

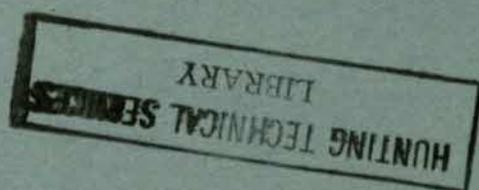
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Report No. 89

Report on a Reconnaissance Soil Survey  
of the  
**LOWER BARAM - BAKONG -  
LOWER TINJAR AREA**  
4 th. Division

By

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# HUNTING TECHNICAL SERVICES

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Reconnaissance Soil Map (1:100,000) in back cover folder.

REPORT ON A RECONNAISSANCE SOIL SURVEY OF THE  
LOWER BARAM - BAKONG - LOWER TINJAR AREA,  
FOURTH DIVISION.

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INTRODUCTION

This report is partly the result of a request made by the Fourth Division Development Committee to examine the lower Tinjar valley around Long Jegan for its agricultural potential, and partly to complete reconnaissance soil survey coverage of the lower Baram-Bakong area.

The area is bordered in the northeast by the Brunei-Sarawak international boundary, in the northwest by Survey Areas 43 and 21, in the west by Survey Area 35 and in the east by Survey Area 62, all reconnaissance soil surveys.

The total area amounts to 886 square miles, of which 50 per cent is deep peat, although good agricultural land occurs, for example in the lower Bok - upper Bakong area where large-scale block development would be possible.

As the soil mapping units used in this report have been fully described in reports of the neighbouring surveys, a duplication of descriptive work is avoided by referring where relevant to these previous reports. The survey methods used were those that are now standard for reconnaissance work in Sarawak. Intensive use of air photograph interpretation is made in conjunction with the examination of soils along selected lines in the field. The boundaries of the mapping units are principally those of vegetation and topography types that were found to coincide with soil changes in the field. Soil samples were not taken during this survey as almost all of the common soils in the area have been studied and reported on in this respect in the previous reports.

GEOLOGY

Detailed descriptions of the geology of the area have been made by Wilford (1961), Liechti (1960) and Haile (1962). The following is an abstract from these accounts.

Sedimentary Rocks of Tertiary age and ranging from sandstone to shales and intergrades underlie the hills in the south of the area. The Tinjar River drains mainly Setap Formation shales which are strongly folded, light grey to dark grey, calcareous in places and interbedded by rare beds of sandstone. The Belait Formation is drained principally by the upper Bakong and Bok rivers and by contrast is only gently folded and contains a high percentage of thickly bedded, massive, pale coloured sandstone. Thick beds of shale and sandy shale also occur. The Lambir Formation outcrops in the few hills around Beluru in the Bakong River where the rocks are weakly folded and comprise both sandstone and shale with intergrades; also some limestone. They are poorly consolidated and the sandstone tends to be weakly cemented. The limestone is found near Beluru and is rather sandy in contrast to the much purer limestone at Subis and Batu Gading. Tukau Formation rocks closely resemble those in the Lambir Formation and are found in the small block of hills at the confluence of the Bakong and Baram rivers.

Quaternary age alluvium ranging from sands to clays mask the rocks in the lower Bakong and Baram valleys. They are derived from sedimentary rocks poor in weatherable minerals, and are therefore equally poorly endowed with minerals that can weather to produce plant nutrients. Quaternary (Pleistocene) quartz sands are found as a thin covering on the terraces at the Bakong-Baram confluence.

Thick peat accumulations overlie recent alluvium in the central and northern parts as extensive swamps, in places known to be forty feet deep. Smaller peat swamps also occur in the Bakong valley as far upstream as Long Jegan.

#### TOPOGRAPHY

The form of the hills in the area tends to be related to the type and structure of the underlying rock. Thus the gently folded, massive, moderately hard sandstones of the Belait Formation have weathered to produce a distinct series of cuestas near the Tisam valley facing southeast; similarly the sandstones of the Lambir Formation near Beluru and in the upper Bakong Valley. To judge by the presence of landslides and the poor appearance of the vegetation sandstone is present on the Balat Ridge north of Mentegai Mountain. More shaley strata have been less resistant to erosion and the topography developed from strongly folded shale comprises low, dissected, gentle to moderately steep hills and short ridges. Shaley strata also underlies Mentegai and Jegan Mountains, however, but it is suspected that hard sandy shales are also present. Shale and sandy shale are predominant in the ridge country south of Lake Bunut and to the north of Jegan Mountain. The ridges in these areas are long and steep-sided with sharp summits.

