

## Papua New Guinea Forest Soil Fact Sheet no. 1

# Madang province – Gleysol in tuffaceous silty terrace alluvium

### Site description

*Occurrence:* Madang province on lowlands below 300 m altitude; rainfall c. 3000-4000 mm

*Parent Rock:* Weakly consolidated silty tuffaceous Quaternary or Pliocene sediments of estuarine origin

*Parent Material and Landform:* Silty alluvium on terraces among dissected low hills

*Drainage Class:* Imperfectly drained

*Vegetation:* Secondary regenerating lowland rainforest

### Distinguishing Soil Properties

*Profile features:*

- Well-developed topsoils with weakly developed structure (peds)
- Silty loam to clay loam textures
- Light grey mottles below topsoil and grey mottles deep in the profile – may be waterlogged for short periods

*Chemical and physical features*

- Medium to high exchangeable calcium and magnesium values
- Slightly to moderately acid
- Medium carbon values in topsoil
- Medium P retention

### Previous description

Imperfectly drained soils of the Karamsarik and Warwin families (CSIRO Land Research Series 37, pages 83 and 84) are similar

### NFI reference

Paia Mt profile. NFI cluster 64259 is 2.34 km northeast of profile site; see profile description for site details

### Degradation potential

- Moderately erodible
- Prone to landslides at terrace margins
- Soils readily damaged and compacted by heavy machinery, particularly when wet



Paia Mt. 13 March 2016

# Location Map



## Site Productivity

Medium to high; intensive use of site may reduce production capacity; clearing and burning may reduce productivity.

## Soil Management

Limit machinery use in wet soil conditions; limit number of skid tracks; avoid compaction and mixing of topsoils. Gap planting with selected native species should be undertaken in degraded areas. Burning, if undertaken, should be by cool fires.

## Suitability for Plantations or Alternative Land Uses

**Plantation suitability:** moderately suitable for trees that can tolerate wet soils; periodic applications of phosphorus, potassium and nitrogen may be required for plantations

**Gardens:** moderately suitable; waterlogging is a limitation

**Intensive horticulture:** low to moderately suitable; waterlogging is a limitation; regular cultivation not recommended because of weakly developed soil structure (peds); nutrient deficiencies may occur, particularly of phosphorus

**Alternative tree crops:** cocoa, rubber, palm oil plantations

**Fertilisers required:** phosphorus; potassium and nitrogen may be required once topsoil reserves are depleted

## Profile

*Profile name:* Paia Mt

*NFI reference:* NFI cluster 64259 is 2.34 km northeast of the profile site.

*Authors:* Nalish Sam and Leroy Moripi

*Date:* 13 March 2016

*Location:* Pit on terrace, 250 m east of Paia Mountain village. Take side road north to Paia Mountain village.

Opposite village is a garden with a path leading down to a small stream with steep banks. Cross this stream (going eastwards) and climb up to second terrace. Pit is on second terrace. Above the terrace is a low hill with a skid track

*Map reference:* GDA 55G 303043 9432682

*Landform:* Terrace of minor stream in dissected undulating landscape of low hills.

*Vegetation:* *Pometia pinnata*, *Dracontamelon* sp, *Pterocarpus indicus*, *Intsia bijuga*, *Dysoxylum* sp, *Myristica* sp, *Mastixidendron* sp, *Paraserienthes falcataria*, *Ficus* sp, *Gnetum gnemon*, *Alphinia* sp, *Calamus* sp,

*Parent material:* Alluvium derived from Quaternary tuffaceous siltstone

*Drainage:* Imperfectly drained

*Slope:* 5°

*Aspect:* West

*Altitude:* 139 m (from Google Earth)

*Photographs:* Held in file UN REDD 3 at FPA, Hobart, Tasmania; copies held at FRI, Lae.

