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Report No. 85

Report on a Reconnaissance Soil Survey
of the
BATANG OYA AREA

3 rd Division

by

I. M. Scott
Soil Surveyor

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REPORT ON A RECONNAISSANCE SOIL SURVEY OF THE BATANG OYA AREA, THIRD DIVISION.

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INTRODUCTION.

A reconnaissance soil survey was made in June and July, 1965 of the lower Batang Oya floodplain between Dalat and Tamin. The survey party comprised Agricultural Assistants Rosli bin Sahari (in charge), Albert Leigh and Ahju Mawat, and V.S.A. Assistant Michael Malthus. The purpose of the survey was to delimit the extent of mineral and shallow organic soil associated with the course of the Batang Oya, it being known that the bulk of the area was mantled by deep peat deposits of very limited use for agriculture. Near Tamin scattered hills are present and these have been included on the attached map although the soils were only briefly investigated.

In 1961 the coastal areas between Miri and Igan, including the lower Batang Oya, were reconnoitred (Wall, 1). The soil map from the present survey has been extended to include data downstream of Dalat taken from the 1961 field sheets. The soil map therefore covers the entire course of the Batang Oya below the point where it enters the coastal peat swamps. The area is located on Fig. 1 and totals some 209,600 acres.

GENERAL

Geology and soil parent material.

The hills in the extreme south of the area are composed of sandstones and shales of the Belaga III Formation, which is considered to be of Middle to Upper Eocene age. It is presumed that rocks of this formation, with possibly some rocks of the Belaga IV Formation (Upper Eocene), underlie the whole area, although over 9/10ths of it no solid geology outcrops. The lithology of these formations has been described by Wolfenden (2). The bulk of the area is, however, mantled by deep organic soils which are replaced close to the main rivers by riverine alluvium and close to the sea by marine alluvium.

Landforms

The hills in the extreme south of the survey area are generally low and do not exceed a height of 100 feet. The larger hill masses tend to be oriented roughly northwest-southeast, following the geological strike. Peat has, however, infilled all minor stream valleys and isolated many uplands. The majority of hill masses within the area are small and entirely surrounded by peat swamps. The latter have a convex surface although this is hardly noticeable on the ground. Levelling done during the survey suggests that the gentle rise from the swamp margin is not more than about 20 feet. Coastal sand deposits and levees along the Batang Oya have subdued microrelief (less than 5 feet amplitude). The area thus gives a general impression of being flat and featureless.

