Report

Field Report on a reconnaissance Soil Survey of the Kebulu Protected Forest, Bintulu District, 4th Division

by

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HUNTING TECHNICAL SERVICES

Field Report of the Soil Reconnaissance of part of the Kebulu Protected Forest, Bintulu District, 4th Division, 1 : 50,000 map sheets 3/113/12 and 16 19th January to 9th February 1959

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Appendices:

Map I : Route and Sample Map, scale 1 : 25,000 approximate.

Map II: Morphology Map and Land Capability Map scale 1:25,000 approximate.

5 Field Record sheets of cut lines I - V.

Itinerary

19 - 1 - 59 : By air from Kuching to Bintulu.

20 - 1 - 59 : Visited the Sibiu rubber plantation.

21 - 1 - 59 : By launch from Bintulu to Tubau.

22 - 1 - 59 : By longboat from Tubau to Camp I on the bank of the Sungei Kebulu.

23 - 1 - 59 : Made rentis I from Camp I in azimuth 35° for 113 tapes of 100 feet.

24 - 1 - 59 : Soil investigation of rentis I.

25 - 1 - 59 : By longboat up the Kebulu and Bubang rivers as far as navigable. Made rentis II from the bank of the S. Bubang in azimuth 90° for 59 tapes, in azimuth 180° for 11 tapes, and cut back to the rentis in azimuth 130°.

26 - 1 - 59 : Soil investigation of rentis II.

27 - 1 - 59 : By longboat to Camp II on the S. Jelalong.

28 - 1 - 59 : Made rentis III from Camp II in azimuth 180° for 65 tapes.

29 - 1 - 59 : Continued rentis III from 65 to 83 tapes. Soil investigation of rentis III.

30 - 1 - 59 : Made rentis IV from a point about 1.75 mile south-west of Camp II in azimuth 180° for 78 tapes; from end of rentis cut for 11 tapes in SWW direction to the bank of the S. Kebulu.

1 - 2 - 59 : Made rentis V from a point about 1 mile north-east of Camp II in azimuth 130° for 80 tapes.

2 - 2 - 59 : Soil investigation of rentis V.

3 - 2 - 59 : Broke Camp. By longboat to Tubau.

/4-2-59 : By

4 - 2 - 59 : By launch from Tubau to Bintulu.

5 - 2 - 59 : Bintulu; visited an area considered for fruit trees.

6 - 2 - 59 : By air from Bintulu to Sibu

7 - 2 - 59 : Sibu

8 - 2 - 59 : Sibu

9 - 2 - 59 : By air from Sibu to Kuching.

The Agricultural Assistants Lim Chin Pang and Ahmad Haji Ebon travelled from Kuching to Bintulu by MV Swee Joo with the luggage. They left Kuching on the 18th and arrived at Bintulu on the 20th of January. On the 3rd of February they travelled by longboat from Tubau to Bintulu arriving just in time to board the Swee Joo for Kuching where they arrived on the 5th February.

Purpose of Survey

The purpose of the reconnaissance was:

(a) training of the agricultural assistants in field soil survey.

(b) to investigate whether there is land within the Protected Forest suitable for Iban settlement.

Maps and aerial photographs.

The 1:50,000 sheets of the area have not yet been published. The only available map on a scale of 2 miles to an inch is inaccurate and unsuited as a basis for soil mapping.

Good aerial photographs made in 1950, f. 6 inches, 12,500 feet i.e. on an approximate scale of 1:25,000 are available. A sketch map has been constructed from the photographs by the Conservator of Forests. This map has been used as the basis for the reconnaissance. It should be kept in mind that it has been made from aerial photographs without corrections, and is, therefore, of limited accuracy.

Preliminary research.

A stereoscopic analysis of the aerial photographs has been made before leaving for the field. A sketch map of the main morphologic units of the area has been made. After the survey the field observations have been checked with this map. It appears to be, in many places, difficult to distinguish on the photographs the empran from low hilly, strongly dissected terrain.

Some geological data can be found in H.J.C. Kirk, "The geology and mineral resources of the Upper Rejang and Adjacent Areas", Memoir 8 of the Geological Survey Department, published in 1957. Only the southern part of the area is situated within the area covered by this geological survey, but it may be inferred that our area is built up of Miocene, marine sediments of the Setap Group. Mainly the rocks are shales with sandstone, which usually are very steeply folded.

In a report on the S. Jelalong area of the 23rd of January 1936, the Assistant Forest Officer 4th Division, J. Garrett states the following:

"The fact that in the vicinity of S. Kebulu there once was a

thriving native settlement trading in forest produce this river has ruffered most from depredations, but, still, like most places in the Jelalong and Posu rivers padi planting and other forms of cultivation have been confined to the immediate sides of streams, and they generally do not exceed more than a depth of 20 chains inland. The rivers are scarcely populated by Penans and Kayans. The Penans do not plant padi."

There are no records regarding the climate in or near the area. According to John Seal's treatise in the Sarawak Museum Journal of June, 1958, Vol. VIII the area lies in the region with a long-term mean annual rainfall of 120 to 160 inches. During the reconnaissance there has been very little rainfall. Also Bintulu had very little rain in this period which must be considered abnormal.

Because of the fact that the area is part of a protected forest there is now no population and no cultivation. Also in the past cultivation has been limited to some small areas.

Methods of survey

To get a reliable impression of the topography, drainage conditions and distribution of soil types, it is necessary to cut rentises preferably across the general strike of the sediments. The rentis is made on a certain compass bearing, and measured with a 100 feet steel tape. In terrain with slopes up to 10 degrees the tape is kept horizontal. In steeper terrain this is not possible and a correction is necessary to get the correct map distances. The slope for each tape is determined with a clinometer ruler. To get the map distance the latitude belonging to the measured slope has to be substituted for the 100 feet of the tape. Very steep terrain was encountered and to give an idea of the corrections the latitudes and departures for 5° slope intervals are given for a measured field distance of 100 feet :

Slope	Lat.	Dep.	Slope	Lat.	Dep.
5°	99.6	08.7	30°	86.6	50.0
10°	98.5	17.4	35°	81.9	57.4
15°	96.6	25.9	40°	76.6	64.3
20°	94.0	34.2	45°	70.7	70.7
25°	90.6	42.3			

With the help of the departures a fairly reliable idea can be had of the approximate height of the terrain above empran level.

