

# LAND CAPABILITY DATA

WOSSAC: 24047  
631.47  
(911.14)

SUBJECT : \_\_\_\_\_

DATE : \_\_\_\_\_

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SNELHECHTER FOLIO TJAP „KEMBANG”

LAND CAPABILITY DATA

12AY

MIRI - BINTULU PROJECT

INSTRUCTION FOR CODING & CLIPPING OF  
SOIL DESCRIPTION EDGE PUNCHED CARDS

MIRI - BINTULU PROJECT

INSTRUCTION FOR CODING AND CLIPPING OF SOIL DESCRIPTION

EDGE PUNCHED CARDS (24th January, 1973).

(Ref.: Soil Description Edge Punched Cards

H.T.S. Standard Procedures No. 1 April 1972 and

A Classification of Sarawak Soils, Soil Survey Staff, Kuching, 1966)

INTRODUCTION

The instructions for Coding and Clipping of Soil Description Edge Punched Cards for this Project have been revised and ammended in the light of field experience gained in the sample areas. Also certain requirements of the Agriculturalists on the Project have been accomodated.

The Sarawak Soil Survey Staff is at present engaged in a modification of the soil classification system and pending the completion of a revised system no clipping will be done as far as soil classification is concerned. A supplement covering this feature will be issued as soon as possible.

The present revised instructions supercede those issued on 9th November and 22nd December, 1972.

LOCATION

1:50,000 topo sheets renumbered as follows:-

4/113/8	} - 9	3/113/3	} - 19	3/113/9	- 4
4/114/5		3/113/15		3/113/10	- 5
4/114/6	- 10	3/113/4	- 8	3/113/11	- 6
4/113/12	- 11	3/114/1	- 20	3/113/12	- 7
4/114/9	- 12	3/114/2	- 21	3/114/9	- 25
4/114/10	- 13	3/114/3	- 22	3/114/10	- 26
4/113/16	- 14	3/113/6	- 1	3/113/13	- 27
4/114/13	- 15	3/113/7	- 2	3/113/14	- 28
4/114/14	- 16	3/113/8	- 3	3/113/15	- 29
4/114/15	- 17	3/114/5	- 23	3/113/16	- 30
3/113/2	- 18	3/114/6	- 24		

Block C and D are assigned to the renumbered topo sheets, Block D for units, Block C for tens, for this purpose sheet numbers run from 1-30 (incl.).

This project's code letters are MBP, followed by the name given to a Survey Area that is MBP/S. Karabungan. S.A. (= sample area).

Clip double hole next to Block D for sample area surveys.

#### SITE REFERENCE

Surveyors' letters are:-

A - ILAY

B - RDL

C - CPL (Lim Chin Pang, S.S. North Sarawak)

D - Basmawi Mahli

E - Rosli B. Sahari

F - Johdi B. Juko

#### AERIAL PHOTO NUMBER

Only recorded on card by run and number; if other than 1:25,000 aerial photographs are used then record appropriate scale. No clipping is required.

#### A.P.I. LEGEND (Ref. Zonation Plan Report. October 1972)

Recording of the aerial photo-interpretation legend is done on the reverse side of the card.

Three Blocks E, F and G are assigned for this purpose. The coding is as follows:-

Block E	Block F
Land Types:- A - 1	Units:- 1 )
B - 2	2 ) Clipped as
C - 3	3 ) appropriate unit
	number

Block E (Cont'd)

- D - 4
- S - 5
- T - 6
- U - 7

Block F (Cont'd)

- 4 } Clipped
- 5 } as appropriate unit
- 6 } number
- 7 }
- 8 - (B2/B3) complex 2/3
- 9 - (B3/B4) complex 3/4

Block G

Subdivisions:-

- v = 1
- b = 2
- s = 3
- c = 4
- r = 5
- p = 6
- o = 7

VEGETATION AND LAND USE

Record the appropriate details on the reverse side of the card.

For clipping two blocks are required, Block A and B have been reserved.

Main Vegetation/Land Use Type

Sub units

Block A		Block B	
Primary forest	- 1	Unlogged	- 1
		Logged	- 2
Kerangas	- 2		
Secondary forest	- 3	Scrub	- 1
		Old Secondary	- 2
		Young Secondary	- 3

Shifting Cultivation	- 4	Hill rice	- 1
		Maize	- 2
		Millet	- 3
		Tapioca	- 4
		Other crops interplanted	- 5
Permanent Cultivation	- 5	Rubber	- 1
		Padi	- 2
		Pepper	- 3
		Fruit trees	- 4
		Pineapple	- 5
		Coconut	- 6
		Coffee	- 7
		Vegetables	- 8
Cleared land not planted	- 6		
Mangrove	- 7		

**SLOPE**

The actual measured slope at the observation site should be entered on the card in the space provided on the reverse side of the card.

Block H is assigned for clipping and the following slope classes have been chosen:-

Degrees	
0 - 3	= 1
4 - 6	= 2
7 - 10	= 3
11 - 15	= 4
16 - 20	= 5
21 - 25	= 6
26 - 30	= 7
31 - 35	= 8
more than 35	= 9

## AMPLITUDE OF RELIEF

This should be recorded in the space provided for Slope and Aspect.

Block I is reserved for clipping, using the following ranges of height:-

0 -	50 feet = 1
51 -	100 feet = 2
101 -	150 feet = 3
over	150 feet = 4

## TEXTURE

As the available water capacity (AWC) is an important factor in crop performance and production the textural classes have been grouped on the basis of Salter and Williams's Modified Triangular Co-ordinate Diagram (Salter, P.J. and Williams, J.B. IV. A Method of Estimating the Available-Water Capacities of Profiles in the Field. Journal of Soil Science, Vol. 18, No. 1, 1967).

CoS	LCoS.	= 1
CoSL,	CoSC.	= 2
MS, LMS, MSL, L,	SCL, FSC	= 3
CL, C, SiC, SiCL		= 4
FS, LFS, FSL		= 5
VFS, LVFS, VFSL, SiL		= 6

Block L, M and N have been reserved for this category. Block L for the weighted mean between 4 and 12 inch, (10-30 cms) Block M for the weighted mean between 12 and 24 inch (30 - 61 cms) and Block N for the weighted mean between 24 and 48 inch (61 - 120 cms) depth.

## LIMITING HORIZON

This is the nature of the horizon for which the effective depth is given. If two features such as iron and manganese concretions and gravel occur mixed in the same horizon then the dominant feature should be clipped.

Block K (single hole) is assigned for the following features:-

Concretions (iron, manganese)	= 1
Gravel and stone lines (including weathering bedrock)	= 2
Rock (inaugerable)	= 3

Pans and cementation, water table and peat are recorded but not clipped, since these features are incorporated in the classification system.

## EFFECTIVE DEPTH

The effective rooting depth for agricultural crops is closely related to the occurrence of limiting horizons.

Block J is assigned to this feature. The depth ranges are as follows:-

Skeletal soils less than 10 inches	(< 25 cms)	= 1
Very shallow	11 - 20 inches (26-50 cms)	= 2
Shallow	21 - 24 inches (51-61 cms)	= 3
Moderately deep	{ 25 - 29 inches (62-79 cms)	= 4
	{ 30 - 36 inches (80-91 cms)	= 5
Deep	37 - 48 inches (92-120 cms)	= 6
Very deep	more than 48 inches (> 120 cms)	= 7

Note:-

According to T.C. Sheng (1971, Land Capability Classification. Jamaica) soils deeper than 36 inches can be freely terraced up to 25 degrees.

## DRAINAGE

The drainage classes are those mentioned in the Soil Survey Manual for Malayan Conditions (Leamy and Panton, 1966). No clipping is required for drainage as this feature is, and after revision of the system will be, incorporated into the classification system.

Very poorly drained

Poorly drained

Imperfectly drained

Moderately well drained

Well drained

Very well drained

Excessively drained

## SAMPLED SITES OR SITES WITH PIT AT BORE SITE

Clip single hole in left hand corner directly next to Classification.

## SOIL CLASSIFICATION

A supplement will be issued as soon as the revision of the classification system is completed.

## MATRIX COLOUR

Block O is assigned for clipping the matrix colour as follows:-

- (i) Alluvial soils :- the matrix colour at 20 inch (50 cms) depth.
- (ii) Residual soils, with limiting horizons:- the matrix colour of the horizon immediately above the limiting horizon containing concretions, weathering bedrock or both.
- (iii) Residual soils, without a limiting horizon within controlled section (48 inches or 120 cms):- the matrix colour of the bottom horizon.

Colour groupings are given below and on the attached figure.

1 = Reds

10R 3/6, (4/2-4/8), (5/2-5/8), (6/2-6/8)  
7.5R (3/6-3/8), (4/2-4/8), (5/2-5/8), (6/2-6/8)  
5R 3/6, (4/2-4/8), (5/2-5/8), (6/2-6/8)  
2.5YR (3/6-6/6), (4/8-6/8)

2 = Red - browns

2.5YR (4/2-6/2), (3/4-6/4)  
5YR (4/2-6/2), (3/3-6/3), (3/4-6/4)

3 = Yellow - reds and Reddish - yellows

5YR (4/6-7/6), (4/8-7/8)  
7.5YR 6/6, 7/6, 6/8, 7/8

4 = Browns

7.5YR 4/2, 4/4, (5/2-5/8), 6/2, 6/4  
10YR (3/3-6/3)

5 = Grey - browns

10YR (4/2-6/2)  
2.5Y (4/2-5/2)

6 = Yellow - browns

10YR (3/4-6/4), 5/6, 5/8  
2.5Y 6/4

7 = Yellows and olives

10YR 6/6, 6/8, 7/6 7/8, 8/6, 8/8  
2.5Y 4/4, 5/4, 5/6, (6/6-6/8), (7/4-7/8), (8/4-8/8)  
5Y (4/3-6/3), (4/4-6/4), (5/6-8/6), 6/8-8/8)

8 = Dk. greys, Greys, dusky

10R 3/3, 3/4, 5R 3/2-3/4

All hues N2, N3, N4, N5, N6

(2/1-2/4), 3/1, 3/2, 4/1, 5/1, 6/1

2.5Y 6/2

5Y 4/2-6/2

All **gleys** (except green) of value 4-6.

9 = Greens

5G 4/2-5G 7/2

11 = Pale

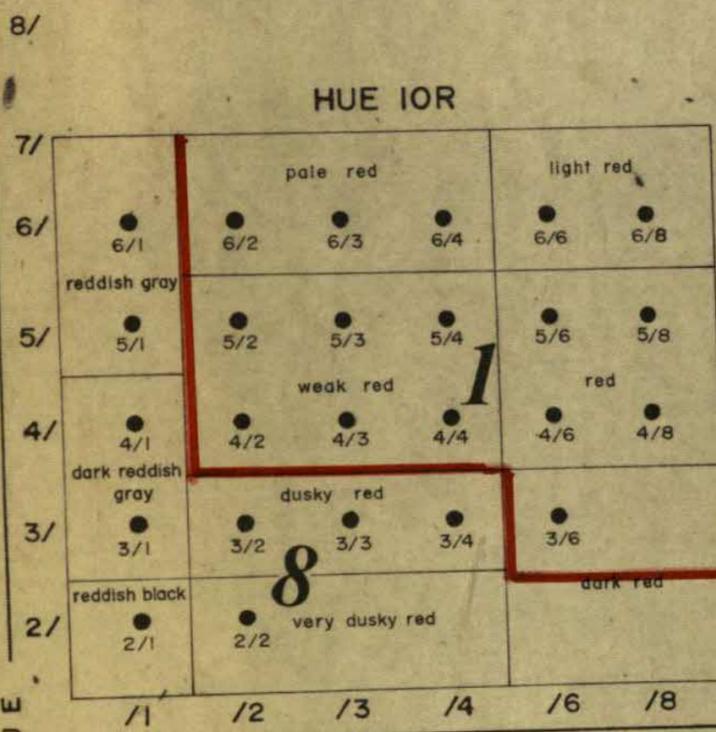
All hues (7/1-7/2), (8/1-8/2) N7, N8

7.5YR 8/6

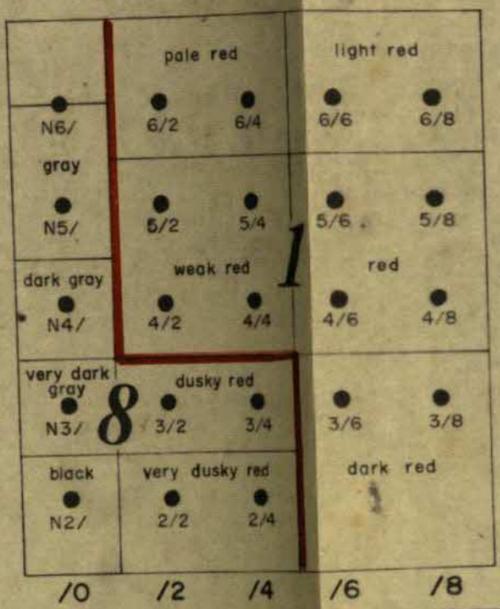
All **gleys** (except green) of value 7

c.c.: MB/3/SOILS/CLASS & CORR.

