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Report on a Semi-Detailed Soil Survey
of the
SUNGAI SEKALOH AREA
LAMBIR - SUBIS

4 th. Division

by

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MAPS: 3 maps at 1:25,000 scale are enclosed in the back pocket of this report.

Map 1: Soil Examination Plan.

Map 2: Soils.

Map 3: Land Suitability for Oil Palm.

Report on a Semi-detailed Soil Survey of the Sekaloh-Tanggap Area,
Lambir-Subis, 4th Division.

1. INTRODUCTION

The semi-detailed soil survey of this area was aimed at assessing its suitability for oil palm cultivation by the Sarawak Economic Development Corporation. The acreage figure for the area surveyed as derived from the Soil Map is 19,490.

The area is situated south of the Lambir-Subis Regional Development Area between mile 51 and mile 53 along the Miri-Bintulu Road. The surveyed area forms the southern continuation of the area surveyed and reported in Report No.139/1, and is bounded in the south by Sungai Sekaloh, in the west and northwest by peat swamps and alluvium formed at the foothills of the Subis Limestones and Sungai Tangap, the survey stopped at the footslopes of steep high hills in the east and reconnaissance investigation along the extensive timber tracks indicates that the area further to the east is much too rugged for oil palm cultivation. This area surveyed in fact constitutes the last part of the Government Reserve south of the Lambir-Subis Regional Development Area. Further south of Sungai Sekaloh all the land is under shifting cultivation.

2. SURVEY WORK

Survey work was conducted along standard procedure which consists of examinations of the soils and topography along cutlines or rentises spaced at 1,300 feet intervals. The rentis pattern used is shown in the Soil Examination Plan (Map 1). The soils along each rentis were described at intervals of 200-300 feet, and relevant data such as topography were also recorded.

3. MAPS

The base map used for the field work was prepared by the Land and Survey Department; this has a scale of 1:10,000 and contours at intervals of 25 feet. The final soil map compilation was aided by air-photograph interpretation but it was found that the low dissected terrain does not permit easy identification of the topographic units and the soil boundaries were drawn mainly from the field data guided by the contours. Three maps at 1:25,000 scale were produced, these are: The Soil Examination Plan, The Soil Map and map showing the Land Suitability for Oil Palm.

4. VEGETATION

The area is mainly under primary forest cover except for a small area of alluvium of the upper Sungai Bakas in the north which is under shifting cultivation. The hill forest along the trunk road has mainly been extracted of timber and at the time of field work, the activity was concentrated in the eastern part of the area and in the high hills outside the area surveyed. Peat swamp forest found in levee-backed riverine basins behind Sungai Sekaloh, Sungai Tangap and near the Subis Limestone hills are of poor quality and does not appear to contain valuable timber trees. Along the entire right bank of Sungai Sekaloh, Bellian trees are found in fairly large number and these are fell by local Ibans and sold as logs, pepper poles or as Billian atap.

5. TOPOGRAPHY AND DRAINAGE

The area is built by Setap Shale of Miocene age with subordinate sandstone and limestones. The resulting topography varies from low gentle to moderately steep and dissected, many of the hill slopes

tend towards strongly convex. Isolated blocks of sandy shales occur, forming the prominent steep hills which are clearly separated in the Land Suitability Map.

Sungai Sekeloh and Sungai Tangap are the two largest streams; these are liable to overtop their banks during the landas and excess water spills onto the lowlying poorly drained alluvial or peat swamps lying between the levees and hills. Most probably, the development of these peat and small alluvial river swamps proceeded concurrently with levee formation; the latter formed would progressively impede drainage of these lowlying areas and thus accounts for the peat swamps along these rivers and the upper parts of valley floor. However, the level of these rivers are well below the banks for greater part of the year and only relative small efforts should be required to drain these alluvial and interior swamps.

6. SOILS

In most aspects the soils mapped in this area closely resemble those reported in Survey Area 139/1 immediately to the north. The most striking difference, however, is the absence of Kabuloh Soils formed from calcareous shale in this area while Kabuloh Soils were mapped in large areas in Survey Area 139/1. This appears abnormalous, as one would expect calcareous rocks to occur in greater abundance with increasing proximity to the Subis Limestone. In the following, the main features of the soils mapped are briefly described.

