

clearing and even planting. There is wide scope for ingenuity in circumventing the bottle neck of limited and costly labour without sacrificing our standards. I may call down the wrath of our fire protection experts in suggesting that fire is still one of our best tools when used properly.

After half a century of planting we may be prone to assume we have thoroughly tested all the exotic species worth considering. But are there not some niches inadequately filled: a sufficient range of species for the areas of highest rainfall, and tolerant trees that might be introduced into some of our inferior pure pine stands? Insects, diseases and soil deterioration will necessitate our reconsidering mixtures.

We are apt to deride the work of our predecessors, though they created great assets. Their errors were mainly in policy, for which the field man could not be blamed. We are much better off than they: there is a vast accumulation of evidence in the forests themselves, while we also have the aid of organised research and training. But we have a long way to go in bringing New Zealand's exotic forest estate to the stage where it can best serve the needs of the country as a whole.

REFERENCES

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SOME VEGETATION CHANGES FOLLOWING A CROP OF 23 YEAR OLD *PINUS RADIATA*.

By J. E. HENRY

(Paper read at Annual Meeting)

Plant succession is normally a slow process, but occasionally interruptions occur which upset the normal trends. Such an interruption took place when pine trees were planted in the pumice areas, and the purpose of this paper is to put on record a change of vegetation that occurred following the growing and harvesting of a twenty three year old crop of *Pinus radiata*. The change has influenced the re-establishment of pines on the areas concerned and for this reason is of interest.

On the pumice soils of the Rotorua-Taupo area three site classes for *Pinus radiata* have been defined. These are Site Class I—tall

teatree, tutu and other broadleaves, and heavy bracken fern ; Site Class II—smaller teatree and lighter bracken fern and Site Class III—tussock and monoao. The area to be discussed is near Tokoroa and it was classed as a typical Site Class III one. It is relatively flat and lies between 1150 and 1200 feet above sea level. The soil was well compacted water washed pumice which showed little or no humus layer and because of the drainage of cold air on to the flats was subject to severe frosts, and to sufficient frost heaving to lift small plants and planted trees out of the ground. The vegetation prior to the planting of the pines was mostly scattered tussock and monoao interspersed with lichen and scabweed and very occasionally scattered, stunted bushes of teatree. There was no sign of any ferns or broad-leaved shrubs and in many patches there was no plantcover at all.

When the *Pinus radiata* was planted in 1925 it was severely damaged by frost and much blanking was necessary to fully stock the area. Attempts were also made to grow poplars on the area but the frosts were too severe. The pines eventually grew and at age twenty two averaged 90-100 feet in height and 12 ins. DBH. There were about 350 trees per acre of which some 50% were malformed mainly due to early frost injury. In 1948 the area was cut over and it was decided that as this was not goodtree country the area should be turned into farms. No further interest was taken in the area until 1951 when it was noticed that the natural regeneration of pines was sufficiently widespread to warrant investigation. A survey showed that most of the area was adequately stocked.

To further this study three old sample plots were relocated and careful note taken of the vegetation growing on them. It was found that in the gaps in the pine regeneration, in place of tussock and monoao, there was bracken fern up to six feet high, other ferns such as *Paesia*, *Histiopteris*, *Blechnum*, *Dicksonia*, and Yorkshire fog, white clover, a few scattered *Coprosmas* and a host of annuals, together with a few tufts of the original tussock, in all, providing a complete plant cover over the ground. Examination of the pine regeneration showed the trees to be of fair quality, vigorous and healthy and could not be described, as were the young trees of the first crop, as "very unhealthy, very few trees of normal development. Most of the stocking suffering from fungi and/or aphid damage."

The factors which have allowed these plants to replace the original ones appear to be:—(1) The formation of a humus layer which protected the soil surface from the frost, prevented the drying out of the soil surface during the summer, and retained a greater amount of moisture as well as providing plant nutrients. (2) The aeration of the soil through the cavities left by the decayed roots ; and (3) The scattered trees left standing assisting in the breaking up of the frost complex. These have altered the ecological conditions

to a degree that would have taken the interrupted plant succession at least one hundred years and probably more to bring about.

These changes have been to the good and have made the conditions suitable for the regeneration of *Pinus radiata* without allowing the competing vegetation to become strong enough to have an adverse effect on the pines. This is an occasion when the changes have been to our advantage. There will be changes also on the better sites and on these foresters will need to keep a watchful eye in case the bracken and other ferns are stimulated to a stage where their competition will have a detrimental effect on regeneration of forest trees.

SOME CHARACTERISTICS OF PINUS RADIATA THAT CONTRIBUTE TO ITS IM- PORTANCE IN AFFORESTATION IN OTAGO AND SOUTHLAND.

By C. R. CRUTWELL

(Paper read at Annual Meeting)

The object of this paper is to discuss some characteristics of *P. radiata* which contribute to its importance in Otago and Southland. The six features to be described are not given in order of their importance, nor are they put forward as being the only special attributes of the species.

(1) The relative immunity of *P. radiata* to serious damage by vermin. This is an attribute that may prove to be indispensable in western Southland because in that region very serious damage has been done to species that are in other respects well suited to our requirements. Such damage may be considered under the following three classes :—

- (a) **DAMAGE TO PLANTING STOCK :** Deer, rabbits, and hares may be expected to bite off leading shoots of almost all species. Therefore, the tree that quickly grows beyond their reach always suffers the least. In this respect *P. radiata* is far more suitable than are most species. Deer in western Southland are menacing beech forests to an extent that should emphasise the value of less palatable exotics in the role of alternative timber resources that might be used until deer are adequately controlled. Only at that very uncertain date in the future, will a serious obstacle to management of hardwood forests be removed.
- (b) **DAMAGE TO SAPLINGS :** *P. radiata* saplings are rarely damaged by browsing. While this is true of most species of pine,