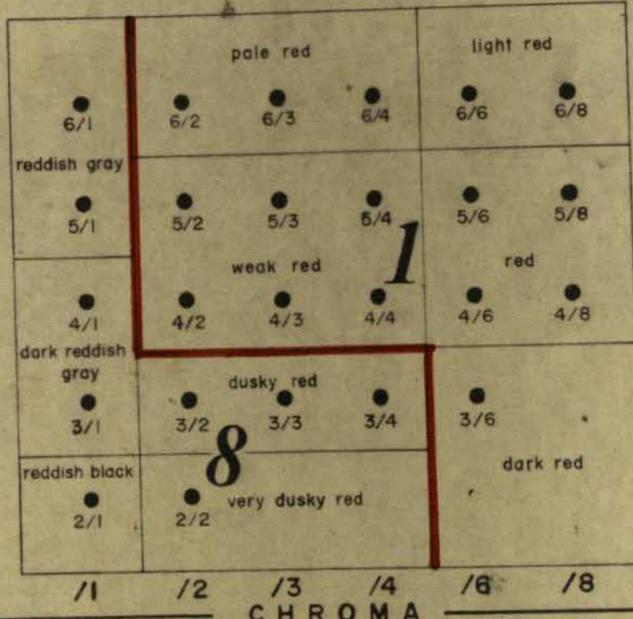
HUE 10R



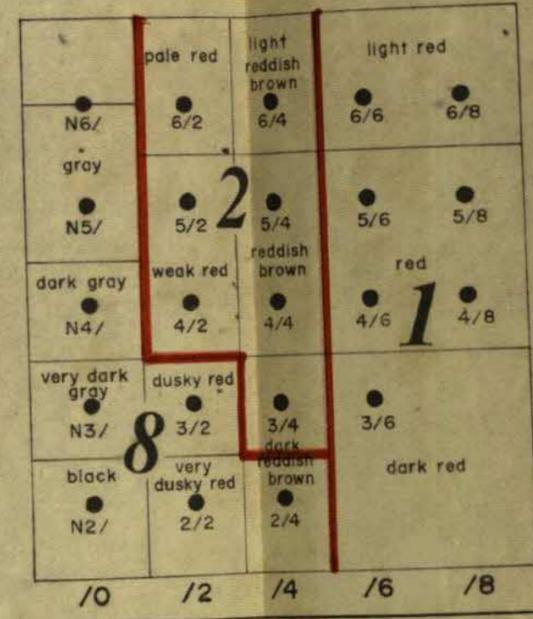
HUE 7.5R



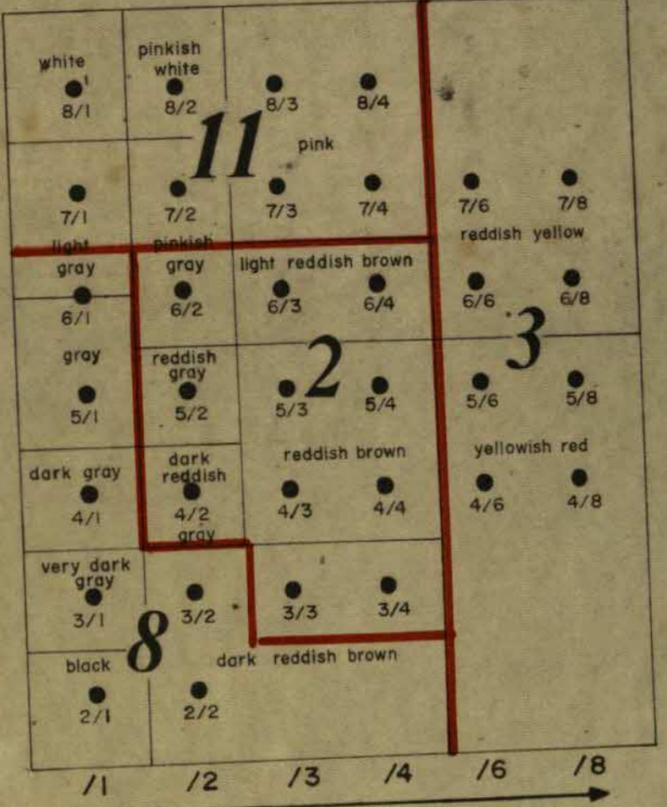
HUE 5R



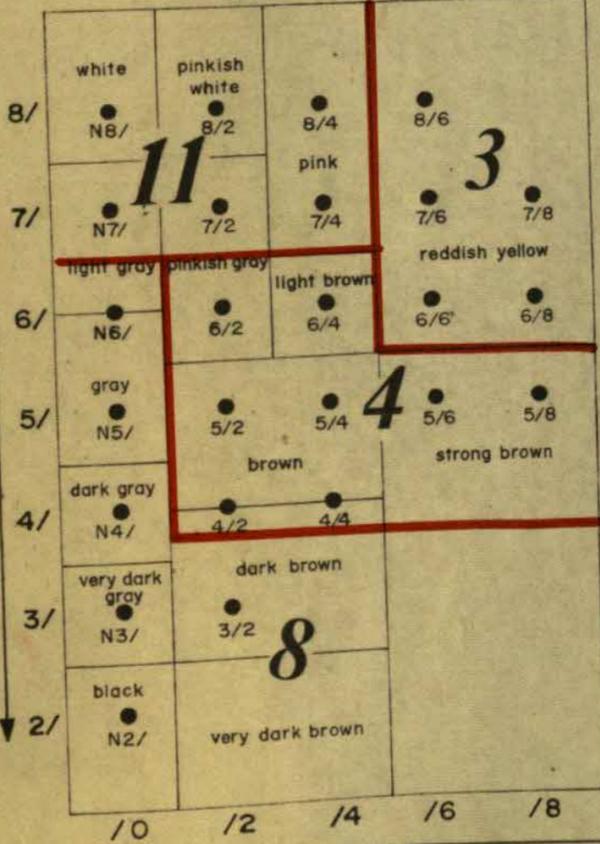
HUE 2.5YR



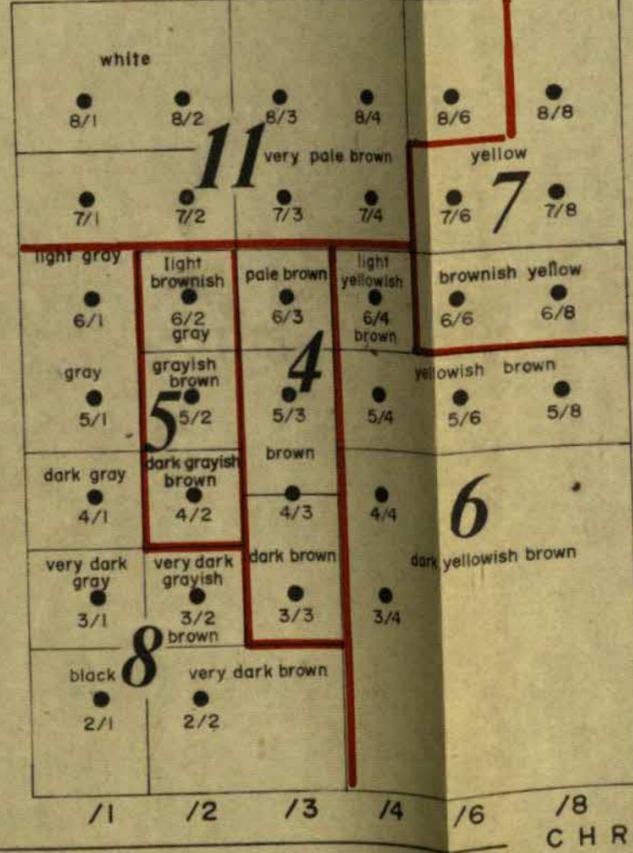
HUE 5YR



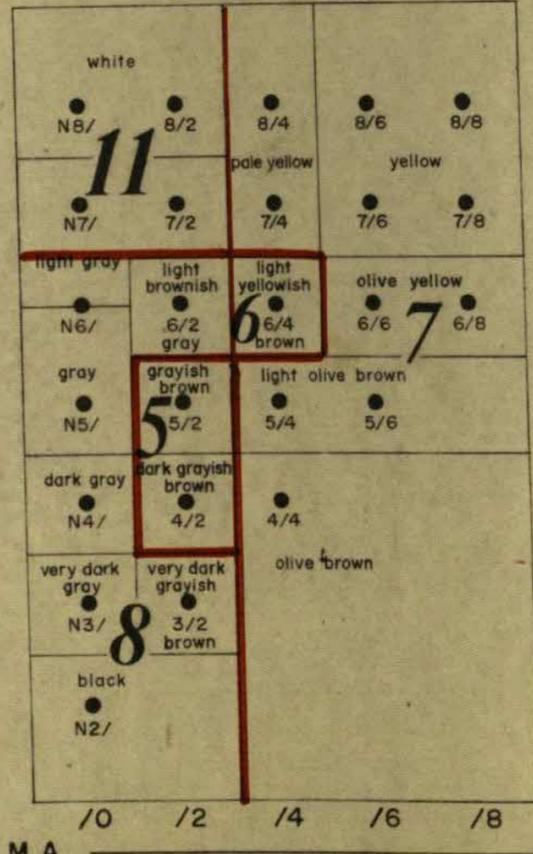
HUE 7.5YR



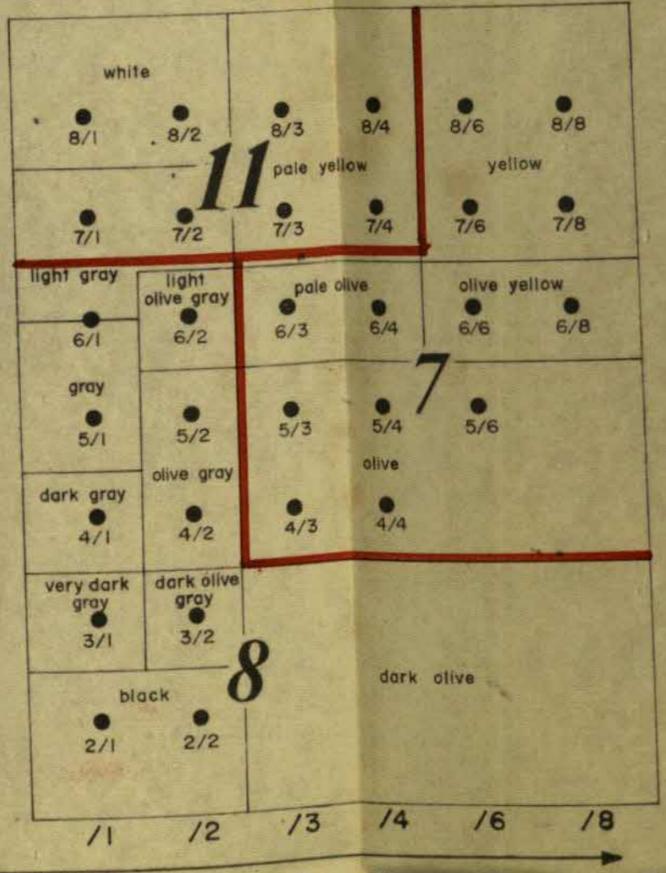
HUE 10YR



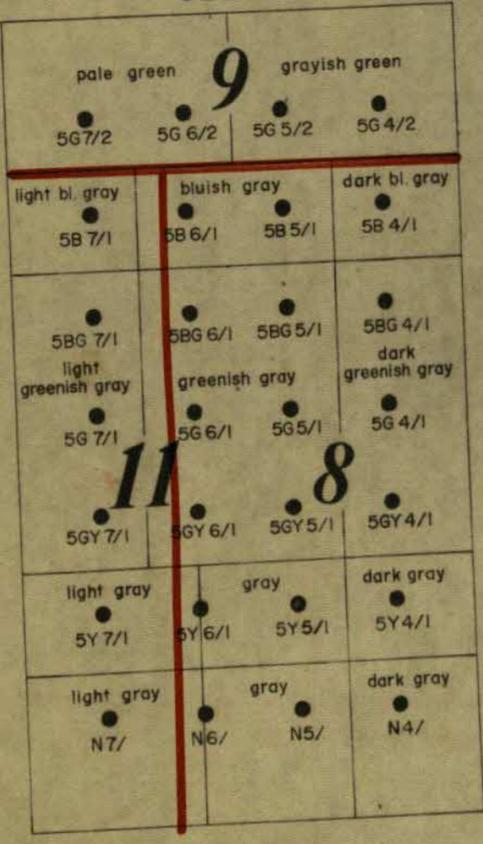
HUE 2.5Y



HUE 5Y



GLEYS



CLASS	I		II	
Sub-class	-	W	S	S
Soil FAMILY and/or Series in each Sub-class	BEMANG - Bemang SEDUAU - Seduan, Malang BEKENU - Bekenu, Sarikei	BEMANG - Bemang SEDUAU - Seduan, Malang	BEKENU - Bekenu, Sarikei MERIT - Merit, Jakar MERIT/BEKENU KABULOH - Karabungan, Tumpang	BEMANG - Semilajau SARATOK - Saratok, Penipah NYALAU - Hyalau, Sebengang NYALAU/BEKENU MERIT/NYALAU
Maximum slope in degrees	3 <del>(CLASS 1)</del>	3 <del>(CLASS 1)</del>	5 <del>(CLASS 1)</del>	3 <del>(CLASS 1)</del>
Erosion hazard	Slight or absent	Slight or absent	Slight	Slight or absent
Effective soil depth in (inches)	Deeper than 100 (40) <del>(CLASS 5)</del>	Deeper than 100 (40) <del>(CLASS 5)</del>	Deeper than 100 (40) <del>(CLASS 5)</del>	Deeper than 100 (40) <del>(CLASS 5)</del>
Drainage	Well	Well to moderately well	Well to moderately well	Well to moderately well
Flooding	None	Infrequent and of short duration	None	None
Texture groups	Loams, silts and clays no surface peat	Loams, silts and clays no surface peat	Loams, silts and clays no surface peat	Loams, silts and clays no surface peat
Crop groups	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16	1, (2), 3, (4), (5), 6, 7, (8), (10), 11, 12, 13, 14, 16  Unsuitable for: Papaya 8 & and pepper 10 <i>∴</i> flooding  Marginal: 2 - flooding 4 - flooding 5 - flooding 11 - flooding except oil palm and coffee.	(1), (2), 3, 4, 5, 6, 7, 8, (9), (10), 11, 12, 13, 14, 16  Marginal: 1 - slope unsuitable > 3 2 - heavy clays (KB) unsuitable for groundnuts 9 - heavy clays (KB) unsuitable 10 - heavy clays (KB) unsuitable for citrus  slopes over 2 degrees Unsuitable.	(1), 2, (3), 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16  Marginal: 1 - light textured <sup>d</sup> soils unsuitable 3 - light textured <sup>d</sup> soils unsuitable

LAND CAPABILITY CLASS I AND II

TABLE 5, 1

LAND CAPABILITY CLASSIFICATION

Sub-class	w	e	s	so
Soil FAMILY and/or Series in each Sub-class	BEMANG-PAKAN SEDUAU-PIJAT	BEKENU - Bekenu, Sarikai MERIT - Merit, Jakar MERIT/BEKENU KABULOH - Karabungan, Tangap	BEKENU - Bekenu, Sarikai MERIT - Merit, Jakar MERIT/BEKENU KABULOH - Kabuloh, Karabungan, Tangap	SARATOK - Saratok, Penipah NYALAU - Nyalau, Sabangang NYALAU/BEKENU MERIT/NYALAU
Maximum slope in degrees	5 <del>(CLASS 1)</del>	10 <del>(CLASS 1 &amp; 2)</del>	5 <del>(CLASS 1)</del>	5 <del>(CLASS 1)</del>
Erosion hazard	Slight	Moderate	Moderate	Moderate
Effective soil depth on (inches)	Deeper than 100 (40) <del>(CLASS 5)</del>	Deeper than 100 (40) <del>(CLASS 5)</del>	Deeper than 75 (30) <del>(CLASS 4 &amp; 5)</del>	Deeper than 100 (40) <del>(CLASS 5)</del>
Drainage	Imperfect	Very well to moderately well	Imperfect to very well	Imperfect to very well
Flooding	Infrequent and of short duration	-	-	-
Texture groups	Loams, silts and clays no surface peat	Loams, silts and clays no surface peat	Loams, silts and clays no surface peat	Loams, silts and clays no surface peat
Crop groups	1, 3, (4), (5), 6, 7, (8), (9), (10), (11), 12, 13, 14, 16 Marginal: 4 - flooding 5 - flooding x 8 (papaya) - flooding 9 - flooding and heavy texture + 10 (pepper) - flooding 11 - flooding; except for oil palm & coffee	(2), 3, (4), (5), 6, 7, 8, (9), (10), 11, 12, 13, 14, 16 Marginal: 4 - heavy texture (KB) unsuitable 5 - heavy texture (KB) unsuitable 10 - heavy texture (KB) unsuitable for citrus & pepper 9 - heavy texture (KB) unsuitable 2 - heavy texture (KB) unsuitable for groundnuts	(2), 3, (4), (5), 6, 7, 8, (9), (10), 11, 12, 13, 14, 16 Marginal: 4 - heavy texture (KB) unsuitable 5 - heavy texture (KB) unsuitable 9 - heavy texture (KB) unsuitable 10 - heavy texture (KB) unsuitable for citrus & pepper 2 - heavy texture (KB) unsuitable for groundnuts	2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16

x 8 - flooding, unsuitable for papaya  
+ 10 - flooding, unsuitable for pepper

Sub-class	w	e	s	se
Soil FAMILY and/or Series in each Sub-class	BEMANG/BIJAT PAKAN - Paken, Dangkar BIJAT - Bijat, Sebandi BIJAT/SEDUAU BIJAT-PENDAM PENDAM - Pendam (if reclamation feasible) PENDAM-MUKAH (if PENDAM reclaimable) MUKAH - (if peat less than 50 cm/20 in), Mukah.	BEKENU - Bekenu, Sarikei MERIT - Merit, Jakar MERIT/BEKENU KABULOH - Kabuloh, Karabungan, Tangap	BEKENU - Bekenu, Sarikei MERIT - Merit, Jakar MERIT/BEKENU KABULOH - Kabuloh, Karabungan, Tangap	SARATOK - Saratok Penipah NYALAU - Nyalau, Sabangang NYALAU/BEKENU MERIT/NYALAU
Maximum slope in degrees	3 <del>(CLASS 1)</del>	15 <del>(CLASS 1, 2, 3)</del>	10 <del>(CLASS 1 &amp; 2)</del>	10 <del>(CLASS 1 &amp; 2)</del>
Erosion hazard	Slight or absent	Moderate	Moderate	Moderate
Effective soil depth cm (inches)	Deeper than 75 (30) <del>(CLASS 4 &amp; 5)</del>	Deeper than 75 (30) <del>(CLASS 4 &amp; 5)</del>	Deeper than 60 (24) <del>(CLASS 3)</del>	Deeper than 75 (30) <del>(CLASS 4 &amp; 5)</del>
Drainage	Very poorly and poorly	Imperfect to very well	Imperfect to very well	Moderately well to very well
Flooding	Common and of moderate duration	-	-	-
Texture groups	Loams, silts and clays surface peat less than 50 cm (20 inches)	Loams, silts and clays no surface peat	Loams, silts and clays no surface peat	Loams, silts and clays no surface peat
Crop groups	1, 6, 15, 16	(3), 6, 7, 8, (9), (10), 11, 12, 13, 14, 16  Marginal: 3 - heavy clays (KB) unsuitable 9 - heavy clays (KB) unsuitable 10 - heavy clays (KB) unsuitable for citrus & pepper	(2), (3), (4), (5), 6, 7, 8, (9), (10), 11, 12, 13, 14, 16  Marginal: 2 - heavy clays (KB) unsuitable for groundnuts, some vegetables require minimum soil depth of 75 cm (30 inches) 3 - heavy clays (KB) unsuitable 4 - heavy clays (KB) unsuitable 5 - heavy clays (KB) unsuitable 9 - heavy clays (KB) unsuitable 10 - heavy clays (KB) unsuitable for citrus & pepper <del>2 - soil depth for vegetables</del>	2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16

TABLE 5. . . . (cont.)  
LAND CAPABILITY CLASS IV.

x x x x

x x x x

x  
x

x

Sub-class	w	e	s	so	sw
Soil FAMILY and/or Series in each Sub-class	BEHANG/BIJAT BIJAT - Bijat, Sebandi BIJAT/MUKAH MUKAH - (if peat less than 50 cm/20 in), Mukah	BEKENU - Bekenu, Sarikei MERIT - Merit, Jakar MERIT/BEKENU KABULOH - Kabuloh, Karabungan, Tangap	KAYAN - Kayan, Kabong, Belawai SILANTEK - Silantek, Tungal, Duso, Grang KERAIT - Kerait, Ajoh KERAIT/PANDANG BEKENU - Bekenu, Sarikei MERIT - Merit, Jakar MERIT/BEKENU KABULOH - Kabuloh, Karabungan, Tangap	SARATOK - Saratok, Penipah SARATOK/KERAIT NYALAU - Nyalau, Sabangang NYALAU/SILANTEK NYALAU/BEKENU MERIT/NYALAU	KAYAN-TATAU KAYAN/BEHANG
Maximum slope in degrees	3 <del>(CLASS 1)</del>	20 <del>(CLASS 1, 2, 3 &amp; 4)</del>	No limit	15 <del>(CLASS 1, 2 &amp; 3)</del>	3 <del>(CLASS 1)</del>
Erosion hazard	Slight or absent	Severe	Moderate - severe	Severe	Slight or absent
Effective soil depth cm (inches)	No limiting	Deeper than 60 (24) <del>(CLASS 3, 4 &amp; 5)</del>	Deeper than 50 (20) <del>(CLASS 2)</del>	Deeper than 60 (24) <del>(CLASS 3, 4 &amp; 5)</del>	Deeper than 60 (24) <del>(CLASS 3, 4 &amp; 5)</del>
Drainage	Very poor	-	Excessively to imperfect	-	Very poor and excessive
Flooding	Frequent	-	None	None	Frequent
Texture groups	Loams, silts and clays surface peat less than 50 cm (20 inches)	Loams, silts and clays no surface peat	Sands, loams, silts and clays no surface peat	Loams, silts and clays no surface peat	Sands no surface peat
Crop groups	1, 6, 15, 16	(6), (10), 11, 12, 13, 14, 16 Marginal: 6 - over 15 degrees only after trials 10 - heavy clays (KB) unsuitable for citrus & pepper P.I.C.	(13), 14, 16, (6) Marginal: 13 - 25 degrees unsuitable 6 - over 15 degrees only after successful trials KY unsuitable	3, 6, 7, 8, 11, 12, 13, 14, 16	(13), (14), 16 Marginal: 14 - sands not suitable for certain tree species 13 - KY/TT unsuitable

TABLE 5 (cont.) LAND CAPABILITY CLASS V

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XXXX

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over

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Sub-class	e	s	se	sw
Soil FAMILY and/or Series in each Sub-class	BEKENU - Bekenu, Serikei MERIT - Merit, Jakar MERIT/BEKENU KABULOH - Karabungan, Tangap, Kabuloh	MIRI - Miri, Peko SILANTEK/MIRI SILANTEK/TIKA TIKA - Tika, Bintulu BEKENU-KAPIT NYALAU-KAPIT MERIT-KAPIT KABULOH-KAPIT MUKAH - Mukah, Tekajong (peat more than 50 cm/20 in)	SARATOK - Saratok, Penipah SARATOK/KERAIT PENINJAU - Peninjau NYALAU - Nyalau, Sabangang NYALAU/PENINJAU NYALAU/SILANTEK NYALAU/BEKENU MERIT/NYALAU	HONOK - Honok HONOK-TATAU TATAU - Plan, Tatau, Matu TATAU/MUKAH TATAU/IGAN RIJAT/ANDERSON I (inland peat) IGAN - Igan, Bruit IGAN/SILANTEK ANDERSON I/MUKAH (inland peat) L
Maximum slope in degrees	25 (CLASS 1, 2, 3, 4 & 5)	No limit	20 (CLASS 1, 2, 3 & 4)	-
Erosion hazard	Severe	-	Severe	Absent
Effective soil depth cm (inches)	Deeper than 60 (24) (CLASS 3, 4 & 5)	Deeper than 25 (10) -	Deeper than 60 (24) (CLASS 3)	No limiting
Drainage	-	-	-	Very poorly
Flooding	-	-	-	No limit
Texture groups	Silts and clays no surface peat	Sands, loams, silts and clays surface peat more than 50 cm (20 inches)	Loams, silts and clays no surface peat	Sands, loams, silts and clays surface peat less than 200 cm (80 inches)
Crop groups	(11), 12, 13, 14, 16 Marginal: 11 - between 20 and 25 degrees	(1), (6), 9, 16 Marginal: 1 - only on Mukah 6 - soil depth, only and offer successful trials	(6), 11, 12, 13, 14, 16 Marginal: 6 - over 15 degrees only after trials	(6), 15, 16 Marginal: 6 - only on RIJAT/ANDERSON I

TABLE 5 ..... (cont.)  
LAND CAPABILITY CLASS VI.

6 - shallow soil, only after successful trials

Sub-class	v	e	s	so
Soil FAMILY and/or Series in each Sub-class	NONOK - Nonok TATAU - Plan, Tatau, Matu <del>BIJAT - Bijat, Sebandi</del> PENDAM-MUKAH (if PENDAM. unreclaimable) MUKAH - Mukah, Tekajong (peat more than 20 inches)	BEKENU - Bekenu, Sarikei MERIT - Merit, Jakar MERIT/BEKENU	BELAT - Belat BELAT-TATAU BELAT/ANDERSON BIJAT/ANDERSON II PENDAM - Pendam (if unreclaimable) PENDAM/RAJANG RAJANG - Rajang RAJANG-ANDERSON PENINJAU/MELUAN NYALAU/MELUAN NYALAU/KAPIT MELUAN - Meluan MELUAN/KAPIT MELUAN/ROCK KAPIT - Kapit KAPIT/MERIT IGAM/ANDERSON ANDERSON I, II & III ANDERSON II & III/MUKAH	SILANTEK - Silantek, Tungal, Buso, Grang SILANTEK/KERAIT SARATOK - Saratok, Penipah PENINJAU - Peninjan NYALAU - Nyalau, Sebangang NYALAU/SILANTEK NYALAU/PENINJAU NYALAU/BEKENU MERIT/NYALAU IGAM/SILANTEK
Maximum slope in degrees	3 ( <del>CLASS 4</del> )	Over 25 ( <del>CLASS 6 &amp; 7</del> )	-	Over 20 ( <del>CLASS 5, 6 &amp; 7</del> )
Erosion hazard	Absent	Severe	Severe hill soils. <del>Not limiting others</del> None on valley soils.	Severe
Effective soil depth cm (inches)	No limit	No limit	Less than 25 (10)	No limit
Drainage	No limit	-	-	No limit
Flooding	No limit	-	-	No limit
Texture groups	Sands, loams, silts and clays surface peat more than 50 cm (20 inches)	Loams, silts and clays no surface peat	Sands, loams, silts and clays surface peat more than 100 cm (40 inches)	Sands, loams, silts and clays no surface peat
Crop groups	15, 16	14, 16	(14), 16	14, 16

TABLE 5. LAND CAPABILITY CLASS VII.

ACCEPTABLE  
MINIMUM SOIL AND TERRAIN REQUIREMENTS FOR CROPGROUPS WITH SIMILAR DEMANDS

(Adapted to Sarawak conditions)

<u>Group</u>	<u>Crops and Cropgroups</u>	<u>Requirements</u>
<u>Annual Crop</u>	1:	
	Rice	Slope: 0-3 degrees.
	(wet land)	Drainage*: moderately well to very poorly.
		Flooding: not worse than infrequent and of short duration.
		Effective soil depth: deeper than 30 cm (12 inches).
		Soil texture: heavier than loam if water-table high; otherwise sandy clay loam and heavier.
		Depth of surface peat: less than 50 cm (20 inches) if well humified and with high base status, otherwise less than 30 cm (12 inches).
		Depth to acid sulphate layer: deeper than 50 cm (12 inches).

Note \* Internal.

3RD DRAFT

31/5-73

"Low-land" or "wet-land"  
Ref. Troy & Sub-Troy Agric.  
p. 1256.)  
Alternative: rain-fed or irrigated

DRAFT

<u>Group</u>	<u>Crops and Cropgroups</u>	<u>Requirements</u>
		Salinity: less than 100 micromhos/cm at 25°C in surface 50 cm (20 inches).
		Workability: surface stones and rocks less than 25 per cent; no submerged timbers in peat. 25 per cent of surface stones and rocks.
2:		Slope: 0-5 degrees, with conservation to 10 degrees.
Ground nuts		Drainage: very well to moderately well.
Vegetables		Flooding: none to imperfect.
Tobacco		Effective soil depth: deeper than 50 cm (20 inches), some vegetables require minimum of 75 cm (30 inches).
		Soil texture: excluding sands and heavy clay.
		Depth to surface peat: less than 50 cm (20 inches); some vegetables could thrive on a depth <sup>of</sup> over 120 cm (48 inches) provided peat is well humified and with acceptable base status.

Note: Temporarily recommended, should be phased out when acreage of wet land rice has reached the required target. Cropping patterns:

*Upland or "dry-land" (Ref. Tropical & Subtropical Agric. p. 128)*

<u>Group</u>	<u>Crops and Cropgroups</u>	<u>Requirements</u>
a)	long term pasture or fodder grass, rice 1 crop, fallow, grasses;	Depth to acid sulphate layer: deeper than 75 cm (30 inches).
b)	fallow, rice 1 or 2 crops, fallow not less than 5 years.	Salinity: less than 100 micromhos/cm at 25°C in surface 75 cm (30 inches). Workability: less than 25 per cent of surface stones and rocks.
3:	Rice (dry land) Sweet potatoes, Ginger,	Slope: 0-5 degrees, with conservation to 15 degrees. Drainage: well to imperfect. Flooding: not worse than infrequent and of short duration. Effective soil depth: deeper than 60 cm (24 inches). Soil Texture: heavier than loam, but excluding heavy clays. Depth of surface peat: less than 50 cm (20 inches).

Note: Temporarily recommended, should be phased out when acreage of wet land rice has reached the required target. Cropping pattern:

"Upland" or "dry-land" (Ref. Tropical & Subtropical Agric. p. 1256)

Group

Crops and Cropgroups

Requirements

- a) long term pasture or fodder grass, rice 1 crop, fallow, grasses;
- b) fallow, rice 1 or 2 crops, fallow not less than 5 years.

Depth to acid sulphate layer: not applicable.

Salinity: not applicable.

Workability: less than 25 per cent of surface stones and rocks.