6A. HILL SOILS

(a) MERIT FAMILY - (13,690 acres)

Merit Family soils are formed from dark grey carbonaceous shale of the Setap Formation; this soil type is the most dominant hill soil mapped. A common profile description is:

A	0 - 10	inches	Brownish-yellow clay loam; moist, friable,
B	10 - 24	"	Brownish-yellow clay loam to clay; moist, firm, with ferruginised breakable shale fragments at lower part of horizon,
BC	24 - 36	"	Yellow or reddish-yellow clay, with abundant, multi-coloured soft weathered shale.
C	36+	"	Multi-coloured soft to moderately hard weathering shale.

Merit soils show moderately well-developed horizons; there is distinct textural change from clay loam A-horizon to clay loam to clay in the B-horizon. Sub-horizon differentiation within the B-horizon is difficult. The occurrence of a thin stoneline commonly at 20-24 inches depth is a persistent feature but this in no way impedes plant root penetration through it. The solum invariably rests on a regolith horizon from 24-36 inches depth before reaching the moderately hard weathering shale or C-horizon. Merit soils in general are therefore of ample depth for tree crops like oil palm; only on scarp slopes or slopes exceeding 30° are shallow phases of Merit Soils of less than 20 inches found resting directly on bedrock.

No profile was sampled for chemical analysis but from data for Merit soils in adjacent areas in the Lambir-Subis Region, these soils are moderately acid, with pH range from 4.5 to 5.0; exchangeables are low, reserves are also low except for potassium and magnesium which range from 2,000 - 4,000 p.p.m. and the values appear to increase with depth.

(b) BEKENU FAMILY - (550 acres)

Bekenu soils are derived from sandy shale or sandstone which forms a subordinate component of the Setap Shale Formation. The occurrence of Bekenu soils is confined to hills which are much steeper and higher than those where Merit soils are mapped. A profile description of Bekenu soils at the upper part of a 25-30° slope is:

- 0 - 4 inches . Yellowish-brown (10YR5/4) fine sandy clay loam;
- 4 - 12 " Yellowish-brown (10YR6/8) very fine sandy clay loam to very fine sandy clay; moist, firm,
- 12 - 26 " Yellowish-brown (10YR6/8) clay, with fine yellow mottles; moist, firm; soft concretionary shale and sandstone fragments occur in increasing amount with depth,
- 26 - 40 " Reddish-yellow clay containing common, slightly hard weathered shale and sandstone.

Bekenu soils are differentiated from Merit soils by the sandy topsoil; stonelines of concretionary shale is present but impersistent. Bekenu soils are chemically similar to Merit soils but physically the lighter topsoil and the less persistent stonelines may render these soils more favourable than Merit soils.

6B. RECENT ALLUVIAL SOILS - (2,440 acres)

The Recent Alluvial Soils mapped consist only of one family, this being the Seduau Family. Seduau soils are formed from clayey alluvium along the main streams, in parts of tributaries draining into them as well as from colluvium admixed with alluvium. A common profile description of Seduau Soils is as follows:

- 0 - 3 inches Dark yellowish-brown loam; moist, friable; many medium to fine roots, very faint grey mottles along root channels,
- 3 - 20 " Yellowish-brown clay loam to clay containing few, fine, faint pale yellow mottles at depth; moist, firm,
- 20 - 32 " Yellowish-brown clay loam to clay with distinct common pale yellow mottles; moist, firm; common fine black organic stainings or incipient manganese concretions(?),
- 32 - 40 " Yellowish-brown clay with many distinct pale yellow and light grey mottles, common black mottles as above; moist, firm.

Seduau soils show only weak horizon differentiation; gleying features are commonly found in the subsoil indicating fluctuating

water tables within 4 feet depth during the wet season but no water table was encountered during the dry period.

Chemical analyses for Seduau soils derived from similar parent materials in the adjacent areas indicate moderate acidic reaction, low in exchangeables and reserves except for potassium and magnesium which tend to be variable, with levels ranging from 2,000 to 4,000 p.p.m.

Seduau soils are considered suitable for oil palm cultivation, the only minor limitation being brief flooding which occurs when the main streams overtop their banks.