The terraces between the lower Bakong and Baram rivers are inextensive, and consist of long, narrow remnants capping ridge tops. Erosion in the area is intense and landslides scar the terrace flanks in many localities. The terraces are estimated to lie at less than 100 feet above adjacent flat land.

River flood-plains penetrate the southern hills for long distances following the strike of rocks predominantly. They are between half and one and a half miles wide in the upper Tinjar and upper Bakong valleys. Numerous, small, narrow, sinuous flood-plains have formed among the low hills between the lower Bok and Bakong valleys. Further downstream the flood-plains are strongly confined by the presence of flanking peat swamps to meandering narrow strips only a few hundred feet wide in places. The presence of a wide flood-plain between the upper Karap River and the Tinjar River at Long Teru is an indication that a large river formerly followed this route, probably an old course of the Tinjar or Teru River.

The peat swamps are known to be distinctly domed close to Marudi (Anderson, 1964; White, 1956) and it is probable that all the swamps, except the smallest, have developed this feature to some extent. The streams draining the swamps form a radial pattern and have predominantly straight courses.

#### VEGETATION AND LAND USE

Primary forest covers almost the whole of the Baram and Bakong swamps and covers the headwater areas of the small streams and rivers draining the hills. The vegetation on the swamps consists of various types of Peat Swamp Forest, ranging from exploitable Alan Forest and Mixed Swamp Forest on the swamp peripheries to stunted, unexploitable Padang Forest in the central swamps. On the hill land is predominantly Mixed Dipterocarp Forest found on the lower hills and ridges, grading to what appears to resemble Heath Forest or poor Mixed Dipterocarp Forest on cuesta dipslopes in the upper Bakong-Tisam area, and on the summits of Selikan Mountain. A thin belt of Saltwater Swamp Forest occurs on the banks of the lower Baram.

Secondary Forest is almost entirely the result of cultivation of hill and swamp rice, but while the former spreads for several miles from population centres, the latter is restricted to small patches close to the longhouses. As yet there seems to be little intensive cultivation of wet rice. Both pepper and rubber gardens are few and scattered.

#### SOILS OF THE AREA

The soils are described below by soil families. As these have been described in detail for adjacent surveys, notably for Survey Areas 62 and 35, the following are confined to broad outlines.

### MERIT FAMILY

The survey showed Merit Family soils to be dominant in the lowlying hill land drained by the Tinjar River, and to be surprisingly common on the high Jegan and Mentegai mountains. Merit soils also occur mainly on the scarp slopes of the Tisam - upper Bakong area and in a few places on the terrace flanks at the Bakong - Baram confluence.

The soils are weakly structured and predominantly moderately deep to deep yellowish brown clay loams or clay. The lower subsoil may be reddish yellow and commonly is mottled light grey and yellow. In some areas there may be a thin stone line of iron-coated shale fragments in the lower subsoil. The topsoil tends to be thin, even beneath primary forest. Internal drainage is good to moderately good.

### BEKENU FAMILY

Bekenu Family soils only seem to be common on the higher hills and ridges where they tend to occupy the steeper slopes. They also occur, however, in the lower Bakong terrace area in association with Nyalau soils.

They consist of yellowish brown loam to sandy loam overlying yellowish brown to reddish yellow clay loam or clay. They are well to moderately well drained, predominantly shallow and stony where in association with Merit soils, and deep and sandy where found with Nyalau soils. The topsoil varies in thickness from place to place, but is generally shallow.

### NYALAU FAMILY

Soils of the Nyalau Family occur in the cuesta landscape in the Tisam - upper Bakong area, among the cuestas around Pantu Lutong and Pantu hills and among the terraces near the mouth of the Bakong River.

The soils are yellowish brown to yellow and reddish yellow sandy loams, increasing generally to sandy clay loam within four feet of the surface. They are well-drained, poorly structured and deep except on the steeper ridges in the south. In the lower Bakong area the Nyalau soils have been eroded strongly by landslides, as in the adjacent Lambir Hills, probably a reflection of the poor structure and low water-holding capacity. Landslides have occurred on Nyalau soils elsewhere in the surveyed area but not to the same extent.

#### SEMADOH FAMILY

On the gentle dip slopes of the cuestas poorly and very poorly drained soils have been noted that are classed as Semadoh Family soils. Such soils are rare in lowland Sarawak, generally being found at altitudes exceeding 4,000 feet.