Workability: less than 25 per cent of surface stones and rocks.

- 4: *Cassava*  
Tapioca,  
Yams,  
Sweet potatoes,  
Ginger,  
Turmeric.

Slope: 0-5 degrees, with conservation to 10 degrees.

Drainage: very well to imperfect.

Flooding: none.

Effective soil depth: deeper than 60 cm (24 inches).

Soil texture: excluding sand, *and heavy clay.*

Depth of surface peat: less than 50 cm.

Depth (20 inches) if peat well humified and with high base status over 50 cm (20 inches).

<u>Group</u>	<u>Crops and Cropgroups</u>	<u>Requirements</u>
		Depth to acid sulphate layer: deeper than 75 cm (30 inches).
		Salinity: less than 500 micromhos/cm at 25°C in surface 75 cm (30 inches).
		Workability: less than 25 per cent of surface stones and rocks.
		Slope: 0-5 degrees, with conservation to after 10 degrees.
	Pulses, (Soyabean, Maize, etc)	Drainage: very well, to imperfect.
	Sorghum,	Flooding: none.
	Chillies.	Effective soil depth: deeper than 50 cm (20 inches).
		Soil texture: excluding loamy sand and lighter textures, and heavy clay.
		Depth of surface peat: less than 50 cm (20 inches).
		Soil: some species will thrive on sand and loamy sand.

no restriction on a wide range of available species available

geographic, may be frequent in certain positions

no restriction on a wide range of available species available

Group

Crops and Cropgroups

Requirements

Depth to acid sulphate layer: deeper than 75 cm (30 inches).

Salinity: less than <sup>150</sup>500 micromhos/cm at 25°C in surface 75 cm (30 inches).

Workability: less than 25 per cent of surface stones and rocks. 50 cm (20 inches).

Workability: less than 50 per cent of

Slope: 0-15 degrees, to 20 degrees only after successful trials.

Drainage: well to imperfect; some grass species will thrive on poor and very poorly drained soils but zero grazing will have to be practised.

Flooding: infrequent and of short duration,

Effective soil depth: deeper than 50 cm (20

Soil inches). excluding loamy sand and lighter

Soil texture: excluding sand and loamy sand;

Depth some species will thrive on sand and loamy sand.

Semi-perennial

6:

Grasses

Crops

7: (pasture)

Grasses

(fodder)

Lemon grass (1)

Citronella grass (2)

Vetiver grass (3)

no restriction as a wide range of adaptable species available.

geographic may be frequent in certain positions.

no restriction as a wide range of adaptable species available.

Note: (1) Andropogon Nardus L.  
var. flexuosus Hack.

(2) Andropogon Nardus L.  
var. genuinus Hack.

Group  
Group

Crops and Cropgroups  
Crops and Cropgroups

Requirements  
Requirements

(3) Andropogon sicanoides,

Urban

Depth to acid sulphate layer: deeper than  
Depth of surface peat: less than 50 cm  
50 cm (20 inches).  
(20 inches).

Salinity: less than 100 micromhos/cm  
Depth to acid sulphate layer: deeper than  
25°C in surface 50 cm (20 inches).  
50 cm (20 inches).

Workability: less than 25 per cent of surface  
Salinity: less than 500 micromhos/cm at  
stones and rocks.  
25°C in surface 50 cm (20 inches).

Workability: less than 50 per cent of  
Slope: 0-10 degrees, with conservation to  
surface stones and rocks.

Slope: 15 degrees.  
Drainage: very well to imperfect.

Slope: 0-5 degrees, with conservation to  
Flooding: none, banana and sugarcane frequent and of short duration  
15 degrees.

Effective soil depth: deeper than 50 cm  
Drainage: very well to imperfect.  
(24 inches).

Flooding: infrequent and of short duration.  
Soil texture: excluding loamy sand and  
Effective soil depth: deeper than 50 cm  
lighter textures.  
(20 inches).

Depth of surface peat: less than 25 cm  
Soil texture: excluding loamy sand and lighter  
(10 inches).  
textures.

Depth to acid sulphate layer: deeper than  
Depth of surface peat: less than 25 cm (10  
75 cm (30 inches).  
inches).

8:

Banana,  
Manilla hemp,  
Sugar cane,

7:

Roads,  
Grasses

Papaya.  
(fodder)

Lemon grass (1)

Citronella grass (2)

Vetiver grass (3)

Note: (1) Andropogon Nardus L.

var. flexuosus Hack.

(2) Andropogon Nardus L.

var. genuinus Hack.

Group

Crops and Cropgroups

Requirements

(3) Andropogon zizanoides,  
Urban

Depth to acid sulphate layer: deeper than 50 cm (20 inches).  
Salinity: less than 100 micromhos/cm at 25°C in surface 50 cm (20 inches).  
Workability: less than 25 per cent of surface

9:

Pineapple

Slope: stones and rocks.  
Drainage: very well to imperfect.

8:

Banana,  
Mannilla hemp,  
Sugar cane,

Slope: 0-10 degrees, with conservation to 15 degrees.  
Depth: deeper than 25 cm (10 inches).  
Drainage: very well to ~~imperfect~~ moderately well.

Ramie,

Flooding: none, banana and sugar cane infrequent and of short duration.

Papaya.

Effective soil depth: deeper than 60 cm

Depth (24 inches). deep peats allowed

Soil texture: excluding loamy sand and lighter textures.

Depth of surface peat: less than 25 cm (10 inches).

Depth to acid sulphate layer: deeper than 75 cm (30 inches).

Nucl. Est.  
Small h.  
Dev. Projects

Group

Crops and Cropgroups

Requirements

Salinity: less than 100 micromhos/cm at 25°C  
in surface 75 cm (30 inches).

Workability: less than 25 per cent of surface  
stones and rocks.

stones and rocks, few submergel timbers  
in peat.

9:

Slope: 0-10 degrees.

Pineapple

Drainage: very well to imperfect.

Perennial

Flooding: none.

Crops

Cocoa,

Effective soil depth: deeper than 25 cm (10  
inches) if well drained.

Pepper,

Soil texture: excluding medium and coarse  
sand and heavy clays.

Citrus,

Avocado

(Persea americana)

Depth of surface peat: deep peats allowed  
if drained, well humified and with  
high base status.

Mangosteen

(Garcinia mangostana)

Mango

(Mangifera indica)

Depth to acid sulphate layer: deeper than  
50 cm (20 inches).

Depth to acid sulphate layer: deeper than  
100 cm (40 inches).

<u>Group</u>	<u>Crops and Cropgroups</u>	<u>Requirements</u>
		Salinity: less than 100 micromhos/cm at 25°C in surface 50 cm (20 inches).
		Workability: less than 25 per cent of surface stones and rocks, few submerged timbers in peat.
		Slope: 0-25 degrees, above 10 degrees with
<u>Perennial</u>	10: palm,	Slope: 0-25 degrees, above 10 degrees with
<u>Crops</u>	Cocoa, (Robusta and Liberica),	Drainage: moderately well.
	Pepper,	Drainage: well and moderately well.
	Citrus,	Flooding: none, infrequent and of short duration, but pepper more.
	Avocado,	Effective soil depth: deeper than 75 cm
	<u>(Persea americana)</u>	(30 inches).
	Mangosteen	Soil texture: excluding loamy sand and
	<u>(Garcinia mangostana)</u>	lighter textures. Citrus light textures
	Mango	excluding clays. Pepper excluding very heavy clays such as Kabulish soil.
	<u>(Mangifera indica)</u>	Depth of surface peat: less than 50 cm (20
		inches).
		Depth to acid sulphate layer: deeper than
		100 cm (40 inches).

Small  
dry fruit

191

Group

Crops and Cropgroups

Requirements

11:

Oil palm,

Coffee (Robusta and Liberica),

Arecanut,

Rambutan,

Nutmeg,

Cloves,

Cinnamon.

Salak (*Zalacca edulis*)  
(*Bixa orellana*) Reinw.

Name checked

Small h.  
div group

Salinity: less than 100 micromhos/cm at 25°C  
in surface 100 cm (40 inches).

Workability: less than 25 per cent of surface  
stones and rocks.

Workability: less than 50 per cent of

Slope: 0-25 degrees, above 10 degrees with  
conservation.

Drainage: well and moderately well.

Flooding: none, for oil palm flooding up to

a week would be acceptable, but coffee for shorter periods.

Effective soil depth: deeper than 60 cm

(24 inches).

Soil texture: excluding sandy loam and

lighter textures.

Depth of surface peat: less than 50 cm

(20 inches).

(30 inches), for rubber and the 100

cm (40 inches), provided peat is well

humified and with acceptable base status

Group

Crops and Cropgroups

Requirements

Depth to acid sulphate layer: deeper than

100 cm (40 inches).

Salinity: less than 100 micromhos/cm at

25°C in surface 100 cm (40 inches).

Workability: less than 50 per cent of

surface stones and rocks.

12:

Slope: 0-25 degrees, above 10 degrees with

13:

Slope: 0-25 degrees, above 10 degrees with

Rubber,

conservation.

Coconut,

conservation.

Tea,

Drainage: very well to imperfect.

Brazil nut,

Drainage: very well to imperfect.

Flooding: ~~none~~ infrequent and of short duration.

Flooding: infrequent and of short duration.

Guava,

Effective soil depth: deeper than 60 cm

Durian,

(24 inches).

Anatto

Soil texture: excluding sandy loam and

Soil texture: no restriction.

lighter textures.

(Bixa orellana) ✓

Name checked.

Depth of surface peat: less than 75 cm

Depth of surface peat: less than 75 cm

deeper if peat well humified and of

(30 inches), for rubber and tea 100

high base status.

cm (40 inches), provided peat is well

Depth of acid sulphate layer: deeper than

humified and with acceptable base status

75 cm (30 inches).

Group

Crops and Cropgroups

Requirements

Forest

14:

Elliptical

13: (Bakabang Pampang,

Coconut, *Styrodia Burck. var.*

Cashew,

Forest plantations,

Forest under controlled

exploitation with

regeneration

Depth to acid sulphate layer: deeper than 100 cm (40 inches).

Salinity: less than 100 micromhos/cm at 25°C in surface 100 cm (40 inches).

Workability: less than 50 per cent of surface stones and rocks.

Drainage: very well to imperfect.

Slope: 0-25 degrees, above 10 degrees with conservation.

Drainage: very well to imperfect.

Flooding: infrequent and of short duration.

Effective soil depth: deeper than 50 cm (20 inches).

Soil texture: no restriction.

Depth of surface peat: less than 75 cm, deeper if peat well humified and of high base status.

Depth of acid sulphate layer: deeper than 75 cm (30 inches).

<u>Group</u>	<u>Crops and Cropgroups</u>	<u>Requirements</u>
<u>Forest</u>	14: Illipinut (Enkabang Pinang, <sup>rusa</sup> 15: <u>Shorea <del>Bacchiptera</del></u> , <sup>stenoptera Burck. var.</sup>	Salinity: less than 500 micromhos/cm at 25°C in surface 50 cm (20 inches). Workability: less than 50 per cent of Salinity surface stones and rocks. a/cm 25°C in surface 100 cm (40 inches); Slope: 0-30 degrees. to mangrove species. Drainage: very well to imperfect. Flooding: infrequent. Effective soil depth: deeper than 50 cm Drainage (20 inches). very poor. Soil texture: no restriction, /sand and Effect: loamy sand <del>are unsuitable for</del> <sup>but for</sup> <del>certain tree species, would have to be selected</del> Depth of surface peat: no restriction for <u>Shorea alba</u> ; Mixed Dipterocarp Depth of Forest less than 200 cm (80 inches); (bamboo and illipinut less than 75 cm Depth to (30 inches). etc layer: deeper than 50 cm (20 inches).
	Bamboo, Forest plantations, Forest under controlled exploitation with regeneration	

Group                      Crops and Cropgroups                      Requirements

Depth of acid sulphate layer: deeper than 100 cm (40 inches); not applicable to mangrove species.

Salinity: less than 500 micromhos/cm at 25°C in surface 100 cm (40 inches); not applicable to mangrove species.

Workability: not applicable.

15:

Slope: 0-5 degrees.

Sago

Drainage: poor and very poor.

Flooding: no restriction.

Effective soil depth: deeper than 50 cm (20 inches).

Soil texture: excluding loamy sand and lighter, and textures.

Depth of surface peat: less than 50 cm (20 inches).

Depth to acid sulphate layer: deeper than 50 cm (20 inches).

Group

Crops and Cropgroups

Requirements

Salinity: less than 500 micromhos/cm at 25°C in surface 50 cm (20 inches).

Workability: not applicable.

16: No restrictions.

Forest and other reserves

It is difficult to argue the pros and cons of your plan but sure what I have got the philosophy behind it right - the plan left something to be desired. For example, some of the limitations in Table A get more limiting from Class I to Class II, which is not logical, but some get better half way down (soil depth - Class I drainage - Class III) and one (very poorly drained - Class I) seems to have a confusing overlap. In Table B, under Very steep slopes with a moderate erosion hazard. I am not sure if any of the prescription errors, and which are following the principles which has accepted me. There is also the use of Class I and I understand you are agreeable to limiting...

The weighting of the limitations is something which we never agree on but in your case, as I understand it, there is a divergence from my views because you confine your aim to the type of large-scale development. I feel that smallholder development should be incorporated since as otherwise one has a reservation which sidesteps many forms of development which are being done in any event and which would benefit from guidance and advice on estate location questions. Many land units are precluded from estate-level development on the grounds of some complex and confused terrain, or just insufficient size, which is a block for the type of development under consideration. I think the unit may be well suited to large-scale development but may be difficult to develop in this form...

ILAY/VS  
31.5.1973.  
...of the rights-holders to their land...  
...smallholder cooperatives, or something like that...



DEPARTMENT OF AGRICULTURE,  
SARAWAK.

MB/3/SOILS/LUP of 18/5/73.

23rd May, 1973.

489/( 33 )

Mr. I.L.A. Ysselmuiden,  
c/o Miri-Bintulu Project;  
Pujut Road,  
Miri.

Dear Reen,

Land Capability Classification

Another long speech, I am afraid, but before I start let me hasten to add that I am not attempting to impose any views on you in this matter. Soil classification is something I find interesting; land capability classification I rate about the level of checking the Vote Book: provided the answer comes out as a sensible map statement, how it is worked out is less important. Nobody seems to agree on a satisfactory system and I am content to raise my hat in passing to any scheme which has a reasonable amount of common sense embodied in it.

Having said that, herewith the views I intent to impose!

It is difficult to argue the pros and cons of your draft as I am not sure that I have got the philosophy behind it right - reception over the phone left something to be desired. For example, most of your limitations in Table A get more limiting from Class I to VI, which is logical, but some get better half way down (soil depth - Class VI; drainage - Class III) and one (very poorly drained - Class IV and V) seems to have a confusing overlap. In Table B, under Vsw, is Tatau-Kayan on 15° slopes with a moderate erosion hazard. I am not sure which, if any, are transcription errors, and which are following some subtle principle which has escaped me. There is also the use of data to 150cm in Class 1 but I understand you are agreeable to limiting this to 100cm.

The weighting of the limitations is something which one would never agree on but in your case, as I understand it, they are partly divergent from my views because you confine your aim to the possibilities of large-scale development. I feel that smallholder development should be incorporated also as otherwise one has a recommendation statement which sidesteps many forms of development which are bound to take place in any event and which would benefit from guidance just as much as estate location questions. Many land units are precluded from large-scale estate-level development on the grounds of heterogeneous soils, complex and confused terrain, or just insufficient acreage in a convenient block for the type of development under consideration. In other cases the unit may be well suited to large-scale planting on physical grounds but may be difficult to develop in this fashion because of the attachment of the rights-holders to their land. Supervised and subsidized smallholder cooperatives, or something like that, may be the only economic form of development which can get off the ground quickly. For all I know, you have avoided these problems by excluding all the land-types mentioned above from the area being surveyed at semi-detailed level but, otherwise, I feel that the problems of such land, and the possibility of a smallholder solution, should be included in the capability classification.

A further point is the type of improvement which you assume to be available and the degree to which the soil has to be rated on its natural

characteristics. As I caught it - in patches through the atmospherics - you consider it best to assume that the least possible improvement is possible. I find this hardly realistic when it is considered that the classification and recommendations maps derived from it are aimed at Government development agencies which have demonstrated that some forms of improvement, such as minor drainage, flood protection, fertilizer additions etc (we won't say too much about the major drainage schemes!) are already available and can be handled, provided there is some guarantee that the resulting improvements in land use justify the cost. Even in the context of smallholder development, some assistance of these kinds is available. With the exception of the special problem of peat drainage, where the geographical location may be overriding and is difficult to incorporate in any rating system, I feel that classifying the soil on its present potential without any improvement is rather academic, therefore.

I tried stirring your classification round a bit and only succeeded in making it worse (capability rating is a messy and irritating subject) and, without being certain of the grounds on which you have allocated certain soils to certain slots, it would confuse things further if I suggested where I think they should be shifted. I therefore abandoned that and gave birth to a new system using an entirely different approach. This was thought of, developed and finalised in 48 hours (which is probably obvious from its content!) but you may be inclined to see some virtue in it. The advantage, to my mind, is that although the method of working out the rating is a bit complicated, the end product is a simple, factual mapping statement giving concrete options at both estate and smallholder level and includes consideration of the size of the mapping unit. You may only wish to have a look at the soil series listing according to the system (Table 4). This is more or less how I would rate the soils given (although it is not entirely satisfactory even to me) and, as I recall, this ordering was the main thing you asked me to supply. The system I tender with it is really a sidetrack, although I would be interested in your reaction to it; I do not know if the approach has any precedent.

The soils are first rated on the basis of their limitations for estate-level and smallholder development, simultaneously, by Tables 1 and 2. The degree of limitation assigned to each type varies depending on the type of development envisaged and is based on the following arguments (which may well be disputed in detail, although the basic statement that requirements for smallholders differ from those of estates must be accepted);

- slope is less critical on a smallholding than an estate as the farmer can either find slope facets which are better than the average for the mapping unit or can use conservation measures which are not practicable on a large scale; he can also make better use of rocky land
- limiting depths for rooting and to acid sulphate layers can be relaxed somewhat for smallholders as he can bank or mound, and on shallow soils can plant crops such as pepper which are unhandy to grow on a large acreage
- drainage is less critical for smallholders for the same reasons provided it is no worse than very poor or has only shallow peat; a combination of shallow drains, banks, and chankolling of the underlying mineral soil allow use where, on an estate, such methods are either impractical or must have an assured increase in resultant land status to justify the cost
- salinity is more critical for smallholders, on the argument that its improvement on an estate is part and parcel of the drainage improvement works which a smallholder cannot cope with; one could then say that salinity is irrelevant in the estate table (Table 1) at all, but it does give an added indication of the practicability of the drainage required: there is more likelihood of a reasonable outfall to a river from a poorly-drained nonsaline soil (Bijat) than that to an estuary from a poorly drained saline soil (Pendam) and efficient drainage works are likely to be less expensive.
- nutrient status is less critical to smallholders in that kitchen trash, pig and chicken manure, etc can be added to no extra cost (although some extra labour and organisation) whereas the estate has the outlay on commercial fertilizer to consider.

The soils are allocated to six capability classes (with subclass suffixes) on the basis of the limitation ratings, being assigned to the first class in the following list for which the definition is appropriate:

- Class EVI and SVI - one or more preclusive limitation )
- Class EV and SV - two or more major limitations )
- Class EIV and SIV - one major limitation )
- Class EIII and SIII - two or more moderate limitations ) plus suffixes
- Class EII and SII - one moderate limitation )
- Class EI and SI - only minor limitations )

The mapping units are then assigned to these six classes (also for both development types) on the basis of their soil components. Once the soil units are broken down to limitation categories, even the simplest soil association is likely to be a complex of capability classes. The class assigned to the mapping unit is that of the lowest class covering a significant proportion of the unit in the estate rating, and the highest class covering a significant area for smallholding rating. This is on the argument that the establishment of an estate must be made with caution, all soils within it will probably have to be used, and it is safest to rate the area on the worst parts of it, whereas smallholders can pick the eyes out of the area and the 'smallholder-carrying capacity' is left fluid in any case.

At the next stage there are a number of options in procedure, which may well be influenced by the number of mapping units being handled. Looking at Table 3, although on a soil for soil basis the bulk of estate/smallholding rating combinations which will occur lie close to the EI/SI-EVI/SVI axis and may be relatively few in number, when the rating system is applied to mapping units and the different approach to compound units for the two forms of development is used as given above, then all possible combinations may occur, and are further extended by the breakdown on subclass combinations.

Firstly, two separate maps for estates and smallholdings can be made, and the individual rating mapping units dealt with separately. Secondly, these maps can be combined and the options for both forms of development given for each mapping unit. Thirdly, and preferably, the combined map is rationalised where the best alternative is obvious and the mapping units are combined where convenient, as follows.

A possible grouping is given in Table 3 into groups A-E (these being labelled for easy reference here, not for use on the map or key which has more than enough symbols requiring explanation already). The suffixes indicating the main type of limitation are carried on from the class ratings, although they are not shown in Table 3. All subclass combinations are presumably possible in all positions. Recommendations for development of the combined rating are made in conjunction with two lists of crops, appropriate to estates and smallholdings respectively, each crop being assigned to a permitted range of subclasses and also, in the case of estate crops, to a minimum recommended acreage. Recommendations are then made as follows:

- Group E - s,d,r,a,c,w,t - not recommended for agriculture
- p - not recommended for agriculture until or unless drainage improvement proved practicable. If improvement achieved, upgraded to a rating dependant on degree of improvement (but probably not above IV).
- n - not recommended for agriculture unless large continuous supplies of organic fertilizer available (in which case upgraded on smallholder rating only, to probably Class SIII).
- Group D - all subclasses - not recommended if better land available; can be used for smallholdings but degree of development probably limited; not recommended for estate cropping.