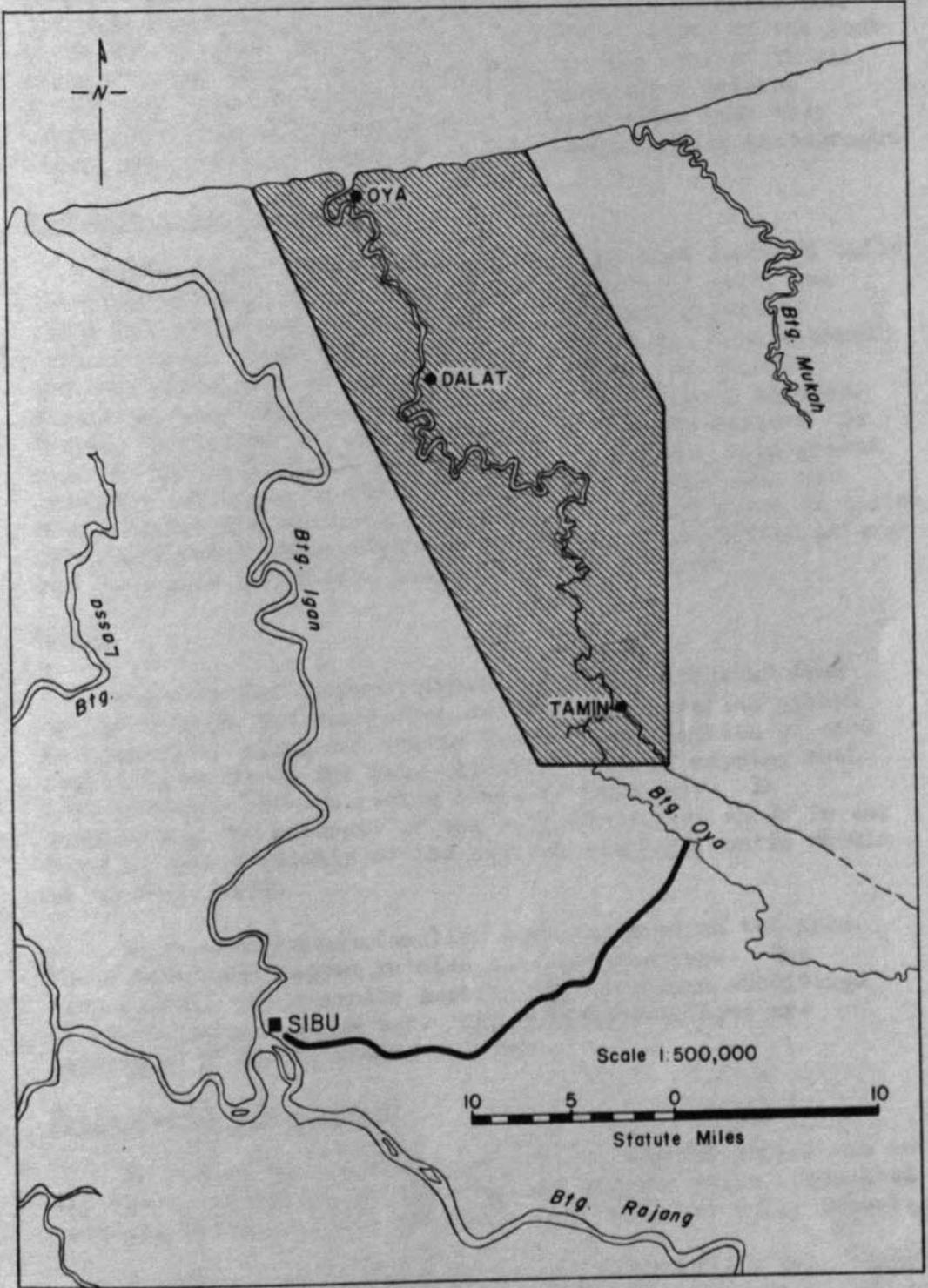


Fig. 1: LOCATION

The watertable is within 2 feet of the surface in almost all localities.

Drainage

The area is largely drained by the Batang Oya which has few tributaries of any length. The coastal fringes of the peat swamps drain direct to the sea by small streams whose drainage channels are rarely well-defined except where they cross the coastal sand deposits. In the interior of the peat swamps surface water may be expected to shed outward in all directions from the centre of the low domes but defined drainage channels are either absent or so minor that they cannot be located through the forest canopy on air photographs.

Vegetation and land use.

The majority of even the smallest and most isolated hills have been cleared in the past, largely for hill padi, and these hills are now generally under secondary growth of various ages. Land close to the Batang Oya has been cleared and cultivated for wet padi, rubber and sago for short distances into the peat swamps proper. These are, however, largely untouched and are mantled by Peat Swamp Forest. On the mineral soils close to the coast this forest type grades into poor Littoral or Mixed Swamp Forest where it has not been cleared for coconuts or vegetables. Small areas of saline clays are found under nipah and some mangrove. Little attempt has been made to utilise these soils for farming.

SOILS

The attached reconnaissance soil map is derived from air photograph interpretation and field information gained from sampling along cut rentis lines. The location of each rentis is shown on the map. At this level of mapping much interpolation between rentis lines is necessary. In considering the accuracy of the soil boundaries shown in any locality the proximity of the nearest sampling rentis should be borne in mind.

Soils of seventeen families were recorded in the area. These have been mapped in nine soil associations. One association, the Anderson Association, has been subdivided in depth phases on the map. The soil associations are described in the following sections.

Nyalau-Merit Association

As stated above, the object of the present survey was to map the distribution of alluvial and organic soils associated with the Batang Oya and the hill soils were not fully investigated.

Of those hills sampled soils of four families were recorded - Nyalau, Merit, Saratok and Kerait. Nyalau soils are yellow to reddish yellow sandy loams to sandy clay loams, grading at depth to sandy clay loams. They are developed over sandstones. Merit soils are yellowish brown to reddish yellow clay loams, overlying clays or sandy clays at depth. A stoneline of iron-enriched weathered rock fragments may be present at depth in the profile. Merit soils are developed over shales. Nyalau and Merit soils appear to be dominant on the higher hills in this area and mantle many of the lower hills. The latter are however, commonly mantled by soils of the Saratok or Kerait families. Saratok soils are grey to pale yellow sandy or gravelly loams, the profile typically being underlain by a stoneline of quartz fragments. Kerait soils

are equally pale-coloured but have heavier subsoil textures. While commonly sandy or silty loam in the upper subsoil, the lower subsoil is a clay or sandy clay.

Nyalau and Merit soils are suitable for rubber although, where slopes are steep, conservation measures are necessary, particularly on Nyalau soils. Nyalau soils also have a lower natural fertility than Merit soils. Pepper also does well on Merit soils in many areas. Kerait and Saratok soils have a low natural fertility but can be used for rubber if adequate fertilizer applications can be given. Where possible, however, it is advised that they be excluded from any planting scheme.

