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**A HAND BOOK OF
CEYLON SOILS
WITH SPECIFIC REFERENCE
TO THE
JAFFNA PENINSULA**

**BY
D. K. GASPERSON.**

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2022
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A HAND BOOK OF
CEYLON SOILS
WITH SPECIFIC REFERENCE
TO THE
JAFNA PENINSULA

BY
D. A. CASTLE

FOREWARD

TO know something about the soil in which one lives, moves and has one's being is a fascinating study indeed. To a speculative mind intent on agricultural and industrial projects a study of the potentialities of various soils will amply repay. The farmer gets this knowledge through experience. But his knowledge is mostly limited to his own locality. The author of this introductory volume has made a general survey of the distribution of the soils in the Island and has to some extent accounted for their differences. The author has indicated, too, in elementary way how the physical composition of the soils can be detected by analysis.

This book on Ceylon Soils by Mr. D. K. Gasperson, probably the first of its kind to appear from the North, is bound to awaken interest in advanced students in the various soils. The section dealing with the soils of the Peninsula is about the most interesting part of the book. The production of a more searching book on the subject by the same author will, I imagine, depend on the measure of encouragement the schools mete out.

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7-11-1957.

PREFACE

SOIL and water constitute the national heritage of Ceylon or any other part of the Globe. The need of soil studies at present, above all other things, is imperative as well as indispensable. This, of course, has induced me to make a careful, critical and analytic study of the distinctive soils, and finally has resulted in my writing this book, primarily for students of Geology, Botany, Physical and Economic Geography and Agriculture of Ceylon. It is meant to be a text as well as a reference book, and it aims at giving a realistic and critical account of the various complex problems connected with these sections. 2022

The recent years have witnessed important changes in the matter and method of Geology, Geography, Botany and Agriculture. The average educated person to-day has been forced, in fact, to be geological, geographical, botanic and agricultural minded.

Judicious arrangement of the subject matter into 2 main parts and selection of topics and the manner of their setting make this reference book thoroughly up-to-date, pre-eminently useful as a reliable and dependable guide to both teachers and students.

I am sure the book will serve its object and be of tremendous use to those for whom it is specially intended. The general reader will also find in it things of topical interest. Necessary illustrations, statistics and maps have been methodically furnished in this book. I am under much obligation to Professor A. K. Mukherjee of the Scottish Church College, Calcutta for his extremely valuable introduction to "The systematic study of the distinctive soils and their economic importance to the world", during my academic career at the same institution.

Suggestions from Soil Chemists for the improvement of the book will be thankfully accepted.

"Anna-Vasa",
Uduppidy, Ceylon.
April, 30, 1957.

THE AUTHOR.

PREFACE

The first part of the book is devoted to a general survey of the subject, and is intended to give the reader a general idea of the scope and extent of the subject. The second part is devoted to a detailed description of the various branches of the subject, and is intended to give the reader a more complete knowledge of the subject. The third part is devoted to a description of the various methods of research, and is intended to give the reader a more complete knowledge of the subject. The fourth part is devoted to a description of the various applications of the subject, and is intended to give the reader a more complete knowledge of the subject.

The present volume is a revised and enlarged edition of the first volume, and is intended to give the reader a more complete knowledge of the subject. The second volume is a revised and enlarged edition of the second volume, and is intended to give the reader a more complete knowledge of the subject. The third volume is a revised and enlarged edition of the third volume, and is intended to give the reader a more complete knowledge of the subject. The fourth volume is a revised and enlarged edition of the fourth volume, and is intended to give the reader a more complete knowledge of the subject.

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THE AUTHOR

London, 1912

2022

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PART I.

"A"

SOIL

NATURE AND ORIGIN OF SOIL

SOIL is a complex mixture of the products of rock waste with varying amounts of organic matter, both living and dead. It forms the outermost layer or shell of the earth's crust where the most superficial rocks, whatever their nature, are continuously in contact with the atmosphere, and where in consequence the processes of chemical decay and mechanical disintegration complete their reactions, or at least exert their maximum effect. Soil is likewise in a sense the meeting place of the organic and the inorganic worlds, for mingled with rock waste and mineral debris are decaying remains of plants and animals, and a wealth of living organisms—earthworms and insects, the roots of living plants, and millions of bacteria. It is quite clear that the character of a soil is dependent on a very large number of factors—chemical, geological and biological—largely controlled by climate.

The sub-soil, which lies just beneath it, is usually more compact in texture for the simple reason that it has not been exposed to the sun, rain and air. It has also moisture and contains less organic matter. Below this again is a still firmer layer or stratum which is really termed rock. It is not necessary for us to consider and analyse the origin of rocks, which is a subject concerned with the domain of Geology, but we must concede the fundamental fact that all soils are derived from rock, whether formed in the place we find them, or whether transported from elsewhere.

A careful observation of a quarry or a railway or road cutting reveals the position of soil and rock. Examine the nature of the area intervening between the rock and the soil. Observe the general colours of the distinctive strata ; the colours of a particular area ; the consistency—compact or loose, hard or soft, dry or damp, homogenous or heterogenous—of the different strata.

Examine cuttings (a) when fresh ; (b) after being exposed for some time. What changes have occurred ? (The glaring appear-

ance when fresh ; dull tarnished appearance later ; compact when fresh ; loose state later.) There are several theories regarding the definite affinity between soil and sub-soil and rock. It has been declared that the underlying rock is solely responsible for both sub-soil and soil. In other cases, there is no connection between the two, by virtue of the fact that the soil has come from elsewhere and has not been formed when it stands. The change from rock to soil is brought about by a process of disintegration or breaking up of the original mass etc. Hence, these are termed denudations or weathering agents and, by their mechanical and chemical action upon rocks, reduce them to the fine particles of which soil is composed. Soils formed where they are found are called sedentary soils ; while soils that have been formed elsewhere and carried through the agency of wind or water or glacial action, and deposited in another place are called transported soils. This latter will be found to have no connection with the rocks underlying them.

In some cases, one finds a sandy soil overlying a more compact sandy sub-soil and beneath this, the sandstone rock which has given origin to both. In other cases, especially in the flat lands near the mouths of rivers, we find the soil made up of a mixture of different ingredients derived from various rocks, the disintegrated material having been brought from great distances through the agency of water, and deposited along the lower reaches of rivers where they form rich alluvium. Much can be inferred about the character of a soil by merely walking over it observantly. It will be found that soils differ in texture, that is that they consist either of coarse particles or fine which tend to make them loose or compact. It will also be noticed that they vary in colour, ranging from very light to very dark. Some sandy soils are almost white ; heavy clays are usually a reddish brown, while soils with an excess of organic matter are nearly black. Another remarkable point that will fascinate the observer is the distinction in the character of the natural vegetation found on different soils—not merely in the nature of their growth, but also in the kind of plants growing on them. Whenever and wherever the soil is fertile or poor, compact or loose, wet or dry, the natural vegetation will vary.

“B”

SOIL CONSTITUENTS

It has been analysed and proved that the bulk of the mineral matter of a soil comprises sand and clay. Sand is formed of hard particles which are generally coarse. These vary in composition, but mainly consist of the substance known as silica or oxide of silicon. Dry sand in exposed situations is lifted and carried by the wind, and such blown sand sometimes collects to form sand hills or dunes as in the case of either Kudatanai in the Vadamradchy East, or Hambantota in the South-East of Ceylon. A soil composed entirely of sand would be unadaptable for agricultural purposes, since it would be too loose in texture to provide a sufficiently firm hold for the roots of plants, while in dry weather it would be apt to lose all its moisture owing to its inability to hold water. It is such loose, dry soils that are distributed in desert places like Sahara in North Africa and Arabia, where in the absence of rain, nothing can be induced to grow save date palms. However in certain fertile or favoured spots in the deserts called oases where water occurs some plants tend to grow. Silica, of which sand is the main component, supplies no essential ingredient of plant food, so that a pure sandy soil would be unsuitable for cultivation owing to its barrenness.

