# NEW CALEDONIA AND OTHER FRENCH PACIFIC TERRITORIES

-:-:-:-:-:-:-

G. TERCINIER

1953

# NEW CALEDONIA AND OTHER FRENCH PACIFIC TERRITORIES.

Report prepared by G. Tercinier.

A section for the study of soils (Pedology) has now been created at the French Institute for Oceania (I.F.O.). The Pedology Section of I.F.O. has for its object the study of the soils and land types of New Caledonia and Dependencies, and of other French possessions in the Pacific: the Society Islands including Tahiti, Tuamotu, Marquesas and the Franco-British Condominium of New Hebrides.

Some interesting studies have been carried out from time to time in the past, but unfortunately they have not been adequately followed up. In effect therefore, it must be reckoned that all the work of classification of soils and land types in the French territories of the Pacific lies ahead.

The recently created Pedology Section of I.F.O. is still in its formative stage and its studies of a preliminary character. In particular, the information so far gained is not sufficient for the establishment of soil maps. However, the collected details, fragmentary though they are, do permit of the following summary.

## Land Use.

1. Total area of country.

| | |
|---|---|
| New Caledonia | 16.700 km$^2$ |
| Dependencies of New Caledonia (Loyalty Islands, Pine Islands) | 2.900 km$^2$ |
| Wallis Islands | 200 km$^2$ |
| Society Islands (including Tahiti) | 1.800 km$^2$ |
| Tuamotu Islands | 860 km$^2$ |
| Marquesas Islands | 1.200 km$^2$ |
| Franco-British Condominium of the New Hebrides | 15.000 km$^2$ |

2. Area of arable land.

The arable surface of New Caledonia is estimated at 100,000 hectares, of which 20,000 hectares are in reasonable use. In the Loyalty Islands, a larger proportion of the land is arable, and the same holds good in the Society, Tuamotu, Marquesas and Wallis Islands. In the New Hebrides, development has been relatively limited having regard to the available amount of land suitable for cultivation.

3. Area of grazing land.

This is estimated at 4,000 km$^2$ in New Caledonia, and proportionately less in the other French Pacific territories.

4. Area of sterile land.

In New Caledonia about 6,000 km$^2$ of land overlying serpentine

parent material can be classed as non-agricultural; these are the soils of mining areas.

5. Area of mountain land.

New Caledonia has an area of about 5,000 $km^2$ of steeply sloping land; the proportion of mountain country in relation to the total area is even greater in the principal islands of the Society Archipelago.

In New Caledonia, annual rainfall varies from 900 mm (36 ins.) (Voh) to 3,300 mm (132 ins.) (Yate). The average is 1,100 mm (44 ins.) on the south-west coast, and 2,000 mm. (80 ins.) on the north-east coast.

There is a clear maximum in February-March, and a less well defined maximum in June-July. Rainfall is well spread over the course of the year, but years with rainfall much below the mean are frequent; this leads to big losses in cattle.

In the remaining French territories in the Pacific, it is exceptional to find an area receiving less than 1,000 mm. (40 ins.) of rain per year.

Irrigation.

The traditional native technique uses furrow irrigation. At present this technique is coming back into favour after a period of disuse. As applied to European cultivation, there have only been some rare local attempts on rice fields (St. Louis) and market gardens. The possibilities for irrigation culture could be fairly significant in New Caledonia, particularly on the south-west and north coasts, but such irrigation would require a preliminary readjustment of the agricultural economy of the country.

Erosion.

Erosion is important in New Caledonia, in consequence of the generally rugged topography and heavy denudation of the slopes.

1. A descriptive study of the phenomena has been made by a specialist of the I.F.O. (F. Dugain) and is in course of publication in "L'Agronomie Tropicale" (45 bis, Avenue de la Belle-Gabrielle, Nogent sur Marne, Seine, France).

2. After a report had been presented by the Pedology Section of the I.F.O., a resolution of the Land Commission led to the formation, by a decree of the Governor of New Caledonia dated 4th August, 1953, of a Soils Commission with the following terms of reference:

(1) A plan of action to counter the erosion of soils in New Caledonia.

(2) A tentative plan of action, aimed either at suppression or control of bush fires.

(3) The factors to be taken into account in the new regulations concerning the tax assessment of land grants for the protection of the forests and soils of New Caledonia.

3. A system of classification of the phenomena of erosion is being set up. It will be based on topography, with observations in the field accompanied by physico-chemical measurements in the pedological laboratory of the I.F.O.

Soil Surveys.

1. Reconnaissance and mapping of the various soil types is in progress

over New Caledonia and its Dependencies; for the other French Pacific territories, the survey is still to come. Field work has been and will continue to be supplemented by detailed analyses in the Pedology laboratory of the I.F.O.