All further mentioned distances in this report are map distances.

As only 4 coolies were available it was not possible to do the cutting of the rentis, the digging of pits, and the soil investigation all on one day. The rentis had to be made on one day, the following day being spent on the soil investigation of this rentis.

For the construction of a rentis the following personnel is needed:

1 agricultural assistant with compass
1 agricultural assistant or trained coolie for measuring and placing and numbering the pegs.
3 coolies for cutting
1 coolie at the end of the tape.

In case the soil investigation is carried out the same day, more coolies are required to dig soil pits.

The soil surveyor notes in his field book all observations concerning:

(a) slope : degree and direction.

(b) vegetation

(b) vegetation

(c) drainage conditions.

(d) rocks, outcrops, dip and strike; loose rocks and stones.

(e) soils : all characteristics discernable on the surface.

Description of cut line I.

See map I and field record of cut line I.

The land along the line had the following topography:

(a) flat empran

5300 - 5600 feet
7100 - 8250 "
8750 - 9550 "
9730 - 9930 "
10230 - 10830 "

(b) hilly land with general slopes of 20 to 40 degrees; hills are generally 30 to 50 feet high; strongly terrain.

4000 - 5300 feet
5656 - 7100 "
9550 - 9730 "
9930 - 10230 "

(c) extremely steep hilly land with general slopes of 40 to 60 degrees; hills and ridges rise to 250 feet above empran level.

0 - 4000 feet
8250 - 8750 "

Broadly the terrain along the rentis can be divided into: (a) 0 - 4000 feet: extremely steep hilly land, and (b) 4000 - 10830 feet: alternating stretches of hilly land and empran.

The aerial photographs show that the rentis in this area runs through a narrow valley of the Kisbena river. The empran along the river is usually not more than 300 feet wide. The actual area of hilly and empran land is limited to a narrow strip along the river, and is bounded at both sides by extremely steep land.

The Klebena, although a main river with a 20 yards wide bed between 5 yards high, steep banks, is not navigable during most of the year. Moreover, the distance from this area to the Kuala Jelalong is great.

The forest along the whole rentis seems to be of good quality. Especially in the extremely steep hills the forest seems to have a large number of heavy trees.

In many places, both in the extremely steep and lower hilly land, hard boulders up to 20 inches in size are found scattered on the hill sides and in the river beds. These boulders consist of very hard, recrystallized quartzitic material. They have originated from hard sandstone and fine conglomerate layers which have been observed interbedded in the normal, softer, dark grey shale and fine sandstone layers of the Setap Group. These boulders are only found on the soil surface where they have been left as a result of the rapid erosion which constantly carries forth the finer soil material.

The occurrence of these boulders in itself is not harmful to cultivation. On the contrary, they can be easily removed by hand, and could be put to good use in the construction of terraces, drains, roads etc.

/Soil investigation of

Soil investigation of cut line I.

Soil pit 410/414

Location: 1,070 feet, on a 40° slope, dipping NNE.
Vegetation: Moderate quality forest.
Profile description:

410	0 - 2 in.	: Moist, yellowish brown clay; very friable very many roots.
411	2 - 4 in.	: Moist, brownish-yellow silty clay; friable; many roots.
412	4 - 18 in.	: Yellow clay, more compact; plastic; slightly sticky; many roots.
413	18 - 32 in.	: Pale yellow clay, weakly reddish-brown mottled; some weathered shale fragments; many roots.
414	32 - + in.	: Weathered shale

The shale surface is covered by a thin layer of loose leaves.

Soil pit 415/418

Location: 10,430 feet; in flat empran of the S. Klebena.
Vegetation: Good empran forest
Profile description:

415	0 - 3 in.	: Dark brown, homous clay in net-work of roots; friable.
416	3 - 10 in.	: Grey and reddish-brown mottled clay; weak blocky structure; roots present.
417	10 - 34+in. (14 - 18)	: Yellowish-brown clay; plastic and slightly sticky; roots present.
418	10 - 34+in. (32 - 36)	: Ditto

Preliminary evaluation for land use.

The extremely steep land is not suitable for any type of agriculture because of the high erosion hazard and the shallowness of the soils.

Assuming that the soils prove to be the normal poor shale-sandstone soils, there seems to be an area of limited extent along the Klebena headwaters consisting of empran and hilly land, suitable for wet padi and rubber growing. This area must, however be considered as too remote and too little accessible.

Description of cut line II.

See Map I and field record of cut line II.

The land along the line has the following topography:

(a) flat empran

0 - 700 feet
3350 - 3750 feet

/(b) low hilly and....

(b) low hilly and rolling land with 10 to 20 degrees slopes 700 - 1100 feet.

(c) Very steep hilly land with 30 to 45 degrees slopes; and strongly dissected lower hilly land.

1100 - 3350 feet
3750 - 5900 feet

The vegetation in the narrow stretch of empran along the river is secondary forest of an estimated age of 30 to 40 years. Trees include meranti species, ubah, engkabang, and keruing.

The vegetation of the steep hilly land appears to me to be of very good quality. The forest here has jelutong bukit, meranti, and a fair number of engkabang trees.

Here again, in the steep hilly land, sandstone boulders are locally found scattered on the surface.

Soil investigation of cut line II.

Soil pit 419/425

Location: 200 feet; in a narrow stretch of empran along the S. Bubang

Drainage: The land is 4 to 6 yards elevated above normal river level, but is flooded annually for a period of a few days according to local people.

Vegetation: Secondary forest of 30 to 40 years; including meranti, ubah, engkabang, and keruing.

Parent rock : In the Bubang outcrops of dark grey shale and fine sandstone which are very steeply folded, showing dips of 60 to 90 degrees.