But sandy soils are seldom made up of pure silica, and, though generally deficient in organic matter, they contain mineral ingredients which are beneficial to the plant. But as a component of soils, sand is of paramount importance, however unsuitable by itself. As such, it invests them with properties which are of immense value from the agriculturist's point of view. It enables soils to preserve an open texture, and permit the water that falls on the surface to sink down below, instead of remaining standing. As the water sinks, it draws down air after it and so aerates the soil. Sand also tends to keep soils warm owing to its ability to absorb and retain heat.

The properties of clay are almost exactly contrary to those of sand. The particles comprising it, are very fine and have a

tendency to adhere closely together, so that water and air cannot percolate it. Owing to its capacity for retaining water, a clay soil is cold.

A pure clay soil would be as useless as a pure sandy soil from the agricultural stand-point, since it would be too dense and wet and cold to enable plants to flourish on it.

In comparison and striking contrast, clay is more complex than sand in composition, consisting of silica chemically combined with alumina (oxide of aluminium) and water. Here again, we find no useful ingredient of plant food, for alumina is of as little use to the plant as silica. Pure white clay known as Kaolin is highly utilised in the manufacture of Chinaware, viz., plates, cups, saucers etc. On the other hand, the less pure forms of brownish colour found in most paddy fields, are used for making pottery as well as bricks and tiles.

Like sand, clay is seldom found in a pure state, and in its impure form it contains useful mineral ingredients of plant food. As a component of all soils, the presence of clay is greatly appreciative, for it enables them to retain water and such useful ingredients as are found dissolved in it. It gives firmness to the soil and enables plants to withstand drought, where a very sandy soil would become dry and hot.

Almost pure white sandy soils distributed in the Negombo District and Thenmaradchy, Pachchilapali Divisions of the Jaffna Peninsula, where cinnamon flourishes in the former, while coconut palms thrive well in the latter.

Heavy clays are commonly found in paddy fields and also occur in the cocoa belt of the Matale District. These soils are, as a general rule, of good depth and very fertile.

Together with sand and clay, there should also be in all good soils, some lime present. Lime is found in soil as carbonate of lime which is familiar to us in one form as the chalk we use in the class room. This carbonate is a compound of lime (oxide of calcium) with carbonic acid.

Lime generally occurs naturally in soils in small proportions, up to about 5 per cent or so, but in some places it enormously predominates, while in others it is practically absent or deficient.

It has been maintained by the Soil Chemists that the presence of lime in the soil counteracts the adhesive property of clay in clay soils, while it promotes the decomposition of organic matter (farmyard manure and green manure), and also assists in the formation of nitrates which are of great importance in the nutrition of plants. It further exerts a sanitary influence on soils and is pernicious to both insects and fungoid pests. Lime as carbonate of lime generally contains certain impurities, such as phosphates and sulphates, which only enhance its value as a constituent of soils.

A fourth constituent of all fertile soils is humus, which is another form for decayed vegetable matter. In ordinary soils, humus is found intimately mixed with other soil constituents; but in certain soils it is present in large proportion, a peaty soil being almost entirely composed of it. Up to a limit of about 10 per cent or so, the more humus present the richer the soil. Humus contains a considerably larger proportion of nitrogen to carbon than in the vegetation from which it was derived, since in the process of decomposition, a great deal of carbon becomes oxidised with carbonic acid gas.

Humus is the main source of the plant's nitrogenous food, but its presence also helps a soil to absorb and retain moisture. A soil containing a considerable proportion of humus is much better able to withstand drought than one from which it is absent. Sandy soils to which humus is added gain body, that is become consolidated, losing their loose texture, while clay soil likewise treated becomes open and porous and both at the same time improve in fertility.

In good agricultural soils, there should be 50 to 70 per cent sand, 20 to 30 per cent clay, 5 to 10 per cent lime and 5 to 10 per cent humus. Alluvial soils owing to their mixed character are of this type.

To sum up, in many soils the ingredients are not well balanced or proportionate, some one or other of them being in excess. The object of proper cultivation is to surmount these natural disadvantages by a judicious system of tillage and manuring.

“C”

HOW TO TEST OR EXAMINE THE SOIL

1. Dig a pit and carefully observe the changes met with as you go deeper—colour, stiffness, presence of stones, depth at which rock is reached. Take specimens from each stratum—sort out and examine the fragments, compare these with the materials of which the rock is composed. What inferences do you elicit? (See Note 1).
2. Make similar observations in a trench, especially one in which a rush of water occurs, as well as in the bank of a stream. Do you observe distinct layers? In what situations do you find large pebbles, smaller pebbles, coarse sand, fine sand, silt? (See Note 2).
3. Take a cigarette tinful of soil from a garden, put half into a large jar or wide-mouthed bottle, and the remainder in another. Fill each a little over half full of water. Shake up well and allow it to stand for some hours. Shake up again and stand it till next day. Number the jars 1 and 2. Observe the next day whether the soil has settled in distinct layers. How does this arrangement compare with that observed in nature?
4. Next shake up jar No. 2 and let it stand for a minute; pour off the water into a third jar. Stand jar No. 3 for an hour and pour off the liquid into jar No. 4. Stand jar No. 4 for twenty four hours. Observe the size and other characters of the different sediments in jars Nos. 2, 3 and 4; compare these with the different layers in jar No. 1.
5. Observe that an important agency of soil formation is water. Notice what has occurred on an old hillside as a result of the action of heavy rain; what is left behind on the surface of the hill? Where is the finer material to be found? How

have river mouths, streams, and the heads of paddy fields become silted? What do you find in the field itself or in any low-lying area which periodically gets flooded? Examine these places and take samples.

6. Take out a little of the sediment from each of the jars 2, 3 and 4. Examine each carefully in your fingers, stirring each with a piece of stick. Which is pasty? Which is made up of coarse particles? How would you make up an ideal soil? (See Note 3).
7. Observe that soil is composed of particles of varying sizes, and that it is only the finest material that possesses adhesive properties. Name the different classes of soils. (See Note 4).

Bring samples of soils from different localities—treat them as you did under 4—observe to which class each belongs.

What plants do you find growing in each of the localities? Are these soils wet or dry, difficult or easy to work, heavy or light by weight? Observe what occurs in each case soon after a heavy shower of rain fall.

Note 1. The fragments of rock and minerals in the soil and the larger pieces in the soil and the larger pieces in the lower layers show a similarity to the composition of the rock. It is evident that the soil above is derived from the rock below and that the rock has gradually undergone changes in the formation of soil. But this is not the case with soils on the sides of rivers—for the material has been brought by the river from elsewhere and deposited here. Thus these soils bear no relation to any rock that may be found below.

Note 2. Coarser material has settled close to the bed, fine material further from the bed. Also the different sediments (larger stones, smaller stones, sand and silt) have been deposited in succeeding order.

Note 3. The very fine material which is sticky when rubbed up with water is clay. The material which does not hold water and which is coarse is sand. A field composed entirely of

clay would always be wet and sticky and would not permit of proper tillage. Whereas, a soil composed entirely of sand will not hold adequate water ; it would dry too fast and remain loose. A good soil should necessarily be composed of half sand and half clay.

Note 4.	Name of type.
1. Soil containing large fragments (stones)	Gravelly soil
2. Soil which is coarse and practically all sand	
and no clay	Sandy soil
3. About 2/3 sand and about 1/3 clay	.. Sandy loam
4. About half sand and half clay Loam
5. About 2/3 clay and 1/3 sand Clayey Loam
6. Almost entirely fine material Clay



PART II.

A critical, comprehensive survey and colourful description of the distinctive soils of Ceylon in general, and their economic utility and importance with specific reference to the Jaffna Peninsula.

IT has been held and realised by the students and voracious readers of both Geography and Geology that a keen and analytic study of soil groups and series nevertheless forms part and parcel of geological studies. It is, therefore, imperative for each and every one highly interested in the study of Geology to analyse with avowed interest and care the characteristic features and structure of the distinctive soils distributed in Ceylon.

