NEW ZEALAND MINISTRY OF FOREIGN AFFAIRS & TRADE
MANATŪ AORERE
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FIJI

Soil Taxonomic Unit Description Handbook

Supplement to the national soil map

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Volume 2
Ogea to Yavuna soils

Soil Series

Volume 2

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Ogea series**

REFERENCE: The Ogea sandy loam (25d) defined by Twyford & Wright (1965) as a yellowish brown phosphatic loam developed on coralline limestone under a climate with a moderate dry season. Occurring on only a small area on Ogea Island the soil was not sampled or described in this survey. This STUD was prepared from original Twyford & Wright data describing Ogea sandy loam as 'merely a pedological curiosity'.

CLASSIFICATION:

(a) Soil Taxonomy: Typic Eutrustox, clayey, ferruginous, isohyperthermic
(b) FAO: Eutric Ferralsol
(c) Twyford and Wright: Latosolic soil with a moderate dry season

INCLUDED MAPPING UNITS AND SYMBOLS:
Ogea soils (79)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Occurs only on Ogea Island in Lau Group.
PARENT ROCK:	Coralline limestone.
PARENT MATERIAL:	Guano deposits with incorporated limestone stones and boulders over *in situ* limestone at depth.
PHYSIOGRAPHIC POSITION/LANDFORM:	Occurs on flattish surfaces in the centre of large masses of raised coralline limestone.
SLOPE CLASS AND RANGE OF SLOPES:	Flat to near level (0-2°).
VEGETATION AND LAND USE:	In natural state supports *Pisonia grandis* dominant forest. Commonly cleared for bush gardens.
RANGE OF ELEVATION:	20-80 m
RAINFALL:	Annual average range: 1,800-2,400 mm; dry season range: 400-600 mm; wet season range: 1,400-1,800 mm.
TEMPERATURE:	Mean annual: 25°C.
SOIL MOISTURE REGIME:	Ustic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Well drained
PERMEABILITY CLASS:	Moderately rapid
FLOODING:	Never floods
EROSION:	No erosion risk because of slope class.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 12 cm of slightly bouldery gritty and sandy loam, of strongly developed fine granular and crumb structure, and loose and very friable, overlying 5 cm of dark brown and strong brown slightly stony sandy loam, of weakly developed fine granular and crumb structure, and very friable, overlying 30 cm of strong brown and reddish yellow fine sandy clay loam, of massive structure breaking easily to crumb, and very friable, overlying 120 cm or more of strong brown fine sandy clay loam, of massive structure breaking easily to crumb, very friable, and with abundant dark brown tubular nodules. Fragments of pisolitic phosphatic limestone occur throughout the subsoils.
DIAGNOSTIC HORIZONS:	Ochric epipedon, oxic horizon.
RANGE OF PROFILE FEATURES:	Not applicable
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Chemical analysis shows this soil to be slightly alkaline, of very high base status and with very high exchangeable calcium but having a low exchangeable magnesium and very low exchangeable potash content. The acid soluble phosphate content is exceedingly high.
LABORATORY Nos:	KRS 781-782 (Twyford & Wright, 1965).
SOIL LIMITATIONS:	Profile stoniness; soil moisture deficits during the dry season; low potassium and nitrogen reserves; and due to slight alkalinity likely trace element deficiencies and imbalances.
ADDITIONAL COMMENTS:	Ogea series are by no means fertile, even cassava growing on these soils are badly stunted and chlorotic.

Typifying Profile

SOIL NAME:	Ogea soils
PROFILE No.:	Refer p.473 in Twyford & Wright (1965) - Profile 181.
SITE LOCATION:	Ogea Island, Lau Group.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Not known other than that the profile was described from Ogea Island, Lau Group.
PARENT MATERIAL:	Guano deposits with incorporated limestone stones and boulders over limestone at depth.
SLOPE:	Level surface
ASPECT:	Not applicable
ELEVATION:	75 m
MICRORELIEF:	Even
SITE VEGETATION:	In natural state supports *Pisonia grandis* dominant forest. Commonly cleared for bush gardens.
LAND USE:	Gardens
DRAINAGE:	Well drained
EROSION:	No erosion risk.
DISTURBANCE:	None described
LABORATORY Nos:	KRS 781-782 (inclusive)

PROFILE DESCRIPTION

Ap	0-12 cm (12 cm)	Dark brown (7.5YR 3/2) slightly bouldery (limestone) gritty and sandy loam; loose and very friable; strongly developed fine granular and crumb structure; sharp boundary,
AB	12-17 cm (5 cm)	Dark brown (7.5YR 3/2) and strong brown (7.5YR 5/6) slightly stony (limestone) sandy loam; weakly developed fine granular and crumb structure breaking to powder easily; slightly plastic; very friable; distinct boundary,
Bw1	17-47 cm (30 cm)	Strong brown (7.5YR 5/6) and reddish yellow (7.5YR 7/6) fine sandy clay loam; massive breaking easily to crumb structure; very friable (compact in place); slightly sticky,
Bw2	47-167 cm+ (120 cm+)	Strong brown (7.5YR 5/6) fine sandy clay loam; massive breaking easily to crumb structure; very friable (compact in place); slightly sticky; abundant soft dark brown (7.5YR 3/2), sometimes tubular, nodules.

Note: Often there are hard gunshot-sized nodules throughout the profile and fragments of pisolitic phosphatic limestone in the subsoil.

Ogea

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Ono series**

REFERENCE: New soil series introduced in the soil survey of Rotuma Island (Laffan & Smith, 1984) and defined as well drained soils formed from basaltic ash on the volcanic ringplains.

Profiles are silt loams to loams in which few to common basalt stones or boulders occur throughout the profile.

Name derived from the Rotuman word for a deep soil.

CLASSIFICATION:

(a) Soil Taxonomy: Hydric Hapludand, hydrous, isohyperthermic
(b) FAO: Mollic Andosol
(c) Twyford and Wright: Latosolic soil with no dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Ono soils, flat to gently undulating phase (89A)
Ono soil, undulating phase (89B)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Confined to the south-western side of Rotuma in valleys and hill slopes with flattish to easy rolling surfaces.
PARENT ROCK:	Basalt
PARENT MATERIAL:	Weakly weathered *in situ* volcanic ash.
PHYSIOGRAPHIC POSITION/LANDFORM:	Volcanic ringplains surrounding the volcanic cones.
SLOPE CLASS AND RANGE OF SLOPES:	Flat to gently undulating (0-3°) and undulating (4-7°).
VEGETATION AND LAND USE:	Originally under indigenous forest which has been cleared for food and cash crops, including coconuts, citrus, dalo, yams, cassava and bananas. Small areas in bush fallow.
RANGE OF ELEVATION:	10-150 m
RAINFALL:	Annual average range: 2,800-4,500 mm.
TEMPERATURE:	Mean annual: 26.5°C.
SOIL MOISTURE REGIME:	Udic (perudic)
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Well drained
PERMEABILITY CLASS:	Moderately rapid
FLOODING:	Never floods
EROSION:	No erosion risk.

Morphological And Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Profiles are characterised by dark brown, very friable A horizons, and brown B horizons which are loamy and very friable. Stoniness varies from few (<5%) to common (5-15%) stones and boulders throughout the profile.
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Ono series have a Ah(Ap), AB, Bw1, Bw2, C horizon sequence. The A horizon thickness ranges 15-28 cm; colours vary dark brown (7.5YR 3/2, 3/3) or very dark greyish brown (10YR 3/2); textures may be silt loam, loam or fine sandy loam; and nutty structures are either fine or medium. The AB horizon thickness ranges 10-15 cm; colours vary dark brown (7.5YR 3/4) and strong brown (7.5YR 4/5); consistence is either friable or very friable; and stones few or absent. The Bw1 horizon thickness ranges 30-60 cm; colours vary dark brown (7.5YR 3/3, 3/4) to strong brown (7.5YR 4/5); may be mottled or not; textures may be loam, fine sandy loam, or bouldery fine sandy loam; and stones are few or common. The Bw2 horizon thickness ranges 22-50 cm; colours are dark brown (7.5YR 3/3 or 10Y 3/3); textures may be loams, stony loams, or silt loams, and stones range from few to common. The C horizon if present is normally a strong brown loamy coarse sand and massive.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	Sumi series. Similar to Ono series except that stones vary from common to many (5-35%) in the upper 50 cm of the profile to many (15-35%) at depths below 50 cm (Laffan & Smith,1986). Reree series. Well drained soils from basaltic ash overlying basaltic scoria at depths of 70-80 cm. Few basalt stones or boulders occur throughout the profile.
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Profiles are moderately acid to slightly acid. Organic carbon and nitrogen values are medium in the topsoil and very low in subsoils. Phosphorus values are high becoming very high in the subsoil but P retention values are extremely high. The CEC is medium to high and the % base saturation is high in the A1 horizon dropping to medium (30-40%) below this. Exchangeable calcium and magnesium values are high in the surface horizon dropping to medium below. Potassium values are very low. The particle-size class is hydrous.
LABORATORY Nos:	SB9712A-F KRS S939-S944 (inclusive)
SOIL LIMITATIONS:	Slight physical limitations to cultivation from few basalt stones and boulders. Severe deficiency of phosphorus, moderate deficiency of potassium and moderate to severe deficiency of nitrogen.

Typifying Profile

SOIL NAME:	Ono soils, flat to gently undulating phase.
PROFILE No.:	R13
SITE LOCATION:	Refer to soil map of Rotuma Island (Laffan & Smith 1986). On central road, 500 m south of Ahau Government Station.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Volcanic ringplain. Lowland surface formed by basalt flows.
PARENT MATERIAL:	Basaltic tephra plus a few basalt boulders.
SLOPE:	Level
ASPECT:	Not applicable
ELEVATION:	30 m
MICRORELIEF:	Flat
SITE VEGETATION:	Coconut, citrus with grass ground cover.
LAND USE:	Coconut plantation with some under grazing (goats).
DRAINAGE:	Well drained
EROSION:	None observed
DISTURBANCE:	None
LABORATORY Nos:	SB9712A-F, KRS S939-S944 (inclusive)
COMMENTS:	Reaction to NaF. Weak in Ap, Bw1 and Bw2 horizons.

PROFILE DESCRIPTION

Ap	0-25 cm (25 cm)	Dark brown (7.5YR 3/2) heavy silt loam; moderately developed fine nut structure; sticky, plastic, friable, stiff consistence; many fine and medium roots; common weakly weathered subangular basalt stones; indistinct wavy boundary,
Bw1	25-60 cm (35 cm)	Dark brown (7.5YR 3/3) loam; moderately developed medium blocky structure breaking to weakly developed fine nut structure; slightly sticky, slightly plastic, very friable, firm consistence; common fine and medium roots; few weakly weathered subangular basalt stones; indistinct wavy boundary,
Bw2	60-110+ cm (50 cm+)	Dark brown (7.5YR 3/3) loam; moderately developed medium blocky structure breaking to weakly developed fine nut structure; slightly sticky, slightly plastic, very friable, firm consistence; many fine and medium roots; few weakly weathered basalt stones; diffuse boundary.

Ono

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Qalinaolo series**

REFERENCE: New soil series introduced in this survey to include stony upland colluvial soils formed on toeslopes and small fans from basic and intermediate materials of low quartz content and formed under a climate with a weak or no dry season.

Previously included with Nabuesa clay (59b) as defined by Twyford and Wright (1965) as an upland humic latosol developed on weathered *in-situ* rock.

Named from Qalinaolo creek, a tributary of the Nunuku system on the Nadrau plateau.

CLASSIFICATION:

(a) Soil Taxonomy: Typic Humitropept, fine, mixed, isothermic
(b) FAO: Humic Cambisol
(c) Twyford and Wright: Upland humic latosol with no dry season

INCLUDING MAPPING UNITS AND PHASES:

Qalinaolo soils, flat to gently undulating phase (227A)
Qalinaolo soils, undulating phase (227B)
Qalinaolo soils, easy rolling phase (227C)
Qalinaolo soils, rolling phase (227D)
Qalinaolo soils, strongly rolling phase (227E)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Restricted to the Nadrau basin.
PARENT ROCK:	Rocks of basic (mainly basalts) composition.
PARENT MATERIAL:	Deep moderately weathered colluvium.
PHYSIOGRAPHIC POSITION/LANDFORM:	Colluvial toeslopes and low angle fans of low rounded hills.
SLOPE CLASS AND RANGE OF SLOPES:	Flat to gently undulating (0-3°), undulating (4-7°), easy rolling (8-11°), rolling (12-15°), and strongly rolling (16-20°).
VEGETATION AND LAND USE:	Mainly under tall rain forest (kaudama, damanu, dakua, vava) with understorey of prickly solanum, guava, *Clidemis* and yagu. Used for rough grazing for village animals.
RANGE OF ELEVATION:	600-900 m
RAINFALL:	Annual average range: 3,000-5,500 mm; dry season range: 800-3,000 mm; wet season range: 2,000-3,200 mm.
TEMPERATURE:	Mean annual: 18°C.
SOIL MOISTURE REGIME:	Udic
SOIL TEMPERATURE REGIME:	Isothermic
SOIL DRAINAGE CLASS:	Well drained
PERMEABILITY CLASS:	Moderate
FLOODING:	Never floods
EROSION:	Moderate sheet and rill erosion risk on slopes > 7° where forest has been removed and cultivated without soil conservation measures.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 15 - 20 cm of dark friable clay loam of medium granular structure overlying 15 - 40 cm of reddish-brown firm clay of coarse blocky structure.
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Not applicable. Only two profile descriptions available.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analysis shows this soils to be moderately to strongly acid, of low base status, with moderate levels of exchangeable calcium, magnesium and potash in the topsoil dropping to very low contents in the subsoil. The particle size family class is fine. The mineralogy class is mixed.
LABORATORY Nos:	V703-705
SOIL LIMITATIONS:	Stoniness and dryness during the cool months when evapotranspiration often exceeds precipitation. Soil fertility is low. High phosphorous fixation.

Typifying Profile

SOIL NAME:	Qalinaolo soils, easy rolling phase.
PROFILE No.:	VS 127
SITE LOCATION:	Nadrau uplands, 3 km north-east of Nadrau School.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Toeslope of low hills surrounding the Nadrau swamp.
PARENT MATERIAL:	Colluvium
SLOPE:	8°
ASPECT:	South
ELEVATION:	700 m
MICRORELIEF:	Disturbed by logging tracks.
SITE VEGETATION:	Thick dakua, vava forest but short grass and bracken where cleared, also carpet grass, solanum and blue flowered goat weed.
LAND USE:	Rough grazing for cattle and horses.
DRAINAGE:	Well drained
EROSION:	Serious sheet erosion where bare.
DISTURBANCE:	Logging activities
LABORATORY Nos:	V703-705

PROFILE DESCRIPTION

Ah	0-18 cm (18 cm)	Moist; very dark grey (10YR 3/2) clay loam; strongly developed medium granular structure breaking to weakly developed fine crumbs; friable; wet; non sticky; slightly plastic; slightly sticky; many large pores; common subrounded stones 2-7 cm diameter; common medium fibrous and woody roots; clear horizontal boundary,
Bw	18-130 cm (112 cm+)	Moist; dark reddish brown (5YR 3/4) clay; massive structure breaking to moderately developed coarse nut and blocky structure; very firm; wet; slightly sticky; common fine pores; common medium roots; common large stones and boulders.

Qalinaolo

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Qaributa series**

REFERENCE: New soil series introduced to include poorly drained shallow peats that overlie marine deposited sands of basic and intermediate composition. The series were previously included with Melimeli peat (54b) defined by Twyford & Wright (1965) to be exclusively very deep weakly decomposed peat though having one or more very thin horizons of alluvium within most profiles.

CLASSIFICATION:

(a) Soil Taxonomy: Terric Tropofibrist, dysic, sandy, isohyperthermic
(b) FAO: Dystric Histosol
(c) Twyford and Wright: Organic soil

INCLUDED MAPPING UNITS AND SYMBOLS:
Qaributa soils (17)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Qaributa soils occur discontinuously along the seaward reaches of the major floodplains in south-east Viti Levu.
PARENT ROCK:	Predominantly rocks of basic and intermediate composition.
PARENT MATERIAL:	Shallow (< 50 cm) weakly decomposed sedges and grasses (*Eleocharis laxiflora, Nephrolepsis exaltata, Cyclosorus gongylodes*) overlying estuarine sands.
PHYSIOGRAPHIC POSITION/LANDFORM:	Flat surface of peat bogs.
SLOPE CLASS AND RANGE OF SLOPES:	Flat
VEGETATION AND LAND USE:	Unused. Kuta sedge, jungle rice, mimosa, yellow primrose are normally predominant in the ground cover.
RANGE OF ELEVATION:	1-3 m
RAINFALL:	Annual average range: 3,200-4,800 mm; dry season range: 800-1,600 mm; wet season range: 1,800-2,800 mm.
TEMPERATURE:	Mean annual: 24.5°C.
SOIL MOISTURE REGIME:	Aquic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Very poorly drained.
PERMEABILITY CLASS:	Medium
FLOODING:	Almost continuous flooding due to permanent high water table.
EROSION:	No erosion risk.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 30 cm of black fibrous peat overlying 20 cm of very dark greyish brown slightly mottled pale olive peat overlying 25 cm of olive grey sandy loam, of massive structure breaking to single grain, and very sticky and plastic moist, overlying 20 cm of dark greenish grey sandy loam, of massive structure breaking to single grain, and slightly sticky and plastic moist, overlying dark greenish grey medium and coarse sand.
DIAGNOSTIC HORIZONS:	Histic epipedon
RANGE OF PROFILE FEATURES:	Not applicable. Other than slight differences in the thickness of the peat layers, profiles show no variation to that described above.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analyses show the soil to be strongly acid to 77 cm and slightly to moderately alkaline below this depth; carbon values are high 0-30 cm, medium 30-77 cm and very low below; nitrogen follows similar trend: very high 0-30 cm, medium 30-53 cm and very low below; low available phosphorus; % base saturation values are low 0-77 cm becoming high below this depth; exchangeable magnesium is very high; calcium is medium 0-30 cm and low below this; and potassium is high 0-30 cm and very low below this.
LABORATORY Nos:	KRS D212-216 (inclusive)
SOIL LIMITATIONS:	Almost continuous flooding from permanent high water table and difficult in being able to drain; strong acid in the upper part of the profile; low subsoil nitrogen and potassium reserves and very low available phosphorus throughout the profile.

Typifying Profile

SOIL NAME:	Qaributa soils
PROFILE No.:	TR16
SITE LOCATION:	West of Lokia (90 m north of pipeline that enters peat from Lokia), Viti Levu.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Peat bog
PARENT MATERIAL:	Sedge and grass materials overlying estuarine sands.
SLOPE:	Flat
ASPECT:	Not applicable
ELEVATION:	4 m
MICRORELIEF:	Hummocky soft ground surface.
SITE VEGETATION:	Predominantly Kuta sedge.
LAND USE:	None
DRAINAGE:	Very poorly drained. Water table at or above ground surface for most times during the year.
EROSION:	None observed
DISTURBANCE:	None
LABORATORY Nos:	KRS D212-216 (inclusive)
COMMENTS:	Water table 25 cm above ground surface.

PROFILE DESCRIPTION

TR16 Qaributa soils

Of1	0-30 cm (30 cm)	Wet; black (10YR 2/1) fibrous peat; same colour when squeezed; non-sticky; some pieces of wood (botanical composition uncertain); very weakly decomposed (material does not squeeze through fingers or disintegrate on rubbing); abundant very fine whitish roots; distinct smooth boundary,
Of2	30-53 cm (23 cm)	Wet; very dark greyish brown (2.5Y 3/2) peat; few very coarse distinct pale olive (5Y 6/3) mottles; peat comprises sedge blades and roots; very weakly decomposed (material does not squeeze through fingers or disintegrate on rubbing); distinct smooth boundary,
Cr1	53-77 cm (24 cm)	Wet; olive grey (5Y 5/2) sandy loam; massive breaking to single grain; very sticky; very plastic; few peaty fibres; a piece of drift-wood at surface of this horizon; distinct smooth boundary,
Cr2	77-100 cm (23 cm)	Wet; dark greenish grey (5GY 4/1) sandy loam; massive breaking to single grain; slightly sticky; plastic; few peaty fibres; indistinct smooth boundary,
Cr3	100-122 cm (22 cm+)	wet; dark greenish grey (5GY 4/1) medium to coarse sand; non-sticky; non-plastic.

Qaributa

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Qeleni series**

REFERENCE: New soil series introduced in this survey to include older weathered soils with argillic horizons from olivine basalt flow rocks and formed under a climate with a weak dry season.

Previously included with the Taveuni clay (23e) and Taveuni hill soils (23eH) as defined by Twyford & Wright (1965).

Named from Qeleni Village northeast Taveuni Island

CLASSIFICATION:

(a) Soil Taxonomy: Typic Hapludult, clayey, mixed, isohyperthermic
(b) FAO: Orthic Acrisol
(c) Twyford and Wright: Latosolic soil with a weak dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Qeleni soils, easy rolling phase (104C)
Qeleni soils, rolling phase (104D)
Qeleni soils, strongly rolling phase (104E)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Occur on the east coast of Taveuni Island between Lavena Village in the south and Waibula Creek in the north.
PARENT ROCK:	Olivine basalt
PARENT MATERIAL:	Strongly weathered *in situ* rock.
PHYSIOGRAPHIC POSITION/LANDFORM:	Broad east sloping surfaces (broken by deep gullies). Generally planar and convex slopes.
SLOPE CLASS AND RANGE OF SLOPES:	Easy rolling (8-11°), rolling (12-15°), and strongly rolling (16-20°).
VEGETATION AND LAND USE:	Some areas still in forest. Elsewhere under coconuts or used for subsistence food crops .
RANGE OF ELEVATION:	0-200 m
RAINFALL:	Annual average range: 3,000-5,500 mm; dry season range: 800-3,000 mm; wet season range: 2,000-3,200 mm.
TEMPERATURE:	Mean annual: 24°C.
SOIL MOISTURE REGIME:	Udic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Well drained
PERMEABILITY CLASS:	Moderate
FLOODING:	Never floods
EROSION:	Slight to moderate sheet and rill erosion potential, particularly on slopes >11° when forest cleared and/or intensively cultivated.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 20 cm of strong brown very firm silty clay loam of strong granular structure overlying 15 cm of yellowish red firm silty clay loam of weak very coarse blocky structure breaking to finer blocky with manganese nodules and clay cutans to ped faces overlying more than 100 cm of yellowish red firm clay loam of massive structure breaking to weak medium blocky and with manganese nodules and clay cutans to ped faces. All horizons are slightly sticky and smeary when moist.
DIAGNOSTIC HORIZONS:	Ochric epipedon, argillic horizon.
RANGE OF PROFILE FEATURES:	Not applicable. Only 2 profile descriptions made.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analysis shows the soil to be moderately acid in the topsoil (0-21 cm) and strongly acid in the other horizons; organic carbon is medium in the topsoil and of very low values below it; phosphorus retention is medium in the topsoil and high for the other horizons; % base saturation is very low throughout the profile; CEC is medium to high and TEB values low; calcium is very low; magnesium medium; potassium very low; and Tamms aluminium extract is high. The particle size family class is clayey. The mineralogical class is halloysitic.
LABORATORY Nos:	USP TAV115A-C
SOIL LIMITATIONS:	Clayey textures; susceptibility to erosion on slopes >10°; soil acidity; nutrient deficiencies of nitrogen, phosphorus and potassium; and probable aluminium toxicity.

Typifying Profile

SOIL NAME:	Qeleni soils, rolling phase.
PROFILE No.:	TAV115
SITE LOCATION:	2 km north of Lavena on coastal road, East Taveuni Island.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Concave midslope in strongly rolling land.
PARENT MATERIAL:	Strongly weathered *in situ* basalt.
SLOPE:	15°
ASPECT:	East
ELEVATION:	20 m
MICRORELIEF:	Small terracettes
SITE VEGETATION:	*Syzygium sp., Hyptis pectinata, Nephrolepsis sp. Ficus sp.* Coconuts and cocoa.
LAND USE:	Cocoa plantation
DRAINAGE:	Well drained
EROSION:	None
DISTURBANCE:	None
LABORATORY Nos:	USP TAV115A-C
COMMENTS:	NaF reaction: negative in topsoil, weak positive in remaining horizons.

PROFILE DESCRIPTION

Ah	0-21 cm (21 cm)	Moist; strong brown (7.5YR 4/6) silty clay loam; strongly developed fine granular structure (compacted by roots); very firm; slightly sticky and smeary; abundant fine and medium fibrous roots; distinct smooth boundary,
Bt1	21-35 cm (14 cm)	Moist; yellowish red (5YR 4/6) clay loam; weakly developed; very coarse blocky structure breaking to medium and fine blocky; firm; slightly plastic and smeary; a few faint thin dark yellowish brown (10YR 4/4) clay cutans; streaks of yellow (10YR 7/8); many dark (manganese?) nodules; few roots; diffuse wavy boundary,
Bt2	35-220 cm (185 cm)	Moist; yellowish red (5YR 4/6) clay loam; massive breaking to weakly developed medium blocky structure; firm; slightly sticky and smeary; few faint yellowish red (5YR 4/6) clay cutans; common yellow (10YR 7/8) streaks; common manganese nodules; no roots; diffuse wavy boundary,
	BC	220-450 cm moist; dark red (2.5YR 3/6) silt loam; massive breaking to weakly fine blocky and single grain; friable to firm; non-sticky; non-plastic; slightly smeary; common yellow (10YR 7/8) streaks; no roots.

Qeleni

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Rana series**

REFERENCE: New soil series introduced and defined in the soil survey of Rotuma Island (Laffan & Smith 1984) as very poorly drained soils formed from organic matter and coral sand in swampy depressions behind beach ridges on the coastal margins. Profiles have thick, strongly decomposed peaty horizons overlying coral sand. Water tables are near the surface.

Name derived from the Rotuman word for swampy soils.

CLASSIFICATION:

(a) Soil Taxonomy: Typic Troposaprist, euic, isohyperthermic
(b) FAO: Eutric Histosol
(c) Twyford and Wright: Organic soil with a very weak or no dry season

INCLUDED MAPPING UNITS AND SYMBOLS:
Rana soils (16)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Occurs in scattered swampy depressions behind beach ridges and the coastal margins of Rotuma. Main areas occur near villages of Fapufa, Motusa and Lapo on western coast, Ujia on the southern coast, and Kekeoko on the eastern coast.
PARENT ROCK:	Not applicable
PARENT MATERIAL:	Organic material over coral sand.
PHYSIOGRAPHIC POSITION/LANDFORM:	Depressions behind beach ridges on the coastal margins.
SLOPE CLASS AND RANGE OF SLOPES:	Flat to gently undulating (0-3°).
VEGETATION AND LAND USE:	Swamp vegetation
RANGE OF ELEVATION:	0-3 m
RAINFALL:	Annual average: 3,650 mm.
TEMPERATURE:	Mean annual: 27°C.
SOIL MOISTURE REGIME:	Aquic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Very poorly drained.
PERMEABILITY CLASS:	Rapid
FLOODING:	Periodic surface flooding due to topographic position and permanent high water table.
EROSION:	No erosion risk.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically show a very friable thick (>1 m) dark brown peaty fine sandy loam that overlies dark grey and loose coarse coral sand. The peat layer(s) is strongly decomposed. Water tables generally occur at or just below the soil surface.
DIAGNOSTIC HORIZONS:	Histic epipedon
RANGE OF PROFILE FEATURES:	Not applicable. Only one profile description made.
VARIANTS:	None recognised. Have Upu and Fapufa series as inclusions within the soil mapping unit (Laffan and Smith, 1983).
SIMILAR SOILS AND DISTINGUISHING FEATURES:	Fapufa series: Very poorly drained soils formed entirely from thick (>1 m) organic matter (peat), which is weakly decomposed (i.e. fibrist). Upu series: Imperfectly drained to poorly drained soils formed from gravelly basaltic scoria and coral sand, have lower water tables and yellowish mottles in upper part of the profile.
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Not sampled for analysis. Likely to be deficient in nitrogen, potassium and phosphorus and some trace elements.
LABORATORY Nos:	Not sampled for analysis.
SOIL LIMITATIONS:	Severe physical limitations of very poor drainage, high water table and shallow rooting depth, plus important nutrient deficiencies.

Typifying Profile

SOIL NAME:	Rana soils
PROFILE No.:	106
SITE LOCATION:	Refer soil map of Rotuma (Laffan & Smith 1983). About 200 m east of Motusa village.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Depression between sand bars.
PARENT MATERIAL:	Organic matter and comminuted coral sand.
SLOPE:	Level
ASPECT:	Not applicable
ELEVATION:	1-2 m
MICRORELIEF:	Hummocky
SITE VEGETATION:	Papoi (root crop), tala (shade-tree for papoi).
LAND USE:	Horticulture
DRAINAGE:	Very poorly drained. Surface floods annually.
EROSION:	None observed
DISTURBANCE:	None
LABORATORY Nos:	Not sampled for analysis.

PROFILE DESCRIPTION

Ah	0-120 cm	Dark brown (7.5YR 3/3) peaty fine sandy loam; sticky; slightly plastic; very friable; very weak; uncemented; soft consistence; few fine and medium roots; sharp boundary,
Cr	120+ cm	Dark grey (5Y 4/1) coarse sand; non-sticky; non-plastic; loose; very weak; uncemented; firm consistence.

Rana

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Rauriko series**

REFERENCE: Rauriko steepland stony sandy clay (92e) defined by Twyford & Wright (1965) as formed from silicified tuffs on reed and fern covered steepland and formed under a climate with a moderate dry season.

Forms part of the Sarowaqa set. The central concept for Rauriko soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Typic Dystropept, fine, kaolinitic, isohyperthermic
(b) FAO: Dystric Cambisol
(c) Twyford and Wright: Steepland soil related to or associated with red yellow podzolic soils, with a moderate dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Rauriko soils, moderately steep phase (152F)
Rauriko soils, very steep phase (152H)
Rauriko soils, steep phase (152G)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Rauriko soils occur extensively in north-eastern Vanua Levu, east of the Wainikoro river and as far as the western end of Udu Point. They are significant in Kadavu but of limited area on Viti Levu.
PARENT ROCK:	Silicified tuffs i.e. acidic rocks.
PARENT MATERIAL:	Moderate to strongly weathered *in situ* rock.
PHYSIOGRAPHIC POSITION / LANDFORM:	Planar and convex backslopes and midslopes in moderate and strongly dissected hill country.
SLOPE CLASS AND RANGE OF SLOPES:	Moderately steep (21-25°), steep (26-35°) and very steep (>35°).
VEGETATION AND LAND USE:	Normally covered by poor forest containing mainly yaka and also yasiyasi and caukoro. No mainly supporting reeds and fern. Used for some subsistence cassava cropping.
RANGE OF ELEVATION:	20-600 m
RAINFALL:	Annual average range: 3,000-4,000 mm; dry season range: 700-1,300 mm; wet season range: 1,600-2,500 mm.
TEMPERATURE:	Mean annual: 24.5°C.
SOIL MOISTURE REGIME:	Udic (marginal to ustic).
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Well drained
PERMEABILITY CLASS:	Moderately rapid
FLOODING:	Never floods
EROSION:	Have experienced past erosion and truncated profiles are not uncommon. Very severe sheet and rill erosion potential.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically show 8 cm of dark brown friable sandy clay loam (commonly stony), of moderate medium and fine nut structure, overlying 12 cm of dark reddish brown structure, overlying 25 cm of dark brown friable sandy clay, of massive structure breaking to weak coarse blocky overlying 20 cm of dark weak medium and coarse blocky structure, and sticky and slightly plastic moist, on strongly weathered *in situ* rock. Profile may be with or without stones
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Not applicable. Only two profile descriptions made.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analysis shows the soil to be moderately acid 0-20 cm, slightly acid 20-44 cm and strongly acid below 44 cm; organic carbon and available phosphorus are very low throughout; % base saturation and TEB are very high 0-44 cm and medium in the other horizons; CEC is high 0-44 cm and medium below 44 cm; exchangeable calcium is low 0-44 cm and very low in the other horizons; magnesium is very high throughout; and potassium is low in the topsoil (0-8 cm) and very low below it. The particle size family class is fine. The mineralogical class is kaolinitic.
LABORATORY Nos:	SB 9402 A-E
SOIL LIMITATIONS:	Slope; shallow profiles; severe erosion hazard; dry season soil moisture deficits; soil acidity; and nutrient deficiencies of phosphorus, nitrogen and potassium.

Typifying Profile

SOIL NAME:	Rauriko soils, steep phase.
PROFILE No.:	VB2
SITE LOCATION:	Vanua Balavu Island, Lau Group.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Convex backslope in moderately dissected hill country.
PARENT MATERIAL:	Moderate to strongly weathered *in situ* silicified tuffs.
SLOPE:	30°
ASPECT:	Southeast
ELEVATION:	120 m
MICRORELIEF:	Terracettes
SITE VEGETATION:	Reed (*Miscanthus floridulus*) dominant with ferns (*D. linearis*) and odd cyperaceous bush.
LAND USE:	Unused (fallow after root crop).
DRAINAGE:	Well drained
EROSION:	Some soil creep
DISTURBANCE:	Previously cultivated
LABORATORY Nos:	SB 9402A-E

PROFILE DESCRIPTION

Ap	0-8 cm (8 cm)	Moist; dark brown (7.5YR 3/2) sandy clay loam; moderately developed coarse blocky structure breaking to moderate medium and fine nut with crumb; friable; abundant fine and medium fibrous roots; many casts; indistinct smooth boundary,
Bw1	8-20 cm (12 cm)	Moist; dark reddish brown (5YR 3/2) sandy clay loam; moderately developed medium nut and blocky structure with some fine nut and crumb; friable; abundant fine and medium fibrous roots; many casts; indistinct smooth boundary,
Bw2	20-44 cm (24 cm)	Moist; dark brown (7.5YR 3/2) sandy clay; massive breaking to weakly developed coarse blocky structure; friable; slightly sticky; many fine fibrous roots; few casts; indistinct smooth boundary,
Bt	44-66 cm (22 cm)	Moist; dark reddish brown (5YR 3/4) clay; massive breaking to weak to moderately developed medium and coarse blocky structure; friable; sticky; slightly plastic; few fine fibrous roots; many relict worm casts; distinct smooth boundary,
BC	66-110 cm+ (44+ cm)	Moist; reddish brown (5YR 5/3) clay loam; massive structure breaking to single grain; friable; slightly sticky; slightly plastic; few very fine fibrous roots; strongly weathered *in situ* rock.

Rauriko

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Ravilevu series**

REFERENCE: Ravilevu steepland stony clay (79a) defined by Twyford & Wright (1965) as a latosolic steepland soil from 'slightly older' basaltic flows formed under a climate with no dry season.

Forms part of the Ravilevu set.

The central concept for Ravilevu soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Andic Dystropept, loamy, mixed, isohyperthermic
(b) FAO: Dystric Cambisol
(c) Twyford and Wright: Steepland soil related to or associated with latosolic soils with no dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Ravilevu soils, steep phase (97G)
Ravilevu soils, very steep phase (97H)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	East coast lowlands of Taveuni Island from Salialailai in the south to the Waibula River in the north under a wet continuous rainfall .
PARENT ROCK:	Basalt
PARENT MATERIAL:	Moderately weathered *in situ* rock.
PHYSIOGRAPHIC POSITION/LANDFORM:	Long steep slopes from the axis of the island (<600 m) to the east coast with close and parallel deeply dissected gullies.
SLOPE CLASS AND RANGE OF SLOPES:	Steep (26-35°) and very steep (>35°).
VEGETATION AND LAND USE:	Almost exclusively under tall rain forest.
RANGE OF ELEVATION:	0-600 m.
RAINFALL:	Annual average range: 3,000-5,500 mm; dry season range: 800-3,000 mm; wet season range: 2,000-3,200 mm.
TEMPERATURE:	Mean annual: 24°C.
SOIL MOISTURE REGIME:	Perudic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Well drained
PERMEABILITY CLASS:	Moderate
FLOODING:	Never floods
EROSION:	Very severe erosion potential if forest were to be cleared particularly in view of the high rainfall experienced during much of the year.

Morphological And Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 15 cm of very dark greyish brown firm clay loam of moderate medium nut structure, with common subrounded to angular stones, overlying 70 cm or more of dark yellowish brown very firm stony and bouldery clay of strong coarse blocky structure and slightly plastic and smeary
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Not applicable. Only 2 profile descriptions made.
VARIANTS:	Unnamed red variant. Colour relates to the colour of the parent material rather than more advanced weathering. Typically shows 8 cm of dark reddish brown friable clay moderately sticky and plastic when moist and of moderate medium and fine nut and blocky structure overlying 30 cm of red friable clay of moderate medium blocky structure, on red basalt.
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analysis shows the soil to be moderately acid; organic carbon is low in the topsoil (0-16 cm) and very low below it; phosphorus retention is medium; CEC is high in the topsoil and medium below it; TEB is medium in all horizons; % base saturation is low 0-16 cm and medium 16-90 cm; calcium is medium and magnesium high throughout; and potassium is high in the topsoil and of very low value 16-90 cm. The particle size family class is fine. The mineralogical class is halloysitic.
LABORATORY Nos:	USP TAV114
SOIL LIMITATIONS:	Slope; excessive rainfall; severe erosion potential if the forest was cleared; soil acidity; and potassium nutrient deficiency.

Typifying Profile

SOIL NAME:	Ravilevu soils, very steep phase.
PROFILE No.:	TAV114
SITE LOCATION:	0.75 km north of Lavena Village on the coastal road East Taveuni Island.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Planar lower midslope in moderately dissected steepland.
PARENT MATERIAL:	Moderately weathered *in situ* basalt rock.
SLOPE:	40°
ASPECT:	North
ELEVATION:	15 m
MICRORELIEF:	Smooth. Common basalt outcrops.
SITE VEGETATION:	Wadamo, mint weed, Mikenia *sp.*
LAND USE:	Subsistence cropping (now in fallow phase).
DRAINAGE:	Well drained
EROSION:	None
DISTURBANCE:	Previously cultivated
LABORATORY Nos:	USP TAV114A-B
COMMENTS:	NaF reaction: Negative 0-16 cm. Weak positive 16-90 cm.

PROFILE DESCRIPTION

Ap	0-16 cm (16 cm)	Moist; very dark greyish brown (10YR 3/2) clay loam; moderately developed medium nut structure; firm; slightly plastic and smeary; non-sticky; abundant fine fibrous roots; common subrounded to angular stones; many large pores; diffuse smooth boundary,
Bw	16-90+ cm (74 cm+)	Moist; dark yellowish brown (10YR 3/4) stony and bouldery clay; strongly developed very coarse blocky structure breaking to strongly developed coarse nut and coarse granular structure; very firm; slightly plastic and smeary; non-sticky; few medium fibrous roots; many large pores; stones (2.5Y 6/0 and 2.5Y 5/0) angular and 2.5 to 10 cm (longest diameter).

Ravilevu

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Raviravi series**

REFERENCE: Raviravi clay (35a) and Raviravi hill soils (35aH) defined by Twyford & Wright (1965) as strongly weathered and leached soils from andesites and andesitic tuffs formed under a climate with a strong dry season. In their natural state they support reeds and short grasses with some nokonoko.

Form part of the Raviravi set.

The central concept for Raviravi soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Ustic Dystropept, fine, kaolinitic, isohyperthermic
(b) FAO: Dystric Cambisol
(c) Twyford and Wright: Ferruginous latosol with a strong dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Raviravi soils, undulating phase (178B)
Raviravi soils, easy rolling phase (178C)
Raviravi soils, rolling phase (178D)
Raviravi soils, strongly rolling phase (178E)
Raviravi soils, moderately steep phase (178F)
Raviravi soils, steep phase (178G)
Raviravi soils, very steep phase (178H)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION: Raviravi soils are extensive in the Nadi and Ba river basins and between the Nadi basin and Momi Bay in Viti Levu. They are well represented in Vanua Levu, particularly in Bua province.

PARENT ROCK: Andesite and andesitic tuffs.

PARENT MATERIAL: Strongly weathered *in situ* rock.

PHYSIOGRAPHIC POSITION / LANDFORM: Planar and easy convex slopes in easy rolling to flattish land.

SLOPE CLASS AND RANGE OF SLOPES: All slope classes from undulating (4-7°) through to very steep (>35°).

VEGETATION AND LAND USE: Originally under reeds and grasses and now in the unused state 'talasiga' vegetation. Used for rough grazing, exotic forest, and sugar cane. In many areas, and for sugar cane cultivation, tonnes/ha of coral sand were added during the 1940's.

RANGE OF ELEVATION: 10-150 m

RAINFALL: Annual average range: 1,800-2,400 mm;
dry season range: 400-500 mm;
wet season range: 1,400-1,800 mm.

TEMPERATURE: Mean annual: 25.5°C.

