SOIL SURVEY I N HAWKES BAY.

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INTRODUCTION.

The Soil Survey in Hawkes Bay was commenced in November 1935 with the object of providing, a basis for land utilization studies of value both to farmers individually and to the community as a whole. Hawkes Bay covers an area of over 5000 square miles so that the work is of regional extent,

From the beginning we met with difficulties which had to be overcome, How detailed should we make the soil survey? The economic ideal was to indicate to each farmer all the types of soil he had on his property, and we adapted cur methods to come as near that as is practical. What rocks gave rise to soils in the province and where did they occur? We did not know but with the help of the Geological Survey we identified them as we worked. What was the topography of the country? We had no topographical maps and we had to find out, so aerial photographs were taken by Mr. Van Asch of Hastings and later by the Defence Department. What was the climate of the district? Dr. Kidson of the Meteorological Office assembled his data for us. How did the climate affect the soils? again we had to find out. What soils were present in the province and what were their- physical and chemical properties? That was the routine work we had to do.

DESCRIPTION OF AREA COMPLETED.

During the last 1.8 months field and chemical investigations have been carried out over 5000 sq. miles south of the Napier - Taihape road and over that area these questions can now. be answered.

Three distinct topographical and geological units exist, -

(1) Western Ranges and rolling country,
(2) Central Plains and
(3) Coastal belt of steep and rolling country.

(1) The western ranges are formed of the indurated sandstones and mudstones called greywacke and argillite and these rocks contain a considerable amount of volanic ash. Ancient gravels, sands and silts derived from them form the rolling country on the eastern flank of the ranges and narrow belts north and east of the central plains. Volcanic ash showers of pumice and andesitic ash derived from Taupo and Tongariro' respectively cover the northern portions of these ranges from a line drawn west of Hastings, and also the limestone, mudstonc and sandstone beds in the high country northwest of Napier, The rainfall over the southern portion of the ranges which was formerly in forest rises from 60 in. to over 80 in,, but over the rest of the belt the rainfall is 50 to 60 in.

(2) The Central plains stretch from the southern boundary of the province to north of Tikokino. They include the Takapau plain& whioh are derived from greywacke gravels, sands, and silts, but a few miles south of Dannevirke mudstone and sandstone alluvium

is incorporated with the greywacke, and the plains are more fertile. The rainfall is mainly between 40 and 50 in.: south of Norsewood and on the extreme west of the plains where the rainfall rises to 50 in. to 60 in, ,forest formerly flourished,

(3) The Coastal Belt contains the fairly steep Co rolling country west of Napier and along the coastal half of the Province, and formed of mudstones, sandstones and limestones. In general, the rainfall is below 40 in. except over the high limestone country west of Waimarama where the rainfall rises to 70 in.

The vegetation of the area was mainly fern, etc. except on the Kaweka and Ruahine Ranges and a few of their foothills and adjacent plains, and on the 40 mile bush belt stretching south of Norsewood. A small area of forest also grew west of Te Auto.

In Hawkes Bay soil types are mapped on the scale of 1 mile to an inch, A specimen map is exhibited. The work that has been completed has shown the main soil types likely to be encountered in the province and the soil processes under which these types were developed. Parent rock topograph vegetation and climate usually govern the characteristics of the soil profile and in Hawkes Bay where the soils are in general very young, parent rock is chief among these factors. In fact different classes of parent material give rise to distinctive groups of soils.

Where the topography is gentle the soils are subject to the fullest influence of rainfall and leaching or the downward movement of certain materials has its greatest effect, However, extreme chemical leaching such as that found in North Auckland, does not take place in the area described. Where the slopes are steep or well developed profile is rare in Hawkes Bay because constant slumping under the rainfall conditions of steep country, causes fragments of the parent rook to be distributed throughout the profile, keeping it fertile and undeveloped.

The effect of vegetation upon soil types is most striking in the case of forest. On the light soils of the brown loam group adjacent to Dannevirke, the humus formed beneath the forest cover has raised the fertility to a high carrying capacity without topdressing. The forest humus in the soil is of a transient nature and if its fertility is not replaced, by topdressing the bush soils should ultimately revert under continued grazing to the same infertile condition as the similar soils developed under fern and this has actually proved to be the case near Norsewood.