As a matter of fact, I, in the capacity of a keen student of Geography with some background and lack of necessary equipment, am seriously inclined to write a critical estimate of the soil groups and series of the Island. To all intents and purposes, careful analyses of Ceylon soils are accompanied by a diagram to show the main soil groups and series and their distribution. In the candid opinion of Soil Chemists, whenever and wherever evaporation is great, we find that the soil retains in general more plant food than the rest of the wet zone.

Let me now proceed to give a critical explanation of each and every soil group and its series with special emphasis on the economic utility and importance. In the first and foremost place, Red to Yellow Laterite and Lateritic soils are taken for consideration and analysis.

In fact, these are one of the major soil groups of Ceylon shown in the diagram.

I.

The origin and distribution of Red to Yellow Laterite Soils.

South of the Maha-Oya in the South-Western Sector of Ceylon, series of high ridges are found which swerve nearer the

coastline. The ridges are the remnants of erosion of Peneplain of the past ages. There are several geological evidences of their formation which are unchallenged by the exponents of both Geology and Geography. It is quite obvious and definite that the ridges are composed of ancient rock of Archaen Age which have been subject to considerable decay or decomposition. The resulting red rock is called laterite. Laterite is the name given to a Red or Brown Clay formed by weathering under a monsoon climate in the sub tropics. The rock is soft in composition and can be cut into blocks or bricks locally termed "kabook", which occurs mainly in the Wet Low Country Zone. The silica/alumina ratio does not always satisfy the standards laid down for laterite soils (= 1.33). On the surface, one can easily find a thin layer or stratum of red soil.

The four main series of laterite, their distribution and their economic utility and importance.

There are four main series of Laterite found in Ceylon. They are :—

(a) Ultra Wet Zone, Yellowish Lateritic Loam. It belongs to the geological era called "Charnockite". It is mainly distributed in Massena, Balangoda and their adjoining areas. It has been chemically analysed and found that garden crops cannot be grown as it is deficient in chemical or mineral properties. The dense growth of "High Jungle" is the main characteristic vegetation of this soil.

(b) Ultra Wet Zone Yellowish Red Lateritic Loam :—

It is termed the second series of "laterite". It belongs to the same category as the first series and is mainly distributed in Ambepussa and its adjacent areas. Unlike the first, however, it contains some chemical properties which are ideal for plants. Coconuts, garden crops, like tobacco, red onions, plantains, and vegetables are extensively grown on this type of soil. Its economic importance should be readily acknowledged.

(c) Wet Zone Yellowish Red Lateritic Loam :—

It is the third series of Lateritic chiefly distributed in Peradeniya, Kandy and Ratnapura Districts. It belongs to "Khonda-

lite". The main geological striking feature of the "khondalite" lies in the fact, that it is endowed with useful minerals such as graphite or plumbago, iron-ore and precious stones as well. It may be noted that plumbago is found in veins and pockets in the rock, whereas gems are found in the valley floors. That is the very reason why the Ratnapura Districts are highly rich in the deposit of precious stones-like Beryl or Sapphire and Ruby which of course, have fetched a world famous market. Besides, tea, rubber, cocoa, chinchona, mana grass are highly grown on this soil. It is prolific of much economic importance.

(d) Dry Zone Red Lateritic Loam:—

It is the last and least series of laterite belonging to "Bintenne Gneiss". It is well-drained, friable loam of fair depth. It is widely distributed in Sigiriya and its surrounding areas. It has got its own peculiarity in regard to its composition. It does contain very small quantities of chemical properties and are therefore unadaptable for cultivation of cereals and garden crops. Slightly acid, alkali or neutral in reaction, it has fair but variable nitrogen and exchangeable base contents. The heavy soil is well supplied with total and exchangeable potash. The only characteristic vegetation of this soil is the growth of "Low Jungle" which has little or no economic utility.

II.

Non-Lateritic Soils and their series :— their distribution and economic importance.

There are three major series of non-Lateritic soils which require first hand careful analysis of their composition.

First Series:— Dry Zone Reddish Brown Non-Lateritic Loam:—

It belongs to "Gneiss". It is widely distributed in Anuradhapura and its adjoining areas. Let me lay a special stress on the structure of "Gneiss" from the geological stand-point. It has its minerals arranged in folia, so that it is quite possible to split it into lenticular slabs. There are quite convincing historical evidences to show and confirm that the ruined edifices of Anuradhapura were constructed out of these lenticular slabs and

these of course can be seen today. The term "gneiss" is strongly applied to any foliated holocrystalline rock whether of the same composition as granite or not. As a matter of fact, this loam contains some chemical properties which are ideal for garden crops and some fruit trees. Dry Zone crops like kurakkan, gingelly and others, and fruit trees like mangoes, jak, lime and pomegranates are grown. This soil has some economic utility and importance.

(b) Semi-dry Zone Dark Grey Non-Lateritic Loam :—

It occurs in low lying locations. It is the second series of "non-lateritic loam of variable depth". It belongs to "Felspathic Gneiss" and is mainly distributed in Minneriya. The findings of chemical analysis have revealed the fact that this loam is generally heavier in texture than the red and brown loams, richer in plant nutrients than the latter and alkaline in reaction. The only vegetation is the "Medium Jungle" and while some paddy is grown on low-lying areas under careful irrigation especially when dry season sets in. In comparison to the former, it has meagre economic utility.

(c) Semi-dry Zone Grey Brown Sandy Loam :—

It is the last and worst series of non-lateritic loam.

It belongs to "Acid Gneiss" and is mainly found in Unich-chai. It overlies decomposing rock and is of poor nutrient status except in regard to potash. It is entirely deficient in chemical properties and therefore not suitable for cultivation. Wide stretches of scrub and low jungle are found. Its economic insignificance should be readily acknowledged.

(2) Limestone and its series :—

✓ **Definition and composition of Limestones**

Limestones consist chiefly of carbonate of lime with varying amounts of impurities as clay or sand. Many organisms build shells or skeletons of carbonate of lime and their remains accumulate at the bottom of the sea as masses of limestone. Foraminifera, corals, crinoids, or sea-lillies, echinoids, crustacea, mollusks, all have skeletons or shells of carbonate of lime and many limestones are made of them. The sea-weeds called

“Nullipores” also form limestone masses. “Chalk is a soft white earthy limestone”, containing abundant tests of foraminifera. The carboniferous limestone is made up of crinoid stems and *platus* and the wenlock limestone is made of coral blocks and debris. Some tertiary limestones are made of fresh water and land snails, and the Red Crag of broken marine shells. Many of the secondary limestones are oolitic. Marls are mixtures of clay and calcareous matter. Limestones occur in far-reaching sheets. In this context Carboniferous, Oolitic, Wenlock, Magnesian and Tertiary limestones are extensively distributed in the British Isles, whereas the Wenlock series are almost found in the Jaffna Peninsula and will be explained later in detail with special reference to the Peninsula.

Limestone series and their economic significance.

There are five major series of limestone which can be described in some detail. They are—Brick red loam, grey loam, black loam, chocolate-red loam, and brownish red loam. Unlike the lateritic series, the limestone series contain enormous quantities of chemical properties which are ideal and adaptable for the cultivation of garden and other crops.

(a) Brick Red Loam (Terra Rossa):—

Its distribution and economic utility:—

Undoubtedly, brick red loam is the first major series of limestone, uniform in texture, colour etc.; which occurs at a depth of 1 to 30 feet from the surface containing an enormous quantity of chemical properties. Soil Chemists have furnished an authentic and highly appreciative report on the “Brick red loam” and its economic value to the Jaffna peasants. This loam is mainly distributed in Tinnevely and its surrounding areas. Geologically, it belongs to Miocene Limestone. It is very well drained, rich in bases including potassium, fairly well supplied with phosphates, slightly alkaline in reaction, poor in nitrogen and organic matter. As a general rule, the red soil is an ideal one for the cultivation of tobacco, and that is the very reason why it is the first and most important commercial or cash crop of Jaffna. Besides, garden crops like red onions, plantains, yams (king), manioc, kurakkan, chillies and vegetables of different varieties are widely

grown on this soil. Another characteristic vegetation of this soil is the extensive growth of fruit trees like mangoes and jaks. It may therefore be asserted that the enormous economic utility and importance of the red loam should be readily acknowledged.