The classification adopted has as its starting point the distinction between Zonal soils (brown soils, podzolic soils, lateritic soils), Intrazonal soils (saline soils, organic soils) and Azonal soils (alluvial soils and rendzina-like and skeletal soils).

2. In New Caledonia and the Loyalties, recognition of the soils is already sufficiently far advanced to enable a provisional table of soil groups to be established (see appendix).

In the other French Pacific territories, the soil surveys have still to be done; however, it is already evident that there are important areas of brown lateritic soils overlying basic rocks, approximating to the "red chocolate soils" and the black paraskeletal coralline soils of the rendzina group. The existence in these territories of decalcified and more or less lateritized soils on coral is equally probable.

3. Detailed studies have been undertaken on Mare Island (Loyalties) by F. Dugain and on the south-west coast in the region of Bourail, by G. Tercinier.

The soil types that have been or are at present being systematically studied are :

On Mare Island: lateritic brown soils and rendzina-like soils.

Bourail region: decalcified red brown earths on slopes, slightly leached, with calcium carbonate accumulation at depth; leached and podzolic soils; rendzina-like soils on shell-bearing sand; rendzinas formed in the zone of accumulation of red brown earths truncated by erosion; deep colluvial rendzinas; undifferentiated silty and clayey alluvial soils; red brown alluvia high in magnesia; paraskeletal soils on non-crystalline schists.

In addition, a rapid examination of the soils in a valley of the northern region of New Caledonia (Tiwaka) has afforded interesting data on the micaceous sand-silt alluvia derived from the crystalline schists of that region.

The work of F. Dugain on the soils of Mare Island will form the subject of a paper to be presented at the Manila Congress.

4. Two soils specialists have been with the I.F.O. for periods of 18 months and 6 months respectively. One of these is particularly concerned with soil conservation and study of erosion, the other with soil classification and land use.

Land Classification.

1. A classification of land according to their agricultural use is being prepared. On the majority of the better lands of New Caledonia, coffee appears to be the most suitable crop. Coffee (C. arabica) is planted on the south-west coast principally on the alluvia derived from non-crystalline schists; this crop could equally well give promising results on the decalcified red brown earths and on the colluvia arising from these red brown earths and the grey brown soils overlying schists. C. robusta is planted on the north-east coast on alluvia and colluvia.

Maize growing is fairly successful on the alluvia on the south-west coast when sufficient precautions are taken to conserve the organic matter of the soil. On decalcified red brown earths, this crop involves too great a risk of erosion. On calcareous coralline soils where it can suffer from

potassium deficiency, precautions must be taken to maintain the organic surface horizon which is the key to the fertility of this soil. On leached soils where phosphate deficiency can be very marked, yields are mediocre and diminish very rapidly.

The cocoa tree thrives on well-drained sands, whether calcareous or not. In New Caledonia it only gives worthwhile yields close to the coast and in fact its ecology is restricted by limiting climatic conditions. At present it is of more importance in the Loyalties (Uvea) while in the Society Islands, Marquesas, Tuamotu, Wallis and the New Hebrides, it represents the chief agricultural resource.

Citrus does well on the brown lateritic soils of the Loyalties and on a certain number of the New Caledonian soils such as the decalcified red brown earths; paradoxically enough it also seems to be possible to get good crops on the red brown magnesian alluvia derived from serpentine, due to the drainage properties of these soils which are otherwise infertile, poor and badly adjusted chemically.

In New Caledonia dark grey colluvial soils derived from the paraskeletal soils on schists are frequently used for subsistence crops in spite of their heavy character. The decalcified red brown earths are favourable for production of vegetables but if so used are susceptible to erosion. Certain subsistence crops which require lime (e.g. garlic) are cultivated on rendzina-like soils whereas vegetables requiring acid conditions are sometimes produced on leached soils. Because of the risk of flooding, growers often refrain from planting vegetables on alluvia despite the fact that for most of the time these soils are capable of giving high yields. In the Loyalties, the brown lateritic soils on dolerites and basalts are excellent market garden soils but only cover a very restricted area.

In the Society Islands (Tahiti) vanilla crops are grown, the soils probably having a high water content.

Cattle raising on an extensive scale, aimed with only rare exceptions at beef production, is at present the principal agricultural resource of New Caledonia. This is not without its drawbacks from the point of view of conserving the soils. The carrying capacity of the pasture varies considerably according to the quality of the land; on poor areas it is too often found that fire is used for a so-called "regeneration of the pastures".

2. At present, land use is determined firstly by considering the natural vegetation and from experience already gained with existing cultivation practices, secondly by true pedological examination with detailed analysis of samples, overall account being taken of the limitations imposed by the need for conserving the soil.

It is to be hoped that more precise trials on an established scientific basis will be conducted on the experimental plot.

Future Extension.

Expansion of the work of soil surveying and land classification, and the setting up of conservation measures, are the essential aims of the Pedology Section of the I.F.O.