Group C - all subclasses - recommended for smallholding development, the crops appropriate depending on the subclass; not recommended for estate agriculture

Groups A and B - all subclasses - recommendations depend on the size of the mapping unit. Where the acreage is sufficiently large for the estate crop(s) appropriate to the subclass, recommended for estate development. Where the acreage is below the required limit estate development not recommended; in this case Group A is recommended for smallholding development, Group B is not recommended for agriculture at all (some areas with ~~only~~ strong salinity and drainage limitations but small acreage may occur here). In assessing minimum acreage requirements for estate possibilities, the capability of the adjacent mapping units must also be considered; alternatively the E/S rating combinations are given on the mapping units and development recommendations given in the key and text.

Capability Class ratings for the main soils are given in Table 4. These probably do not cover the full range for each soil but are roughly in the order I would expect them to be rated. Some explanation of how the limitation scales are interpreted for soil rating are necessary:

acid sulphate - the pH limits for Rajang, etc. apply and the rating is based on the depth at which horizons qualify. Your criteria for pH do not appear to agree with the soil classification definitions and would make life a bit difficult. I am rather more stringent regarding this limitation than you are, on the grounds that the feature (as established in sampling and analysis) is rather erratic and if the lower subsoil is proved to be acid sulphate at one point it is best to assume that the whole subsoil is acid sulphate nearby unless there is evidence to the contrary.

drainage - I have downgraded excessively drained to a preclusive limitation but this is because I only apply it to upland soils (Tika, Peninjau, etc) where the groundwater table is almost permanently at great depth (I assume). I do not consider coastal or riverine soils (Kabong, Kayan, etc) excessively drained as the groundwater table is at a shallower depth and is intermittently within the profile (I assume). These are thus assigned to the 'good' drainage slot, although I agree it is arguable.

nutrient status - difficult to gauge and can only be related arbitrarily to certain soils at present. This has been done on the definitions to Tables 1 and 2. - Peninjau, Tatau; It is all very arguable, however.

You will note that I have not included a 'risk of flooding' limitation in my scheme. I assume that you refer here mainly to upriver flash floods, as downriver estuarine flooding should be already reflected in the drainage status. If this is correct I wonder whether this can be reliably assessed on your four-level scale and also reliably bound on the map. Added to which the rectification needed may be a dam upstream (outside the study area perhaps, let alone the mapping unit). I would thus prefer to treat this on the same level as 'frequency of long droughts', i.e. of acknowledged great importance in some areas, but best treated as extra to the classification rather than a part of it.

Erosion hazard I take to be covered already in the slope limits, otherwise there seems little point in splitting those limits or texture. You may have special problem soils which make this extra limitation worthwhile, however.

The other criticisms of your draft are best inferred from the foregoing

Table 1 : Rating of soils for estate-level - 5 - culture

paragaphs.					
How valid they are depends on how much your basic aim differs from mine, and I am still a little vague on this. For the purpose of the sample 1:50,000 sheet I will obviously have to coin an independant legend, in any case, and serious consideration of the capability classification to be adopted for the series can wait until we are committed to doing it.					
I trust that this letter does not confuse more than it helps. As stated at the beginning, you are welcome to ignore it entirely!					
slope (°)	s	less than 5	5 - 10	10 - 20	more than 20
rocks (% surface)	r	none	less than 10	10 - 25	more than 25
acid sulphate (cm)	a	none	none to 100	75 - 100	above 75
drainage and	d	good	imperfect	poor	excessive; very poor;
surface peat (cm)	p	-	-	-	more than 25
salinity (cm)	c	nil	-	strong	-
nutrient status	n	optimum	good	poor; very poor	extremely poor; toxic
texture	t		see below		

*Regards*

(I.M. Scott)  
Soil Surveyor, Central Sarawak.

Table 2 : Rating of soils for smallholding development

slope, clays	s	less than 10	10 - 20	20 - 30	more than 30
slope, sands	s	less than 5	5 - 15	15 - 25	more than 25
depth	d	75 plus	50 - 75	25 - 50	50 plus
rocks	r	less than 10	10 - 25	25 - 50	50 plus
acid sulphate	a	none to 100	75 - 100	50 - 75	less than 50
drainage and	d	good	imperfect; poor	very poor	excessive
surface peat	p	-	-	less than 50	more than 50
salinity	c	nil	slight below 50	slight above 50; strong	-
nutrient status	n	optimum; good	poor	very poor	extremely poor; toxic
texture	t		see below		

texture: where soil rated as Class I - IV on other limitations, and the texture is sand or coarse, reduce rating by one class if drainage is good to imperfect, reduce rating by one class if drainage is good to imperfect, reduce rating by two classes (or rate as Class V, whichever is higher) if drainage is poor or very poor, or there is surface peat of any depth.

Definitions of limitations apply: (where not as in your draft)

slope. clays = silt and clay groups  
sands = loams and sands

acid sulphate. pH parameters quoted for Bajang, Belat, etc.

salinity. nil = less than 100 micromhos conductivity

slight = 100-500

strong = over 500

surface peat. assumed to be waterlogged residual peat. Luk is considered a mineral soil with poor nutrient status for rating

Table 1 : Rating of soils for estate-level agriculture

Limitation	Subclass suffix	Minor	Moderate	Major	Preclusive
slope (°) clays	s	less than 3	3 - 15	15 - 25	more than 25
slope (°) sands	s	less than 3	3 - 10	10 - 20	more than 20
soil depth (cm)	d	100+	75 - 100	50 - 75	less than 50
rocks (% surface)	r	none	less than 10	10 - 25	more than 25
acid sulphate (cm)	a	none possible	none to 100	75 - 100	above 75
drainage and	d-w	good	imperfect	poor	excessive; very poor;
surface peat (cm)	p	-	-	-	more than 25
salinity (cm)	c	nil	slight	strong	-
nutrient status	n	optimum	good	poor; very poor	extremely poor; toxic
texture	t	see below			

Table 2 : Rating of soils for smallholding development

slope, clays	s	less than 10	10 - 20	20 - 30	more than 30
slope, sands	s	less than 5	5 - 15	15 - 25	more than 25
depth	d	75 plus	50 - 75	25 - 50	50 plus
rocks	r	less than 10	10 - 25	25 - 50	50 plus
acid sulphate	a	none to 100	75 - 100	50 - 75	less than 50
drainage and	d	good	imperfect; poor	very poor	excessive
surface peat	p	-	-	less than 50	more than 50
salinity	c	nil	slight below 50	slight above 50; strong	-
nutrient status	n	optimum; good	poor	very poor	extremely poor; toxic
texture	t	see below			

**Texture:** where soil rated as Class I - IV on other limitations, and the texture is sand or coarser, ~~reduce rating by one class if drainage is good to imperfect,~~ reduce rating by one class if drainage is good to imperfect, reduce rating by two classes (or rate as Class V, whichever is higher) if drainage is poor or very poor, or there is surface peat of any depth.

**Definitions of limitation scales:** (where not as in your draft)

**slope.** clays = silt and clay groups

sands = loams and sands

**acid sulphate.** pH parameters quoted for Rajang, Belat, etc.

**salinity.** nil = less than 100 micromhos conductivity

slight = 100-500

strong = over 500

**surface peat.** assumed to be waterlogged residual peat. Luk is considered a mineral soil with poor nutrient status for rating

cont. Tables 1 and 2

nutrient status. as for the following soils:

- optimum = Seduau, Bemang
- good = Merit, Nyalau, Bijat, Semilajau
- poor = Peninjau, Saratok, Kerait, Kabong, Kayan, Tatau
- very poor = Tika, Bakau, Metading, Anderson
- extremely poor = Miri, Silanteks (other than Metading, Bakau)

Note: very poor drainage and shallow peat are considered together for rating, i.e. 'd' and 'p' subclasses are treated as one limitation and are not counted twice.

Table 3 : Possible grouping of estate/smallholding rating combinations

		<u>Estates</u>					
		Class 1	2	3	4	5	6
Smallholdings	Class 1						
	2		A			C	
	3						
	4						
	5					D	
	6		B				E

(These figures should have been Romanised)

Table 4 : soil ratings (only the main soils in my area considered, and only the common combinations of limitation levels)

Estate-level development

- Class EVI - Tika, Bintulu, Paloh, Rajang, Miri, Bako, Silantek, Tunggal, Buso, Grang, Daup, Peninjau, Luis, Matu, Jol, Mukah, Igan, Anderson, Sebandi\*
- Class EV - Tatau, Plan, Sirik, Pendam, Nonok, Kayan, Kabong, Belawai, Metading, Bakau
- Class IV - Merit, Jakar, Pintasah, Bekenu, Sarikei, Nyalau, Bijat, Daro, Pakan, Saratok, Durin, Bandang, Kerait, Penipah, Timang, Ajoh, Luk
- Class III - Merit, Jakar, Pintasah, Bekenu, Sarikei, Nyalau,
- Class II - Merit, Jakar, Pintasah, Bekenu, Sarikei, Nyalau, Sabangang, Lupar, Semilajau
- Class I - Bemang, Seduau, Malang

should be needs further

Smallholder-level development

- Class SVI - Tika, Bintulu, Paloh, Rajang, Miri, Bako, Silantek, Tunggal, Buso, Grang, Daup, Peninjau, Mukah(deep), Igan(deep), Anderson
- Class SV - Jol, Nonok, Metading, Bakau, Mukah(shallow), Igan(shallow), Luis, Matu
- Class SIV - Bekenu, Sarikei, Nyalau, Pendam, Sirik, Tatau, Plan, Sebandi,
- Class SIII - Merit, Jakar, Pintasah, Bekenu, Sarikei, Nyalau, Saratok, Durin, Bandang, Kerait, Penipah, Timang, Ajoh, Kayan, Kabong, Belawai

Class SII - Merit, Jakar, Pintasah, Bekenu, Sarikei, Nyalau, Lumar, Bijat, Daro, Pakan, Luk

Class SI - Bemang, Seduau, Semilajau, Malang, Lumar, Sabangang

Note: soils underlined can have their rating significantly raised where drainage is practicable, should be mapped with a 'p' subclass suffix and a note to that effect included in the key.

*[Faint handwritten notes and a list on graph paper. The list includes:]*

- 1) ... 10% detection
- 2) Wood Trained 20% & 10% detection
- 3) ... 5% detection

The following  
 for planning purposes, Land which has been  
 assessed as suitable for agricultural development,  
 at a particular density of soil survey, will  
 still have areas within it which are un-  
 suitable for agriculture. This is due to  
 the mapping scale and its limitation. For  
 planning purposes the following deduction  
 should be made to arrive at net areas  
 for agricultural development :-

- |  |                 |                      |
|--|-----------------|----------------------|
| 1) Semi-Detailed Soil Survey           | 1:50,000 scale  | 10% deduction        |
| 2) Broad Traversal Soil Survey         | 1:100,000 scale | 20% + 10% deduction. |
| 3) Areas covered by Zoning Plan study. | 1:250,000 scale | 55% deduction        |

The drawing up of a regional development plan involves the inventory and analysis of all relevant resources within the region.

Soil suitability classification system based on a similar approach to the Land Use Classification :-

- (a) Klingebiel and Montgomery (1961)
- (b) Macintyre (1962)
- (c) Ardouan (1966)

and like (b) and (c) have also been considered.

# ABSTRACT

VIII/C.

WONG, I.F.T. in 2nd ASEAN SOIL CONFERENCE

The ultimate aim of a regional master plan study is the production of appropriate guidelines for the optimum utilization of land on a rational basis. Such a study only possible if the necessary basic resource information is available (viz. soils and terrain), and presented in a way which makes it accessible to all disciplines within a study. This information is contained in the soil suitability map, and constitutes a vital contribution to the assessment of land for long term agricultural development.

The drawing up of a regional development plan involves the inventory and analysis of all relevant resources within the region.

The Soil Suitability Classification system based on a similar approach to the Land Cap. Classif. of :-

- (a) Klingebiel and Montgomery (1961)
- (b) Haantjens (1962)
- (c) Andriese (1966)

and like (b) and (c) taken into consideration.

perennial (tree) crops, wet land padi and arable farming of land use.

This classification therefore :-

- a) classifies soils according to the presence of crop growth limiting factors
- b) groups soils according to the severity of crop growth limitations.
- c) grades soils by the number of crops they are suitable for.

Table 1. Characteristics of soils most suitable for cocoa cultivation

Soil property	Levels considered adequate	Depths	SOIL SERIES					CULTIVATION					For comparison
			Silangor	Kangkong	Briah	Telemong	Aaob	Segamat	Kuantun	Kompong Kilam	Jerangau		
C.E.C.	topsoil: 12-13 m.e./100gm. within 1 metre of surface } $\geq 3$ m.e./100gm.	0-6" within 6-36" layer	23.1-44.8 (29.9)	26.16-42.65 (31.62)	18.73-40.11 (26.70)	5.9-16.3 (12.7)	13.2-28.0 (17.8)	8.96-17.66 (13.5)	13-20.46 (15.41)	7.76-13.64 (10.75)	8.13-11.39 (9.75)		
% Carbon	$\geq 2\%$ in 0-6" layer (0-15 cm)	0-6" layer	0.64-7.53	0.87-3.34	0.49-2.82	0.66-2.04	0.37-5.24	0.54-2.38	1.47-3.13	0.48-1.79	0.68-2.76		
C/N ratio	$\geq 9$ in 0-6" layer	0-6" layer	7.15-21.3	5.16-10.64	5.07-15.0	6.1-10.8	5.3-20.0	4.9-19.05	7.3-14.46	6.0-10.64	9.83-12.63		
Base Saturation	$\geq 30-40\%$ within 20 inches (50cm) of the surface (especially in soils with high kaolinitic clay content)	Rango (0-24")	4-30 (16.2)	42.3-103 (68.9)	4-30.3 (11.6)	4-17.5 (10.9)	5.8-65 (26.8)	2-16.0 (7.5)	1-3.3 (2.5)	9-38.1 (16.5)	1-7.5 (3.2)		
pH	Optimal: 6.0-7.5 adequate: 4.0-9.5	topsoil	3.4-5.2	4.3-5.9	3.9-4.5	3.5-6.5	4.3-5.8	3.9-5.1	3.9-5.1	3.8-5.2	4.1-5.3		
Phosphorus "available"	$\geq 40$ p.p.m. (17mg)	topsoil subsoil	36-246 <sup>†</sup> 24-273	325-328.3 15-11.8	64.0-261.1 14.0-145.0	30-133 5.5-115.7	26.8-194.5 6.0-168	30-164.3 12-174.0	84.7-334.7 72.0-372.7	2.8-288.0 2.0-382.0	33-94.7 24-80		
Calcium "Exchangeable"	$\geq 8$ m.e./100 gm.	topsoil subsoil	0.16-9.08 0.10-12.77	2.24-7.86 1.78-9.15	0.19-1.48 0.01-2.37	0.19-1.72 0.03-0.70	0.61-6.06 0.07-7.02	0.04-1.19 0.01-0.63	0.01-0.16 0.01-0.15	0.16-2.01 0.10-1.37	0.01-0.21 0.01-0.24		
Magnesium "Exchangeable"	$\geq 2$ m.e./100 gm.	topsoil subsoil	0.13-20.66 0.07-23.04	5.03-16.64 6.39-23.56	0.37-2.97 0.16-7.56	0.44-1.44 0.10-1.32	0.79-2.84 0.14-4.26	0.22-2.31 0.10-0.69	0.03-0.41 0.01-0.16	0.56-2.29 0.20-1.48	0.11-0.45 0.01-0.28		
Potassium "Exchangeable"	$\geq 0.24$ m.e./100 gm.	topsoil subsoil	0.24-1.43 0.08-11.65	0.32-0.81 0.68-1.03	0.12-0.41 0.01-1.01	0.05-0.38 0.02-0.35	0.12-0.67 0.02-0.26	0.04-0.47 0.01-0.36	0.04-0.11 0.01-0.07	0.10-0.23 0.02-0.08	0.04-0.11 0.01-0.06		
Ca/Mg ratio	$\leq 4$ in top 6" (15cm)	0-6"	0.4	0.4	0.3	0.7	1.7	0.5	0.4	0.7	0.3		
Ca/Mg ratio	$\geq 25$ in top 6" (15cm)	0-6"	18.6	112.7	9	8.4	14.9	6	4	10.6	6.2		

<sup>†</sup> Average in t. acetate.  
<sup>‡</sup> N/10 NaOH extractant

CLASS	I	II	III	IV
Sub-class	-	w	s	e
Soil FAMILY and/or Series in each Sub-class	BEMANG - Bemang SEDUAU - Seduau, Malang BEKENU - Bekenu, Sarikei	BEMANG - Bemang SEDUAU - Seduau, Malang	BEMANG - Semilajau SARATOK - Saratok, Penipah NYALAU - Nyalau, Sabangang NYALAU/BEKENU MERIT/NYALAU	BEKENU - Bekenu, Sarikei MERIT - Merit, Jakar MERIT/BEKENU KABULOH - Karabungan, Tengap
Maximum slope in degrees	3 (CLASS 1)	3 (CLASS 1)	3 (CLASS 1)	5 (CLASS 1)
Erosion hazard	Slight or absent	Slight or absent	Slight or absent	Slight
Effective soil depth cm (inches)	Deeper than 100 (40) (CLASS 5)	Deeper than 100 (40) (CLASS 5)	Deeper than 100 (40) (CLASS 5)	Deeper than 100 (40) (CLASS 5)
Drainage	Well	Well to moderately well	Well to moderately well	Well to moderately well
Flooding	None	Infrequent and of short duration	None	None
Texture groups	Loams, silts and clays no surface peat	Loams, silts and clays no surface peat	Loams, silts and clays no surface peat	Loams, silts and clays no surface peat
Crop groups	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16 8 (papaya) - flooding 9 - flooding and heavy texture 10 (pepper) - flooding 11 - flooding, except oil palm & coffee	1, (2), 3, (4), (5), 6, 7, (8), (10), 11, 12, 13, 14, 16 Unsuitable for: Papaya 8 & pepper 10 - flooding Marginal: 2 - flooding 4 - flooding 5 - flooding 11 - flooding except oil palm	(1), 2, (3), 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16 Marginal: 1 - light textures unsuitable 3 - light textures unsuitable 2 - heavy texture unsuitable	(1), (2), 3, 4, 5, 6, 7, 8, (9), (10), 11, 12, 13, 14, 16 Marginal: 1 - slope unsuitable >3 2 - heavy clays (KB) unsuitable for groundnuts 9 - heavy clays (KB) unsuitable 10 - heavy clays (KB) unsuitable for citrus

TABLE LAND CAPABILITY CLASSIFICATION

## CLASS III

Sub-class	BEMANG-PAKAN SEDUAU-BIJAT	BEKENU - Bekenu, Sarikei MERIT - Merit, Jakar MERIT/BEKENU KABULOH - Karabungan, Tanggap	BEKENU - Bekenu, Sarikei MERIT - Merit, Jakar MERIT/BEKENU KABULOH - Karabungan, Tanggap	SARATOK - Saratok, Penipah NYALAU - Nyalau, Sabangang NYALAU/BEKENU MERIT/NYALAU
Soil FAMILY and/or Series in each Sub-class	BEMANG-PAKAN SEDUAU-BIJAT	BEKENU - Bekenu, Sarikei MERIT - Merit, Jakar MERIT/BEKENU KABULOH - Karabungan, Tanggap	BEKENU - Bekenu, Sarikei MERIT - Merit, Jakar MERIT/BEKENU KABULOH - Karabungan, Tanggap	SARATOK - Saratok, Penipah NYALAU - Nyalau, Sabangang NYALAU/BEKENU MERIT/NYALAU
Maximum slope in degrees	5 (CLASS 1)	10 (CLASS 1 & 2)	5 (CLASS 1)	5 (CLASS 1)
Erosion hazard	Slight	Moderate	Moderate	Moderate
Effective soil depth cm (inches)	Deeper than 100 (40) (CLASS 5)	Deeper than 100 (40) (CLASS 5)	Deeper than 75 (30) (CLASS 4 & 5)	Deeper than 100 (40) (CLASS 5)
Drainage	Imperfect	Very well to moderately well	Imperfect to very well	Imperfect to very well
Flooding	Infrequent and of short duration	-	-	-
Texture groups	Loams, silts and clays no surface peat	Loams, silts and clays no surface peat	Loams, silts and clays no surface peat	Loams, silts and clays no surface peat
Crop groups	1, 3, (4), (5), 6, 7, (8), (9), (10), (11), 12, 13, 14, 16 Marginal: 4 - flooding 5 - flooding 8 (papaya) - flooding 9 - flooding and heavy texture 10 (pepper) - flooding 11 - flooding, except oil palm & coffee	(2), 3, (4), (5), 6, 7, 8, (9), (10), 11, 12, 13, 14, 16 Marginal: 4 - heavy texture (KB) unsuitable 5 - heavy texture (KB) unsuitable 10 - heavy texture (KB) unsuitable for citrus & pepper 9 - heavy texture (KB) unsuitable 2 - heavy texture (KB) unsuitable for groundnuts	(2), 3, (4), (5), 6, 7, 8, (9), (10), 11, 12, 13, 14, 16 Marginal: 4 - heavy texture (KB) unsuitable 5 - heavy texture (KB) unsuitable 9 - heavy texture (KB) unsuitable 10 - heavy texture (KB) unsuitable 2 - for citrus & pepper 2 - heavy texture (KB) unsuitable for groundnuts	2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16