Grey Calcareous Loam—(Rendzina).

(b) It is the second major series of limestone. It belongs to the same category as the first. It is mainly confined to Delft and the other Islands of the Peninsula. It is of shallow depth and has a fairly high content of calcium carbonate, and is well supplied with bases but is poor in nitrogen. The fundamental distinction between the brick-red loam and grey loam with regard to their composition, is that the former contains an enormous quantity of iron, while the latter calcium carbonate. The chief characteristic vegetation of this soil is the extensive growth of pasture grass and the cultivation of paddy mainly and some dry grains and tobacco. That is the main reason why the Delft Island is the most suitable sector for horse breeding in the entire Peninsula. Judging from the economic stand point and according to the authentic report of the Soil Chemists, the grey loam areas are the most adaptable for paddy cultivation and for other crops, and also for the rapid and steady growth of mahogany and margosa as timber trees. The latter is used for medicinal purposes.

Black Loam.

(c) It is the third major series of limestone belonging to "Limestone over felsphatic gneiss". It is sometimes termed "regur" of South India. The parent rock of the black earth is usually the wind-borne loess, but sediments of various kinds including limestone and granite can form an almost identical soil under these conditions. The dark colour is due to the presence of a high proportion of organic matter, which may amount to 10 per cent or so. Chemical Analysts have examined this soil carefully and submitted their authentic report, stating that it has sufficient chemical properties containing mostly potash. It is mainly distributed in Thunukkai and its adjacent areas and in the North Western part of the Island with an annual rainfall of about 40 inches. As a

general rule, black loam is chiefly adaptable to the cultivation of both cotton and wheat. That is why a certain portion of Russia especially the Ukraine is called the "Black earth region", where wheat is grown extensively; while the southern portion of India called "regur area" is highly concentrated in cotton cultivation. Nevertheless, the cultivation of cotton has been going on in Thunukkai for some years, and it has been proved to be successful under experiment. It is my candid opinion that even paddy can be grown on this soil under careful irrigation even during the dry season. The other characteristic vegetation is the luxuriant growth of scrub-jungle. Besides, there is another economic utility and importance of this loam, and that is the fact that the thick clayey black loam distributed in Murunkan, Oddichuttan and Puliampulam in the Vanni and Vavuniya Districts, is the most adaptable one to cement manufacture at Kankasanturai for the first time in the annals of the Jaffna Peninsula. It is prolific of enormous economic significance.

Chocolate Red Loam.

(d) It is the fourth main series of limestone belonging to "Dolomitic limestone". It is heavy loam of varying depth but imperfectly drained owing to their relatively high magnesium content. Occasionally it is associated with a high proportion of iron stone gravel. It contains some potash, poor in phosphates and is best suited to the cultivation of tobacco and citrus fruits like oranges, pine-apples and mangosteens are extensively grown. It is quite clear that garden crops and fruits prevail in this soil. The fundamental peculiarity of this soil lies in its colour compared to Brick red loam. It is mainly distributed in Nalanda and its neighbouring areas. It has, of course, some economic importance.

Brownish Red Loam.

(e) It is the last and most important series of Limestone. It belongs to "Jurassic Limestone" and is widely found in Tabbowa near Puttalam. Like the grey loam, it does not contain any stone or gravel but has carbon, nitrogen and potash. Soil Chemists have revealed the fact that the presence of the chemical

properties has made this soil become brownish red in colour, and the latter may account for the fact that cocount palms thrive well on this soil. It does not have much economic utility compared to the first four series of limestone.

After all, a careful and comparative study of the analyses of the soils in Ceylon already shown in the diagram reveals to the student of Geology the fact that the limestone series contain more economic utility and importance than the remaining soil groups. I strongly feel that no objection can be made to that contention.

III.

Humic series and their distribution

A careful and analytic study of the Humic series creates an avowed interest in the mind of the keen student of Geography. Unlike the first two main series, the Humic series contain more humus and that is why the term "Humic" is applied here. It can be indexed under four main series. They are :— Wet grassland, dry grass land, fernland and peaty loam. A fairly detailed explanation of each of the series is given below.

(a) Wet grassland (Patana) its distribution and economic importance.

It is the first kind of Humic series. It belongs to "Khondalite", and is mainly confined to Kandapola and its adjoining areas of high annual precipitation, evenly distributed and at an elevation of 4,000 to 6,000 feet. It contains more carbon and nitrogen but is strongly acid in reaction, extremely poor in available calcium, but moderately suffused with potassium, deficient in phosphates but rich in organic matter and nitrogen in the A and B horizons. Coarse grasses like "Mana" and "Illuk" are grown. Tea is the mainly cultivated crop. Trees dot the surface of these areas, the chief of them being the "Rhododendrons". Some clumps of stunted trees are also found.

(b) Dry grassland (Patana).

It is the second major Humic series belonging to "Khondalite" as the first. It is chiefly located in Welimada

and its adjacent areas of low annual precipitation. Unlike the first series, it occurs at elevations of about 3,000 to 4,000 feet. It has a shallow humic surface horizon which overlies in turn a reddish to purplish loam of variable depth and rock in varying stages of decomposition. The soil is moderately acid in reaction, poor in bases and phosphoric acid, and has little nitrogen and organic matter. Grass is extensively grown on this soil; while tea, fruits like oranges, lemons, grapes and pears are widely grown. Some paddy is cultivated on the terraced hillsides of this region. Another important feature of this region is that it has been characterised by a marked wet and dry season. It has some economic utility and importance to the peasants inhabiting this region.

(c) **Fernland (Kekilla)**

Among the four main Humic series, it occupies the least and last position for want of adequate mineral nutrients and phosphorous. Undoubtedly it belongs to "Charnockite" and is widely distributed in Liniyawa. It is also acid humic soil occurring in regions of high rainfall and rain forest region. The humic layer does not generally exceed 1 foot in depth. The main characteristic vegetation is the dense growth of ferns and some stunted trees which are economically insignificant. Tea and rubber are the principal cultivated crops of this soil.

(d) **Peaty Loam.**

It is the last and most important Humic series.

It can be safely said that the peaty loam is the resulting decomposition of Carboniferous limestone. In fact, it belongs to "Recent Cumulose" containing all the essential qualities of chemical properties which are ideal for the extensive cultivation of paddy. However, it contains more clayey structure and is fairly a rich soil in comparison with and contrast to the first three series. It is mainly distributed in Labuduwa and its adjoining areas. It is of variable depth from 1 to 4 feet and over. Its organic matter contents often exceed 25 per cent. The surface soil is acid in reaction, but has fairly high exchangeable base contents and is lateritic in type.

It may be classified as half-bog soils. Occasionally it is inundated with salt water from adjacent lagoons. A variant of this soil type is a low-lying, ill drained, humic sand overlying clay and known locally as a "deniya soil". The alumina content of the clay fraction is very high.

IV.

Soils derived from Pleistocene and Sub-Recent Deposits.

Brownish red sand, the bleached white sands (cinnamon soils) and the reddish brown loam are three main series which fall within the domain of this group.

(a) **Brownish Red Sand—its distribution and economic importance**

It belongs to Pleistocene deposits residual and is mainly confined to Marawilla and its adjacent areas. It is generally deep, well drained light loam and sand. The surface loam is slightly darker in colour owing to its abundant organic matter content. It occasionally overlies gravelly loam. Although deficient in all plant nutrients, particularly potash, it gives excellent crops of coconuts when manured. It is non-lateritic in type and has to some extent economic significance.

(b) **White Sand.**

It belongs to the same category as the first. It is a bleached sand occurring in areas of higher rainfall. It is extremely poor in nutrients and is characterised by a drak grey clay humic alluvial pan at a depth of 5 feet or so. It is distributed in the Negombo Districts with an annual rainfall of 90 inches. Cinnamon and coconuts are the chief crops of this region. In comparison to the former series it has, of course, a fairly high economic significance.