Soil survey and the determination of land use for the agricultural regions of New Caledonia, will be based on detailed surveys at the scale of 1 : 30,000 or 1 : 40,000 on sectors typical of the broad natural regions.

The conclusions which can be drawn from these spot surveys will appreciably hasten the reconnaissance and mapping of the soil groups of the Island. Desirable conservation measures will be worked out simultaneously.

Field work is supplemented and rounded off by very detailed analyses; in some cases 30 different determinations may be made on one sample of soil.

These analyses are carried out in the Pedology laboratory of the L.F.O. under the direct control of soil specialists. To date, the Pedology Section only has the use of a small laboratory and is not equipped to carry out more than 30 analytical determinations per week, but the section is pressing urgently for the construction of a much larger new laboratory to allow of 90 - 100 determinations per week.

Selected List of Major Publications since about 1940.

1. New Caledonia.

STAATMENS, W. and BARRAU, J. (1950, September-October), - First observations on the soils of New Caledonia. Rev. Agric. Nlle. Caledonie: Noumea, pp. 7-12, 1 fig.

BARRAU, J. (1951, July-August). - The agricultural problem in New Caledonia. Rev. Agric. Nlle. Caledonie: Noumea, pp. 3-12.

SAMLIN, P. (1952, May-June).- Agricultural statistics. Results of an agricultural investigation in New Caledonia in 1951. Rev. Agric. Nlle. Caledonie: Noumea, pp. 3-10, 2 fig., 3 (cartes).

DUGAIN, F. (1952, November-December). - Bush fires. Rev. Agric. Nlle. Caledonie: Noumea, pp. 5-10, 8 photos.

2. Other French Pacific Territories.

THEVENOT, M. (1952, May-June). - Monograph on Uvea or Wallis. "L'Agronomie Tropicale": Paris, pp. 276-288, (analytical data).

TKATCHENKO, R. (1952, May-June). - Brief interpretation of results of analyses from soils of Uvea or Wallis. "L'Agronomie Tropicale": Paris, p. 288.

Maps of Soil Surveys.

Up till now no soil maps have been published: the production of maps of this type will constitute part of the work of the Pedology Section of the I.F.O.

TABLE 1.

CLASSIFICATION OF SOILS OF NEW CALEDONIA.

| | | | | |
|---|---|---|---|---|
| 1. Zonal Soils | 1. Brown Soils (S.W. Coast) | (a) Red-brown decalcified soils more or less leached with $CaCO_3$ accumulation at depth.<br>(b) Other probable types not yet fully defined. | | |
| | 2. Podzolic Soils (S.W.Coast) | (a) Leached Soils<br>(b) Podzolic Soils )<br>(c) Podzols ) | 1. - A reddish horizon with accumulations<br>2. - Gleyed A horizon | without concretions at the level of grass roots.<br>with concretions at grass root level. |
| | 3. Lateritic Soils or Allites (Central chain East slopes, Loyalties) | (a) Red-brown ferruginous lateritic soils on serpentine, low in alumina (a typical red chocolate soil)<br>(b) Yellow-red lateritic soils on schists | | (1. - with ferruginous fine gravel.<br>(2. - with autochtonous iron pan.<br>(3. - with allochtonous iron pan.<br>(1. shallow solum on coral, rich in phosphates.<br>(2. deep and stony, on dolerites and basalts. |
| 2. Intra Zonal Soils | 1. Saline Soils covering large areas of the S.W. Coast, not yet studied. | | | |
| | 2. Raw humus Soils, not yet defined. | | | |
| 3. Azonal Soils | 1. Alluvial Soils | ⋇ (a) Silt-clays, undifferentiated, derived from non-crystalline schists (S.W. Coast).<br>/ (b) Silt-sands, differentiated (leached with gleying) derived from the above.<br>⋇ (c) Silt-sands with mica, slightly differentiated, derived from crystalline schists.<br>(d) Magnesian red-brown earths derived from serpentine. | | |
| | 2. Rendzina-like Soils (S.W. Coast) Loyalties. | Ø (a) On shell-bearing sands (raised terraces), very sandy and grading laterally into leached soils.<br>Ø (b) Formed on the horizon of lime accumulation of the eroded decalcified red-brown earths.<br>Ø (c) Deep soils of colluvial origin, derived from the above two and grading laterally to leached gley soils having concretions at "grass-root" level. | | |
| | 3. Skeletal or Paraskeletal Soils. | (a) Grey brown soils of heavy texture on non-calcareous schists (with important associated colluvia).<br>(b) Magnesian black and red-brown earths on serpentines and giobertites. | | |

⋇ = Arable Soils.
Ø = Soils suitable for cultivation when precautions are taken.
/ = Soils which can be cultivated under favourable conditions.
Remainder are non-agricultural soils.