Semadoh soils are characterised by strongly impeded internal drainage and slow surface run-off. They tend to be sandy in the upper few inches but rapidly increase in texture to loams or clays in the deeper subsoil. They are pale-coloured beneath the dark peaty topsoil but commonly are strongly mottled with yellow and red in the lower subsoil. The depths do not generally exceed three feet and there is commonly a sharp change to hard rock at the base of the profile which is believed to be the main cause of the impeded internal drainage.

#### BAKO FAMILY

Bako Family soils are found on cuesta dipslopes and probably occur on the summit of Selikan Mountain. They are associated with Semadoh, Nyalau and possibly Matang Family soils.

The soils are sufficiently podsolised to show a well-developed podsol profile with a hard, dark brown humus pan at depth generally resting directly on rock. The textures are sandy throughout the profile and the soils are generally poorly or very poorly drained to the extent that the topsoil becomes peaty. Bako soils are infertile, structureless and commonly less than three feet deep. In places the humus pan is not cemented hard, which is a characteristic of the otherwise identical Silantek Family.

#### KAPIT FAMILY

Steeply sloping land containing Kapit soils are common in the southeast of the area and in patches around Mentegai Mountain. The soils are predominantly well-drained stony loams less than ten inches deep overlying rock rubble, penetrable by auger. Where the rock is impenetrable the soils are classed in the Meluan Family, but this is rare.

#### KABULOH FAMILY

A small area of Kabuloh Family soils is believed to occur near Beluru, where sandy limestone outcrops (Haile, 1962). This is based on the known presence of such soils above limestone and calcareous shale in the adjacent Sibuti River basin (Wall, 1964).

Kabuloh Family soils range in colour from pale yellow to reddish yellow and brown. They have clay textures and are dense and rather poorly structured giving imperfect to moderately good internal drainage. Hard limestone rock is common beneath two feet and its presence bequeaths a characteristic high calcium content to the soil. Kabuloh soils have a high exchange capacity compared to other residual soils in Sarawak.

#### MIRI FAMILY AND BUSO FAMILY

Both soil families occur on the terraces near the mouth of the Bakong River and adjacent to the Miri River tributaries in the northwest. They are strongly podsolised with a deep, loose, white sand A2 horizon resting on a dark brown humus pan. The hardness of the pan is used to differentiate between the two families, that of the Miri Family being hard and impenetrable by auger, that of the Buso Family being soft. In several places on the terraces the depth of the A2 horizon exceeds four feet. The terrace margins have been severely eroded to the extent that only ridges are left in some areas with vestigial Miri or Buso soils on them. Both soil families are infertile and have bad drainage properties, tending to flood easily and dry out rapidly.

#### MALANG FAMILY

Malang Family soils have been found on the river banks of the Tinjar River predominantly upstream from the Bok - Tinjar river confluence, backing the levees of the Tinjar River upstream of Long Jegan, and in the upper valleys of the many smaller streams among the lowlying hills with Merit soils. Small patches occur in the lower Bakong - Baram area on the river levees.

The soils are deep, yellowish brown clay loams to clays mottled light grey and reddish brown or black in the deep subsoil where waterlogging occurs. Internal drainage is imperfect, external drainage is slow.

#### KAYAN FAMILY

Soils of the Kayan Family only occur as a narrow strip on the levees of the Tinjar River in the south and in a few small patches on the lower Baram. The soils are mainly yellow and consist of layered sand with loam, sandy clay loam and clay loam. They are mainly well to moderately well-drained. The textural variation with depth and the presence of sand is an indication of fast-moving flood water, a factor which should be considered in the planting of low crops.

#### BIJAT FAMILY AND SEBANDI FAMILY

Soils of the Bijat and Sebandi families are common in all the flood-plains. In down-river locations, they are situated on the river bank and behind the river bank and in up-river locations they occur in the lowlying basins.

The soils of these families are closely similar in most respects the main difference being that the Sebandi soils are very poorly drained with up to ten inches of peat topsoil, while the Bijat soils are poorly drained with no overlying peat. The mineral subsoil in both families consists of pale-coloured loam, clay loam or clay and is dense, sticky and plastic. Reddish and yellowish mottles are more typical in the Bijat upper subsoil than in the Sebandi soils where olive shades seem more dominant. Peat or muck lenses occur in the subsoil of both families and are particularly common on the margins of peat swamps.

#### MUKAH FAMILY

Mukah Family soils are less common than might be expected in view of the large areas of peat swamp present. They mainly occupy a narrow belt on some swamp margins in the lower river courses, particularly in the inside meanders of the Baram River, and also occur in association with Bijat and Sebandi soils in small up-river swamps.