Profile description:

419	0 - 2 in.	: Moist, brown to dark brown, humus-containing silty clay loam; fine crumb structure; slightly plastic and sticky; very many roots.
420	2 - 8 in.	: Moist, yellowish-brown, in places grey mottled, silty clay loam; medium to fine crumb structure; friable; very many roots.
421	8 - 18 in.	: Weakly yellow, yellowish-brown and grey mottled silty clay loam; slightly firmer; slightly plastic and sticky; very many roots.
422	18 - 36 in.	: Moist, yellowish-brown silty clay loam; friable; slightly plastic and non-sticky; roots present.
423	36 - + in.	: Moister, ditto silty clay loam; plastic, very slightly sticky; few roots.
424	60 - 68 in.	: Auger sample; moister.
424	88 - 93 in.	: Auger sample; wet; grey and yellow mottled.

/The surface.....

The surface of the soil is covered by a thin layer of loose leaves. Till a depth of 18 inches charcoal was found in the soil; indicating cultivation in the past.

Rock sample from 4,200 feet.

17A : recrystallized sandstone with quartz crystals; outcropping layers of Miocene formation.

Soil pit 427/432

Location: About 500 yards upstream from Camp I on the east bank of the Kebulu river in flat empran; the empran here is about 500 feet wide; several 2 to 3 yards deep, steep-sided gullies.

Vegetation: Empran forest, secondary growth of some 30 to 40 years old; belian seen.

Profile description:

427 0 - 2 in. : Moist to wet, brown, humus-containing silty clay loam; slightly plastic and sticky; very many horizontal roots.

428 2 - 8 in. : Moist to wet, grey, weakly yellowish-brown mottled silty clay loam; fairly friable; slightly plastic and sticky; roots present.

429 8 - 16 in. : Moist, brownish-yellow silty clay, with very weak reddish-brown veins and spots; stiff; slightly plastic and sticky; few roots.

430 [illegible] in. : Yellowish-brown silty clay with weak yellow and reddish-brown mottling; stiff; slightly plastic and sticky.

431 30 - + in. : Moister, ditto silty clay; very sticky; no roots.

432 (60 - 64)in. : Auger sample.

A ground-water table was found at a depth of 90 inches; at 92 inches depth a red and grey mottled, wet clay is found.

This profile is of heavier texture than 10/16 A. The soil is less permeable, and the rooting goes less deep. It can still be considered suitable for wet padi cultivation.

Rock sample 200 yards upstream from Camp I in riverbed.

24 A: dark grey fine sandstone.

Preliminary classification for land use.

The very steep land should be considered too steep for agricultural use, and be preserved for hydrological reasons.

The empran soils occupy a narrow stretch of land along the river. No reliable data are available about the risk of flooding of this land.

/Assuming that this .....

Assuming that this risk is normal, and does not prevent the use of the land for wet padi, an estimated total, of some 60 acres of empran is available near the junction of the S. Kebulu and S. Bubang. In this area there is also some lower hill land which seems suitable for rubber plantations.

The total extent of empran and low hilly land is estimated at some 200 acres. The area which may have possibilities for settlement of some families has been marked as II on Map II.

In this small area the type of agriculture should be wet padi and vegetable cultivation on the empran and rubber and fruit tree plantation on the hills. The rubber plantation should require terracing and generally good management such as is required by the Rubber Plant Scheme.

There is hardly any room here for a settlement practising shifting hill padi cultivation.

Description of cut line III.

See Map I and field record of cut line III.

The land along the line has the following topography:

(a) flat empran.

200 -	550 feet	4200 -	4400 feet
930 -	1030 "	4930 -	6700 "
1130 -	1200 "	6700 -	6800 "
1200 -	1800 "	7050 -	7850 "
1900 -	2100 "		

(b) peat swamp

2800 - 4200 feet

(c) low hilly land with ridge tops usually 30 to 60 feet, but locally rising to 100 feet above empran level.

0 -	200 feet	4700 -	4930 feet
550 -	930 "	6800 -	7050 "
1030 -	1130 "		
1800 -	1900 "		

(d) extremely steep land with 40 to over 60 degrees slopes

7850 - 8000+ feet.

Broadly the terrain along the line can be divided into the following land units:

(a) The land from 0 - 2800 feet consists of alternating strips of flat empran and hill ridges, usually 30 to 60 feet, locally up to 120 feet high. Along this part of the line 1320 feet of empran against 780 feet of hill land was measured.

(b) A peat swamp area with an open growth of fairly tall trees with an undergrowth of many asam paya palms was found from 2800 to 4200 feet. From 3800 to 4200 feet an open enclave is crossed with a low growth of Cyperacea ie, Melastoma Lycopodium and other mosses and ferns. Here an area of some 5 acres has been planted to padi possibly 4 or 5 years ago. It does, therefore, not show on the aerial photograph. Thickness of the peat in the forest proved to be about 3 yards. In the enclave 8 tests with a long pole invariably gave a thickness of the peat over a grey clay of 2 yards. The extent of the peat area is limited. The aerial photographs suggest that the peat may cover an area of about 60 acres.

(c) From 4200 to 7850 there is another empran area with minor low hills and ridges.

/There are signs....

There are signs of recent occupation of some land, probably by one or two families. Remnants of a bridge and old fish traps were seen in the small and strongly winding Sungei Spari at 5180 feet. This river is not navigable. The land between 7150 and 7850 feet has a blukar vegetation of some 8 to 10 years old.

(b) Beyond the empran, from 7850 feet onwards the land is extremely steep hilly with slopes of 40 to over 60 degrees and with wide and deep, steep sided ravings.

The vegetation on the hills is generally good forest. Secondary forest was only found in the first 100 feet of the Jelalong river bank. Also the empran has been little used till now. Many trees of the empran have high stilt roots.

Soil investigation of cut line III.

Soil pit 433/438

Location: 6280 feet, in flat empran.

Vegetation: Empran forest; many trees have stilt roots indicating poor drainage conditions.