SOIL MOISTURE REGIME: Ustic

SOIL TEMPERATURE REGIME: Isohyperthermic

SOIL DRAINAGE CLASS: Well drained

PERMEABILITY CLASS: Moderately rapid

FLOODING: Never floods

EROSION: Have experienced serious past topsoil losses as a result of repeated burning. Moderate to very severe rill and sheet erosion potential.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES: Typically shows 10 cm of dark red very variable clay loam of moderately developed fine nut structure, commonly with a few block manganese mottles overlying 80 cm of red firm clay loam, of moderate coarse blocky structure overlying more than 30 cm of red firm clay loam, of massive structure breaking to single grain, and with many reddish yellow and pinkish grey parent material mottles.

DIAGNOSTIC HORIZONS: Ochric epipedon, cambic horizon.

RANGE OF PROFILE FEATURES: Raviravi series have an Ah, Bt, Bw, BC horizon sequence.

The Ah horizon thickness ranges from 12 to 15 cm; its colours include dark reddish brown (2.5YR 3/4, 2/4) and dark red (2.5YR 3/6, 10R 3/6); textures are clay and clay loam; consistence is either friable or very friable; and structures may be moderate or strongly developed fine or medium nut or granular.

The Bt horizon thickness ranges from 20 to 55 cm; its colours include reddish brown (2.5YR 4/4, 5/4) and red (2.5YR 4/6, 4/8, 5/6, 5/8); textures are clay and clay loam; consistence may be friable or firm; and structures are moderate fine, medium or coarse blocky.

The Bw horizon thickness ranges from 15 to 40 cm; other than weaker structures, the horizon is similar in all other respects to the Bt1 horizon.

The BC horizon thickness ranges from 15-35 cm; its colours include dark reddish brown (2.5YR 3/4) or red (2.5YR 4/6, 4/8, 5/8 and 10R 4/6, 4/8); textures are clay loam, clay or silty clay loam; parent material mottles may be few, common or many in abundance; and consistence is either friable or firm.

VARIANTS: None recognised

SIMILAR SOILS AND DISTINGUISHING FEATURES: None recognised

GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES: Analysis shows the soil to be strongly acid in the topsoil (0-13 cm) and extremely acid in the other horizons; organic carbon and nitrogen are both very low in all horizons; available phosphorus is very low and phosphorus retention is medium; CEC is medium throughout; % base saturation is low in the topsoil and of very low values below it; exchangeable calcium and potassium are very low in all horizons; magnesium is high in the topsoil and medium below this; and aluminium is very significant in the exchange complex.

The particle size family class is fine.

The mineralogical class is kaolinitic.

LABORATORY Nos: USP LOL14A-D

SOIL LIMITATIONS: Moderately rapid permeability; severe soil moisture deficits experienced during the dry season; severe soil erosion potential under cultivation on slopes >3°; very strong soil acidity; nutrient deficiencies of nitrogen, phosphorus and potassium; and probable aluminium toxicity.

Typifying Profile

SOIL NAME:	Raviravi soils, undulating phase.
PROFILE No.:	LOL14
SITE LOCATION:	Site X2, Lololo forest, Ba Province, Viti Levu.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Broad planar surface in weakly rolling hill country.
PARENT MATERIAL:	Strongly weathered *in situ* rock of intermediate and basic composition.
SLOPE:	4°
ASPECT:	East
ELEVATION:	100 m
MICRORELIEF:	Even surface covered with pine needles.
SITE VEGETATION:	15 year old *Pinus caribaea* with no under understorey or ground cover.
LAND USE:	Exotic forestry
DRAINAGE:	Well drained
EROSION:	Past topsoil losses.
DISTURBANCE:	None
LABORATORY Nos:	USP LOL14A-D

PROFILE DESCRIPTION

Ah	0-13 cm (13 cm)	Dry; moist dark red (10R 3/6) and dry red (10R 4/6) clay loam; common distinct black (7.5YR N2/0) manganese mottles; moderately developed fine and medium nut structure breaking to single grain; very friable; sticky; non-plastic; many fine medium and coarse roots; distinct smooth boundary,
Bt	13-61 cm (48 cm)	Dry; moist red (2.5YR 4/8) and dry red (2.5YR 4/6) clay loam; few coarse distinct pinkish grey (7.5YR 7/2) parent material mottles; moderately developed coarse blocky structure; weakly developed thin clay coatings; firm; very sticky; slightly plastic; common fine and medium roots; diffuse smooth boundary,
Bw	61-93 cm (32 cm)	Dry; moist and dry red (2.5YR 4/6) clay loam; weak to moderately developed coarse blocky structure breaking to single grain; firm; slightly sticky; non-plastic; no roots; indistinct smooth boundary,
BC	93-115 cm	Dry; moist and dry red (2.5YR 4/6) clay loam; many (22 cm+) coarse distinct reddish yellow (7.5YR 6/6) and common medium distinct pinkish grey (7.5YR 7/2) parent material mottles; massive breaking to single grain; firm; slightly sticky; non-plastic; no roots.

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Rawiti series**

REFERENCE: New soil series introduced in the detailed soil survey of Seaqaqa Agricultural Research Station (Laffan, Purdie & Shepherd 1985) to include imperfectly drained soils formed from recent alluvium, derived from andesitic rocks, on floodplains adjacent to streams. Profiles are characterised by buried A horizons and greyish mottles in lower subsoils.

Rawiti series cannot be correlated with any of the established soil series defined by Twyford & Wright (1965). It would previously have been included with either Bua (35c) or Tabia (31c) soils of Twyford & Wright (1965).

Named after Rawiti Creek, a small tributary creek north-west of Seaqaqa Agricultural Research Station.

CLASSIFICATION:

(a) Soil Taxonomy: Fluventic Dystropept, fine, ferruginous, isohyperthermic
(b) FAO: Gleyic Cambisol
(c) Twyford and Wright: Recent soil from alluvium with a strong dry season

INCLUDED MAPPING UNITS AND SYMBOLS:
Rawiti soils (58)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Rawiti soils occur in association with Tabia soils and are mapped throughout the dry zone of Vanua Levu.
PARENT ROCK:	Andesite
PARENT MATERIAL:	Recent fine textured alluvium from andesitic rocks.
PHYSIOGRAPHIC POSITION/LANDFORM:	Floodplains adjacent to stream margins.
SLOPE CLASS AND RANGE OF SLOPES:	Flat to gently undulating, (0-3°) .
VEGETATION AND LAND USE:	Indigenous forest and small area of coconuts.
RANGE OF ELEVATION:	50-150 m
RAINFALL:	Annual average range: 1,800-2,400 mm; dry season range: 400-500 mm; wet season range: 1,400-1,800 mm.
TEMPERATURE:	Mean annual: 26°C.
SOIL MOISTURE REGIME:	Aquic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Imperfectly drained
PERMEABILITY CLASS:	Moderate
FLOODING:	Frequently - probably every 2-3 years. Sedimentation occurs occasionally in association with major floods.
EROSION:	Minor stream-bank in places.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Deep, heavy textured soils characterised by buried A horizons. B horizons have variable colours ranging from 5YR to 78.5YR hues, and mottles with chroma of 2 or less are common in the lower subsoil
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Not applicable. Only 2 profile descriptions made.
VARIANTS:	Unnamed variant: Occurs in low-lying depressions (former flood channels) in association with Rawiti soils. The variant is characterised by clayey textures and grey subsoil colours (chromas 2) and reddish mottles. (Soil Taxonomy: Aeric Tropaquept, fine, kaolinitic, isohyperthermic).
SIMILAR SOILS AND DISTINGUISHING FEATURES:	Natua humic clay: Occurs in low-lying depressions in undulating and rolling land and formed from slope wash materials rather than recent stream alluvium (Laffan, 1988).
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Strongly acid through profile (pH 4.9-5.2). Organic C % medium in A horizons (including buried A horizons). % base saturation very low throughout profile. Exchangeable calcium and potassium very low throughout profile. Exchangeable magnesium medium in A and low in B horizons.
LABORATORY Nos:	KRS S1983-1990 (inclusive)
SOIL LIMITATIONS:	Seasonal soil moisture excess due to imperfect drainage, and also risk of frequent flooding from adjacent streams; very low pH; and severe nutrient deficiencies of nitrogen, potassium and phosphorus.

Typifying Profile

SOIL NAME:	Rawiti soils
PROFILE No.:	S35
SITE LOCATION:	Refer to soil map of Seaqaqa Agricultural Research Stratton (Laffan, 1988).

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Low-lying floodplain.
PARENT MATERIAL:	Recent fine textured alluvium derived mainly from andesitic rocks.
SLOPE:	0°
ASPECT:	Not applicable
ELEVATION:	135 m
MICRORELIEF:	Slight alluvial ridge and swale.
SITE VEGETATION:	Indigenous forest
LAND USE:	Unused
DRAINAGE:	Imperfectly drained
EROSION:	Minor stream bank erosion. Subject to frequent flooding and accumulation of sediment.
DISTURBANCE:	None observed
LABORATORY Nos:	KRS S1983-1990 (inclusive)

PROFILE DESCRIPTION

Ah	0-15 cm (15 cm)	Dusky red to dark reddish brown (2.5YR 3/3) silty clay; friable; sticky; plastic; moderately developed medium nut structure breaking to strongly developed fine nut structure; many roots; distinct smooth boundary,
Bw	15-21 cm (6 cm)	Reddish brown (5YR 4/4) clay; friable; sticky; plastic; weakly developed medium nut structure; many roots; distinct smooth boundary,
bAh	21-29 cm (8 cm)	Very dark grey (2.5YR 3/1) silt loam; very friable; non-sticky; non-plastic; single grain; many roots; distinct wavy boundary,
bAB	29-37 cm (8 cm)	Dusky red to dark reddish brown (2.5YR 3/3) clay loam; friable; slightly sticky; plastic; moderately developed medium blocky structure breaking to single grain; common roots; distinct smooth boundary,
bBw	37-56 cm (14 cm)	Strong brown (7.5YR 4/6) clay; friable; slightly sticky; plastic; moderately developed medium blocky structure; few faint yellowish red (5YR 4/6) clay cutans; common roots; indistinct wavy boundary,
bBwg	56-72 cm (16 cm)	Yellowish red (5YR 4/6) clay; common medium distinct brown (7.5YR 5/2) mottles; firm; slightly sticky; plastic; massive breaking to weakly developed medium blocky structure; few roots; indistinct wavy boundary,
bC	72-110+cm (38+ cm)	Strong brown (7.5YTR 5/6) clay; few medium distinct red (2.5YR 4/6) and a few medium distinct grey (7.5Yr 5/1) mottles; firm; slightly sticky; plastic; massive; few roots; few strongly weathered subrounded gravels.

Note: Cutans not diagnostic for argillic horizon.
Few soft weathered andesite grits and gravels <5%.
Earthworms in Ah horizon.

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Reree series**

REFERENCE: New soil series introduced in the soil survey of Rotuma Island (Laffan & Smith 1983) and defined as well drained soils formed from basaltic ash over basaltic scoria on the volcanic ringplains. Profiles are loamy with loose basaltic scoria occurring at depths of 70-80 cm. Few scoria gravels and/or basalt stones occur in the upper 70-80 cm.

Named derived from the Rotuman word for reddish gravelly scoria.

CLASSIFICATION:

(a) Soil Taxonomy: Eutric Fulvudand, hydrous over fragmental, isohyperthermic
(b) FAO: Mollic Andosol
(c) Twyford and Wright: Latosolic soil with no dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Reree soils, flat to gently undulating phase (91A)
Reree soils, undulating phase (91B)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Occurring the central parts of Rotuma, north of Pepjei and also at Itamuta and Losa
PARENT ROCK:	Basalt
PARENT MATERIAL:	Weakly weathered volcanic ash over weathering scoria.
PHYSIOGRAPHIC POSITION/LANDFORM:	Volcanic ringplains surrounding the volcanic cones.
SLOPE CLASS AND RANGE OF SLOPES:	Flat to gently undulating (0-3°) and undulating (4-7°).
VEGETATION AND LAND USE:	Originally in indigenous forest which has been cleared for food and cash cropping, including coconuts, citrus, pineapple, yams and dalo. A small area is in bush fallow.
RANGE OF ELEVATION:	40-150 m
RAINFALL:	Annual average: 3560 mm.
TEMPERATURE:	Mean annual: 26.5°C.
SOIL MOISTURE REGIME:	Udic (perudic)
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Well drained
PERMEABILITY CLASS:	Moderately rapid
FLOODING:	Never floods
EROSION:	No erosion risk.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Profiles are characterised by moderately thick (25-45 cm) dark brown loamy A horizons, and by B horizons which are brown, very friable and loamy. A few basalt stones or boulders often occur throughout the profile. Gravelly or coarse sandy scoriaceous basalt occurs at depths of 70-80 cm.
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Reree series have a Ah1, Ah2, Bw1, Bw2, BC horizon sequence. The Ah1 horizon thickness ranges 16-26 cm; colours are dark brown (7.5YR 3/2) or very dark grey (10YR 3/1); textures are either silt loam, loam or clay loam; and structures fine or medium. The Ah2 horizon thickness ranges 15-30 cm; textures are loams or sandy loams; and the fine structures are either nutty or blocky; and there may or may not be bouldery or gravels. The Bw1 horizon thickness ranges 30-45 cm; colours are dark brown (7.5YR 3/4, 4/4) or strong brown (7.5YR 4/6) and rarely dark reddish brown (5YR 3/4); textures are sandy loams, gritty loams, or silt loams; gravels may be common or many. The Bw2 horizon thickness ranges 20-45 cm; colours range as for the Bw1 horizon; textures are either sandy loams or loamy sands; and blocky structures are medium or coarse. The BC horizon exceeds 30 cm in thickness; structures are massive or single grain; and textures gravelly coarse sand or loamy coarse sand.
VARIANTS:	The unnamed shallow soil with less than 50 cm of loamy volcanic ash overlying gravelly scoriaceous basalt.
SIMILAR SOILS AND DISTINGUISHING FEATURES:	Paptoa series. Develop from loamy volcanic ash overlying tuff at depths of 70-80 cm. Subsoils are redder and the tuff is very firm (Laffan and Smith, 1983).
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Profiles are slightly acid, with very high total phosphorus but extremely high P retention values. Organic carbon and nitrogen values are medium to 40 cm dropping to very low values below. % Base saturation is medium in the Au1 horizon dropping progressively to very low below 65 cm. The CEC is high to very high in all horizons. Exchangeable calcium and magnesium values are very high in the topsoil and drop progressively to very low values below 65 cm. Potassium is very low. Very high Tamms oxalate extractable aluminium, iron and silica values were measured for all horizons. The particle size family class is hydrous over fragmental with the fine earth fraction dominated by amorphous materials.
LABORATORY Nos:	SB9719A-F. KRS S945-949 (inclusive)
SOIL LIMITATIONS:	Slight physical limitations to cultivation of a few basalt stones and boulders. Shallow variants may suffer occasional soil moisture deficits. Severe deficiency of nitrogen and phosphorus, and slight deficiency of potassium, sulphur and some trace elements.

Typifying Profile

SOIL NAME:	Reree soils, undulating phase.
PROFILE No.:	R22
SITE LOCATION:	Refer soil map of Rotuma Island (Laffan & Smith 1983). Southern coast of Rotuma, 500 m north of Pepjei.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Valley floor on volcanic ringplain. Lowland surface formed by basalt flows.
PARENT MATERIAL:	Basaltic ash overlying scoriaceous basalt flow rock.
SLOPE:	5°
ASPECT:	South-east
ELEVATION:	47 m
MICRORELIEF:	Even
SITE VEGETATION:	Coconuts
LAND USE:	Coconut plantation
DRAINAGE:	Well drained
EROSION:	None observed
DISTURBANCE:	None observed
LABORATORY Nos:	SB9719A-F KRS S945-949 (inclusive)
COMMENTS:	Reaction to NaF. Strong in all horizons.

PROFILE DESCRIPTION

Ah1	0-18 cm (18 cm)	Very dark grey (10YR 3/1) silt loam; strongly developed fine nut structure; sticky, plastic, very friable, very weak, uncemented, firm consistence; abundant fine and medium roots; indistinct wavy boundary,
Ah2	18-42 cm (24 cm)	Very dark greyish brown (7.5YR 3/2) sandy loam; moderately developed very fine and fine nut structure; slightly sticky, slightly plastic, friable, moderately weak, uncemented, stiff consistence; many fine and medium roots; few weakly weathered subrounded basalt boulders; distinct wavy boundary,
Bw	42-70 cm (28 cm)	Dark brown (7.5YR 4/4) sandy loam; moderately developed medium blocky structure breaking to moderately developed very fine and fine blocky structure; slightly sticky, slightly plastic, friable, moderately weak, uncemented, firm consistence; common fine and medium roots; few strongly weathered rounded scoria gravels; distinct wavy boundary,
BC	70-110+ cm (40 cm+)	Dark reddish brown (5YR 3/3) gravelly very coarse sand; single grain; non-sticky, non-plastic, loose, very weak, uncemented, firm consistence; few medium roots; profuse weakly weathered and strongly weathered angular scoria gravels.

Reree

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Rewa series**

REFERENCE: The Rewa soil set defined by Twyford & Wright (1965) comprised Rewa sandy loam and loamy sand (4a), Rewa sandy clay loam (4b), Rewa clay (4c), Rewa clay mottled phase (4d), Rewa brown clay (4c) and Rewa brown clay mottled phase (4f). These alluvial soils develop on free draining sites on the levees of the Rewa and Navua River systems.

Adoption of Soil Taxonomy requires subdivision of the original Rewa soil set into 4 series. The weakly developed coarser textured soils are included with the Muainase the less fertile brown phases with Naduru series; Muana and Toga series; the poorer draining, mottled soils with the Tamanua series. Thus, the central concept of the Rewa series in this survey is the clay loam, well drained soil with a cambic horizon and irregular decrease of organic carbon values down the profile.

CLASSIFICATION:

(a) Soil Taxonomy: Fluventic Eutropept, fine-silty, mixed, isohyperthermic
(b) FAO: Eutric Cambisol
(c) Twyford and Wright: Recent soil from alluvium with a very weak or no dry season

INCLUDED MAPPING UNITS AND SYMBOLS:
Rewa soils (22)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Rewa soils develop in better drained sites on levees of the floodplains of the Rewa River, and its tributaries, and the floodplains of the Navua River in South south-east and East south-east Viti Levu.
PARENT ROCK:	Predominantly basic and intermediate rocks.
PARENT MATERIAL:	Recent weakly weathered riverine alluvium.
PHYSIOGRAPHIC POSITION/LANDFORM:	Summit and middle positions on major levees.
SLOPE CLASS AND RANGE OF SLOPES:	Near level to very gently sloping (0-3°).
VEGETATION AND LAND USE:	Intensively cultivated for vegetables, root crops and bananas, pawpaw and tree crops such as cocoa. Where irrigated utilised for rice. For dairying, supports para grass, mimosa and centrosema.
RANGE OF ELEVATION:	3-10 m.
RAINFALL:	Annual average range: 3,200-4,800 mm; dry season range: 800-1,600 mm; wet season range: 1,800-2,800 mm.
TEMPERATURE:	Mean annual: 24°C.
SOIL MOISTURE REGIME:	Perudic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Well drained to moderately well drained.
PERMEABILITY CLASS:	Moderately slow infiltration rate. Fairly rapid permeability.

FLOODING:	One in 10 year return period for floods depositing alluvium. One in 2 year return period for smaller (water only) flood events.
EROSION:	None observed; mainly sites of deposition.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Deep, friable well drained soils with predominantly clayey textures; sandy or silty horizons are not uncommon; most profiles show a well expressed paleosol(s) below 40 cm; topsoils are dark brown, subsoils, dark yellowish brown with colours almost always of a 10YR hue; mottling where it occurs is weakly expressed and if high in profile relates to a particular land use, i.e. rice cultivation; and structures are weakly developed and fine in most profiles.
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Rewa series have a Ap1, Ap2, Bw, BC, bAh horizon sequence. The Ap horizons combined thickness ranges from 20-30 cm; its colours include dark brown (10YR 3/3) and very dark greyish brown (10YR 3/2); textures are clay loam, silty clay loam or silt loam; and weak mottles may or may not be present. The Bw horizon thickness ranges from 30-70 cm (dependent on presence of multilayered paleosols of varying expression and thickness); its colours include dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/4, 5/6, 5/8); and structures may be weak or moderate fine or medium nut.
VARIANTS:	(Refer Purnell, 1972). Rewa clay loam over sand phase; Rewa clay loam, shelly phase and Rewa sandy clay loam.
SIMILAR SOILS AND DISTINGUISHING FEATURES:	Muana series: coarser textured, no cambic B horizon, textures predominantly sands and loamy sands; water table within 1 m of soil surface (Leslie, 1984). Toga series: no cambic B horizon; textures loamy sand and sandy loams, paleosol(s) common (Leslie, 1984). Naduru series: Colour tends to be of redder hue and the dark brown topsoil is deeper. Water table shallower and internal drainage slower. Tamanua series: strongly mottled, may be browner, water table commonly within 1 m of soil surface in 'wet' season.
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	From analysis soils are moderately to slightly acid naturally with pH varying according to past usage; they have a moderate exchange capacity of about 25-30 me.%; base saturation is about 70 percent or slightly higher in the less acid soils; organic carbon values are very low in all horizons though decreasing irregularly with depth; nitrogen is of low to very low values; exchangeable sodium is low, calcium high, magnesium high to very high, and potassium very low. The particle size family class is fine-silty. The mineralogical class is mixed.
LABORATORY Nos:	SB9591A-E; KRS R1344-1348
SOIL LIMITATIONS:	Susceptibility to flooding; and nutrient deficiencies of nitrogen, phosphorus and potassium.

ADDITIONAL COMMENTS: These well drained, easily cultivated, soils constitute some of the best land in the 'wet' zone. Their fertility is only moderate and mineral nutrients are rapidly depleted under intensive farming. Most crops require applications of N, P and K. Response to trace elements, particularly B and Mo has been recorded (Twyford & Wright 1965). In dry periods, plants with a high water requirement tend to suffer from drought and some supplementary irrigation is desirable for high value crops. They have very favourable structure and drainage properties. More research is required to determine the fertiliser needs and the most profitable systems of farming these soils.

Typifying Profile

SOIL NAME: Rewa soils

PROFILE No.: KN05

SITE LOCATION: Refer soil map of Koronivia Agricultural Research Station (scale 1:3000) Leslie (1984). Northern part of Station, 25 m south of Toga Creek.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM: High position on levee of the Rewa River system.

PARENT MATERIAL: Mixed alluvium derived from quartz-poor rocks.

SLOPE: Flat

ASPECT: Not applicable

ELEVATION: 6 m

MICRORELIEF: Hummocky, due to planting method for cocoa, i.e. mounded around tree base with consequent depressions between trees - amplitude 50 cm.

SITE VEGETATION: Bare ground surface under cocoa plot.

LAND USE: Well established 10 year cocoa.

DRAINAGE: Moderately well drained.

EROSION: None. Subject to flooding and 'fresh' accretion of sediment i.e. accumulating soil.

DISTURBANCE: Nil. Cultivated pre-cocoa establishment.

LABORATORY Nos: SB9591A-E; KRS R1344-1348 (inclusive)

PROFILE DESCRIPTION

Ap1	0-18 cm (18 cm)	Slightly moist; dark brown (10YR 3/3) for ped face and rubbed; silty clay loam; weakly developed fine nut structure with weakly developed medium crumb structure; non-sticky; non-plastic; friable; many, fine and medium live roots; diffuse smooth boundary,
Ap2	18-28 cm (10 cm)	Slightly moist; dark brown (10YR 3/3) for ped face and rubbed silty clay loam; few fine faint dark brown (7.5YR 4/4) mottles; weakly developed coarse blocky structure breaking to weakly developed fine nut structure; non-sticky; friable to firm; common fine live roots; indistinct smooth boundary,

Bw	28-77 cm (49 cm)	Slightly moist; dark yellowish brown (10YR 4/4) for both ped face and rubbed; silty clay loam; weakly developed fine nut structure; non-sticky; non plastic; shiny ped faces with weakly expressed clay coatings to voids and pores; few fine live roots; indistinct smooth boundary,
BC	77-106 cm (29 cm)	Moist; yellowish brown (10YR 5/6) ped face and dark yellowish brown (10YR 4/6) rubbed silty clay loam; common fine faint yellowish red (5YR 4/8) mottles; few very fine, Fe/Mn dark reddish brown (5YR 2/2) concretions; weakly developed coarse nut structure breaking to weakly developed very fine nut structure; non-sticky; non-plastic; friable; few fine live roots; distinct smooth boundary,
bAh	106-126 cm (20 cm)	Moist; dark brown (10YR 3/3) for ped face and rubbed silt loam; weakly developed fine nut structure; non-sticky; non-plastic; friable; few very fine live roots.

Typifying Profile

SOIL NAME:	Rewa clay loam, shelly phase.
PROFILE No.:	P169. Purnell (1972)
SITE LOCATION:	60 m from Kings Road near road to FAO pilot farm, Nausori. Photo 078.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Summit of Rewa River levee.
PARENT MATERIAL:	Mixed alluvium derived from quartz-poor rocks and shells applied by sugar company.
SLOPE:	Flat
ASPECT:	Not applicable
ELEVATION:	7 m
MICRORELIEF:	Slightly uneven surface. Soil surface dry, no cracks, with small clods.
SITE VEGETATION:	Weeds and grass, hedge guavas, para grass, *Digitaria*, few sedges, *C. rotundus*, Ageratum, *Phyllanthus*, *Cuphea*.
LAND USE:	Cultivation for vegetables.
DRAINAGE:	Well drained
EROSION:	None. Subject to flooding and 'fresh' accretion of sediment.
DISTURBANCE:	Seasonal ploughing
LABORATORY Nos:	KRS C2679-2684 (inclusive)
COMMENTS:	Water table 168 cm. Suggestion of buried topsoil at 71-79 cm.

PROFILE DESCRIPTION

Ap1	0-15 cm (15 cm)	Dry; dark greyish brown (10YR 3/3) clay loam; strongly developed, fine, nut structure; firm to friable; sticky; plastic; a few shells; porous; many, fine roots; distinct, smooth boundary,
Ap2	15-35 cm (20 cm)	Slightly moist; very dark greyish brown (10YR 3/2) shelly clay loam; moderately developed, medium and fine blocky structure; firm; slightly sticky; plastic; few pores; many, fine roots; abundant shells in lower part of horizon; sharp, smooth boundary,
Bw1	35-71 cm (36 cm)	Moist; strong brown (7.5YR 4/4) silty clay; common fine, faint reddish yellow mottles (7.5YR 6/8); moderately developed, fine blocky structure; firm; sticky; plastic; few medium pores; shiny faces; few, fine roots; distinct, smooth boundary,
Bw2	71-101 cm (30 cm)	Very moist; dark brown (10YR 4/3) clay; few, fine, faint dark yellowish brown (10YR 4/4) mottles; weakly developed, fine, blocky structure; firm; sticky; very plastic; rare, fine roots; indistinct, smooth boundary,
Bw3	101-142 cm (41 cm)	Very moist; yellowish brown (10YR 5/4) sandy clay loam; common, fine, faint dark yellowish brown (10YR 4/4) and greyish brown (10YR 5/2) mottles; weakly developed, fine, blocky structure; firm; sticky; plastic; no roots; many medium vertical pores; zone of water table fluctuation; distinct, smooth boundary,
C1	142-183 cm (41 cm)	Wet; yellowish brown (10YR 5/4) loamy medium sand; common, medium, faint dark brown (7.5YR 4/3) mottles; single grain; friable; non sticky; non plastic; mica flakes; porous,
C2	183-304 cm (121 cm)	Wet; yellowish brown (10YR 5/4) clay; common, fine, faint greyish brown (10YR 5/2) and few, medium, prominent dark reddish brown (5YR 3/3) mottles; massive; very firm; slightly sticky; very plastic.

Rewa

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Rewasa series**

REFERENCE: The Rewasa clay (19b) defined by Twyford & Wright (1965) as slightly degraded soils from basic flows and agglomerates formed under a climate with a strong dry season in association with Nunukuloa soils.

They form part of the Nunukuloa set.

The central concept as defined for Rewasa soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Udic Haplustalf, fine, mixed, isohyperthermic
(b) FAO: (Eutric) Luvisol
(c) Twyford and Wright: Nigrescent soil with a moderate dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Rewasa soils, undulating phase (196B)
Rewasa soils, easy rolling phase (196C)
Rewasa soils, rolling phase (196D)
Rewasa soils, strongly rolling phase (196E)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION: Rewasa soils occur mainly as small areas in association with Vaidoko soils on the east coast of Viti Levu from Dawasamu to just east of the Penang valley.

PARENT ROCK: Basic flows and agglomerates.

PARENT MATERIAL: Moderate to strongly weathered *in situ* rock.

PHYSIOGRAPHIC POSITION/LANDFORM: Convex and concave midslopes and backslopes in moderately dissected hill country. Rock outcrops not uncommon.

SLOPE CLASS AND RANGE OF SLOPES: Undulating (4-7°), easy rolling (8-11°), rolling (12-15°) and strongly rolling (16-20°).

VEGETATION AND LAND USE: Are used for sugar cane, pulses (pigeon pea) and root crops (cassava). Mostly (slopes >14°) under grass and used for extensive grazing.

RANGE OF ELEVATION: 25-250 m

RAINFALL: Annual average range: 1,800-2,400 mm;
dry season range: 400-500 mm;
wet season range: 1,400-1,800 mm.

TEMPERATURE: Mean annual: 25.5°C.

SOIL MOISTURE REGIME: Ustic

SOIL TEMPERATURE REGIME: Isohyperthermic

SOIL DRAINAGE CLASS: Well drained

PERMEABILITY CLASS: Medium

FLOODING: Never floods

EROSION: Moderate sheet and rill erosion potential on slopes >3° when cultivated.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 20 cm of dark reddish brown friable clay, of strongly developed medium nut structure, with common unweathered stones, overlying 40 cm of dark reddish brown firm clay, of strongly developed medium and coarse blocky structure, with prominent clay cutans to peds and many unweathered stones, overlying more than 40 cm of dark grey extremely firm and massive weathering *in situ* rock. Manganese coatings to rock fissures are common and profiles may have the rare unweathered rounded boulder.
DIAGNOSTIC HORIZONS:	Ochric epipedon, argillic horizon.
RANGE OF PROFILE FEATURES:	Rewasa series have an Ah, Bt, C horizon sequence. The Ah horizon thickness ranges from 15 to 22 cm; its colours include very dark grey (5YR 2/1) and dark reddish brown (5YR 2/2, 3/2, 3/3); consistence is either friable or very friable; and structures are strong, medium, fine or very fine nut or granular. The Bt horizon thickness ranges from 25 to 50 cm; its colours include dark reddish brown (5YR 3/4) and reddish brown (5YR 4/4, 5/4); consistence may be friable or firm; structures are strong medium or fine blocky or nut; clay cutans vary between many and profuse; and unweathered stones may be few, many or common. The C horizon exceeds 30 cm in thickness; its normally varicoloured reddish brown (5YR 5/3, 5/4) dark greyish red (5YR 4/2), dark grey (5YR 4/1) and grey (5YR 5/1). Moist consistence for Ah and Bt horizons are consistently sticky and slightly plastic; and boulders are rare or few in the Bt horizon.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analysis shows the soil to be moderately acid in the A horizon (0-20 cm) and slightly acid in the other horizons; organic carbon and nitrogen have low values in the topsoil and very low below this; available phosphorus is very low; CEC is high; % base saturation is very high in all horizons; exchangeable calcium is high, magnesium very high, sodium medium, and potassium is high in the topsoil and very low in the other horizons. The particle size family class is fine. The mineralogical class is mixed.
LABORATORY Nos:	KRS U1864-1866
SOIL LIMITATIONS:	Surface rock outcrops; surface and profile boulders; severe soil moisture deficits experienced during the dry season; clayey nature of the soils inhibit attainment of a fine tilth where cultivated; moderate acidity in the topsoil; nutrient deficiencies of nitrogen, phosphorus and possibly potassium under sustained cropping.

Typifying Profile

SOIL NAME:	Rewasa soils, undulating phase.
PROFILE No.:	Pedon LOL18
SITE LOCATION:	Lololo forest, Ba Province, Viti Levu.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Linear backslope in strongly dissected hill country.
PARENT MATERIAL:	Strongly weathered *in situ* basalt.
SLOPE:	4°
ASPECT:	West north-west
ELEVATION:	120 m
MICRORELIEF:	Smooth
SITE VEGETATION:	Dense mission grass.
LAND USE:	Goat grazing
DRAINAGE:	Well drained
EROSION:	None observed
DISTURBANCE:	None
LABORATORY Nos:	KRS U1864-1866

PROFILE DESCRIPTION

Ah	0-20 cm (20 cm)	Dry; moist dark reddish brown (5YR 3/2) and dry dark reddish grey (5YR 4/2) clay; strongly developed medium nut structure; friable; sticky; slightly plastic; many fine and medium roots; common unweathered subrounded stones; distinct smooth boundary,
Bt	20-62 cm (42 cm)	Dry; moist; dark reddish brown (5YR 3/4) and dry reddish brown (5YR 4/4) clay; strongly developed medium blocky structure; firm; sticky; slightly plastic; many prominent dark reddish brown (5YR 3/4) clay skins; many fine and medium roots; many unweathered subrounded and subangular stones (rare boulder); sharp wavy boundary, (paralathic contact),
C1	62-100 cm+ (38 cm+)	Dry; moist dark grey (5YR 4/1) and dry grey (5YR 5/1) sandy loam; massive; extremely firm; non-sticky; non-plastic; many prominent black (2.5YR N2/0) manganese coatings to rock fissures; no roots.

Rewasa

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Roroa series**

REFERENCE: New soil series introduced in the soil survey of Rotuma Island (Laffan & Smith 1984) and defined as well drained soils formed from weakly weathered basaltic tuff on volcanic cones. Profiles have sandy loam A horizons overlying loamy sand to coarse sand B horizons. Stoniness varies from few to common throughout. Massive indurated tuff occurs at depths >50 cm.

The name is derived from Solroroa at the western end of Rotuma Island.

CLASSIFICATION:

(a) Soil Taxonomy: Typic Eutropept, sandy, mixed, isohyperthermic
(b) FAO: Eutric Cambisol
(c) Twyford and Wright: Latosolic soil with no dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Roroa soils, rolling phase (109D)
Roroa soils, strongly rolling phase (109E)
Roroa soils, moderately steep phase (109F)
Roroa soils, steep phase (109G)
Roroa soils, very steep phase (109H)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION: Occurs mainly at the western end of Rotuma Island, and also on Solnohu and Solkope Islands.

PARENT ROCK: Basalt

PARENT MATERIAL: Weakly weathered *in situ* tuff.

PHYSIOGRAPHIC POSITION/LANDFORM: Sides and crests of cones comprising basaltic tuff.

SLOPE CLASS AND RANGE OF SLOPES: Rolling (12-15°), strongly rolling (16-20°), moderately steep (21-25°), steep (26-35°) and very steep (>35°).

VEGETATION AND LAND USE: Originally in indigenous forest, part of which has been cleared for coconut plantations and food crops.

RANGE OF ELEVATION: 2-235 m

RAINFALL: Annual average: 3,560 mm.

TEMPERATURE: Mean annual: 26.5°C.

SOIL MOISTURE REGIME: Udic (perudic)

SOIL TEMPERATURE REGIME: Isohyperthermic

SOIL DRAINAGE CLASS: Well drained

PERMEABILITY CLASS: Moderately rapid

FLOODING: Never floods

EROSION: Slight to moderate sheet erosion, particularly where cultivated. Landslide erosion is prevalent, particularly on steep slopes.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Dark brown, very friable, fine sandy loam Ah horizons overlying brown, firm, loamy coarse sand Bw horizons. Massive, indurated basaltic tuff is encountered at depths between 50-100 cm.
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Not applicable. Only 1 profile description.
VARIANTS:	(Refer Laffan and Smith, 1983): Unnamed shallow variant: Profiles have massive, indurated basaltic tuff at depths <50 cm. Kelega series is mapped as an inclusion in the Roroa series soil mapping unit.
SIMILAR SOILS AND DISTINGUISHING FEATURES:	(Refer Laffan and Smith, 1983): Kelega series: Well drained soils formed from moderately weathered tuff with yellower and heavier textured subsoils. Kugai series: Well drained soils formed from strongly weathered tuff with reddish, clay textured profiles.
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Not sampled. Likely to have similar properties to Umea series, viz. slightly acid with medium phosphorus status but high P retention. High CEC and % base saturation throughout the profile. The particle size family class is sandy. The mineralogical class is mixed.
LABORATORY Nos:	Not sampled for analysis.
SOIL LIMITATIONS:	Severe physical limitations of slope, shallow rooting depth, low available waterholding capacity and erosion risk. Likely to have similar nutrient deficiencies as Umea series, i.e. moderate to severe nitrogen and phosphorus deficiency and slight deficiency of potassium and sulphur.

Typifying Profile

SOIL NAME:	Roroa soils, moderately steep phase.
PROFILE No.:	R39
SITE LOCATION:	Refer soil map of Rotuma Island (Laffan & Smith 1983). Midslope of Solroroa Hill, in the northwestern part of Rotuma.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Ridge of a steep slope on a weakly dissected tuff cone.
PARENT MATERIAL:	Weakly weathered basaltic tuff.
SLOPE:	25°
ASPECT:	South
ELEVATION:	100 m
MICRORELIEF:	Uneven
SITE VEGETATION:	Cassava, dalo, scattered coconuts, some fallow and scattered sugar cane.
LAND USE:	Coconut plantation, subsistence crops.
DRAINAGE:	Well drained
EROSION:	Slight sheet erosion at site.
DISTURBANCE:	Periodically cultivated.
LABORATORY Nos:	Not sampled
COMMENTS:	Reaction to NaF: Nil in Ah; strong in Bw; very weak to nil in C and R horizons.

PROFILE DESCRIPTION

Ah	0-16 cm (16 cm)	Dark brown (7.5YR 3/2) fine sandy loam; moderately developed medium nut structure, slightly sticky, slightly plastic, very friable, very weak, uncemented, firm consistence; many fine and medium roots; few unweathered subrounded basalt stones; distinct wavy boundary,
Bw	16-23 cm (7 cm)	Strong brown (7.5YR 5/7) gravelly loamy very coarse sand; weakly developed coarse blocky structure; non-sticky, non-plastic, firm, moderately firm, uncemented, firm consistence; few medium roots; common moderately weathered subrounded tuff stones; indistinct wavy boundary,
C	23-60 cm (37 cm)	Light olive brown (2.5Y 5/6) very coarse sand; massive; non-sticky, non-plastic, very firm, rigid, weakly cemented, hard consistence; few medium roots; common weakly weathered subangular tuff stones; diffuse boundary,
R	60-100+ cm (40 cm+)	Olive (5Y 5/3-5/4) very coarse sand; massive; non-sticky, non-plastic, extremely firm, few medium roots.

Roroa

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Rukuruku series**

REFERENCE: Rukuruku clay and stony clay (32b) and Rukuruku hill soils (32bH) defined by Twyford & Wright (1965) as colluvial and outwash soils formed under a strong dry climate from weathered basic rocks on flattish land under reeds and tall grass.

Forms part of the Makomako set.

The central concept defined for Rukuruku soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Ultic Paleustalf, very fine, mixed, isohyperthermic
(b) FAO: Eutric Nitosol
(c) Twyford and Wright: Humic latosol with a strong season

INCLUDED MAPPING UNITS AND SYMBOLS:

Rukuruku soils, undulating phase (201B)
Rukuruku soils, easy rolling phase (201C)
Rukuruku soils, rolling phase (201D)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION: Rukuruku soils are widely developed in Macuata and Bua provinces and occur also on the Kubulau peninsula in southern Vanua Levu. Of minor extent in Viti Levu.

PARENT ROCK: Basic rocks, predominantly basalts.

PARENT MATERIAL: Strongly weathered colluvium.

PHYSIOGRAPHIC POSITION/LANDFORM: Planar and concave toeslopes, lower midslopes.

SLOPE CLASS AND RANGE OF SLOPES: Undulating (4-7°), easy rolling (8-11°) and rolling (12-15°).

VEGETATION AND LAND USE: In natural state under reeds and grasses and used for rough grazing. Used for subsistence root crops, followed by bush fallow, and for sugar cane.

RANGE OF ELEVATION: 20-200 m

RAINFALL: Annual average range: 1,800-2,400 mm;
dry season range: 400-500 mm;
wet season range: 1,400-1,800 mm.

TEMPERATURE: Mean annual: 25.5°C.