Sub-class	W	e
Soil FAMILY and/or Series in each Sub-class	BEMANG-PAKAN SEDUAU-SIJAT	BERKUN - Bekun, B MERIT - Merit, Laka MERIT/BERKUN KALUHON - Karuhon Tangap
Maximum slope in degrees	2 (CLASS 1)	10 (CLASS 1 & 2)
Erosion hazard	Slight	Moderate
Effective soil depth cm (inches)	Deeper than 100 (40) (CLASS 2)	Deeper than 100 (CLASS 2)
Firmness	Imperfect	Very soft to moderately w
Flooding	Intermittent and of short duration	-
Texture groups	Loams, silts and clays no surface peat	Loams, silts and no surface peat
Crop Groups	1, 2, (4), (5), 6, 7, (8), (9), (10), (11), 12, 13, 14, 15	(2), 3, (4), (5), 8, (9), (10), 11, 13, 14, 15
	Marginal: 4 - flooding 5 - flooding 6 (pepper) - flooding 9 - flooding and heavy texture 10 (pepper) - flooding 11 - flooding, except oil palm & coffee	Marginal: 4 - heavy texture unsuitable 5 - heavy texture unsuitable 10 - heavy texture unsuitable olive & pe 9 - heavy texture unsuitable 2 - heavy texture unsuitable groundnuts

CLASS IV

Sub-class	w	e	s	se
Soil FAMILY and/or Series in each Sub-class	BEMANG/BIJAT PAKAN - Pakan, Dangkar BIJAT - Bijat, Sebandi BIJAT/SEDUAU BIJAT-PENDAM PENDAM - Pendam (if reclamation feasible) PENDAM-MUKAH (if PN reclaimable) MUKAH - (if peat less than 50 cm/20 in), Mukah.	BEKENU - Bekenu, Sarikei MERIT - Merit, Jakar MERIT/BEKENU KABULOH - Kabuloh, Karabungan, Tangap	BEKENU - Bekenu, Sarikei MERIT - Merit, Jakar MERIT/BEKENU KABULOH - Kabuloh, Karabungan, Tangap	SARATOK - Saratok Penipah NYALAU - Nyalau, Sabangang NYALAU/BEKENU MERIT/NYALAU
Maximum slope in degrees	3 (CLASS 1)	15 (CLASS 1, 2, 3)	10 (CLASS 1 & 2)	10 (CLASS 1 & 2)
Erosion hazard	Slight or absent	Moderate	Moderate	Moderate
Effective soil depth cm (inches)	Deeper than 75 (30) (CLASS 4 & 5)	Deeper than 75 (30) (CLASS 4 & 5)	Deeper than 60 (24) (CLASS 3)	Deeper than 75 (30) (CLASS 4 & 5)
Drainage	Very poorly and poorly	Imperfect to very well	Imperfect to very well	Moderately well to very well
Flooding	Common and of moderate duration	-	-	-
Texture groups	Loams, silts and clays surface peat less than 50 cm (20 inches)	Loams, silts and clays no surface peat	Loams, silts and clays no surface peat	Loams, silts and clays no surface peat
Crop groups	1, 6, 15, 16	(3), 6, 7, 8, (9), (10), 11, 12, 13, 14, 16  Marginal: 3 - heavy clays (KB) unsuitable 9 - heavy clays (KB) unsuitable 10 - heavy clays (KB) unsuitable for citrus & pepper	(2), (3), (4), (5), 6, 7, 8, (9), (10), 11, 12, 13, 14, 16  Marginal: 2 - heavy clays (KB) unsuitable for groundnuts 3 - heavy clays (KB) unsuitable 4 - heavy clays (KB) unsuitable 5 - heavy clays (KB) unsuitable 9 - heavy clays (KB) unsuitable 10 - heavy clays (KB) unsuitable for citrus & pepper 2 - soil depth for vegetables	2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16

Sub-class	w	sw	e	s	se
Soil FAMILY and/or Series in each Sub-class	BEMANG/BIJAT BIJAT - Bijat, Sebandi BIJAT/MUKAH MUKAH - (if peat less than 50 cm/20 in), Mukah	KAYAN-TATAU KAYAN/BEMANG	BEKENU - Bekenu, Sarikei MERIT - Merit, Jakar MERIT/BEKENU KABULOH - Kabuloh, Karabungan, Tangap	KAYAN - Kayan, Kabong, Belawai SILANTEK - Silantek, Tungal, Buso, Grang KERAIT - Kerait, Ajoh KERAIT/BANDANG BEKENU - Bekenu, Sarikei MERIT - Merit, Jakar MERIT/BEKENU KABULOH - Kabuloh, Karabungan, Tangap	SARATOK - Saratok, Penipah SARATOK/KERAIT NYALAU - Nyalau, Sabangang NYALAU/SILANTEK NYALAU/BEKENU MERIT/NYALAU
Maximum slope in degrees	3 (CLASS 1)	3 (CLASS 1)	20 (CLASS 1, 2, 3 & 4)	No limit	15 (CLASS 1, 2 & 3)
Erosion hazard	Slight or absent	Slight or absent	Severe	Moderate - severe	Severe
Effective soil depth cm (inches)	Not limiting	Deeper than 60 (24) (CLASS 3, 4 & 5)	Deeper than 60 (24) (CLASS 3, 4 & 5)	Deeper than 50 (20) (CLASS 2)	Deeper than 60 (24) (CLASS 3, 4 & 5)
Drainage	Very poorly	Very poorly and excessively	-	Excessively to imperfect	-
Flooding	Frequent	Frequent	-	None	None
Texture groups	Loams, silts and clays surface peat less than 50 cm (20 inches)	Sands no surface peat	Loams, silts and clays no surface peat	Sands, loams, silts and clays no surface peat	Loams, silts and clays no surface peat
Crop groups	1, 6, 15, 16	(13), (14), 16  Marginal: 14 - sands not suitable for certain tree species 13 - KY/TT unsuitable	(6), (10), 11, 12, 13, 14, 16  Marginal: 6 - over 15 degrees only after trials 10 - heavy clays (KB) unsuitable for citrus & pepper	(13), 14, 16, (6)  Marginal: 13 - >25 degrees unsuitable 6 - over 15 degrees only after successful trials KY unsuitable	3, 6, 7, 8, 11, 12, 13, 14, 16

CLASS VI

Sub-class	e	s	se	sw
Soil FAMILY and/or Series in each Sub-class	BEKENU - Bekenu, Sarikei MERIT - Merit, Jakar MERIT/BEKENU KABULOH - Karabungan, Tangap, Kabuloh	MIRI - Miri, Bako SILANTEK/MIRI SILANTEK/TIKA TIKA - Tika, Bintulu BEKENU-KAPIT NYALAU-KAPIT MERIT-KAPIT KABULOH-KAPIT MUKAH - Mukah, Tekajong (peat more than 50 cm/20 in)	SARATOK - Saratok, Penipah SARATOK/KERAIT PENINJAU - Peninjau NYALAU - Nyalau NYALAU/PENINJAU NYALAU/SILANTEK NYALAU/BEKENU MERIT/NYALAU	NONOK - Nonok NONOK-TATAU TATAU - Plan, Tatau, Matu TATAU/MUKAH TATAU/IGAN BIJAT/ANDERSON I (inland peat) IGAN - Igan, Bruit IGAN/SILANTEK ANDERSON I/MUKAH
Maximum slope in degrees	25 (CLASS 1, 2, 3, 4 & 5)	No limit	20 (CLASS 1, 2, 3 & 4)	-
Erosion hazard	Severe	-	Severe	Absent
Effective soil depth cm (inches)	Deeper than 60 (24) (CLASS 3, 4 & 5)	Deeper than 25 (10) -	Deeper than 60 (24) (CLASS 3)	Not limiting
Drainage	-	-	-	Very poorly
Flooding	-	-	-	No limit
Texture groups	Silts and clays no surface peat	Sands, loams, silts and clays surface peat more than 50 cm (20 inches)	Loams, silts and clays no surface peat	Sands, loams, silts and clays surface peat less than 200 cm (80 inches)
depth in (inches)	(11), 12, 13, 14, 16	(1), (6), 9, 16	(6), 11, 12, 13, 14, 16	(6), 15, 16
Drainage	Marginal: 11 - between 20 and 25 degrees	Marginal: 1 - only on Mukah 6 - soil depth, only and offer success- ful trials	Marginal: 6 - over 15 degrees after trials	Marginal: 6 - only on BIJAT/ANDERSON I
Crop groups				
Texture groups	Loams, silts and clays no surface peat	Sands, loams, silts and clays surface peat more than 50 cm (20 inches)	Loams, silts and clays no surface peat	Sands, loams, silts and clays surface peat less than 200 cm (80 inches)

CLASS VII

Sub-class	e	s	se	w
Soil FAMILY and/or Series in each Sub-class	BEKENU - Bekenu, Sarikei MERIT - Merit, Jakar MERIT/BEKENU	BELAT - Belat BELAT-TATAU BELAT/ANDERSON BIJAT/ANDERSON II PENDAM - Pendam (if unreclaimable) PENDAM/RAJANG RAJANG - Rajang RAJANG-ANDERSON PENINJAU/MELUAN NYALAU/MELUAN NYALAU/KAPIT MELUAN - Meluan MELUAN/KAPIT MELUAN/ROCK KAPIT - Kapit KAPIT/MERIT IGAN/ANDERSON ANDERSON I, II & III ANDERSON II & III/MUKAH	SILANTEK - Silantek, Tunggal, Buso, Grang SILANTEK/KERAIT SARATOK - Saratok, Penipah PENINJAU - Peninjau NYALAU - Nyalau, Sabangang NYALAU/SILANTEK NYALAU/PENINJAU NYALAU/BEKENU MERIT/NYALAU IGAN/SILANTEK	NONOK - Nonok TATAU - Plan, Tatau, Matu BIJAT - Bijat, Sebandi PENDAM-MUKAH (if PN unreclaimable) MUKAH - Mukah, Tekajong (peat more than 20 inches)
Maximum slope in degrees	Over 25 (CLASS 6 & 7)	-	Over 20 (CLASS 5, 6 & 7)	3 (CLASS 1)
Erosion hazard	Severe	Severe hill soils Not limiting others	Severe	Absent
Effective soil depth cm (inches)	No limit	Less than 25 (10)	No limit	No limit
Drainage	-	-	No limit	No limit
Flooding	-	-	No limit	No limit
Texture groups	Loams, silts and clays no surface peat	Sands, loams, silts and clays surface peat more than 100 cm (40 inches)	Sands, loams, silts and clays no surface peat	Sands, loams, silts and clays surface peat more than 50 cm (20 inches)
Crop groups	14, 16	(14), 16	14, 16	15, 16

NOT CORRECTED

CLASS	I		II	
Sub-class	-		w	e
Soil FAMILY and/or Series in each Sub-class	BEMANG - Bemang SEDUAU - Seduan, Malang BEKENU - Bekenu, Sarikei		BEMANG - Bemang SEDUAU - Seduan, Malang	BEMANG - Semilajau SARATOK - Saratok, Penipah NYALAU - Nyalau, Sebangang NYALAU/BEKENU MERIT/NYALAU
Maximum slope in degrees	3 (CLASS 1)		3 (CLASS 1)	5 (CLASS 1)
Erosion hazard	Slight or absent		Slight or absent	Slight
Effective soil depth on (inches)	Deeper than 100 (40) (CLASS 5)		Deeper than 100 (40) (CLASS 5)	Deeper than 100 (40) (CLASS 5)
Drainage	Well		Well to moderately well	Well to moderately well
Flooding	None		Infrequent and of short duration	None
Texture groups	Loams, silts and clays no surface peat		Loams, silts and clays no surface peat	Loams, silts and clays no surface peat
Crop groups	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16		1, (2), 3, (4), (5), 6, 7, (8), (10), 11, 12, 13, 14, 16  Unsuitable for: Papaya 8 & pepper 10 - flooding  Marginal: 2 - flooding 4 - flooding 5 - flooding 11 - flooding except oil palm	(1), (2), 3, 4, 5, 6, 7, 8, (9), (10), 11, 12, 13, 14, 16  Marginal: 1 - slope unsuitable >3 2 - heavy clays (KB) unsuitable for groundnuts 9 - heavy clays (KB) unsuitable 10 - heavy clays (KB) unsuitable for citrus

TABLE

LAND CAPABILITY CLASSIFICATION

CLASS III

Sub-class	w	e	s	se
Soil FAMILY and/or Series in each Sub-class	BERANG-PAKAN SEDUAU-DIJAT	BEKENU - Bekenu, Sarikoi MERIT - Merit, Jakar MERIT/BEKENU KABULOH - Karabunga, Tangap	BEKENU - Bekenu, Sarikoi MERIT - Merit, Jakar MERIT/BEKENU KABULOH - Kabuloh, Karabungan, Tangap	SARATOK - Saratok, Penipah NYALAU - Nyalau, Sabangang NYALAU/BEKENU MERIT/NYALAU
Maximum slope in degrees	5 (CLASS 1)	10 (CLASS 1 & 2)	5 (CLASS 1)	5 (CLASS 1)
Erosion hazard	Slight	Moderate	Moderate	Moderate
Effective soil depth cm (inches)	Deeper than 100 (40) (CLASS 5)	Deeper than 100 (40) (CLASS 5)	Deeper than 75 (30) (CLASS 4 & 5)	Deeper than 100 (40) (CLASS 5)
Drainage	Imperfect	Very well to moderately well	Imperfect to very well	Imperfect to very well
Flooding	Infrequent and of short duration	-	-	-
Texture groups	Loams, silts and clays no surface peat	Loams, silts and clays no surface peat	Loams, silts and clays no surface peat	Loams, silts and clays no surface peat
	1, 3, (4), (5), 6, 7, (8), (9), (10), (11), 12, 13, 14, 16	(2), 3, (4), (5), 6, 7, 8, (9), (10), 11, 12, 13, 14, 16	(2), 3, (4), (5), 6, 7, 8, (9), (10), 11, 12, 13, 14, 16	2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16
Crop groups	Marginal: 4 - flooding 5 - flooding 8 (papaya) - flooding 9 - flooding and heavy texture 10 (pepper) - flooding 11 - flooding, except oil palm & coffee	Marginal: 4 - heavy texture (KB) unsuitable 5 - heavy texture (KB) unsuitable 10 - heavy texture (KB) unsuitable for citrus & pepper 9 - heavy texture (KB) unsuitable 2 - heavy texture (KB) unsuitable for groundnuts	Marginal: 4 - heavy texture (KB) unsuitable 5 - heavy texture (KB) unsuitable 9 - heavy texture (KB) unsuitable 10 - heavy texture (KB) unsuitable for citrus & pepper 2 - heavy texture (KB) unsuitable for groundnuts	

CLASS IV

Sub-class	w	e	s	so
Soil FAMILY and/or Series in each Sub-class	<p>BERANG/BIJAT</p> <p>PAKAN - Pakan, Dangkar</p> <p>BIJAT - Bijat, Sebandi</p> <p>BIJAT/SEDUAU</p> <p>BIJAT-PENDAM</p> <p>PENDAM - Pendam (if reclamation feasible)</p> <p>PENDAM-MUKAH (if FH reclaimable)</p> <p>MUKAH - (if peat less than 50 cm/20 in), Mukah,</p>	<p>BEKENU - Bekenu, Sarikai</p> <p>MERIT - Merit, Jekar</p> <p>MERIT/BEKENU</p> <p>KABULOH - Kabuloh, Karabungan, Tangap</p>	<p>BEKENU - Bekenu, Sarikai</p> <p>MERIT - Merit, Jekar</p> <p>MERIT/BEKENU</p> <p>KABULOH - Kabuloh, Karabungan, Tangap</p>	<p>SARATOK - Saratok Penipah</p> <p>NYALAU - Nyalau, Sabangang</p> <p>NYALAU/BEKENU</p> <p>MERIT/NYALAU</p>
Maximum slope in degrees	3 (CLASS 1)	15 (CLASS 1, 2, 3)	10 (CLASS 1 & 2)	10 (CLASS 1 & 2)
Erosion hazard	Slight or absent	Moderate	Moderate	Moderate
Effective soil depth cm (inches)	Deeper than 75 (30) (CLASS 4 & 5)	Deeper than 75 (30) (CLASS 4 & 5)	Deeper than 60 (24) (CLASS 3)	Deeper than 75 (30) (CLASS 4 & 5)
Drainage	Very poorly and poorly	Imperfect to very well	Imperfect to very well	Moderately well to very well
Flooding	Common and of moderate duration	-	-	-
Texture groups	Loams, silts and clays surface peat less than 50 cm (20 inches)	Loams, silts and clays no surface peat	Loams, silts and clays no surface peat	Loams, silts and clays no surface peat
Crop groups	1, 6, 15, 16	(3), 6, 7, 8, (9), (10), 11, 12, 13, 14, 16  Marginal: 3 - heavy clays (KB) unsuitable 9 - heavy clays (KB) unsuitable 10 - heavy clays (KB) unsuitable for citrus & pepper	(2), (3), (4), (5), 6, 7, 8, (9), (10), 11, 12, 13, 14, 16  Marginal: 2 - heavy clays (KB) unsuitable for groundnuts 3 - heavy clays (KB) unsuitable 4 - heavy clays (KB) unsuitable 5 - heavy clays (KB) unsuitable 9 - heavy clays (KB) unsuitable 10 - heavy clays (KB) unsuitable for citrus & pepper 2 - soil depth for vegetables	2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16

## CLASS V

Sub-class	w	sw	s	so	
Soil FAMILY and/or Series in each Sub-class	BERIANG/BIJAT BIJAT - Bijat, Sebandi BIJAT/MUKAH MUKAH - (if peat less than 50 cm/20 in), Mukah	KAYAN-TATAU KAYAN/BERIANG	BEKENU - Bekenu, Sarikoi MERIT - Merit, Jekar MERIT/BEKENU KADULOH - Kaduloh, Karabunga, Tangap	KAYAN - Kayan, Kabong, Belawai SILANTEK - Silantek, Tunggal, Buso, Grang KERAIT - Kerait, Ajoh KERAIT/PANDANG BEKENU - Bekenu, Sarikoi MERIT - Merit, Jekar MERIT/BEKENU KADULOH - Kaduloh, Karabungan, Tangap	SARATOK - Saratok, Penipah SARATOK/KERAIT NYALAU - Nyalau, Sebangang NYALAU/SILANTEK NYALAU/BEKENU MERIT/NYALAU
Maximum slope in degrees	3 (CLASS 1)	3 (CLASS 1)	3 (CLASS 1, 2, 3 & 4)	No limit	15 (CLASS 1, 2 & 3)
Erosion hazard	Slight or absent	Slight or absent	None	Moderate - severe	Severe
Effective soil depth cm (inches)	Not limiting	Deeper than 60 (24) (CLASS 3, 4 & 5)	Deeper than 60 (24) (CLASS 3, 4 & 5)	Deeper than 50 (20) (CLASS 2)	Deeper than 60 (24) (CLASS 3, 4 & 5)
Drainage	Very poorly	Very poorly and excessively	.	Excessively to imperfect	-
Flooding	Frequent	Frequent	.	None	None
Texture groups	Loams, silts and clays surface peat less than 50 cm (20 inches)	Sands no surface peat	Loams, silts and clays no surface peat	Sands, loams, silts and clays no surface peat	Loams, silts and clays no surface peat
Crop groups	1, 6, 15, 16	(13), (14), 16  Marginal: 14 - sands not suit- able for certain tree species 13 - KY/TT unsuitable	(6), (10), 11, 12, 13, 14, 16  Marginal: 6 - over 15 degrees only after trials 10 - heavy clays (KH) unsuitable for cocoa & pepper	(13), 14, 16, (6)  Marginal: 13 - > 25 degrees unsuitable 6 - over 15 degrees only after successful trials KY unsuitable	3, 6, 7, 8, 11, 12, 13 14, 16

CLASS VI

Sub-class	e	s	se	sw
Soil FAMILY and/or Series in each Sub-class	BEKENU - Bekenu, Sarikei MERIT - Merit, Jaker MERIT/BEKENU KABULOH - Karabungan, Tangap, Kabuloh	MIRI - Miri, Peko SILANTEK/MIRI SILANTEK/TIKA TIKA - Tika, Bintulu BEKENU-KAPIT NYALAU-KAPIT MERIT-KAPIT KABULOH-KAPIT MUKAH - Mukah, Tekajong (peat more than 50 cm/20 in)	SARATOK - Saratok, Penipah SARATOK/KERAIT PENINJAU - Peninjau NYALAU - Nyalau NYALAU/PENINJAU NYALAU/SILANTEK NYALAU/BEKENU MERIT/NYALAU	HONOK - Honok HONOK-TATAU TATAU - Plan, Tatau, Matu TATAU/MUKAH TATAU/IGAN HIJAT/ANDERSON I (inland peat) IGAN - Igan, Bruit IGAN/SILANTEK ANDERSON I/MUKAH
Maximum slope in degrees	25 (CLASS 1, 2, 3, 4 & 5)	No limit	20 (CLASS 1, 2, 3 & 4)	-
Erosion hazard	Severe	-	Severe	Absent
Effective soil depth cm (inches)	Deeper than 60 (24) (CLASS 3, 4 & 5)	Deeper than 25 (10) -	Deeper than 60 (24) (CLASS 3)	Not limiting
Drainage	-	-	-	Very poorly
Flooding	-	-	-	No limit
Texture groups	Silts and clays no surface peat	Sands, loams, silts and clays surface peat more than 50 cm (20 inches)	Loams, silts and clays no surface peat	Sands, loams, silts and clays surface peat less than 200 cm (80 inches)
Soil groups	(11), 12, 13, 14, 16 Marginal: 11 - between 20 and 25 degrees	(1), (6), 9, 16 Marginal: 1 - only on Mukah 6 - soil depth, only and offer successful trials	(6), 11, 12, 13, 14, 16 Marginal: 6 - over 15 degrees after trials	(6), 15, 16 Marginal: 6 - only on HIJAT/ANDERSON I
Crop groups				
Texture groups				
Soil groups				

CLASS VII

Sub-class	e	s	so	w
Soil FAMILY and/or Series in each Sub-class	BEKENU - Bekenu, Sarikei MERIT - Merit, Jakar MERIT/BEKENU	BELAT - Belat BELAT-TATAU BELAT/ANDERSON BIJAT/ANDERSON II PENDAM - Pendam (if unreclaimable) PENDAM/RAJANG RAJANG - Rajang RAJANG-ANDERSON PENINJAU/MELUAN NYALAU/MELUAN NYALAU/KAPIT MELUAN - Meluan MELUAN/KAPIT MELUAN/ROCK KAPIT - Kapit KAPIT/MERIT IGAN/ANDERSON ANDERSON I, II & III ANDERSON II & III/MUKAH	SILANTEK - Silantek, Tunggal, Rano, Grang SILANTEK/KERAIT SARATOK - Saratok, Penipah PENINJAU - Peninjau NYALAU - Nyalau, Sabangang NYALAU/SILANTEK NYALAU/PENINJAU NYALAU/BEKENU MERIT/NYALAU IGAN/SILANTEK	HONOK - Honok TATAU - Plan, Tatau, Matu BIJAT - Bijat, Sebandi PENDAM-MUKAH (if FF unreclaimable) MUKAH - Mukah, Tekajong (peat more than 20 inches)
Maximum slope in degrees	Over 25 (CLASS 6 & 7)	-	Over 20 (CLASS 5, 6 & 7)	3 (CLASS 1)
Erosion hazard	Severe	Severe hill soils Not limiting others	Severe	Absent
Effective soil depth cm (inches)	No limit	Less than 25 (10)	No limit	No limit
Drainage	-	-	No limit	No limit
Flooding	-	-	No limit	No limit
Texture groups	Loams, silts and clays no surface peat	Sands, loams, silts and clays surface peat more than 100 cm (40 inches)	Sands, loams, silts and clays no surface peat	Sands, loams, silts and clays surface peat more than 50 cm (20 inches)
Crop groups	14, 16	(14), 16	14, 16	15, 16

Your comment please

Studies don't show.

