m. This value is based on all hourly readings between these time limits. In addition, tall grass lowered air temperatures on the average by 1.1° C at 0.1 cm both in the open and under the forest. Air temperatures at this same level peaked just above 21° C at noon under shade while they did not reach their maximum (just above 24° C) till 4 p.m. in the open (Fig. 1). The rapid morning rise is probably due to the stand being open to the east, which permitted the sun to reach the ground. The afternoon drop is probably caused by the disappearance of the sun's rays. Finally, the temperatures over shaded and scarified ground (at 0.1 cm) were intermediate between those under tall grass and those over humus both under forest shade.

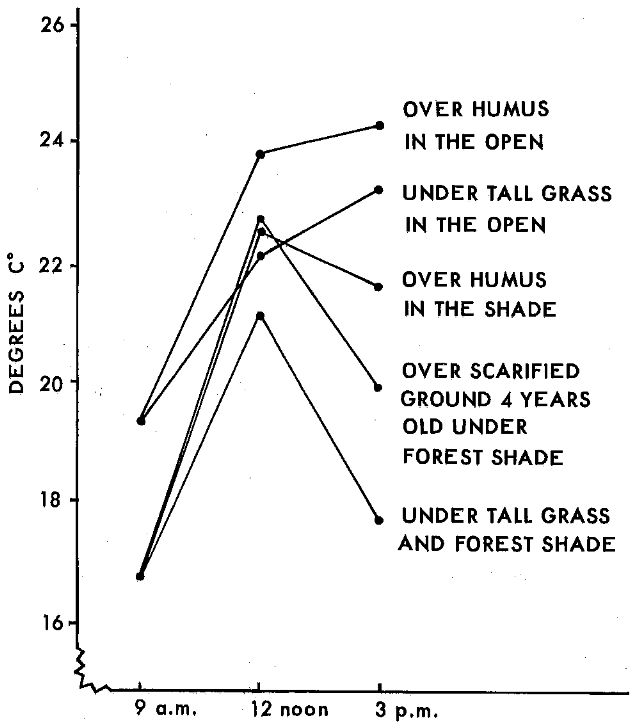

FIGURE 1. The influence of tall grass, forest shade, and scarification on temperatures 0.1 cm above the ground between 9 a.m. and 3 p.m.

The combined influences of tall grass and forest shade reduce air temperatures just above the ground by 3.7° C. This is of the approximate magnitude found by Geiger (1965). The temperatures would affect both germination (U.S.D.A., For. Sev. Misc. Publ. 654. 1948) and early growth of trees (Kramer and Kozlowski, Physiology of Trees, 1960) adversely because they did not reach optimal levels (between 25 and 35° C) for these phenomena in the open even on warm, sunny days. On the study sites, therefore, vegetation competition or shade lower air temperatures below the optimum for both the establishment and growth of white spruce. The forest cover is over twice as effective in lowering air temperatures than is lesser vegetation.—A. K. Hellum, Forest Research Laboratory, Calgary, Alta.

ENTOMOLOGY

Relation of Attack by Ambrosia Beetle (*Trypodendron lineatum* (Oliv.)) to Felling Date of Spruce in Central British Columbia.—In British Columbia, all the studies of *Trypodendron* attack in relation to felling date have been in the coastal forest where long growing seasons and mild winters are normal. The data presented here were obtained in central British Columbia, near Prince George where the growing season is relatively short and the winters cold. *Trypodendron* breeds in both climates but differences are apparent in the relationship of attack density to the felling date of logs.

During studies of *Dendroctonus* in white spruce, *Picea glauca* (Moench) Voss, trees were felled at each of two sites in May, July and September 1964, May and July 1965, and May and July 1966. The sites were 100 miles apart at Kerry Lake to the north of, and in the Naver Forest to the south of Prince George. The felled trees were cut into four 20-ft logs but a few logs were reduced in length to 14 ft or less. A glass-barrier trap was placed on each log of each tree and emptied at 2-week intervals. In August 1966, counts were made of *Trypodendron* holes in the wood where the bark had been removed on the shaded side of each log.

The long logs (14-20 ft) felled in July 1964 and 1965 were heavily attacked the following spring and large flight-trap catches were obtained at both the Naver Forest and Kerry Lake. The 1964-felled logs in the Naver Forest were also slightly attacked in 1964 (Table 1, flight trap records); the attack occurred in early August a few weeks after felling. Long logs felled in September and May at the same two locations were nearly free from attack during the year of felling and the following year. Flight-trap collections over these logs were also relatively small (Table 1).

TABLE 1

Attack density and flight number of *Trypodendron* related to the felling date of spruce in two areas of Central British Columbia.

Felling date of trees	Holes per square foot*		Beetles in flight traps					
			Naver			Kerry		
	Naver	Kerry	1964	1965	1966	1964	1965	1966
July 1964	18.2	25.6	116	492	—	2	888	—
Sept. 1964	0.0	0.8		27	—		52	—
May 1965	0.8	0.2		45	40		5	41
July 1965	23.0	24.8		2	479		3	307
May 1966	0.0	0.0			3			12
July 1966	0.0	0.0			0			0

*Means based on half-square-foot samples: 60 on trees felled in 1964; 40 on trees felled in 1965; 32 and 16 respectively on trees felled May and July 1966

The lack of attack on September-felled longer logs and the dense attack on July-felled logs indicated a difference from the attack preference shown by this insect on logs in the coastal forest where September-felled logs were densely attacked and July-felled were only slightly attacked. This may result from differences in the tree species, the climatic differences or a combination of both. It appears that in this climate only spruce trees felled well before the onset of winter are attractive to *Trypodendron* during the spring swarming flight. Short sections (3 ft and about 8 ft in length) felled in September and May were, however, frequently attacked during the first spring. Previous studies (e.g., Dyer, E. D. A., and J. A. Chapman. Can. Entomologist 97: 42-57. 1965.) have shown that short log sections become attractive more rapidly than corresponding long logs.

Winter felling and logging have been common practice in spruce stands of the Prince George District and would tend to minimize damage from ambrosia beetle attacks. Year-round logging, however, is now becoming more common and it is probable that summer-felled logs will be damaged if not utilized before beetle flight the following spring.—E. D. A. Dyer, Forest Research Laboratory, Victoria, B.C.