CLASSIFICATION OF SOILS.

A preliminary genetic classification of the soils based on the processes under which they were developed has been made. Over 100 distinct soil types have been recognised in the field and these are classified into three broad groups according to the physical and chemical characters of their soil profiles. There groups are,

1. Rendzina group derived from limestones.
2. Podsol " " " mudstones and sandstones.
3. Brown loam " " partly or exclusively from volcanic ash.

Each group is further subdivided into classes according. to the stage of development reached in the soil profile by its particular set of soil processes. The classes are provisionally subdivided into series according to parent rock and the series are divided into soil types according to changes in the texture.

DESCRIPTION OF SOIL TYPES.

1. Rendzina group. The rendzina soils are derived from calcareous rocks usually limestone, They have a high base saturation and free lime in the subsoil and are regarded as the best of the hill country in Hawkes Bay. The immature rendzina soils are usually developed on very steep slopes and soft limestone country where slumping is considerable and does not allow the profile to attain maturity. These soils have a high base status and are high in phosphate, The moderately. developed rendzinas are derived from sandstones and mudstones Containing thick bands of limestone, A certain amount of clay has moved down in the profile and the available phosphate is only fair. The strongly developed rendzinas are produced on rolling country from limestone, They are less alkaline and less highly saturated than the other soils in this group and may be regarded as deficient in phosphate. The soils in this class are dependent for their fertility on rainfall and five types are distinguished each having a very narrow range of rainfall,

2. Podsol group. The podsol soils are derived from mudstones, argillites, sandstones and greywacke . They have a high base saturation and their phosphate status is closely allied to the phosphate content of the parent rock. Skeletal podsol soilsare developed **on** steep country and on recent alluvium such as the Hastings plains, In the final classification other skeletal soils may be regarded as a separate group. They. are fertile except when derived from argillite which is poor in phosphate , Immature and midly, weakly and moderately podsolized soils show progressively greater development in their profiles and they are therefore progressively less fertile,

3. Brown Loam group, The brown loams include soils high in iron oxide and alumina and derived exclusively or in part from volcanic ash. The free iron oxides largely responsible for the good structure of these soils generally colour the profile shades of chocolate brown or-golden and the base status of the soils is extremely low being highest in soils derived from greywacke less in soils derived from andesitid ash and lowest in the Taupo pumice soils. Skeletal soils are developed mainly **on** steep greywacke hills and the immature brown loams on young volcanic ash showers while the more developed soils in this group are derived from alluvium consisting mainly of greywacke gravels sands and silts and arc' the poorest in the group,

DISCUSSION.

The genetic classification gives an index to the fertility of each soil type in relation to others, In Hawkes Bay soil fertility depends on, -

1, The soil group to which the type belongs,
2, The stage to which it has been developed.
3. The parent rock.
4. The v eg etation.

All these factors are inter-dependent. The group to which the soil type belongs depends mainly on the parent rock which allows rendzina soil processes when it contains sufficient lime, podsol processes because the rocks are of a certain composition and brown loam processes when the iron alumina content is high The stage to which the soil profile has been developed depends hoth **on** the intensity of the lieaching processes which have been shown to depend on rainfall and topography and on the ease with

which they *are* able to act depending on the texture and structure. of the soil which in turn depends on the parent rock and vegetation. Parent rock has an additional influence on fertility *in* that its base status determines the relative fertility of a soil type compared with others at the same stage of development in the same group. Finally, when the original vegetation was forest the effect of. the forest humus which represents the return to the top soil of the plant foods collected at a depth by the roots of forest trees may completely mask the effect of the other factors by imparting a temporary high natural fertility.

The above represents a brief summary of the results of the Soil Survey in Hawke s Bay. It has not been possible to touch on certain other aspects of the work such as erosion, the soil survey of the Heretaungn Plains, the mapping of economic lime deposits, and so on; the outline purports to indicate the results being obtained from the regular mapping work.