(c) **Reddish Brown Loam.**

Viewed in its true perspective, it is the only and rare loam available in the Pleistocene deposits residual. It is confined to Middeniya and its neighbouring areas. As in the case of the first series, it does also have deficiency of plant nutrients, particularly potash.

Fruits, citrus and rotation crops are the chiefly characteristic vegetations of this region.

V.

Recent Series comprise three main divisions. They are :—
(a) Brown sandy loam (b) Yellowish brown loam and (c) Dark grey clay loam. In this context, the first two series belong to recent alluvial deposits and are mainly confined to areas like Mannampitiya and Peradeniya. The reddish brown, grey brown and yellowish brown alluvial silts, loams, and clays are essentially paddy loams by virtue of their location. They infrequently exhibit a gley horizon intermittently water-logged. The paddy soils vary markedly in texture from light loams to clays and are equally richer in plant nutrients than the adjacent Highland soils. Most of them contain some phosphorous, and they respond well to applications of this fertilizer. While in the case of brown sandy loam, high jungle, is the natural vegetation and tobacco is the main cultivated crop.

Referring to yellowish brown loam it has been found that paddy is the principal crop. The last series termed "Dark grey clay loam", (Gleisols) belonging to "Alluvial over biotite gneiss" is mainly confined to areas like Tambalagam where paddy is the principal crop. Hence the real economy of this region depends on paddy cultivation which is an admitted fact.

To sum up, favourable climate, geology, vegetation and topography are the predominant factors for the development and character of local soils. "The earth is the environment of the plant". Man is dependent upon the Vegetable Kingdom, and so ultimately he is dependent on the produce of the soil. The soil of Ceylon is thus the natural capital of the Island and of such vital importance that every effort should be made to preserve it.

History of the Limestone series of the Jaffna Peninsula and their Economic Importance.

It gives me considerable interest and pleasure to testify to the richness of soils found in the limestone series of the Jaffna Peninsula.

Admittedly, the Jaffna Peninsula has been marked out as an entire geographical region in itself but not as a mere "geographi-

cal expression" as Italy has been termed. It is a gigantic and marvellous limestone block—limestone laid down when the Island was submerged in Miocene eras. It is therefore quite obvious that Jaffna Limestone series wholly belongs to the Miocene Period. The Canadian geologist Adams has given ample evidences of the origin, structure and marvellous importance of the limestone series in his book entitled "Canadian Journal of Research". The depth of the layer of the limestone is unfathomable.

In the Northern and North-Western sections of the Peninsula, this limestone crops up to the surface and it is denuded by the action of rain into rocks pitted with enormous quantity of tiny holes. In other parts of the Peninsula this parent limestone is mantled by layers of sand as in the North-East or by red or grey loam. One significant point of interest to the student of Geography of the Peninsula is that the limestone has accumulated enormous quantity of water and this is tapped by wells. Herein lies the magnificence and utility of the limestone especially to the Soil Chemists and Agriculturalists. The accompanying map shows the distribution of soil in the Peninsula. On the Northern and Western fringes of the Peninsula, limestone wastes are widely distributed. These are not merely confined to specified areas but are almost scattered throughout the Peninsula, especially on the Western half. In these tracts, the parent or original limestone appears on the surface. It is a callous rock and is split up for road material in the manner in which the granite rock is split up in the remaining portions of Ceylon for the same purpose. These wastes are highly unproductive and therefore not adaptable for either intensive or extensive cultivation. In fact they contain little or no soil covering, and hence tiny shrubs or cactus plants are widely grown with no human effort and care. In spite of its unproductiveness, some palmyrah trees grow wild in these areas where their long roots force their way down to tap the water underneath the surface. In certain parts of the Peninsula the surface limestone is dug out and removed and in its stead a thin covering of soil and leaf mould is spread to form garden soil for tobacco. Delft and

other Islands of the Peninsula are mainly concerned with this process. This process of soil reclamation is heavily imposed on the populace by the small extent of arable land found in the Peninsula. Along the Lagoon or (Lake) a narrow strip of land is found where the soil is salt impregnated to such an extent that only scrub grass can grow there. The fairly wide tract known as the Vallai in the Vadamaradchy Division is an illustration in point. Along the North-east and South-east margins of the Peninsula sandy areas are extensively distributed. These have been blown in by the North-east and South-west monsoons and sand-dunes are thus formed and are seen to this day in places like Kudathanai, Amban and Nagerkoil of the Vadamaradchy East Division. All these sandy tracts are unproductive except for coconut and for a few palmyrah palms. Besides, blackberries as fruit trees wildly grow in these areas. Some paddy is cultivated in the hinterland under careful tillage and manure.

Grey Loam Area of the Delft Island and other Islands

Fairly extensive stretches of grey loam are found in this Island and other Islands as well. This soil is the direct outcome of the decomposition of the limestone. Major paddy-lands of Jaffna Peninsula contain this grey loam. It is somewhat clayey but in the long dry season it gets caked and breaks up into a fine white powdery soil. As has been indicated earlier, this loam contains nearly 60% of calcium carbonate and that is the main reason why it gets caked in the dry season.

Red-Loam

In the western half of the Peninsula are the areas of red soil where the most valuable tobacco and garden lands are distributed. This soil like the grey loam is very fine grained, but the only distinction lies with regard to their composition and colour. There are many theories set forth as regards the origin of the red soil, but the most convincing and acceptable explanation is that they are the obvious results of the decomposition of the parent Miocene limestone, and the red colour is due to the soil not being leached.

The chemical or mineral importance of this soil should be readily acknowledged.

Major Divisions of the Jaffna Peninsula—Their soil distribution and their economic importance. Geographically speaking, Jaffna Peninsula comprises nine Major Divisions. They are Vadamaradchy West and East, Thenmaradchy, Pachchilaipali, Valikamam North, West and East, Jaffna Proper and the Islands.

A critical account of each of the eight divisions with regard to its soil and economic utility is given below.

1. Vadamaradchy West.

The main areas included in this prominent Division are the following:—Thondaimannar, Kerudavil, Mailiathanai, Kommantharai, Kambarmalai, Uduppiddy, Kalluvam, Karanavai, Valveddy, Valvettiturai, Polikandy, Samarapahuthevan, Navindil, Nelliady, Vathiry, Alvai, Thikkam, Karaveddy, Kaddaively, Thunnalai, Theduththanai, Puttalai, Manthikai, Thambachetty, Viyaparimoolai, Imperchiddy, Kaladdy, Thumpalai, Point Pedro, Mathanai, Puloly and Katkoyalam. Certain specified greyloam areas of Kerudavil, Uduppiddy, Kalluvam, Karanavai, Karaveddy, Kaddaively, Thunnalai and Theduththanai are set apart for both paddy cultivation and some garden crops. The paddy cultivation is done in these areas during the rainy season (winter) annually, while the garden crops are grown in the dry season (summer) under irrigation by means of wells. Chempadu—a specified portion of Kerudavil, Matha-Chempadu a specified portion of Uduppiddy, Kalluvam, Navindil, Vathiry, Nelliady and Puloly South are areas of brownish red loam, but actually not of the brick red loam distributed in areas of both Valikamam North and Valikamam East Divisions. The colour, composition and texture of the red loam of the former is entirely different from the latter. Anyhow, the specified red loam areas already mentioned in this Division are highly concentrated in the cultivation of tobacco, red onions, vegetables, manioc and dry grains and hence they are termed “garden lands of Vadamaradchy West”. Practically the garden crops are grown in these areas for a certain season of the year but not throughout areas like those of Valikamam North and

