

Summary.—Pinhole and shothole borers must be looked upon as forest insects whose great increase in numbers is inevitably brought about by milling operations, particularly in Southland. The type of damage and method of attack is described and the loss caused is serious. An improvement in stacking methods which will isolate the timber for the most dangerous months of the year appears to be the most promising method of dealing with the problem.

SILVICULTURAL NOTES ON AN OVERMATURE BEECH FOREST.

By T. T. C. BIRCH.

The suppression of regeneration by overmature seed-bearers is well illustrated in the mixed beech forests on the slopes of Mt. Ruapehu. In Provisional State Forest No. 74, at an altitude of approximately 2,750 ft. a silvicultural unit was established during 1936 to coincide with a good seed year*. An area of 8.64 acres was demarcated, stock-mapped and classified as follows :—

	ac.	%
Area under canopy of overmature red beech ...	7.74	77.6
Area of beech pole-stands	1.36	22.4
Total area of virgin forest in Unit ...	6.08	100.0
Cut-over area prepared for seed reception ...	2.56	
Total area of unit	8.64 ac.	

This unit is typical of the surrounding forest which is dominated by 10-15 overmature red beech (*Nothofagus fusca*) per acre, fairly evenly spaced and forming a dense canopy. The almost complete absence of the middle age classes of merchantable red beech is characteristic of this forest. Beneath the veteran canopy trees (average D.B.H. 50-60 ins. and 100-150 ft. high), a lower storey of suppressed and malformed silver beech (*Nothofagus Menziesii*) usually occurs ; in this locality silver beech, unlike red beech, is outside its optimum range and by reason of its heavily branched and short-boled form, is usually an undesirable component of regeneration groups. Matai (*Podocarpus spicatus*) miro (*Podocarpus ferrugineus*) and Hall's totara (*Podocarpus Hallii*) also occur sporadically.

Although the shade cast by the upper canopy of veteran red beech is considerable, it is rarely sufficient to prevent the germination of beech seed, young seedlings being found in varying densities throughout the stand, usually beneath a dense ground covering of *Coprosma tenuifolia* and *C. foetidissima*. Groups of regeneration

* A note on the 1936 Seed Year appears elsewhere in this issue. [Ed.]

occasionally reach the pole stage but become suppressed and stagnant as they approach the upper canopy ; more commonly, however, beech regeneration, in all but the seedling stage, is absent and *Coprosma* thicket completely dominates the forest floor. The proportion of virgin forest in this experimental unit, dominated by overmature red beech, is 77.6 per cent ; the remaining 22.4 per cent. being occupied by sapling or pole groups which develop rapidly in the gaps created by the fall of veteran seed-bearers ; these regeneration groups are approximately even-aged and are of great density, suppressing all other ground vegetation.

The above proportions are probably representative of the greater part of this forest which may be described as in a stagnant condition.

Assuming that maximum productivity is the object of future management, it is evident that the slow natural process of displacement of veterans by wind and decay must be accelerated by silvicultural treatment, the guiding principle being the release from suppression of young regeneration. Alternative measures are :—

(1) Improvement fellings, involving the removal of veteran seed-bearers.

(2) Killing of veteran seed-bearers *in situ*. (ring-barking or poisoning).

Portions of the unit were subjected to (1) and (2) respectively, and although no discussion on the merits and demerits of these treatments would be complete without reference to the utilization of improvement fellings (and alternatively the waste of produce inseparable from ring-barking or poisoning), these preliminary notes will, on the plea of brevity, be confined to a few silvicultural issues.

(1) **Improvement fellings.**—The felling of ten overmature red beech in an area of approximately 2 acres did not cause a great deal of harm to surrounding regeneration due partly to careful selection of the direction of fall and partly to the stagheaded nature of the crowns. In spite of all reasonable precautions, however, splitting, stacking and the extraction of timber by caterpillar tractor caused very considerable damage to the undergrowth, in many sites laying bare the mineral soil. Consequently it was decided to leave standing a small proportion of the seed-bearers to restock the denuded areas ; this precautionary measure was fully justified for in the following spring a dense crop of beech regeneration was in evidence in the clearings. It appears to be certain that in the absence of a seed year immediately following an improvement felling of this type, serious obstacles are placed in the way of an adequate restocking of beech regeneration. Thus, adjoining the unit a number of large red beech were felled for firewood in 1932 ; at the present time (4 years after this operation) the clearings are occupied by a dense thicket of fern (*Pteridium esculentum*) lawyer (*Rubus australis*), Californian thistle and many other exotic weeds, whilst beech regeneration is scarce and



Photo : T. T. C. Birch

Portion of red beech (*Nothofagus fusca*) forest after improvement felling. Stump of overmature red beech in background, surrounded by red beech saplings.

heavily suppressed in spite of the fact that sufficient seed-bearers were left standing. The exposure of the soil which inevitably follows utilization operations, appears, also, to be desirable silviculturally only if it can be proved that beech regeneration is able to survive the first critical seasons without shelter.