Soil Profile description:

433	0 - 1 in.	: Wet, brown or light brown silty clay loam; plastic and sticky; very many roots.
434	1 - 8 in.	: Light brown weakly light grey mottled silty clay loam; fairly friable slightly plastic and sticky; many roots
435	8 - 17 in.	: Moist, strongly light grey and reddish-brown mottled silty clay loam; plastic and sticky; roots present.
436	17 - 25 in.	: Strongly, coarse mottled with light grey, red, and minor yellowish-brown, clay; dense; plastic and sticky.
437	25 - 40 in.	: Wet, ditto silty clay.
438	40 - 92+ in.	: Wet, water logged silty clay; very plastic and sticky; olive grey.

The main rooting goes till a depth of 10 inches. The soil seems suitable for wet padi cultivation. For rubber it is too slowly permeable and too difficult to drain.

Soil pit 439/444

Location : 2400 feet, on a 25° slope.

Vegetation : Good hill forest

Profile description:

439	0 - 1 in.	Brown, humus-containing silty clay loam in net-work of roots.

/440 1 - 4 in. :

440	1 - 4 in.	: Yellow, friable silty clay; very many roots.
441	4 - 12 in.	: Weakly grey and yellow mottled clay; more compact; fair number of roots; the boundary with the layer above is wavy with vertical differences of 15 cms.
442	12 - 28 in.	: Ditto mottled clay with some reddish mottles; many small, hardened, dark red, breakable pieces of laterits and of weathered shale.
443	28 - 40 in.	: Ditto, more reddish mottling.
444	40 - + in.	: Weathered, dark grey shale.

Some pieces of weathered fine sandstones are found in the profile. They have originated from thin layers interbedded in the shale.

Preliminary evaluation for land use.

The land along the line is largely flat empran with low hill ridges. From the aerial photographs it is estimated that the extent of this type of land totals some 600 acres (see Map II). Of these at least 400 acres is flat empran land, which is considered suitable for wet padi cultivation, unless the risk of flooding is too great. The hilly land within and adjacent to this area, although often rather steep, can provide sufficient land for the cultivation of cash crops such as rubber, coconut trees, fruit trees and bananas.

If necessary land for hill padi can be found in the hills south north and north-east of the low-lying area.

The peat swamp area is of very limited extent. The aerial photographs suggest that there may be about 60 acres. No data could be obtained concerning the results of the recent padi crop.

The thickness of the peat must be considered to be somewhat too great to make the area attractive. Peat swamp rice cultivation will probably be less suited to Iban settlers.

The extremely steep land is unsuitable for agriculture and should be preserved.

Description of cut line IV.

See Map I and field record of cut line IV

The land along the line has the following topography:

(a) flat empran

0 - 685 feet
1250 - 1550 "
2550 - 2650 "
3325 - 3525 "
4675 - 5125 "
5225 - 5350 "

(b) hilly land with general slopes from 25 to 45 degrees; hills generally 30 to 40 feet high, becoming somewhat higher towards the south where they rise some 80 feet above empran level

685 - 1250 feet
1550 - 2550 "
2650 - 3325 "
3525 - 4275 "

/(c) extremely steep.....

(c) extremely steep hilly land with slopes varying from 30 to 60 degrees; hills rise to a height of some 140 feet above empran level

4275 - 4675 feet
5125 - 5225 "
5350 - 7100 "

Broadly the following two landscapes can be distinguished:

(a) The area of 0 to 5350 feet consisting of low hills and strips of flat empran. In this area 1800 feet of empran against 3100 feet of hill land were measured, the rest being very steep ridges.

(b) Beyond 5350 feet the land is extremely steep with general slopes of 45 to over 60 degrees and hills rising to a height of 200 feet above empran level.

The vegetation seems generally to be good forest. Very little secondary forest was seen. Only between 1300 and 1600 feet in the empran was found under blukar. The forest has a large number of tall trees. It may be possible to find fairly easy access to the Jelalong river by way of flat empran land for the extraction of timber.

At least 10 belian trees were seen felled for the production of shingles. One was still being worked. The waste of timber by this method is very great indeed.

Soil investigation of cut line IV

Soil pit 445/449

Location : 3900 feet, on a 30° sloping hill side.

Vegetation : Good quality forest with engkabang, meranti sp., nyatoh, menggris, djumpah, uban. Open ground vegetation with much daun biru palms.

Profile description:

445 0 - 1/3 in. : Moist to wet, very thin layer of light brown clay loam with organic matter; very many fine roots.

446 1/3 - 8 in. : Moist, yellow clay loam; friable; fairly loose and soft; slightly plastic, non-sticky; large worm holes; many horizontal roots.

447 8 - 16 in. : Yellow clay loam; somewhat firmer; fairly dense; plastic slightly sticky; worm gangs with greyish-brown silty clay loam materials; fair number of roots.

448 16 - 28 in. : Yellow clay loam; plastic and slightly sticky; some worm gangs; reddish patches of breakable sandstone fragments; fair number of roots; some pieces of weathered sandstone up to 2 inches in size; boundary with layer above is variable within 8 inches vertically.

/449. 28 - 44 in. :

449 28 - 44 in. : Yellow clay loam with grey, rounded boulders of weathered shale 4 to 6 inches in size; boulders have grey and yellow colours; deeper more dark grey, weathered shale, soft with brownish-yellow clay coatings on surface; roots present.

The soil surface is well covered by loose leaves.

Soil pit 450/457

Location: 1975 feet, on a level hill top; 35 feet high.

Vegetation : Good forest with engkabang, meranti, jelutong, selangan batu, krandji, mengbami.

Profile description.

450 0 - 1/3 in. : Light brown, humous loam in a thin layer of fine roots.

451 1/3 - 8 in. : Yellow silt loam to clay, friable; slightly plastic and sticky; very many roots.

452 8 - 16 in. : Yellow clay loam with weak mottling with light grey and yellowish-brown; many, horizontal roots.

453 16 - 26 in. : Yellow friable clay loam; slightly plastic and sticky; fair number of roots.

454 26 - 28 in. : Layer with quartzite gravel up to ½ inch. in size, usually poorly rounded; some pieces of reddish weathered fine sandstone up to 4 inches in size.

455 28 - 38 in. : Very moist, yellow silty clay loam, brownish-red and minor light grey mottled fairly dense; some fine roots.

