

NATIVE VEGETATION AS A SOIL FORMING FACTOR IN NORTH AUCKLAND.

(Abstract of Talk by Mr. N.H. Taylor of the Soil Bureau on 21st October, 1946.)

INTRODUCTION.

Dr. Jonny of California, in his textbook, "Factors of Soil Formation" draws attention to the difference of opinion which exists among pedologists as to whether vegetation is an independent variable in soil formation. North Auckland provides some evidence on this question.

In the course of time a rock weathers to form a skeletal soil which is influenced by climate, topography and soil life, part of which is the vegetation. Living organisms, by using parts of the soil as food, prevent these materials from leaching out and draining away as they otherwise would. All plants are not equally efficient; those that take most from the soil also return most to it and so keep it fertile. Rapid leaching is favoured by high rainfall, open soil and rock, and low fertility demanding plants. Where a rich litter is formed it breaks down quickly and returns fertility to the soil. Slope affects soil formation; on a steep slope, for instance, the surface is constantly eroded away, weathering of the underlying rock is also continuous, and a skeletal soil rather uniform throughout is the result.

THE SOILS OF NORTH AUCKLAND.

A map showed the soils of North Auckland. These include sands that are easily altered by vegetation, clays that are slow to change, and some peat. There are sandstones and mudstones, limestones with high reserves of fertility, greywacke of medium fertility that gives rise to clays, and acid, intermediate, and basic volcanic rocks.

Rainfall is usually 60-70 inches, in places 100 inches; the mean temperature is around 57°, and the altitudes are moderate, Tutuoko plateau (c. 2000 feet) being the highest part. Topography varies from steep hills to gently rolling country. The primitive vegetation included dicotylous forest, a mosaic forest with much kauri and various podocarps.

INDIVIDUAL TREES AND THE SOILS THEY FORM.

Cockayne contrasted shade-tolerant with shade-intolerant tree species, and suggested that where kauri and taraire grow together the taraire, being shade tolerant in its juvenile stages, may come to dominate the climax vegetation.

The pedologist groups trees rather as high fertility demanding and low fertility demanding species. Trees demanding high fertility produce rich sweet humus - mull; for example tree litter under puriri and taraire has a pH of 6.2 and 5.8 respectively. Coastal forest is usually mull-producing. A section or profile of soil under taraire shows no great change with depth, the humus being fairly uniformly incorporated to a considerable distance below the surface.

Trees tolerating low fertility, on the other hand, produce a sour humus - mor. In kauri forest this acid humus (pH about 4.2) lies on the surface of the soil without becoming much incorporated in it. Near trees the humus may form mounds up to ten feet thick, and elsewhere a layer eighteen inches to two feet deep. Similarly under rimu the humus is mainly outside the actual soil. The soil then becomes leached since the trees do not return food into it. In this way a podzol develops, with light powdery sand near the surface. The lime washes out downwards, and then the iron and alumina move down to form a hard layer known as a clay "pan", leaving only a siliceous skeleton of the original yellow earth. A characteristic white ash layer develops, through which the humus runs in solution, and precipitates above the iron pan. Below the pan is the clay, loose sand, or sandstone from which the soil was originally produced. Tree roots do not easily penetrate a pan and a big tree may have a widespread flat root system that goes only a foot or so into the soil. It is then easily blown over, and widespread wind-damage of this kind may explain the presence of extensive gum lands that seemed to be typical of even primitive North Auckland. Fires, either man-made or begun by lightning, also undoubtedly helped to clear trees from some gumlands where now stunted scrubby vegetation grows on strongly podzolized soils. Where sluicing is used to recover buried kauri gum, stumps and roots tell something of the original forest.

On some rocks podzols can develop on quite a small scale; e.g. a slide showed a section of an eggcup-shaped podzol, complete with its own pan, and only a few yards across, left by a single kauri estimated to be only about 300 years old, growing on coastal sands. On greywacke, on the other hand, a kauri 5-6 feet through has not yet produced a podzol because there the clay soil is more fertile and less permeable; the rate of podzolization depends on the fertility reserve of the soil and how freely it drains.

FOREST AND SOIL MOSAIC.

New Zealand trees do not produce pure stands especially on hilly country; "kauri" forest is usually a mosaic. The convex slopes and ridge tops where light is strongest favour kauri, concave slopes are more suited to shade-tolerant trees. Natural erosion oversteepens slopes, slips follow and give advantage, even on these slopes, to light-demanding trees like kauri. In such places podzolization proceeds only slowly, but the soil pattern tends to follow the forest pattern which is itself controlled by climate and topography.

Near Whangarei, on greywacke the ridge tops are podzolized with kauri while the rest is in broad-leaved forest; but once off the greywacke on to yellow claystone, even steep slopes are podzolized and taraire, etc., appear only in real gullies.

EFFECT OF SOIL FERTILITY RESERVE ON FOREST.

In places the parent rock, through the soil fertility reserve, controls the type of forest. An example was shown near Mangawai where poor claystone country colonized by kauri surrounds a basalt area which carried a forest of taraire, kohokoho, etc. Here is a sharp-edged control of vegetation by the parent rock factor.