The Range of acceptable conditions & MINIMUM SOIL AND TERRAIN REQUIREMENTS FOR CROPCROUPS WITH SIMILAR DEMANDS

(Adapted to Sarawak conditions)

Soil fertility & humus content

Crops and Groupings

1: Rice (wet land)   
 Swamp land?   
 Personally this refers to flat valley land on which it is possible to get water to stand and has no reference to irrigation? Yes

Group

Annual Crop

Requirements

- Slope: 0-3 degrees.
- Drainage: moderately well to very poorly.   
 *As acceptable provided it is controllable and the water is not flowing.*
- Flooding: not worse than infrequent and of short duration.
- Effective soil depth: deeper than 30 cm (12 inches).
- Soil texture: heavier than loam if water table high; otherwise sandy clay loam and heavier.
- Depth of surface peat: less than 50 cm (20 inches) if well humified and with high base status, otherwise less than 30 cm (12 inches).
- Depth to acid sulphate layer: deeper than 50 cm (20 inches).
- Salinity: less than 100 micromhos/cm at 25°C in surface 50 cm (20 inches).   
 *and*
- Workability: surface stones, ~~at~~ rocks less than 25 per cent; submerged timbers in ~~past~~ surface layers.

Soil classification term

Has this any significance in the Yes, along coast Study Area?

Possibility a range of pH values would be of more practical use under the conditions here, but the soil of where can be altered so perhaps the whole thing could be

Note: \* Internal.

require lime depending on pH value 5.0 All pH values are around 3.8 - 5.5. except Kabuloh soil

1102 Molecular Physics 2.3 - 8.8 Lonsdale and Andrew HP MA

Notes - Laboratory

not satisfactory for

not satisfactory for  
not satisfactory for  
not satisfactory for

lines make all

not satisfactory for  
not satisfactory for  
not satisfactory for

not satisfactory for  
not satisfactory for  
not satisfactory for

not satisfactory for

not satisfactory for

(subject to general conditions)

MINIMUM SOIL VIB MEASUREMENTS FOR CROPLANDS AND RURAL DEVELOPMENT

Group

Crops and Cereals

2: and rice has reached the required

Ground nuts sowing patterns

Vegetables - potatoes or fodder crops

Tobacco - crop, fallow, etc.

Is there any difference between the 5 years?

significant difference between the 5 years?

crop group and group 5? If not can

we combine them and make appropriate

remarks in each 'Requirement' covering the

crops whose 'Requirement' differs from that

given.

3:

Rice

(dry land)

Note: Temporarily recommended, should be phased out when acreage of wet

have we got any areas which we have rejected because of dryness? yes.

Requirements

Slope: 0-5 degrees, with conservation to 15 degrees. 10.

Drainage: very well to moderately well (30 inches)

Flooding: none.

Effective soil depth: deeper than 50 cm (20 inches), some vegetables

require minimum of 75 cm (30 inches).

Soil texture: excluding sands and heavy clay.

Depth of surface peat: less than 50 cm (20 inches); some vegetables

could thrive on a depth of over 120 cm (48 inches) provided peat

is well humified and with acceptable base status.

Depth to acid sulphate layer: deeper than 75 cm (30 inches).

Salinity: less than 100 microhm/cm at 25°C in surface 75 cm (30 inches).

Workability: less than 25 per cent of surface stones and rocks.

Slope: 0-5 degrees, with conservation to 15 degrees.

Drainage: well to imperfect.

Flooding: not worse than infrequent and of short duration.

Effective soil depth: deeper than 50 cm (20 inches) or deeper than 75 cm (30 inches) if

Group

Crops and Cropping

land rice has reached the required target. Cropping pattern:  
a) long term pasture or fodder grass,  
rice 1 crop, fallow, grasses;  
b) fallow, rice 1 or 2 crops,  
fallow not less than 5 years.

4:

Tapioca,

Yams,

Sweet potatoes,

Ginger,

Turneric.

Requirements

Soil texture: heavier than loam, but excluding heavy clays.

Depth of surface peat: less than 50 cm (20 inches).

Depth to acid sulphate layer: ~~less than 30 cm (12 inches)~~, not applicable  
*not applicable*

Salinity: less than ~~100~~ <sup>100</sup> microhm/cm at 25°C ~~in surface 30 cm (12 inches)~~.

Workability: less than 25 per cent of surface stones and rocks.

Depth of surface peat: less than 30 cm (12 inches).

Depth to acid sulphate layer: deeper than 75 cm (30 inches).

Slope: 0-5 degrees, with conservation to 10 degrees.

Drainage: very well to imperfect.

Flooding: none.

Effective soil depth: deeper than 60 cm (24 inches).

Soil texture: excluding sand and heavy clay.

Depth of surface peat: less than 50 cm (20 inches) if peat well humified and with high base status over 50 cm (20 inches).

Depth to acid sulphate layer: deeper than 75 cm (30 inches).

Salinity: less than 500 microhm/cm at 25°C in surface 75 cm (30 inches).

Workability: less than 25 per cent of surface stones and rocks.

*Does 'imperfect mean any water logging?'  
become the crops cannot tolerate any water logging*

**No.**

Group

5:

Pulses,  
Soybeans ✓  
Maize,

Sorghum,  
Chillies.

7:  
Grasses  
(Kodhu)

Luzerne grass (1)  
Citravalle grass (2)

6: Live grass (3)

Grasses *Stylosanthes* L.  
(pasture) *Stylosanthes* Nees.

(2) *Stylosanthes* L.

var. *Stylosanthes* Nees.

(3) *Stylosanthes* L.

Other

Groups and Crop groups

Group & changed to 10.

Requirements

Slope: 0-5 degrees, with conservation to 10 degrees.

Drainage: very well, to imperfect. ✓

Flooding: none. *Soil layers on this soil, no water logging is the, significantly different from, probably will be*

Effective soil depth: deeper than 50 cm (20 inches), and rocks.

Soil texture: excluding loamy sand and lighter textures, and heavy clay.

Depth of surface peat: less than 50 cm (20 inches).

Depth to acid sulphate layer: deeper than 75 cm (30 inches).

Salinity: less than 600 micromhos/cm at 25°C in surface 75 cm (30 inches).

Workability: less than 25 per cent of surface stones and rocks.

Soil texture: excluding loamy sand and lighter textures.

Slope: 0-15 degrees, to 20 degrees only after successful trials.

Drainage: well to imperfect; some grass species will thrive on poor *and soil texture: no restriction, considering the range of grasses available.* ✓

Salt and very poorly drained soils but zero grazing will have to be practised.

Flooding: infrequent and of short duration, on stones and rocks.

Effective soil depth: deeper than 50 cm (20 inches).

Soil texture: excluding sand and loamy sand; some species will thrive on sand and loamy sand.

No. 1



Group

Groups and Crops/Group

8:

Banana,

Sugar cane,

Ramie,

Papaya.

Cassava,

Pigeon,

Citrus,

Avocado

9:

Pineapple

*From the depth of the soil this is the most shallow soil of the lot. That the soil is too shallow to grow pine apple plants, crop groups 8 will be grown on the previous about peat.*

Requirements

Slope: 0-10 degrees, with conservation to 15 degrees. 50 cm (20 inches).

*mod. well.*

Drainage: very well to imperfect. of surface stones and rocks, few

Flooding: none. *to prevent ed of about elevation*

Effective soil depth: deeper than <sup>60</sup> 35 cm (24 inches).

Soil texture: excluding loamy sand and lighter textures.

Depth of surface peat: less than 25 cm (10 inches).

Depth to acid sulphate layer: deeper than 75 cm (30 inches).

Salinity: less than 100 microhmoh/cm at 25°C in surface 75 cm (30 inches).

Workability: less than 25 per cent of surface stones and rocks. Light

*textures excluding clay.*

Slope: 0-10 degrees. Less than 50 cm (20 inches).

Drainage: very well to imperfect. Less than 100 cm (40 inches).

Flooding: none. Less than 100 microhmoh/cm at 25°C in surface 100 cm (40 inches).

Effective soil depth: deeper than 25 cm (10 inches) if well drained.

Soil texture: excluding medium and coarse sand and heavy clays.

Depth of surface peat: deep peats allowed if drained, well humified

*and with high base status.*

Depth to acid sulphate layer: deeper than 50 cm (20 inches).

Group

*Soil profile  
has been  
classified as  
Mangrove  
Climate  
etc.*

Perennial

Crops

*9 thick groups*

*10, 11 - 12 could be*

*grouped together except*

*that some can*

*stand independent. that*

*division of that with*

*other cannot be that*

*any of these*

*Not sure  
them about*

Groups and Crops

*Coffee, (C. arabica and C. liberica)*

*Avocado*

*Pepper*

*Citrus*

*10:*

*Cocoa,*

*Pepper,*

*Citrus,*

*Avocado*

*(Persea americana)*

*Mangosteen*

*(Garcinia mangostana)*

*Mango*

*(Mangifera indica)*

*11:*

*Oil palm,*

Requirements

Salinity: less than 100 micromhos/cm at 25°C in surface 50 cm (20 inches).

Workability: less than 25 per cent of surface stones and rocks, few

submerged timbers in past.

Slope: 0-25 degrees, with conservation above 10 degrees.

Drainage: well and moderately well.

Flooding: none.

Effective soil depth: deeper than 75 cm (30 inches).

Soil texture: excluding loamy sand and lighter textures. Citrus light

textures excluding clays.

Depth of surface peat: less than 50 cm (20 inches).

Depth to acid sulphate layer: deeper than 100 cm (40 inches).

Salinity: less than 100 micromhos/cm at 25°C in surface 100 cm (40 inches).

Workability: less than 25 per cent of surface stones and rocks.

Slope: 0-25 degrees, with conservation above 10 degrees.

Drainage: well and moderately well.

Group

Groups and Crops/groups

Coffee, (*Rubra* and *Liberica*)

Areca nut,

Rambutan,

Nutmeg,

Cloves,

Cinnamon

12:

Rubber,

Tea,

Brazil nut,

Guava,

Burian, *(Burmese Pineapple)*

Anatto *(Bixa orellana)*

(Bixa orellana)

Forest plantations

So far we have not considered this should we? Climate: *climatic ally* *okay to be*

Requirements

Flooding: none, for oil palm flooding up to a week would be acceptable.

Effective soil depth: deeper than <sup>60</sup> 35 cm (<sup>24</sup> 30 inches).

Soil texture: excluding sandy loam and lighter textures.

Depth of surface peat: less than 50 cm (20 inches).

Depth to acid sulphate layer: deeper than 100 cm (40 inches).

Salinity: less than 100 micromhos/cm at 25°C in surface 100 cm (40 inches).

Workability: less than 50 per cent of surface stones and rocks.

Depth of acid sulphate layer: deeper than 75 cm (30 inches).

Slope: 0-25 degrees, with conservation above 10 degrees. 30 cm (40 inches).

Drainage: very well to imperfect. of surface stones and rocks.

Flooding: zone. infrequent and of short duration.

Effective soil depth: deeper than <sup>60</sup> 25 cm (<sup>24</sup> 30 inches).

Soil texture: excluding sandy loam and lighter textures.

Depth of surface peat: less than 75 cm (30 inches), for rubber and

Tea 100 cm (40 inches), provided peat is well humified, and with acceptable lime status.

Depth to acid sulphate layer: deeper than 100 cm (40 inches).

Salinity: less than 100 micromhos/cm at 25°C in surface 100 cm (40 inches).

Workability: less than 50 per cent of surface stones and rocks.

Group

Groups and Crops

Requirements

13: Coconut, Cashew  
plantations with regeneration

Slope: 0-25 degrees, with conservation above 10 degrees.  
Drainage: very well - imperfect.  
Flooding: infrequent and of short duration.  
Effective soil depth: deeper than 50 cm (20 inches).  
Soil texture: no restriction.  
Depth of surface peat: less than 75 cm, deeper if peat well humified and of high base status.  
Depth of acid sulphate layer: deeper than 75 cm (30 inches).  
Salinity: less than 500 micromhos/cm at 25°C in surface 50 cm (20 inches).  
Workability: less than 50 per cent of surface stones and rocks.

Forest

14: Illipinut  
(Enkabang Pinang,  
Shorea Brachyptera),  
Bamboo,  
Forest plantations,

Slope: 0-30 degrees.  
Drainage: very well to imperfect.  
Flooding: infrequent.  
Effective soil depth: deeper than 50 cm (20 inches).  
Soil texture: no restriction, sand and loamy sand are unsuitable for certain tree species to be selected. ✓

Group

Groups and Croplands

Forest under controlled  
exploitation with regeneration

Requirements

Depth of surface peat: no restriction for Shorea alba; Mixed  
Dipterocarp forest less than 200 cm (80 inches); bamboo and  
illipinit less than 75 cm (30 inches).

Depth of acid sulphate layer: deeper than 100 cm (40 inches); not  
applicable to mangrove species.

Salinity: less than 500 micromhos/cm at 25°C in surface 100 cm  
(40 inches); not applicable to mangrove species.

Workability: not applicable.

15:

Sago

Slope: 0-5 degrees.

Drainage: poor and very poor.

Flooding: no restriction.

Effective soil depth: deeper than 50 cm (20 inches).

Soil texture: excluding loamy sand and lighter.

Depth of surface peat: less than 50 cm (20 inches).

Depth to acid sulphate layer: deeper than 50 cm (20 inches).

Vanilla

Climate unsuitable.

requires 3 months of dry weather during the year.

Depth phases (rooting depth)

0 - 50 cm	(0 - 20 inches)	- 1.	Very shallow
51 - 60 "	(20 - 24 "	- 2	shallow
61 - 75 "	(24 - 30 "	- 3.	mod. shallow
76 - 100 "	(30 - 40 "	- 4	mod. deep.
over 100 cm.	(over <del>100</del> <sup>40</sup> "	- 5	deep.

0 - 5 1  
5 - 10 2  
10 - 15 3  
15 - 20 4  
20 - 25 5  
4 25 - 30 6  
< 30 7

~~Depth~~

~~Sq. Karabunya~~

~~1 0 - 50  
2 50 - 75  
3 75 - 100  
4 > 100~~

CROP	SOIL REQUIREMENT	TOPOGRAPHIC REQUIREMENT	CLIMATIC REQUIREMENTS
(1) Rubber	Munchong, Segamat, Serdang, Durian, Telemong, Bungor, Malacca	0 - 18° (a. from 16° increase 20°) Flooding # Undesirable	Jengka climate well suited
(2) Oil Palm	Good soils should be deep, rich in humus and with good permeability Serdang, Munchong, Malacca, Durian, could be suitable	Flat areas best as fruit evacuation costs will be low. Labour efficiency in harvesting will be higher than in steep areas	Optimum mean temp. 26°C (79°F) optimum annual rainfall 80" - 120" minimum 40" Higher demand for light
(3) Coconuts	Wide adaptability on well drained soils - grows in sandy or clayey soils Serdang, Segamat, Munchong, Malacca, Durian could be suitable	Flat land best as fruit collection will be less costly	Annual rainfall 50" - 100" Temp. 80° - 90°F.
(4) Tapioca	Rich sandy loam best suited to the crop to the crop pH range 6.0 - 7.5 Serdang and Munchong could be suitable.	Preferably flat - annual crop - requires lifting erosional hazards high	Annual rainfall 50" - 100" and well distributed throughout the year.

CROP	SOIL REQUIREMENT	TOPOGRAPHIC REQUIREMENT	CLIMATIC REQUIREMENTS
(5) Bananas  (10) Manilla	Well drained and at least 3 feet deep. Loading preferable. Serdang, Durian, Segamat, mun-chone could be suitable.	preferably flat for easy harvesting	Crop observed to be growing very well with annual rainfall of 87" - dry periods with rainfall between 4.5 and 5.5/month
(6) Cacao	Soil in Malaya best suited to the crop are those derived from fine grained granite, volcanic soil, the well-drained coastal clays and river deposits. Water table more than 3 feet below. Only Segamat recommended by Department of Agriculture.	Undulating land not recommended	A well distributed annual rainfall of 80" and a temp. of 80° F is best suited. Prolonged dry seasons after yields adversely. Shade essential.
(7) Citrus	Observed to be growing well on Telemong, Segamat and Serdang soil	Flat or undulating	Holdings around Jenka give economical yields.
(8) Pineapples	Serious erosional hazards face pineapple cultivation on upland soils. Crop confined to the coast peak soils	Flat	Malayan pineapple industry centred around areas with annual rainfall of 100 - 110" and temp. of 80 - 85° F.

CROP	SOIL REQUIREMENT	TOPOGRAPHIC REQUIREMENT	CLIMATIC REQUIREMENTS
(9) Rice	Water Logged Akob suitable	Flat <del>and on</del> valley bottoms or coastal alluvium	A well established crop in Malaya.
(10) Manila Hemp	Deep well-drained soils preferable Segamat recommended	Flat or undulating observed to be growing well on 1 in 3 slopes/ (estimated)	Rainfall should not be less than 80"/year.

MC. suggest changing "Optimum requirement" to "acceptable soil and terrain characteristics": - title: Acceptable Soil and Terrain Characteristics for Crop Groups with Similar Demands.

NB/3/SOILS/LUP

OPTIMUM REQUIREMENTS FOR

CROPGROUPS WITH SIMILAR DEMANDS

(Adapted to Sarawak conditions and soils not subjected to human interference)

Group	Cropgroups and crops	Optimum Requirements
Annual Crops	1: Rice (Wetland)	<ul style="list-style-type: none"> <li>✓ Slope: 0-<sup>3</sup> degrees</li> <li>✓ Drainage: <del>Well</del>; Moderately well; imperfectly well, poorly drained.</li> <li>✓ Effective soil depth: Deeper than 30 cm (12 inches)</li> <li>✓ Soil texture: Heavier than sandy clay loam, but loam allowed if watertable constantly high.</li> <li>✓ Depth to acid sulphate layer: Deeper than 30 cm (12 inches).</li> <li>✓ Surface organic layer: Less than 30 cm (12 inches).</li> <li>✓ Salinity: Less than 100 micromhos/cm at 25°C in surface 50 cm (20 inches).</li> <li>✓ Workability: No stones; and submerged timbers in peat.</li> </ul>
	2: Ground nuts Vegetables Tobacco	<ul style="list-style-type: none"> <li>✓ Slope: 0-5 degrees, with conservation to 10 degrees.</li> <li>✓ Drainage: Very well, well, moderately well and imperfect.</li> <li>✓ Effective soil depth: Deeper than 50 cm (20 inches).</li> <li>✓ Soil texture: Excluding sands, and heavy clays.</li> <li>✓ Depth to acid sulphate layer: Deeper than 50 cm (20 inches)</li> </ul>
Non-perennial Crops	3: Cereals Lemon grass Citronella grass Vetiver grass	<ul style="list-style-type: none"> <li>✓ Slope: 0-20 degrees only</li> <li>✓ Drainage: Well</li> <li>✓ Surface organic layer: Less than 30 cm (12 inches); for most vegetables over 120 cm (48 inches) if organic layer well humified and with high base status.</li> <li>✓ Salinity: Less than 100 micromhos/cm at 25°C in surface 60 cm (24 inches).</li> <li>✓ Workability: No stones.</li> </ul>

RDL: suggests well drained soil only of fine texture, to limit loss of water by leaching.