*FAO Classification:* Gleysol

A1	0-20 cm	Very dark brown (10YR2/2) (moist) silty loam; weak strength; weak 5-20 mm granular structure; common medium and few coarse roots.
AB	20-35 cm	Very dark grey (10YR3/1) (moist) silty clay loam; firm strength; weak 5-20 mm polyhedral structure; common very fine and few medium roots.
B2g	35-100 cm	Yellowish brown (10YR5/4) (moist) clay loam; 40% 10 mm light grey (5Y7/2) mottles; weak strength; weak 5-10 mm polyhedral structure; common very fine and few medium roots.
BCg	100+cm	Yellowish brown (10YR5/6) (moist) silty loam; 70% 10 mm light grey (5Y7/2) mottles; weak strength, weak 10-20 mm polyhedral structure; no roots.

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## Laboratory Analyses

Depth (cm)	pH (H <sub>2</sub> O)	Total C (%)	Total N (%)	C/N	Oxalate Al (%)	Oxalate Fe (%)	Oxalate Si (%)	P retention (%)
0-10	5.86	4.84	0.42	12	0.23	1.15	0.07	35
10-20	5.46	2.13	0.19	11	0.29	0.96	0.06	42
20-30	5.50	1.57	0.13	12	0.28	0.54	0.05	43
30-60	6.11	1.30	0.13	10	0.25	0.46	0.06	34
60-100	6.49	0.39	0.06	7	0.22	0.19	0.06	27

Depth (cm)	Exchangeable cations (cmol/kg)				CEC (cmol/kg)	BS (%)	Bray P (mg/kg)	Total P (mg/kg)
	Ca	Mg	K	Na				
0-10	19.8	8.92	0.78	0.09	37.7	79	3	612
10-20	8.06	8.36	0.37	0.12	31.1	54	1	409
20-30	7.76	11.1	0.28	0.18	34.1	57	0	276
30-60	19.8	16.3	0.48	0.18	43.1	85	1	215
60-100	20.1	23.0	0.49	0.36	46.3	95	0	196

### Fertility note, 0-30 cm soils

The soil is moderately to slightly acid with high to very high exchangeable Ca and Mg levels in topsoils, probably due to volcanic ash in the parent material. N and K levels in topsoils are medium. Moderate P retention and medium to high oxalate-extractable Fe levels are probably due to andesitic ash in the soil. Bray P levels are low. Total P levels are low in subsoils and medium at 0–20 cm depth. The total P increase towards the surface in these unfertilised soils may be due to either nutrient cycling or additions of recent volcanic ash. Oxalate Fe values support the latter explanation.

### Site C and N values

Depth (cm)	BD (t/m <sup>3</sup> )	C (%)	C (t/ha)	N (%)	N (t/ha)	Site C (t/ha)	Site N (t/ha)
0-10	0.77	5.16	67.7	0.44	3.38	79*	7*
10-20	0.88	2.52	33.6	0.23	2.03		
20-30	0.84	2.00	25.3	0.18	1.52		
30-60	1.01	1.30	39.4	0.13	3.94	56	6
60-100	1.07	0.39	16.6	0.06	2.56		
<b>Total to 1 m depth (t/ha)</b>						<b>135</b>	<b>13</b>

*Note:* C, N and BD figures for 0-10 cm, 10-20 cm and 20-30 cm depths are means of nine replicates taken within 20 m of the pit including samples from the profile site; 30-60 cm and 60-100 cm figures are derived from single profile samples only; figures marked \* have been corrected for slope. Analyses were by Landcare Research Environmental Chemistry Laboratory, Palmerston North, New Zealand. C and N were determined using a LECO furnace. Total P is acid-soluble P after ignition of the soil. No free carbonate was detected.

## Reference

- Bain, J.H.C. and Mackenzie, D.E. (Compilers) 1975. Ramu. *Papua New Guinea 1:250 000 Geological Series Sheet SB 55-5*. Department of Lands, Surveys and Mines, Papua New Guinea.
- Robbins R.G. (Compiler) 1976. Lands of the Ramu-Madang area, Papua New Guinea. CSIRO Land Research Series No. 37. CSIRO, Australia.

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