

Madang province – Cambisol in tuffaceous silty colluvium on steeplands



Site description

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

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

Parent material and Landform: Silty colluvium (including landslide deposits) on steep slopes in strongly dissected hill country

Drainage Class: Well drained

Vegetation: Secondary regenerating lowland rainforest

Distinguishing Soil Properties

Profile features:

- Layered parent material (due to mass movement or colluvial processes)
- Weakly developed thin topsoil with weakly developed structure (peds)
- Predominantly silty loam textures

Chemical and physical features

- High to very high exchangeable calcium and magnesium values
- Very high base saturation values
- Slightly acid to near neutral pH
- Low carbon values in topsoil and subsoils

Previous description

Well drained soils of the Karamsarik family (CSIRO Land Research Series 37, page 83) are similar

Degradation potential

- Moderately erodible
- Prone to landslides; landslides readily induced by midslope tracks

NFI reference

Kokun profile. NFI cluster 67271 is 4.5 km south of the profile site in similar strongly dissected hill country with steep slopes



Kokun 17 March 2016

Location map



Site Productivity

Medium to high; soil disturbance and burning may cause instability and soil loss, decreasing productive capacity

Soil Management

Exclude machinery; avoid commercial timber harvest (which is excluded by the PNG Logging Code of Practice); if harvesting trees for local use, leave at least a basal area of 20 m² per hectare to maintain soil stability; avoid tracking on steep slopes; avoid directing drainage discharge onto steep slopes

Suitability for Plantations or Alternative Land Uses

Plantation suitability: not suitable

Gardens: not suitable to moderately suitable, depending on slope angle; plots should be narrow (along contour)

Intensive horticulture: not suitable

Alternative tree crops: low to moderately suitable for crops such as cocoa, rubber and palm oil provided no machine access is required for land preparation or harvest

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

Profile

Profile name: Kokun

NFI reference: NFI cluster 67271 is 4.5 km south of the profile site.

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Date: 13 March 2016

Location: Pit on steep slope with northeasterly aspect, about 200 m east of Utu school, at the end of the road travelling up the north bank of the Kokun River. Immediately downslope of the site is a creek with a spring on its western side which is the village water supply for most months of the year

Map reference: GDA 55G 331599 9411840

Landform: Colluvium including mass movement (landslide) deposits

Vegetation: *Pometia pinnata*, *Dracontamelon* spp, *Pterocarpus indicus*, *Intsia bijuga*, *Octomeles sumatrana*, *Terminalia complanata*, *Kleinhovia hospita*, *Dysoxylum* sp, *Myristica* sp, *Melanolepis* sp *Paraserienthes falcata*, *Ficus* sp, *Alphinia* sp, *Calamus* sp

Parent material: Colluvium derived from Pliocene tuffaceous fine sandstone and siltstone

Drainage: Well drained

Slope: 29°

Aspect: Northeast

Altitude: 125 m (from Google Earth)

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

FAO Classification: Cambisol

A1	0-8 cm	Dark brown (10YR3/3) (moist) silty loam; very weak strength, weak 5-10mm angular blocky structure; few fine and medium, common coarse roots.
B1	8-28 cm	Dark yellowish brown (10YR3/4) (moist) silty loam; weak strength; weak 2-5 mm subangular blocky structure; few medium and coarse roots.
B2	28-50 cm	Dark yellowish brown (10YR4/4) (moist) silty loam; weak strength; weak 10-20 mm polyhedral structure; few fine and medium roots.
2C1	50-80 cm	Yellowish brown (10YR5/4) (moist) silty loam; loose strength; weak 2-5 mm subangular blocky structure; common subangular 5-10 mm gravels of weathered fine sandstone; very fine and few medium roots.
2C2	100+cm	Light yellowish brown (10YR6/4) (moist) silty clay loam; loose strength, weak 2-5 mm subangular blocky structure; common subangular 5-10 mm gravels of weathered fine sandstone; few fine roots.

Laboratory Analyses

Depth (cm)	pH (H ₂ O)	Total C (%)	Total N (%)	C/N	Oxalate Al (%)	Oxalate Fe (%)	Oxalate Si (%)	P retention (%)
0-10	6.59	2.73	0.28	10	0.26	0.65	0.12	21
10-20	6.13	1.72	0.20	9	0.29	0.73	0.12	30
20-30	6.17	1.16	0.14	8	0.29	0.64	0.11	29
30-60	6.00	0.57	0.08	7	0.22	0.28	0.08	23
60-100	6.47	0.29	0.05	6	0.18	0.20	0.09	13

Depth (cm)	Exchangeable cations (cmol/kg)				CEC (cmol/kg)	BS (%)	Bray P (mg/kg)	Total P (mg/kg)
	Ca	Mg	K	Na				
0-10	31.9	6.45	1.39	0.08	40.1	99	8	642
10-20	24.7	6.66	0.97	0.15	36.0	90	3	587
20-30	23.6	7.64	0.89	0.16	37.9	85	3	443
30-60	20.6	8.21	0.48	0.30	36.0	82	4	250
60-100	26.4	7.51	0.26	0.48	37.1	93	11	271

Fertility note

The soil is slightly acid to near neutral with high to very high exchangeable Ca and Mg values in topsoils. K values are likely to be adequate for the limited production possible on these soils. Total P values are low to medium. 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.

Note on soil formation

Oxalate Fe values in surface horizons are lower than at other sites (see fact Sheets 1 and 2) so the soil has not accumulated large amounts of volcanic ash and is probably young. The thin A horizon and the clear break in the parent material at 50 cm depth (see photograph) and the low total carbon values support this interpretation.

Site C and N values

Depth (cm)	BD (t/m ³)	C (%)	C (t/ha)	N (%)	N (t/ha)	Site C (t/ha)	Site N (t/ha)
0-10	0.90	2.68	24.1	0.26	2.30	45*	5*
10-20	1.01	1.23	12.5	0.14	1.40		
20-30	1.03	0.75	7.7	0.09	0.90		
30-60	1.13	0.57	19.3	0.08	2.70	32	5
60-100	1.06	0.29	12.3	0.05	2.10		
Total to 1 m depth (t/ha)						77	10

Note: C, N and BD figures for 0-10 cm, 10-20 cm and 20-30 cm depths are means of ten 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 angle. 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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Citation

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