R.I.: Pacli on steeper land? Only temporarily up to 15°.

with fodder grass

R.I. suggests slopes to 8 and 17° respectively

→ Rice (Dry land)

<u>Group</u>	<u>Cropgroups and crops</u>	<u>Optimum Requirements</u>
3:	Tapioca Yams Sweet potatoes Ginger	<ul style="list-style-type: none"> <li>✓ Slope: 0-5 degrees, with conservation to 10 degrees.</li> <li>✓ Drainage: Very well, well, moderately well and imperfect.</li> <li>✓ Effective soil depth: Deeper than 75 cm (30 inches).</li> <li>✓ Soil texture: Excluding sands and heavy clays.</li> <li>✓ Depth to acid sulphate layer: Deeper than 75 cm (30 inches).</li> <li>✓ Surface organic layer: Less than 50 cm (20 inches); tapioca over 50 cm (20 inches) if peat well humified and with high base status.</li> <li>✓ Salinity: Less than 500 micromhos/cm at 25°C in surface 75 cm (30 inches).</li> <li>✓ Workability: No stones.</li> </ul>
4:	Pulses Maize Sorghum Cowpeas Chillies	<ul style="list-style-type: none"> <li>✓ Slope: 0-5 degrees, with conservation to 10 degrees.</li> <li>✓ Drainage: Very well, well, moderately well, and imperfect.</li> <li>✓ Effective soil depth: Deeper than 50 cm (20 inches).</li> <li>✓ Soil texture: Excluding loamy sand and lighter textures, and heavy clay.</li> <li>✓ Depth to acid sulphate layer: Deeper than 50 cm (20 inches).</li> <li>✓ Surface organic layer: Less than 50 cm (20 inches).</li> <li>✓ Salinity: Less than 500 micromhos/cm at 25°C in surface 50 cm (20 inches).</li> <li>✓ Workability: No stones.</li> </ul>
<u>Semi-perennial Crops</u>	5: Grasses (pasture) Lemon grass Citronella grass Vetiver grass	<ul style="list-style-type: none"> <li>✓ Slope: 0-15 degrees, to 20 degrees only after successful trials.</li> <li>✓ Drainage: Well, moderately well, imperfect; poor and very poor for some species.</li> <li>✓ Soil texture: Excluding sand and loamy sand for most species, some species can thrive on sand and loamy sand.</li> <li>✓ Effective soil depth: Deeper than 25 cm (10 inches).</li> </ul>

with fodder gran

RDL: If very poor drained, will management be difficult? Yes.

Cropgroups and crops

Optimum Requirements

Group

Perennial  
crops

Coconut  
Rubber  
Tea  
Cloves  
Nutmeg  
Ginger  
Cassava  
Bananas  
Sugar cane  
Rambie  
Papaya  
Oil palm  
Jackfruit  
Mango  
Pineapple

R.D.L.: drainage required when zero grazing.

6:  
Bananas  
Sugar cane  
Rambie  
Papaya

R.D.L. - drainage required? Yes.

7:  
Pineapple

Coconut  
Rubber  
Tea  
Cloves  
Nutmeg  
Ginger  
Cassava  
Bananas  
Sugar cane  
Rambie  
Papaya  
Oil palm  
Jackfruit  
Mango  
Pineapple

- ✓ Depth to acid sulphate layer: Deeper than 50 cm (20 inches).
- ✓ Surface organic layer: Less than 50 cm (20 inches), if zero-grazing is practised then deep well humified peats could be suitable.
- ✓ Salinity: Less than 500 micromhos/cm at 25°C in surface 50 cm (20 inches).
- ✓ Workability: Less than 25 per cent of surface covered with stones and rocks. Without cultivation less than 50 per cent of surface.
- ✓ Slope: 0-10 degrees, with conservation to 15 degrees.
- ✓ Drainage: Well, moderately well, and imperfect.
- ✓ Soil texture: Excluding loamy sand and lighter textures.
- ✓ Effective soil depth: Deeper than 75 cm (30 inches).
- ✓ Depth to acid sulphate layer: Deeper than 100 cm (40 inches).
- ✓ Surface organic layer: Less than 25 cm (10 inches).
- ✓ Salinity: Less than 100 micromhos/cm at 25°C in surface 100 cm (40 inches).
- ✓ Workability: No stones.
- ✓ Slope: 0-10 degrees.
- ✓ Drainage: Well ~~well~~ to imperfect.
- ✓ Soil texture: Excluding medium and coarse sand, and heavy clays.
- ✓ Effective soil depth: Deeper than 25 cm (10 inches), if well drained.
- ✓ Depth to acid sulphate layer: Deeper than 50 cm (20 inches).
- ✓ Surface organic layer: Deep peats allowed if drained, well humified and of high base status.
- ✓ Salinity: Less than 100 micromhos/cm at 25°C in surface 50 cm (20 inches).
- ✓ Workability: No stones.

R.I. Pineapple cannot stand "wet feet". Agreed, but imperfectly drained is not wet feet.

Cropgroups and crops

Optimum Requirements

Group  
Perennial Crops

- 8:
- Coffee
- Cocoa
- Citrus
- Avocado

- ✓ Slope: 0-20 degrees.
- ✓ Drainage: Well and moderately well.
- ✓ Soil texture: Excluding sandy loam and lighter textures, *and heavy clays.*
- ✓ Effective soil depth: Deeper than 100 cm (40 inches).
- ✓ Workability: Few stones.
- ✓ Depth to acid sulphate layer: Deeper than 150 cm (60 inches).
- ✓ Surface organic layer: Less than 50 cm (20 inches).
- ✓ Salinity: Less than 100 micromhos/cm at 25°C in surface 150 cm (60 inches).

RDL: - Effect of great on regeneration: will this limit to great

- 9:
- Pepper
- Oil palm
- Arecanut
- Mangosteen
- Rambutan -

- ✓ Slope: 0-25 degrees.
- ✓ Drainage: Well to moderately well.
- ✓ Soil texture: Excluding sandy loam and lighter textures.
- ✓ Effective soil depth: Deeper than 100 cm (40 inches).
- ✓ Depth to acid sulphate layer: Deeper than 150 cm (60 inches).
- ✓ Surface organic layer: Less than 75 cm (30 inches).
- ✓ Salinity: Less than 100 micromhos/cm at 25°C in surface 150 cm (60 inches).
- ✓ Workability: No stones.

RDL: - benching required > 20%? Yes.

- 10:
- Coconut
- Rubber
- Tea
- Cloves
- Nutmeg
- Cinnamon
- Brasil nut
- Cashew nut
- Guava
- Durian
- Amatto

- ✓ Slope: 0-25 degrees.
- ✓ Drainage: Very well to moderately well.
- ✓ Soil texture: Excluding sandy loam and lighter textures; cashew nut low demanding therefore sands included for this crop.
- ✓ Effective soil depth: Deeper than 75 cm (30 inches).
- ✓ Depth to acid sulphate layer: Deeper than 100 cm (40 inches).
- ✓ Surface organic layer: Less than 75 cm (30 inches).
- ✓ Salinity: Less than 100 micromhos/cm at 25°C in surface 150 cm (60 inches). Some crops such as coconut can thrive under higher salinity conditions.
- ✓ Workability: Stones over less than 50 per cent of the surface.

ILAY/21/15

For your comment.

Soil characteristics for acceptable crops

Group CROPS

Optimum Requirements

11: ✓ Slope: 0-30 degrees.  
 Illipinut ✓ Drainage: No restriction, illipinut and  
 (Engkabang) bamboo very well to imperfect.  
 Bamboo ✓ Soil texture: No restrictions; sand and  
 Forest plantation Soil texture: No restrictions; sand and  
 Forest under loamy sand are unsuitable for certain  
 controlled tree species.  
 exploitation with regeneration ✓ Effective soil depth: Deeper than 50 cm  
 (20 inches).

✓ Depth to acid sulphate layer: Deeper than  
 150 cm (60 inches), not applicable to  
 mangrove species.

✓ Surface organic layer: No restriction for  
Shorea alba; Mixed Dipterocarp forest  
 less than 200 cm (80 inches), bamboo  
 less than 50 cm (20 inches).

Salinity: Less than 500 micromhos/cm at 25°C  
 in surface 100 cm (40 inches). Not  
 applicable to mangrove species.

Workability: Not applicable.

Surface organic layer: Less than 30 cm  
 (12 inches).  
 No restrictions.

Salinity: Less than 100 micromhos/cm at  
 25°C in surface 50 cm (20 inches).

Workability: No stoned and submerged  
 risk in peat.

Slope: 0-5 degrees, with conservation, 15-  
 40 degrees.

Drainage: Very well, well, moderately well  
 and imperfect.

Effective soil depth: Deeper than 50 cm  
 (20 inches).

Soil texture: Excluding sands, and heavy  
 clays.

Depth to acid sulphate layer: Deeper than  
 50 cm (20 inches).

Surface organic layer: Less than 30 cm  
 (12 inches); for most vegetables over  
 100 cm (40 inches) if organic layer  
 well benefited and with high base  
 status.

Salinity: Less than 100 micromhos/cm at  
 25°C in surface 50 cm (20 inches).

Workability: No stoned and submerged  
 risk in peat.

Annual Crops

To Rice

Intensified Sugarcane

RDL:- Effect of peat  
 on regeneration: will  
 this limit to peat  
 tolerant species.  
 I would have thought  
 so.

12:  
 Forest and  
 other  
 reserves

2:  
 Ground nuts  
 Vegetables  
 Tobacco

Are we going to meet  
 acid sulphate conditions?

ILAY/al/15.5.73

4 seems a bit  
 too deep a  
 peat layer

acceptable soil and terrain characteristics for crop groups with similar demands.

MC

For your comment.

Terrain and Soil Characteristics for acceptable crop growth.

MB/3/SOILS/LUP

OPTIMUM REQUIREMENTS FOR

CROPGROUPS WITH SIMILAR DEMANDS

(Adapted to Sarawak conditions and soils not subjected to human interference) Effective soil depths: Deeper than 75 cm (30 inches).

Group	Cropgroups and crops	Optimum Requirements
1:	Rice	<p>Slope: 0-2 degrees</p> <p>Drainage: Well; moderately well; imperfectly well, poorly drained.</p> <p>Effective soil depth: Deeper than 30 cm (12 inches)</p> <p>Soil texture: Heavier than sandy clay loam, but loam allowed if watertable constantly high.</p> <p>Depth to acid sulphate layer: Deeper than 30 cm (12 inches).</p> <p>Surface organic layer: Less than 30 cm (12 inches).</p> <p>Salinity: Less than 100 micromhos/cm at 25°C in surface 50 cm (20 inches).</p> <p>Workability: No stones and submerged timbers in peat.</p>
2:	Ground nuts Vegetables Tobacco	<p>Slope: 0-5 degrees, with conservation to 5-10 degrees.</p> <p>Drainage: Very well, well, moderately well and imperfect.</p> <p>Effective soil depth: Deeper than 50 cm (20 inches).</p> <p>Soil texture: Excluding sands, and heavy clays. No stones.</p> <p>Depth to acid sulphate layer: Deeper than 50 cm (20 inches)</p> <p>Surface organic layer: Less than 30 cm (12 inches); for most vegetables over 120 cm (48 inches) if organic layer well humified and with high base status.</p> <p>Salinity: Less than 100 micromhos/cm at 25°C in surface 60 cm (24 inches).</p> <p>Workability: No stones and submerged timbers in peat.</p>

Internal Surface flooding

ly high out

do we not call peat?

Falson  
Kadan  
Sergian  
Geyard  
Gillies

Are we going to meet acid sulphate conditions?

It seems a bit too deep a water table layer

maps your other papers

Optimum growth

Group      Cropgroups and crops

Optimum Requirements

- 3:
- Tapioca
- Yams
- Sweet potatoes
- Ginger

Slope: 0-5 degrees, with conservation to 10 degrees.

Drainage: Very well, well, moderately well and imperfect.

Effective soil depth: Deeper than 75 cm (30 inches).

Soil texture: Excluding sands and heavy clays.

Depth to acid sulphate layer: Deeper than 75 cm (30 inches).

Surface organic layer: Less than 50 cm (20 inches); tapioca over 50 cm (20 inches) if peat well humified and with high base status.

Salinity: Less than 500 micromhos/cm at 25°C in surface 75 cm (30 inches).

Workability: No stones.

Why sigh out Tapioca.

- 6:
- Bananas
- Sugar cane
- Rice
- Coconut

- 4:
- Pulses
- Maize
- Sorghum
- Cowpeas
- Chillies

Slope: 0-5 degrees, with conservation to 10 degrees.

Drainage: Very well, well, moderately well, and imperfect.

Effective soil depth: Deeper than 50 cm (20 inches).

Soil texture: Excluding loamy sand and lighter textures, and heavy clay.

Depth to acid sulphate layer: Deeper than 50 cm (20 inches).

Surface organic layer: Less than 50 cm (20 inches).

Salinity: Less than 500 micromhos/cm at 25°C in surface 50 cm (20 inches).

Workability: No stones.

Loamy sands ok.

- Semi-perennial Crops
- 5:
- Grasses
- Lemon grass
- Citronella grass
- Vetiver grass

Effective soil depth: Deeper than 25 cm

Slope: 0-15 degrees, to 20 degrees only after successful trials.

Drainage: Well, moderately well, imperfect; poor and very poor for some species.

Soil texture: Excluding sand and loamy sand for most species, some species can thrive on sand and loamy sand.

Effective soil depth: Deeper than 25 cm (10 inches).

pasture grass

perhaps your other grasses could go into 4.

optimum growth?

Group      Cropgroups and crops

Optimum Requirements

Group

Perennial  
Crops

3:  
Coffee  
Cocoa  
Citrus  
Avocado

Depth to acid sulphate layer: Deeper than 50 cm (20 inches).

Surface organic layer: Less than 50 cm (20 inches), if zero-grazing is practised then deep well humified peats could be suitable.

Salinity: Less than 500 micromhos/cm at 25°C in surface 50 cm (20 inches).

Workability: Less than 25 per cent of surface covered with stones and rocks. Without cultivation less than 50 per cent of surface.

Slope: 0-10 degrees, with conservation to 15 degrees.

Drainage: Well, moderately well, and imperfect.

Soil texture: Excluding loamy sand and lighter textures.

Effective soil depth: Deeper than 75 cm (30 inches).

Depth to acid sulphate layer: Deeper than 100 cm (40 inches).

Surface organic layer: Less than 25 cm (10 inches).

Salinity: Less than 100 micromhos/cm at 25°C in surface 100 cm (40 inches).

Workability: No stones.

Slope: 0-10 degrees.

Drainage: Well well to imperfect.

Soil texture: Excluding medium and coarse sand, and heavy clays.

Effective soil depth: Deeper than 25 cm (10 inches).

Depth to acid sulphate layer: Deeper than 50 cm (20 inches).

Surface organic layer: Deep peats allowed if drained, well humified and of high base status.

Salinity: Less than 100 micromhos/cm at 25°C in surface 50 cm (20 inches).

Workability: No stones. Some crops such as coconut can strive under higher salinity conditions.

Workability: Stones over less than 30 per cent of the surface.

6:  
Bananas  
Sugar cane  
Ramie  
Papaya ←

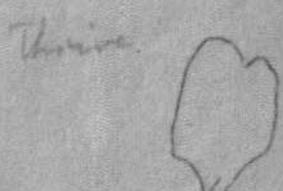
Oil palm  
Arecanut  
Kangaroo  
Pandan

*Depth for oil palm to 30"*

7:  
Pineapple

*Loamy sands ok.*

Tea  
Cloves  
Rubber  
Ginseng  
Ginseng  
Brazil nut  
Cashew nut  
Guava  
Durian



Crop groups and crops

Optimum Requirements

Group

Perennial Crops

- 8:
- Coffee
- Cocoa
- Citrus
- Avocado

Slope: 0-20 degrees.  
 Drainage: Well and moderately well.  
 Soil texture: Excluding sandy loam and lighter textures.  
 Effective soil depth: Deeper than 100 cm (40 inches).  
 Workability: Few stones.  
 Depth to acid sulphate layer: Deeper than 150 cm (60 inches).  
 Surface organic layer: Less than 50 cm (20 inches).  
 Salinity: Less than 100 micromhos/cm at 25°C in surface 150 cm (60 inches).

- 9:
- Pepper
- Oil palm
- Arecanut
- Mangosteen
- Rambutan

Slope: 0-25 degrees.  
 Drainage: Well to moderately well.  
 Soil texture: Excluding sandy loam and lighter textures.  
 Effective soil depth: Deeper than 100 cm (40 inches).  
 Depth to acid sulphate layer: Deeper than 150 cm (60 inches).  
 Surface organic layer: Less than 75 cm (30 inches).  
 Salinity: Less than 100 micromhos/cm at 25°C in surface 150 cm (60 inches).  
 Workability: No stones.

- 10:
- Cocunut
- Rubber
- Tea
- Cloves
- Nutmeg
- Cinnamon
- Brasil nut
- Cashew nut
- Guava
- Durian

Slope: 0-25 degrees.  
 Drainage: Very well to moderately well.  
 Soil texture: Excluding sandy loam and lighter textures; cashew nut low demanding therefore sands included for this crop.  
 Effective soil depth: Deeper than 75 cm (30 inches).  
 Depth to acid sulphate layer: Deeper than 100 cm (40 inches).  
 Surface organic layer: Less than 75 cm (30 inches).  
 Salinity: Less than 100 micromhos/cm at 25°C in surface 150 cm (60 inches). Some crops such as cocunut can strive under higher salinity conditions.  
 Workability: Stones over less than 50 per cent of the surface.

Wooding

all.

to a ?

week

Piggot limited  
depth for oil palm to 30"

ILAY/01/15

Thrive

ETZ

KB/3/BOILS/15

Group

Cropgroups and crops

Optimum Requirements

11:  
Illipinut  
(Engkabang)  
Bamboo

Slope: 0-30 degrees.

Drainage: No restriction, illipinut and bamboo very well to imperfect.

Forest plantation  
Forest under controlled exploitation with regeneration

Soil texture: No restrictions; sand and loamy sand are unsuitable for certain forest tree species.

Effective soil depth: Deeper than 50 cm (20 inches).

Depth to acid sulphate layer: Deeper than 150 cm (60 inches), not applicable to mangrove species.

Surface organic layer: No restriction for Shorea alba; Mixed Dipterocarp forest less than 200 cm (80 inches), bamboo less than 50 cm (20 inches).

Salinity: Less than 500 micromhos/cm at 25°C in surface 100 cm (40 inches). Not applicable to mangrove species.

Workability: Not applicable.

Surface organic layer: Less than 30 cm (12 inches).

No restrictions. Less than 100 micromhos/cm at 25°C in surface 50 cm (20 inches).

Workability: No stones; and submerged timbers in peat.

12:  
Forest and other reserves

Slope: 0-5 degrees, with conservation to 10 degrees.

Drainage: Very well, well, moderately well and imperfect.

Effective soil depth: Deeper than 50 cm (20 inches).

Soil texture: Excluding sands, and heavy clays.

Depth to acid sulphate layer: Deeper than 50 cm (20 inches)

Surface organic layer: Less than 30 cm (12 inches); for most vegetables over 120 cm (48 inches) if organic layer well humified and with high base status.

Salinity: Less than 100 micromhos/cm at 25°C in surface 60 cm (24 inches).

Workability: No stones.

2:  
Ground nuts  
Vegetables  
Tobacco

ILAY/a1/15.5.73

RDL  
CPL

MB/3/SOILS/LUP

OPTIMUM REQUIREMENTS FOR CROPGROUPS WITH SIMILAR DEMANDS

(Adapted to Sarawak conditions and soils not subjected to human interference)

Group	Cropgroups and crops	Optimum Requirements
Annual Crops	1: Rice	<p>Slope: 0-2 degrees</p> <p>Drainage: Well; moderately well; imperfectly well, poorly drained.</p> <p>Effective soil depth: Deeper than 30 cm (12 inches)</p> <p>Soil texture: Heavier than sandy clay loam, but loam allowed if watertable constantly high.</p> <p>Depth to acid sulphate layer: Deeper than 30 cm (12 inches).</p> <p>Surface organic layer: Less than 30 cm (12 inches).</p> <p>Salinity: Less than 100 micromhos/cm at 25°C in surface 50 cm (20 inches).</p> <p>Workability: No stones; and submerged timbers in peat.</p>
	4: Pulses Maize Sorghum Cowpeas Chillies	
	2: Ground nuts Vegetables Tobacco	<p>Slope: 0-5 degrees, with conservation to 10 degrees.</p> <p>Drainage: Very well, well, moderately well and imperfect.</p> <p>Effective soil depth: Deeper than 50 cm (20 inches).</p> <p>Soil texture: Excluding sands, and heavy clays.</p> <p>Depth to acid sulphate layer: Deeper than 50 cm (20 inches)</p> <p>Surface organic layer: Less than 30 cm (12 inches); for most vegetables over 120 cm (48 inches) if organic layer well humified and with high base status.</p> <p>Salinity: Less than 100 micromhos/cm at 25°C in surface 60 cm (24 inches).</p> <p>Workability: No stones.</p>
Semi-perennial Crops	5: Grasses Lemon grass Citronella grass Vetiver grass	

fine textures only if well drained assuming used for irrig.

if easy peat drainage, will not movement be inhibited?

Group                      Cropgroups and crops

Optimum Requirements

3:  
Tapioca  
Yams  
Sweet potatoes  
Ginger

Slope: 0-5 degrees, with conservation to 10 degrees.

Drainage: Very well, well, moderately well and imperfect.

Effective soil depth: Deeper than 75 cm (30 inches).

Soil texture: Excluding sands and heavy clays.

Depth to acid sulphate layer: Deeper than 75 cm (30 inches).

Surface organic layer: Less than 50 cm (20 inches); tapioca over 50 cm (20 inches) if peat well humified and with high base status.

Salinity: Less than 500 micromhos/cm at 25°C in surface 75 cm (30 inches).

Workability: No stones.

4:  
Bananas  
Sugar cane  
Rice  
Papaya

Slope: 0-5 degrees, with conservation to 10 degrees.

Drainage: Very well, well, moderately well, and imperfect.

Effective soil depth: Deeper than 50 cm (20 inches).

Soil texture: Excluding loamy sand and lighter textures, and heavy clay.

Depth to acid sulphate layer: Deeper than 50 cm (20 inches).

Surface organic layer: Less than 50 cm (20 inches).

Salinity: Less than 500 micromhos/cm at 25°C in surface 50 cm (20 inches).

Workability: No stones.

5:  
Pulses  
Maize  
Sorghum  
Cowpeas  
Chillies

Slope: 0-15 degrees, to 20 degrees only after successful trials.

Drainage: Well, moderately well, imperfect; poor and very poor for some species.

Soil texture: Excluding sand and loamy sand for most species, some species can thrive on sand and loamy sand.

Effective soil depth: Deeper than 25 cm (10 inches).