456 38 - 66 in. : Light grey and yellowish-brown mottled silty clay loam; plastic and sticky; some fine roots; some old roots passages.

457 66 - 74 in. : Dark grey, weathered shale; stiff; somewhat yellow mottled.

The quartzitic gravel and sandstone in the 2 inches thick layer 454 must be considered to be local accumulations of this material originating from the parent rock, and not as a sign of a more continuous water borne sediment in this area.

This soil with weathered layers till a depth of some 66

/inches can be .....

inches can be considered suitable for well managed rubber cultivation.

Soil pit 458/461

Location : 300 feet, in flat empran along the Jelalong river.

Vegetation : Empran forest with tall trees; many trees have stilt.

Profile description:

458 0 - 3 in. : Moist, brown silty clay loam in net-work of roots.

459 3 - 13 in. : Dark grey, weakly yellowish-brown mottled silty clay loam; dense; massif; plastic and sticky; many worm holes; many, mostly horizontal, roots.

460 13 - 32 in. : Light grey and yellowish-brown mottled clay loam; dense; tough; roots present.

461 32 - + in. : Ditto, with more reddish-brown and less grey.

The soil is dense and has probably slow permeability. It can be used for wet padi cultivation and vegetable growing on raised beds, but is not suitable for rubber.

Preliminary evaluation for land use.

The hill land with empran stretches can provide substantial areas which may be suitable for wet padi cultivation and vegetable growing in the empran and rubber and fruit tree plantations in the hills. No data are available about the flood hazard. Also it should be kept in mind that the hills are low with steep and short sides. Only hill sides with slopes of less than 30 degrees at most should be used and terracing is necessary to reduce erosion.

The extremely steep land is too steep and has too shallow soils for agriculture use.

Description of cut line V.

See Map I and field record of cut line V.

The land along the line has the following topography:

(a) flat empran

1400 - 1550 feet
1850 - 2150 "
2525 - 2650 "
2900 - 3400 "
5400 - 5650 "
6650 - 7550 "

(b) gently undulating to low hilly, dissected terrace (?) at about 8 to 10 metres (25 to 35 feet) above empran level.

0 - 800 feet.

(c) hilly land with slopes of 20 to 30 degrees, rising to a height of 75 feet above empran level.

800 - 1400 feet
1550 - 1850 "
2150 - 2525 "
2650 - 2900 "

/(d) low ridge land,

(d) low ridge land, rising to 40 feet above empran level
6000 - 6800 feet

(c) extremely steep hill land with general slopes of 40 to 60 degrees, rising to 150 feet above empran level.

3500 - 5750 feet
6800 - 7100 "

Soil investigation of cut line V.

Soil pit 462/465

Location : 3850 feet; very steep hilly land; pit on a 50 degree slope dipping SE; scattered boulders on the surface.

Vegetation : Good quality forest with meranti and kapur bukit

Profile description:

462 0 - 2 in. : Wet, brownish-yellow clay loam moderately plastic and sticky very many roots.

463 2 - 8 in. : Moist to wet, weakly pale brown and reddish-yellow mottled clay loam; moderately plastic and sticky; fair number of roots; irregular boundary with layer below varying between 4 and 16 in. depth; locally weathered shale layers in this horizon.

464 8 - 32 in. : Weathered shale with pockets of yellow clay; some roots.

465 32 - + in. : Weathered shale, steeply folded; dark grey with yellow clay films on planes. The shale consists of massive layers of varying thickness, usually from 5 mm. to 5 cm. in thickness.

This is the very shallow Lithosol of the very steep hill sides.

Soil pit 466/468.

Location : 3100 feet, in empran with many gullies and poor drainage.

Vegetation : Poor empran forest.

Profile description:

466 0 - 4 in. : Wet, grey and yellow mottled silty clay loam.

467 4 - 18 in. : Wet, grey and yellow mottled clay.

468 18 - 18 in. : Wet sandy loam.

Soil pit 469/472.

Location : 2800 feet, on a 30 degrees slope dipping south.

Vegetation : Moderate to poor primary hill forest or old temuda.

/Profile description....

profile description:

469	0 - 4 in.	: Brown, organic-matter containing sandy loam in a net-work of roots; in upper part some bleached sand.
470	4 - 20 in.	: Yellow sandy loam, locally weakly mottled very pale brown and reddish-brown roots present
471	20 - 30 in.	: Layer of gravel and sandstone fragments up to 1 in. in size; gravel is rounded and mostly broken.
472	30 - 60 in.	: Grey and red mottled dense clay roots present.
	60 - + in.	: Weathered shale.

The upper 75 cms. (30 inches) of the profile have been developed from a more recent gravelly and sandy deposit on top of the Miocene shale. The elevation is estimated at some 40 to 50 feet above empran level. This is an old river deposit or it may even be a remnant of a more extensive pre-glacial plain deposit.

Several augerings were made. At 500 feet the soil proved to be a white sandy clay without any sign of mottling. It proceeds till over 4 feet depth. The forest vegetation on this dissected terrace is moderate to poor.

At 2300 feet in hilly land a yellow clay soil was found which appears to be suitable for rubber cultivation.

At 1500 feet the soil is a yellow fine sandy clay loam, and at 900 feet a yellow fine sandy clay.

Preliminary evaluation for land use.

In this area more sandy soils were locally observed both in the low hill land and the empran. This higher sand content may have an adverse influence on the quality of the soils. The forest vegetation in these sandy areas is moderate to poor.

It seems advisable not to draw any conclusions about the suitability for land use of this area at the present stage.

CONCLUSIONS.

(1) A part of the Kebulu Protected Forest covering some 6,000 acres has been reconnoitred during an 11-days field survey. The field observations and aerial photography analysis have resulted in the construction of Map II showing the morphology of the terrain and some areas in which it is thought that land can be found for settlement.

(2) The areas in which land for settlement may be found are:

(a) An area between the Jelalong and Kebulu rivers, marked I on the Map and covering roughly 2,400 acres. Within this area extremely steep terrain covers some 250 acres and deep peat some 60 acres, leaving roughly 2,000 acres of hilly land and empran, part of which is suitable for wet padi and rubber cultivation.