6C. GLEYSOILS

(a) BIJAT FAMILY - (950 acres)

Bijat Soils are formed from poorly drained clayey alluvium and are mapped in interior valley floors, margins of peat swamps or riverine swamps behind the present levee deposits of the main streams. These soils consist of light grey to grey clay, mottled with prominent strong brown or yellowish brown in the subsoils; water table remains near the surface for most part of the year and flooding by stagnant water for long period may occur during the wet season. Bijat soils are suitable for wet padi cultivation, but if drainage can be effected to lower the water table these soils should also be suitable for oil palm.

(b) SEBANDI FAMILY - (330 acres)

Sebandi soils, like the Bijat soils are also derived from poorly drained clayey alluvium and occur in almost similar sites. The only difference, however, is the presence of up to 10 inches of a peaty or much horizon over light grey to grey clay. There is less mottling in the subsoils, due probably to the more pronounced anaerobic conditions which these soils are subjected to. Sebandi soils are considered suitable for oil palm cultivation provided they can be drained to ensure permanent lowering of the water table. Where Sebandi soils occur in association with deeper peat, the drainage requirements of these soils would be proportionately greater.

6D. PEAT SOILS

(a) MUKAN FAMILY - (300 acres)

Mukan Family soils comprise shallow peat from 10-40 inches deep and they are found in isolated bodies in poorly drained sites of riverine basin swamps. These areas are subjected to seasonal flooding when the water spills over from the levee deposits of the main streams. The proximity of these peat areas to the main drainage channels and the relative low water level of these river from their banks when not in flood would permit gravity drainage to reclaim these soils for oil palm. The fertility of these peat soils is generally low in both major and minor elements.

(b) ANDERSON FAMILY - (850 acres)

Peat over 40 inches is mapped in the Anderson Family which is further subdivided into:

- Anderson 1: 40 - 80 inches deep (100 acres),
- Anderson 2: 80 - 120 " " (160 "), and
- Anderson 3: over 120 " " (590 ").

Shallower parts of Anderson 1 peat may be considered for oil palm, but peat of Anderson 2 and Anderson 3 is unsuitable both because of the expensive drainage requirements involved and the suitability of these poor soils for oil palm has not been proven. Peat of Anderson Family should therefore be excluded in the consideration for oil palm planting at present.

7. LAND SUITABILITY FOR OIL PALM

To facilitate interpretation of the soils and terrain of the area investigated for planning of oil palm cultivation, the Land Suitability Map was compiled (Map 4), the criteria for this compilation being based on soils, terrain, drainage conditions and flooding hazards. The seven land suitability classes as shown here are specifically intended for oil palm and apply to this area only.

Of the 19,490 acres investigated, it will be seen that:

I. Area without or with only minor limitations:

(i) Suitable hill land	.. ..	8,350 acres
(ii) Moderately suitable hill land	.. ..	3,350 "
(iii) Moderately suitable flat alluvial land	.. ..	<u>2,570 "</u>
Total:		14,270 acres =====

II. Area in which soils are mainly suitable for oil palm after drainage improvements:

(i) Area requiring minor drainage improvement	.. ..	1,310 acres
(ii) Area requiring moderate drainage improvement	.. ..	<u>300 "</u>
Total:		1,610 acres =====

III. Area unsuitable for oil palm:

(i) Steep hills	.. ..	900 acres
(ii) Peat swamp		<u>2,730 "</u>
Total:		3,630 acres =====

CONCLUSIONS

Semi-detailed soil survey of 19,490 acres lying south of the Lambir-Subis Development Region indicates that the bulk of it is suitable for oil palm cultivation. It is estimated that 14,270 acres comprise low hills or moderately well drained alluvium with only minor limitations; this area can be planted up with oil palm immediately; another 1,610 acres also can be used for oil palm after minor-moderate drainage improvements while the remainder of the area - 3,630 acres, comprises deep peat and steep hills which are largely unsuitable for oil palm.