Semi-perennial Crops  
Lemon grass  
Citronella grass  
Vetiver grass

*if very poor drainage, will not management be difficult?*



Cropgroups and crops

Optimum Requirements

Group

Perennial Crops

- 8:
- Coffee
- Cocoa
- Citrus
- Avocado

- 9:
- Pepper
- Oil palm
- Arecanut
- Mangosteen
- Rambutan

- 10:
- Coconut
- Rubber
- Tea
- Cloves
- Nutmeg
- Cinnamon
- Brazil nut
- Cashew nut
- Guava
- Durian

Slope: 0-20 degrees.

Drainage: Well and moderately well.

Soil texture: Excluding sandy loam and lighter textures.

Effective soil depth: Deeper than 100 cm (40 inches).

Workability: Few stones.

Depth to acid sulphate layer: Deeper than 150 cm (60 inches).

Surface organic layer: Less than 50 cm (20 inches).

Salinity: Less than 100 micromhos/cm at 25°C in surface 150 cm (60 inches).

Slope: 0-25 degrees.

Drainage: Well to moderately well.

Soil texture: Excluding sandy loam and lighter textures.

Effective soil depth: Deeper than 100 cm (40 inches).

Depth to acid sulphate layer: Deeper than 150 cm (60 inches).

Surface organic layer: Less than 75 cm (30 inches).

Salinity: Less than 100 micromhos/cm at 25°C in surface 150 cm (60 inches).

Workability: No stones.

Slope: 0-25 degrees.

Drainage: Very well to moderately well.

Soil texture: Excluding sandy loam and lighter textures; cashew nut low demanding therefore sands included for this crop.

Effective soil depth: Deeper than 75 cm (30 inches).

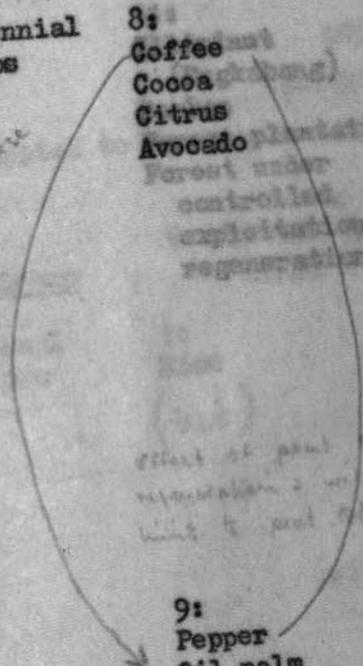
Depth to acid sulphate layer: Deeper than 100 cm (40 inches).

Surface organic layer: Less than 75 cm (30 inches).

Salinity: Less than 100 micromhos/cm at 25°C in surface 150 cm (60 inches). Some crops such as coconut can thrive under higher salinity conditions.

Workability: Stones over less than 50 per cent of the surface.

4 Crops



Pepper preferably in a group by itself, 20 inches apart, on slope, and straight if slope gentle.

11/21/15

Coconut does not appear to fit in here, it grows reasonably well on sandy loams, and on near up to 40 inches.

For your comment.

Group CROPS

Optimum Requirements

11: Illipinut (Engkabang) Bamboo Forest plantation Forest under controlled exploitation with regeneration

Slope: 0-30 degrees. Drainage: No restriction, illipinut and bamboo very well to imperfect. Soil texture: No restrictions; sand and loamy sand are unsuitable for certain forest tree species. Effective soil depth: Deeper than 50 cm (20 inches). Depth to acid sulphate layer: Deeper than 150 cm (60 inches), not applicable to mangrove species.

(Adapted to)

Annual Crops

12: Rice (but) effect of plant on regeneration will this limit to plant tolerant species?

Surface organic layer: No restriction for Shorea alba; Mixed Dipterocarp forest less than 200 cm (80 inches), bamboo less than 50 cm (20 inches). Salinity: Less than 500 micromhos/cm at 25°C in surface 100 cm (40 inches). Not applicable to mangrove species. Workability: Not applicable.

12: Forest and other reserves

No restrictions. Workability: No stumps and submerged fishers in peat.

2: Ground nuts Vegetables Tobacco

Slope: 0-5 degrees, with conservation to 10 degrees. Drainage: Very well, well, moderately well and imperfect. Effective soil depth: Deeper than 50 cm (20 inches). Soil texture: Excluding sands, and heavy clays. Depth to acid sulphate layer: Deeper than 50 cm (20 inches).

ILAY/al/15.5.73

Surface organic layer: Less than 30 cm (12 inches); for most vegetables over 120 cm (48 inches) if organic layer well humified and with high base status. Salinity: Less than 100 micromhos/cm at 25°C in surface 50 cm (20 inches). Workability: No stumps.

R.I. ✓

For your comments

MB/3/SOILS/LUP

Optimum Requirements

OPTIMUM REQUIREMENTS FOR CROPGROUPS WITH SIMILAR DEMANDS  
(Adapted to Sarawak conditions and soils not subjected to human interference)  
Slope: 0-5 degrees, with conservation to  
Effective soil depth: Deeper than 75 cm (30 inches).

<u>Group</u>	<u>Cropgroups and crops</u>	<u>Optimum Requirements</u>
Annual Crops	1: Rice (Wet)	<p>Slope: 0-7 degrees</p> <p>Drainage: Well; moderately well; to imperfectly well; poorly drained.</p> <p>Effective soil depth: Deeper than 30 cm (12 inches)</p> <p>Soil texture: Heavier than sandy clay loam, but loam allowed if watertable constantly high.</p> <p>Depth to acid sulphate layer: Deeper than 30 cm (12 inches).</p> <p>Surface organic layer: Less than 30 cm (12 inches).</p> <p>Salinity: Less than 100 micromhos/cm at 25°C in surface 50 cm (20 inches).</p> <p>Workability: No stones; and submerged timbers in peat.</p>
	2: Ground nuts Vegetables Tobacco	<p>Slope: 0-5 degrees, with conservation to 10 degrees. - 12%</p> <p>Drainage: Very well, well, moderately well and imperfect.</p> <p>Effective soil depth: Deeper than 50 cm (20 inches).</p> <p>Soil texture: Excluding sands, and heavy clays.</p> <p>Depth to acid sulphate layer: Deeper than 50 cm (20 inches)</p> <p>Surface organic layer: Less than 30 cm (12 inches); for most vegetables over 120 cm (48 inches) if organic layer well humified and with high base status.</p> <p>Salinity: Less than 100 micromhos/cm at 25°C in surface 60 cm (24 inches).</p> <p>Workability: No stones.</p>
Semi-perennial Crops	3: Grasses Lemon grass Citrosella grass Vetiver grass	<p>Slope: 0-20 degrees only</p> <p>Drainage: Well</p> <p>Soil texture: Excluding sand and heavy clays</p> <p>Salinity: Less than 100 micromhos/cm at 25°C in surface 60 cm (24 inches).</p> <p>Workability: No stones.</p>

Group                      Cropgroups and  
crops

Optimum Requirements

- 3:
- Tapioca
- Yams
- Sweet potatoes
- Ginger

Slope: 0-5 degrees, with conservation to 10 degrees.

Drainage: Very well, well, moderately well and imperfect.

Effective soil depth: Deeper than 75 cm (30 inches).

Soil texture: Excluding sands and heavy clays.

Depth to acid sulphate layer: Deeper than 75 cm (30 inches).

Surface organic layer: Less than 50 cm (20 inches); tapioca over 50 cm (20 inches) if peat well humified and with high base status.

- 6:
- Bananas
- Sugar cane
- Banana
- Papaya

Slope: 0-5 degrees, with conservation to 10 degrees.

Drainage: Very well, well, moderately well, and imperfect.

Effective soil depth: Deeper than 50 cm (20 inches).

Soil texture: Excluding loamy sand and lighter textures.

Depth to acid sulphate layer: Deeper than 50 cm (20 inches).

Surface organic layer: Less than 50 cm (20 inches).

Salinity: Less than 500 micromhos/cm at 25°C in surface 75 cm (30 inches).

Workability: No stones.

- 4:
- Pulses
- Maize
- Sorghum
- Cowpeas
- Chillies

Slope: 0-5 degrees, with conservation to 10 degrees.

Drainage: Very well, well, moderately well, and imperfect.

Effective soil depth: Deeper than 50 cm (20 inches).

Soil texture: Excluding loamy sand and lighter textures, and heavy clay.

Depth to acid sulphate layer: Deeper than 50 cm (20 inches).

Surface organic layer: Less than 50 cm (20 inches).

- 7:
- Pineapple

Slope: 0-15 degrees, to 20 degrees only after successful trials.

Drainage: Well, moderately well, imperfect; poor and very poor for some species.

Soil texture: Excluding sand and loamy sand for most species, some species can thrive on sand and loamy sand.

Effective soil depth: Deeper than 25 cm (10 inches).

- Semi-perennial Crops
- 5:
- Grasses
- Lemon grass
- Citronella grass
- Vetiver grass

*perfect in soil - but feet*

*no cannot...*

*large*

*give rise to X*

*these problems*

*drainage?*

Cropgroups and crops

Optimum Requirements

Group

Perennial Crops

- Coffee
- Cocoa
- Citrus
- Avocado

clay / heavy clay  
 light textured  
 (not too sandy)

6:

- Bananas
- Sugar cane
- Ramie
- Papaya

- Oil palm
- Areca nut
- Mango tree
- Rubber tree

imperfect in not  
 "wet feet"

er cannot  
 "wet feet"  
 give rise to  
 disease problems.

least 20" free  
 draining?

7:

Pineapple

- Coconut
- Rubber
- Tea
- Clayon
- Katag
- xx xx
- Brazil nut
- Cashew nut
- Guava
- Burian

Depth to acid sulphate layer: Deeper than 50 cm (20 inches).

Surface organic layer: Less than 50 cm (20 inches), if zero-grazing is practised then deep well humified peats could be suitable.

Salinity: Less than 500 micromhos/cm at 25°C in surface 50 cm (20 inches).

Workability: Less than 25 per cent of surface covered with stones and rocks. Without cultivation less than 50 per cent of surface.

Slope: 0-10 degrees, with conservation to 15 degrees.

Drainage: Well, moderately well, and imperfect.

Soil texture: Excluding loamy sand and lighter textures.

Effective soil depth: Deeper than 75 cm (30 inches).

Depth to acid sulphate layer: Deeper than 100 cm (40 inches).

Surface organic layer: Less than 25 cm (10 inches).

Salinity: Less than 100 micromhos/cm at 25°C in surface 100 cm (40 inches).

Workability: No stones.

Slope: 0-10 degrees.

Drainage: Well to imperfect.

Soil texture: Excluding medium and coarse sand, and heavy clays. \*

Effective soil depth: Deeper than 25 cm (10 inches), if well drained.

Depth to acid sulphate layer: Deeper than 50 cm (20 inches).

Surface organic layer: Deep peats allowed if drained, well humified and of high base status.

Salinity: Less than 100 micromhos/cm at 25°C in surface 50 cm (20 inches).

Workability: No stones. Some crops such as coconut can thrive under higher salinity conditions.

Workability: Stones over less than 50 per cent of the surface.

Group                      Cropgroups and  
crops

Optimum Requirements

Perennial  
Crops

- 8:
- Coffee
- Cocoa
- Citrus
- Avocado

clay/heavy clay  
lighter textured  
(not too sandy)

Slope: 0-20 degrees.  
 Drainage: Well and moderately well.  
 Soil texture: Excluding sandy loam, ~~and~~ lighter textures, ~~and~~ heavy clays.  
 Effective soil depth: Deeper than 100 cm (40 inches).  
 Workability: Few stones.  
 Depth to acid sulphate layer: Deeper than 150 cm (60 inches). ~~not applicable to~~  
 Surface organic layer: Less than 50 cm (20 inches). ~~No restriction for~~  
 Salinity: Less than 100 micromhos/cm at 25°C in surface 150 cm (60 inches).

- 9:
- Pepper
- Oil palm
- Arecanut
- Mangosteen
- Rambutan
- Forest and other trees

Slope: 0-25 degrees.  
 Drainage: Well to moderately well.  
 Soil texture: Excluding sandy loam and lighter textures.  
 Effective soil depth: Deeper than 100 cm (40 inches).  
 Depth to acid sulphate layer: Deeper than 150 cm (60 inches).  
 Surface organic layer: Less than 75 cm (30 inches).  
 Salinity: Less than 100 micromhos/cm at 25°C in surface 150 cm (60 inches).  
 Workability: No stones.

- 10:
- Coconut
- Rubber
- Tea
- Cloves
- Nutmeg
- Cinnamon
- Brasil nut
- Cashew nut
- Guava
- Durian

MAY/21/15

Slope: 0-25 degrees.  
 Drainage: Very well to moderately well.  
 Soil texture: Excluding sandy loam and lighter textures; cashew nut low demanding therefore sands included for this crop.  
 Effective soil depth: Deeper than 75 cm (30 inches).  
 Depth to acid sulphate layer: Deeper than 100 cm (40 inches).  
 Surface organic layer: Less than 75 cm (30 inches).  
 Salinity: Less than 100 micromhos/cm at 25°C in surface 150 cm (60 inches). Some crops such as coconut can thrive under higher salinity conditions.  
 Workability: Stones over less than 50 per cent of the surface.



15th June, 1973

ARC.237/(9)

I.L.A. Yaselawidan,  
Miri-Bintulu Project,  
Project Manager,  
Miri-Bintulu Feasibility Study,  
PWD Depot,  
Pujut Road,  
Miri.

*File 144/3/Soils*

I enclose herewith four copies (including two for Chin Pang) of  
Dear Mr. Cooper,

I have a copy of 'Minimum Soil and Terrain Requirements for  
Cropgroups with similar Demands - Adapted to Sarawak Conditions' written by  
your consultants and conveyed to us through Mr. I. Scott. The following  
comments are the main ones from my research officers :-

1. P.2 - 3 : Rice (dryland). Hill padi is grown mostly on  
slopes of 30 - 60°. The slope 0 - 5 degrees, with conservation  
to 15 degrees is ideal condition for growing the crop. The length  
of fallow is agreed, but considered not practical.
2. P.3 - 4 : Tapioca. Very heavy clays should be excluded as  
the soil texture may impede root development. Unimproved peats  
deeper than 50 cm are always low in bases. Such peats with high  
base status are theoretical under Sarawak conditions.
3. P.4 - 6 : Grasses. It is stated that zero grazing must be  
practiced for pasture grown on poorly and very poorly drained soils.  
This would mean that harvest of pasture by machines or hands are  
necessary. The former means additional investment in machine and  
operational costs and in any case cannot be used where topography  
does not favour mechanization (e.g. water-logged area are at the  
bottom of valley). It is doubtful that the use of hand labour to  
harvest pasture is economical. Zero grazing is even less practical  
here because our topography is more hilly.

We are of the opinion that the pasture on wet and poorly drained  
soil can be grazed lightly without causing excessive damage to the  
soil surface on selected grasses (e.g. Bracharia mutica - which seems  
promising for water-logged area and can withstand only light grazing).

4. P.5 - 7 : Vetiver grass should not be grown on soil with heavy  
texture as it may impede the growth of root and also will make harvesting  
of roots difficult.

Incidentally, it is noted that soya beans has been left out in  
your Tables.

Yours faithfully,

I fully appreciate that you are now at the stage where you have to  
have a system to adhere to for the project and cannot wait for any further  
changes. I would suggest that you accept the system as it  
stands at present, with the small changes which are close to Kyalaw. The  
Bekenu family to isolate those soils which are close to Kyalaw. The  
definition of the soil series profile on file. I hope they  
occur somewhere else.

(E.S. Sim)  
Assistant Director of Agriculture  
(Research), Semongok

c.c. Soil Surveyor (Central Sarawak)

ESS/is



DEPARTMENT OF AGRICULTURE,  
SARAWAK.

25th May, 1973

480/(49)

Mr. I.L.A. Ysselmuiden,  
c/o Miri-Bintulu Project,  
PWD Depot,  
Pujut Road,  
Miri.

Dear Reen,

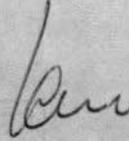
I enclose herewith four copies (including two for Chin Pang) of the draft soil classification as promised.

MS/12  
This was on stencil before Chin Pang's notes (attached to your MD/3/SOILS/LUP of 18/5/73) arrived and I did not want to make further changes at that stage. Most of the comments are, in any case disposed of already in the draft. Ramun/Terbat are ignored for the present, as are the skeletal soils of igneous rocks. The Gaya-Kelup-Binatang scheme has already been altered and partly conforms to your views (and is unimportant anyway). Regarding the three comments on the second, hand-written sheet, firstly one cannot confine Kapit to steep and hilly country. That would not be a soil feature in itself and would be inconsistent with the rest of the classification. I also have Kapits in intermittent patches on ridge summits which are neither high nor steep. The only landform which can be separated out is the alluvial plain associated with Binatang and Kelupu (and note that even in these soils the paralithic material which is their main feature is still residual). Secondly, Semilajau is made a coarse loam series rather than a coarse and fine loam family partly for convenience, on arguments already stated; that any splits made in well-drained alluvials must be repeated for both poorly-drained nonsaline and poorly-drained saline alluvials, to avoid confusing intergrade nomenclature. Splitting as for the residual soils does not arise. No alluvial/residual intergrades are possible and these groups are treated independantly. (If there is doubt regarding the derivation of the soil this is decided by carbon figures as a last resort.) As is stated in the preamble to the system a Semilajau coarse-fine loam series is also not possible. No series can extend beyond one texture grouping. If the family extends to a larger texture range a split into single texture groups is automatically made at series level. Thirdly, keeping Merit to constant hue is too restrictive, to my mind. 10YR over 7.5YR is common and 10YR/7.5YR/5YR also occurs. The important point is that whatever happens at the bottom Merit is typically 10YR at the top. Jakar, on the other hand, is over red or purple siltstones or mudstones and is uniformly 7.5YR or redder throughout. It is not the increase in hue which is being contrasted with uniform profiles, but the very red ones which are being separated from the rest here. There may be a case for separating constant hue profiles (10YR or yellower) off at series level as I mentioned in passing when in Miri but it is difficult to justify. It is done in Bekenu Family to isolate those soils which are close to Nyalau. The definitions are not yet very satisfactory here, but have been left meanwhile. One irritating feature is that all my Bekenu family soils are Sarikei series; I don't seem to have a Bekenu series profile on file. I hope they occur somewhere else.

I fully appreciate that you are now at the stage where you have to have a system to adhere to for the project and cannot wait for many further changes. I would suggest, therefore, that you accept the system as it stands at present, with the exception of Kabuloh, and propose any required

series within that family which we can then discuss immediately and come to a decision on. With those amendments the system can be considered final for your purpose. It is probably best left to settle for a bit after that and can be stirred around again next year when it has been applied in practice for a while and when your profile data are all available for consideration.

Regards



(I.M. Scott)  
Soil Surveyor, Central Sarawak.

IMS/le.

Profile

Salinity  
(EC) at

Depth  
Sulphur

Depth  
Organic

St/

Surface

Natural

# LAND CAPABILITY CLASSIFICATION

1st Nyirru: maximum May 1973  
Subject to alterations.

CLASS	I	II	III	IV	V	VI	VII
KIND OF LIMITATION							
Maximum slope in degrees and Texture.	2° Maximum percentage Coarse sand and mm. AWC. to be worked out.	5° - heavier than NYALAU 4° - NYALAU and lighter textured.	10° - heavier than NYALAU 5° - NYALAU and lighter textured.	15° - heavier than NYALAU 10° - NYALAU and lighter textured.	20° - heavier than NYALAU 15° - NYALAU and lighter textured.	25° heavier than NYALAU 20° - NYALAU and lighter textured.	Over 25° - heavier than NYALAU Over 20° - NYALAU and lighter textured.
Effective soil Depth	deeper than 150 cm	deeper than 100 cm, if stoneline or concretionary layer present this should be less than 15 cm.	deeper than 100 cm.	deeper than 50 cm.	to max. 20° slope, deeper than 50 cm to max. 15° slope, deeper than 50 cm.	to maximum of 25° slope, deeper than 75 cm. to maximum of 20° slope deeper than 75 cm.	No limit
Drainage	Well drained	Moderately well drained	Imperfectly & very well drained.	Very poorly Poorly/draind.	Very poorly or excessively drained.	No limit	No limit
Risk of Flooding	None.	Infrequent and of short duration	Infrequent and of short duration	Common and of moderate duration.	Frequent	No limit	No limit
Salinity (EC micro mhos/cm at 25°C)	less than 100 in top 150 cm.	less than 100 in top 100 cm	less than 100 in top 100 cm	less than 500 in top 100 cm.	less than 500 in top 75 cm.	less than 500 in top 50 cm	No limit
Depth to Acid Sulphate Layer.	less than 0.1 percent Sulphate at pH 3.3 or higher, in top 150 cm.	less than 0.1 percent Sulphate at pH 3.3 or higher, in top 100 cm	less than 0.1 percent Sulphate at pH 3.3 or higher in top 100 cm	less than 0.1 percent Sulphate at pH 3.3 or higher in top 150 cm.	less than 0.1 percent Sulphate at pH 3.3 or higher in top 50 cm.	less than 0.1 percent Sulphate at pH 3.3 or higher in top 50 cm	No limit
Depth of Overlying Organic Layer.	Not present	Not present	less than 50 cm	less than 75 cm	less than 100 cm.	less than 200 cm	No limit.
Structure	Well structured	Moderately well structured.	Moderately well structured; slightly compacted.	Weakly structured; moderately compacted	Weakly structured; compacted.	No structure; cemented.	No limit
Surface Rocks and Stones.	None or few	less than 10 percent of surface.	less than 25 percent of surface	less than 50 percent of surface.	less than 75 percent of surface	less than 75 percent of surface.	Over 75 percent of surface
Nutrient Imbalance	slight and easily ameliorated.	moderate and easily ameliorated.	moderate and easily ameliorated.	severe, difficult to ameliorate.	severe.	severe	No limit