SOIL MOISTURE REGIME: Ustic

SOIL TEMPERATURE REGIME: Isohyperthermic

SOIL DRAINAGE CLASS: Well drained

PERMEABILITY CLASS: Moderate

FLOODING: Never floods

EROSION: Moderate sheet and rill erosion potential on slopes >11° where cultivated. Some of these soils have experienced significant topsoil losses in the past.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 15 cm of dark reddish brown very friable clay loam, of moderately developed fine granular and crumb structure overlying 20 cm of dark red friable clay loam, of weakly developed medium nut structure and crumb, slightly plastic moist, overlying more than 60 cm of red friable clay loam, of weakly developed coarse blocky structure, commonly with weakly expressed clay cutans to peds.
DIAGNOSTIC HORIZONS:	Ochric epipedon, argillic horizon.
RANGE OF PROFILE FEATURES:	Rukuruku series have an Ah, Bt1, Bt2 horizon sequence. The Ah horizon thickness ranges from 5-15 cm; its colours include dark brown (7.5YR 3/2, 4/2) and dark reddish brown (5YR 3/2, 3/3, 3/4 and 2.5YR 2/4, 3/4); textures are clay loam or clay; structures are moderate fine or medium nut, blocky or granular and commonly with crumb; and either friable or very friable. The Bt1 horizon thickness ranges from 18-30 cm; its colours include dark red (2.5YR 3/6) or red (2.5YR 4/6, 4/8, 5/8); textures are clay loam or clay; structures are weak fine or medium nut or blocky; and consistence is either friable or firm. The Bt2 horizon thickness ranges from 40-80 cm; its colours are as for the Bt1 horizon; textures are clay or clay loam; structures are weak or moderate coarse blocky; consistence may be friable or firm; strongly weathered parent material fragments may or may not be present in the lower part; and there may be some weak mottling near the boundary with the BC.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analysis shows the soil to be strongly acid; organic carbon is low in the topsoil (0-13 cm) and very low below; nitrogen is low in the topsoil; available phosphorus is very low throughout; % base saturation is high but has a medium value at 135 cm; CEC is high in horizons 0-35 cm and of medium value below this; calcium is medium 0-35 cm and low below; magnesium is extremely high (>13 me.% throughout); and potassium is medium in the topsoil but of very low values in the other horizons. The particle size family class is very fine. The mineralogical class is mixed.
LABORATORY Nos:	USP SQ77A-E
SOIL LIMITATIONS:	Moderate permeability; experiences severe soil moisture deficits during part of the dry season; moderate sheet and rill erosion potential on slopes >11° where cultivated; strong soil acidity; nutrient deficiencies of potassium, phosphorus and nitrogen.

Typifying Profile

SOIL NAME:	Rukuruku soils, undulating phase.
PROFILE No.:	SQ77
SITE LOCATION:	Seaqaqa Forest, Bua Province.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Planar toeslope in rolling land.
PARENT MATERIAL:	Strongly weathered colluvium from rocks of basic composition.
SLOPE:	4° (length 150 m)
ASPECT:	South-west
ELEVATION:	180 m
MICRORELIEF:	Smooth
SITE VEGETATION:	*Pinus caribaea* (planted 1977).
LAND USE:	Exotic forestry
DRAINAGE:	Well drained
EROSION:	None observed.
DISTURBANCE:	None
LABORATORY Nos:	USP SQ77A-E

PROFILE DESCRIPTION

Ah	0-13 cm (13 cm)	Slightly moist; moist and rubbed dark reddish brown (2.5YR 3/4) clay loam; moderately developed fine granular plus weak very fine crumb structure; very friable; non-sticky; non-plastic; many fine and very fine roots; distinct smooth boundary,
Bt1	15-35 cm (20 cm)	Slightly moist; moist and rubbed dark red (2.5YR 3/6) clay loam; weakly developed medium nut structure breaking to weak fine crumb structure; well expressed clay coatings; friable; non-sticky; slightly plastic; common fine medium and coarse roots; indistinct smooth boundary,
Bt2	35-103+ cm (68+ cm)	Moist; red (10R 4/8) and rubbed red (10R 4/6) clay loam; weakly developed coarse blocky breaking to weak fine blocky structure; well developed clay coatings; friable; non-sticky; slightly plastic; prominent shiny faces to peds; few fine roots.

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Sabeto series**

REFERENCE: Sabeto clay (14a) and Sabeto hill soils (14aH) defined by Twyford & Wright (1965) as heavy clays from marls and calcareous tuffs formed under a climate with a moderate dry season.

Forms part of the Sabeto set.

The central concept for Sabeto soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Typic Ustropept, fine, smectitic, isohyperthermic
(b) FAO: Eutric Cambisol
(c) Twyford and Wright: Nigrescent soil with a moderate dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Sabeto soils, easy rolling phase (116C)
Sabeto soils, rolling phase (116D)
Sabeto soils, strongly rolling phase (116E)
Sabeto soils, moderately steep phase (116F)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Of limited extent on the Nausori highlands road, in the upper Sigatoka valley and in the upper Sabeto valley.
PARENT ROCK:	Marls and calcareous tuffs.
PARENT MATERIAL:	Moderately weathered *in situ* rock.
PHYSIOGRAPHIC POSITION/LANDFORM:	Convex backslopes and midslopes in moderately rolling land.
SLOPE CLASS AND RANGE OF SLOPES:	Easy rolling (8-11°), rolling (12-15°), strongly rolling (16-20°), and moderately steep (21-25°).
VEGETATION AND LAND USE:	These soils are little used except for rough grazing.
RANGE OF ELEVATION:	100-500 m
RAINFALL:	Annual average range: 1,800-2,400 mm; dry season range: 400-500 mm; wet season range: 1,400-1,800 mm.
TEMPERATURE:	Mean annual: 25.5°C.
SOIL MOISTURE REGIME:	Ustic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Well drained
PERMEABILITY CLASS:	Moderate
FLOODING:	Never floods
EROSION:	Severe sheet and rill erosion potential. Experienced annual burning of the vegetation which has caused severe sheet erosion and often complete loss of soil altogether.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 18 cm of black to very dark grey friable to firm clay of very strongly developed medium blocky structure, slightly sticky and moderately plastic when moist, overlying 25 cm of varicoloured, mainly light brownish grey stony clay, containing much weathering marl, on pale grey slightly weathered marl.
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Not applicable. Only two profile descriptions made.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Chemical analysis shows the soil to be slightly acid, of high to very high base status, with a very high content of exchangeable calcium and of magnesium and a high content of potassium. Also, extremely high acid soluble phosphate content
LABORATORY Nos:	KRS 742-743 (inclusive)
SOIL LIMITATIONS:	Profile shallowness; severe erosion hazard; severe soil moisture deficits during the season; and deficiency of nitrogen.

Typifying Profile

SOIL NAME:	Sabeto soils, rolling phase.
PROFILE No.:	TW 70
SITE LOCATION:	Close to Nadele village, Sabeto valley, western Viti Levu.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Planar backslope
PARENT MATERIAL:	Weathered *in situ* calcareous tuff.
SLOPE:	13°
ASPECT:	West
ELEVATION:	180 m
MICRORELIEF:	Even
SITE VEGETATION:	Improved pasture (nadi blue grass, batiki blue grass).
LAND USE:	Rough grazing
DRAINAGE:	Well drained
EROSION:	Severe past and current sheet and rill erosion.
DISTURBANCE:	Erosion related to frequent burning.
LABORATORY Nos:	KR 742-743

PROFILE DESCRIPTION

Sabeto soils, rolling phase

Ah	0-18 cm (18 cm)	Moist; black (10YR 2/1) to very dark grey (10YR 3/1) clay; very strongly developed medium blocky structure; friable to firm; slightly sticky; moderately plastic; common fine fibrous roots; distinct smooth boundary,
Bw	18-43 cm (25 cm)	Moist; varicoloured, mainly light brownish grey (10YR 6/1) stony clay; weakly developed coarse blocky structure; firm; slightly sticky; slightly plastic; many weathering marl fragments; few fine fibrous roots; distinct wavy boundary,
R	on	Light grey (10YR 7/1) slightly weathered marl.

Sabeto

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Saliadrau series**

REFERENCE: Saliadrau loamy sand and sandy clay loam (8a) defined by Twyford & Wright (1965) as formed on levees and low terraces from alluvium of high quartz content (from acidic rocks) under a climate with a weak dry season and subject to occasional to frequent flooding.

This central concept for Saliadrau soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Fluventic Eutropept, coarse-loamy, mixed, isohyperthermic
(b) FAO: Eutric Fluvisol
(c) Twyford and Wright: Recent soil from river alluvium with a weak dry season

INCLUDED MAPPING UNITS AND SYMBOLS:
Saliadrau soils (61)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Saliadrau soils develop in the upper reaches of rivers in the centre of Viti Levu. They are of very minor occurrence in Vanua Levu, where they are confined to narrow valleys of the interior draining to the dacite mountains.
PARENT ROCK:	Rocks of high quartz content (i.e. from acidic rocks).
PARENT MATERIAL:	Deep weakly weathered coarse textured alluvium.
PHYSIOGRAPHIC POSITION/LANDFORM:	Low terraces of contemporary flood plains.
SLOPE CLASS AND RANGE OF SLOPES:	Near level to flat (0-2°).
VEGETATION AND LAND USE:	Subsistence root crops and bananas followed by bush fallow. Many areas have been invaded by Yagona-ni-onolulu.
RANGE OF ELEVATION:	10-40 cm
RAINFALL:	Annual average range: 3,200-4,800 mm; Dry season range: 800-1,600 mm; Wet season range: 1,800-2,800 mm.
TEMPERATURE:	Mean annual: 24°C.
SOIL MOISTURE REGIME:	Udic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Well drained
PERMEABILITY CLASS:	Rapid
FLOODING:	1 in 10 year return period for floods depositing 'fresh' alluvium and 1 in 2 year return period for other floods.
EROSION:	No erosion risk.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 30 cm of brown or dark brown very friable loamy fine sand of weakly developed fine nut structure and single grain, and sometimes weakly mottled olive brown in the lower part, overlying 40 cm of loose loamy sand of weakly developed medium blocky structure in the upper part and single grain below. A buried topsoil of 15 cm is normally encountered at 70 cm depth, and having olive mottled brown very friable silt loam, of weakly developed fine and medium nut structure overlying more than 40 cm of olive loose loamy sand.
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Not applicable. The range of profile features recognised are due to variation in the layered alluvium and the number of thickness of buried topsoils.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analysis shows strongly acid pH to 30 cm depth and moderately acid below this; nitrogen and carbon have very low values with carbon showing an irregular decrease with depth; available phosphorus is very low; % base saturation is high; CEC medium to high (7.69-18.22 me.%); exchangeable calcium and magnesium are medium; sodium low; and potassium very low. The particle size family class is coarse - loamy. The mineralogical class is mixed.
LABORATORY Nos:	KRS V134-139
SOIL LIMITATIONS:	Susceptibility to and frequency of flooding; coarse textures, rapid permeability, and low waterholding capacity may result in soil moisture deficits during the period May to October; soil acidity; and nutrient deficiencies of nitrogen, potassium and phosphorus.

Typifying Profile

SOIL NAME:	Saliadrau soils
PROFILE No.:	VS08
SITE LOCATION:	Adjacent Saliadrau Village on Navua River.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Flat planar terrace 3 m above contemporary floodplain.
PARENT MATERIAL:	Coarser textured alluvium from quartzose rocks.
SLOPE:	Level
ASPECT:	Not applicable
ELEVATION:	90 m
MICRORELIEF:	Even
SITE VEGETATION:	Short carpet grass with scattered guava.
LAND USE:	Cattle grazing
DRAINAGE:	Well drained
EROSION:	None
DISTURBANCE:	None
LABORATORY Nos:	KRS V134-139

PROFILE DESCRIPTION

Ah	0-12 cm (12 cm)	Moist; brown (10YR 4/3) loamy fine sand; weakly developed fine nut structure plus single grain; very friable; common fine and very fine roots; distinct smooth boundary,
bAh	12-30 cm (18 cm)	Moist; dark brown (10YR 3/3) silt loam; few fine faint olive brown (2.5Y 4/4) mottles; weak to moderately developed fine and medium nut plus single grain; very friable; common very fine roots; distinct smooth boundary,
BWb	30-45 cm (15 cm)	Moist; olive (5Y 5/3) loam; weakly developed medium blocky structure breaking to single grain; loose; common very fine roots; indistinct smooth boundary,
bC	45-70 cm (25 cm)	Moist; olive (5Y 5/4) loamy sand; single grain; loose; few very fine roots; distinct smooth boundary,
2bAh	70-84 cm (14 cm)	Moist; olive (5Y 4/3) silt loam; few fine distinct dark brown (7.5YR 4/4) mottles; weakly developed fine and medium nut structure breaking to single grain; very friable; few very fine roots; distinct smooth boundary,
2bC	84-125 cm (41 cm+)	Moist; olive (5Y 5/4) loamy sand; single grain; loose; few very fine roots.

Saliadrau

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Salialailai series**

REFERENCE: Salialailai steepland peaty loam and bouldery loam (94a) defined by Twyford & Wright (1965) as an upland soil related to latosolic soils from young olivine basalt ash and formed under a climate with no dry season.

Forms part of the Salialailai set.

The central concept for Salialailai soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Lithic Fulviudand, medial, isothermic
(b) FAO: Humic Andosol
(c) Twyford and Wright: Upland steepland soil related to or associated with latosolic soils with no dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Salialailai soils, steep phase (219G)
Salialailai soils, very steep phase (219H)

Environmental Factor

GEOGRAPHICAL DISTRIBUTION:	Occurs on the steeper surfaces (cf. to Matana series) fringing the axial range of scoria cones in upland Taveuni
PARENT ROCK:	Olivine basalts
PARENT MATERIAL:	Weakly weathered *in situ* ash.
PHYSIOGRAPHIC POSITION / LANDFORM:	Long steep planar and gently convex surfaces in dissected steepland.
SLOPE CLASS AND RANGE OF SLOPES:	Steep (26-35°) and very steep (>35°).
VEGETATION AND LAND USE:	Unused (in natural state of rain forest).
RANGE OF ELEVATION:	600-1,050 m
RAINFALL:	Annual average range: 3,000-6,400 mm; dry season range: 800-3,000 mm; wet season range: 2,000-3,200 mm.
TEMPERATURE:	Mean annual: 18°C.
SOIL MOISTURE REGIME:	Perudic
SOIL TEMPERATURE REGIME:	Isothermic
SOIL DRAINAGE CLASS:	Well drained
PERMEABILITY CLASS:	Moderately rapid
FLOODING:	Never floods
EROSION:	Very severe sheet and rill erosion potential if forest ever cleared.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Under forest typically shows 2 cm of decomposing litter overlying 15 cm of very dark grey firm slightly peaty silt loam of weak medium blocky structure overlying 25 cm of dark brown friable silty clay loam, of weak medium and coarse blocky structure becoming stony and bouldery with depth over basalt flow rock. Smeary consistence when moist.
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Not applicable. Only 2 profile descriptions made.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analysis shows the soil to be strongly acid in the topsoil (0-15 cm) and moderately acid in the Bw (15-40 cm); organic carbon is high in topsoil and of medium value in the Bw horizon; phosphorus retention is very high; % base saturation is very low; CEC is very high 0-15 cm and high 15-40 cm; calcium is medium 0-15 cm and very low below 15 cm; magnesium is high 0-15 cm and low below 15 cm; potassium is low 0-15 cm and very low 15-40 cm; and Tamms aluminium extract values are very high.
LABORATORY Nos:	USP TAV111A-B
SOIL LIMITATIONS:	Slope; surface boulders; severe erosion potential; profile shallowness; moderately rapid permeability; soil acidity; very high phosphate fixation properties; and nutrient deficiencies of nitrogen and potassium.

Typifying Profile

SOIL NAME:	Salialailai soils, very steep phase.
PROFILE No.:	TAV111
SITE LOCATION:	Above Soqulu Estate, southwest Taveuni Island.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Planar slope in steep country.
PARENT MATERIAL:	Basaltic ash over *in situ* basalt flow rock.
SLOPE:	40°
ASPECT:	West
ELEVATION:	900 m
MICRORELIEF:	Uneven. Many basalt outcrops and basalt surface boulders.
SITE VEGETATION:	Rain forest with open low canopy.
LAND USE:	Unused (natural state).
DRAINAGE:	Well drained
EROSION:	None observed
DISTURBANCE:	None
LABORATORY Nos:	USP TAV 111 A-B
COMMENTS:	NaF reaction. Strong positive for all horizons described below.

PROFILE DESCRIPTION

L	2-0 cm	Partly decomposed litter with some humus material.
Ah	0-15 cm (15 cm)	Moist; very dark grey (10YR 3/1) slightly peaty silt loam; weakly developed medium blocky structure; firm; smeary; abundant fine and medium woody roots; diffuse smooth boundary,
Bw	15-40 cm (25 cm)	Moist; dark brown (10YR 3/3) silty clay loam; weakly developed medium and coarse blocky structure; friable; very smeary; becoming stony and bouldery with depth; many fine and medium woody roots; distinct wavy boundary,
	on	Basalt flow rock.

Salialailai

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Samabula series**

REFERENCE: Samabula clay (11a) and Samabula hill soils (11aH) defined by Twyford and Wright (1965) as developed from marls and calcareous tuffs under a climate with no or weak dry season. The central concept for Samabula soils is retained in this survey.

CLASSIFICATION:

(c) Soil Taxonomy: Lithic Hapludoll, fine, smectitic, isohyperthermic
(b) FAO: Lithic Phaeozem
(c) Twyford and Wright: Nigrescent soil with no or weak dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Samabula soils, flat to gently undulating phase (110A)
Samabula soils, undulating phase (110B)
Samabula soils, easy rolling phase (110C)
Samabula soils, rolling phase (110D)
Samabula soils, strongly rolling phase (110E)
Samabula soils, moderately steep phase (110F)
Samabula soils, steep phase (110G)
Samabula soils, very steep phase (110H)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Samabula soils are developed on rolling and hilly land in the south-east and east of Viti Levu.
PARENT ROCK:	Marls and calcareous tuffs.
PARENT MATERIAL:	Moderately weathered *in situ* rock
PHYSIOGRAPHIC POSITION/LANDFORM:	Convex rolling ridges, backslopes and midslopes in easy to easy rolling country.
SLOPE CLASS AND RANGE OF SLOPES:	From flat to gently undulating (0-3°) and including all slope classes through to very steep (>35°).
VEGETATION AND LAND USE:	Dairying (with pastures of carpet grass, batiki blue, some paspalum and mimosa), market gardening, and subsistence root crops.
RANGE OF ELEVATION:	5-350 m
RAINFALL:	Annual average range: 3,200-4,800 mm; dry season range: 800-1,600 mm; wet season range: 1,800-2,800 mm.
TEMPERATURE:	Mean annual: 24°C.
SOIL MOISTURE REGIME:	Udic (perudic)
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Well drained
PERMEABILITY CLASS:	Moderate
FLOODING:	Never floods
EROSION:	Moderate sheet and rill erosion potential on slopes >12°.

Morphological And Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 5 cm of dark brown friable clay, of weakly developed blocky structure breaking to moderate medium granular, sticky and plastic moist, and with fragments of angular marl, overlying 15 cm of dark yellowish brown friable stony clay of weak to moderately developed fine granular structure, over 10 cm of dark yellowish brown bouldery clay on (lithic contact) weakly weathered *in situ* marl.
DIAGNOSTIC HORIZONS:	Mollic epipedon, cambic horizon, lithic contact.
RANGE OF PROFILE FEATURES:	Samabula series have a Ah(Ap), AB, (BC), R horizon sequence. The A horizon thickness ranges from 5-35 cm; to colours in very dark grey (10YR 3/1, 3/2) black (10YR 2/1), very dark brown (10YR 2/2) and dark brown (10YR 3/3); structures may be weakly developed coarse blocky breaking to moderate or strong fine and medium granular. The AB horizon (if present) thickness ranges from 5-15 cm; its colours include dark yellowish brown (10YR 3/4, 4/4), dark brown (10YR 3/3, 4/3) and very dark brown (10YR 2/2); and structure are weak or moderate, fine or medium nut or granular. Profile depth to the rock varies between 5 cm and 40 cm, depending on the position of the slope and the amount of erosion that has occurred.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analysis shows near neutral pH for the A horizon (0-5 cm), slightly alkaline (5-20 cm) and moderately alkaline below these depths; organic carbon and nitrogen values are medium (0-5 cm) and low below this depth; CEC is very high; free lime recorded below 5 cm depth so base data for topsoil only and are as follows: % base saturation, high; calcium and magnesium very high; sodium high; and potassium very high. The particle size family class is fine. The mineralogical class is smectitic.
LABORATORY Nos:	USP NS1A-C
SOIL LIMITATIONS:	Profile shallowness; clayey textures; moderate sheet erosion potential on slopes >3°; soil alkalinity.

Typifying Profile

SOIL NAME:	Samabula soils, flat to gently undulating phase.
PROFILE No.:	NS1
SITE LOCATION:	Nasinu, Viti Levu; 20 m north of Kings Road opposite Nasinu Teachers Training College.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Gently rolling terrain.
PARENT MATERIAL:	Calcareous Suva marl.
SLOPE:	Flat
ASPECT:	Not applicable
ELEVATION:	40 m
MICRORELIEF:	Smooth
SITE VEGETATION:	Grass, ferns, shrubs.
LAND USE:	Unused
DRAINAGE:	Well drained
EROSION:	Past sheet erosion.
DISTURBANCE:	Cropped for root crops.
LABORATORY Nos:	USP NS1A-C

PROFILE DESCRIPTION

Ap	0-5 cm (5 cm)	Moist; dark brown (10YR 3/3) clay (rubbed) containing some small pieces of marl; weakly developed coarse blocky structure breaking to moderately developed medium granular structure; friable; sticky; plastic; many roots; indistinct boundary;
AB	5-20 cm (15 cm)	Moist; dark yellowish brown (10YR 4/4) stony clay with many pieces of marl; friable; sticky; plastic; weak to moderately developed fine granular structure, few roots; indistinct boundary,
BC	20-30 cm	Moist; dark yellowish brown (10YR 4/4) stony and boundary clay with more marl pieces than soil; distinct boundary (lithic contact),
R	30+ cm	Weakly weathered *in situ* marl.

Samabula

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Sarowaqa series**

REFERENCE: Sarowaqa steepland stony sandy clay (92a) defined by Twyford and Wright (1965) as forming from highly siliceous acid tuffs under a climate with a moderate dry season.

Forms part of the Sarowaqa set.

The central concept for Sarowaqa soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Typic Dystropept, fine, kaolinitic, isohyperthermic
(b) FAO: Dystric Cambisol
(c) Twyford and Wright: Steepland soil related to or associated with red yellow podzolic soils with a moderate dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Sarowaqa soils, moderately steep phase (135F)
Sarowaqa soils, steep phase (135G)
Sarowaqa soils, very steep phase (135H)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	These soils are found in the upper Sarowaqa river area and also to a small extent in north-eastern Vanua Levu.
PARENT ROCK:	Highly siliceous acid tuffs.
PARENT MATERIAL:	Strongly weathered *in situ* rocks.
PHYSIOGRAPHIC POSITION/LANDFORM:	Hill summits and hill slopes.
SLOPE CLASS AND RANGE OF SLOPES:	Moderately steep (21-25°), steep (26-35°), and very steep (35-40°).
VEGETATION AND LAND USE:	Mainly under forest and only rarely used for subsistence agriculture.
RANGE OF ELEVATION:	100-500 m
RAINFALL:	Annual average range: 3,200-4,800 mm; dry season range: 800-1,600 mm; wet season range: 1,800-2,800 mm.
TEMPERATURE:	Mean annual: 24°C.
SOIL MOISTURE REGIME:	Udic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Well drained
PERMEABILITY:	Moderate
FLOODING:	Never floods
EROSION:	Have experience severe soil erosion in some places. Very severe sheet erosion and rill erosion potential.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 10 cm of dusky red friable to firm sandy clay, containing a few large quartz grains, on 30 cm of dark red friable clay, of moderate medium blocky structure on 35 cm of red friable clay slightly vari-coloured, of moderate blocky structure, on vari-coloured red clay containing many fragments of soft weathering tuff.
DIAGNOSTIC HORIZONS:	Orchic epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Not applicable. Only two profile descriptions available.
VARIANTS:	Unnamed shallow variant. Typically shows 7 cm of dark reddish grey sandy clay loam, on 18 cm of red sandy clay overlying 10 cm of reddish brown firm heavy clay, and very plastic when moist, on weathering sandy tuff.
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analysis shows the soil to be moderately acid in the topsoil and strongly acid in the subsoil; organic carbon and nitrogen and medium in the topsoil and very low in the subsoil; very low available phosphorus; % base saturation is high in the topsoil and low below it; CEC is very high in the topsoil and high below; calcium and magnesium are very high in the topsoil with calcium low and magnesium high in the subsoil; and potassium is high in the topsoil and very low in the subsoil. The particle size family class is fine. The mineralogical class is kaolinitic.
LABORATORY NOS:	FACL 9211161-64
SOIL LIMITATIONS:	Slope; erosion potential; dry season soil moisture deficits; soil acidity; and nutrient deficiencies of nitrogen, phosphorus and potassium.

Typifying Profile

SOIL NAME:	Sarowaqa series
PROFILE NO:	MAC 19
SITE LOCATION:	Uluitana area, Nasarowaqa, Vanua Levu - base of Uluitana; East of the trig station.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	A concave of the hill slope.
SLOPE:	35^0
ASPECT:	South
ELEVATION:	515 m
MICRORELIEF:	Uneven ground surface.
SITE VEGETATION:	Secondary vegetation; sama, balabala, mission grass, lololo.
LAND USE:	Heavy bush
DRAINAGE:	Well drained
MOISTURE CONDITIONS:	Moist
EROSION:	None observed
DISTURBANCE:	Some rock outcrops in places.
LABORATORY Nos.:	FACL 9211161-64

PROFILE DESCRIPTION

Ah	0-10 cm (10 cm)	Moist; dusky red (2.5YR 3/2) sandy clay; of moderately developed medium and fine nut structure; friable to firm; common large quartz grains; many fine and medium fibrous roots; indistinct smooth boundary,
Bw1	10-40 cm (30 cm)	Moist; dark red (2.5YR 3/6) clay; moderately developed medium blocky structure; friable; common fine and medium fibrous roots; indistinct smooth boundary,
Bw2	40-75 cm (35 cm)	Moist; red (2.5YR 5/6) clay; moderately developed medium blocky structure; friable; slightly sticky; slightly plastic; few fine fibrous roots; distinct smooth boundary,
C	on	Vari-coloured red (2.5YR 5/6) clay; many fragments of soft weathering tuff.

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Saunaka series**

REFERENCE: Saunaka clay (49c) defined by Twyford and Wright (1965) as clays from basic and intermediate rocks formed under a climate with a moderate to strong dry season.

Forms part of the Veisaru set.

The central concept for Saunaka soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Oxyaquic Dystropept, fine, kaolinitic, isohyperthermic
(b) FAO: Dystric Cambisol
(c) Twyford and Wright: Gley soil related to latosols with a strong dry reason

INCLUDED MAPPING UNITS AND SYMBOLS:

Saunaka soils, loamy sand, flat to gently undulating phase (34A)
Saunaka soils, loamy sand, undulating phase (34B)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Saunaka soils develop in association with Nadi soils and Namaka soils, particularly just south of Nadi Airport.
PARENT ROCK:	Not known, but probably mainly acidic rocks.
PARENT MATERIAL:	Strongly weathered siliceous alluvium.
PHYSIOGRAPHIC POSITION/LANDFORM:	Footslopes and toeslopes of dissected terraces.
SLOPE CLASS AND RANGE OF SLOPES:	Flat to gently undulating (0-3°), and undulating (4-7°).
VEGETATION AND LAND USE:	Fallow land, experimental crops, grassland.
RANGE OF ELEVATION:	2-20 m
RAINFALL:	Annual average range: 1,800-2,400 mm; dry season range: 400-500 mm; wet season range: 1,400-1,800 mm.
TEMPERATURE:	Mean annual 25°C.
SOIL MOISTURE REGIME:	Aquic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Imperfectly drained.
PERMEABILITY CLASS:	Moderately slow.
FLOODING:	Periodic surface flooding during wet season.
EROSION:	Negligible to severe sheet erosion when under cultivation.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Heavy textured soils with a gradational texture profile (sandy clay loam over clay loam to clay or fine sandy clay) and grey-mottled subsoil horizons (mottles or base colours have chroma < 2). Few very strongly weathered stones or gravels (pseudomorphs) occur in some profiles. Subsoil structures are massive or weakly developed blocky.
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Saunaka series has an Ap, AB, Bwg, Btg horizon sequence. Ap horizon thickness ranges from 25-35 cm (mean 29 cm) and texture include clay loam, fine sandy clay loam and silty clay loam. Structures are weakly developed blocky or massive breaking to blocky crumb with friable or firm consistence. Matrix colours are mainly 5YR and 7.5YR hues. Btg horizons generally have greyish matrix colours (5Y 7/2-7/3) with yellowish brown or reddish mottles, or reddish matrix colours (2.5YR 4/8-5YR 6/6) with many grey mottles. Textures range from clay loams to fine sandy clays or clays. Structures are mainly massive breaking to blocky and consistence generally is friable. Few or common clay cutans occur.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	% base saturation high in A horizon, medium in B, and low at depths > 1.25 m below the surface. Exchangeable calcium medium in A and upper B, low to very low in lower B, magnesium low in A and upper B, high in lower B horizon, potassium very low throughout profile. % base saturation > 35 at depth 1.25 m below top of cambic horizon. The particle size family class is fine. The mineralogy class is kaolinitic.
LABORATORY Nos:	KRS R2736-41, SB 9663 A-F
SOIL LIMITATIONS:	Imperfect drainage with soil moisture excess during wet season and soil moisture deficit during dry season, nutrient deficiencies.

Typifying Profile

SOIL NAME:	Saunaka soils, flat to gently undulating phase.
PROFILE No.:	L 69
SITE LOCATION:	Legalega Agricultural Research Station, Nadi basin, western Viti Levu.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Crest of dissected terrace.
PARENT MATERIAL:	Strongly weathered alluvium.
SLOPE:	2°
ASPECT:	North
ELEVATION:	13 m
MICRORELIEF:	Smooth
SITE VEGETATION:	In fallow
LAND USE:	Experimental crop trials.
DRAINAGE:	Imperfectly drained
EROSION:	None
DISTURBANCE:	Cultivated
LABORATORY Nos:	KRS R2736-41, SB 9663 A-F

PROFILE DESCRIPTION

Saunaka soils, flat to gently undulating phase

Ap	0-25 cm (25 cm)	Dry; dark brown (7.5YR 4/4) (moist, ped face and rubbed colours) fine sandy clay loam; non-sticky; non-plastic; friable; weakly developed fine crumb structure; distinct smooth boundary,
AB	25-38 cm (13 cm)	Slightly moist; dark grown (7.5YR 4/4) (moist, ped face and rubbed colours) clay loam; few medium distinct yellowish red (5YR 5/6) mottles; slightly sticky; non-plastic; friable; moderately developed fine blocky structure and weakly developed very fine blocky structure; distinct smooth boundary,
Bwg	38-60 cm (22 cm)	Slightly moist; light grey (5Y 7/2) (moist, ped face and rubbed colours) clay loam; slightly sticky; slightly plastic; profuse medium prominent yellowish brown (10YR 5/6) mottles; massive breaking to weakly developed fine blocky structure; distinct smooth boundary,
Btg	60-110 cm (50 cm)	Slightly moist; light grey (5Y 7/2) (moist, ped face and rubbed colours) fine sandy clay; many fine distinct dark yellowish brown (10YR 4/6) mottles; slightly sticky; non-plastic; friable; massive breaking to weakly developed very fine blocky structure; few clay cutans.

Saunaka

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Savudrodro series**

REFERENCE: Savudrodro steepland bouldery clay (91a) defined by Twyford and Wright (1965) as steepland soils from diorites and granodiorites formed under a climate with a weak dry season.

Forms part of the Savudrodro set.

The central concept for Savudrodro soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Typic Humitropept, fine, kaolinitic, isohyperthermic
(b) FAO: Humic Cambisol
(c) Twyford and Wright: Red yellow podzolic soil with a weak or no dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Savudrodro soils, easy rolling phase (161C)
Savudrodro soils, rolling phase (161D)
Savudrodro soils, strongly rolling phase (161E)
Savudrodro soils, moderately steep phase (161F)
Savudrodro soils, steep phase (161G)
Savudrodro soils, very steep phase (161H)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Confined to the dissected plateau landscapes of Viti Levu and Vanua Levu being more extensive in the latter.
PARENT ROCK:	Rocks of acid composition (diorites, granodiorites and some metamorphic rocks).
PARENT MATERIAL:	Moderately weathered *in-situ* rock.
PHYSIOGRAPHIC POSITION/LANDFORM:	Dissected plateau under forest.
SLOPE CLASS AND RANGE OF SLOPES:	Easy rolling (8-11°), rolling (12-15°), strongly rolling (16-20°), moderately steep (21-25°), steep (26-35°), and very steep (35-40°).
VEGETATION AND LAND USE:	Mainly support grasses with scrub and scattered forest species.
RANGE OF ELEVATION:	50-600 m
RAINFALL:	Annual average range: 3,200-4,800 mm; dry season range: 800-1,600 mm; wet season range: 1,800-2,800 mm.
TEMPERATURE:	Mean annual: 24.5°C.
SOIL MOISTURE REGIME:	Udic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Well drained
PERMEABILITY CLASS:	Moderate
FLOODING:	Never floods
EROSION:	Have severe sheet, rill and mass movement erosion potential.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 8 cm of brown friable sandy clay loam of strong medium granular structure overlying 30 cm of yellowish brown very firm mottled sandy clay of strongly developed coarse blocky structure and with clay and/or organic cutans to ped faces, overlying 50 cm or more of yellowish brown and white profusely mottled firm sandy clay of weak coarse blocky structure and having clay cutans to ped faces.
DIAGNOSTIC HORIZONS:	Ochric epipedon; cambic horizon .
RANGE OF PROFILE FEATURES:	Not applicable. Only two profile descriptions available.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Savudrodro soils are strongly acid and of low base status, with low contents of exchangeable calcium, magnesium and potash and only moderate phosphate levels. The particle size family class is fine. The mineralogy class is kaolinitic.
LABORATORY Nos:	FACL 192047
SOIL LIMITATIONS:	Steep slope, low fertility, and erosion potential.

Typifying Profile

SOIL NAME:	Savudrodro series, moderately steep phase.
PROFILE No:	VS 28
SITE LOCATION:	Tagaqe/Baravi district, Nadroga Province.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Convex shoulder slope in steepland country.
PARENTAL MATERIAL:	
SLOPE:	25°
ASPECT:	West
ELEVATION:	100 m
MICRORELIEF:	Uneven
SITE VEGETATION:	Grasses with scattered scrub and forest species.
LAND USE:	Unused (natural state).
DRAINAGE:	Well drained
EROSION:	Some soil creep.
DISTURBANCE:	None
LABORATORY Nos:	FACL 192047

PROFILE DESCRIPTION

Ah	0-8 cm (8 cm)	Moist; brown (10YR 5/3) sandy clay loam; strongly developed medium granular structure; friable; sticky; non plastic; abundant fine roots; diffuse irregular boundary,
Bw1	8-16 cm (8 cm)	Moist; yellowish brown (10YR 5/6) and dark yellowish brown (10YR 3/4) sandy clay; common fine mottles; strongly developed coarse blocky structure; extremely firm; slightly sticky; slightly plastic; few distinct organic cutans; abundant fine roots; indistinct irregular boundary,
Bw2	16-40 cm (24 cm)	Moist; yellowish brown (10YR 5/6) and dark yellowish brown (10YR 3/4) sandy clay; common fine mottles; strongly developed coarse blocky structure; very firm; slightly sticky; slightly plastic; common distinct organic cutans; abundant fine roots; indistinct and irregular boundary,
Bw3	40-120 cm (80 cm)	Moist; yellowish brown (10YR 5/8) and white (2.5Y 8/2) sandy clay; profuse coarse and prominent mottles; weakly developed coarse blocky structure; firm; slightly sticky; slightly plastic; many prominent organic cutans; common very fine roots.

Savudrodro

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Sawakasa series**

REFERENCE: Sawakasa clay (47a) defined by Twyford and Wright (1965) as a moderately mottled, weakly to strongly gleyed soil related to latosols and formed under a climate with a weak dry season.

Forms part of the Sawakasa set.

The central concept for Sawakasa soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Oxyaquic Eutropept, fine, kaolinitic, isohyperthermic
(b) FAO: Gleyic Cambisol
(c) Twyford and Wright: Gley soil related to latosols with a weak dry season

INCLUDING MAPPING UNITS AND PHASES:
Sawakasa soils (48)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Confined to the lowlands of east and north-east Viti Levu.
PARENT ROCK:	Basalt
PARENT MATERIAL:	Deep gleyed and mottled alluvium.
PHYSIOGRAPHIC POSITION/LANDFORM:	Back swamp positions behind levees and on small planar alluvial terraces.
SLOPE CLASS AND RANGE OF SLOPES:	Flat to near level (0-2°).
VEGETATION AND LAND USE:	Rough grazing dominated by Navua sedge. Used for rice crops, dairying, and dalo gardens.
RANGE OF ELEVATION:	40 m
RAINFALL:	Annual average range: 3,200-4,800 mm; dry season range: 800-1,600 mm; wet season range: 1,800-2,800 mm.
TEMPERATURE:	Mean annual: 24°C.
SOIL MOISTURE REGIME:	Udic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Imperfectly drained
PERMEABILITY CLASS:	Moderate
FLOODING:	One in ten year return period for floods depositing small amounts of fresh alluvium. Other minor floods have a one in two year return period.
EROSION:	No erosion risk.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 30 cm of dark yellowish brown mottled reddish brown friable clay loam, of moderate medium nut structure, with common rounded basalt boulders, overlying 40 cm of yellow red mottled reddish yellow firm clay loam, of moderate medium and coarse blocky structure, over 50 cm or more of yellowish red mottled pinkish grey firm clay, of massive structure, and slightly sticky and plastic when moist.
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Not applicable. Only two profile descriptions available.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Sawakasa soils have moderately high nutrient status, with slightly acid reaction with a high base status. Phosphate is low with phosphate fixation high. The particle size family class is fine. Mineralogy class is kaolinitic.
LABORATORY Nos:	FACL 194177
SOIL LIMITATIONS:	Imperfect drainage; periodic flooding; phosphate fixation; and high wet season water table.

Typifying Profile

SOIL NAME:	Sawakasa soils
PROFILE No.:	VS38
SITE LOCATION:	Lodoni, Tailevu province.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Alluvial terrace
PARENT MATERIAL:	Moderately weathered alluvium from basic.
SLOPE:	Flat
ASPECT:	Not applicable
ELEVATION:	
MICRORELIEF:	Smooth
SITE VEGETATION:	Vau, guava, lantana, coconuts, sedges and yellow primrose.
LAND USE:	Rough grazing
DRAINAGE:	Imperfectly drained
EROSION:	None
DISTURBANCE:	None
LABORATORY Nos:	FACL 194177

PROFILE DESCRIPTION

Ag	0-30 cm (30 cm)	Moist; dark yellowish brown (10YR 4/4) clay loam; many distinct fine reddish brown (5YR 4/3) mottles; moderately developed medium nut structure; friable; slightly sticky; abundant fine and very fine fibrous roots; common unweathered rounded boulders; distinct smooth boundary,
Bg	30-70 cm (40 cm)	Moist; yellowish red (5YR 5/8) clay loam; many distinct medium reddish yellow (5YR 6/6) mottles; moderately developed medium and coarse blocky structure; firm; slightly sticky; many fine and medium fibrous roots; few strongly weathered subangular boulders; diffuse irregular boundary,
Cg	70-120cm (50 cm)	Moist; yellowish red (5YR 4/8) clay; many distinct pinkish grey (7.5YR 7/2) mottles; massive; firm; slightly sticky; plastic; few fine fibrous roots.

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Saweni series**

REFERENCE: Saweni clay (50c) as described by Twyford & Wright (1965) as a strongly mottled, moderately to strongly gleyed soil developed in valley bottoms and low lying depressions under a climate with a moderate to strong dry season related to nigrescent soils.

Forms part of the Matavelo set.