The soils consist of between ten and forty inches of surface peat (including muck) overlying light grey plastic clay. In places this gives way to peat in the deep subsoil, the clay being simply a thick lens within the peat. The soils are poorly drained.

#### IGAN FAMILY

The only places where Igan soils are known in the area surveyed is in the lower Baram valley. They are present on swamp margins in the inner meander bends, and also occupy a belt adjacent to the Miri River tributaries in the northwest in association with soils of the Miri Family.

The soils comprise a peat topsoil between ten and forty inches thick overlying wet, loose sand that ranges from brown to light grey in colour. Internal drainage is very poor, external drainage is slow.

#### RAJANG FAMILY

Saline soils of the Rajang Family only occur adjacent to the lower Baram Rivers. They have been mapped by the presence of mangrove and nipah vegetation.

The profile consists of deep, grey to greyish brown clay or silty clay with in places abundant semi-decomposed organic matter. The topsoil may be sandy in some areas and the deep subsoil may be peaty near peat swamp margins. Elsewhere in Sarawak Rajang soils are strongly saline and cannot be used for agriculture before improvement. They are poorly drained and are flooded regularly by salt or brackish water.

#### PENDAM FAMILY

Although not mapped it is suspected that Pendam soils occur in the lower Baram and possibly lower Bakong valleys between the river banks and adjacent peat swamps. Chemical analyses would be required to distinguish between these soils and those of the physically similar Bijat soils. The former has a moderately high electric conductivity indicating the presence of salts, while Bijat soils have a low conductivity.

#### LIMBANG FAMILY

In the lower Baram Valley are thin strips of Limbang soils between the saltwater-flooded clays on the river bank of the Rajang Family and the neighbouring Anderson Family peats. The soils consist essentially of deep organic matter containing moderate amounts of clay, which are flooded regularly by salt-water or brackish water to give a high acquired conductivity.

#### ANDERSON FAMILY

Deep peat of the Anderson Family is predominant in all the swamps of the area surveyed. Most peats exceed ten feet in depth and near Marudi depth recordings of about forty feet have been made before reaching underlying clayey soils. The peat increases in depth rapidly with distance from river banks so that shallow peats are by comparison rare. The peat is mainly woody and little decomposed. Large patches of surface water are common in the widespread 'padang' areas. The peat subsoil appears to be mainly clay where recorded, except in the lower Baram downstream from the Lubok Pau Stream and in the Miri River area where sand underlies the peat.

#### AREAS SUITABLE FOR LARGE-SCALE DEVELOPMENT

Among the hilly land, those areas with good or moderately good soils combined with low, gently dissected to moderately steep hills are confined to the land west and southwest of the Tuyut River (11,800 acres) the land between the lower Bok and upper Bakong rivers and extending into the Laong Stream area (30,100 acres), and the land drained by the upper Mechau Stream extending north and southwest (11,800 acres).

These areas are indicated on the accompanying soil map, and include small patches of steep hills that may be unsuitable for development: these blocks would be worthwhile soil surveying at a semi-detailed level when the need arises, the Sebatu-Laong block being the best. The soils consist of loams, clay loams and clays of the Merit Family mainly with small areas of Bekenu soils and possibly Kapit soils. They would be most suitable for rubber and possibly oil palm block planting.

Roads will be required to open up these areas. It is suggested that, should a feeder road connection be required between Long Lama in the east and Beluru, a suitable route would be the one indicated on the soil map as it would aid development of two of the blocks of land.

The flat land suitable for development amounts to a large acreage, but there are no large single blocks of land except for that in the lower Bok Valley. Here, the main soils are of the Bijat and Sebandi families with patches of deep peat in places. Flooding is the main impediment to development of the flat land with alluvial soils. Many small schemes for wet rice cultivation could be initiated in the main valleys, and the flat land of the upper valleys could be drained in many places for inclusion with hill crop planting.

#### CONCLUSIONS

Of the 886 square miles mapped approximately 50 percent consists of deep peat swamps. Some flat land is suitable for development, however, particularly alongside the rivers in the hill land of the south where soils of the Bijat, Malang and Sebandi families occur.

The hills contain much land that is either too steep or has too infertile soils for development. Three blocks of land with soils and topography that appear to be suitable for agriculture are indicated, however, and a road connection is suggested that could also link Long Lama with Beluru and thence to the Miri-Bintulu trunk road.

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