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The Soils of Australia in relation to Vegetation and Climate

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SUMMARY.

The principles of soil classification, based on a study of the soil profile, are examined in the light of the distribution of the major groups of Australian soil types and of the corresponding vegetation associations.

Soil types are determined by the relative positions of various soil constituents in the profile as controlled by the movements of soil water, while in arid localities, owing to the importance of wind effects, surface features characterize desert and semi-desert soil forms.

The distribution within the profile of water soluble salts, calcium and magnesium carbonates, oxides of iron and manganese, and clay is discussed. The accession of cyclic salt and the control of leaching by daily rainfall incidence is shown to be of importance in southern Australia. The mobility of oxides of iron and manganese is determined both by hydrogen ion concentration and by oxidation-reduction equilibrium. The mobility of clay is favoured by neutral to slightly acid conditions (*podsolisation*) or by a degree of sodium saturation (*solonisation*).

In Australia, a marked general correlation exists between the hydrogen ion concentration of the soil and the rainfall. An important exception is the group of Western Australian sand plains, which are more acid than would be expected from current climatic conditions.

Many Australian soils show relatively high proportions of replaceable magnesium.

The climatic control of soil type is discussed in terms of the Meyer ratio of precipitation to saturation deficit. Australian evaporation records show a high degree of correlation with saturation deficit of water vapour pressure, and the Meyer ratio is therefore a useful measure of the ratio of precipitation to evaporation. The climatic distribution of Australian soil groups in relation to these two factors is discussed, and the affinity between the Australian black soils and those of Russia, America, India, and Morocco is brought out. Seasonal incidence of rainfall is also shown to be of some importance.

In the light of recent research, capillary movements may be regarded as being of minor importance, except where a water-table is close to the surface.

The effect of temperature appears to be mainly in the direction of reducing rainfall efficiency.

Wind action is the dominant factor in the arid regions.

The nitrogen content of the soil, as a measure of soil organic matter, is shown to be closely related to climatic conditions. A tentative

statistical examination shows a higher correlation with the Meyer ratio than with rainfall. The direct correlation of nitrogen content to temperature is small and negative.

Laterite is now recognized by geologists as forming an important surface feature of many parts of Australia. Its occurrence is independent of current climatic conditions, and is very widespread in various forms in western and north tropical Australia.

The physiographic evidence is that the lateritic cappings form the peneplanic remains of an ancient land surface, and further evidence of the antiquity of these formations is provided by the examination of the profiles and reaction of the Western Australian sand plains and ironstone gravel deserts. Until further evidence is available, these sand plains are presumed to represent ancient podsols. Soils of lateritic origin are characterized by special vegetation associations, and frequently present considerable fertility problems.

The survey records and ecological literature of Australia have been examined with a view to defining, mapping, and correlating the major vegetation associations and soil groups. Maps of the vegetation associations and of the soil groups are presented.

The following vegetation associations are recognized:—Desert grass (porcupine grass) on sandhills; desert scrub, characterized by acacias, mulga, myall, and gidjea; shrub steppes of saltbush and bluebush; savannahs and Mitchell grass downs; savannah woodlands; Mallee scrub and sclerophyll woodlands; brigalow scrub; sclerophyll forests; rain forests; mountain grasslands and high moors; heath and sclerophyll scrub.

The soil groups proposed include:—Desert soils and semi-desert soils of sandhills, gibber and gravel plains and stony surfaces; Mallee soils, calcareous, somewhat saline and weakly solonised; red-brown earths, weakly podsolised surface with calcium carbonate in deeper horizons; black earths, mainly heavy soils in eastern Australia; grey and brown soils, principally heavy soils in the semi-arid zone; podsolised soils in regions of higher rainfall under sclerophyll forests; red loams mainly derived from deeply weathered basalts; high moor; lateritic sand plains, presumed to be ancient podsols.