The central concept for Saweni soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Vertic Tropaquept, fine, smectitic, isohyperthermic
(b) FAO: (Vertic) Gleysol
(c) Twyford and Wright: Gley soil related to nigrescent soils with a strong dry season

INCLUDED MAPPING UNITS AND SYMBOLS:
Saweni soils (53)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Of restricted areal extent and is mapped in the upper Sigatoka Valley and at the head of Natewa Bay, Vanua Levu.
PARENT ROCK:	Variable base rich rocks.
PARENT MATERIAL:	Deep weathering alluvium.
PHYSIOGRAPHIC POSITION/LANDFORM:	Valley floors and depressions.
SLOPE CLASS AND RANGE OF SLOPES:	Flat to near level (0-2°).
VEGETATION AND LAND USE:	Dalo and tavioka growing, rough grazing and sometimes used for rainfed rice .
RANGE OF ELEVATION:	10-80 m
RAINFALL:	Annual average range: 2,000-3,200 mm; dry season range: 500-800 mm; wet season range: 1,400-2,000 mm.
TEMPERATURE:	Mean annual: 24.5°C.
SOIL MOISTURE REGIME:	Aquic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Poorly drained
PERMEABILITY CLASS:	Moderately slow
FLOODING:	Floods in normal years occur on 2 to 3 occasions sometime in the period November to APRIL. Waterlogging for up to 60 days below 50 cm depth occur during this period.
EROSION:	No erosion risk.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 20 cm of black heavy clay, of strongly developed coarse blocky structure, very firm and hard when dry; overlying 25 cm of white mottled olive yellow clay, of strongly developed coarse prismatic structure, extremely firm, and plastic when moist, overlying more than 70 cm of white mottled olive yellow silty clay, of moderately developed coarse prismatic structure, extremely firm, and plastic when moist.
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Saweni series has an Ap, Bg, BCg horizon sequence. The Ap horizon thickness ranges from 18-22 cm; few dusky red (2.5YR 3/2) mottles may or may not be present; blocky structures may be either strongly or moderately developed; and moist consistence varies from slightly sticky to very sticky. The Bg horizon thickness ranges from 20-50 cm; colours range between light grey (2.5Y 7/1, 7/2) and white (2.5Y 8/0); prominent mottles (high chroma) range from 2.5Y, 10YR, 7.5YR to 5YR hue; and structures may be either coarse or medium prismatic or very coarse blocky. The BCg horizon exceeds 70 cm in thickness; it shows the same range of variation in matrix and mottle colours as that described for the Bg horizon; and textures may be either sandy clays or silty clays.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Slightly acid, slightly alkaline pH in the BCg horizon; very high % base saturation; high cation exchange capacity with the exchange complex dominated by calcium (very high values) and magnesium (high values) but very low values for potassium; and available phosphorus is very low. The particle size family class is fine. The mineralogy class is smectitic.
LABORATORY Nos:	KRS U233-235
SOIL LIMITATIONS:	Very poor internal drainage; seasonal (summer) waterlogging below 50 cm depth; soil moisture deficits that occur sometime in the period May to October; the combination of strong coarse aggregates, vertic properties and soil hardness when dry; and nutrient deficiencies (phosphorus and potassium).

Typifying Profile

SOIL NAME:	Saweni soils
PROFILE No.:	27/9/a
SITE LOCATION:	Nawai back road.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Narrow valley bottom .
PARENT MATERIAL:	Deep alluvium derived from base rich rocks.
SLOPE:	Level
ASPECT:	Not applicable
ELEVATION:	25 m
MICRORELIEF:	Polygonal cracking during periods of soil moisture deficit (May to October).
SITE VEGETATION:	Miscellaneous grasses and weeds.
LAND USE:	Rainfed rice (wet season), fallowed or grazed during dry months.
DRAINAGE:	Poorly drained
EROSION:	None observed
DISTURBANCE:	Cultivated
LABORATORY Nos:	KRS U233-235 (inclusive)

PROFILE DESCRIPTION

Saweni soils

Ap	0-20 cm (20 cm)	Dry; moist black (10YR 2.5/1) heavy clay; strongly developed coarse blocky structure; very firm; common fine fibrous roots; distinct smooth boundary,
Bg	20-45 cm (25 cm)	Dry; moist white (2.5Y N8/0) clay; common coarse prominent olive yellow (2.5Y 6/6) mottles; strongly developed coarse prismatic structure; extremely firm; plastic; diffuse wavy boundary,
BCg	45-120cm (75 cm)	Dry; moist white (2.5Y N8/0) silty clay; coarse prominent olive yellow (2.5Y 6/6) mottles; moderately developed coarse prismatic structure; extremely firm; plastic.

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Seatura series**

REFERENCE: Seatura steepland stony and bouldery clay (83d) defined by Twyford & Wright (1965) as a steepland soil from basalt formed under a climate with no dry season.

Forms part of the Visa set.

The central concept for Seatura soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Oxic Humitropept, fine, ferruginous, isohyperthermic
(b) FAO: Humic Cambisol
(c) Twyford and Wright: Steepland soils related to or associated with humic latosols with no dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Seatura soils, rolling phase (172D)
Seatura soils, strongly rolling phase (172E)
Seatura soils, moderately steep phase (172F)
Seatura soils, steep phase (172G)
Seatura soils, very steep phase (172H)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION: Seatura soils are very widespread in the wetter parts of Tailevu province from the hills above Lawaki in the east to the Wailoa river in the west of Viti Levu. They are widespread in western Vanua Levu, particularly near Sentura Mountain.

PARENT ROCK: Basalt

PARENT MATERIAL: Deep moderately weathered *in situ* rock.

PHYSIOGRAPHIC POSITION/LANDFORM: Long planar backslope and midslopes in strongly dissected hill country.

SLOPE CLASS AND RANGE OF SLOPES: Rolling (12-15°), strongly rolling (16-20°), moderately steep (21-25°), steep (27-35°), and very steep (>35°).

VEGETATION AND LAND USE: Indigenous forest. Some areas cleared and used for subsistence crops.

RANGE OF ELEVATION: 50-600 m

RAINFALL: Annual average range: 3,200-4,800 mm;
dry season range: 800-1,600 mm;
wet season range: 1,800-2,800 mm.

TEMPERATURE: Mean annual: 24°C.

SOIL MOISTURE REGIME: Udic (perudic)

SOIL TEMPERATURE REGIME: Isohyperthermic

SOIL DRAINAGE CLASS: Well drained

PERMEABILITY CLASS: Moderately rapid

FLOODING: Never floods

EROSION: Moderate and severe sheet, rill and debris slide (on slopes > 20°) erosion potential when forest cleared and cultivated.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 12 cm of dark yellowish brown friable humic clay loam, of strongly developed fine granular structure, overlying 15 cm of reddish brown firm stony clay, of weakly developed medium granular structure and commonly having stones, overlying more than 80 cm of reddish yellow very firm stony silty clay, of massive structure with stones and boulders.
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Seatura series have an Ah, Bw1, Bw2 horizon sequence. The Ah horizon ranges in thickness from 10 to 15 cm; its colours include dark brown (10YR 3/3, 4/3) and dark yellowish brown (10YR 3/4, 4/4); textures may be clay loam or clay and commonly stony and/or humic; structures are moderate or strong fine or medium nut or granular; and consistence may be friable or very friable. The Bw1 horizon ranges in thickness from 15-25 cm; its colours include yellowish red (5YR 4/6, 4/8, 5/6, 5/8) and reddish brown (5YR 4/4, 5/3, 5/4); textures may be clay loam or clay and with or without stones; and structures are weak or moderate, fine, blocky, nut or granular. The Bw2 horizon thickness exceeds 60 cm; its colours include reddish yellow (5YR 6/6, 6/8) and yellowish red (5YR 5/6 and 5/8); textures as for the Bw1 horizons; structures are massive or weak medium or fine blocky; and boulders may be few, common or many.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analysis shows the soil to be strongly acid 0-24 cm and moderately acid below 24 cm depth; organic carbon is high in the topsoil (0-12 cm), low 12-24 cm and very low below 24 cm; nitrogen is low 0-24 cm; very low available phosphorus and phosphorus retention is high; % base saturation is very high 0-24 cm and low below this; CEC is medium in the topsoil and very low below it; exchangeable calcium and magnesium have high values in the topsoil and low or very low below it; and potassium is low in the topsoil and very low in the other horizons. The particle size family class is fine. The mineralogical class is ferruginous.
LABORATORY Nos:	KRS U503-505 (inclusive)
SOIL LIMITATIONS:	Slope; erosion potential when forest cleared and cultivated; surface boulders; strong soil acidity; and nutrient deficiencies of nitrogen, phosphorus and potassium.

Typifying Profile

SOIL NAME:	Seatura soils, strongly rolling phase.
PROFILE No.:	TEA019
SITE LOCATION:	Wainunu area, Western Vanua Levu.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Concave hillside to plateau 'like' surface in rolling country.
PARENT MATERIAL:	Weathered *in situ* basalt rock.
SLOPE:	16°, length 100 m
ASPECT:	North north-east.
ELEVATION:	420 m
MICRORELIEF:	Smooth
SITE VEGETATION:	Indigenous forest
LAND USE:	Unused
DRAINAGE:	Well drained
EROSION:	None observed
DISTURBANCE:	None
LABORATORY Nos:	KRS U503-505 (inclusive)

PROFILE DESCRIPTION

Ah	0-12 cm (12 cm)	Moist; dark yellowish brown (10YR 4/4) humic clay loam; friable; strongly developed fine granular structure; abundant medium roots; distinct irregular boundary,
Bw1	12-29 cm (17 cm)	Moist; reddish brown (5YR 5/4) stony clay; firm; slightly sticky; slightly plastic; weakly developed medium granular structure; few medium roots; few unweathered subrounded gravels; diffuse wavy boundary,
Bw2	29-120 cm (91 cm+)	Moist; reddish yellow (5YR 6/8) stony silty clay; massive; very firm; sticky; slightly plastic; few weakly weathered subrounded and subangular stones and boulders.

Seatura

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Serea series**

REFERENCE: Serea sandy loam and loamy sand (5a) and Serea clay loam (5b) described by Twyford and Wright (1965) as developed from alluvium of low quartz content (from basic rocks) under a climate with no dry season and subject to frequent to occasional flooding.

The central concept for Serea series is that defined by Twyford and Wright (1965) for Serea sandy loam and loamy sand (5a).

CLASSIFICATION:

(a) Soil Taxonomy: Fluventic Eutropept, coarse-loamy, mixed, isohyperthermic
(b) FAO: Eutric Cambisol
(c) Twyford and Wright: Recent soil from river alluvium with no dry season

INCLUDED MAPPING UNITS AND SYMBOLS:
Serea soils (46)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Floodplains of the Wainimala and upper Rewa rivers, Naitasiri/Tailevu provinces.
PARENT ROCK:	Rocks of low quartz content (i.e. mainly basic rocks).
PARENT MATERIAL:	Coarse textured weakly weathered alluvium.
PHYSIOGRAPHIC POSITION/LANDFORM:	Low terrace and levees.
SLOPE CLASS AND RANGE OF SLOPES:	Flat to near level (0-2°).
VEGETATION AND LAND USE:	Bananas, subsistence root crops and pasture (dairying).
RANGE OF ELEVATION:	10-30 m
RAINFALL:	Annual average range: 3,200-4,800 mm; dry season range: 800-1,600 mm; wet season range: 1,800-2,800 mm.
TEMPERATURE:	Mean annual: 24°C.
SOIL MOISTURE REGIME:	Perudic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Well drained
PERMEABILITY CLASS:	Moderately rapid to rapid.
FLOODING:	1 in 10 year return period for floods depositing 'fresh' alluvium and 1 in 2 year return period for other floods.
EROSION:	Apart from some stream bank erosion no erosion risk.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 6 cm of dark yellowish brown very friable loamy very fine sand, of weakly developed fine nut structure with single grain overlying 15 cm of dark yellowish brown, very dark greyish brown and pale yellow loose structureless fine sand, overlying a paleosol of 65 cm of dark brown faintly mottled olive brown friable loamy very fine sand, of weakly developed fine nut and granular structure, over a very dark greyish brown paleosol of loamy very fine sand, of weak fine nut structure with single grain on a C horizon of varicoloured fine sand. The paleosols are of variable thickness and properties.
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Not applicable. Only 3 profile descriptions made.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analysis shows slightly alkaline pH in the topsoil (0-6 cm), near neutral 6-17 cm, and becoming slightly acid below; carbon values are very low and decrease irregularly with depth, nitrogen values are very low except for the buried topsoil (82-92 cm) which has a low value; available phosphorus is low; % base saturation is very high throughout the profile; CEC is high in the topsoil and medium elsewhere; exchangeable calcium is very high in the topsoil and high in the other horizons, magnesium is high throughout, sodium medium, and potassium is low in the topsoil and of very low values in the other horizons. The particle size family class is coarse-loamy. The mineralogical class is mixed.
LABORATORY Nos:	KRS V100-104
SOIL LIMITATIONS:	High flooding risk; rapid permeability, coarse textures and low water holding capacity which in combination can cause soil moisture deficits for short periods sometime during the months May to October; and nutrient deficiencies of potassium, nitrogen and phosphorus.

Typifying Profile

SOIL NAME:	Serea soils
PROFILE No.:	VS01
SITE LOCATION:	Vunidawa village on the upper Rewa river, western Viti Levu.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Planar low terrace 5 m above contemporary floodplain.
PARENT MATERIAL:	Alluvium from basic rocks.
SLOPE:	Level
ASPECT:	Not applicable
ELEVATION:	45 m
MICRORELIEF:	Even
SITE VEGETATION:	Guinea grass and Castor oil shrubs.
LAND USE:	Unused
DRAINAGE:	Well drained
EROSION:	None observed
DISTURBANCE:	None
LABORATORY Nos:	KRS V100-104

PROFILE DESCRIPTION

Ah	0-6 cm (6 cm)	Slightly moist; dark yellowish brown (10YR 4/4) loamy very fine sand; weakly developed fine nut structure breaking to single grain; very friable; many fine and very fine roots; distinct smooth boundary,
C	6-17 cm (11 cm)	Slightly moist; 30% dark yellowish brown (10YR 4/4) 30% very dark greyish brown (2.5Y 3/2) 30% pale yellow (2.5Y 7/4) fine sand; single grain; loose; common fine and very fine roots; distinct smooth boundary,
bBw	17-82 cm (65 cm)	Slightly moist; dark brown (10YR 3/3) loamy very fine sand; few fine faint olive brown (2.5Y 4/4) mottles in bottom 20 cm; moderate faunal activity; weakly developed fine nut and granular structure breaking to single grain; friable; few very fine roots; distinct smooth boundary,
b2Ah	82-92 cm (10 cm)	Slightly moist; very dark greyish brown (10YR 3/2) loamy very fine sand; weakly developed medium nut structure breaking to weak very fine nut plus single grain; friable; few very fine roots; distinct smooth boundary,
b2C	92-150 cm (58 cm+)	Slightly moist; 30% olive brown (2.5Y 4/4) 30% pale yellow (2.5YR 7/4) 30% dark greyish brown (2.5Y 3/2) fine sand; single grain; loose; few very fine roots.

Serea

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Serua series**

REFERENCE: Serua steepland clay and bouldery clay (83g) defined by Twyford & Wright (1965) as a red steepland soil from indurated tuffs formed under a climate with no dry season.

Forms part of the Visa set. The central concept for Serua soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Typic Kanhaplohumult, clayey, ferruginous, isohyperthermic
(b) FAO: Humic Acrisol
(c) Twyford and Wright: Steepland soil related to or associated with humic latosols with no dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Serua soils, strongly rolling phase (128E)
Serua soils, moderately steep phase (128F)
Serua soils, steep phase (128G)
Serua soils, very steep phase (128H)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION: Serua soils are very widespread in the Serua hills and in some of the Navua hills, in the mountains drained by the Wainimala river, in parts of Tailevu and in the upper Wainikoroiluva hills in Viti Levu.

PARENT ROCK: Indurated andesitic tuffs and marls.

PARENT MATERIAL: Strongly weathered colluvium.

PHYSIOGRAPHIC POSITION/LANDFORM: Concave and planar slopes of hill sides in strongly dissected hill country.

SLOPE CLASS AND RANGE OF SLOPES: Strongly rolling (16-20°), moderately steep (20-26°), steep (27-35°) and very steep (36-40°).

VEGETATION AND LAND USE: Mostly under tall indigenous forest. In some places selectively logged and replanted in mahogany, elsewhere minor areas in pasture and used for subsistence crops (followed by > 15 years bush fallow).

RANGE OF ELEVATION: 50-400 m

RAINFALL: Annual average range: 3,200-4,800 mm;
dry season range: 800-1,600 mm;
wet season range: 1,800-2,800 mm.

TEMPERATURE: Mean annual: 24°C.

SOIL MOISTURE REGIME: Udic (perudic)

SOIL TEMPERATURE REGIME: Isohyperthermic

SOIL DRAINAGE CLASS: Well drained

PERMEABILITY CLASS: Medium

FLOODING: Never floods

EROSION: Severe and very severe sheet and rill erosion potential when forest cleared and cultivated. Also potential for soil slips and debris slides of the same severity.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 8 cm of dark brown friable clay loam, of moderate fine and medium nut structure, overlying 35 cm of red friable silty clay loam of weak to moderate fine and medium blocky, with few faint clay cutans to peds, overlying 25 cm of red friable silty clay, of weak to moderate fine and medium blocky, with clay cutans to peds and brownish yellow parent material mottles, over more than 60 cm of dark red firm clay, of massive cutans and parent material mottles. All horizons are sticky moist and the subsoils plastic moist.
DIAGNOSTIC HORIZONS:	Ochric epipedon, argillic horizon.
RANGE OF PROFILE FEATURES:	Serua series have an Ah, Bw, Bt horizon sequence. The Ah horizon thickness ranges from 8 to 12 cm; its colours include reddish brown (5YR 4/3, 4/4) and dark brown (7.5YR 3/2, 4/4); textures are clay or clay loam; and structures are moderate or strong, fine, very fine or medium nut. The Bw horizon thickness ranges from 20-40 cm; its colours include red (2.5YR 4/6, 4/8) and dark red (2.5YR 3/6); textures are clay, clay loam or silty clay loam; structures are weak or moderate, fine or medium blocky; and with or without faint clay cutans. The Bt horizon thickness ranges from 60 to 120 cm; its colours include red (2.5YR 4/6, 4/8, 5/8), dark red (25.YR 3/6) and yellowish red (5YR 5/6, 5/8); textures are clay, clay loam and silty clay; structures are moderate or strong very fine, fine, medium or coarse blocky tending massive at depth; and clay cutans may be few, common or many.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analysis shows the soil to be strongly acid; organic carbon has a medium value for the topsoil (0-8 cm) with very low values for the other horizons; nitrogen is high in the topsoil and very low below; available phosphorus is very low; % base saturation is medium in the topsoil, low 8-65 cm and very low below these; CEC medium in the topsoil and low below it; TEB medium in the topsoil and very low below it; magnesium medium in the topsoil and of low values below it; and potassium has very low values throughout the profile. The particle size family class is clayey. The mineralogical class is ferruginous.
LABORATORY Nos:	KRS V 114-117 (inclusive)
SOIL LIMITATIONS:	Slope; severe and very severe soil erosion potential when forest cleared and cultivated; strong soil acidity; and nutrient deficiencies of nitrogen, potassium and phosphorus.

Typifying Profile

SOIL NAME:	Serua soils, steep phase.
PROFILE No.:	VS04
SITE LOCATION:	Namosi Road 5 km inland from Mau Village on the Queens Highway, Serua Province .

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Concave-planar midslope in strongly rolling and steep hill country .
PARENT MATERIAL:	Strongly weathered *in situ* andesitic tuff with some colluvium.
SLOPE:	27°
ASPECT:	North
ELEVATION:	325 m
MICRORELIEF:	Uneven due to surface roots.
SITE VEGETATION:	Indigenous forest
LAND USE:	Protective forest
DRAINAGE:	Well drained
EROSION:	None observed
DISTURBANCE:	None
LABORATORY Nos:	KRS V114-117 (inclusive)

PROFILE DESCRIPTION

Ah	0-8 cm (8 cm)	Moist; dark brown (7.5YR 4/4) clay loam; moderately developed fine and medium nut structure; friable; sticky; slightly plastic; abundant fine, medium and coarse roots; distinct smooth boundary,
Bw	8-43 cm (35 cm)	Moist; red (2.5YR 4/6) silty clay loam; weak to moderately developed medium blocky structure breaking to weak fine blocky structure; friable; sticky; slightly plastic; few faint red (2.5YR 4/6) clay coatings; common fine and very fine roots; diffuse smooth boudnary,
Bt1	43-65 cm (22 cm)	Moist; red (2.5YR-5YR 4/6) silty clay; few coarse prominent brownish yellow (10YR 6/6) parent material mottles; weak to moderately developed medium blocky structure breaking to weak fine blocky structure; friable; sticky; plastic; few faint red (2.5YR 4/6) clay coatings; few very fine roots; diffuse smooth boudnary,
Bt2	65-125 cm (60 cm+)	Moist; dark red (2.5YR 3/6) clay; few coarse prominent brownish yellow (10YR 6/6) parent material mottles; massive breaking to moderately developed coarse blocky structure; firm; sticky; plastic; few faint red (2.5YR 4/6) clay coatings; few very fine roots.

Serua

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Sigatoka series**

REFERENCE: The Sigatoka set defined by Twyford & Wright (1965) included the Sigatoka sand and sandy loam (7a) and Sigatoka clay (7b). The former are now described as Nasau and Lawai series respectively, and Sigatoka clay is taken as the central concept or type for the Sigatoka series and correlates with that (7b) described by Twyford & Wright (1965). In this survey Sigatoka series are confined to soils that rarely flood (accumulating only a small amount of 'fresh' sediment), are well drained and generally have heavy textures (clay loam, clay, silty clay and silty clay loam).

CLASSIFICATION:

(a) Soil Taxonomy: Cumulic Haplustoll, fine-silty, mixed, isohyperthermic
(b) FAO: Eutric Fluvisol
(c) Twyford and Wright: Recent soil with a moderate to strong dry season

INCLUDED MAPPING UNITS AND SYMBOLS:
Sigatoka soils (27)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Extensive on the high terraces of the Sigatoka River system.
PARENT ROCK:	Includes argillite, sandstone, andesite, probably basalts and hydrothermally altered rock i.e. rocks predominantly of basic and intermediate composition.
PARENT MATERIAL:	Deep riverine alluvium.
PHYSIOGRAPHIC POSITION/LANDFORM:	Highest broad river terrace.
SLOPE CLASS AND RANGE OF SLOPES:	Flat (-1°)
VEGETATION AND LAND USE:	Pasture, intensive cropping for a wide range of vegetable and fruit crops, sugar cane, tobacco and some tree crops.
RANGE OF ELEVATION:	5-15 m
RAINFALL:	Annual average range: 2,000-3,200 mm; dry season range: 600-800 mm; wet season range: 1,400-2,000 mm.
TEMPERATURE:	Mean annual: 25°C.
SOIL MOISTURE REGIME:	Ustic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Well drained
PERMEABILITY CLASS:	Medium
FLOODING:	1 in 10 year return period for floods depositing minor amounts of sediment.
EROSION:	No erosion risk.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 30 cm of dark brown to very dark greyish brown friable clay loam of weakly developed nut and crumb structure, overlying 75 cm of very dark greyish brown clay loam, of weakly developed blocky structure, aggregates are humus coated, sticky and plastic moist, with common parent material fragments over more than 30 cm of dark greyish brown fine sandy clay loam, of weakly developed coarse blocky structure, soft slightly sticky consistence, numerous black humus coatings to aggregates, and many fine parent material fragments.
DIAGNOSTIC HORIZONS:	Mollic epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Sigatoka series have an Ap, bAh1, bAh2, BC horizon sequence. The Ap horizon thickness ranges 20-40 cm; its colours include dark brown (10YR 3/3) and very dark greyish brown (10YR 3/2); and texture ranges between clay loam, silty clay, clay and silt loam. The bAh1 horizon thickness ranges 8-30 cm; its colours include brown (10YR 4/3) and very dark brown (10YR 2/2); texture ranges between silt loam, clay loam and clay; and structures vary from strong coarse blocky to moderately developed medium nut. The bAh2 horizon thickness ranges 50-70 cm; its colours include very dark greyish brown (10YR 3/2) and very dark grey (10YR 3/1); texture ranges between clay loam, clay and silty clay; and structures are either weakly developed coarse or fine blocky. The BC horizon exceeds 20 cm; its colours include dark greyish brown (2.5Y 4/2) and dark brown (10YR 3/3); texture ranges between sandy clay loam, silty clay, clay loam, and fine sandy loam; consistence can be either soft or firm; and humus coatings black or very dark grey in colour.
VARIANTS:	Commonly silt loam textures are found on the terrace surface nearer levee.
SIMILAR SOILS AND DISTINGUISHING FEATURES:	(Refer Rijkse, 1990) Nasau series: Flood fequently and occur on the lowest river terrace bordering the major rivers. Coarse textures. Lawai series: Flood infrequently, have silt loam surface horizons over loamy sand subsoils. Naroro series: Moderately well-drained and mottling in subsoils.
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	High % base saturation. High to very high exchangeable calcium and magnesium; high exchangeable potassium in the topsoil decreasing to low levels in the subsoil; high to medium exchangeable sodium levels. Low organic carbon values.
LABORATORY Nos:	KS T1780-1784 (inclusive)
SOIL LIMITATIONS:	Possibly the only limitation is that of soil structure which will likely breakdown under sustained cropping if not correctly managed under an extensive cropping system. Also an infrequent flood risk. Sigatoka series are amongst the most fertile and versatile series in Fiji.

Typifying Profile

SOIL NAME:	Sigatoka soils
PROFILE No.:	SG1
SITE LOCATION:	Refer soil map of Sigatoka Agricultural Research Station (Rijkse, 1990). Grid reference Sheet Viti Levu 16 (1:50 000) 98E 574N.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	River terrace surface.
PARENT MATERIAL:	Alluvium derived from rocks with predominantly basic and intermediate composition.
SLOPE:	Flat
ASPECT:	Not applicable
ELEVATION:	7 m
MICRORELIEF:	Uniformly flat
SITE VEGETATION:	Fallow. Recently disced.
LAND USE:	MAF vegetable crop trials.
DRAINAGE:	Well drained
EROSION:	None observed
DISTURBANCE:	Disced
LABORATORY Nos:	KRS T1780-1784 (inclusive)

PROFILE DESCRIPTION

Ap	0-24 cm (24 cm)	Dark brown (10YR 3/3) dry; very dark greyish brown (10YR 3/2) moist; clay loam; sticky slightly plastic; friable; moderately developed nut structure breaking to fine nut and crumb; few fine roots; many distinct very dark grey (10YR 3/1) humus coats on peds; many fine light yellowish brown (10YR 6/4) parent material grains; few medium (2-20 mm diam.) dark reddish brown (5YR 5/4) parent material fragments; many medium and fine pores; indistinct smooth boundary,
bAh1	24-32 cm (8 cm)	Brown (10YR 4/3) dry; dark brown (10YR 3/3) moist silt loam; slightly sticky; slightly plastic; firm *in situ*; friable; strongly developed coarse blocky structure; abundant distinct very dark grey (10YR 3/1) humus coats on peds; few fine roots; few fine white (10YR 8/2) parent material grains; many medium and fine pores; indistinct smooth boundary,
bAh2	32-100 cm (78 cm)	Very dark greyish brown (10YR 3/2) dry; very dark greyish brown to very dark grey (10YR 3/2-3/1) moist; clay loam; firm *in situ*; sticky; plastic; weakly developed coarse blocky structure breaking to weak fine blocky; abundant distinct very dark grey (10YR 3/1) humus coats on peds; few fine roots; many medium and fine pores; few medium (5 mm diam.) white (10YR 8/2) parent material fragments; few coarse parent material fragments (4 cm diam.) reddish brown (2.5YR 5/8); few medium (2 cm diam.) brown (10YR 5/3) parent material fragments; indistinct smooth boundary,

BC	100-120 cm	Dark greyish brown (2.5Y 4/2) dry; dark brown moist; (10YR 3/3) moist; fine sandy clay loam; slightly sticky; non-plastic; soft; weakly developed coarse blocky structure; many fine pores; few fine white (10YR 8/2) parent material grains; few very dark grey (10YR 3/1) and black (10YR 2/1) humus deposits in old root channels; few medium (up to 2 cm diam.) red (2.5YR 4/6) parent material fragments.

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Solevu series**

REFERENCE: Solevu clay and silty clay loam (27e) and Solevu hill soils (27eH) defined by Twyford & Wright (1965) as developed on rolling and hilly land from basalt under a climate with little or no dry season.

They form part of the Sote set.

The central concept for Solevu soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Typic Dystropept, fine, mixed, isohyperthermic
(b) FAO: Dystric Cambisol
(c) Twyford and Wright: Humic latosol with little or no dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Solevu soils, undulating phase (171B)
Solevu soils, easy rolling phase (171C)
Solevu soils, rolling phase (171D)
Solevu soils, strongly rolling phase (171E)
Solevu soils, moderately steep phase (171F)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION: Solevu soils are only of very limited extent in south-eastern Viti Levu. They are restricted to the highest rainfall region on the south-western coast of Vanua Levu.

PARENT ROCK: Basalt

PARENT MATERIAL: Moderate to strongly weathered *in situ* rock.

PHYSIOGRAPHIC POSITION/LANDFORM: Planar and convex slopes in rolling and hilly country.

SLOPE CLASS AND RANGE OF SLOPES: Undulating (4-7°) through all slope classes to moderately steep (4-27°).

VEGETATION AND LAND USE: Dense forest in places. Elsewhere in pasture or subsistence crops.

RANGE OF ELEVATION: 50-600 m

RAINFALL: Annual average range: 3,200-4,800 mm;
dry season range: 800-1,600 mm;
wet season range: 1,800-2,800 mm.

TEMPERATURE: Mean annual: 24°C.

SOIL MOISTURE REGIME: Udic

SOIL TEMPERATURE REGIME: Isohyperthermic

SOIL DRAINAGE CLASS: Well drained

PERMEABILITY CLASS: Moderately rapid

FLOODING: Never floods

EROSION: Slight and moderate sheet and rill erosion potential on slopes >11° when forest removed.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 15 cm of dark reddish brown firm clay, of strongly developed nut structure overlying 35 cm of yellowish red firm clay of weak coarse blocky structure breaking to strong nut, on light grey massive *in situ* weathered basalt.
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Solevu series have an Ah, Bw, C horizon sequence. The Ah horizon thickness ranges from 50 to 20 cm; its colours include dark reddish brown (5YR 3/2, 3/3, 3/4), dusky red (2.5YR 3/2), very dark brown (10YR 3/2); textures may be clay, clay loam or silty clay loam; consistence is friable or firm; and structures are moderate or strong medium or coarse nut. The Bw horizon thickness ranges from 25-40 cm; colours include yellowish red (5YR 4/6, 4/8, 5/6), red (2.5YR 4/6, 4/8, 5/6) and dark red (2.5YR 3/6); textures are clay or clay loam; consistence is friable or firm; and structures are weak or moderate medium or coarse blocky. The C horizon is varicoloured and massive.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analysis shows the soil to be strongly acid; organic carbon is low in the topsoil (0-15 cm) and very low in the other horizons; nitrogen is medium in the topsoil and very low below; CEC is high in the topsoil and very high below it; % base saturation is high 0-15 cm, low 15-50 cm, and high below these depths; exchangeable calcium is medium in the topsoil and low below it; magnesium has extremely high values; sodium is medium and potassium low throughout. The particle size family class is very fine. The mineralogical class is mixed.
LABORATORY Nos:	USP LQ1 A-C
SOIL LIMITATIONS:	Profile shallowness; moderate and severe erosion risk when forest cleared on slopes > 11°; soil acidity; and nutrient deficiencies of potassium and nitrogen.

Typifying Profile

SOIL NAME:	Solevu soils, flat to gently undulating phase.
PROFILE No.:	LQ1
SITE LOCATION:	Laqere, Viti Levu; 100 m north of Kings Road, 250 m after quarry entrance travelling towards Nausori .

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Gently rolling terrain.
PARENT MATERIAL:	Weathered amygdaloydal basalt in place.
SLOPE:	Flat
ASPECT:	Not applicable
ELEVATION:	60 m
MICRORELIEF:	Bouldery and uneven.
SITE VEGETATION:	Scrub and miscellaneous weeds.
LAND USE:	Unused
DRAINAGE:	Well drained
EROSION:	None observed
DISTURBANCE:	None
LABORATORY Nos:	USP LQ1 A-C

PROFILE DESCRIPTION

Ah	0-15 cm (15 cm)	Moist; dark reddish brown (5YR 3/3) clay; strongly developed coarse nut structure; firm; many roots; distinct boundary,
Bw	15-50 cm (35 cm)	Moist; yellowish red (5YR 4/6) clay; weakly developed coarse blocky structure, breaking to strongly developed medium nut structure; firm; few roots; distinct boundary,
C	50 cm	Dry; light grey (10YR 7/1) sandy clay; massive; weathered *in situ* basalt.

Solevu

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Soqulu series**

REFERENCE: Soqulu steepland gravelly peaty stony silt loam (94b) defined by Twyford & Wright (1965) as upland latosolic soils developed on scoriae cones under a climate with no dry season.

Forms part of the Salialailai set.

The central concept for Soqulu soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Hydric Fulvudand, medial over ashy-skeletal, isothermic
(b) FAO: Humic Andosol
(c) Twyford and Wright: Upland steepland soil related to or associated with latosolic soils with no dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Soqulu soils, steep phase (217G)
Soqulu soils, very steep phase (217H)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Occur on the upland scoriae cones along the axial ridge of Taveuni Island.
PARENT ROCK:	Basalt
PARENT MATERIAL:	Weakly weathered ash and scoria.
PHYSIOGRAPHIC POSITION/LANDFORM:	Planar steep sides of volcanic cones and crater rims.
SLOPE CLASS AND RANGE OF SLOPES:	Steep (26-35°) and very steep (>35°).
VEGETATION AND LAND USE:	Unused (in natural state of rainforest).
RANGE OF ELEVATION:	600-1,350 m
RAINFALL:	Annual average range: 3,000-6,400 mm; dry season range: 800-3,000 mm; wet season range: 2,000-3,200 mm.
TEMPERATURE:	Mean annual: 18°C.
SOIL MOISTURE REGIME:	Perudic
SOIL TEMPERATURE REGIME:	Isothermic
SOIL DRAINAGE CLASS:	Somewhat excessively drained.
PERMEABILITY CLASS:	Rapid
FLOODING:	Never floods
EROSION:	Very severe sheet and debris slide erosion potential were forest ever to be cleared.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 12 cm of black very friable (soft when wet) peaty silt loam of weak fine structure (structureless when wet) overlying 25 cm of very dark brown friable and smeary peaty silt loam of weak medium granular structure overlying 20 cm of dark yellowish brown firm gravelly and gritty loam of massive structure breaking to single grain overlying 15 cm of reddish brown friable loamy fine sandy scoriaceous gravel of single grain on varicoloured weathering gravelly scoria.
DIAGNOSTIC HORIZONS:	Ochric epipedon
RANGE OF PROFILE FEATURES:	Not applicable. Only 2 profile descriptions made.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analysis shows the soil to be moderately acid 0-38 cm and slightly acid in the other horizons; organic carbon is medium 0-38 cm, low 38-57 cm, and very low below 57 cm; very high phosphorus retention throughout; CEC high 0-57 cm and of medium value below 57 cm; very low % base saturation throughout; calcium is very low; magnesium is low 0-57 cm and very low below 57 cm; potassium is very low throughout; and Tamms aluminium extract values are very high.
LABORATORY Nos:	USP TAV105A-D
SOIL LIMITATIONS:	Slope; very severe erosion potential; excessively drained; rapid permeability; soil acidity; very high phosphate fixation properties; and nutrient deficiencies of potassium and nitrogen.

Typifying Profile

SOIL NAME:	Soqulu soils, steep phase.
PROFILE No.:	TAV105
SITE LOCATION:	West Taveuni Island; Des Veoux Peak road, 4.5 km from Wairaki Mission and 30 m north of road close to 1125 m marker post.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Planar surface on steepland with deep gullies entrenched across the slope.
PARENT MATERIAL:	Basaltic scoria and ash.
SLOPE:	29° (350 m length)
ASPECT:	West
ELEVATION:	1100 m
MICRORELIEF:	Uneven
SITE VEGETATION:	Upland rain forest with reeds, tree ferns, and various shrubs.
LAND USE:	Unused (natural state).
DRAINAGE:	Somewhat excessively drained.
EROSION:	None observed
DISTURBANCE:	None
LABORATORY Nos:	USP TAV105A-D
COMMENTS:	NaF reaction. Strong positive in all horizons described below.

PROFILE DESCRIPTION

Ah1	0-12 cm (12 cm)	Wet; black (10YR 2/1) peaty silt loam; compacted by roots but essentially structureless (n value >0.7 i.e. water freely expressed on squeezing); soft; slightly plastic; a few volcanic grits; abundant fine fibrous roots; diffuse wavy boundary,
Ah2	12-38 cm (26 cm)	Wet; very dark brown (10YR 2/2) peaty silt loam; compacted by abundance of fibrous roots; weakly developed medium granular structure; friable; somewhat smeary; diffuse smooth boundary,
BC	38-57 cm (19 cm)	Wet; dark yellowish brown (10YR 4/4-4/6) gravelly and gritty loam; massive breaking to single grain; firm; not roots; sharp smooth boundary,
C1	57-70 cm (13 cm)	Wet; reddish brown to dark grey (5YR 4/4-4/1) loamy fine sandy scoriaceous gravel; single grain; friable; no roots; diffuse smooth boundary,
C2	70-150 cm+ (80+ cm)	Wet; varicoloured red and black slightly weathered basaltic gravelly scoria; single grain.

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Soso series**

REFERENCE: Soso clay, sandy clay etc. (55a) as defined by Twyford & Wright (1965) saline soils in the marine marsh where the surface level is somewhat above high water mark and mangrove does not normally grow. Thus Soso soils are found in mangrove-free patches in the middle of mangrove swamps upon slight hummocks and along the landward edge of mangrove swamps.

Like Dogo series with which they are found in association. Soso series normally have more variable profile characteristics.

CLASSIFICATION:

(a) Soil Taxonomy: Typic Tropaquept, clayey, mixed, isohyperthermic
(b) FAO: (Thionic) Gleysol
(c) Twyford and Wright: Saline soil of the marine marsh

INCLUDED MAPPING UNITS AND SYMBOLS:
Soso soils (3)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Soso soils are formed in the marine marsh where the surface level is somewhat above high water mark and mangrove does not normally grow. They occur in all climatic zones.
PARENT ROCK:	A range of rock types.
PARENT MATERIAL:	Diverse alluvia deposited partly by a slowing in river current but mainly to the flocculation of silt and clay in the lagoons resulting in the gradual raising of the sea bed to a certain height where mangrove species made initial colonisation; to be succeeded by salt tolerant grasses as the elevation increased.
PHYSIOGRAPHIC POSITION/LANDFORM:	Predominantly on deltas and river edges inland of the true mangrove swamps.
SLOPE CLASS AND RANGE OF SLOPES:	Flat to near level (0-1°).
VEGETATION AND LAND USE:	In natural state - salt tolerant grasses and weeds. Used for rainfed or irrigated rice.
RANGE OF ELEVATION:	0-2 m
RAINFALL:	Annual average range: 1,800-5,000 mm; dry season range: 400-1,600 mm; wet season range: 1,400-2,800 mm.
TEMPERATURE:	Mean annual range: 24-26°C.
SOIL MOISTURE REGIME:	Aquic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Very poorly drained.
PERMEABILITY CLASS:	Slow

FLOODING: Floods frequently particularly during spring tides and other abnormally high tide events. During normal high water table cones to between 30 and 50 cm of the ground surface.

EROSION: No erosion risk.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES: Typically shows 10 cm of block faintly mottled yellowish peaty silty clay, of moderately developed crumb structure, friable, and slightly sticky moist, overlying 40 cm of grey mottled yellowish brown clay, of massive structure, firm, and plastic and sticky moist, overlying more than 80 cm of predominantly greyish clays and silty clays, of massive structure.

All horizons have dead woody mangrove roots and gypsum crystals are common below 100 cm depth.

DIAGNOSTIC HORIZONS: Ochric epipedon, cambic horizon.

RANGE OF PROFILE FEATURES: Soso series have a Ah, Bg1, Bg2, Cr1, Cr2, Cr3 etc. horizon sequence.

The Ah horizon thickness ranges 6-15 cm; colours are black (either 2.5Y, 10YR or 7.5YR hues); textures are peaty and either silt loams, clay loams or silty clays; and structures may be either granular or crumb.

The Bg horizons range from 30 to 45 cm thickness; colours are grey (2.5Y 5/0, 6/0 or 10YR 5/1, 6/1) or light brownish grey (10YR 6/2, 2.5Y 6/2) or greyish brown (2.5Y 5/2); the mottles may be common, many or profuse.

The Cr horizons exceed 70 cm in thickness; colours may be dark grey (2.5Y 3/0, 4/0 or 10YR 3/1, 4/1), dark brown (10YR 3/3, 4/3), or light olive brown (2.5Y 5/4, 5/6); textures vary between clays, silty clays, sandy clays, silty clay loams, and clay loams, and shell fragments or gypsum crystals may or not be present.

VARIANTS: None recognised

SIMILAR SOILS AND DISTINGUISHING FEATURES: None recognised

GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES: pH determination on fresh moist samples gave extremely acid values in the surface horizons (to 44 cm depth), then becoming less acid with depth becoming slightly acid below 95 cm; % base saturation is low in the A horizon but high in other horizons; CEC values are very high throughout; exchangeable calcium values increased progressively with depth from a low A horizon value to extremely high values (45 me.%) at depth, with potassium following a similar trend; magnesium very high throughout and sodium giving extremely high values for all horizons; and available phosphorus values low.

LABORATORY Nos: KRS T2676-2682

SOIL LIMITATIONS: Soil acidity, poor internal drainage, detrimental salt water effects on the soil chemistry, and low phosphorus status.