Valikamam East. Onion cultivation is carried on throughout the year. The paddy lands of the abovementioned areas of the Division have fairly grey soils subject to tillage and manure, both leafy and farmyard, which are ideal for paddy cultivation. The Vadamaradchy Lagoon Scheme and its saline paddy test or trial under experiment sponsored by the Department of Agriculture are illustrations of this. It may be noted that 8 acres of land are under experiment while 25 varieties of saline paddy are under observation in two tracts. A few years ago several Soil Experts of Ceylon accompanied by Indian Experts surveyed the entire Vallai area and submitted an authentic report, stating that poultry farming can be set up. For want of initial capital, poultry farming undertaking is left out for the time being. The land holdings of the peasants of this Division are comparatively meagre, and as a consequence they depend on foodstuffs from other parts of Ceylon. It is worth noting that the peasants of this Division are very much industrious and hard-earning. As a matter of fact, the average income of a family is very low when compared to Sinhalese areas. The people of the coastal areas are engaged in fishing. The intensive cultivation of tobacco and red onions as cash crops brings in a fairly expected source of income to the peasants of this Division. The fertility of both red and grey soils of this Division has fostered in the density of population in areas like Uduppiddy, Karaveddy and Puloly West. Besides these, another notable feature to be considered is with regard to a particular and peculiar clayey soil found in a specified portion of Manthikai. This loam is orange yellow in colour and contains more clay. In between 5 to 10 feet surface layer, we find this clayey soil interspersed with stone. Further in between 10 to 15 feet or so we find the same with no gravel and stone. The clay dug out and removed at this depth is an ideal one for pottery work. At present it is more or less exhausted. But still there is a much debated question among the potters as to whether the clay found in Manthikai is superior to those found in Kandavalai, Karachchi, Murunkan, Oddichuddan and Puliampulam in the Vanni and Vavuniya Districts. It pertains to the fact that the clay of the latter areas is more durable than the former; yet the clay of Manthikai is undoubtedly noted for its fine texture.

2. Vadamaradchy East.

It comprises Vallipurakurichchy, Kudathanai, Amban, Nagerkoil, Chempianpattu, Maruthankerny, Thalaiyady, Vaththirayan, Uduththurai and Aliyavalai. This Division evidently shows the lowest density of population for the Peninsula, and this is undoubtedly due to the barrenness of the long stretch of land. The soil map accurately shows areas of alkaline soil and barren sands; yet there is little cultivation done in the interior areas.

The coastal people with the exception of Amban and Vallipurakurichchy are highly engaged in fishing. The white porous clayey soil of Kudathanai and Amban are best suited for paddy cultivation, where it is intensively done under regular tillage and proper manure, both leafy and farmyard. If both these processes are carefully and proportionally done, the average yield of between $1\frac{1}{2}$ and 2 bushels of paddy per lachcham can be realised in these areas. Practically paddy cultivation is performed in these areas once a year, specially during the rainy season. Another admirable feature of this Division unlike Vadamaradchy West is the prevalence of sand dunes in these areas. The other characteristic vegetation of these areas are coconut and palmyrah palms, and more especially Nagerkoil is noted for the wild growth of palmyrahs, but the coconuts are very few. It has been the main point of distinction in this area which is not found in the remaining areas. Maruthankerny, Chempianpattu, Vaththirayan, Uduththurai and Aliavalai have some coconut estates. To the south of Amban, scrub trees grow wild. Blackberries as fruit trees extensively and wildly grow on these sandy areas. Further more, the quartz sand of Nagerkoil and Vallipuram Temple circuits is ideal for building purposes. In this context some years ago several Western Experts on soil toured these areas and finally submitted their frank and authentic report maintaining persistently that the glossy sand of both Nagerkoil and Vallipuram Temple and more especially of the latter are most ideal for glass manufacture. It is rather a pity that for want of initial capital, no steps have been so far taken to set-up a glass factory in the Peninsula. If it is implemented, it will be of considerable economic prosperity not only to this Division but to the entire Peninsula.

In addition to all these, the presence of valuable quartz sands in the respective areas are of paramount geological and economic importance.

3. Thenmaradchy.

Towards the south and west along the coast of the Jaffna Lagoon, we find sandy soil stretching for about five to six miles. In the sandy soil areas coconut palms are the most important commercial crop. Towards the east of Thenmaradchy along the Lagoon between half and one mile, one finds alkaline soil. This soil is declared unproductive. The natural vegetation is typical tall grass which is found to grow on alkaline soil areas. This is not very good for animals. In between the sandy and alkaline soils in the east of Tenmaradchy, grey loam is found. This is the best of the three, but very much inferior to the brick red loam of Valikamam North. The chief areas of this Division are Kaithady, Navatkuly, Nunavil, Madduvil, Sarasalai, Varani, Manthuvil, Kalvayal, Chavakachcheri, Meesalai, Kodikamam, Usan, Mirusuvil and Eluthumadduval. Of these areas, Kaithady, Navatkuli, Nunavil, Varani, Usan, Kalvayal, Meesalai and Mirusuvil have some paddy lands. These lands are of course under strict and careful tillage and receive both green leaves and farmyard manure. The arable land is mostly grey loam land. Hence paddy and coconuts are grown almost everywhere in this Division and some garden crops are grown on areas like Kaithady, Madduvil, Sangaththanai and Kalvayal. Kalvayal is especially noted for the growth of enormous quantities of sweet yams (potatoes). While pine apples sour in taste are grown on areas like Meesalai and Nuna-vil. Mangoes, jak, quava and other fruit trees are grown in these areas whose fruits are not so sweet and tasty as those grown in the red loam areas. Palmyrahs grow wild in these areas too. In Sarasalai, Varani, Manthuvil and Madduvil we find some dense growth of scrub trees which have little or no economic value. Certain portions of Varani and Manthuvil, Sarasalai and Madduvil are declared paddy and garden lands in cleared scrub jungle areas. Madduvil is especially noted for the growth of brinjals as one of the major garden crops; while Varani is the homeland for palmyrah products. Chavakachcheri and

Kodikamam are declared market places of this Division. Some tobacco cultivation is carried on in certain specified portion of Kodikamam. The soils of these areas are almost sandy, while saline soils are found in certain specified areas both in Navatkuli and Kaithady. Some time ago, the Soil Chemists of Ceylon accompanied by some Indian Experts toured the areas of this Division, and in their report they made special reference to the fact that cotton cultivation could be carried on in these areas commencing from Kaithady, under irrigation.

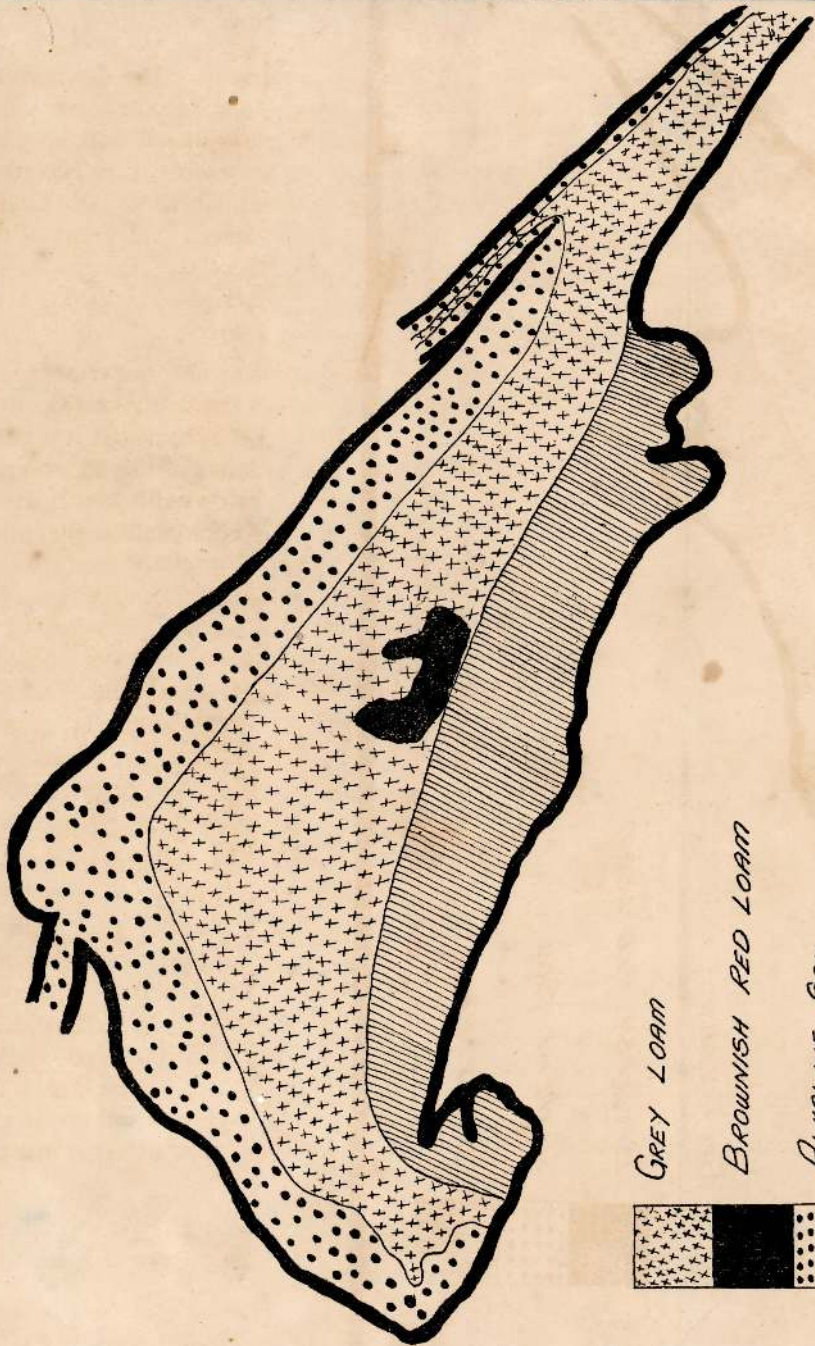
Recently, the Department of Irrigation has undertaken the sole responsibility to convert the saline areas into arable ones through the set up of the Navatkuli Lagoon Scheme. If it is completed, in course of time, neglected wastelands of these two areas can be easily brought under paddy and cotton cultivation. Here, too, we find the absence of intensive cultivation unlike the other divisions of the Peninsula.