(b) An area near the junction of the S. Bubang and S. Kebulu

/marked II on the map ....

marked II on the map and covering roughly 200 acres. The extent of empran, occurring in narrow strips along the river banks, is small and is estimated at some 60 acres.

(c) An area marked III on the map in the headwaters of the S. Bubang. This area has not been visited, but the aerial photographs suggest the presence of suitable land. It is estimated to cover some 600 acres, and should be kept in view for further investigation.

(d) The flat empran land is considered to be suitable for wet padi cultivation and vegetable growing under proper management. No reliable data could be obtained concerning the flood hazard in these areas. It is likely that in most areas annual floodings of short duration must be expected.

(e) The low hilly land can provide sites suitable for rubber cultivation, depending on the depth of the soil which, generally depends on the slope. A thickness of 32 inches of soil must be considered the minimum. Generally, in the area this coincides with a slope of some 30 degrees. Land with slopes of less than 30 degrees should be selected for the planting of rubber. A serious setback is shortness of the slopes in this land type. A 50 feet high hillside with the gradient of 30° is only 100 feet long.

(f) The quality of the timber seems to be good in most parts of the area. Locally, extraction of timber to the Jelalong river might be economically feasible.

(g) The soil samples are now being investigated. It is expected that the soils are extremely poor in plant nutrients, as well as extremely acid. Felling and burning of the forest will result in an initial top dressing of the soil and, under otherwise favourable conditions, in one good harvest. To obtain sustained yields, proper management including the use of fertilizers, will be necessary, both on empran and hill soils. Regeneration of the forest on cleared land is expected to be very slow and of poor quality. From the point of view of proper land use it would be best to establish a more intensive type of agriculture with proper management, and not to practise shifting hill padi cultivation.

(h) If necessary under pressure of circumstances to allow Ibans to use land for hill padi cultivation, substantial areas suitable for this purpose can be found, mainly in area I. The forest can provide other sources of income such as shingles, timber, rottan, jelutong, and illipe nuts.

T.W.G. Dames (F.A.O.)

Appendix I. Field record of cut line I.

Location : From Camp I on the bank of the Kebulu river in azimuth 35° for 113 field tapes of 100 feet.

Field tapes		Map distances
0 - 50 ft.	horizontal, cross small stream	50 ft.
50 - 150 "	40° rise; on hill top hard boulders up to 2 ft. in size.	127 "
150 - 300 "	ridge top; fair forest	277 "
300 - 400 "	20° descend; at 400 small gully.	370 "
400 - 600 "	40 to 45° rise; boulders on surface	518 "
600 - 700 "	level tape across slope	618 "
700 - 800 "	35° descend	700 "
800 - 900 "	ravine with gullies	800 "
900 - 1030"	60° rise; shallow soils.	865 "
1030 - 1200"	level tape across a 50° slope; shallow soil; high rate of natural erosion.	1035 "
1200 - 1300"	45° descend; very good forest	1105 "
1300 - 1500"	15° descend; forest less good	1300 "
1500 - 1850"	20° rise of tape across steep side	1625 "
1850 - 1950"	40° descend.	1705 "
1950 - 2300"	nearly level tape across ravines	2050 "
2300 - 2400"	10° rise of tape across steep slope.	2150 "
2400 - 2600"	nearly level tape	2350 "
2600 - 2830"	40° descend at 2830 small river running towards NNE; boulders on surface.	2530 "
2830 - 2900"	level	2600 "
2900 - 3100"	30° rise	2700 "
3100 - 3200"	25° descend; at 3220 stream running NW.	2880 "
3220 - 3400"	30° rise	3035 "
3400 - 3620"	30° descend	3225 "
3620 - 3720"	level bottomland with many boulders.	3325 "
3720 - 3800"	20° descend	3400 "
3800 - 4300"	level bottomland; probably periodically flooded; tall trees; 4200-4300 a winding stream running NW.	3900 "
4300 - 4400"	25° rise	3990 "
4400 - 4500"	nearly level tape across slope; terrain low hilly with 50 feet high hills separated by narrow valleys with 40° sloping sides; moderate forest	4090 "
4500 - 4600"	10° descend.	4190 "
4600 - 4900"	level bottomland; at 4750 small stream running NNE	4490 "
4900 - 5000"	15° rise; many boulders	4590 "
5000 - 5700"	low hilly to undulating terrain	5290 "
5700 - 6050"	level bottomland; at 5800 a main river with 6 yards high; steep banks, 15 yards wide, running from E to W here; moderate forest	5640 "
6050 - 6100"	10° rise	5690 "
6100 - 6400"	nearly level; boulders on surface.	5990 "
6400 - 6500"	10° rising tape across 30° slope.	6090 "
6500 - 6600"	15° descend	6185 "
6600 - 7500"	strongly dissected, low hilly land; many boulders; good forest.	7085 "
7500 - 8600"	level bottomland; moderately good forest; soil; soil seems suitable padi land; yellow and grey mottled clay loam to clay; at 8200 a shallow gully	8185 "
8600 - 9000"	15° tape; steep hilly land with 30 to 50 degrees slopes; many boulders; fair forest.	8585 "

/9000-9100 ft.

Field tapes		Map distances
9000 - 9100 ft.	10° descend; ditto	8685 ft.
9100 - 9900 "	level bottomland; at 9500 a major river (S. Klebena) running NW.	9485 "
9900 - 9950 "	20° rise; hilly terrain with 30 to 60 ft. high hills; good forest.	9530 "
9950 - 10000"	level hill top	9580 "
10000 - 10100"	10° descend	9680 "
10100 - 10300"	level bottomland.	9880 "
10300 - 10400"	5 yards high ridges with boulders	9980 "
10400 - 10500"	10° descend; at 10500 a small river running WNW	10080 "
10500 - 10700"	level bottomland; at 10700 a major river running W (S.Klebena)	10280 "
10700 - 11300"	level bottomland; open empran forest with tall trees; at 11000 across S. Klebena; again at 11300.	10880 "

Appendix 2. Field record of cut line II.