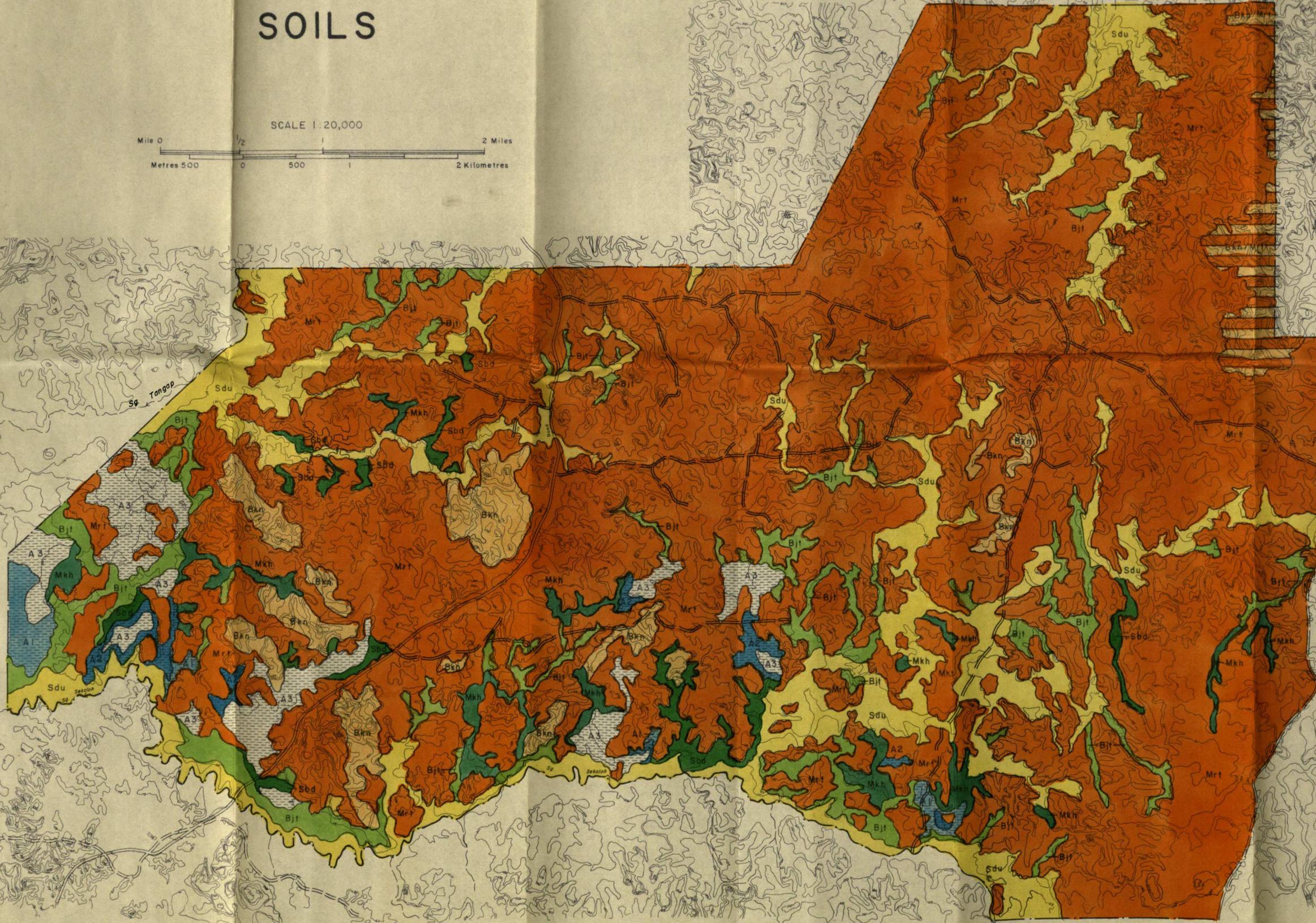
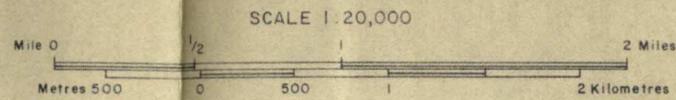
Origin	Great Soil Group	Family	Mapping Symbol	Parent Material	Main Soil Characteristics	Topography	Limitation to Oil Palm Cultivation	Acreage	
Residual	Red - Yellow Podzolics	Merit		Shale	Yellowish-brown clay loam to clay; moderately deep, 24 - 36 inches to weathering shale; shallow phases of less than 24 inches occur on steep slopes.	Low to moderately high hills, gentle to moderately steep.	Soils generally low in chemical fertility; slopes too steep in some areas.	13,690	
		Bekenu		Sandy shale/sandstone	Yellowish-brown to yellow fine sandy clay loam over clay; moderately deep.	Hill crests, ridges and strongly dissected slopes.	Slopes generally too steep and dissected for oil palm.	550	
Alluvial	Recent Alluvial Soils	Seduau		Recent river alluvium and colluvium	Brown to yellowish-brown clay loam to clay; deep; freely drained to imperfectly drained.	Levées of main streams; alluvium and colluvium in interior valleys.	Occasional flash flooding.	2,440	
	Gley Soils	Bijat		River alluvium	Light grey clay, strongly mottled in subsoil; high water table and flooded during wet season.	Flat river alluvium.	Drainage	980	
		Sebandi			Light grey clay, with up to 10 inches of muck topsoil; high water table and flooded during wet season.	Flat river alluvium and interior valley floor.			330
		Mukah			Shallow peat	10-40 inches of muck or peat over light grey or grey clay; very poorly drained.			Flat river alluvium and margin of peat swamps.	300
Organic	Peat Soils	Anderson 1		Deep peat	40-80 inches peat over clay; very poorly drained.	Peat swamps.			Drainage and soils.	100
		Anderson 2			80-120 inches peat over clay; very poorly drained.		160		
		Anderson 3			Over 120 inches peat over clay; very poorly drained.		590		
Compound Mapping Unit		Merit/Bekenu		Shale and sandy shale	Yellowish-brown clay loam to clay; in places topsoils are sandy clay loam; moderately deep to shallow.	Moderately steep to steep hills; dissected.	Slopes mainly too steep.	350	