The economic prosperity of this Division is not so much advanced.

4, Pachchilaipali.

Along the east coast up to Elephant-Pass, one finds stretch of sandy soil to a width of 4 to 5 miles. In the west of Pachchilaipali along the lagoon that extends from Thondaimannar to Uduththurai we find alkaline soil. Here tall grass is the chief natural vegetation unsuited for animals. In the centre in between alkaline and sandy soils there is a narrow stretch of grey loam where paddy cultivation is going on. Just because grey loam is a narrow stretch, cultivation of crops, other than tobacco is not an important occupation of the people. This Division contains a few areas in comparison and contrast to both Vadamaradchy and Thenmaradchy Divisions. The chief areas included in this Division are Mukamalai, Pallai, Iyakatchy etc. These areas are highly concentrated in the cultivation of coconuts and the sandy soils of these areas are best suited to this group, while palmyrahs are also found growing wild in these areas.

The population of this Division is very sparse due to several relevant reasons : (a) unproductivity of soil (b) spread of malaria

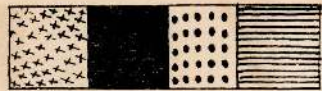


GREY LOAM

BROWNISH RED LOAM

ALKALINE SOIL

SANDY LAND



SOIL MAP OF TENMARACHY AND PACHCHILLAPALI DIVISIONS



(c) lack of proper means of transport and communication, and (d) absence of intensive cultivation. Considering the retrogression of this Division in general, it is my candid opinion along with the report of Soil Chemists, that cashew nuts can be grown on areas like Pallai, Iyakkatchi and its adjoining places.

It is, therefore, clear in conclusion that the main income of these areas is derived from the coconut products.

5. Valikamam North.

This Division is made up of Inuvil, Maruthanamadam, Uduvil, Chunnakam, Erlalai, Alaveddy, Mallakam, Kadduvan, Telli-palai, Palali, Myliddy, Vasavilan, Kankesanturai, Maviddapuram and Keerimalai. With the exception of Keerimalai, Myliddy and Kankesanturai, the remaining areas are endowed with brick red loams. Sanguvely in Uduvil, Mallakam, Kantharodai and Telli-palai have some specified paddy lands whenever and wherever the grey soils occur, while the other brick red loam areas are extensively engaged in the tobacco cultivation and garden crops on which the real economy depends in garden lands of these areas. The chief garden crops of these areas are red onions, chillies, beans, and pulses, brinjals, bittergourds, snakegourds, tomatoes, manioc and yams of distinctive kinds and other varieties of vegetables. Unlike the Vadamaradchy and Thenmaradchy Divisions, this particular Division is greatly concentrated in the cultivation of garden crops throughout the year. Another notable feature of this Division is that there are more cultivable lands than in Valikamam West. Thus we find the density of population in this Division just because of the prevalence of red soil and cultivable lands. Undoubtedly, the total income of this Division mainly depends on tobacco and garden crops cultivation. Some plantain trees are grown mainly in Chunnakam, Erlalai and Maruthanamadam.

Besides, fruit trees like mangoes, jak, pomegranates and limes are extensively grown. Some palmyrah palms grow wild on these areas; places like Maviddapuram and Ilavalai are highly concentrated in the cultivation of betel leaves, which are locally consumed with the arecanuts, by the peasants and thus form one source of income of these areas.

As a matter of fact, the economic prosperity of this Division is fairly and considerably great. Credit goes to the most industrious, persevering, and hard-earning peasants of this Division, in particular.

6. Valikamam West.

This Division comprises Suthumalai, Anaikkodai, Navali, Manipay, Sandilipay, Vaddukkodai, Araly, Tholpuram, Chankanai, Chulipuram, Moolai, Pandatheruppu, Mathakal and Periyavilan. Admittedly Valikamam West has many extensive tracts of limestone wastes and grey loams, where paddy is the principal crop and some garden crops are grown on rotation throughout the year. The chief paddy areas of this Division are Kaddudai in Manipay, Navali, Anaikkodai, Arali, Chulipuram, Pandatheruppu, Chankanai, Moolai and Vaddukodai. In fact these areas do follow the process of transplantation of paddy. The agriculturists of this Division admit the fact that the average yield of paddy is considerably great unlike the other divisions of the Jaffna Peninsula. The Kaddudai paddy fields in Manipay are striking examples. Approximately 30% of the total area is under paddy cultivation while 2 or 3% of the total area is under tobacco. When compared with Valikamam North this Division is not so much advanced. Sandilipay is well known for drumsticks of the superior quality, while Mathakal is highly endowed with corals in the entire division, and in addition bitter gourds are grown as one of the major garden crops. The areas of this Division are fairly densely populated.

7. Valikamam East.

The chief areas included in this Division are Tinnevely, Kondavil, Thavady, Annunkai, Urumpirai, Irupalai, Kopay, Neervely, Atchelu, Evinai, Sirupiddy, Puttur, Vatharavattai, Navukkeeri, Avarangal, Thoppu, Atchuvely, Idaikkadu and Valalai. This Division has some tracts of lands bordering the Jaffna Lagoon, and they are barren and only 25% of the total areas are under cultivation. The principal occupation of the people of this Division is tobacco cultivation and market gardening. Places like Kopay

North, Urumpirai, Neerveli and Sirupiddy are famous for their vegetables of different varieties, and especially Neervely is highly concentrated in the cultivation of plantains both for the local market and for sale outside the Peninsula. Intensive cultivation is carried on in this Division.