Typifying Profile

SOIL NAME:	Soso soils
PROFILE No.:	DK20
SITE LOCATION:	Dreketi rice irrigation scheme.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Planar surface on estuarine delta.
PARENT MATERIAL:	Estuarine alluvia from rocks of diverse lithology.
SLOPE:	Flat
ASPECT:	Not applicable
ELEVATION:	1 m
MICRORELIEF:	Hummocky
SITE VEGETATION:	Salt tolerant grasses and weeds.
LAND USE:	Unused (about to be prepared for rice cultivation).
DRAINAGE:	Recently drained
EROSION:	None
DISTURBANCE:	Rodent and crab holes.
LABORATORY Nos:	KRS T2676-2682

PROFILE DESCRIPTION

Ah	0-8 cm (8 cm)	Wet; black (2.5Y 2/0) peaty silty clay; few medium distinct yellowish brown (10YR 5/8) mottles (from horizon 2); moderately developed medium crumb structure; friable; slightly sticky; non-plastic; abundant fine dead roots ('kuta'); black blocky clay patches; distinct irregular boundary,
Bg1	8-24 cm (16 cm)	Very moist; grey to light grey (10YR 6/1) clay; many fine to medium distinct, yellowish brown (10YR 5/8) mottles along root channels only; massive; very firm; slightly sticky; very plastic; many very fine and fine dead roots ('kuta'); distinct smooth boundary,
Bg2	24-44 cm (20 cm)	Very moist; light brownish brey (10YR 6/2) clay; profuse medium to coarse prominent yellow (10YR 7/8) to yellowish brown (10YR 5/8) mottles; massive; firm; slightly sticky; plastic; many very fine and fine dead roots ('kuta'); sharp boundary,
Cr1	44-67 cm (23 cm)	Wet; grey to greyish brown (10YR 5/1 to 5/2) clay; massive; firm; slightly sticky; plastic; common very fine and fine dead roots ('kuta'); distinct wavy boundary,
Cr2	67-95 cm (78 cm)	Very moist; dark grey (5Y 4/1) silty clay; massive; friable; very sticky; slightly plastic; many very fine to medium dead roots ('vadra'); distinct wavy boundary,

Cr3	95-142 cm (47 cm)	Very moist; dark brown to brown (7.5YR 4/2) silty clay loam; few medium faint light grey (7.5YR 7/0 to 6/0) mottles (weathered shell fragments); massive; friable; very sticky; non-plastic; many very fine to medium dead roots ('vadra'); many gypsum crystals (mainly along root channels); distinct wavy boundary,
Cr4	142-160+ cm (18 cm+)	Wet very dark grey (5Y 3/1) loamy fine sand; simple grain; loose; slightly sticky; non-plastic; few very fine and fine dead roots ('vadra').

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Sote series**

REFERENCE: The Sote clay (27f) and Sote hill soils (27fH) defined by Twyford & Wright (1965) as Humic Latosols derived from parent materials of basic and intermediate composition and formed under a climate with a weak or no dry season.

The central concept for Sote series are retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Typic Humitropept, very fine, kaolinitic, isohyperthermic
(b) FAO: Humic Cambisol
(c) Twyford and Wright: Humic latosol with a very weak or no dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Sote soils, undulating phase (126B)
Sote soils, easy rolling phase (126C)
Sote soils, rolling phase (126D)
Sote soils, strongly rolling phase (126E)
Sote soils, moderately steep phase (126F)
Sote soils, steep phase (126G)
Ste soils, very steep phase (126H)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION: Sote soils are very extensive on the rolling and hilly lands of south-eastern Viti Levu. They are of limited extent in the wetter areas of southern Vanua Levu.

PARENT ROCK: Sedimentary rocks of basic and intermediate composition.

PARENT MATERIAL: Strongly weathered *in situ* marine sandstones and siltstones.

PHYSIOGRAPHIC POSITION/LANDFORM: Crests, midslopes and low-angle benches on hilly ridges.

SLOPE CLASS AND RANGE OF SLOPES: Undulating (4-7°), easy rolling (8-11°), rolling (12-15°), strongly rolling (16-20°), moderately steep (21-25°), steep (26-35°), and very steep (>35).

VEGETATION AND LAND USE: Indigenous forest but cleared in many places for pasture (dairying).

RANGE OF ELEVATION: 1 0-250 m

RAINFALL: Annual average range: 3,200-4,800 mm;
dry season range: 800-1,600 mm;
wet season range: 1,800-2,800 mm.

TEMPERATURE: Mean annual: 24°C.

SOIL MOISTURE REGIME: Perudic

SOIL TEMPERATURE REGIME: Isohyperthermic

SOIL DRAINAGE CLASS: Well drained

PERMEABILITY CLASS: Moderate

FLOODING: Never floods

EROSION: Slump deposits of unknown age (probably related to bush clearance period). Slight to moderate sheet and rill erosion potential when forest cleared.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically soils with clayey textures and dark brown A horizons overlying yellowish red and red B horizons. One or two B horizons may be identified - where two, the upper B horizons are mainly of 5YR hue, whilst to lower B are mainly of 2.5YR hue. Where only a single B horizon is identified it is of 2.5YR hue. Faint dark brown humus coatings to peds in the B horizon(s). Combined thickness of A and B horizons varies from 50 to over 100 cm C horizons are reddish strongly weathered parent material with some fractures and bedding of the parent rock preserved. They are clayey and friable to firm.
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Sote series have a Ah, (AB), Bw, C horizon sequence. Ah horizons are up to 13 cm thick and are of 7.5YR hue. Their textures include clay loams, clay or silty clay loams and they have friable consistencies and nut structures. Bw horizons are red (2.5YR 4/8 or 5/8), have blocky structures and are friable or firm. The combined thickness of A and B horizons varied between 55 and 65 cm in the profiles observed. However, it is likely that this could exceed 1 m. In some profiles a thin, transitional AB horizon was noted. C horizons are of reddish (2.5YR hue) colours and sometimes preserve faint traces of bedding, fracturing and spheroidal weathering from the now strongly weathered parent rock. They have clay, silty clay loam or sandy clay loam textures and are friable or firm. In some strongly weathered siltstone of very pale brown and yellow colours (10YR and 2.5Y hues) is present. All horizons may contain a few stone-sized fragments of weathering parent rock.
VARIANTS:	Sote series, weakly gleyed subsoil variant (described in the attached).
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Strongly acid soils of medium varying to very low base saturation. Exchangeable calcium values are mainly low; magnesium, high varying to low; potassium, mainly very low; and sodium medium. The particle size family class is very fine. The mineralogical class is kaolinitic.
LABORATORY Nos:	KRS T1411-1414 (inclusive)
SOIL LIMITATIONS:	Soil erosion potential when forest cleared and cultivated particularly on slopes >3°; strong soil acidity; and nutrient deficiencies of phosphorus and potassium.

Typifying Profile

SOIL NAME:	Sote
PROFILE No.:	N80
SITE LOCATION:	Refer soil map of Naduruloulou Agricultural Research Station (Palmer, 1992). Grid reference: Sheet Viti Levu 14 (1:50 000) 608E, 124N.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Crest of narrow, very gently sloping ridge crest.
PARENT MATERIAL:	Strongly weathered siltstone.
SLOPE:	1°
ASPECT:	Not applicable
ELEVATION:	35 m
MICRORELIEF:	Smooth surface
SITE VEGETATION:	Raintree (Albazia) with low shrubs.
LAND USE:	Unused
DRAINAGE:	Well drained
EROSION:	None
DISTURBANCE:	None
LABORATORY Nos:	KRS T1411-1414 (inclusive)

PROFILE DESCRIPTION

Ah	0-13 cm (13 cm)	Brown to dark brown (7.5YR 4/4) clay loam; friable; sticky; plastic; moderately developed fine nut structure; common (10%) distinct fine yellowish red (5YR 5/8) mottles of material from lower horizons; few fine roots; distinct smooth boundary,
AB	13-22 cm (9 cm)	Brown to dark brown (7.5YR 4/4) and red (2.5YR 5/8) clay loam; friable; sticky; plastic; moderately developed medium nut structure with worm cast granules; few fine roots; distinct wavy boundary,
Bw	22-65 cm (43 cm)	Red (2.5YR 5/8) clay; firm; sticky; plastic; weakly developed medium nut structure; few fine roots; indistinct wavy boundary,
C	65-100 cm (35 cm+)	Red (2.5YR 5/8) and pale yellow (2.5Y 7/4) clay; firm; sticky; plastic; massive; a few small strongly weathered stones of parent rock present.

SOIL NAME: **Sote series, weakly gleyed variant**

REFERENCE: Variant introduced in the soil survey of Nadururloulou Agricultural Research Station (Palmer & Smith 1984) to include soils with slowly permeable lower subsoils that induce weak gley features in the upper subsoil. They are similar in all respects to the 'type' Sote differing only in the distinctive pale coloured ped faces and pore linings, the chromas of which are to high to meet criteria for an aquic soil moisture regime.

CLASSIFICATION:

(a) Soil Taxonomy: Typic Humitropept, fine, kaolinitic, isohyperthermic
(b) FAO: Chromic Cambisol
(c) Twyford and Wright: Humic latosol with no dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Variant and mapped as inclusion with Sote series

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	As for Sote series type.
PARENT ROCK:	Sedimentary rocks of intermediate and basic composition.
PARENT MATERIAL:	Strongly weathered *in situ* rock and sometimes as large hummocky rotational slump. deposits
PHYSIOGRAPHIC POSITION/LANDFORM:	Midslopes and benches in hilly land.
SLOPE CLASS AND RANGE OF SLOPES:	Moderately steep. Slopes range from 0° on benches to 26° on midslopes.
VEGETATION AND LAND USE:	Mainly forested, some areas cleared for grazing.
RANGE OF ELEVATION:	10-250 m
RAINFALL:	Annual average range: 3200-4800 mm; dry season range: 800-1600 mm; wet season range: 1800-2800 mm.
TEMPERATURE:	Mean annual: 24.5°C.
SOIL MOISTURE REGIME:	Perudic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Moderately well drained.
PERMEABILITY CLASS:	Slow permeability
FLOODING:	Never floods
EROSION:	Slump deposits of unknown age. Slight to moderate sheet and rill erosion potential on slopes >3°.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	These are soils of clayey textures with dark brown A horizons overlying mainly reddish coloured B horizons. The combined depth of A and B horizons varies between 28 and 65 cm, but mostly >50 cm. C horizons are of reddish and pale brownish colours and vary from being friable to very firm. Roots penetrate C horizons. Their distinguishing feature (cf. 'type' Sote) is the brown to yellow colour of ped faces and pore linings. These are not clay cutans. The ped interiors are unaffected.
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Sote variant has a Ap, Bw, Bg, C horizon sequence. Soil textures vary from clay through clay loam to silty clay loam. Consistencies are friable or firm, sometimes very firm in C horizons. A and B horizons have nut structures. Ap horizons are up to 20 cm thick and are of 7.5YR hue. Bw horizons are of 5YR 5/8 colour or of a combination of 7.5YR 4/4 and 2.5YR 4/8 colours. Ped faces and pore linings are 10YR 5/4 varying to 10YR 6/4 and 2.5Y 6/3. The combined thickness of A and B horizons varied from 28 to 65 cm in the profiles observed. However, in most it was greater than 50 cm and could be expected to exceed 1 m. C horizons are of similar colours to the B horizons but have no structure.
VARIANTS:	Mapped as a variant with Sote series.
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	As for Sote series.
LABORATORY Nos:	Not sampled for analysis.
SOIL LIMITATIONS:	Occasional subsoil waterlogging during the wet season; erosion potential on sloping land when forest cleared; strong soil acidity; and nutrient deficiencies of phosphorus and potassium.

Typifying Profile

SOIL NAME:	**Sote soils, weakly gleyed variant**
PROFILE No.:	N103
SITE LOCATION:	Refer soil map of Naduruloulou Agricultural Research Station (Palmer & Smith 1984). Grid reference - Viti Levu: Sheet 14 (1:50 000) 604E 122N.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Midslope position below low-angle bench on hill slope in hilly terrain.
PARENT MATERIAL:	Strongly weathered marine siltstone.
SLOPE:	25°
ASPECT:	South
ELEVATION:	15 m
MICRORELIEF:	Smooth
SITE VEGETATION:	Grasses, Navua sedge and Macadamia trees.
LAND USE:	Tree crops
DRAINAGE:	Moderately well drained.
EROSION:	None
DISTURBANCE:	None evident
LABORATORY Nos:	Not sampled for analysis

PROFILE DESCRIPTION

Ap	0-8 cm (8 cm)	Dark brown (7.5YR 3/3) clay; friable; sticky; plastic; moderately developed fine nut structure; many fine roots; distinct smooth boundary,
Bw	8-22 cm (14 cm)	Brown to dark brown (7.5YR 4/4) and yellowish red (5YR 5/8) clay; friable; sticky; plastic; moderately developed fine nut structure; few fine roots; indistinct irregular boundary,
Bg	22-52 cm (30 cm)	Red (2.5YR 4/8) clay; friable; sticky; plastic; weakly developed coarse blocky structure; ped faces and root channels of light yellowish brown (10YR 6/4) colour; a few small stones of strongly weathered sandstone; few fine roots; indistinct irregular boundary,
C	52-100 cm (48 cm+)	Yellowish red (5YR 5/8), light yellowish brown (10YR 6/4) and strong brown (7.5YR 5/6) clay loam; friable; sticky; plastic; massive; a few small stones of strongly weathered sandstone; no roots noted.

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Suva series**

REFERENCE: Suva clay (11c) defined by Twyford & Wright (1965) as a colluvial derivative of Samabula and Verata soils and formed from marls and calcareous tuffs under a climate with a weak or no dry season.

Forms part of the Samabula set.

The central concept for Suva soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Cumulic Hapludoll, fine, smectitic, isohyperthermic
(b) FAO: Haplic Phaeozem
(c) Twyford and Wright: Nigrescent soil with a weak or no dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Suva soils, undulating phase (119B)
Suva soils, easy rolling phase (119C)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Suva soils are of limited extent in Viti Levu and are found in association with Samabula and Wailotua soils in the south-east coastal region.
PARENT ROCK:	Marls and calcareous tuffs.
PARENT MATERIAL:	Strongly weathered moderately deep colluvium.
PHYSIOGRAPHIC POSITION/LANDFORM:	Concave toeslopes and lower midslopes in flattish to strongly rolling land.
SLOPE CLASS AND RANGE OF SLOPES:	Undulating (4-7°) and easy rolling (8-11°).
VEGETATION AND LAND USE:	
RANGE OF ELEVATION:	10-200 m
RAINFALL:	Annual average range: 3,200-4,800 mm; Dry season range: 800-1,600 mm; Wet season range: 1,800-2,800 mm.
TEMPERATURE:	Mean annual: 24°C.
SOIL MOISTURE REGIME:	Udic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Well drained
PERMEABILITY CLASS:	Moderate
FLOODING:	Never floods
EROSION:	Very slight sheet erosion potential.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 35 cm of black, friable to firm clay of strong medium blocky and medium granular structure, and very sticky and very plastic when moist overlying 45 cm of dark brown firm clay, commonly mottled very dark grey and dusky red, and of strong medium and fine blocky structure, very sticky and very plastic when moist, on light grey weathering marl.
DIAGNOSTIC HORIZONS:	Mollic epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Not applicable. Only two profile descriptions made.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Not analysed but considered to be near neutral to slightly acid, with a high base status and very high levels of exchangeable calcium and magnesium but low in potassium and available phosphorus.
LABORATORY Nos:	Not sampled for analysis.
SOIL LIMITATIONS:	Clayey textures; become wet during parts of the wet season; and nutrient deficiencies of phosphorus and potassium.

Typifying Profile

SOIL NAME:	Suva soils, easy rolling phase.
PROFILE No.:	DL20
SITE LOCATION:	Nukulau Road, Veiuto, Suva City.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Concave lower midslope in easy rolling country.
PARENT MATERIAL:	Moderately deep colluvium from Suva marl.
SLOPE:	9°
ASPECT:	South-west
ELEVATION:	10 m
MICRORELIEF:	Smooth
SITE VEGETATION:	Cassava with miscellaneous weeds.
LAND USE:	Intensive subsistence food gardening.
DRAINAGE:	Well drained
EROSION:	None
DISTURBANCE:	Cultivated
LABORATORY Nos:	Not sampled for analysis.

PROFILE DESCRIPTION

Ap	0-35 cm (35 cm)	Moist; black (10YR 2/1) clay; strongly developed medium blocky structure with some medium and fine granular; friable to firm; very sticky; very plastic; common fine and medium fibrous roots; indistinct smooth boundary,
Bw	35-75 cm (40 cm)	Moist; dark brown (10YR 3/3) clay; few faint very dark grey (10YR 3/1) and dusky red (2.5YR 3/2) mottles; strongly developed medium blocky structure; firm; very sticky; very plastic; few fine fibrous roots; rare angular stone of marl; distinct irregular boundary (paralithic contact),
R	on	Light grey (10YR 7/1) massive slightly weathered *in situ* marl.

Suva

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Tabaka series**

REFERENCE: Tabaka stony clay (22) and Tabaka hill soils (22H) defined by Twyford & Wright (1965) as latosolic soils 'from olivine basalt flows somewhat older than Vakawau basalts' and formed under a climate with no dry season.

Forms the Tabaka set. The central concept for Tabaka soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Andic Humitropept, fine-silty, halloysitic, isohyperthermic
(b) FAO: Humic Cambisol
(c) Twyford and Wright: Latosolic soil with no dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Tabaka soils, easy rolling phase (103C)
Tabaka soils, rolling phase (103D)
Tabaka soils, strongly rolling phase (103E)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	East coast lowlands of Taveuni Island from Salialailai in the south to the Waibula River in the north where they occur in association with Ravilevu series under a wet continuous rainfall regime.
PARENT ROCK:	Basalt
PARENT MATERIAL:	Moderately weathered *in situ* rock. Narrow planar easy sloping long.
PHYSIOGRAPHIC POSITION/LANDFORM:	Narrow and planar easy sloping long surfaces from 600 m to the cliffed coast of eastern Taveuni.
SLOPE CLASS AND RANGE OF SLOPES:	Easy rolling (8-11°), rolling (12-15°) and strongly rolling (16-20°).
VEGETATION AND LAND USE:	Almost exclusively under tall rain forest. Small areas have been cleared in the past for subsistence food gardens.
RANGE OF ELEVATION:	0-600 m
RAINFALL:	Annual average range: 3,000-6,400 mm; dry season range: 800-3,000 mm; wet season range: 2,000-3,200 mm.
TEMPERATURE:	Mean annual: 24°C.
SOIL MOISTURE REGIME:	Perudic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Well drained
PERMEABILITY CLASS:	Moderate
FLOODING:	Never floods
EROSION:	Even under forest have experienced severe sheet erosion as exemplified by basalt boulders (50 m in diameter) reposing on columns of soil 15 to 25 cm high indicating recent erosion as the soil columns can hardly be stable.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 12 cm of dark greyish brown friable clay of moderate fine and medium nut structure, slightly sticky and slightly plastic moist overlying 50 cm of dark yellowish brown friable loamy clay of moderate medium nut structure also slightly sticky and slightly plastic moist and commonly with weathered basalt stones overlying more than 30 cm of dark yellowish brown loose to very friable loamy sand of weak medium blocky structure and with abundant basalt stones of various stages of weathering. Large basalt boulders typifying the ground surface.
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Not applicable. Only two profile descriptions made.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analysis shows the soil to be extremely acid in the topsoil (0-12 cm) and strongly acid in the other horizons; organic carbon and nitrogen are high in the topsoil and low below 12 cm, and the C/N ratio is medium; % base saturation is low 0-12 cm, and very low 12-90 cm; CEC is high in the topsoil and of low values below 12 cm; calcium is low in the topsoil and very low in the other horizons; magnesium and potassium are medium 0-12 cm and of very low values in the other horizons; and sodium is medium throughout. The particle size family class is fine-silty. The mineralogical class is halloysitic.
LABORATORY Nos:	ORSTOM TAV14A-C
SOIL LIMITATIONS:	Continuous intense rainfall; surface boulders; severe past erosion and very severe potential erosion hazard; soil acidity; nutrient deficiencies of phosphorus and potassium.

Typifying Profile

SOIL NAME:	Tabaka soils, rolling phase.
PROFILE No.:	TAV14
SITE LOCATION:	Nasau district, northeast Taveuni Island.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Planar midslope in weakly dissected volcanic terrain.
PARENT MATERIAL:	Moderately weathered *in situ* basalt.
SLOPE:	13°
ASPECT:	North-east
ELEVATION:	400 m
MICRORELIEF:	Uneven
SITE VEGETATION:	Dalo
LAND USE:	Subsistence cropping (dalo) after forest clearance
DRAINAGE:	Well drained
EROSION:	None observed
DISTURBANCE:	Cultivated
LABORATORY Nos:	ORSTOM TAV14A-C

PROFILE DESCRIPTION

Ap	0-12 cm (12 cm)	Moist; dark greyish brown (10YR 4/2) clay; moderately developed fine and medium nut structure; friable; slightly sticky; slightly plastic; many macropores; few weakly weathered basalt fragments; abundant fine and medium fibrous roots; distinct smooth boundary,
Bw	12-60 cm (48 cm)	Moist; dark yellowish brown (10YR 4/4) loamy clay; moderately developed medium nut structure; friable; slightly sticky; slightly plastic; few weakly weathered basalt stones and fragments; few fine fibrous roots; distinct irregular boundary,
BC	60-90 cm (30 cm)	Moist; dark yellowish brown (10YR 4/4) loamy sand; weakly developed medium blocky structure; loose; porous; abundant basalt stones and fragments at varying stages of weathering; no roots.

Tabaka

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Tabia series**

REFERENCE: Tabia soil set (31c) defined by Twyford & Wright (1965) as colluvial derivatives of the infertile red and brownish talasiga soils (Ferruginous latosols) formed on flattish land from more basic rocks under a climate with a strong dry season.

Forms part of the Drasa set.

The central concept for Tabia soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Humic Kandiustox, clayey, ferruginous, isohyperthermic
(b) FAO: Humic Ferralsol
(c) Twyford and Wright: Humic latosol with strong a dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Tabia soils, flat to gently undulating phase (189A)
Tabia soils, undulating phase (189B)
Tabia soils, easy rolling phase (189C)
Tabia soils, rolling phase (189D)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION: Tabia soils form in association with Nabiti and Nadi soils and are only of very minor occurrence in Viti Levu. They are particularly common in the Macuata and Bua provinces of Vanua Levu.

PARENT ROCK: Andesite and basalts.

PARENT MATERIAL: Strongly weathered colluvium.

PHYSIOGRAPHIC POSITION/LANDFORM: Footslope and toeslope positions in undulating and rolling lowland hill country.

SLOPE CLASS AND RANGE OF SLOPES: Flat to gently undulating, (0-3°), undulating, (4-7°), easy rolling (8-11°), and rolling (9-11°).

VEGETATION AND LAND USE: Unused scrubland with stagshorn fern, cultivated fallow land, indigenous forest, and elsewhere cultivated for sugar cane, rainfed rice and pulse crops.

RANGE OF ELEVATION: 80-180 m

RAINFALL: Annual average range: 1,800-2,400 mm;
Dry season range: 400-500 mm;
Wet season range: 1,400-1,800 mm.

TEMPERATURE: Mean annual: 26°C.

SOIL MOISTURE REGIME: Ustic

SOIL TEMPERATURE REGIME: Isohyperthermic

SOIL DRAINAGE CLASS: Well drained

PERMEABILITY CLASS: Moderate

FLOODING: Occasional surface flooding from higher slopes. Sedimentation has occurred in past, but probably infrequent now.

EROSION: Slight sheet erosion potential on slopes >3° under a cultivation regime.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Deep, very friable soils with dark reddish brown, clayey subsoils. Recent slope-wash material 50 cm thick overlies a well developed paleosol. Subsoils satisfy oxic horizon criteria. Surface horizons are relatively thick and dark reddish brown.
DIAGNOSTIC HORIZONS:	Umbric epipedon, oxic horizon.
RANGE OF PROFILE FEATURES:	Tabia series have an Ah, AB, bAh, bBw horizon sequence. A, AB and bA horizons are dusky red to dark reddish brown, very friable clay loams or clays. Bwb horizons are reddish brown, very friable clays or clay loams with weakly developed structures.
VARIANTS:	Unnamed variant: A soil with paleosol at a depth of 52 cm has been included within Tabia series. According to Soil Taxonomy criteria this profile would be classified differently (>50 cm aggradation) based on properties of the material above the paleosol. (Tentative classification: Fluventic Humitropept, fine, ferruginous, isohyperthermic).
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Moderately acid throughout profile. Organic C% varies from medium to very low throughout profile in accordance with presence of buried A horizons. % base saturation low in surface horizon and low to very low in subsurface horizons. Exchangeable calcium low and magnesium medium in surface horizon, and in subsurface horizons calcium is very low, while magnesium is low to very low; exchangeable potassium is very low throughout profile. The particle size family class is clayey. The mineralogical class is ferruginous.
LABORATORY Nos:	KRS S1947-1951 SB9812A-E
SOIL LIMITATIONS:	Major soil physical limitations of severe seasonal soil moisture deficits experienced during the dry season; susceptible to periodic flooding and sedimentation; clayey textures; strongly acid pH; and severe nutrient deficiencies of nitrogen, potassium and phosphorus.

Typifying Profile

SOIL NAME:	Tabia soils, flat to gently undulating phase.
PROFILE No.:	S29
SITE LOCATION:	Refer soil map of Seaqaqa Agricultural Research Station (Laffan, Purdie & Shepherd 1984).

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Lowland hill country.
PARENT MATERIAL:	Slope-wash material derived from strongly weathered red andesite.
SLOPE:	2°
ASPECT:	East
ELEVATION:	130 m
MICRORELIEF:	Slightly hummocky
SITE VEGETATION:	Scrubland with staghorn fern.
LAND USE:	Occasional extensive cattle grazing.
DRAINAGE:	Well drained. Water table at 150 m.
EROSION:	None, but has been subject to accumulation of slope-wash material in the past.
DISTURBANCE:	None observed
LABORATORY Nos:	KRS S1947-1951 (inclusive) SB9812A-E

PROFILE DESCRIPTION

Ah1	0-13 cm (13 cm)	Dusky red to dark reddish brown (2.5YR 3/3) clay; friable; slightly sticky; plastic; strongly developed fine nut structure; abundant roots; distinct smooth boundary,
Ah2	13-20 cm (7 cm)	Dusky red to dark reddish brown (2.5YR 3/3) clay; friable; sticky; plastic; strongly developed fine nut structure; many roots; distinct smooth boundary,
Ah3	20-28 cm (8 cm)	Dusky red to dark reddish brown (2.5YR 3/3) clay; common medium distinct dark red (2.5YR 3/6) mottles; very friable; slightly sticky; plastic; strongly developed fine nut structure; many roots; indistinct smooth boundary,
AB	28-43 cm (15 cm)	Dark reddish brown (2.5YR 3/4) clay loam; many coarse distinct dark red (2.5YR 3/6) mottles; very friable; slightly sticky; slightly plastic; weakly developed medium nut structure breaking to single grain; many roots; distinct wavy boundary,
bAh1	43-51 cm (8 cm)	Dusky red (2.5YR 3/2) silt loam; loose; non-sticky; non-plastic; weakly developed medium blocky structure breaking to single grain; many roots; distinct wavy boundary,

bAh2	51-69 cm (18 cm)	Dusky red to dark reddish brown (2.5YR 3/3) fine sandy clay loam; loose; non-sticky; slightly plastic; massive breaking to single grain; many roots; distinct wavy boundary,
bBw1	69-84 cm (15 cm)	Dark reddish brown (5YR 3/3) clay loam; very friable slightly sticky; plastic; massive breaking to single grain; many roots; indistinct smooth boundary,
bBw2	84-125 cm (41 cm)	Dark red (2.5YR 3/6) gritty clay loam; very slightly sticky; slightly plastic; massive breaking to single grain; many roots.

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Tabuquto series**

REFERENCE: New soil series introduced in this survey to include soils developed on argillaceous rocks in the ustic soil moisture regime. Previously included with Tuva soils (34b) as defined by Twyford & Wright (1965) and separated from Tuva soils because of different parent material.

The name is derived from Tabuquto trig (410 m) 3.5 km south of Nawaicoba Agricultural Research Station, Nadroga Province.

CLASSIFICATION:

(a) Soil Taxonomy: Typic Kanhaplustult, clayey, kaolinitic, isohyperthermic
(b) FAO: Humic Acrisol
(c) Twyford and Wright: Ferruginous latosol with a strong dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Tabuquto soils, flat to gently undulating phase (165A)
Tabuquto soils, undulating phase (165B)
Tabuquto soils, easy rolling phase 165C)
Tabuquto soils, rolling phase (165D)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION: Tabuquto soils in Viti Levu are confined to a few small valleys draining terrain carrying Tuva soils, particularly in Nadroga, south-west Viti Levu.

PARENT ROCK: Argillites of basic composition.

PARENT MATERIAL: Strongly weathered colluvium over *in situ* rock of the same origin.

PHYSIOGRAPHIC POSITION/LANDFORM: All slope positions and slope forms on moderately dissected hill country.

SLOPE CLASS AND RANGE OF SLOPES: From flat to gently undulating through all slope classes to rolling phase (0-15°).

VEGETATION AND LAND USE: Generally unused for agriculture but exotic forestry adapts well to these infertile, degraded soils. In natural state supports Nokonoko trees with a ground cover of fern and grass.

RANGE OF ELEVATION: 50-200 m

RAINFALL: Annual average range: 1,800-2,400 mm;
dry season range: 400-500 mm;
wet season range: 1,400-1,800 mm.

TEMPERATURE: Mean annual: 26°C.

SOIL MOISTURE REGIME: Ustic

SOIL TEMPERATURE REGIME: Isohyperthermic

SOIL DRAINAGE CLASS: Well drained

PERMEABILITY CLASS: Moderately rapid

FLOODING: Never floods

EROSION: Due to sparse vegetative cover, soils experience severe wind and sheet and rill erosion.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 10 cm of dark brown loam, of strongly developed fine nut structure, very friable; and sticky and plastic moist, overlying 50 cm of red clay, of moderately developed blocky or nut structure, firm to friable, very sticky and very plastic moist, and with distinct clay cutans to peds, overlying 30 cm of strong brown fine sandy clay loam, of massive structure breaking to single grain, firm, sticky and plastic moist, and with profuse very strongly weathered *in situ* angular stones , over moderately weathered fracture argillaceous rock.
DIAGNOSTIC HORIZONS:	Ochric epipedon, argillic horizon.
RANGE OF PROFILE FEATURES:	Tabuquto series have an Ah, Bt1, Bt2, BC, C horizon sequence. The Ah horizon thickness ranges from 8-12 cm; colours include dark brown (10YR 3/3, 4/3, 7.5YR 3/2); textures range clay, clay loam and silty clay loam; and the nut structures are either moderate or strongly developed; and consistence may be friable or very friable. The Bt1 horizon thickness ranges from 15-25 cm; colours include red (2.5YR 4/6, 4/8) and yellowish red (5YR 4/6, 4/8); textures are either clay or heavy clay; and clay cutans may be common or many. The Bt2 horizon thickness ranges from 20-30 cm; colours vary as for the Bt1 horizon; textures are either clay loam, clay or heavy clay; moderate structure may be blocky or nutty; and clay cutans range between few and profuse. The BC horizon thickness ranges from 25-30 cm; varicoloured by predominantly strong brown; textures are either sandy clay loam, silty clay loam or clay loam; and structures may be massive or weak blocky. The weathered C horizon is normally encountered between 80 and 100 cm depth.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Moderately acid soil with medium base status in the topsoil but values drop off sharply with depth; topsoil values for bases are: magnesium medium; calcium low; potassium low; and sodium medium; and for subsoils: magnesium low; calcium very low; potassium medium (below 70 cm); and sodium medium; organic carbon is low to very low.
LABORATORY Nos:	KRS R2612-2616 (inclusive) SB 9692A-E
SOIL LIMITATIONS:	Clayey textures, severe soil moisture deficits during the dry season; general low fertility; moderately acid pH; and rill and sheet erosion potential on slopes >7°

Typifying Profile

SOIL NAME:	Tabuquto soils, rolling phase.
PROFILE No.:	N162
SITE LOCATION:	Refer soil map Nawaicoba Agricultural Research Station (Leslie, 1984).

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Convex backslopes on hill side in weakly dissected hill country.
PARENT MATERIAL:	*In situ* weathered argillaceous rock with colluvium of the same origin.
SLOPE:	12°
ASPECT:	East north-east
ELEVATION:	150 m
MICRORELIEF:	Terracettes
SITE VEGETATION:	Nokonoko, fern and grass (*Digitasis fuscescens*).
LAND USE:	Very rough grazing for beef cattle.
DRAINAGE:	Well drained
EROSION:	Has experienced severe past erosion associated with burning.
DISTURBANCE:	None observed
LABORATORY Nos:	KRS R2612 (inclusive) SB9692A-E

PROFILE DESCRIPTION

Ah	0-9 cm (9 cm)	Moist; moist and ped face very dark greyish brown (10YR 3/2) and rubbed, dark brown (10YR 3/3) clay loam strongly developed fine and very fine nut structure; very friable; sticky; plastic; abundant fine and very fine roots; distinct wavy boundary,
Bt1	9-29 cm (20 cm)	Moist; red (2.5YR 4/6), ped face dark brown (7.5YR 3/4) and rubbed yellowish red (5YR 4/6) clay; moderately developed fine and medium blocky structure breaking to moderately developed very fine nut structure; firm to friable; very sticky; very plastic; many distinct dark reddish brown (2.5YR 3/4) clay coatings; common fine and very fine roots; distinct wavy boundary,
Bt2	29-55 cm (26 cm)	Moist; moist and ped face red (2.5YR 4/6), rubbed yellowish red (5YR 5/8) clay; moderately developed fine and medium nut structure breaking to moderate to strongly developed very fine nut structure; firm to friable; very sticky; very plastic; common distinct red (2.5YR 4/6) clay coatings; few very fine roots; common strongly weathered angular gravels and stones; distinct wavy boundary,
BC	55-85 cm (30 cm)	Moist; variegated colours, rubbed, strong brown (7.5YR 4/6) fine sandy clay loam; massive breaking to single grain; firm; sticky; plastic; few very fine roots; profuse very strongly weathered angular stones (*in situ* rock); distinct irregular boundary,
C	on	Moderately weathered fractured *in situ* argillaceous rock.

Tabuquto

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Tacilevu series**

REFERENCE: A new soil series introduced in this survey to include calcareous dune soils developed on a strongly cemented calcareous beach rock platform on the flat and gently undulating backslope of the coastal dunes under a climate with a weak dry season.

Previously included with the Nuku loamy sands and stony sands (1c) as defined by Twford & Wright (1965) and are similar to them but differs in having a paler topsoil and a very moist and wet lower subsoil due to a perched water table on a cemented calcareous beach rock platform within 1 m of the soil surface.

CLASSIFICATION:

(a) Soil Taxonomy: Aquic Tropopsamment, carbonatic, isohyperthermic
(b) FAO: Arenosol
(c) Twyford and Wright: Recent soil from coastal sands

INCLUDED MAPPING UNITS AND SYMBOLS:
Tacilevu soils (8)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Tacilevu soils are mapped in association with Nuku soils and are found on the windward coasts where the dry season is less marked.
PARENT ROCK:	Reef coral
PARENT MATERIAL:	Comminuted sands and cemented coral stones over coral 'beach rock'.
PHYSIOGRAPHIC POSITION/LANDFORM:	Flat to gently undulating backslope of coastal sand dunes.
SLOPE CLASS AND RANGE OF SLOPES:	Flat to near level (0-2°).
VEGETATION AND LAND USE:	Mainly in coconuts with rough under grazing.
RANGE OF ELEVATION:	1-2 m
RAINFALL:	Annual average range: 3,200-4,800 mm; dry season range: 800-1,600 mm; wet season range: 1,800-2,800 mm.
TEMPERATURE:	Mean annual: 24°C.
SOIL MOISTURE REGIME:	Udic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Poorly drained
PERMEABILITY CLASS:	Rapidly permeable soil over very slowly permeable beach rock.
FLOODING:	Never floods
EROSION:	No erosion risk other than some surface scouring during hurricane events.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 15 cm of dark greyish brown friable sandy loam, of weakly developed fine and medium nut structure, and with many shelly gravels, overlying 30 cm of pale brown friable sandy loam, single grain, commonly having brown humus coatings and common shelly gravels, overlying 40 cm of very pale brown friable sandy loam, single grain, commonly having brown humus stained and stones of cemented coral, overlying more than 30 cm of very pale brown loose coarse sand, with many stones of cemented coral and at about 1 m depth overlying a cemented calcareous beach rock platform.
DIAGNOSTIC HORIZONS:	Ochric epipedon
RANGE OF PROFILE FEATURES:	Not applicable. Only 2 profile descriptions made.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Chemical analysis shows moderately alkaline topsoil and strongly alkaline in the subsoil; available phosphorus is very low throughout the profile; carbon and nitrogen have medium values in the topsoil and very low in the other horizons, and C/N ratios are low; exchangeable calcium is very high, sodium and magnesium are medium, and potassium is very low in all horizons; TEB and % base saturation are very high throughout the profile; CEC is very high in the topsoil and high in the subsoil. The mineralogical class is carbonatic
LABORATORY Nos:	KRS S2083-2086
SOIL LIMITATIONS:	The high soil alkalinity and low and very low nitrogen, phosphorus and potassium levels would adversely affect plant growth as would the non-availability of Fe, which could cause chlorisis in plants.

Typifying Profile

SOIL NAME:	Tacilevu soils
PROFILE No.:	V5
SITE LOCATION:	Vunilagi Estate. Located 20 m to the west of where the north/south trending Estate road turns 35° to the west.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Backslope of lowlying coastal sand dune.
PARENT MATERIAL:	Comminuted coralline sand and cemented coral stones over coral 'beach rock'.
SLOPE:	Planar
ASPECT:	Not applicable
ELEVATION:	2 m
MICRORELIEF:	Hummocky
SITE VEGETATION:	Pasture grasses under coconuts.
LAND USE:	Coconut plantation (copra) and cattle grazing.
DRAINAGE:	Poorly drained (i.e. somewhat excessively drained soil over a very poorly drained beach rock platform).
EROSION:	None observed
DISTURBANCE:	None
LABORATORY Nos:	KRS S2083-2086

PROFILE DESCRIPTION

Ah	0-16 cm	Moist; dark greyish brown (10YR 4/2) sandy loam with many weakly weathered shelly gravels; friable; stiff penetration; weakly developed fine and medium nutty structure; rapid permeability; many fine roots; distinct wavy boundary,
C1	16-46 cm	Very moist; very pale brown (10YR 7/4) sandy loam with common weakly weathered shelly gravels; friable; stiff penetration; single grain; common distinct brown (10YR 5/3) organic cutans; rapid permeability; common very fine roots; diffuse boundary,
C2	46-81 cm	Very moist; very pale brown (10YR 7/3) sandy loam with many weakly weathered medium and small stones of cemented coral; friable; stiff penetration; single grain; common distinct brown (10YR 5/3) organic cutans; rapid permeability; few very fine roots; indistinct boundary,
C3	81-100 cm	Wet; very pale brown (10YR 8/4) coarse sand with many weakly weathered medium and small stones of cemented coral; loose; soft penetration; single grain; perched water table; no roots (paralithic contact),
	on	A cemented calcareous beach rock platform.

Tacilevu

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Tagimaucia series**

REFERENCE: Tagimaucia clay loam (58b) defined by Twyford & Wright (1965) as an upland latosolic 'colluvial soil related to Naitata soils (58a)' formed under a climate with no dry season. Forms part of the Naitata set and occurs in one small area in the centre uplands of Taveuni Island.

Not resampled or described in this survey and the data presented in Twyford & Wright (1965) is used to define the series here.