In that portion of the unit which was heavily cut-over only two years previously, light cultivation of clearings with drag rakes during seed-fall provided good seed-bed conditions ; this operation, which was done at small cost, not only checked the early establishment of weed species but also broke up the hard exposed surface of the mineral soil for the better reception of seed.

(2) **Killing of veteran seed-bearers in situ.**—Ringbarking or poisoning trees for the improvement of a stand has long been practised in tropical and sub-tropical forests. The chief advantages are :—
(a) Elimination of unmerchantable* trees, with the minimum of damage to ground vegetation and (b) Small cost factor.

In the forest under review, beech regeneration is generally present beneath the secondary shelter of *Coprosma* thickets and with the increased light following the gradual removal of the upper canopy it would be reasonable to expect the rapid development of the suppressed beech seedlings. One factor, however, prevents the writer from being entirely sanguine about the results of ringbarking in this locality. Beneath the dense shade of the veteran trees the layers of humus and organic debris are often exceptionally thick and it is significant that the beech regeneration growing under these conditions is almost entirely in the seedling stage. It is suggested that the apparent failure of previous seedling crops to survive and develop into saplings is due to a lack of sufficient moisture in the layers of only partially decomposed leaf mould. This theory is supported by observations in sites where regeneration is definitely established ; here the humus is relatively shallow, offering to the seedling roots easy access to the mineral soil. (In this connection it is of interest to record that *Lagenophora petiolata* and *Nertera dichondraefolia* are fairly constant indicators of conditions which are suitable for beech regeneration ; these two small plants require a fair degree of light and invariably occur in association with beech seedlings in sites where the mineral soil is close to the surface). The removal of the upper canopy would probably accelerate the decomposition of accumulated organic debris where this is excessive, but would, by the same token, first cause markedly drier conditions on the forest floor, the latter factor being definitely detrimental to seedlings dependent upon moisture retained by the humus layers.

Thirty-one overmature red beech were ring-barked in an area of approximately 5 acres ; these trees yielded their last heavy crop of

* The overmature red beech in this forest are unmerchantable for milling purposes, owing to the extent of heart-rot, but yield a considerable volume of split and hewn timber.

seed during the same season, resulting in prolific germination. Subsequent observations on the degree of survival under the altered conditions should provide evidence of considerable value.

Establishment of regeneration.—As a result of the seed-year of 1936, prolific red beech germination occurred throughout the range of that species, practically regardless of soil or light conditions. During the early summer, regeneration was as dense on mineral soil exposed to direct sunlight as on deep (and as yet moist) humus beneath the dense shade of the overmature seed-bearers. An excellent opportunity has thus been provided within a silvicultural unit for initial observations on the "survivability" of red beech regeneration under a wide range of conditions : indeed, the successful treatment of this type of forest will depend primarily upon the solution of the following problems :—(a) To what extent does beech regeneration require cover during the period of establishment ? and (b) To what extent is the value of cover dependent upon the nature of the seed bed ?

It is fairly safe to assume that a heavy mortality will eventually occur in the seedling crop situated on deep humus, for reasons suggested in an earlier paragraph ; similarly, dry summer conditions are likely to cause the death of a large proportion of seedlings growing on mineral soil in exposed sites. At this comparatively high elevation, the effects of frost is also an unknown factor. Probably ideal conditions for beech regeneration are briefly, a seed-bed composed of a thin covering of moisture conserving plants such as *Lagenophora*, *Nertera* and mosses, in close contact with the mineral soil, shelter being provided by a lower storey of shrub species (*Coprosma*, *Myrtus*, etc.) of medium density. Such conditions are obtainable in this overmature red beech forest, provided a solution can be found to the problem of excess humus,—a problem which appears to be by no means insurmountable.

1936 SEED YEAR.

An exceptionally heavy crop of seed was produced by most native trees and shrubs, and from a number of exotics, during the past season. With the exception of kauri, all the native conifers had exceptional crops : kahikatea was most conspicuous on account of its large fruit ; rimu also bore a large amount, and its arils were unusually well developed, at least in the vicinity of Wellington. All species of beech were conspicuous among the hardwoods. Among the exotic forest trees many which mature their seed in one year bore heavily.

In seeking the cause of this abundance of nature, climatic factors suggest themselves. Forestry and botanical literature contain references to the effect of drought in stimulating the formation of flower