Location: From the bank of S. Bunbang in azimuth 90° for 59 field tapes of 100 feet.

Field tapes		Map distances
0 - 700 ft.	nearly level to gently undulating empran; small trees; shallow gullies.	700 ft.
700 - 1000 "	20° rising hill sides.	980 "
1000 - 1100 "	10° descend.	1080 "
1100 - 3600 "	tape generally 25° across steep hilly land with 40-45 degrees slopes; strongly dissected; many sandstone boulders up to 2 ft. in size on the surface; very good forest with meranti species, jelutong bukit, engkabang; soils seems good yellow clay suitable for hill padi and bananas etc. but the terrain is very steep.	3350 "
3600 - 4000 "	level to undulating, strongly gullied.	3750 "
4000 - 5900 "	low hilly; strongly dissected land; at 4500 large outcrops of hard sandstone and fine conglomerate; at 5900 a main river, probably an affluent from the S. Bubang.	5600 "

Appendix 3. Field record or cut line III.

Location: From Camp II in azimuth 180° for 83 tapes of 100 feet. The cut line starts at a hill top on the bank estimated at about 60 feet above normal river level, or 50 feet above empran level.

Field tapes			Map distances
0 -	70 ft.	small, rounded hill; temuda forest of some 20 years old.	70 ft.
70 -	100 "	40° descend	93 "
100 -	200 "	15° descend	190 "
200 -	550 "	flat empran; will be flooded during very high water level; fairly extensive strip of flat land suitable for wet padi.	540 "
550 -	625 "	45° rise	590 "
625 -	700 "	25° rise	660 "
700 -	800 "	Level tape	760 "
800 -	900 "	20° descend	855 "
900 -	1000 "	40° descend	930 "
1000 -	1100 "	flat empran	1030 "
1100 -	1230 "	30 ft. high hill top	1105 "
1230 -	1300 "	flat empran with wet gully; at 1300 a small river running west.	1200 "
1300 -	1900 "	empran, about 1 metre higher, somewhat older river terrace (?); at 1600 a 4 yards wide and 2 yards deep gully; trees have stilt roots indicating poor drainage; some low ridges.	1800 "
1900 -	2000 "	low, 8 yards high hills	1900 "
2000 -	2200 "	flat empran	2100 "
2200 -	2400 "	40° rise	2260 "
2400 -	2600 "	Level, narrow ridge top; good forest.	2460 "
2600 -	2750 "	40° descend.	2570 "
2570 -	2820 "	level gully	2640 "
2820 -	2900 "	30° rise across 45° slope.	2710 "
2900 -	3000 "	30° descend	2800 "
3000 -	4000 "	peat swamp; water logged; fairly tall but open tree growth with much asam paya undergrowth; peat over 3 metres deep; at 3300 - 3330 low ridges; 3900-4000 small hill.	3800 "
4000	4400 "	open enclave in peat swamp with a low growth of Cyperaceae, Melastoma, Lycopodium moss etc. 4 to 5 acres of padi cultivation some 4 to 5 years ago; not on aerial photo.	4200 "
4400 -	4900"	flat empran with some low ridges	4700 "
4900 -	5000"	20° rise; 12 metres high hill.	4800 "
5000 -	5100 "	level hill ridge top	4900 "
5100 -	5150 "	45° descend	4930 "
5150 -	6900 "	flat empran with tall trees; at 5400 river, old road and old bridge and fish traps; river running in NW direction.	6680 "
6900 -	7020 "	Very gentle rise towards foothills	6800 "
7020 -	7300 "	steep hilly land with 40 to 45 degrees slopes.	7060 "
7300 -	7400 "	level	7160 "
7400 -	8100 "	level empran with recent blukar growth	7860 "
8100 -	8170 "	30° rise	7920 "
8170 -	8200 "	70° rise; from here very steep land with deep ravines	7935 "

Appendix 4. Field record of cut line IV.

Location: From a point on the Jelalong bank about 1.75 mile south-west of Camp II, azimuth 180° for 78 tapes of 100 feet.

Field tapes		Map distances
0 - 685 ft.	flat empran with tall trees	685 ft.
685 - 775 "	45° rise; good hill forest.	750 "
775 - 900 "	hill top and 30° descend	860 "
900 - 1300 "	low hilly, good forest	1240 "
1300 - 1630 "	flat empran; from 1300 - 1450 secondary forest; from 1450 - 1600 dense, 8 yards high blukar.	1570 "
1630 - 2650 "	low hilly land with slopes from 25 to 45 degrees; very good quality forest.	2560 "
2650 - 2750 "	flat empran.	2660 "
2750 - 3400 "	low hilly land with 20 to 40 degrees slopes; hill tops about 10 metres above empran; very valuable forest.	3330 "
3400 - 3600 "	flat empran	3530 "
3600 - 3800 "	20° rise and descend	3720 "
3800 - 3830 "	flat empran	3750 "
3830 - 4160 "	low hilly	4040 "
4160 - 4240 "	empran with small stream running west	4120 "
4240 - 4950 "	steep hilly land with 30 to 50 degrees slopes	4780 "
4950 - 5400 "	flat empran; trees have stilt roots; wet gullies; good forest but fairly open.	5230 "
5400 - 5500 "	low ridge.	5330 "
5500 - 5630 "	empran	5460 "
5630 - 5800 "	steep hilly	5580 "
5800 - 5830 "	empran	5610 "
5830 - 6900 "	very steep hill land; 30 to 60 degrees slopes; good forest; locally boulders on surface and in canyon.	6620 "
6900 - 7000 "	flat empran	6720 "
7000 - 7750 "	very steep hilly terrain; slopes of 40 to over 60 degrees	7200 "

A great number of belian trees were seen in the hill land especially in the extremely steep area. Most of these were felled and had been worked for shingles. The great waste of timber by this method is most impressive.

Appendix 5. Field record of cut line V.

Location : From point on the Jelalong bank about 1 mile north-east of Camp II in azimuth 130° for 80 tapes of 100 feet. Zero point is on the top of a low hill about 30 feet above high river level.