CLASSIFICATION:

(a) Soil Taxonomy: Acrudoxic Hapludand, medial, isothermic
(b) FAO: Vitric Andosol
(c) Twyford and Wright: Upland latosolic soil with no dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Tagimaucia soils, flat to undulating phase (220A)
Tagimaucia soils, undulating phase (220B)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Of restricted occurrence north and south of Tagimaucia Lake on the eastern side of the axial range in uplands Taveuni.
PARENT ROCK:	Basalt
PARENT MATERIAL:	Deep moderately weathered colluvium.
PHYSIOGRAPHIC POSITION/LANDFORM:	Planar flattish surfaces.
SLOPE CLASS AND RANGE OF SLOPES:	Flat to gently undulating (0-3°), and undulating (4-7°).
VEGETATION AND LAND USE:	Entirely under forest comprising kura (*Morinda citrifolia*), bulei (*Hedstromia latifolia*), wakacere, sama (*Commersonia echinata*) and yagoyaqona (*Piper macgillivrayi*) and rare climber tagimaucia (*Medinilla waterhousei*).
RANGE OF ELEVATION:	800-900 m
RAINFALL:	Annual average range: 3,000-6,400 mm; dry season range: 1,800-2,500 mm; wet season range: 2,500-3,500 mm.
TEMPERATURE:	Mean annual: 18°C.
SOIL MOISTURE REGIME:	Perudic
SOIL TEMPERATURE REGIME:	Isothermic
SOIL DRAINAGE CLASS:	Well drained
PERMEABILITY CLASS:	Moderately rapid
FLOODING:	Never floods
EROSION:	No erosion risk.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 2 cm of dark reddish brown friable slightly sandy clay loam of strong medium and fine nut and crumb structure, overlying the surface of the soil (this is probably very recent colluvium). The soil proper shows about 25 cm of reddish brown friable clay loam faintly mottled yellowish of massive structure, on 65 cm or more of reddish brown slightly gravelly clay. None of the horizons are noticeably sticky nor plastic when moist.
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Not applicable. Only one profile description made.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analysis shows the soil to be strongly acid and of very low base status with only moderate contents of exchangeable calcium, magnesium and potassium. Acid soluble phosphate is very low.
LABORATORY Nos:	KRS 702-703
SOIL LIMITATIONS:	Constant wetness; accumulating site so receiving periodic fresh accretions of colluvium; strong soil acidity; very high phosphate fixation; and nutrient deficiencies of potassium, and nitrogen

Typifying Profile

SOIL NAME:	Tagimaucia soils, undulating phase.
PROFILE No.:	58b
SITE LOCATION:	Upland Taveuni Island, near the 'crater' lake.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Flattish to gently undulating.
PARENT MATERIAL:	Basaltic ash, partly colluvial.
SLOPE:	3°
ASPECT:	East
ELEVATION:	800 m
MICRORELIEF:	Uneven
SITE VEGETATION:	Rain forest. Includes the Tagimaucia orchid (*Medinilla waterhousei*) from which the series was named.
LAND USE:	Unused (natural state).
DRAINAGE:	Well drained
EROSION:	None observed
DISTURBANCE:	None
LABORATORY Nos:	KRS 702-703

PROFILE DESCRIPTION

Ah1	0-2 cm (2 cm)	Moist; dark reddish brown (5YR 3/4) slightly sandy clay loam; strongly developed medium and fine nut structure breaking to very fine nut and crumb; friable; sharp smooth boundary,
Ah2	2-25 cm (23 cm)	Moist; reddish brown (5YR 4/3) clay loam; very faint and coarse (as stains along cracks) yellowish brown (10YR 5/6) mottles; massive breaking to weakly developed medium and fine blocky with granular structure; firm; slightly sticky; slightly plastic; diffuse smooth boundary,
Bw	25-90 cm (65 cm)	Very wet; reddish brown (5YR 4/3) slightly gravelly clay; soft; slightly sticky; slight plastic.

Tagimaucia

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Tailevu series**

REFERENCE: Tailevu steepland stony and bouldery clay (84b) defined by Twyford & Wright (1965) as a steepland soil formed mainly from basalt sheets and agglomerates with overlying tuffs under a climate with a weak dry season.

They form part of the Visa set. The central concept for Tailevu soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Typic Dystropept, fine, kaolinitic, isohyperthermic
(b) FAO: Dystric Cambisol
(c) Twyford and Wright: Steepland soil related or associated with humic latosols, with weak dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Tailevu soils, easy rolling phase (170C)
Tailevu soils, rolling phase (170D)
Tailevu soils, strongly rolling phase (170E)
Tailevu soils, moderately steep phase (170F)
Tailevu soils, steep phase (170G)
Tailevu soils, very steep (170H)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION: Tailevu soils are the main type on the Nakorotubu coastal ranges in Tailevu province and in the upper Sigatoka valley of Viti Levu. They are of limited extent in Vanua Levu.

PARENT ROCK: Basalt

PARENT MATERIAL: Weathered colluvium over *in situ* rubbly basalt.

PHYSIOGRAPHIC POSITION/LANDFORM: Concave and planar sideslopes in strongly dissected hill country.

SLOPE CLASS AND RANGE OF SLOPES: Easy rolling (8-11°), rolling (12-15°), strongly rolling (16-20°), moderately steep (21-26°), steep (27-35°), and very steep (>35°).

VEGETATION AND LAND USE: Much under dense indigenous forest and in the drier areas of the udic zone they support gasau and scrub. Used for subsistence root crops (followed by 10 years of fallow) and yaqona.

RANGE OF ELEVATION: 30-600 m

RAINFALL: Annual average range: 3,200-4,800 mm;
Dry season range: 800-1,600 mm;
Wet season range: 1,800-2,800 mm.

TEMPERATURE: Mean annual: 24°C.

SOIL MOISTURE REGIME: Udic

SOIL TEMPERATURE REGIME: Isohyperthermic

SOIL DRAINAGE CLASS: Well drained

PERMEABILITY CLASS: Medium

FLOODING: Never floods

EROSION: Moderate and severe sheet erosion potential when forest cleared.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 15 cm of dark yellowish brown friable silty clay loam, of strong medium nut structure overlying 20 cm of red firm clay, of moderate coarse nut structure and with a few rounded gravels, overlying 25 cm of red very firm clay, of moderately developed coarse nut structure overlying 20 cm of red, reddish yellow and yellow very firm clay, of moderate coarse nut structure, and very sticky moist, on yellowish brown and pale olive *in situ* angular rubble with black manganese coatings.
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Tailevu series have an Ah, (AB), Bw1, Bw2, BC horizon sequence. The Ah horizon thickness ranges from 12-18 cm; its colours include dark yellowish brown (10YR 3/4, 4/4), dark brown (7.5YR 4/4) and reddish brown (5YR 4/3, 4/4); its textures include clay, clay loam and silty clay loam; and structures are moderate or strong fine, medium or very fine nut. The Bw1 horizon thickness ranges from 20-60 cm; its colours include red (2.5YR 4/6, 4/8, 5/6, 5/8); textures are clay or clay loam; consistence may be friable, firm or very firm; structures may be moderate, very fine, fine or medium nut or blocky; and boulders may be none, few, many or common. The Bw2 horizon thickness ranges from 20-30 cm; its colours include red (2.5YR 4/6, 4/8, 5/6, 5/8) and yellowish red (5YR 5/6, 5/8) with weathered patches of reddish yellow and yellow; consistence is friable, firm or very firm; structures as for the Bw12 horizon; and boulders few, many to profuse in abundance.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised.
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analysis shows the soil to be strongly acid; organic carbon and nitrogen have medium values in the topsoil (0-15 cm) and are of very low values below this; very low available phosphorus; % base saturation is medium to 60 cm depth becoming low below this; CEC is high in the topsoil, dropping to medium with depth and raising to high again below 50 cm; exchangeable calcium is medium; magnesium is high 0-35 cm and medium in the other horizons; potassium is low in the topsoil and very low in the other horizons. The particle size family class is fine. The mineralogical class is kaolinitic.
LABORATORY Nos:	KRS V159-163 (inclusive)
SOIL LIMITATIONS:	Slope; surface boulders; moderate to severe risk of erosion when the forest is cleared; strong soil acidity; and nutrient deficiencies of nitrogen, potassium and phosphorus.

Typifying Profile

SOIL NAME:	Tailevu soils, strongly rolling phase.
PROFILE No.:	VS14
SITE LOCATION:	2 km south-west of Korovou township.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Convex backslope
PARENT MATERIAL:	Weathered colluvium over *in situ* rubbly basalt.
SLOPE:	20°
ASPECT:	North
ELEVATION:	100 m
MICRORELIEF:	Smooth
SITE VEGETATION:	Sama, yaqona, gasau and mint wed..
LAND USE:	Unused
DRAINAGE:	Well drained
EROSION:	None observed
DISTURBANCE:	None
LABORATORY Nos:	KRS V159-163 (inclusive)

PROFILE DESCRIPTION

Ah	0-15 cm (15 cm)	Moist; dark yellowish brown (10YR 4/4) silty clay loam; strongly developed medium nut structure; friable; non-sticky; non-plastic; common fine fibrous roots; distinct smooth boundary,
AB	15-35 cm (20 cm)	Moist; red (2.5YR 4/8) clay; moderately developed coarse nut structure; firm; slightly sticky; slightly plastic; few medium rounded gravels; few fine fibrous roots; diffuse smooth boundary,
Bw1	35-60 cm (25 cm)	Moist; red (2.5YR 4/6) clay; moderately developed medium nut structure; very firm; sticky; slightly plastic; diffuse irregular boundary,
Bw2	60-80 cm (20 cm)	Moist; red (2.5YR 5/8) reddish yellow (7.5YR 7/8) and yellow (10YR 8/8) clay; moderately developed coarse nut structure; very firm; very sticky; slightly plastic; distinct smooth boundary,
C	80-140 cm (60 cm)	Moist; yellowish brown (10YR 5/6) and pale olive (5Y 6/4) *in situ* coarse angular rubble; black (10YR 2/1) manganese coatings.

Tailevu

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Talacagi series**

REFERENCE: Talacagi sandy clay(53c) defined by Twyford & Wright (1965) as very strongly mottled and gleyed soils formed on low terraces of quartz rich alluvium. They are gley soils related to red yellow podzolic soils formed under a climate with a strong to moderate dry season.

This concept for Talacagi series has been retained for this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Aeric Tropaquept, coarse loamy over clayey, siliceous, isohyperthermic
(b) FAO: Dystric Gleysol
(c) Twyford and Wright: Gley soil related to red yellow podzolic soils with strong to moderate dry season

INCLUDED MAPPING UNITS AND SYMBOLS:
Talacagi soils (66)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Occur on a few river flats in the Nadi-Momi area and in restricted areas of Vanua Levu.
PARENT ROCK:	Predominantly rocks of acid composition.
PARENT MATERIAL:	Deep weathered alluvium.
PHYSIOGRAPHIC POSITION/LANDFORM:	Planar surfaces on low terraces.
SLOPE CLASS AND RANGE OF SLOPES:	Near level to flat (0-2°).
VEGETATION AND LAND USE:	Mainly used for rainfed rice and sugar cane.
RANGE OF ELEVATION:	2-20 m
RAINFALL:	Annual average range: 1,800-2,400 mm; dry season range: 400-500 mm; wet season range: 1,400-1,800 mm.
TEMPERATURE:	Mean annual: 25.5°C.
SOIL MOISTURE REGIME:	Aquic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Poorly drained
PERMEABILITY CLASS:	Slow
FLOODING:	Floods depositing sediment have a 1 in 25 year return period. Other floods have a 1 in 5 year return period.
EROSION:	No erosion risk. Accumulating site.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 18 cm of dark yellowish brown sandy loam, of weakly developed blocky structure with single grain, common quartz grits and pebbles, very friable, overlying 18 cm of dark brown to brown mottled yellowish red and strong brown sandy loam, of weak developed fine and medium blocky structure, common quartz grits and pebbles, friable to firm, overlying more than 60 cm of pale yellow mottled red, white and reddish yellow clay loam, of moderately developed fine and medium blocky structure, common iron/manganese concretions and quartz grits, and firm.
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Not applicable. Only 3 profile descriptions made.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Strongly acid; low % base saturation; low CEC; low exchangeable calcium and magnesium; very low exchangeable potassium; and very low phosphorus.
LABORATORY Nos:	Not sampled for analysis.
SOIL LIMITATIONS:	Frequent flooding; soil moisture deficits in the dry season; low pH and nutrient deficiencies (potassium and phosphorus).

Typifying Profile

SOIL NAME:	Talacagi soils
PROFILE No.:	SC6
SITE LOCATION:	Legalega area east of Nadi Airport.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Planar surface on low terrace.
PARENT MATERIAL:	Deep alluvium derived from rocks of acidic compositions i.e. rocks with a high quartz content.
SLOPE:	1°
ASPECT:	Not applicable
ELEVATION:	10 m
MICRORELIEF:	Smooth
SITE VEGETATION:	Rice
LAND USE:	Rainfed rice cultivation.
DRAINAGE:	Poorly drained
EROSION:	None observed
DISTURBANCE:	Cultivated
LABORATORY Nos:	Not sampled for analysis.

PROFILE DESCRIPTION

Talacagi soils

Ap1	0-18 cm (18cm)	Dry; moist dark yellowish brown (10YR 3/4) sandy loam; weakly developed medium blocky structure with much single grain; very friable; some (1-2 mm) quartz grains; few small rounded pebbles; abundant fine and medium fibrous roots; indistinct smooth boundary,
Ap2	18-36 cm (18 cm)	Moist; dark brown to brown (10YR 4/3) sandy loam; profuse varicoloured medium and coarse yellowish red (5YR 5/6) and strong brown (7.5YR 5/8) mottles; few iron/manganese concretions; weakly developed fine and medium blocky structure; friable to firm; few quartz grains and rounded pebbles; few fine fibrous roots; indistinct smooth boundary,
Bw	36-102cm+ (66 cm+)	Moist; pale yellow (5YR 8/3) clay loam; profuse varicoloued medium and coarse red (2.5YR 4/8), reddish yellow (5YR 6/8), and white (5YR 8/2) mottles; a few iron/manganese concretions in the upper 20 cm; moderately developed fine and medium blocky structure; firm; few quartz grits.

Talacagi

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Tamanua series**

REFERENCE: New soil series introduced in this survey to include strongly mottled poorer drained soils within the Rewa soil set, previously described by Twyford and Wright (1965) as Rewa clay mottled phase (4d) and Rewa brown clay mottled phase (4f). Purnell (1972) also recognised the Rewa mottled clay loam, Rewa brown mottled clay loam and Rewa brown mottled clay loam over sand. All these are now included as part of the Tamanua series. Tamanua series were established by Huntings (1969) in the Navua soil survey.

The name derives from the Tamanua locality immediately across the Navua River from Navua township.

CLASSIFICATION:

(a) Soil Taxonomy: Fluvaquentic Eutropept, fine, kaolinitic, isohyperthermic
(b) FAO: Eutric Fluvisol
(c) Twyford and Wright: Recent soil from alluvium with a very weak to no dry season

INCLUDED MAPPING UNITS AND SYMBOLS:
Tamanua soils (24)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Tamanua series occurs on the contemporary or relict levee's of the Rewa and Navua Rivers systems in ESE and SSE Viti Levu.
PARENT ROCK:	Predominantly rocks of basic and intermediate composition.
PARENT MATERIAL:	Weakly weathered riverine alluvium.
PHYSIOGRAPHIC POSITION/LANDFORM:	Develop on old levees of former courses of the Rewa River and in the Narua River system it normally occupies a lower position on the levee sequence than soils of the Rewa series.
SLOPE CLASS AND RANGE OF SLOPES:	Near level or very gently undulating (0-3°).
VEGETATION AND LAND USE:	Irrigated and/or rainfed rice. Pasture for dairying in which para grass with miscellaneous weeds and sedges, particularly Navua sedge. In a few areas intensive market gardening is practised.
RANGE OF ELEVATION:	2-10 m
RAINFALL:	Annual average range: 3,200-4,800 mm; dry season range: 800-1,600 mm; wet season range: 1,800-2,800 mm.
TEMPERATURE:	Mean annual: 24°C.
SOIL MOISTURE REGIME:	Perudic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Imperfectly drained
PERMEABILITY CLASS:	Moderate. Very low infiltration rates.
FLOODING:	One in 10 year return period for floods depositing alluvium. One in 2 year return period for smaller (water flooding only) flood events.

EROSION: No erosion risk.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES: Typically show deep firm imperfectly drained profiles with predominantly silty clay loam textures; topsoils are thick (>25 cm) dark brown and commonly having a few fine manganese nodules; subsoils are yellowish brown with coarse grey mottling (5Y hue), common soft manganese mottles and nodules, and structures are well developed coarse blocky.

The manganese concentrations throughout all profiles is considered to reflect considerable water table fluctuations.

DIAGNOSTIC HORIZONS: Ochric epipedon, cambic horizon.

RANGE OF PROFILE FEATURES: Not applicable. Only 2 profile descriptions made.

VARIANTS: Three variants recognised by Purnell (1972) as follows: Tamanua brown mottled clay loam; Tamanua brown loam; and Tamanua brown mottled clay loam over sand.

SIMILAR SOILS AND DISTINGUISHING FEATURES: Rewa series: well drained, less intense mottling and absence of manganese mottles and nodules. Soil structures are weaker in development and profile consistency is friable.

Navua series: poorly drained, gleyed topsoil, finer textures (higher clay fraction), absence of manganese mottles and more strongly gleyed due to higher water table.

GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES: Tamanua series are generally moderately acid, with high % base saturation (though they tend to be lower than for Rewa series). Organic carbon values are very low and decrease irregularly down subsoils. Calcium and magnesium values are medium with potassium very low.

The particle size family class is fine.

The mineralogy is kaolinitic.

LABORATORY Nos: D026-28 (inclusive)

SOIL LIMITATIONS: Imperfect drainage; susceptibility to flooding; wet season subsoil waterlogging to within 65 cm of the ground surface; moderately acid pH; and nutrient deficiencies of nitrogen, potassium and phosphorus.

Typifying Profile

SOIL NAME:	Tamanua soils
PROFILE No.:	D008
SITE LOCATION:	100 m north of Queens Highway on Consolidated Agriculture Ltd property 1 km west of Navua township.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Lower slope of levee of the Navua River.
PARENT MATERIAL:	Mixed alluvium derived from quartz-poor rocks.
SLOPE:	Flat
ASPECT:	Not applicable
ELEVATION:	8 m
MICRORELIEF:	Uniformly planar and level.
SITE VEGETATION:	Grassland: Para grass and Navua sedge.
LAND USE:	Improved pasture for dairying.
DRAINAGE:	Imperfectly drained
EROSION:	Nil. Subject to periodic flooding and accretions of 'fresh' alluvium.
DISTURBANCE:	Previously ploughed
LABORATORY Nos:	DO26-28 (inclusive)
COMMENTS:	Water table at 92 cm.

PROFILE DESCRIPTION

Ah	0-38 cm (38 cm)	Moist; dark greyish brown to dark brown (10YR 4/2-4/3) ped face and rubbed very fine sandy clay loam; firm; moderately developed medium nut structure breaking to moderately developed granular structure in top 12 cm; few manganese nodules; few fine roots with many in the top 12 cm; distinct smooth boundary,
Bw	38-61 cm (23 cm)	Moist; dark yellowish brown (10YR 4/4) ped face and rubbed silty clay loam; firm to very firm; moderately developed coarse blocky structure; few faint coarse grey (5Y 5/1) mottles; many manganese mottles and soft nodules; few fine roots; diffuse smooth boundary,
Bg	61-97 cm (36 cm)	Very moist; yellowish brown (10YR 5/6), ped face silty clay; firm; moderately developed coarse blocky structure; many coarse distinct grey (5Y 5/1) mottles; many manganese mottles and soft nodules; few fine roots.

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Tau series**

REFERENCE: Tau steepland bouldery and stony clay loam (66) defined by Twyford and Wright (1965) as shallow steepland soils developed on hard limestone and supporting heavy broadleaf forest under a climate with a strong to moderate dry season.

The central concept for Tau soils is retained for this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Lithic Haplustoll, fine, smectitic, isohyperthermic
(b) FAO: Haplic Kastanozem
(c) Twyford and Wright: Steepland soil related to and associated with nigrescent soils with a strong to moderate dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Tau soils, easy rolling phase (76C)
Tau soils, rolling phase (76D)
Tau soils, strongly rolling phase (76E)
Tau soils, moderately steep phase (76F)
Tau soils, steep phase (76G)
Tau soils, very steep phase (76H)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION: Tau soils develop on steepland in the Tau district of Nadroga and in the Sigatoka valley at Qalimare.

PARENT ROCK: Indurated marble-like Viti limestone

PARENT MATERIAL: *In-situ* limestone rock

PHYSIOGRAPHIC POSITION/LANDFORM: Predominantly convex backslopes in mesa like limestone massifs or strongly dissected hill country.

SLOPE CLASS AND RANGE OF SLOPES: From easy rolling through all slope classes to very steep (8-40°).

VEGETATION AND LAND USE: Still supports broadleaf forest. Some areas have been cleared and are extensively grazed.

RANGE OF ELEVATION: 100-500 m

RAINFALL: Annual average range: 1,800-2,400 mm;
dry season range: 400-500 mm;
wet season range: 1,400-1,800 mm.

TEMPERATURE: Mean annual: 26°C.

SOIL MOISTURE REGIME: Ustic

SOIL TEMPERATURE REGIME: Isohyperthermic

SOIL DRAINAGE CLASS: Well drained

PERMEABILITY CLASS: Medium

FLOODING: Never floods

EROSION: Active erosion where forest has been removed. Severe sheet erosion potential.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 15 to 20 cm of very dark grey or black friable clay loam of strong fine and medium nut structure commonly with limestone fragments overlying 20 to 30 cm of brown to yellowish brown firm stony clay loam of moderate medium nut structure and with many limestone stones on hard limestone, the boundary being a lithic contact.
DIAGNOSTIC HORIZONS:	Mollic epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Not applicable. Only two profile descriptions made.
VARIANTS:	Unnamed colluvial variant of small extent that occurs no association with Tau series commonly on slopes <5°. Profile description and analyses appended. Classifies as Cumulic Haplustoll, fine, smectitic, isohyperthermic
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analysis shows this soil to be moderately alkaline, has high base status, high exchangeable calcium and magnesium, and under forest is well supplied with available potash. The particle size family class is fine. The mineralogy class is smectitic.
LABORATORY Nos:	KRS D 1896-97
SOIL LIMITATIONS:	Slope; profile stones and shallowness; rock outcrops; alkaline reaction that results in trace element deficiencies; and susceptibility to sheet erosion.

Typifying Profile

SOIL NAME:	Tau soils, strongly rolling phase.
PROFILE No.:	SC4
SITE LOCATION:	Slopes of Koroqele, 2.5km South East of Tubairata village in the Sigatoka valley.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Convex midslope in moderately steep country commonly with kaarst features.
PARENT MATERIAL:	Shallow *in situ* impure limestone.
SLOPE:	19°
ASPECT:	North-east
ELEVATION:	100 m
MICRORELIEF:	Smooth
SITE VEGETATION:	Miscellaneous grasses
LAND USE:	Rough grazing
DRAINAGE:	Well drained
EROSION:	None observed
DISTURBANCE	None
LABORATORY Nos:	KRS D 1896 - 97

PROFILE DESCRIPTION

A	0 - 18cm (18 cm)	Moist; very dark grey (10 YR 3/1) clay loam; strongly developed fine nut structure; abundant fine and medium fibrous roots; indistinct smooth boundary,
Bw	18 - 40 cm (22 cm)	Moist; brown (10 YR 5/3) to yellowish brown (10 YR 5/6) stony clay loam; firm; slightly sticky; slightly plastic; moderately developed medium blocky structure; abundant weathering chips and stones (limestone); (lithic contact),
R	on	Hard *in situ* limestone

Tau

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Taveuni series**

REFERENCE: Taveuni clay loam and clay (23e) and Taveuni hill soils (23eH) defined by Twyford & Wright (1965) as latosolic soils from olivine basalt flows somewhat older than the Vuna basalts under a climate with a weak dry season. Form part of the Waiqere set.

Twyford & Wright described three different profile forms for Taveuni soils each representing stages of profile development. The most developed variant is recognised by Qeleni series in this survey, the type Taveuni is taken to be the intermediary profile form with the less developed form as a variant of the latter.

CLASSIFICATION:

(a) Soil Taxonomy: Hydric Melanudand, hydrous, isohyperthermic
(b) FAO: Humic Andosol
(c) Twyford and Wright: Latosolic soil with a weak dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Taveuni soils, easy rolling phase (93C)
Taveuni soils, rolling phase (93D)
Taveuni soils, strongly rolling phase (93E)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Occur on the west coast of Taveuni Island north of Soqulu Estate and extensively at the very north end of the island.
PARENT ROCK:	Olivine basalt
PARENT MATERIAL:	Moderately weathered older lava flows with volcanic ash cover.
PHYSIOGRAPHIC POSITION/LANDFORM:	Occur in rolling and hilly land of the volcanic ring surfaces and ringplains to the central volcanic core.
SLOPE CLASS AND RANGE OF SLOPES:	Easy rolling (8-11°), rolling (12-15°), and strongly rolling (16-20°).
VEGETATION AND LAND USE:	Mainly under coconuts and to a small extent for subsistence crops or under grazing by cattle. New areas planted out in coffee or cocoa.
RANGE OF ELEVATION:	0-600 m
RAINFALL:	Annual average range: 3,000-6,000 mm; dry season range: 800-3,000 mm; wet season range: 2,000-3,200 mm.
TEMPERATURE:	Mean annual: 24°C.
SOIL MOISTURE REGIME:	Udic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Well drained
PERMEABILITY CLASS:	Moderately rapid
FLOODING:	Never floods
EROSION:	Some evidence of soil creep and sheet erosion. Moderate potential for sheet and rill erosion if soil bared and intensively cultivated.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically show a thin very friable black humic fine loamy topsoil overlying very friable dark brown fine loamy subsoils with abundant boulders and stones encountered between 30 and 90 cm from the surface but normally occurring below 70 cm. Buried topsoils are common in most profiles.
DIAGNOSTIC HORIZONS:	Umbric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Taveuni series have an Ah, Bw1, Bw2, bAh, bBw horizon sequence. The Ah horizon thickness ranges from 11 to 46 cm; colours include black (5YR 2/1), very dark grey (10YR 3/1) or dark reddish brown (5YR 3/2, 3/3, 3/4); textures may be humic loams or humic clay loams; and structures are either moderate or strong fine and very fine nut. The Bw horizons thickness ranges from 14 to 79 cm; its colours include dark brown (10YR 3/3, 4/3) or dark yellowish brown (10YR 3/4, 4/4); textures range between loams, sandy clay loams, clay loams or silty clay loams; and structures are moderate or weak medium or very fine nut. The lower Bw horizons may have few or abundant stones or boulders. The Bt horizons thickness ranges from 20 to 30 cm; textures are either clay loams or silty clay loams; and structures are moderate medium or fine nut. The bAh horizons thickness ranges from 14 to 47 cm; colours may be dark brown (10YR 3/3, 4/3) or dark yellowish brown (10YR 3/4, 4/4); textures include fine sandy clay loams, clay loams, or silty clay loams; structures are moderate medium or very fine nut; and there may be common or abundant subrounded stones.
VARIANTS:	Waica series (Hydric Fulvudand, hydrous over clayey-skeletal, isohyperthermic) defined in the detailed soil survey of the Tutu Estate (Shepherd & Neall, 1991). Have greater than 35% by volume of stones and boulders throughout the profile. They also have a greater percentage (10-15%) of boulders and large stones on the surface.
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Moderately acid soils; available phosphorus medium but phosphorus retention very high; organic carbon and nitrogen values high in the topsoil but decreasing progressively to very low values with depth; % base saturation medium in the topsoil and low in the other horizons; CEC very high in the topsoil and medium below it; TEB high in the topsoil and very low in the other horizons with the main cations following a similar trend.
LABORATORY Nos:	Not sampled for analysis.
SOIL LIMITATIONS:	Slope; susceptibility to erosion on steeper slopes; abundant boulders in the lower subsoil; low nutrient status and very high phosphate fixation properties; soil acidity; and very high 15 bar water content that may result in loss of a certain degree of structural coherence due to vibrations (earthquakes, vehicles etc.) with the instability greatest in the upper 75 cm due to absence of a large number of boulders.

Typifying Profile

SOIL NAME:	Taveuni soils, rolling.
PROFILE No.:	T31
SITE LOCATION:	North-eastern sector of Tutu Estate, Taveuni Island. 2.45 km NE of the Tutu Chapel.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Convex midslope in rolling volcanic terrain.
PARENT MATERIAL:	Weakly weathered volcanic ash over moderately weathered old basalt lava flow rocks.
SLOPE:	10°
ASPECT:	West
ELEVATION:	545 m
MICRORELIEF:	Hummocky
SITE VEGETATION:	Indigenous forest comprising damanu, yasiyasi, mali, vesi and yaro.
LAND USE:	Unused (natural state).
DRAINAGE:	Well drained
EROSION:	Slight soil creep.
DISTURBANCE:	None
LABORATORY Nos:	Not sampled for analysis.
COMMENTS:	NaF reaction: very strong for all five horizons described.

PROFILE DESCRIPTION

Ah	0-11 cm (11 cm)	Slightly moist; black (5YR 2/1) humic loam; very friable; slightly sticky; slightly plastic; medium nut plus weakly developed fine nut; abundant very fine roots; few weakly weathered subrounded basalt stones; distinct wavy boundary,
Bw1	11-31 cm (20 cm)	Moist; very dark greyish brown (10YR 3/2) clay loam; very friable; sticky; plastic; very fine nut plus weakly developed medium nut structure; many fine roots; common weakly weathered subrounded basalt stones; distinct wavy boundary,
Bw2	31-54 cm (23 cm)	Moist; dark brown (10YR 3/3) loam; friable; slightly sticky; slightly plastic; moderately developed coarse blocky breaking to moderately developed fine nut structure; common fine roots; common weakly weathered subrounded basalt stones; distinct irregular boundary,
bAh	54-75 cm (21 cm)	Moist; very dark greyish brown (10YR 3/2) silty clay loam; friable; sticky; very plastic; moderately developed medium nut plus weakly developed very fine nut structure; common faint clay very dark grey (10YR 3/1) cutans; common fine roots; many weakly weathered subangular basalt stones; distinct irregular boundary,

bBw	75-114 cm (39 cm)	Moist; dark yellowish brown (10YR 4/6) gravelly loam; friable; non-sticky; slightly plastic; single grain; distinct very dark greyish brown (10YR 3/2) organic cutans; few fine roots; profuse moderately weathered subangular basalt boulders.

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Tavua series**

REFERENCE: The Tavua bouldery clay (20a) and Tavua hill soils (20aH) defined by Twyford & Wright (1965) as soils developed from basalt flow rocks under a climate with a strong dry season. Form part of the Tavua set.

The central concept for Tavua soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Typic Haplustalf, fine, smectitic, isohyperthermic
(b) FAO: Eutric Nitosol
(c) Twyford and Wright: Nigrescent soil with a strong dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Tavua soils, easy rolling phase (197C)
Tavua soils, rolling phase (197D)
Tavua soils, strongly rolling phase (197E)
Tavua soils, moderately steep phase (197F)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Coastal, rolling and hilly land in Ra, Ba and Nadroga Provinces of Viti Levu.
PARENT ROCK:	Basalt
PARENT MATERIAL:	Very deep strongly brown weathered *in situ* rock.
PHYSIOGRAPHIC POSITION / LANDFORM:	All slope positions; predominantly convex surfaces on moderately dissected hill country.
SLOPE CLASS AND RANGE OF SLOPES:	Easy rolling (8-11°), rolling (12-15°), strongly rolling (16-20°) and moderately steep (21-25°).
VEGETATION AND LAND USE:	Where grazed and in improved pasture; nadi blue grass, mission grass and desmodium. Exotic forestry with sugar cane on the more gentle slopes elsewhere.
RANGE OF ELEVATION:	50-300 m
RAINFALL:	Annual average range: 1,800-2,400 mm; dry season range: 400-500 mm; wet season range: 1,400-1,800 mm.
TEMPERATURE:	Mean annual: 26°C.
SOIL MOISTURE REGIME:	Ustic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Well drained
PERMEABILITY CLASS:	Moderately rapid
FLOODING:	Never floods
EROSION:	Subject to sheet erosion following successive cultivation as a result of structural breakdown, and impact of rain when in fallow, or early stages of sugar cane cropping. Have a moderate to severe sheet and rill erosion potential on slopes >11°.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Very deep soils with C horizon encountered at 90-120 cm. Strongly weathered gravels in all profiles. Dark brown (7.5YR 3/2) topsoil with friable clay loam or silty clay loam texture and of moderate fine and medium nut structure. Subsoils are dark brown friable clay loam or silty clay loam of moderate to strong medium blocky structure and commonly with clay coatings, overlying strongly weathered *in situ* basalt which is normally encountered by 100 cm.
DIAGNOSTIC HORIZONS:	Ochric epipedon, argillic horizon.
RANGE OF PROFILE FEATURES:	Tavua series have an Ah, Bt1, Bt2 horizon sequence. The Ah horizon thickness ranges from 13 to 27 cm; its colours include dark reddish brown (5YR 2/2) dark brown (7.5YR 3/2) or black (10YR 2/1); textures are silty clay loam or clay loam; structures are moderate or strong, fine or medium, nut or blocky; and they may be friable or very friable. The Bt1 horizon thickness ranges from 30 to 70 cm; its colours include dark brown (7.5YR 3/2, 3/4 or 4/3); textures vary between silty clay loam, clay loam and clay; structures are either moderate or strong blocky; consistence is either friable or firm; and dark brown clay cutans may be few, common, or many. The Bt2 horizon thickness exceeds 30 cm; its colours include dark brown (7.5YR 3/3, 4/3, 10YR 3/3, 4/3); textures vary silty clay loam, clay loam, clay and rarely sandy clay loam; structures are massive breaking to either weak or moderate blocky; clay cutans are few, common or many; and boulders may or may not be present.
VARIANTS:	None recognised in this survey.
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Slightly acid soils with high base status. Values for calcium, magnesium and sodium are very high in all horizons; organic carbon is low in topsoils and very low in subsoils; potassium high for topsoils and medium in subsoils. The particle size family class is fine. The mineralogy class is smectitic.
LABORATORY Nos:	KRS R2597-2601 (inclusive) SB9683A-E
SOIL LIMITATIONS:	Surface boulders; clayey nature of the soils inhibit attainment of a fine tilth where cultivated; severe soil moisture deficits experienced during the dry season; and nutrient deficiency of nitrogen and probably potassium under sustained cropping.

Typifying Profile

SOIL NAME:	Tavua soils, rolling phase
PROFILE No.:	N24
SITE LOCATION:	Refer soil map of Nawaicoba Agricultural Research Station (Leslie, 1984).

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Concave toeslope on hill side in weakly dissected hill country.
PARENT MATERIAL:	Colluvium from basaltic flow rocks over *in situ* rock of the same origin.
SLOPE:	14°
ASPECT:	North north-west
ELEVATION:	200 m
MICRORELIEF:	Flat
SITE VEGETATION:	Nadi blue grass, wire grass and mission grass.
LAND USE:	Grazing for beef cattle.
DRAINAGE:	Well drained
EROSION:	Negligible sheet erosion.
DISTURBANCE:	None observed
LABORATORY Nos:	KRS R2597-2601 (inclusive) SB9683A-E

PROFILE DESCRIPTION

Ah	0-18 cm (18 cm)	Dry; rubbed, ped face and moist, black (10YR 2/1) clay loam; moderately developed coarse blocky structure breaking to strongly developed very fine nut structure; friable; sticky; plastic; common very fine roots; few moderately to strongly weathered subangular gravels; indistinct smooth boundary,
Bw	18-38 cm (20 cm)	Dry; rubbed, ped face and moist, dark brown (7.5YR 3/2) clay loam; strongly developed fine blocky structure, breaking to strongly developed very fine nut structure; friable; sticky; plastic; common very fine roots; few strongly weathered subangular gravels; indistinct smooth boundary,
Bt1	38-70 cm (32 cm)	Dry; rubbed, ped face and moist, dark brown (7.5YR 3/2) clay; moderately developed fine and medium blocky structure; friable; sticky; plastic; common distinct dark reddish brown (5YR 3/4) clay coatings; common very fine roots; few strongly weathered subangular gravels; indistinct smooth boundary,
Bt2	70-100 cm (30 cm)	Dry; rubbed, ped face and moist, reddish brown (5YR 4/3) clay; strongly developed fine and medium blocky structure; firm; very sticky; very plastic; prominent distinct dark reddish brown (5YR 3/4) clay coatings; few very fine roots; many moderate to strongly weathered subangular mauve and red gravels and stones,
C	on	Green moderately weathered *in situ* basalt rock.

Tavua

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Tavuyaga series**

REFERENCE: Tavuyaga steepland silt loam (78a) defined by Twyford and Wright (1965) as a latosolic soil from young basaltic ash on volcanic cones under a climate with no dry season.

Forms part of the Tavuyaga set.

The central concept for Tavuyaga soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Thaptic Fulvudand, ashy, isohyperthermic
(b) FAO: Mollic Andosol
(c) Twyford and Wright: Latosolic soils with no dry season

INCLUDING MAPPING UNITS AND PHASES:

Tavuyaga soils, steep phase (107G)
Tavuyaga soils, very steep phase (107H)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Restricted to the scoriae cones (that form the axis of Taveuni Island) of the lowlands at the southern end of the island.
PARENT ROCK:	Basalt
PARENT MATERIAL:	Weakly weathered basaltic ash and lapilli.
PHYSIOGRAPHIC POSITION/LANDFORM:	Slopes of volcanic cones. Mainly planar slopes.
SLOPE CLASS AND RANGE OF SLOPES:	Step (26-35°), and very steep (>35°).
VEGETATION AND LAND USE:	Scattered forest and subsistence crops (yams, kumala, cassava, yagona and bananas).
RANGE OF ELEVATION:	10-600 m
RAINFALL:	Annual average range: 3,000-5,500 mm; dry season range: 800-3,000 mm; wet season range: 2,000-3,200 mm.
TEMPERATURE:	Mean annual: 24°C.
SOIL MOISTURE REGIME:	Perudic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Somewhat excessively drained.
PERMEABILITY CLASS:	Moderately rapid
FLOODING:	Never floods
EROSION:	Moderate to severe sheet, rill and debris slide erosion potential.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 15 cm of very dark greyish brown friable sandy clay loam of moderate nut structure overlying 50 cm of dark brown friable sandy loam of weak medium nut structure, with common lapilli gravels and slightly sticky and slightly plastic when moist, overlying 70 cm or more of brown gravelly sandy loam of weak medium blocky structure.
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Tavuyaga series have an Ah, Bw, BC horizon sequence. The Ah horizon thickness ranges from 10 to 25 cm; its colours include very dark greyish brown (10YR 3/2) and dark brown (7.5YR 3/2, 10YR 3/3); textures may be silt loam, silty clay loam or sandy clay loam; and structures are moderate or strong fine or medium nut or blocky. The Bw horizon thickness ranges from 25 to 60 cm; its colours include dark brown (7.5YR 3/2, 10YR 3/3); textures are gritty silty clay loam or sandy loam; and structures may be weak coarse or medium blocky or nut. The BC horizon exceeds 60 cm in thickness; its colours include brown (7.5YR 4/2, 5/2), dark brown (7.5YR 3/2) and reddish brown (5YR 4/3, 4/4 and 5/3); textures may be gravelly sandy loam, gravelly clay or gritty silty clay; and structures tend to massive breaking to weak blocky or nut.
VARIANTS:.	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analysis shows soil to be slightly acid in the topsoil (0-16 cm) and near neutral in the other horizons; organic carbon is medium in the topsoil and low 16-70 cm; nitrogen is high in the topsoil and low 16-70 cm, and the C/N ratio is low; % base saturation is medium throughout; CEC high to very high; calcium is very high in the topsoil and high in the other horizons; magnesium is high throughout; and potassium is medium in the topsoil and of very low values below it.
LABORATORY Nos:	ORSTOM TAV9A-C
SOIL LIMITATIONS:	Slope; susceptibility to erosion; moderately raped permeability; nutrient deficiencies of nitrogen, potassium and probably phosphorus; and very high phosphate retention properties.

Typifying Profile

SOIL NAME:	Tavuyaga soils, steep phase.
PROFILE No.:	TAV9
SITE LOCATION:	ORSTROM TAV9A-C

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	1 km north-east of Tavuyaga trig and adjacent to coastal road (south side) between Kanacea and Navakawau villages.
PARENT MATERIAL:	Planar midslope of ash cone.
SLOPE:	29°
ASPECT:	West
ELEVATION:	170 m
MICRORELIEF:	Uneven
SITE VEGETATION:	Dalo
LAND USE:	Subsistence cropping
DRAINAGE:	Somewhat excessively drained.
EROSION:	Moderate sheet erosion.
DISTURBANCE:	Cultivated
LABORATORY Nos:	ORSTROM TAV9A-C

PROFILE DESCRIPTION

Ah	0-16 cm (16 cm)	Moist; very dark greyish brown (10YR 3/2) sandy clay loam; friable; moderately developed fine and medium nut structure; very porous; dense root mat for up to 2 cm then abundant fine and medium fibrous roots below; distinct smooth boundary,
Bw	16-70 cm (54 cm)	Moist; dark brown (10YR 3/3) sandy loam; weakly developed medium nut structure; friable; slightly sticky; slightly plastic; few weathered and unweathered basalt gravels associated with occasional layers of lapilli; porous aggregates; common medium and fine fibrous roots; distinct wavy boundary,
BC	70-140 cm (70 cm)	Dry; brown (7.5YR 4/2) sandy loam; weakly developed medium blocky structure; abundant rust coloured basalt gravels and small fragments; few very fine roots.

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Tiri series**

REFERENCE: New soil series introduced in this survey to describe recently drained saline soils of the marine marsh (i.e. Dogo series in natural state occurring in any of the lowland climatic zones of Fiji. The central concept for Tiri series is the presence of a sulfuric horizon, typified by prominent recently formed jarosite mottles and low (<3.5) pH, whose upper boundary is within 50 cm of the surface.