Again, near Broadwood, where there are basic igneous rocks on steep slopes or sandstone under hilly rolling country, the forest is predominantly of broad-leaved trees, but on poor claystone is kauri-podocarp with well-developed podzol.

VEGETATION AS AN INDEPENDENT VARIABLE.

Some other factor is at work where, as at Patana near the coast, there are areas of poor quartzite, poor claystone, andesite, and greywacke. The kauri occupied the inland belt where it formed podzolized soils, but it did not usurp the coastal claystone which here carries typical broad-leaved coast vegetation.

Contrasting with the cases where the limits of one kind of parent rock coincide with changes in kind of forest are others where forest remains uniform right across the boundary between two different parent rocks. At Puhipuhi a basalt plateau abuts on poor quartzite. Kauri forest covers the quartzite but extends also on to the basalt where it seems to have successfully invaded a mosaic forest of which parts are held by taraire. The basalt soils do not podzolize but become leached and nodular under the influence of kauri.

At Waipoua the western portion is of easily altered sand, the rest on semi-basic igneous rock with a good fertility reserve. In the part examined by Cockayne the kauri was mostly of one age and was going down before broad-leaved trees. From the podologist's view point it appears that kauri must once have been dominant all over the sandy part - stumps and gum as well as the soil developed support this - and there is still a remnant of kauri on the sand. From there the kauri invaded the high fertility soils to the east and forced back the broad-leaved forest. The kauri destroyed itself on the sand through extreme podzolization of the soil, and so reduced its pressure on the inland parts (through lessened seed supply?); now it is likely to give place again on the high fertility soils to the broad-leaved forest.

These cases illustrate that vegetation can be an independent variable and that the soil pattern can develop according to the vegetation pattern alone.

DEGENERATION AND REGENERATION.

It has been shown that yellow earth produced under the mull-forming trees is degenerated to a podzol where invaded by mor-formers. The reverse can take place where podzolization is not well advanced, and this is of special importance to the forester. The difficulty of regenerating a mature podzol however, appears to give a decided advantage to the mor-forming trees.

In North Auckland there are 1600 square miles of well-drained easy rolling land underlain by sedimentary rocks; of this 1100 square miles is podzolized (860 sq.miles strongly, 230 sq.miles weakly), while much of the remainder was dominated by coastal forest. This evidence alone suggests that when man came to New Zealand it was the kauri-podocarp species which were the aggressive ones. The power they possessed of depressing the fertility of the soil below the level at which the broad-leaved trees are vigorous competitors offset the latter's advantage in possessing shade-tolerant juvenile forms.

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ESMOND ATKINSON: ARTIST AND BOTANIST.

Esmond Atkinson will long be remembered by those who know him and his work as one who loved the scenery of his country, and sought to preserve for us some glimpses of its beauties as he saw them through the eyes of an artist. Botanists too will continue to value the faithful drawings he made of plants of special interest, combining truth of detail with appreciation of form.

All will welcome the tribute to his memory edited by John L. Moore and reproduced in excellent style by A.H. and A.W. Rood. The book contains extracts from Atkinson's letters and reviews, 16 plates in colour, 15 in half-tone, and 6 botanical drawings. Those who know the scenes he depicted will be gladdened by the quietly appealing charm of "Waimakariri River", "Lake Taupo", "Cora Lynn", "Lake Brunner" and many another from the painter's gifted brush.

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THE GARDENING CIRCLE.

A real inspiration for the coming year was given to gardening members who were fortunate enough to be present at the Society's lantern lecture evening given by Mr. George Simpson of Dunedin on February 21st.

These glimpses of some of our South Island mountains were entrancing, with their far flung riotous acres of natural flower garden. *Colmisias*, - miles of them; *Ranunculus Lyallii* and stone-loving *Buchanani* - two of the loveliest. *Veronicas* or *Parahobos*, *Curisias* and showy *Aciphylla*; beautiful carpets and cushions of *Raoulia*, *Phyllachne*, *Drapetes*, *Pygmaea* - all of these plants and many others massed together in places, were gardens indeed. Perhaps as we learn to understand the needs of our beautiful and unique mountain plants, they too may have a place in the home gardens of their own country and cause much astonishment and delight. That it is possible to grow many of these mountain plants on the lowlands, with care and the right conditions, has already been proved by gardening botanists, such as Dr. Cockayne, Mr. Scott-Thomson, Mr. Brockie and Mr. Simpson himself.

Many *Colmisias* we know can be grown on the lowlands, and Mr. Simpson told us that *Ranunculus Lyallii* could be successfully grown even in hot dry country, with broken stone placed on the surface to prevent the sun drying the roots.

We are very grateful to these botanical enthusiasts for the privilege of seeing these really magnificent slides, together with much useful information regarding their growth and the general state of the high country, especially when we realise the difficulties under which these pictures are taken.

We have much fresh seed available just now - *Colmisias*, *Xoronoma*, *Libertia*, *Meryta Sinclairii*, *Leucopogon Fraseri*, *Brachycome Thomsoni*, *Glenatis afoliata*, and *indivisa*, *Chordospartium Stevensonii*, *Microtis uniflora*, *Gastrodia Cunninghamii* - to mention just a few.

Mrs. W.W. Samson.

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