Field tapes		Map distances
0 - 300 ft.	level to gently undulating; moderate to poor forest with several small belian trees.	300 ft.
300 - 800 "	low-hilly, dissected plateau; 30° slopes; at 700 - 800 rounded quartzite gravel on surface.	800 "
800 - 1550 "	hilly with 30° slopes; fair forest.	1400 "
1550 - 1700 "	level bottomland; old temuda (?) or poor forest	1550 "
1700 - 2000 "	low hilly land.	1850 "
2000 - 2300 "	level bottomland	2150 "
2300 - 2600 "	low hilly land	2440 "
2600 - 2720 "	flat empran with sandy material in gullies	2560 "
2720 - 3000 "	low hilly; at 2720 - 2800 rounded gravel	2820 "
3000 - 3500 "	wet empran with many wet gullies; poor drainage; poor type of forest.	3320 "
3500 - 5750 "	very steep hilly terrain with up to 60 degrees slopes; deep, steep-sided canyons; locally shale outcrops, and hard boulders on surface; better forest.	5310 "
5750 - 6000 "	flat empran; at 6000 a fair size river with boulders and rock outcrops; running west	5560 "
6000 - 6800 "	low ridge land; at 6200 big river	6360 "
6800 - 7100 "	very steep terrain; good forest; locally boulders	6470 "
7100 - 8000 "	flat empran near river; between 7500 and 7800 cross 3 times the main river; very hard siliceous boulders in bed; running Nw; fair forest	7370 "
8000 - + "	Very steep hilly land.	

ROUTE AND SAMPLE MAP OF PART OF THE KEBULU PROTECTED FOREST

BINTULU DISTRICT 4 th. DIVISION

SCALE 1 : 25,000 Approximate

I 35 — Cut line with numbers at 1,000 feet intervals; measured

Cut line; not measured

410/14 □ Soil pit location with horizon-sample numbers

\+ Rock sample locations

△ Camp site

▬ Long house

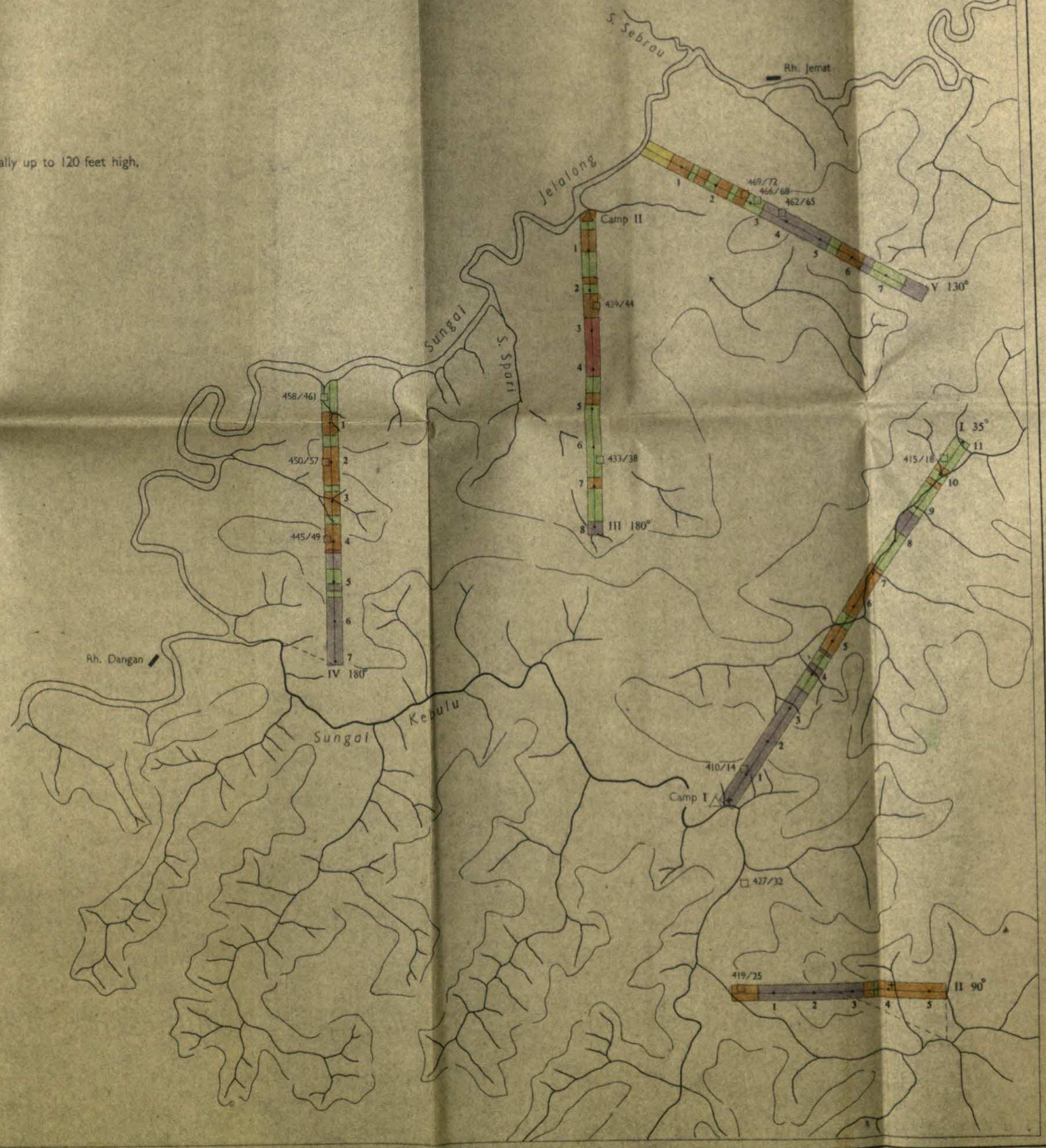
Mainly flat empran with minor low hills and ridges

Low hilly land with minor stretches of empran; hills 30 to 60 feet, locally up to 120 feet high, with very narrow ridge tops and slopes varying from 20° to 40°

Extremely steep land with slopes from 40° to over 60°

Deep peat

T? Terrace remnant



SOIL SURVEYS DRAWING NO. 3