The Nyalau-Merit Association covers approximately 4,900 acres.

Kabong Association

The Kabong Association largely comprises a narrow strip of well-drained to excessively-drained grey to brownish yellow marine sands of the Kabong Family which is found immediately behind the shoreline. Water tables are low and not generally within 24 inches of the surface. Such soils are used in part for coconuts but benefit from applications of organic fertilizer. Weakly-developed podzols of the Buso Family may occur in the Association as in the neighbouring Mukah area (Wall, 2) and in small drainage lines running parallel to the coast Tatau Family soils are present.

The Kabong Association covers approximately 1,000 acres.

Tatau Association

The Tatau Association largely comprises soils of the Tatau Family, grey or greyish brown mottled marine sands in which watertables are always high and within 24 inches of the surface. Where thin (less than 6 inches) peat or muck horizons overlie the profile the soil is separated in the Matu Family. These soils form a transitional belt between the Kabong soils along the coast and the poorly-drained Igan or Mukah soils which fringe the peat swamps. Tatau and Matu soils are used for coconuts and vegetables but require fertilizer applications and drainage control.

The Tatau Association covers approximately 2,900 acres.

Rajang Association

The Rajang Association largely comprises soils of the Rajang Family. These are marine clays present in the estuary of the Batang Oya and subject to tidal incursions of saline water. Groundwater conductivity is above 500 μ mhos throughout the year and is generally above 4,000 μ mhos indicating that these soils are strongly saline. 'Catclay' has been recorded in these soils in the adjacent Mukah area and scattered occurrences are likely in this area also. In their present state Rajang soils are unsuitable for agriculture and reclamation by leaching of salts is likely to induce other problems. At present they are ignored by local farmers and bear a cover of nipah and mangrove.

