## FOREST-TREE GROWING IN THE ROTORUA DISTRICT.

## (By H. A. Goudie, Superintending Nurseryman.)

This article is intended to encourage tree-planting, and it should therefore be remembered that Rotorua is 1,000 ft. above sea-level, and is subjected to extremes of temperature that have caused the failure of many of the species tried. Many intending planters may have a less trying climate to contend with, and a failure of a species at Rotorua does not necessarily mean a failure with them. Our operations will at least give an idea of the hardiest species, as well as a list of the most useful ones. Although failures have occurred at Rotorua, it must not be concluded that the district is unsuitable for afforestation work. On the contrary, those species which we now grow extensively make an annual growth that is not exceeded in any part of New Zealand.

To grow good crops a farmer endeavours to keep his land in good condition by ploughing and cultivating. Land not in use is ploughed and left in the rough state in order to catch all the rain that may fall, and the moisture thus got is retained by frequent applications of the harrows, which causes the surface soil to become dry, and thus act as an insulator in preventing the evaporation of the moisture from the subsoil. Land thus treated, too, is porous, and the roots of the crops grown thereon can easily penetrate it, and reach the stored-up moisture. In forestry operations, such preparations over large areas are too expensive, and when the trees are a few years old, quite impracticable. The forester, however, attains the same result in another way. The soil is protected from the sun and wind as quickly as possible by close planting. In a few years' time the land is covered with a layer of leaves, which allows the rain to penetrate the soil without making it too compact; it is thus kept in a porous condition, and gets the full benefit of the rain and air.

The protection of the soil, then, is one of the principal reasons why trees meant for the production of timber are planted closely. The density of planting varies considerably in different countries, but in New Zealand it has been found that 4 ft. is a suitable distance for most of the pine family. Close planting is also essential for the production of clean straight timber, in that the lower branches become suppressed, wither, and drop off, leaving the trunk quite clean. The lateral growth never really attains a sufficient size to cause a knot in the timber. As a young plantation grows the branches of the trees gradually interlace, so that in time the whole of the land is covered by an uninterrupted canopy of foliage, under which will be found the withered remains of any weed-growth that may have occupied the land before it was planted. This canopy should be maintained throughout the life of the plantation, and kept uniform. Up to a certain age it is found that every tree appears to be thriving and forming new wood annually, but there comes a time when some of the trees are overtopped by others, and are gradually being suppressed for want of light. All the suppressed or dominated trees should then be removed, provided their removal will not cause an interruption in the canopy. The functions of the canopy are the protection of the soil or forest-floor from the drying effects of the sun and the wind, thus conserving the moisture in the soil for the use of the trees, preventing washing away of the soil by breaking the force of heavy rains, and manuring and enriching the soil by depositing leaves which decay and supply food for the trees. The most important function of the canopy, however, is the fixation of carbon.

Trees, and, in fact, most plants under the action of sunlight, collect through their leaves the carbon-dioxide from the atmosphere, and this carbon-dioxide is assimilated by the leaves, and eventually becomes what is known as wood. The process of taking in carbon can only go on under the action of light; hence a tree that has few leaves, or one that is shaded, cannot obtain much food from the atmosphere, and therefore its growth is small. The production of wood is in proportion to the leaf-space of the tree. Light is necessary to all trees, but it is known that some trees are more light-demanding than others, and on account of this peculiarity foresters have divided them into two classes—light-demanding and shade-enduring; and, again, under each of these classes trees have been sorted out in their relative positions. The light-requirements of the various species of trees must be taken fully into consideration in forming and attending plantations. Light-demanding trees thin out at an early age, and do not give sufficient protection to the soil, so that they should either be mixed with a shade-enduring species or underplanted with a shade-enduring species of trees that have been thinned. A list is appended heretc which shows the different species of trees that have been tried in the Rotorua District, and a glance at this list will show that very few of the economic trees that would be likely to succeed have been neglected.

Yet when we peruse this list it is astonishing how few of those tried are really suitable for extensive cultivation in this district. It will be noticed that almost all the deciduous hardwoods have failed, and these species include some of the most valuable timber trees. A general reason can be assigned for the failures amongst this class, and that is, unseasonable frosts. The temperature in this district not infrequently goes as low as 17° Fahr. during the months of July and August, but this does very little damage, if any. If, however, frost—even 2°—is registered in November, the deciduous trees suffer severely, and as these spring and summer frosts come regularly every year, the trees never get beyond the bush stage.

Extensive experiments were made with *Catalpa speciosa*, but at the present time not a single tree is alive to give evidence of these experiments. The same results are recorded against oak, sweet chestnut, Robina, hickory, butternut, black walnut, English ash, and sugar-maple. The common walnut failed in most localities, but on two small blocks of land on which the bracken grows to a height of 6 ft., these have done passably well. The expense, however, of protecting the young trees from injury by the bracken is very heavy, and it is doubtful if it is a good policy