Previously included with Dogo soils (56) as defined in Twyford and Wright (1965). The name Tiri comes from the Fijian word for *Rhizophora micronata* and *R. mangle*.

CLASSIFICATION:

(a) Soil Taxonomy: Typic Sulfaquept, clayey over fine loamy, mixed, isohyperthermic
(b) FAO: Thionic Fluvisol
(c) Twyford and Wright: Saline soil of the marine marsh

INCLUDED MAPPING UNITS AND SYMBOLS:
Tiri soils (2)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION: Tiri soils develop in the marine marsh where Dogo and Soso series have been drained.

PARENT ROCK: Various rock types.

PARENT MATERIAL: Diverse alluvia deposited partly by a slowing in river current but mainly to the flocculation of silt and clay in the lagoons resulting in the gradual raising of the sea bed to a certain height, where the different mangrove species were able to colonise it.

PHYSIOGRAPHIC POSITION/LANDFORM: Behind seawalls in recently drained sites (and protected from marine tides) on the delta and river margins.

SLOPE CLASS AND RANGE OF SLOPES: Flat to near level (0-1°).

VEGETATION AND LAND USE: Normally in fallow or miscellaneous weeds and grasses following clearance of Mangrove species or in preparation for initial irrigated rice crop.

RANGE OF ELEVATION: 0-1.5 m

RAINFALL: Annual average range: 1,800-500 mm;
dry season range: 400-1,600 mm;
wet season range: 1,400-2,800 mm.

TEMPERATURE: Mean annual: 24-26°C.

SOIL MOISTURE REGIME: Aquic

SOIL TEMPERATURE REGIME: Isohyperthermic

SOIL DRAINAGE CLASS: Very poorly drained.

PERMEABILITY CLASS: Slow

FLOODING: Although artificially drained the water table, which rises to 60 cm depth, fluctuates with the tides. Floods on 5 to 6 occasions during the wet season, or coincident with high spring tides with water lying for up to 3 days at each event.

EROSION: No erosion risk.

Morphological And Chemical Properties

CHARACTERISTIC PROFILE FEATURES: Typically shows 30 cm of yellowish brown profusely mottled (jarosite) yellow humic loamy clay, of weakly developed granular and crumb structure, very friable and sticky when moist, overlying 35 cm of very dark greyish brown profusely mottled (jarosite) yellow peaty silt loam, of massive structure, soft and sticky with abundant dead mangrove roots, overlying 40 cm of dark brown peaty silt, of massive structure, soft and sticky, with many dead mangrove roots, overlying more than 30 cm of very dark greyish brown silt loam, soft and sticky, many dead mangrove roots, many shell fragments, and commonly containing small gypsum crystals.

DIAGNOSTIC HORIZONS: Ochric epipedon, cambic horizon (sulfuric).

RANGE OF PROFILE FEATURES: Tiri series have a Ap, Bg, Cr1, Cr2 horizon sequence.

The Ap horizon thickness ranges 25-40 cm; colours vary dark brown (10YR 3/2), brown (10YR 4/3, 5/3) and yellowish brown (10YR 5/4); textures are always humic and range from clay loams, to silt loams, to fine sandy loams, to loamy clays; and structures are either weak medium nutty or granular with crumb.

The Bg horizon thickness ranges 30-40 cm; colours vary very dark grey (10YR 3/1, 2.5Y 3/0), very dark greyish brown (10YR 3/2), dark grey (10YR 4/1) or dark greyish brown (10YR 4/2); textures range between peaty silt loams and peaty fine sandy loams.

The Cr horizons exceed 75 cm in thickness; colours are dark brown (10YR 3/3) and brown (10YR 4/3, 5/3) and textures are either peaty silt loams, silt loams, or silty clay loams; shell fragments and gypsum may or not be present.

VARIANTS: Tiri soil, peaty subsoil variant (DK3). Profile description is appended.

SIMILAR SOILS AND DISTINGUISHING FEATURES: None recognised

GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES: pH determinations on fresh moist samples were strongly acid for the A horizon, extremely acid (<3.5) 32-108 cm and near neutral below this; carbon values range from low to high and show an irregular decrease with depth; C/N ratios are very high; CEC, % base saturation and values for bases are high or very high in the A horizon (0-32 cm) but drop very sharply into the Bg horizon raising equally sharply to very high values below the Bg (i.e. >66 cm depth); sodium for example gives 17 and 35 me.% for the Cr1 and Cr2 horizon respectively indicating the influence of saline tidal waters in the subsoil.

LABORATORY Nos: KRS T2708-2711. USP DK26A-E

SOIL LIMITATIONS: Extreme soil acidity; marine saline influences on the water table that have a marked affect on soil chemistry; the high amounts of iron oxidation (as represented by the jarosite mottles); significantly high levels of aluminium in the subsoils; and poor internal drainage.

Typifying Profile

SOIL NAME:	Tiri soils
PROFILE No.:	DK26
SITE LOCATION:	Drekiti rice irrigation scheme.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Planar surface on estuarine delta.
PARENT MATERIAL:	Estuarine alluvia from rocks of diverse lithology.
SLOPE:	Flat
ASPECT:	Not applicable
ELEVATION:	75 cm
MICRORELIEF:	Smooth
SITE VEGETATION:	In fallow
LAND USE:	Being prepared for initial crop of irrigated rice.
DRAINAGE:	Very poorly drained.
EROSION:	No erosion
DISTURBANCE:	Recently cleared of mangrove species and drained.
LABORATORY Nos:	KRS T2708-2711. USP DK26A-E

PROFILE DESCRIPTION

Ap	0-32 cm (32 cm)	Moist; yellowish brown (10YR 5/4) humic loamy clay; profuse medium and coarse prominent yellow (2.5Y 8/6) jarosite mottles; weakly developed medium to coarse granular structure breaking to weakly developed fine and medium crumb structure; very friable; sticky; non-plastic; common fine to coarse live roots (fern and 'tiri'); distinct wavy boundary,
Bg	32-66 cm (34 cm)	Moist; very dark greyish brown (10YR 3/2) peaty silt loam; common medium distinct yellow (2.5Y 8/6)jarosite mottles (only to 45 cm); massive; soft; sticky; non-plastic; abundant very fine to medium dead woody roots ('tiri'); indistinct smooth boundary,
Cr1	66-108 cm (42 cm)	Moist; dark brown (10YR 3/3) peaty silt loam massive; soft; sticky; non-plastic; many very fine to medium dead woody roots ('tiri'); distinct smooth boundary,
Cr2	108-135 cm+ (27 cm+)	Very moist; very dark greyish brown (2.5Y 3/2) silt loam; soft; sticky; non-plastic; common to many very fine and fine roots ('tiri'); many shell fragments (few whole shells); many crab fragments ('kuka'); small gypsum crystals.

PROFILE DESCRIPTION

Tiri soils, peaty subsoil variant

PROFILE NO.: DK3

LABORATORY NOS: KRS S2119-2122

Ag	0-14 cm (14 cm)	slightly moist; dark reddish brown (5YR 3/3) clay loam; many coarse prominent yellow (2.5Y 8/6) mottles; massive breaking to single grain; firm; slightly sticky; non-plastic; sharp smooth boundary,
Of	14-41 cm (27 cm)	moist; dark reddish brown (5YR 2/2) fibrous peat; profuse coarse prominent pale yellow (5Y 7/4) mottles; massive; friable; sticky; non-plastic; distinct wavy boundary,
Cgj	41-63 cm (22 cm)	very moist; very dark grey (5Y 3/1) silty clay; very coarse, prominent pale yellow (5Y 7/4) mottles; massive breaking to single grain; friable; distinct wavy boundary,
C	63-90 cm+ (27 cm+)	wet; very dark greyish brown (2.5Y 3/2) silty clay; massive breaking to single grain; friable; sticky; non-plastic.

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Toguru series**

REFERENCE: New soil series introduced to include poorly drained non-saline soils derived from estuarine alluvium, which are no longer subject to flooding with saline waters. The series was previously included with Deuba sandy loam (52b) as defined by Twyford & Wright (1965). Toguru series were first established by Huntings (1969) in the Navua soil survey and subsequently by Purnell (1972) in the Rewa delta survey. Toguru heavy sandy loam is taken as the type for the series.

The central concept for Toguru series is medium textures with, occasionally, coarse textured subsoils. They contain a high percentage of coarse sand and have high quartz content.

Subsoils contain significant amounts of rather woody organic matter (mangrove) that has darkened soil colours.

Name derived from Toguru River which crosses the Queens Road 2 km east of Navua.

CLASSIFICATION:

(a) Soil Taxonomy: Typic Tropaquept, sandy, mixed, isohyperthermic
(b) FAO: Dystric Gleysol
(c) Twyford and Wright: Gley soil related to red yellow podzolic soils with a weak or no dry season

INCLUDED MAPPING UNITS AND SYMBOLS:
Toguru soils (19)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Toguru series are widely represented in areas that previously supported mangrove i.e. estuarine belt of the Rewa and Navua River systems in ESE and SSE Viti Levu.
PARENT ROCK:	Acid rocks
PARENT MATERIAL:	Estuarine alluvium with a high quartz content. In some areas the alluvium overlies, at depths >1.5 m, an old coral reef.
PHYSIOGRAPHIC POSITION/LANDFORM:	Widely represented on a belt of low lying land on the inland margins of the present saline areas and also in narrow areas on the inland margins of the coastal sands.
SLOPE CLASS AND RANGE OF SLOPES:	Level
VEGETATION AND LAND USE:	Dairying and rice cultivation.
RANGE OF ELEVATION:	0.5-2 m
RAINFALL:	Annual average range: 3,200-4,800 mm; dry season range: 800-1,600 mm; wet season range: 1,800-2,800 mm.
TEMPERATURE:	Mean annual: 24°C.
SOIL MOISTURE REGIME:	Aquic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Poorly and very poorly drained.

PERMEABILITY CLASS:	Rapid. Both permeability and infiltration levels are high. Note: The very poor natural drainage is mainly a result of the low lying situation
FLOODING:	Frequently flooded
EROSION:	Nil, other than disturbance by crabs, rodents etc.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Profiles are uniformly dark grey with heavy sandy loam textures. Profiles are not mottled except when drained where some red mottling develops in the top few centimetres of the topsoil. Topsoils are friable with well developed nut structure. Weaker structures are a feature of subsoils where subsoil textures are coarse or where the content of raw organic matter is sufficient to mask any structure. Cohesion in many of the subsoils is low and here ripening of the subsoil appears incomplete. The water table is normally encountered between 70 and 100 cm.
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
TYPIFYING PROFILE:	D003 D010-D013 (inclusive)
RANGE OF PROFILE FEATURES:	Toguru soils have an Ap, Bw1, Bw2, Bw3 horizon sequence. The Ap horizon thickness ranges from 20-30 cm; its colours include very dark grey (2.5Y N3/0, 10YR 3/1) and very dark greyish brown (2.5Y 3/2, 10YR 3/2); textures include heavy sandy loam, silty sandy loam and sandy loam; and structure may be moderate or strong, medium blocky or nut. The Bw1 and Bw2 together range in thickness from 40-60 cm; their colours include dark grey (10YR 4/1, 2.5Y 4/1) and very dark grey (2.5Y N3/0, 10YR 3/1); texture range as for the Ap horizon; and structures are either weak or moderate coarse blocky or nutty. The Bw3 exceeds 20 cm in thickness; its colours include dark grey (2.5Y N4/0, 10YR 4/1) and very dark grey (2.5Y N3/0, 10YR 3/1); textures may be heavy loam, silty sandy loam, sandy loam or sandy clay loam; and coral shells and fragments may or may not be present.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	Soso series: High salinity levels Nakelo series: better drained. Dark brown surface horizons with dark yellowish-brown mottled grey merging to dark greyish subsoils. The surface horizons are sandy clay loam merging to sandy loam in the subsoils. Have high sulphide content below 90 cm.
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	The upper 50-80 cm is strongly acid, and acidity increases with depth, subsoil pH values of below 3 being general. The very acid subsoils contain large amounts of acetate soluble sulphate. They have low base status and the available nutrient content is low. Most have weakly saline subsoils with an E.C. <4 mm ho/cm at 1.5-2 m and <1 mm ho/cm in the top 50 cm. Extractable aluminium values are high in these soils especially at depth. The mineralogy is mixed. The fine earth fraction is dominated by sand in all horizons >70% in the subsoils.
LABORATORY Nos:	D010-D013 (inclusive)

SOIL LIMITATIONS: Susceptibility to flooding, permanent high seasonal water table; rapid permeability that can result in soil moisture deficits at some time during the dry season; acidity; aluminium toxicity in the subsoil; and nutrient deficiencies of nitrogen, phosphorus and potassium.

Typifying Profile

SOIL NAME: Toguru soils

PROFILE No.: D003

SITE LOCATION: Floodplain of Toguru river, 2 km east of Navua township.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM: Lower floodplain bordering tidal estuarine areas.

PARENT MATERIAL: Predominantly alluvium of estuarine derivation overlain by riverine alluvium.

SLOPE: Flat

ASPECT: Not applicable

ELEVATION: 2 m

MICRORELIEF: Slightly hummocky

SITE VEGETATION: In fallow following rice crop.

LAND USE: Former rice seedling bed.

DRAINAGE: Poorly drained

EROSION: None observed

DISTURBANCE: Previously ploughed

LABORATORY Nos: KRS D010-D013 (inclusive)

PROFILE DESCRIPTION

Ap	0-23 cm (23 cm)	Moist; very dark grey (10YR 3/1) heavy sandy loam; no mottles; moderate to strongly developed medium, nut structure; friable; few, fine roots; medium organic mottles; worm channels; distinct wavy boundary,
Bw	23-46 cm (23 cm)	Moist; dark grey (10YR 4/1) and grey (10YR 5/1) heavy sandy loam; weakly developed, coarse, blocky structure; very firm; few stones; medium organic matter; no roots; distinct wavy boundary,
bBw1	46-68 cm (22 cm)	Wet; dark grey (2.5Y 4/1) heavy sandy loam; moderately developed, coarse, blocky structure; slightly sticky; high organic matter, mangrove residue; no roots; distinct smooth boundary,
bBw2	68-92 cm (24 cm)	Wet; dark grey (2.5Y 4/0) and very dark grey (2.5Y 3/0) heavy loam; weakly developed, coarse, blocky structure; sticky; abundant shell fragments; few stones of andesite; many coral fragments; high organic matter; water flowing into pit at 90 cm.

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Tokotoko series**

REFERENCE: The Tokotoko soil set as defined by Twyford & Wright (1965) is closely allied to the Navua soil set with Tokotoko soils being more gleyed. The set comprises the Tokotoko clay (45a), a soil with a mottled topsoil indicating fluctuating water tables, overlying a gleyed subsoil which implies permanent water saturation; a drained phase of the Tokotoko clay (45b); Tokotoko clay on sandy clay (45c), the lower horizon of an estuarine origin.

Purnell (1972) recognised a Tokotoko clay loam and a Tokotoko clay over loam, the latter correlating, in parent material terms, to Twyford and Wright's 45c.

The central concept for this series is taken to be that described as the Tokotoko clay (45a) by Twyford & Wright (1965).

CLASSIFICATION:

(a) Soil Taxonomy: Aeric Tropaquept, very-fine, kaolinitic, isohyperthermic
(b) FAO: Eutric Gleysol
(c) Twyford and Wright: Gley soil related to latosols with a very weak or no dry season

INCLUDED MAPPING UNITS AND SYMBOLS:
Tokotoko soils (30)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION: Tokotoko series develop on the flood plains of the Navua and Rewa rivers in SES and SSE Viti Levu where they are recognised behind Navua series, to which they intergrade, and towards the river from Nausori series.

PARENT ROCK: Rocks of intermediate and basic composition.

PARENT MATERIAL: Recent, weakly weathered riverine alluvium.

PHYSIOGRAPHIC POSITION/LANDFORM: Near level low-lying surfaces of the floodplains.

SLOPE CLASS AND RANGE OF SLOPES: Level or near level, 0-1°.

VEGETATION AND LAND USE: Undrained areas support inferior pasture comprising para grass, mimosa, mile-a-minute, kuta and navua sedge. Where drained and water table controlled Tokotoko series support improved pasture for dairying or intensive irrigated or rainfed rice.

RANGE OF ELEVATION: 2-5 m

RAINFALL: Annual average range: 3,200-4,800 mm;
dry season range: 800-1,600 mm;
wet season range: 1,800-2,800 mm.

TEMPERATURE: Mean annual: 24°C.

SOIL MOISTURE REGIME: Aquic

SOIL TEMPERATURE REGIME: Isohyperthermic

SOIL DRAINAGE CLASS: Very poorly drained. Water table rarely below 50 cm of the ground surface.

PERMEABILITY CLASS: Very slow permeability. Where drained, structural cracks develop and permeability becomes more rapid.

FLOODING: Due to high water tables and slow surface runoff the water table, undrained soils are flooded during the months April to November in most years.

EROSION: No erosion observed.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES: Soil texture becomes finer progressively with depth, from silty clay loam to clay loam to clay; all horizons display well expressed gley features and with the following mottle pattern with depth - yellow-brown (topsoil), greenish grey (B horizon), and strong-brown below 60 cm; horizons have well developed blocky structures; and subsoils tend to be compact with firm consistence.

DIAGNOSTIC HORIZONS: Ochric epipedon, cambic horizon.

RANGE OF PROFILE FEATURES: Tokotoko series have Ag1, Ag2, Bg, BCr horizon sequence.

The Ag horizon combined thickness ranges 35-45 cm; its colours include dark greyish brown (2.5Y 4/2), very dark greyish brown (2.5Y 3/2), olive grey (5Y 4/2, 5/2) and dark olive grey (5Y 3/2); textures may be silty clay loam, clay loam or clay; structures may be weak prismatic or weak coarse blocky; and consistence may be friable or firm.

The Bg horizon thickness ranges from 25-35 cm; its colours include strong brown (7.5YR 5/6, 5/8) and yellowish brown (10YR 5/6, 5/8); textures are clay loams or clays; structures are massive or weak coarse blocky; and mottles may be few, common or many.

The BCr horizon exceeds 40 cm in thickness; colours include light olive grey (5Y 6/2) and pale olive (5Y6/3, 6/4); textures are clays or clay loams; and mottles may be many, abundant or profuse.

VARIANTS: A buried topsoil phase.

SIMILAR SOILS AND DISTINGUISHING FEATURES: Navua clay: Less gleyed and mottled profiles; textures are coarser; structures finer; and a paleosol is recognised in most profiles.

Nausori clay: Gleyed master horizon has sandy clay texture; profiles have more intense gleying and mottling, the latter of reddish hues; and subsoils tend to be massive and of firmer consistence.

GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES: Moderately acid topsoil with strongly acid subsoils; base saturation values are high in topsoils and very high in subsoils; organic carbon decreases down the profile from low (topsoil) to very low at depth; calcium is high, sodium low, magnesium increases from high to very high with depth and potassium from high to very low with depth.

The particle size family class is very fine.

The mineralogical class is kaolinitic.

LABORATORY Nos: SB9593A-D
KRS 1355-1358 (inclusive)

SOIL LIMITATIONS: Very poor internal drainage, high seasonal water table; susceptibility to flooding; clayey textures; soil acidity; and nutrient deficiencies of nitrogen, potassium and phosphorus.

Tokotoko

Typifying Profile

SOIL NAME:	Tokotoko soils
PROFILE No.:	KN09
SITE LOCATION:	Refer soil map of Koronivia Research Station (Scale 1:3000), Leslie (1984). North eastern part of the Station, 180 m south of Koronivia Road.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Floodplain of the Rewa River.
PARENT MATERIAL:	Mixed alluvium derived from quartz-poor rocks.
SLOPE:	Flat
ASPECT:	Not applicable
ELEVATION:	17 m
MICRORELIEF:	Uniformly planar
SITE VEGETATION:	Para grass, Navua sedge and Tarweed.
LAND USE:	Improved pasture for dairying.
DRAINAGE:	Very poorly drained.
EROSION:	Nil, subject to periodic flooding.
DISTURBANCE:	Has been ploughed in the past.
LABORATORY Nos:	SB9593A-D KRS 1355-1358 (inclusive)
COMMENTS:	Water table at 1 m.

PROFILE DESCRIPTION

Tokotoko soils

Ag1	0-17 cm (17 cm)	Moist; dark greyish brown (2.5Y 4/2) both for ped face and rubbed; silty clay loam; common, fine, faint yellowish-red (5YR 5/6) mottles; weakly developed, coarse, blocky structure breaking to weakly developed, very fine nut structure; friable; slightly sticky; non-plastic; many fine and medium roots; indistinct smooth boundary,
Ag2	17-37 cm (20 cm)	Moist; olive grey (5Y 4/2), ped face, dark greyish brown (2.5Y 4/2), rubbed, clay loam; common, fine, faint dark yellowish brown (10YR 4/6) mottles; weakly deeloped, coarse, prismatic structure, breaking to weakly deeloped, medium, blocky structure; friable to firm; slightly sticky; non-plastic; many fine roots; distinct wavy boundary,
Bw	37-69 cm (32 cm)	Moist; strong brown (7.5YR 5/6), ped face, yellowish brown (10YR 5/6), rubbed, clay; many, medium, distinct greenish grey (5GY 6/1) mottles; massive, breaking to weakly developed medium, blocky structure; firm; sticky; slightly plastic; few, very fine, roots; worm mixing in upper 10 cm; diffuse smooth boundary,
BCr	69-134 cm (65 cm)	Wet; light olive grey (5Y 6/2) and pale olive (5Y 6/3) rubbed, clay; profuse, coarse, prominent strong brown (7.5YR 5/6) mottles; massive; sticky; plastic; firm; no roots.

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Totoya series**

REFERENCE: The Totoya sandy clay (30a) defined by Twyford & Wright (1965) as a colluvial soil derived from basalts, basic andesites and basic tuffs under a climate with a moderate dry season.

Forms part of the Delaimatai set.

Totoya series is restricted to occurring in the ustic moisture regime in this survey. Otherwise the central concept for Totoya soils are retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Udic Haplustalf, fine, kaolinitic, isohyperthermic
(b) FAO: Orthic Luvisol
(c) Twyford and Wright: Ferruginous latosol with a moderate to strong dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Totoya soils, undulating phase (191B)
Totoya soils, easy rolling phase (191C)
Totoya soils, rolling phase (191D)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Totoya soils are small in area in Viti Levu and Vanua Levu, but significant in Lau Group where mapped in association with Vuya, Delaimatai and Burenitu soils.
PARENT ROCK:	Andesites and basalts.
PARENT MATERIAL:	Moderately weathered colluvium (and sometimes alluvium).
PHYSIOGRAPHIC POSITION/LANDFORM:	Planar and concave toeslope positions and sometimes in sloping, narrow valley floors) in broad valleys (underfit) of moderately dissected hill country.
SLOPE CLASS AND RANGE OF SLOPES:	Undulating (4-7°), easy rolling (8-11°), and rolling (12-15°).
VEGETATION AND LAND USE:	In unused state supports grasses and reeds. Elsewhere in food gardens and coconuts.
RANGE OF ELEVATION:	5-100 m
RAINFALL:	Annual average range: 1,800-2,400 mm; dry season range: 400-500 mm; wet season range: 1,400-1,800 mm.
TEMPERATURE:	Mean annual: 25.5°C.
SOIL MOISTURE REGIME:	Ustic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Well drained
PERMEABILITY CLASS:	Moderately rapid
FLOODING:	Never floods
EROSION:	Moderate and severe sheet and rill erosion potential.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 10 cm of dark reddish brown friable gritty clay, sticky and slightly plastic moist, and of weak coarse blocky structure breaking to strong fine nut structure, overlying 10 cm of dark reddish brown friable gritty clay with abundant stones and having similar structures to the surface horizon. Below this lies 50-90 cm of dark reddish brown friable gritty clay, of coarse blocky or nut structure with clay coatings to the ped faces. This horizon is sticky and plastic when moist.
DIAGNOSTIC HORIZONS:	Ochric epipedon, argillic horizon.
RANGE OF PROFILE FEATURES:	Not applicable. Only 2 profile descriptions made.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	The soil is slightly acid with pH values increasing slightly with depth. Available phosphorus is very low. Organic carbon is low in the surface horizon and very low in the subsoil. % base saturation is high increasing from 60% in the topsoil to >80 below 40 cm. The CEC follows a similar trend but overall is of medium value. Exchangeable calcium and potassium is low; sodium, medium; and magnesium very high. The particle size family class is fine. The mineralogical class is kaolinitic.
LABORATORY Nos:	SB9358A-E
SOIL LIMITATIONS:	Moderate to severe soil moisture deficits during the dry season; severe soil erosion potential when cultivated; and nutrient deficiencies of phosphorus and nitrogen.

Typifying Profile

SOIL NAME:	Totoya soils, undulating phase.
PROFILE No.:	LK2
SITE LOCATION:	Map I 111 (Lakeba) 452580 E, 114870 N Lakeba Island, Lau Group.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Toeslope in a linear valley bottom.
PARENT MATERIAL:	Stratified colluvium derived from andesitic rocks.
SLOPE:	5°
ASPECT:	North
ELEVATION:	35 m
MICRORELIEF:	Smooth
SITE VEGETATION:	Reed (*M. floridulus*) dominated savanna with ferns (*D. linearis*).
LAND USE:	Unused
DRAINAGE:	Well drained, moderately rapid permeability, slow to medium runoff.
EROSION:	None observed
DISTURBANCE:	None
LABORATORY Nos:	SB9358A-E

PROFILE DESCRIPTION

Ah	0-9 cm (9 cm)	Dry; dark reddish brown (5YR 3/2) moist dark reddish brown (5YR 3/3) rubbed, dark reddish brown (5YR 3/2) gritty clay; friable; slightly plastic; sticky; primary structure of weakly developed coarse block with secondary structure of strongly developed fine nut structure; abundant medium to coarse roots; few fine strongly weathered stones; indistinct regular boundary,
Bw	9-18 cm (9 cm)	Dry; dark reddish brown (5YR 3/3) moist dark reddish brown (5YR 3/4) rubbed dark reddish brown (5YR 3/4) gritty clay; friable; slightly plastic; sticky; primary structure of weakly developed coarse block with a secondary structure of moderately developed fine and very fine nut structure; few medium roots; abundant fine strongly weathered stones; indistinct regular boundary,
Bt1	18-35 cm (17 cm)	Dry; dark reddish brown (5YR 3/3) moist dark reddish brown (5YR 3/4) rubbed dark reddish brown (5YR 3/4) slightly gritty clay; friable; plastic; sticky; primary structure of weakly developed coarse nut with a secondary structure of moderately of moderately developed very fine nut and crumb; few faint and thin (5YR 4/4) cutans; abundant fine and medium strongly weathered stones; diffuse regular boundary,

Bt2	35-63 cm (28 cm)	Dry; dark reddish brown (5YR 3/3) moist dark reddish brown (5YR 3/4) rubbed dark reddish brown (5YR 3/4), clay; very friable to friable; plastic; sticky; a primary structure of weakly developed medium blocky and a secondary structure of single grain with crumb; lenses of different size fractions of strongly weathered grits and fine stones; indistinct regular boundary,
Bt3	63-90 cm (27 cm+)	Moist; dark reddish brown (5YR 3/4) rubbed dark reddish brown (5YR 3/4) gritty clay; friable; sticky; plastic; massive structure breaking to single grain; few faint thin cutans in pores and relict worm channels; many very strongly weathered fine stones.

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Tuva series**

REFERENCE: The Tuva clay (34b) and Tuva hill soils (34bH) defined by Twyford & Wright (1965) as 'talasiga' soils on undulating and rolling downland from parent materials of basic and intermediate composition and formed under a climate with a moderate dry season.

Forms part of the Tuva set.

In this survey Tuva soils are restricted to the ustic soil moisture regime. Otherwise the central concept for Tuva soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Typic Kanhaplustult, fine, ferruginous, isohyperthermic
(b) FAO: Orthic Acrisol
(c) Twyford and Wright: Ferruginous latosol with a strong dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Tuva soils, flat to gently undulating phase (181A)
Tuva soils, undulating phase (181B)
Tuva soils, easy rolling phase (181C)
Tuva soils, rolling phase (181D)
Tuva soils, strongly rolling phase (181E)
Tuva soils, moderately steep phase (181F)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION: Tuva soils are mainly mapped near the Queen's road to the west of the Tuva river, also in the upper reaches of the Tuva river and in Ra province of Viti Levu. They are mapped in Vanua Levu dry zone but of limited extent.

PARENT ROCK: Basalts and andesites.

PARENT MATERIAL: Strongly weathered shallow colluvium over *in situ* rock.

PHYSIOGRAPHIC POSITION/LANDFORM: Planar, gently convex midslopes and backslopes in rolling and hilly land.

SLOPE CLASS AND RANGE OF SLOPES: Flat to gently undulating (0-3°), undulating (4-7°), easy rolling (8-11°), rolling (12-15°), strongly rolling (16-20°), and moderately steep (21-25°).

VEGETATION AND LAND USE: Commonly support degraded 'talasiga' vegetation, are in rough poor pasture, planted out in *Pinus caribaea* or sometimes cultivated for sugar cane.

RANGE OF ELEVATION: 20-200 m

RAINFALL: Annual average range: 1,800-2,400 mm;
dry season range: 400-500 mm;
wet season range: 1,400-1,800 mm.

TEMPERATURE: Mean annual: 25.5°C.

SOIL MOISTURE REGIME: Ustic

SOIL TEMPERATURE REGIME: Isohyperthermic

SOIL DRAINAGE CLASS: Moderately well drained.

PERMEABILITY CLASS: Moderate

FLOODING: Never floods

EROSION: Have experienced past sheet erosion (in some places quite severe) and have a severe sheet and rill erosion potential for slopes >3° under cultivation.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 12 cm of dark reddish brown very friable silty clay loam, of moderate fine nut and crumb structure, overlying 25 cm of red friable clay, of moderately developed blocky structure that breaks easily to crumb, and having faint clay cutans to peds, overlying more than 80 cm of varicoloured pink and red firm clay loam, of massive structure breaking to single grain, with clay cutans to rock fissures.
DIAGNOSTIC HORIZONS:	Ochric epipedon, argillic horizon.
RANGE OF PROFILE FEATURES:	Tuva series have a Ah, Bt, BC horizon sequence. The Ah horizon thickness ranges from 10 to 15 cm; its colours include dark reddish brown (5YR 3/3, 3/4, 2.5YR 3/4) and reddish brown (5YR 4/3, 4/4); textures are silty clay loam, clay loam and clay; consistence may be friable or very friable; and structures are moderate fine or medium nut or granular, with crumb. The Bt horizon thickness ranges from 20 to 70 cm; its colours include red (2.5YR 4/6, 4/8, 5/6, and 10R 4/8, 5/8); textures are clay or clay loam; consistence friable or firm; structures are moderate or strong medium or coarse blocky or nutty; and clay cutans may be few, common or many. The BC horizon thickness ranges from 80 to 120 cm; its colours are variable but of 2.5YR, 5YR and 10R hues; textures may be clay, clay loam or silty clay loam; consistence friable or firm; and with or without clay cutans to rock fissures.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analysis show this soil to be strongly acid; organic carbon and nitrogen are both very low; available phosphorus very low; CEC low throughout; % base saturation is very high 0-12 cm, high 12-36 cm, medium 36-60 cm, and low 125-160 cm; calcium is low 0-12 cm and of very low values in the other horizons; magnesium is high 0-60 cm and medium below this depth; and potassium is very low throughout the profile. The particle size family class is fine. The mineralogical class is ferruginous.
LABORATORY Nos:	USP NB08A-D
SOIL LIMITATIONS:	Severe soil moisture deficits experienced during the dry season; severe sheet and rill erosion potential on slopes >3° under cultivation; strong soil acidity; and severe nutrient deficiencies of nitrogen, phosphorus and potassium.

Typifying Profile

SOIL NAME:	Tuva soils, undulating phase.
PROFILE No.:	NB08
SITE LOCATION:	P74/I/24 Nabou Forest, Nadroga Province.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Planar midslope in rolling country.
PARENT MATERIAL:	Shallow colluvium over *in situ* strongly weathered basic rock.
SLOPE:	5° (200 m length)
ASPECT:	South-west
ELEVATION:	100 m
MICRORELIEF:	Flat
SITE VEGETATION:	1 m Mission grass and 50 cm fern under 8 year old *Pinus caribaea*.
LAND USE:	Exotic forestry
DRAINAGE:	Moderately well drained.
EROSION:	None observed
DISTURBANCE:	None observed
LABORATORY Nos:	USP NB08A-D

PROFILE DESCRIPTION

Ah	0-12 cm (12 cm)	Slightly moist; moist dark reddish-brown (5YR 3/4) rubbed reddish brown (5YR 4/4) silty clay loam; patches of yellowish red (5YR 4/0) in bottom 3 cm; moderately developed fine nut structure with moderate fine crumb structure; very friable; non-sticky; non-plastic; many medium and coarse roots; distinct smooth boundary,
Bt	12-36 cm (24 cm)	Slightly moist; moist red (2.5YR 4/6) and rubbed dark red (2.5YR 3/6) clay loam; patches of dark reddish brown (5YR 3/4) i.e. weak AB horizon in upper 5 cm; moderately developed medium blocky structure breaking to moderate fine crumb; friable; non-sticky; non-plastic; very few faint red (2.5Y 4/6) clay coatings to voids only; common medium and coarse roots; distinct wavy boundary,
BC	36-126 cm (90 cm+)	Slightly moist; moist 50% pink (5YR 7/3) and 50% red (10R 4/8) rubbed red (2.5YR 4/6) clay loam; many fine distinct brownish yellow (10YR 6/6) mottles; massive breaking to single grain; friable to firm; non-sticky; non-plastic; few faint red (2.5YR 4/6) discontinuous clay coatings to rock fissures only; few fine roots.

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Tuvuca series**

REFERENCE: The Tuvuca sandy loam (25e) defined by Twyford & Wright (1965) as a black manganiferous loam derived from limestone much mixed with manganese sand. Occurring on only small areas of Tuvuca and Nayau islands the series was not sampled or described in this survey. Twyford and Wright (1965) information is used to define the series.

CLASSIFICATION:

(a) Soil Taxonomy: Cumulic Haplustoll, fine-loamy, mixed, isohyperthermic
(b) FAO: Haplic Kastanozem
(c) Twyford and Wright: Latosolic soil with a moderate dry season

INCLUDED MAPPING UNITS AND SYMBOLS:
Tuvuca soils (80)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Occurs only on Tuvuca and Nayau Islands in Lau Group.
PARENT ROCK:	Limestone and manganese mineralized volcanic rocks.
PARENT MATERIAL:	Deep *in situ* mixed limestone and manganese sand.
PHYSIOGRAPHIC POSITION/LANDFORM:	Occurs on flattish surfaces in the centre of large masses of raised coralline limestone.
SLOPE CLASS AND RANGE OF SLOPES:	Flat to gently undulating (0-3°).
VEGETATION AND LAND USE:	Under forest on Nayau and bush gardens on Tuvuca.
RANGE OF ELEVATION:	170-195 m
RAINFALL:	Annual average range: 1,800-2,400 mm; dry season range: 400-500 mm; wet season range: 1,400-1,800 mm.
TEMPERATURE:	Mean annual: 25°C.
SOIL MOISTURE REGIME:	Ustic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Well drained
PERMEABILITY CLASS:	Moderately rapid
FLOODING:	Never floods
EROSION:	No erosion risk because of slope class.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows more than 100 cm of black slightly gritty very sandy loam, of strongly developed fine granular and crumb structure, and very friable to loose.
DIAGNOSTIC HORIZONS:	Mollic epipedon
RANGE OF PROFILE FEATURES:	Not applicable
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Tuvuca series are neutral to slightly alkaline, of moderate to high acid soluble phosphate status, with a very high base saturation, high exchangeable calcium and magnesium but very low exchangeable potash content. MnO 21.4%.
LABORATORY Nos:	KRS 779 (Twyford & Wright, 1965)
SOIL LIMITATIONS:	Soil moisture deficits during the dry season, low potassium content, manganese toxicity, and due to slight alkalinity likely trace element deficiencies and imbalances.

Typifying Profile

SOIL NAME:	Tuvuca soils
PROFILE No.:	Profile 179 (Twyford & Wright, 1965).
SITE LOCATION:	Tuvuca Island, Lau Group

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM	Not known, other than that the profile was described from Tuvuca Island, Lau Group.
PARENT MATERIAL:	Deep *in situ* mixed limestone and manganese sand.
SITE VEGETATION:	Under forest on Nayau and bush gardens on Tuvuca islands.
DRAINAGE:	Well drained
EROSION:	None observed
LABORATORY Nos:	KRS 779

PROFILE DESCRIPTION

Ah	0-100 cm	Black (2.5YR N2/0) slightly gritty, very sandy loam; very friable to loose; strongly developed fine granular and crumb structure.

Tuvuca

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Uaua series**

REFERENCE: Uaua gravelly sandy loam (41b) defined by Twyford & Wright (1965) as a colluvial derivative from Nukusa soils (42a) that form from quartz-rich acid tuffs or tuff sandstone under a climate with a strong dry season.

Form part of the Kelikoso set.

The central concept for Uaua soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Kanhaplic Haplustult, clayey, ferruginous, isohyperthermic
(b) FAO: Orthic Acrisol
(c) Twyford and Wright: Red yellow podzolic soil with a strong dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Uaua soils, flat to gently undulating phase (147A) Uaua soils, undulating phase (147B)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Uaua soils develop in the dry zone of Vanua Levu in association with Nukusa and Nabuono soils from which they are colluvial derivatives.
PARENT ROCK:	Quartz-rich acid tuffs or tuff sandstone.
PARENT MATERIAL:	Deep strongly weathered colluvium.
PHYSIOGRAPHIC POSITION/LANDFORM:	Planar underfit valley floors and concave to planar toeslopes in hilly land.
SLOPE CLASS AND RANGE OF SLOPES:	Flat to gently undulating (0-3°) and undulating (4-7°).
VEGETATION AND LAND USE:	They are normally covered by low fern with occasional shrubs like sama, nuqanuqa and usi often overrun with cuscula species. Occasionally used for cassava crops but for little else.
RANGE OF ELEVATION:	20-200 m
RAINFALL:	Annual average range: 1,800-2,400 mm; dry season range: 400-500 mm; wet season range: 1,400-1,800 mm.
TEMPERATURE:	Mean annual: 25°C.
SOIL MOISTURE REGIME:	Ustic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Imperfectly drained
PERMEABILITY CLASS:	Moderately rapid
FLOODING:	In normal years flooding associated with high intensity storms during the wet season can occur on 3 or 4 occasions with water lying for no more than 3 days at each event.
EROSION:	Slight sheet and rill erosion potential.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 10 cm of pinkish grey very friable gravelly sandy loam, of moderate fine blocky structure, overlying 10 cm of mottled dark grey brown and reddish yellow friable heavy sandy loam of weak fine blocky structure overlying 25 cm of mottled dark red friable sandy clay of moderate medium blocky structure, on 50 cm or more of coarsely reticulately mottled red sandy clay containing many fragments of tuff. Over wide areas the soil surface may be bare and covered with a thin veneer of coarse white quartz sand.
DIAGNOSTIC HORIZONS:	Ochric epipedon, argillic horizon.
RANGE OF PROFILE FEATURES:	Not applicable. Only two profile descriptions made.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analysis shows the soil to be strongly acid 0-45 cm and moderately acid below 45 cm; organic carbon and nitrogen are both very low and the C/N ratio is low; very low available phosphorus, % base saturation low 0-45 cm and very low below 45 cm; CEC values are medium; exchangeable calcium is low 0-45 cm and very low below 45 cm; magnesium is medium throughout and potassium very low. The particle size family class is clayey. The mineralogical class is ferruginous.
LABORATORY Nos:	KRS 552-554
SOIL LIMITATIONS:	Some seasonal flooding of short duration on slopes <30°; severe soil moisture deficits during the dry season; soil acidity; nutrient deficiencies of phosphorus, nitrogen and potassium.

Typifying Profile

SOIL NAME:	Uaua soils, undulating phase.
PROFILE No.:	TW 57
SITE LOCATION:	Close to Nabutubutu village, on the Nabu river north-eastern Vanua Levu.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Concave lower toeslope.
PARENT MATERIAL:	Deep weathered colluvium.
SLOPE:	6 °
ASPECT:	North
ELEVATION:	30 m
MICRORELIEF:	Smooth
SITE VEGETATION:	Low fern with shrubs (sama, nuqanuqa, usi).
LAND USE:	Food gardens followed by fallow periods.
DRAINAGE:	Imperfectly drained
EROSION:	None observed
DISTURBANCE:	Cultivated
LABORATORY Nos:	KRS 552-554

PROFILE DESCRIPTION

Ah1	0-10 cm (10 cm)	Moist; pinkish grey (5YR 6/2) gravelly sandy loam; moderately developed fine blocky structure; very friable, common fine and medium fibrous roots; common fine quartz sandy grits; distinct smooth boundary,
Ah2	10-20 cm (10 cm)	Moist; pinkish grey (5YR 6/2) heavy sandy loam; common distinct dark greyish brown (10YR 4/2) and reddish yellow (7.5YR 6/6) mottles; weakly developed fine blocky structure; friable; slightly sticky; slightly plastic; common fine fibrous roots; indistinct smooth boundary,
Bt1	20-45 cm (25 cm)	Moist; light yellowish brown (10YR 6/4) sandy clay; many distinct dark red (2.5YR 3/6) mottles; moderately developed medium blocky structure; friable; slightly sticky; slightly plastic; few fine fibrous roots; distinct smooth boundary,
Bt2	45-130 cm+ (85 cm+)	Moist; dark red (2.5YR 3/6) sandy clay; coarse distinct reticulate red (2.5YR 5/8) mottling; massive structure; firm; sticky; slightly plastic; many weathered tuff fragments.