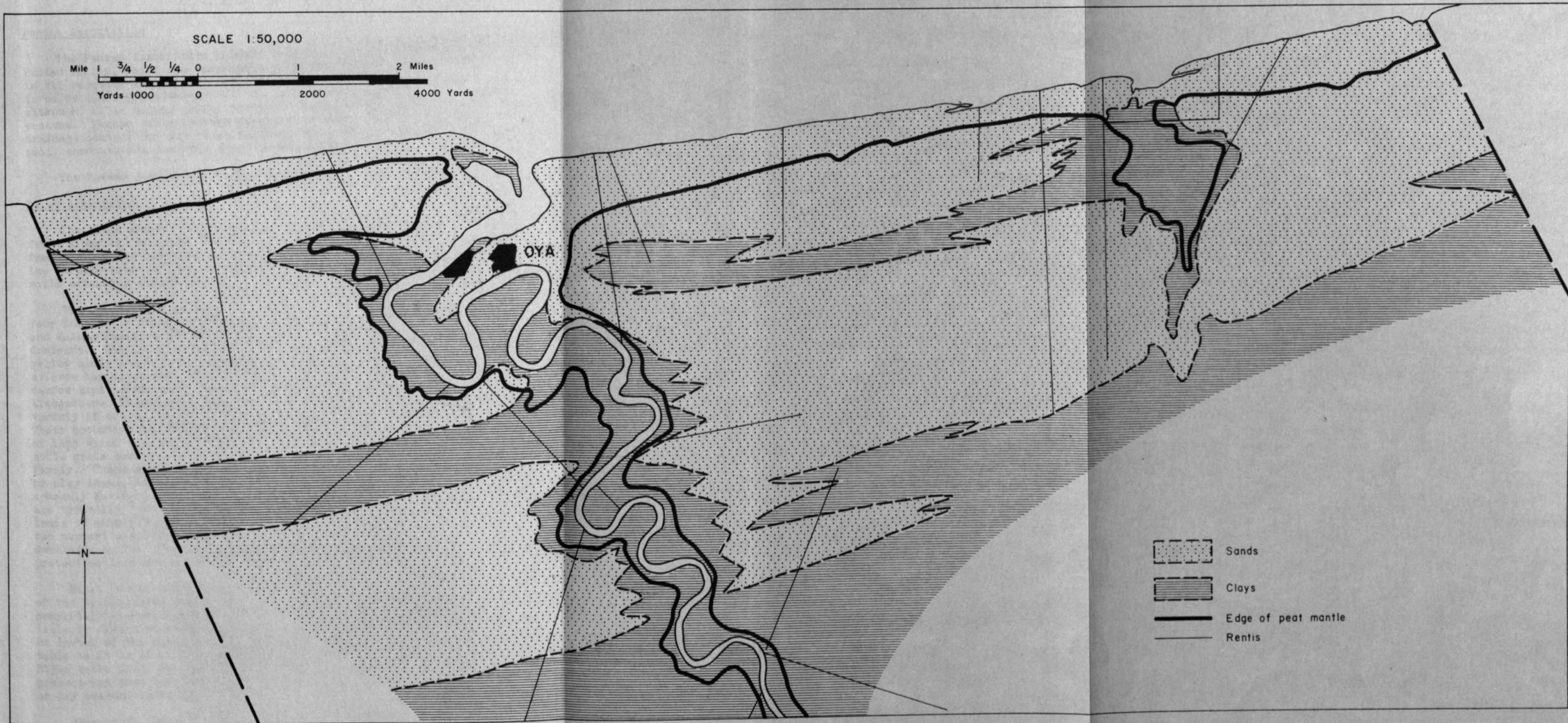


Fig. 2: APPROXIMATE DISTRIBUTION OF COASTAL SANDS AND CLAYS UNDER THE PEAT MANTLE. (after J.R.D. Wall, ref. 1)

Pendam Association

The Pendam Association largely comprises soils of the Pendam Family, which are comparable to Rajang Family soils in all respects except salt levels. Groundwater conductivity is below 4,000 μ mhos throughout the year in Pendam soils although, as in Rajang soils, 'catclay' may be patchily present. Pendam soils require leaching of salts and drainage control but with such measures are suitable for wet padi, coconuts and possibly some vegetable crops.

The Pendam Association covers approximately 1,700 acres.

Bijat Association

The Bijat Association comprises the mineral soils found along the banks of the Batang Rajang. As can be seen from the map the association forms a very narrow band and on the outside bends of many tanjongs is virtually absent, peat soils extending almost to the river banks.

The association is largely a compound mapping unit of four families - Semilajau, Malang, Bijat and Sebandi. Semilajau and Malang Families are inextensive, Bijat Family soils being dominant. Semilajau soils are yellowish brown to brownish yellow sandy loams found immediately on the river banks where a levee has developed. The family rarely forms more than a narrow strip along each bank and in many localities is absent altogether. These soils have been found suitable for a variety of crops, including rubber, fruit trees, and vegetables. Their potential is limited, however, by the restricted amount of land which they cover in most localities. Semilajau soils grade back from the river into soils of the Malang Family. These are brownish yellow to yellowish brown clays or clay loams, becoming increasingly mottled with depth and commonly having a gley horizon below 24 inches. Malang soils are typically found on the better-drained parts of the bottomlands of main rivers. They are suitable for agriculture and can support a similar range of crops to that quoted for Semilajau soils. Drainage control is needed, however, and protection from wet season flooding is particularly required.

Bijat Family soils occupy the more poorly drained parts of the bottomlands. Bijat soils are light grey, mottled or completely gleyed, clays or sandy clays. The groundwater table is always at least moderately high and usually within 24 inches of the surface. During the wet season the water table is at or above the surface. With drainage control Bijat soils could be used for a variety of crops but in their present drainage condition are best suited for wet padi or dry season vegetables.

Where thin (less than 6 inches) surface peat or muck horizons overlie Bijat profiles the soil is separated in the Sebandi Family which form a transitional strip between Bijat and Mukah soils.

The Bijat Association covers approximately 9,100 acres.

Igan and Mukah Association

Proceeding inland from the coast soil drainage conditions become poorer and a surface accumulation of peat or muck is developed on the marine sands. Such soils form a transition belt between the Tatau Family and the deeper Bog Soils of the Anderson Family. Where the organic material is greater than 6 inches but less than 3 feet deep these soils are separated as the Igan Family, deeper organic soils being included in the Anderson Family regardless of the texture of the underlying mineral horizons. A similar sequence is found when proceeding from the Batang Oya floodplain into the peat swamp proper. The alluvial clays of the Bijat Family are overlain by an increasingly deep organic layer. Where underlain by clays at depths of 6 inches to 3 feet these soils are separated as the Mukah Family.

On the coastal fringes of the peat swamps the transition from deep to shallow peat deposits forms a rather broad belt and a belt of Igan soils of mappable width is always present. Along the Batang Oya, however, the transition from mineral alluvial soils to deep peat soils is very abrupt in many areas. Mukah soils thus rarely cover extensive areas and in many localities cannot be mapped at all.

Where the water table can be lowered and controlled Igan soils are suitable for coconuts. Mukah soils are suitable for wet padi. If drainage can be improved and protection given against wet season flooding they can be used for other crops.

The Igan Association covers approximately 4,100 acres and the Mukah Association approximately 4,000 acres.