As has been already indicated, the brick red loams are fairly distributed at Tinnevely, Urumpirai, Kondavil, Thavady, Kopay North and Evinai where extensive tobacco cultivation is going on. This finds a ready market in Malayalam in South India. However from this year onwards the Malayalam Tobacco Company will not purchase Jaffna tobacco. The Ceylon Tobacco Company has undertaken the sole responsibility of purchasing Jaffna tobacco in future, and further it has advised the peasants to grow more cigarette tobacco. The majority of the peasants in these areas derive their income from tobacco and plantains, in addition to garden crops. At Tinnevely there is a Government Experiment Station noted for its poultry and dairy farming, and also the cultivation on a small scale of different varieties of such up-country vegetables as cabbages, carrots, beetroots, turnips, beans and pulses for more than 20 years. The enterprise seems to be successful. The red soil areas of Atchelu, Evinai, Navukkeeri, Thoppu, Puttur and Valalai contain some stones and gravel, and therefore they are ideal for the cultivation of manioc, different varieties of yams and dry grains like kurakkan, varagu, and gingelly. At Atchvely, vines are grown on an experimental basis at Tholagatty under the aegis of the Rosarian Monastery. Cotton, vegetables and other garden crops are also grown here. As regards Idaikkadu and Valalai, the soil being rocky, chillies, tobacco, manioc and dry grains are extensively cultivated in the reclaimed allotments. Such fruit trees as mangoes, jaks and pomegranates are widely grown. It should be noted that the fruits of the red soil areas are usually very sweet and tasty, unlike those of the other areas in the Peninsula. Here too we find density of population. In addition to these, there is mulberry cultivation carried on at Puttur by way of an experiment. It has not been successful due to the lack of

initiative among the authorities concerned. The economic prosperity of this Division may be said to be considerably great.

8. Delft and Other Important Islands in the Peninsula.

The chief islands in the Jaffna Peninsula are Karainagar, Kayts, Delft, Velanai, Pungudutheevu, Nainatheevu, Analaitheevu, Mandaitheevu, Eluvaitheevu etc. These islands are richly endowed with numerous corals. Geologically speaking, the corals are of great economic importance, because an enormous quantity of lime can be obtained by heating heaps of corals. It is useful for whitewashing and building purposes. Besides, these islands have grey loams containing enormous quantities of calcium carbonate which is ideal for paddy cultivation. Hence paddy lands are fairly distributed in these islands. Some garden crops are grown under careful tillage and manure. Coconut and palmyrah form the additional economy of the islands. Margosa trees thrive well on the soil of the islands, and they have medicinal and timber values. Careful examination of the soil of these islands reveals its economic utility and importance. Delft Island is the only place engaged in horse breeding in the entire Peninsula and it is very suitable for this purpose. The soil at Karainagar in particular, contains a peculiar kind of sand, which is confined mainly to "Karunkali", a section of the place. This sand resembles the sand at Kudathanai, and is of a light yellow colour. It is very soft with a fine texture. This particular sand is used for concrete works and building purposes, at Karainagar and its neighbouring areas.

In conclusion, it must be borne in mind that the main income of these islands is mainly derived from paddy cultivation, coconut and palmyrah, and some tobacco.

A Critical Summary of the Foregoing Analyses of the Soils of the Jaffna Peninsula.

Setting aside the infertile or unproductive soils of the Peninsula, let me make a careful qualitative analysis of both red and

grey soils. It must be borne in mind that the amount of productive land is meagre when compared to the extent of available land in the Peninsula and this has forced the peasants to direct their entire attention to intensive cultivation of the soil. That is why the Jaffna peasant has been humorously referred to as the "Scotsman of Ceylon", and there is a great deal of truth in this statement.

At present with the steady increase in the population, the average extent of land-holding is small, and it is very essential to convert the barren lands of the Peninsula into arable lands by the application of scientific methods. The Thondaimannar and Navatkuli Lagoon Schemes sponsored by the Government of Ceylon, especially by the Department of Agriculture, may now be commented upon. The main object of the schemes is to test the extent of salinity and make the land suitable for paddy cultivation. Eight acres of land are under saline paddy cultivation experiment at Vallai, and artificial and cattle manure are used. Twenty five varieties of saline paddy are under observation in two tracts. Green manure, non-manure and cattle manure have been tried. Another serious handicap of the experiment is the scarcity of the usual rain for the germination of the seeds. The Thondaimannar Scheme, however, came into operation on September 1952. The two major schemes are mainly designed to drain the marshy areas and bring them under cultivation at any cost. On the other hand, these schemes are not fully implemented. When they are completed, they will be a great asset to the agriculturists of the Peninsula. Nevertheless, both grey and red soils are derived from the parent Miocene limestone. These have a very fine texture which permit root development and aeration of the soil, and therefore they are an immense asset to any garden crop. Comparatively speaking, red soils are very much suited to the extensive growth of fruit trees as well as vegetables of distinctive varieties.

On the contrary, the grey soils are mostly adapted for paddy cultivation and for the rapid and steady growth of hard timber trees like the margosa, mahogany and bunyan.

Serious Draw-backs of the Soils of the Jaffna Peninsula.

Presumably the soils of the Peninsula are not usually fertile for want of plant food and humus. As the soil lacks humus, it retains very little moisture when a long dry period sets in. So it has been the main case in the red soil unlike the grey. The former loses its moisture quickly in the dry season while the latter has the capacity to retain some moisture. In fact it has been the main reason why the Jaffna peasants are very industrious and careful about manuring the soil from time to time. It can thus become highly productive. High credit always goes to the Jaffna peasants for their industry, skill and hard earning. Good soil in this Peninsula is definitely and totally man made.

A word about the process of manuring in the Peninsula. Green leaf manuring leads to the formation of humus which increases the water retaining capacity of the soil, to the aggregation of soil particles by flocculation and to the production of tilt. In this connection the advantages of green manures over artificial fertilisers should be noted. The latter add chemical salts to the soil and their indiscriminate use may lead to the accumulation in the soil of alkaline or acid residues in such quantity that conditions which are adverse or even injurious to the plant may be produced. Green manures in addition to improving soil physically do not have this disadvantage and their presence may counteract the pernicious effect produced by excess of artificial manures. For this reason alone the increased use of green manure is strongly recommended. Economic agricultural production depends upon the maintenance of soil fertility. Besides applying leaf manure and decay of thatching and fencing to the soil, farmyard manure is utilised to the fullest extent and with the greatest caution. It is therefore common practice among the Jaffna peasants to rent out sheep and goats for this purpose.

Climatically, the major wet period of this Peninsula falls within the influence of the North-East Monsoon. The absence of rivers and tanks in the Peninsula has led to the development of numerous well-systems for irrigation purposes. The tidal wells

at Navukeeri, Pokkanai in Urelu, Iddykundu in Kaddudai, and Jamunari in Nallur, are cited as examples.

A noteworthy fact worth considering is that the presence of enormous quantities of limestone has made the Peninsula contain subterranean water, which is tapped by means of wells, and the labours of the peasants or pumping machines raise the water to irrigate fields or gardens. The deep tidal well at Navukeeri is a clear cut illustration in point.

To add to all these, the influence of both geographical and topographical factors of the Peninsula has made it entirely an agricultural sector. Hence the total economic prosperity of the Peninsula is dependent on the quantity of its agricultural production, which is again dependent on the fertility of its soil.

Soil Erosion and Soil Exhaustion.

Soil erosion is the removal of the surface layers of the soil. It is usually caused by the action of wind and heavy and intense rainfall, but sometimes takes the form of gulying or sheet erosion. The rate of erosion depends on vegetation cover, the slope of the land and the chemical qualities of the soil. It will vary considerably with the type of farming practised, and frequently is the direct result of soil exhaustion brought about by over-cropping and the removal of humus at a too rapid rate.

The prevention of soil erosion lies in using land in such a way as to maintain its fertility, or in some cases in changing the type of utilization to increase fertility. Much soil erosion has been caused by lack of knowledge of local soil conditions and characteristics by settlers in new lands—this accounts for much of the erosion now being experienced in the New World.

However, the severe erosion of the soils of the highlands in Ceylon has been caused by the heavy rainfall resulting in the depletion of the valuable surface soil with its accumulation of humus, colloidal material and easily available plant fertilising constituents. There are many ways of preventing soil erosion. The chief are terracing, contour-forming,

afforestation and the lighter stocking of cattle ranges. While such feasible methods are common knowledge, the real problem of the present and future is to adopt them on a wide scale and to fit them all into an organised system of land utilization that will permit the optimum development of the region in question. Such an approach to the problem requires regional planning on a wider scale as is being practised in the U. S. A. (T. V. Authority), Australia, South Africa and U. S. S. R.



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