Total Acreage - 19,490

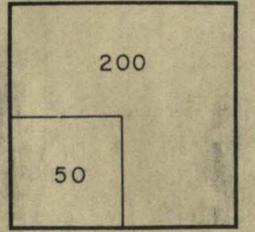
Sungai Sekaloh - Tangap Area Lambir - Subis

SOILS

SURVEY AREA
139/1



ACREAGE SCALE



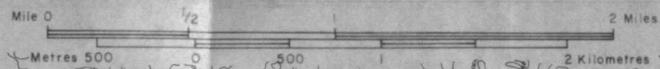
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Sungai Sekaloh -Tangap Area LAND SUITABILITY for OIL PALM

Suitability for Oil Palm	Suitability Classes	Mapping Symbols	Soils	Topography	Limitations	Acreage
Suitable	1		Mainly Merit Family derived from shale with minor Bekenu Family derived from sandy shale, moderately deep.	Low hilly, slopes mainly below 20°.	Low chemical fertility.	8,350
Moderately suitable	2		Mainly Merit Family with minor Bekenu Family as in Class 1.	Low to moderately high hills; many slopes 20-27°, some slopes strongly dissected.	Some slopes are of marginal suitability for oil palm; low chemical fertility.	3,360
Moderately suitable	3		Mainly Sedauu Family derived from recent alluvium, imperfectly drained.	Levées of main streams and interior valleys.	Subject to flash flooding.	2,570
Suitable after minor drainage improvement	4		Bijar and Sebandi Families, poorly drained soils derived from river alluvium and colluvium.	River alluvium and interior valleys.	Very poor drainage.	1,280
Suitable after moderate drainage improvement	5		Mukah Family - shallow peat of 10-40 inches over clay, very poorly drained.	Peat swamps and interior valleys.	Very poor drainage; soils low in chemical fertility.	300
Unsuitable	6		Deep peat - commonly over 10 feet deep.	Peat swamps.	Very poor drainage; very low in plant nutrients.	900
Unsuitable	7		Mainly Merit Family with minor Bekenu and Nyalau Families.	Strongly dissected steep hills; many slopes 27-35°, generally 100-200 feet high.	Slopes too steep for oil palm.	2,730