Anderson Association

The Anderson Association comprises soils of the Anderson Family. This family covers all peat soils in which the organic surface horizons are more than 3 feet deep, regardless of the nature of the underlying mineral horizons. Work by Wall (1) has shown that the marine sands in which Kabong, Tatau and Igan soils have developed extend some distance under the peat mantle behind these coastal soils and Anderson soils underlain by sands are found up to 4 miles from the coast. Farther inland, however, these soils are typically underlain by heavy gleyed clays. The extent of basal sand under the coastal peats, as far as it is known, is illustrated in Fig.2.

In the central part of the area the peat swamp surface is convex. The absolute amplitude of relief is not known as areas far from a main river were not investigated. Four rentis lines on the present survey were, however, levelled (by M. Malthus) and a rise of 14 feet was recorded on rentis B, this being at the rentis end point beyond which the peat surface is believed to continue to rise. It is possibly significant that while this rentis (Fig.3, B) extends across the cultivated belt close to the river and some distance into primary forest, rentis A and rentis C (see Fig.3) are located in areas where the cultivated belt is much wider and the upward gradient from the river banks is seen to be much less than that of rentis B. This may be due in part to intentional or fortuitous improvements in the drainage of the cultivated areas and subsequent shrinkage of the peat.

Figures 3, A, B and C and the distribution of Anderson 1 and 2 on the soil map show that proceeding upstream the downward gradient of the mineral soil at the base of the peat becomes greater. Around Dalat there are mappable and continuous belts of Anderson 1 and Anderson 2 (depth phases, 3-6 feet and 6-10 feet of peat respectively) but farther upstream in the Sg. Narub - Sg. Bach area mineral alluvial soils grade back from the river abruptly into peat soils deeper than 10 feet (Anderson 3). The topography of the peat surface and the underlying mineral layers do not appear to be connected. On rentis C, for example, peats deeper than 20 feet are present close to the river bank but farther from the river shallower peats are again found (as the rentis approaches hill land to the southeast). The peat surface, on the other hand, rises gently throughout the section sampled, apparently uninfluenced by these subsurface features. Where mineral horizons were within 20 feet of the surface and could be detected on the survey the data suggests that the subsurface relief is very subdued and sharp changes in relative height (or depth) in the mineral layers is unusual.

Figure 3, D shows a section through peats in the extreme south of the area mapped. Here the characteristics of the basin peats described above are not found. The peat surface slopes downwards from the river bank and, while very deep peats are recorded here also, the level of the underlying mineral layers is more variable. It is apparent that a previously exposed surface, with significant amplitude of relief, is now buried under the peat mantle. Such extension of the peat is evidenced by the many minor valleys extending back into the hills, all of which appear to be filled by peat soils and the majority by peats deeper than 10 feet.

The datum for each section in Fig. 3 was the river level at the time of survey. It can be seen that, apart from rentis A (near Dalat) the underlying mineral layers in the localities studied were far below this datum. If these localities are typical, and there is no reason to suggest otherwise, there are no possibilities for large-scale reclamation of the deep peats without first considerably altering the regime of the Batang Oya.

At the present the Anderson Association is largely untouched but sago is grown quite extensively on the fringes of the mapping unit near the Batang Oya. Some rubber is also found, this in most cases being an extension from rubber plantings on the adjacent Bijat and Mukah soils. Anderson soils are at present best considered unsuitable for agriculture with the exception of sago and there is some doubt regarding the extent to which they can be recommended for even that crop. Sago is normally grown on these soils but this is probably more to leave other soils available for crops less tolerant of waterlogged conditions than because deep peat soils are the optimum medium for this palm. Wall (3) has stated that sago in the adjacent Mukah area matures more quickly on mineral alluvial soils than on peats and, on the analytical data available, concluded that, of the peat soils, those close to the coast or a major river were likely to have somewhat higher nutrient levels than the interior peats, a fact possibly significant in connection with sago cultivation. While experimental data is lacking, however, it is difficult to give any recommendations for this crop beyond pointing out the obvious: that it appears to be economic to grow the palm on all depth phases of the Anderson Family which are close to a river. The Anderson Association covers approximately 180,600 acres.

