

alone is put down by Dr. Hopkins at the sum of £20,000,000 sterling annually, and the timber destroyed by fungi will more than double these figures—and that for one single country alone. Facts such as these should impress on any one the great necessity of disease-control in forests. Especially is this so in artificial ones, which naturally involve the expenditure of large sums of money before any return can be expected from them. The protection of a crop up to the point of harvesting is one of the fundamental principles of agriculture. This is even more important with regard to forests, as they are the slowest of all crops to mature, and their destruction by disease involves not only the loss of the money that has been expended, but also the labour of many years.

#### THE DAMAGE CAUSED BY DISEASE.

The diseases of forests are caused by both insect and fungi, each class being of equal importance so far as its destructive effects are concerned.

It has been conclusively demonstrated that certain species of both insects and fungi are the direct cause of the death of forest trees of all ages, and that from time to time they increase to such an alarming extent that their depredations assume the character of a destructive invasion, which may result in the death of a large percentage of the best timber over thousands of square miles. At no period in the life of a forest are the trees secure from attack. In general, however, it can be stated that the greatest losses may occur when they are attaining maturity. Full-grown trees are naturally of less vigorous growth than younger ones, and they have not the same power of recovery from infection. Certain diseases, however, on the other hand, are of danger only when the trees are small—there are, in fact, a succession of diseases, each of which may be of some particular significance right from the sowing of the seed to the cutting of the mature timber. Although tree-planting has been undertaken for many years past in New Zealand, it has, with the exception of the work of the Forestry Branch of the Department of Lands and Survey, been in the nature of comparatively small and isolated plantations, which give no indication of the diseases that will have to be feared in extensive forests composed of in many cases pure plantings of a single species. The example of the gum-tree scale (*Erilococcus cortaceus*) in the blue-gum plantations of the South Island, where very extensive damage has been done, shows that it is not to be expected that our artificial forests will be in any way less liable to the attacks of disease than is the case of other countries. In fact, so far as plant-diseases are concerned, the conditions in New Zealand seem to be especially suitable for their development. Although the vast majority of our most serious ones are of foreign origin, it must be remembered that this is all the more significant when it is considered that our tree-planting is almost entirely confined to exotic species. The destructiveness of any particular disease cannot, however, be gauged by its effects in other countries, for in many cases diseases of comparative insignificance in their original home have become in New Zealand of prime importance. The reverse is often the case; many serious diseases of other lands when imported here seem to be of little importance. The San Jose scale in certain countries, one of the most dreaded of destructive insects, is a case in point.

#### DISEASE-CONTROL IN NATURAL AND PLANTED FORESTS.

There is a great and essential difference in the action of diseases in natural and planted forests. This is, in the main, due to the fact that the trees comprising the natural forest vary greatly in age, and that the individuals liable to attack may be quite widely separated from each other; whereas in planted trees whole blocks will be composed of individuals of the same age. Thus in many cases a disease-invasion in a natural forest may result in only a percentage of the trees being immediately destroyed, but the variation in the size and age of the trees is likely to cause them to be gradually destroyed, and each year a certain number will die. In planted forests, disease attack, owing to the uniform growth of the trees and the equal susceptibility of the individuals to infection, may result in the entire destruction of the whole plantation within a very few years. This has been well shown in European forest plantings, where whole forests of larch have been swept away through the attack of the larch-canker. In New Zealand, owing to the fact that our natural forests do not in the majority of cases reproduce themselves after lumbering, and are in consequence annually diminishing, disease-control will in future years be confined almost entirely to our planted areas, and their adequate protection will become one of the most important problems in our forestry operations.

#### PRESENT CONDITION OF THE PLANTATIONS.

The plantations under the supervision of the Forestry Branch, although all of recent origin, the oldest being not more than twelve years' growth, already comprise many thousands of acres. So far, the main planting has taken place on the pumice lands of the Rotorua district, but there are extensive areas under trees in the South Island, notably at Hanmer, and in the vicinity of Tapanui.

Recognizing the importance of disease-control, the Under-Secretary of Crown Lands desired me to inspect the various plantations in both Islands, and report on their present conditions so far as the presence of injurious insects and fungi are concerned. Accordingly, during the past summer I have visited the main plantations and nurseries where the trees are grown prior to being planted out. As one of the main branches of forestry operations at present is the production of the young trees from seed, the prevalence of disease in the nursery beds may well be dealt with first.

#### ROTORUA NURSERY.

The nursery at Rotorua is remarkably free from any very injurious diseases, as the small percentage of losses amongst the seedlings amply testify. The main trouble that has to be contended with is the