Total Acreage - 19,490

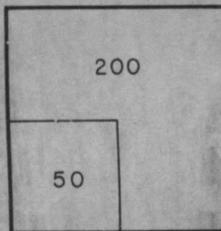
SCALE 1:20,000



SURVEY AREA
139/1

N

ACREAGE SCALE



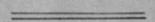
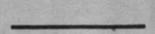
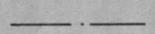
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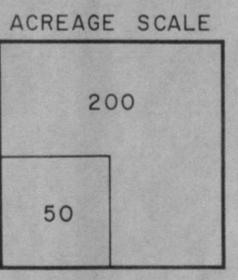
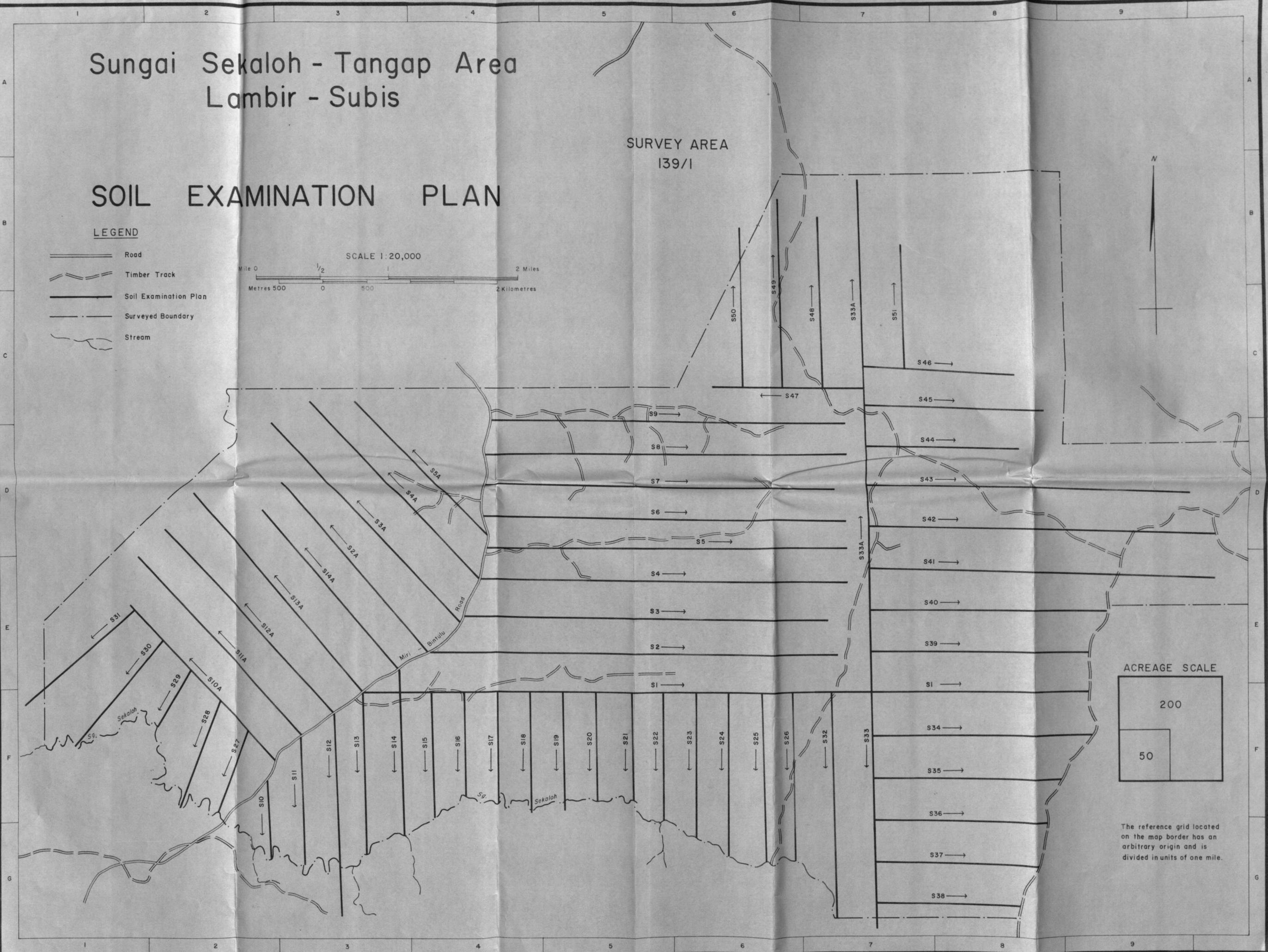
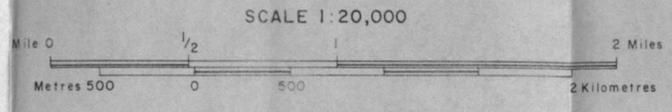
Sungai Sekaloh - Tangap Area Lambir - Subis

SURVEY AREA
139/1

SOIL EXAMINATION PLAN

LEGEND

-  Road
-  Timber Track
-  Soil Examination Plan
-  Surveyed Boundary
-  Stream



The reference grid located on the map border has an arbitrary origin and is divided in units of one mile.