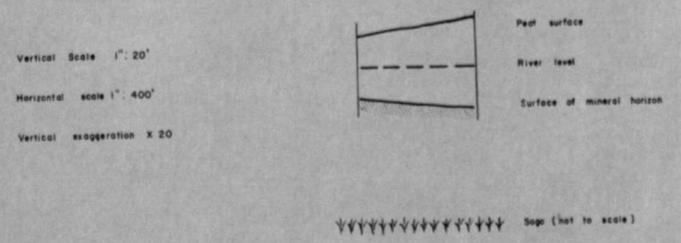
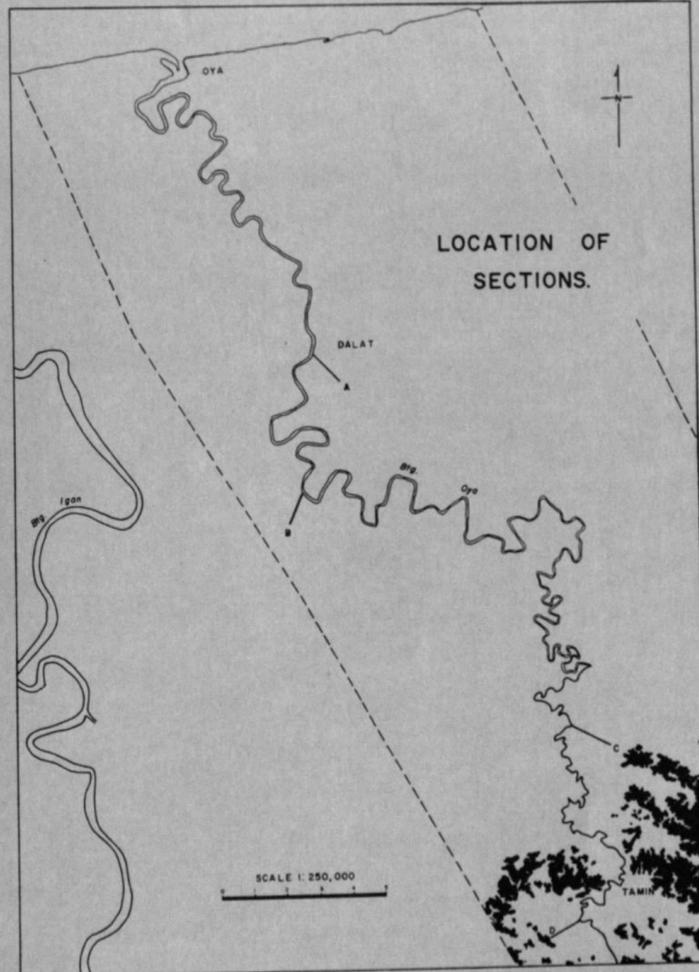
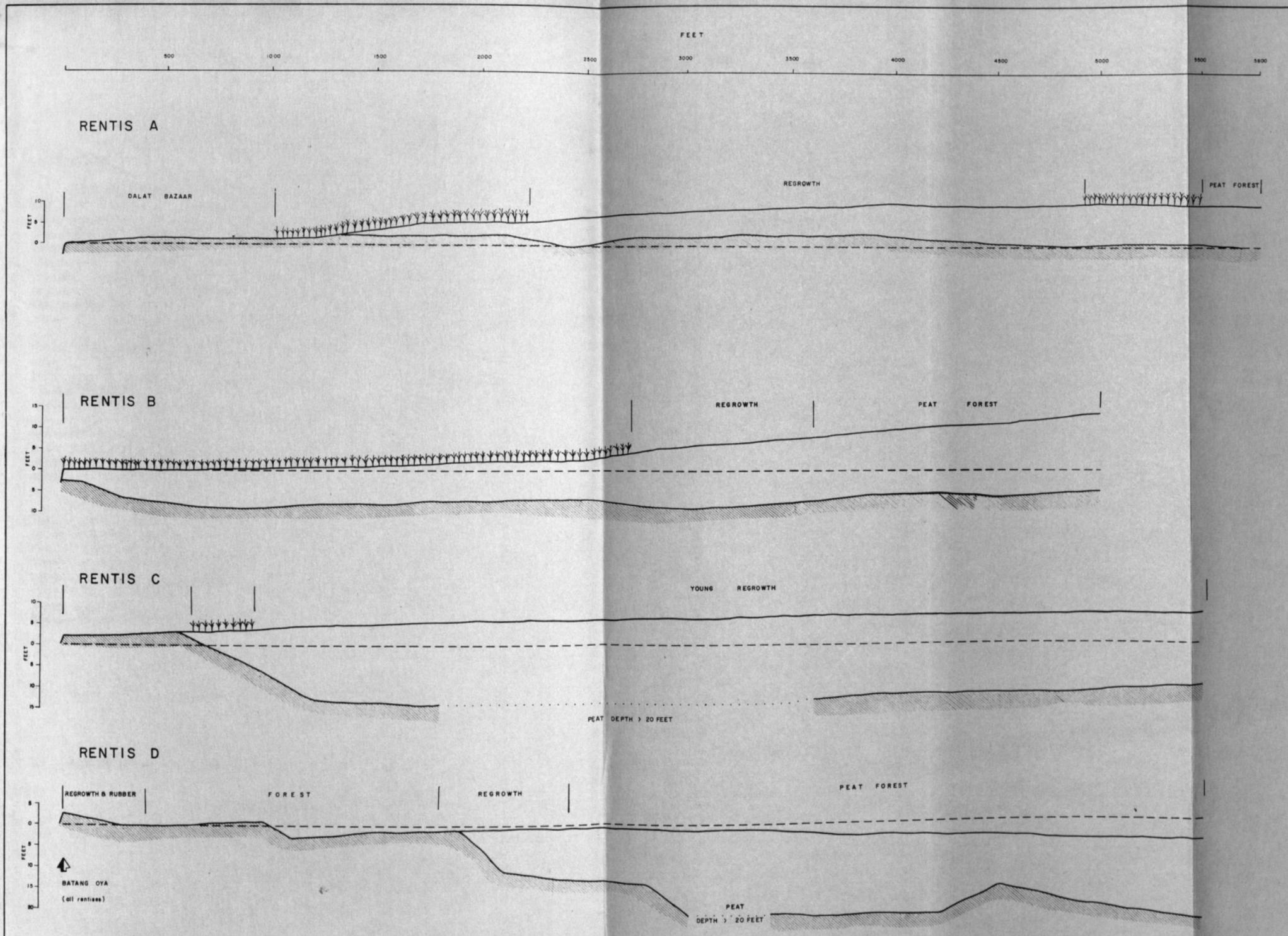


Fig. 3 LEVELLED SECTIONS THROUGH THE PEAT SWAMP MARGIN

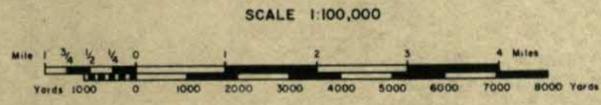
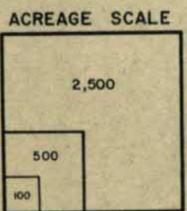
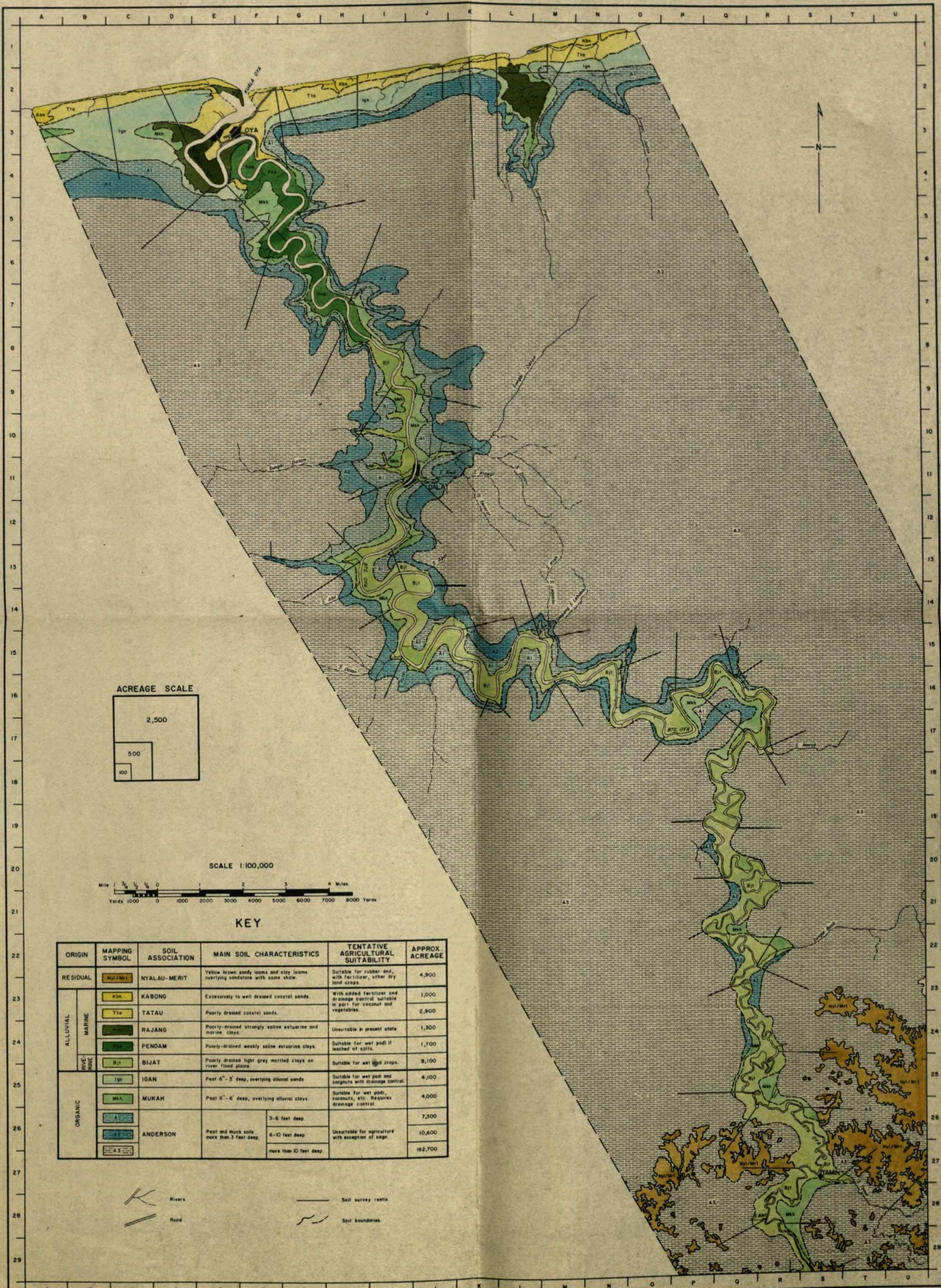
CONCLUSIONS

Along the coastal section included in the soil map there are some 8,000 acres of Kabong, Tatau and Igan soils which, with appropriate drainage control and fertilizer applications are suitable for coconuts, vegetables and possibly other crops. In the south a few areas of uplands are included on the map and bear soils suitable for rubber and, in part, for pepper. The present survey was mainly concerned with the soils associated with the middle section of the Batang Oya. The survey shows that the area of mineral alluvial soil on the river floodplain is very narrow, comprising approximately 13,100 acres of Bijat and Mukah soils, and in some localities these soils grade back very rapidly from the river into peats deeper than 10 feet. Bijat and Mukah soils are suitable for wet padi and, with drainage control and protection against wet season flooding, the range of possible crops can be considerably extended. The peat soils, mapped as the Anderson Association, can be used for sago as at present but the few levelling data available suggests that there is little scope for reclaiming these deep peat areas by large-scale drainage schemes. Sago is thus likely to remain the only appropriate crop for these soils in most areas.

The main scope for agricultural development in the Dalat-Tamin area is thus on Mukah and Bijat soils. In considering small schemes within the tanjongs of the river the reconnaissance nature of the soil map should be borne in mind, together with the fact that Bijat soils are known to grade rapidly into Anderson 3 soils in some localities. Unless a rentis has crossed the area of interest prior investigation by local Agriculture Department staff is advised in order to check the distribution and depth of any peat soils present.

REFERENCES

1. WALL, J.R.D. 1962 Progress report on the coastal reconnaissance survey, Miri-Igan, 3rd and 4th Divisions. (Report No.43 in this series).
2. WOLFENDEN, E.B. 1960 The geology and mineral resources of the lower Rajang valley and adjoining areas. Brit. Borneo Geol. Survey Mem.11
3. WALL, J.R.D. 1961 Report on a detailed reconnaissance soil survey of the Mukah area, 3rd Division. (Report No.38 in this series).



KEY

ORIGIN	MAPPING SYMBOL	SOIL ASSOCIATION	MAIN SOIL CHARACTERISTICS	TENTATIVE AGRICULTURAL SUITABILITY	APPROX. ACREAGE
RESIDUAL	Ny/Mr	NYALAU-MERIT	Yellow brown sandy loams and clay loams overlying sandstone with some shale	Suitable for rubber and, with fertilizer, other dry land crops	4,900
ALLUVIAL MARINE	Kbn	KABONG	Excessively to well drained coastal sands	With added fertilizer and drainage control suitable in part for coconut and vegetables	1,000
	Tta	TATAU	Poorly drained coastal sands		2,900
	Raj	RAJANG	Poorly drained strongly saline estuarine and marine clays	Unsuitable in present state	1,300
	Pnd	PENDAM	Poorly drained weakly saline estuarine clays	Suitable for wet padi if leached of salts	1,700
RIVERINE	B1	BIJAT	Poorly drained light grey mottled clays on river flood plains	Suitable for wet padi crops	9,100
ORGANIC	Ign	IGAN	Peat 6"-3' deep, overlying alluvial sands	Suitable for wet padi and coconuts with drainage control	4,100
	Mkh	MUKAH	Peat 5"-6' deep, overlying alluvial clays	Suitable for wet padi, coconuts, etc. Requires drainage control	4,000
	A2	ANDERSON	3-6 feet deep	Unsuitable for agriculture with exception of sago	7,300
	A1		6-10 feet deep		10,600
A3	more than 10 feet deep		162,700		