Цаца

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Ucunilawe series**

REFERENCE: Ucunilawe steepland peaty gritty silty clay loam (94c) defined by Twyford & Wright (1965) as an upland latosolic soil 'from fairly young olivine basalt flows' formed under a climate with no dry season. Forms part of the Salialailai set.

The central concept for Ucunilawe soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Hydric Fulviudand, hydrous, isothermic
(b) FAO: Humic Andosol
(c) Twyford and Wright: Upland steepland soil related to or associated with latosolic soils with no dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Ucunilawe soils, steep phase (216G)
Ucunilawe soils, very steep phase (216H)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Occurs on the steeper surfaces fringing the axial range of scoriae cones in upland Taveuni particularly on the east (windward) coast.
PARENT ROCK:	Basalt
PARENT MATERIAL:	Weakly weathered *in situ* rock with minor amounts of basaltic ash.
PHYSIOGRAPHIC POSITION/LANDFORM:	Long steep planar and gently convex surfaces in dissected steepland.
SLOPE CLASS AND RANGE OF SLOPES:	Steep (26-35°) and very steep (>35°).
VEGETATION AND LAND USE:	Unused (in natural state of rain forest).
RANGE OF ELEVATION:	600-1050 m
RAINFALL:	Annual average range: 3,000-6,400 mm; dry season range: 800-3,000 mm; wet season range: 2,000-4,200 mm.
TEMPERATURE:	Mean annual: 18°C.
SOIL MOISTURE REGIME:	Perudic
SOIL TEMPERATURE REGIME:	Isothermic
SOIL DRAINAGE CLASS:	Well drained
PERMEABILITY CLASS:	Moderately rapid
FLOODING:	Never floods
EROSION:	Very severe sheet and rill erosion potential if forest ever cleared.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 30 cm of very dark grey very friable loam of strong medium and fine granular structure and smeary when moist overlies 30 cm of black very friable loam of moderate medium and fine granular structure, smeary moist and commonly with basalt stones on 60 cm or more of yellowish brown very friable clay loam of coarse and medium blocky structure, slight sticky; slightly plastic and very smeary when moist.
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Not applicable. Only 3 profile descriptions made (includes a variant) .
VARIANTS:	Unnamed variant (Andic Troporthent, medial, isothermic). Shallow soil of Ah, R horizon sequence. Profile description and analytical data attached.
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analysis shows the soil to be strongly acid; organic carbon is high in the topsoil (0-30 cm) and medium in the other horizons; phosphorus retention is very high (98%) throughout; CEC is very high and TEB very low for all horizons; % base saturation is extremely low (<3%); calcium and potassium values are very low; magnesium is medium in the topsoil and very low below it; and Tamms aluminium extract values are very high.
LABORATORY Nos:	USP TAV112A-C Variant: USP TAV113A
SOIL LIMITATIONS:	Slope; surface boulders and rock outcrops; very severe erosion potential; moderately rapid permeability; strong soil acidity; very high phosphate fixation properties; and nutrient deficiencies of potassium, phosphorus and nitrogen.

Typifying Profile

SOIL NAME:	Ucunilawe soils, steep phase.
PROFILE No.:	TAV112
SITE LOCATION:	Above Soqulu Estate, southwest Taveuni Island.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Planar midslope in steepland.
PARENT MATERIAL:	Weakly weathered basalt flow rocks with some basaltic ash.
SLOPE:	30°
ASPECT:	West
ELEVATION:	680 m
MICRORELIEF:	Uneven; many basalt boulders and surface rock outcrops.
SITE VEGETATION:	Rain forest with low canopy of ferns.
LAND USE:	Unused (natural state).
DRAINAGE:	Well drained
EROSION:	None observed
DISTURBANCE:	None
LABORATORY Nos:	USP TAV 112A-C
COMMENTS:	NaF reaction: Strongly positive in all horizons

PROFILE DESCRIPTION

Ah1	0-30 cm (30 cm)	Moist; very dark grey (10YR 3/1) loam; strongly developed medium and fine granular structure; very friable; smeary; many fibrous and woody roots; distinct smooth boundary,
Ah2	30-60 cm (30 cm)	Moist; black (10YR 2/1) loam; moderately developed medium and fine granular structure; very friable; smeary; common fibrous and woody roots; few basalt stones in the lower part; diffuse smooth boundary,
Bw	60-120 cm+ (60 cm+)	Moist; yellowish brown (10YR 4/6) clay loam; moderately developed very coarse blocky structure breaking to medium blocky; very friable; slightly sticky; slightly plastic; very smeary; few fine fibrous roots.

Typifying Profile

SOIL NAME:	Ucunilawe series variant (Andic Troporthent, medial, isothermic).
PROFILE No.:	TAV113
SITE LOCATION:	Above Soqulu Estate SW Taveuni Island (between river and Navavuloa).

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Hill crest on steep slope.
PARENT MATERIAL:	Weakly weathered *in situ* basalt with some basaltic ash.
SLOPE:	35°
ASPECT:	West
ELEVATION:	640 m
MICRORELIEF:	Uneven. Many surface boulders and rock outcrops.
SITE VEGETATION:	Rain forest with low canopy of ferns.
LAND USE:	Unused (natural state).
DRAINAGE:	Well drained
EROSION:	None observed
DISTURBANCE:	None
LABORATORY Nos:	USP TAV 113A
COMMENTS:	NaF reaction: Strong positive 0-35 cm

PROFILE DESCRIPTION

Ah	0-35 cm (35 cm)	Moist; very dark grey (10YR 3/1) and black (10YR 2/1) loam; strongly developed fine and medium granular structure; very friable; smeary; many fine fibrous and woody roots; few basalt stones and boulders in the lower part; distinct smooth boundary,
R	35 cm+	Massive *in situ* basalt flow rock.

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Ura series**

REFERENCE: Ura silty clay loam (21a) and Ura hill soils (21aH) defined by Twyford & Wright (1965) as a latosolic soil from young basalt ash developed under a climate with no dry season.

Forms part of the Ura set.

The central concept for Ura soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Thaptic Fulvudand, ashy, isohyperthermic
(b) FAO: Humic Andosol
(c) Twyford and Wright: Latosolic soil, with no dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Ura soils, rolling phase (95D)
Ura soils, strongly rolling phase (95E)
Ura soils, moderately steep phase (95F)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	On the windward side of the lowland scoriae cones at the southern end of Taveuni Island.
PARENT ROCK:	Basalt
PARENT MATERIAL:	Deep young volcanic ash overlying basalt flow rocks at depth.
PHYSIOGRAPHIC POSITION/LANDFORM:	Rolling land on the volcanic ringplains.
SLOPE CLASS AND RANGE OF SLOPES:	Rolling (12-15°), strongly rolling (16-20°) and moderately steep (21-25°).
VEGETATION AND LAND USE:	Originally forest covered. Now much in coconut plantations and undergrazed by beef cattle. Also used for subsistence crops (bananas, yagona, root crops) and cocoa.
RANGE OF ELEVATION:	0-600 m
RAINFALL:	Annual average range: 3,000-6,400 mm; dry season range: 800-2,000 mm; wet season range: 2,000-3,200 mm.
TEMPERATURE:	Mean annual: 24°C.
SOIL MOISTURE REGIME:	Perudic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Somewhat excessively drained.
PERMEABILITY CLASS:	Moderately rapid
FLOODING:	Never floods
EROSION:	Moderate to severe sheet erosion potential if cultivated.

Morphological And Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 20 cm of very dark brown loose clay, of moderate nut structure, overlying 25 cm of very dark greyish brown friable sandy loam of moderate medium nut structure, commonly having basalt grits and fine stones overlying 40 cm of dark brown friable sandy clay loam of weak fine blocky structure on 30 cm or more of brown friable sandy loam, of weak medium blocky structure and having many basalt stones and grits.
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Ura series have an Ah1, Ah2, Bw1, Bw2 horizon sequence. The Ah1 horizon thickness ranges from 10 to 25 cm; its colours include very dark brown (10YR 2/2) dusky red (2.5YR 3/2) and dark reddish brown (2.5YR 2/4, 3/4 and 5YR 3/3, 3/4); textures may be silty clay loam, clay loam or clay; and consistence loose, very friable or friable. The Ah2 horizon thickness ranges from 20-30 cm; its colours include very dark greyish brown (10YR 3/2) or dark reddish brown (5YR 3/3, 3/4); textures may be silty clay loam, silt loam, fine sandy loam or sandy loam; and consistence friable or very friable. The Bw1 horizon thickness ranges from 25 to 40 cm; its colours include dark brown (10YR 3/3 or 7.5YR 3/2); textures are sandy clay loam or gritty silty clay loam; and structures weak fine or medium blocky. The Bw2 horizon exceeds 30 cm; its colours include brown (7.5YR 4/2), dark reddish brown (5YR 3/2, 3/3, 3/4) or reddish black (10R 2/1); textures are coarse sand, loamy sand or sandy loam; consistence loose or very friable; and structures single grain or weak fine blocky.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analysis shows the soil to be moderately acid 0-22 cm, slightly acid 22-50 and near neutral below these depths; organic carbon is high in the topsoil (0-22 cm) and medium in the other horizons; nitrogen is high 0-50 cm, medium 50-90 cm and very low below 90 cm; the C/N ratio is low; % base saturation is medium in the topsoil, and low in the other horizons; CEC is very high throughout; calcium is high 0-50 and medium below 50 cm depth; magnesium is very high 0-22 and high below the topsoil; and potassium is very low throughout the profile.
LABORATORY Nos:	ORSTOM TAV5A-D
SOIL LIMITATIONS:	Slope, susceptibility to erosion; moderately rapid permeability; high phosphate fixation properties; and potassium nutrient deficiency.

Typifying Profile

SOIL NAME:	Ura soils, rolling phase.
PROFILE No.:	TAV5
SITE LOCATION:	Navakawau district, southeast of Taveuni Island.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Volcanic ringplain to scoria cones.
PARENT MATERIAL:	Weakly weathered basaltic ash.
SLOPE:	19°
ASPECT:	South-east
ELEVATION:	30 m
MICRORELIEF:	Smooth
SITE VEGETATION:	Dalo under coconuts with ferns.
LAND USE:	Market gardening and coconuts.
DRAINAGE:	Somewhat excessively drained.
EROSION:	None observed
DISTURBANCE:	Cultivated
LABORATORY Nos:	ORSTOM TAV5A-D

PROFILE DESCRIPTION

Ah1	0-22 cm (22 cm)	Moist; very dark brown (10YR 2/2) clay; moderately developed medium nutty structure; loose; slightly sticky; slightly plastic; many pores; many fine fibrous roots; distinct smooth boundary,
Ah2	22-50 cm (28 cm)	Moist; very dark greyish brown (10YR 3/2) sandy loam; moderately developed medium nutty structure; friable; few weakly weathered basalt gravels and fragments; abundant fine and medium roots; indistinct smooth boundary,
Bw1	50-90 cm (40 cm)	Moist; dark brown (10YR 3/3) sandy clay loam; weakly developed fine blocky structure; friable; common fine and medium roots; distinct smooth boundary,
Bw2	90-120 cm (30 cm)	Moist; brown (7.5YR 4/2) sandy loam; weakly developed medium blocky structure; very friable; many weakly weathered basalt stones and fragments; few fine and medium roots.

Ura

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Vaidoko series**

REFERENCE: The Vaidoko steepland bouldery clay (76) defined by Twyford & Wright (1965) as shallow soils developed on agglomerates and flow rocks of basic and intermediate composition (with bold outcrops of rock bluffs and volcanic plugs a feature of the landscape) under a climate with a moderate dry season.

Forms part of the Vanuavou set.

The central concept for Vaidoko soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Lithic Hapludoll, fine, kaolinitic, isohyperthermic
(b) FAO: Haplic Phaeozem
(c) Twyford and Wright: Steepland soils related and associated to nigrescent soils with a moderate dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Vaidoko soils, undulating phase (167B)
Vaidoko soils, easy rolling phase (167C)
Vaidoko soils, rolling phase (167D)
Vaidoko soils, strongly rolling phase (167E)
Vaidoko soils, moderately steep phase (167F)
Vaidoko soils, steep phase (167G)
Vaidoko soils, very steep phase (167H)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION: Vaidoko soils are extensive on the east and north coasts of Viti Levu from the Ra-Tailevu province boundary to the Penang valley and are widespread over the outer islands.

PARENT ROCK: Andesites and basalts

PARENT MATERIAL: Weak to moderately weathered *in situ* rock.

PHYSIOGRAPHIC POSITION/LANDFORM: All side slope positions and forms in very strongly rolling hill country.

SLOPE CLASS AND RANGE OF SLOPES: Undulating (4-7°), easy rolling (8-11°), rolling (12-15°), strongly rolling (16-20°), moderately steep (21-25°), steep (26-35°) and very steep (>35°).

VEGETATION AND LAND USE: Scrub, reeds and scattered forest trees. Commonly regularly burnt. Used for rough grazing and in some places (on lower slopes) for subsistence crops (yams, tavioka).

RANGE OF ELEVATION: 20-250 m

RAINFALL: Annual average range: 2,000-3,000 mm;
dry season range: 700-1,200 mm;
wet season range: 1,400-2,500 mm.

TEMPERATURE: Mean annual: 24.5°C.

SOIL MOISTURE REGIME: Udic

SOIL TEMPERATURE REGIME: Isohyperthermic

SOIL DRAINAGE CLASS: Well drained

PERMEABILITY CLASS: Moderate

FLOODING:	Never floods
EROSION:	Moderate, and in places severe sheet erosion. Moderate and severe sheet and rill erosion potential. Slopes >15° also have a potential for soil slip and debris slide erosion.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Vaidoko series typically show 20 to 30 cm of dark friable clay or clay loam of strongly developed fine and medium nut structure, and with a few weakly weathered stones (<5 cm), overlying 15 to 30 cm of dark reddish brown firm clay of massive or weak medium nut structure, and weakly weathered subangular boulders and stones are common in this horizon. Hard massive (lithic contact) rock is normally encountered between 40-50 cm depth.
DIAGNOSTIC HORIZONS:	Mollic epipedon, cambic horizon, lithic contact.
RANGE OF PROFILE FEATURES:	Not applicable. Only 2 profile descriptions made.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Slightly acid topsoil and moderately acid subsoil. Organic carbon values are medium in the topsoil and though low are still >3% in the BC horizon. The CEC is high for the topsoil but is low in the BC, while % base saturation is very high for the topsoil and high below. Exchangeable magnesium is extremely high; calcium high, though dropping to low in the BC; and exchangeable potassium is medium, dropping to very low in the BC horizon. Tamm oxalate extractable aluminium, iron and silica give very low values in all horizons. The particle size family class is fine. The mineralogical class is kaolinitic.
LABORATORY Nos:	SB9401A-B
SOIL LIMITATIONS:	Profile shallowness; slope; moderate soil moisture deficits experienced some time during the dry season; severe soil erosion potential; moderate soil acidity; and nutrient deficiencies of potassium and nitrogen.

Typifying Profile

SOIL NAME:	Vaidoko soils, strongly rolling phase.
PROFILE No.:	VB1
SITE LOCATION:	Map I43 (Vanua Balavu) 178° 59' 10" E, 17° 17' 53" N. Vanua Balavu Island, Lau Group

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Upper convex midslope.
PARENT MATERIAL:	Moderately weathered *in situ* basaltic agglomerate.
SLOPE:	18°
ASPECT:	North-east
ELEVATION:	100 m
MICRORELIEF:	Uneven, boulders on the surface, and rock outcrops in vicinity of the site.
SITE VEGETATION:	Reed (*Miscanthus floridulus)* dominated savanna with ferns (*D. linearis*).
LAND USE:	Unused. Burnt regularly.
DRAINAGE:	Well drained
EROSION:	Moderate to severe sheet erosion in some places.
DISTURBANCE:	Burning
LABORATORY Nos:	SB9401A-B

PROFILE DESCRIPTION

Ah	0-30 cm (30 cm)	Dry; dusky red (2.5YR 3/2) clay loam; friable, firm *in situ*; slightly sticky; non-plastic; strongly developed medium and fine nut with fine cast granular structure; many fine and medium roots; profuse casts; few to many weakly weathered stones (<5 cm); indistinct smooth boundary,
BC	30-48 cm (20 cm)	Dry; dark reddish brown (2.5YR 3/4) clay; firm; slightly sticky; non-plastic; massive; few medium roots; few weakly weathered subangular boulders (10-15 cm); stone line (<5 cm) at boundary; distinct regular boundary (lithic contact),
R	48-70 cm+ (20 cm+)	Dry; reddish yellow (7.5YR 6/8) with white flecks, sandy clay loam; non-sticky; non-plastic; massive weakly weathered *in situ* rock.

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Vakawau series**

REFERENCE: Vakawau bouldery gritty loam (21b) defined by Twyford & Wright (1965) as formed from young bouldery olivine basalt flows under a climate with no dry season.

Forms part of the Ura set.

The central concept for Vakawau soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Hydric Melanudand, medial-skeletal, isohyperthermic
(b) FAO: Humic Andosol
(c) Twyford and Wright: Latosolic soil with no dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Vakawau soils, strongly rolling phase (98E)
Vakawau soils, moderately steep phase (98F)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Occurs in south-eastern Taveuni on the windward fringing volcanic ringplains of the axial scoriae cones.
PARENT ROCK:	Basalt
PARENT MATERIAL:	Weakly weathered bouldery rock with some ash.
PHYSIOGRAPHIC POSITION/LANDFORM:	Uneven lava surfaces of the volcanic ringplains.
SLOPE CLASS AND RANGE OF SLOPES:	Strongly rolling (16-20°) and moderately steep phase (21-25°).
VEGETATION AND LAND USE:	Almost entirely under coconuts with undergrazing with beef cattle.
RANGE OF ELEVATION:	0-350 m
RAINFALL:	Annual average range: 3,000-5,000 mm; dry season range: 800-3,000 mm; wet season range: 2,000-3,200 mm.
TEMPERATURE:	Mean annual: 24°C.
SOIL MOISTURE REGIME:	Perudic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Well drained
PERMEABILITY CLASS:	Moderately rapid
FLOODING:	Never floods
EROSION:	Slight to moderate sheet erosion potential of soil bared and because of the constant high rainfall these soils experience.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically show 35 cm of very dark greyish brown very friable silty clay loam, of weak to moderate granular structure and with many boulders and stones overlying 35 cm of dark brown friable loam of moderate coarse nut breaking to fine granular structure, with abundant stones and boulders, overlying 35 cm or more of dark yellowish brown very friable silt loam of weak fine blocky structure with profuse boulders and stones. The fine earth fraction is smeary but neither sticky or plastic. The described profile represents the fine earth fraction in the interstices between the boulders.
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Not applicable. Only 2 profile descriptions made.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analysis shows the soil to be moderately acid in the topsoil (0-30 cm) and slightly acid below it; organic carbon high in the topsoil and low in the other horizons; phosphorus retention is very high; % base saturation is extremely low throughout; CEC is very high 0-35 cm, high 35-70 cm, and very high 70-105 cm; calcium very low throughout; magnesium high 0-35 cm and medium below 35 cm; and potassium medium in the topsoil and of very low values in the other horizons.
LABORATORY Nos:	USP TAV103A-C
SOIL LIMITATIONS:	Slope; surface boulders and rock outcrops; profile boulders and stoniness; very high phosphorus fixation properties; nutrient deficiency of potassium.

Typifying Profile

SOIL NAME:	Vakawau soils, strongly rolling phase.
PROFILE No.:	TAV103
SITE LOCATION:	700 m north of Salialevu Estate manager's residence south-east Taveuni Island.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Concave slope on overall sloping planar surface on the volcanic ringplains.
PARENT MATERIAL:	Weakly weathered bouldery basaltic lava with minor ash in interstices.
SLOPE:	16°
ASPECT:	South-east
ELEVATION:	70 m
MICRORELIEF:	Gently undulating, many boulders on the surface.
SITE VEGETATION:	Coconuts, with ground cover of *Mikania micrantha*, goat weed, tar weed, mint weed, *Nephrolepsis sp. Lantana sp.*
LAND USE:	Coconut (copra) production with undergrazing (beef cattle).
DRAINAGE:	Well drained
EROSION:	None observed
DISTURBANCE:	None
LABORATORY Nos:	USP TAV103A-C
COMMENTS:	NaF reaction: Strong positive for all horizons.

PROFILE DESCRIPTION

Ah1	0-35 cm (35 cm)	Moist; very dark greyish brown (10YR 3/2) silty clay loam; massive breaking to weak to moderately developed medium granular structure; very friable; somewhat smeary; slightly sticky; non plastic; many stones and boulders; many fibrous and fine woody roots; diffuse smooth boundary,
Ah2	35-70 cm (35 cm)	Moist; dark brown (10YR 3/3) loam; moderately developed very coarse nut structure breaking to weak fine nut and granular structure; friable; smeary; slightly sticky; non-plastic; few fine roots; abundant stones and many boulders; diffuse smooth boundary,
Bw	70-105+ cm (35 cm+)	Moist; dark yellowish brown (10YR 3/4) silt loam; weakly developed fine blocky and nut structure; very friable; very smeary; very slightly sticky; wet; few fine roots; abundant stones and boulders.

Vakawau

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Varaciva series**

REFERENCE: Varaciva steepland gravelly loam (89) defined by Twyford & Wright (1965) as a steepland talasiga soil from strongly weathered basic parent materials formed under a climate with a strong dry season.

The central concept defined for Varaciva soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Typic Kanhaplustult, clayey, kaolinitic, isohyperthermic
(b) FAO: Orthic Acrisol
(c) Twyford and Wright: Steepland soils related to or associated with ferruginous latosols with a strong dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Varaciva soils, strongly rolling phase (195E)
Varaciva soils, moderately steep phase (195F)
Varaciva soils, steep phase (195G)
Varaciva soils, very steep phase (195H)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION: Varaciva soils occur mainly between the 'Ba closed area' and the Ba river.

PARENT ROCK: Basic rocks, predominantly basalts.

PARENT MATERIAL: Very strongly weathered *in situ* rock.

PHYSIOGRAPHIC POSITION/LANDFORM: Very uneven short planar side slopes in plateau land (mesas).

SLOPE CLASS AND RANGE OF SLOPES: Strongly rolling (16-20°), moderately steep (21-25°), steep (26-35°), and very steep (>35°).

VEGETATION AND LAND USE: Talasiga vegetation, mainly *Dicranopteris* fern, bracken and nokonoko trees. Some areas are planted under exotic forest (*Pinus caribaea*).

RANGE OF ELEVATION: 25-200 m

RAINFALL: Annual average range: 1,800-2,400 mm;
dry season range: 400-500 mm;
wet season range: 1,400-1,800 mm.

TEMPERATURE: Mean annual: 25.5°C.

SOIL MOISTURE REGIME: Ustic

SOIL TEMPERATURE REGIME: Isohyperthermic

SOIL DRAINAGE CLASS: Well drained

PERMEABILITY CLASS: Moderately rapid

FLOODING: Never floods

EROSION: Has suffered significant past erosion (sheet, rill) and has a moderate to severe erosion potential.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 6 cm of yellowish red gravelly clay loam, of weakly developed fine and medium nut structure breaking easily to crumb and single grain, very friable, slightly sticky and slightly plastic moist, and with many iron concretions and nodular ironstones, overlying 0.5 cm of hard discontinuous iron pan, that overlies 25 cm of red gritty clay, of moderately developed medium blocky structure breaking easily to fine nut and crumb, friable, slightly sticky and slightly plastic moist, and with a few strongly weathered basalt boulders and pinkish white parent material mottles, overlying more than 30 cm of grey fine sandy clay loam, of massive structure breaking to single grain, firm, sticky when moist, with pockets of red clay infilling rock fissures in the upper 10 cm.
DIAGNOSTIC HORIZONS:	Ochric epipedon, argillic horizon.
RANGE OF PROFILE FEATURES:	Varaciva series have an Ah, Bfm, Bt, C horizon sequence. The Ah horizon thickness ranges from 5-8 cm; colours include yellowish red (5YR 4/6, 4/8, 5/6) or red (2.5YR 4/6); textures vary gravelly, gritty or sandy loams, silt clay loam, clay loam or clays, and iron concretions, nodular ironstones and weathered may be few, many or abundant. The Bfm horizon ranges from 0.5-1.5 cm in thickness and is always discontinuous. The Bt horizon thickness ranges from 20-45 cm; colours include red (2.5YR 4/6, 4/8, 5/8) and yellowish red (5YR 4/8, 5/8); pinkish white (alumina) mottles may be few, many or abundant; and weathered basalt boulders may be few, many or profuse. The C horizon exceeds 30 cm in thickness; colours are variegated (red, pinkish white, grey and yellowish red); consistence may be friable or firm.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analyses show Varaciva series to be strongly acid; nitrogen is very low and C/N ratios are high; available phosphorus is very low; CEC is low as is exchangeable magnesium; exchangeable aluminium is most significant in exchange complex; and % base saturation is very low. The particle size family class is clayey. The mineralogical class is kaolinitic.
LABORATORY Nos:	KRS U1860-1861 (inclusive)
SOIL LIMITATIONS:	Slope; very uneven ground surface due to past erosion; severe potential for sheet and rill erosion; very severe soil moisture deficits during the dry season; aluminium toxicity; strong acidity; and nutrient deficiencies of nitrogen, potassium and phosphorus.

Typifying Profile

SOIL NAME:	Varaciva soils, strongly rolling phase.
PROFILE No.:	LOL16
SITE LOCATION:	Site 74/II/4B Lololo Forest.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Lower convex midslope in 'badland' eroded landscape.
PARENT MATERIAL:	Strongly weathered and chemically degraded *in situ* basalt.
SLOPE:	18°
ASPECT:	North-east
ELEVATION:	50 m
MICRORELIEF:	Hummocky and very uneven.
SITE VEGETATION:	9 year old *P. caribaea*, with *Dicranopteris sp* and *Bischofia javanica*.
LAND USE:	Exotic forestry
DRAINAGE:	Well drained
EROSION:	Has suffered very severe sheet and rill erosion.
DISTURBANCE:	Past erosion
LABORATORY Nos:	KRS U1860-1861 (inclusive)

PROFILE DESCRIPTION

Varaciva soils, strongly rolling phase

Ah	0-6 cm (6 cm)	Dry; yellowish red (5YR 4/6) and moist reddish brown (5YR 4/4) gravelly clay loam; weakly developed fine and medium nut structure breaking to crumb structure and single grain; very friable; slightly plastic; slightly sticky; abundant fine and medium fibrous roots; many iron concretions and nodular iron stones; few strongly weathered basalt boulders; sharp smooth boundary,
Bfm	6-6.5 cm (0.5 cm)	Hard discontinuous iron pan; sharp smooth boundary.
Bt	6.4-24 cm (23.5 cm)	Dry; moist red (2.5YR 4/8) gritty clay; pinkish white (5YR 8/2) parent material mottles; friable; slightly sticky; slightly plastic; moderately developed medium blocky structure breaking to crumb and fine nut structure; few very fine fibrous roots; few strongly weathered basalt boulders; distinct smooth boundary,
C	24-56 cm+ (32 cm+)	Dry; moist grey (7.5YR N5/0) fine sandy clay loam; massive breaking to single grain; firm; sticky; non-plastic; few very fine roots following rock fissures; pockets of red (10R 4/6) clay (2 cm width) infilling rock fissure in upper 10 cm; strongly weathered *in situ* basalt.

Varaciva

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Vasilaulau series**

REFERENCE: New soil series introduced in this survey to include extremely shallow soils with lithic contacts and high organic matter status developed on siltstones, marls and tuffs of intermediate composition under a climate with a strong dry season.

Vasilaulau series are mapped in class association with Nadroga steepland soils (72) as defined by Twyford & Wright (1965).

Named from Vasilaulau trig in Nabou Forest.

CLASSIFICATION:

(a) Soil Taxonomy: Lithic Dystropept, loamy-skeletal, mixed, isohyperthermic
(b) FAO: Dystric Cambisol
(c) Twyford and Wright: Nigrescent soil with a strong dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Vasilaulau soils, rolling phase (131D)
Vasilaulau soils, strongly rolling phase (131E)
Vasilaulau soils, moderately steep phase (131F)
Vasilaulau soils, steep phase (131G)
Vasilaulau soils, very steep phase (131H)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION: Vasilaulau soils develop in association with Nadroga soils chiefly in Nadroga province of south-west Viti Levu and are of limited extent in Vanua Levu, mapped in two small areas - Lekutu, Upper Dreketi region and near Nakelikoso.

PARENT ROCK: Marine sediments and tuffs of intermediate composition.

PARENT MATERIAL: Weakly weathered *in situ* rock.

PHYSIOGRAPHIC POSITION/LANDFORM: Planar long slopes (including all slope positions) in strongly dissected hill country.

SLOPE CLASS AND RANGE OF SLOPES: Rolling (12°), strongly rolling (16-20°), moderately steep (21-26°), steep (26-35°) and very steep (>35°).

VEGETATION AND LAND USE: Grasses, especially gasau. Rough grazing. Some areas planted in *P. caribaea*.

RANGE OF ELEVATION: 30-250 m

RAINFALL: Annual average range: 1,800-2,400 mm;
dry season range: 400-500 mm;
wet season range: 1,400-1,800 mm.

TEMPERATURE: Mean annual: 25.5°C.

SOIL MOISTURE REGIME: Ustic

SOIL TEMPERATURE REGIME: Isohyperthermic

SOIL DRAINAGE CLASS: Well drained

PERMEABILITY CLASS: Moderately rapid

FLOODING: Never floods

EROSION: Moderate to severe sheet and rill erosion potential.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 25 cm of black very friable clay loam of strongly developed fine nut structure, and commonly with a few angular stones, overlying 20 cm of dark reddish brown friable stony clay loam, of moderate fine and medium nut structure, with dusky red iron/organic cutans to the stones overlying massive pale red weakly weathered *in situ* rock with dusky red iron/organic coatings to fissures in the rock. The lithic contact is normally encountered between 35 and 45 cm depth.
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Not applicable. Profiles described show very little variation to that described above.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analysis shows the soil to be strongly acid in horizons 0-42 cm with the R horizon moderately acid; organic carbon and nitrogen values are low in the topsoil (0-24 cm) and very low below it; available phosphorus is very low throughout and phosphorus retention is medium; CEC and % base saturation are medium in the topsoil and low below it; exchangeable calcium and potassium have low values in the topsoil and very low in the other horizons; and magnesium is medium. The particle size family class is fine-silty. The mineralogical class is mixed.
LABORATORY Nos:	USP NB12A-C
SOIL LIMITATIONS:	Profile shallowness; slope; sheet and rill erosion potential; severe soil moisture deficits experienced during the dry season; strong soil acidity; nutrient deficiencies of phosphorus, potassium and nitrogen.

Typifying Profile

SOIL NAME:	Vasilaulau soils, steep phase.
PROFILE No.:	NB12
SITE LOCATION:	P75/III/13B Nabou Forest, Nadroga Province.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Planar midslope in strongly dissected hill country.
PARENT MATERIAL:	Weakly weathered *in situ* flow rock of intermediate composition.
SLOPE:	28° (length 100 m)
ASPECT:	North
ELEVATION:	250 m
MICRORELIEF:	Flat, even
SITE VEGETATION:	Mission grass and nokonoko saplings under 7 year old *Pinus caribaea*.
LAND USE:	Exotic forestry
DRAINAGE:	Well drained
EROSION:	None observed
DISTURBANCE:	None observed
LABORATORY Nos:	USP NB12A-C

PROFILE DESCRIPTION

Ah	0-24 cm (24 cm)	Slightly moist; moist black (5YR 2/1) rubbed dark reddish brown (5YR 2/2) clay loam; strongly developedfine nut structure; very friable; slightly sticky; non plastic; many fine and medium roots; few weakly weathered subangular stones; distinct, smooth boundary,
AC	24-42 cm (18 cm)	Slightly moist; moist 50% dark reddish brown (5YR 2/2) 50% dark reddish brown (5YR 3/3) and rubbed dark reddish brown (5YR 3/2) stony clay loam; moderately developed medium nut structure with weak fine nut and crumb structure; friable; slightly sticky; many prominent very dusky red (2.5YR 2/2) Fe/organic coatings to stones; many fine roots; profuse; weakly weathered subangular stones; distinct, wavy boundary (lithic contact),
R	42-72 cm+ (30 cm+)	Dry; pale red (2.5YR 6/2) massive weakly weathered *in situ* rock; very firm many prominent very dusky red (2.5YR 2/2) Fe/organic coatings along rock fissures; few fine roots.

Vasilaulau

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Vatubaba series**

REFERENCE: Vatubaba steepland stony clay (92c) defined by Twyford and Wright (1965) as formed from silicified tuffs under a climate with a moderate dry season.

Forms part of the Sarowaqa set.

The central concept for Vatubaba soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Typic Eutropept, loamy-skeletal, mixed, isohyperthermic
(b) FAO: Eutric Cambisol
(c) Twyford and Wright: Steepland soil associated with and related to red yellow podzolic soils with a moderate dry season

INCLUDING MAPPING UNITS AND PHASES:

Vatubaba soils, moderately steep phase (150F)
Vatubaba soils, steep phase (150G)
Vatubaba soils, very steep phase (150H)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Extensive in the South-west of Viti Levu between Yavuna and Nawaqadamu and a small area on the coast near Korolevu, Sigatoka.
PARENT ROCK:	Silicified and indurated tuffs, sandstones, marls and agglomerates.
PARENT MATERIAL:	Moderately weathered *in situ* rock.
PHYSIOGRAPHIC POSITION/LANDFORM:	Planar and convex surfaces occupying most slope positions in steepland.
SLOPE CLASS AND RANGE OF SLOPES:	Moderately steep (21-25°), steep (26-35°), and very steep (>35°).
VEGETATION AND LAND USE:	Casuarina, gasau, sisal and guava with mission grass and reeds. Idle land regularly burnt and used for rough grazing.
RANGE OF ELEVATION:	20-600 m
RAINFALL:	Annual average range: 2,000-3,000 mm; dry season range: 700-1,200 mm; wet season range: 1,400-2,500 mm.
TEMPERATURE:	Mean annual: 24.5°C.
SOIL MOISTURE REGIME:	Udic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Well drained
PERMEABILITY CLASS:	Moderate
FLOODING:	Never floods
EROSION:	Moderate to severe sheet and rill erosion potential.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 20 cm of very dark grey very friable clay loam of strong fine crumb structure passing through a transitional AB horizon to 40 cm of dark yellowish brown and brownish yellow very firm bouldery loam of moderate fine blocky structure overlying 50 cm or more of strong brown and dark reddish brown very firm bouldery sandy loam with moderate coarse blocky structure and profuse strongly weathered rounded boulders.
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Not applicable. Only two profile descriptions made.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analysis shows Vatubaba soils to be strongly acid and of low base status, with low contents of exchangeable calcium, magnesium and potash and only moderate available phosphorous. The particle size family class is loamy-skeletal. The mineralogy class is mixed.
LABORATORY Nos:	FACL 9411756-57
SOIL LIMITATIONS:	Slope; nutrient deficiency; acidity; and susceptibility to erosion.

Typifying Profile

SOIL NAME:	Vatubaba soils, steep phase.
PROFILE No.:	VS 27
SITE LOCATION:	Tagaqe district, Nadroga province.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Convex shoulder slope on steep slope in moderately dissected hill country.
PARENT MATERIAL:	Weathered silicified marl.
SLOPE:	30°
ASPECT:	South
ELEVATION:	100 m
MICRORELIEF:	Uneven
SITE VEGETATION:	Dryland grasses
LAND USE:	Rough grazing
DRAINAGE:	Well drained
EROSION:	None observed
DISTURBANCE:	None
LABORATORY Nos:	FACL 9411756-57

PROFILE DESCRIPTION

Ah	0-20 cm (20 cm)	Moist; very dark grey (10YR 3/1) clay loam; strongly developed fine crumb structure; very friable; non sticky; non plastic; abundant fine roots; few weakly weathered rounded gravels; distinct smooth boundary,
AB	20-30 cm (10 cm)	Moist; dark brown (10YR 4/3) stony clay loam; moderately developed medium crumb structure; friable; slightly sticky; non plastic; abundant fine roots; common weakly weathered rounded stones; distinct smooth boundary,
Bw1	30-40 cm (10 cm)	Moist; strong brown (7.5YR 5/6) and yellowish red (5YR 5/8) stony clay; strongly developed very coarse blocky structure; very firm; slightly sticky; plastic; few faint dark grey (10YR 3/1) organic cutans; few medium roots; many strongly weathered rounded boulders; diffuse smooth boundary,
Bw2	40-70 cm (30 cm)	Moist; dark yellowish brown (10YR 3/4) and brownish yellow (10YR 6/6) bouldery loam; moderately developed fine blocky structure; very firm; slightly sticky; plastic; abundant strongly weathered subrounded boulders; diffuse irregular boundary,
BC	70-120 cm (50 cm)	Moist; dark reddish brown (2.5YR 3/4) and strong brown (7.5YR 5/8) bouldery sandy loam; moderately developed coarse blocky structure; very firm; slightly sticky; non plastic; profuse strongly weathered rounded boulders.

Vatubaba

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Vatukoula series**

REFERENCE: The Vatukoula steepland bouldery clay (77) defined by Twyford & Wright (1965) as shallow bouldery soils with very many rocky outcrops and bluffs, derived from olivine basalt flows and agglomerates, supporting predominantly a reed association and formed under a climate with a strong dry season.

Forms part of the Vanuavou set.

The central concept for Vatukoula soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Udic Rhodustalf, fine, mixed, isohyperthermic
(b) FAO: Ferric Luvisol
(c) Twyford and Wright: Nigrescent soil with a strong dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Vatukoula soils, easy rolling phase (198C)
Vatukoula soils, rolling phase (198D)
Vatukoula soils, strongly rolling phase (198E)
Vatukoula soils, moderately steep phase (198F)
Vatukoula soils, steep phase (198G)
Vatukoula soils, very steep phase (198H)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION: Vatukoula soils occur in the strong dry season of northern Viti Levu, particularly below Nadarivatu on the slopes down to Tavua and including the Vatukoula gold mine area.

PARENT ROCK: Olivine basalt

PARENT MATERIAL: Shallow strongly weathered *in situ* rock.

PHYSIOGRAPHIC POSITION/LANDFORM: Planar and convex backslopes and midslopes in very strongly rolling and hilly land. Many rock outcrops.

SLOPE CLASS AND RANGE OF SLOPES: Easy rolling (8-11°), rolling (12-15°), strongly rolling (16-20°), moderately steep (21-25°), steep (26-35°) and very steep (>35°).

VEGETATION AND LAND USE: Formerly under gasau with scattered open forest species but mission grass has now invaded the reed association.

RANGE OF ELEVATION: 25-350 m

RAINFALL: Annual average range: 1,800-2,400 mm;
dry season range: 400-500 mm;
wet season range: 1,400-1,800 mm.

TEMPERATURE: Mean Annual: 25.5°C.

SOIL MOISTURE REGIME: Ustic

SOIL TEMPERATURE REGIME: Isohyperthermic

SOIL DRAINAGE CLASS: Well drained

PERMEABILITY CLASS: Moderate

FLOODING: Never floods

EROSION: Have a severe sheet and rill erosion potential.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 10 cm of dark brown friable clay of strongly developed medium nut structure, and commonly with many angular stones overlying 40 cm of dark red firm strongly developed blocky structure, with prominent clay cutans to ped faces over red firm and massive silt loam of massive structure breaking to blocky on weathering basalt. Boulders are common throughout most profiles
DIAGNOSTIC HORIZONS:	Ochric epipedon, argillic horizon.
RANGE OF PROFILE FEATURES:	Vatukoula series have an Ah(Ap), Bt, BC horizon sequence. The Ah horizon thickness ranges from 9-12 cm; its colours include dark brown (7.5YR 3/2) and dark reddish brown (5YR 3/3, 3/4); textures are either clay or clay loam; and structures are either moderate or strong medium nut or granular. The Bt horizon thickness ranges from 20-45 cm; its colours include strong brown (7.5YR 5/6), yellowish red (5YR 5/6, 4/6, 4/8) and more commonly red (2.5YR 4/6, 4/8); textures are bouldery clay or bouldery clay loam; structures are moderate or strong medium or coarse blocky; and clay cutans are common or many. The BC horizon thickness ranges from 10 to 55 cm; its colours include red (2.5YR 4/6, 4/8) or yellowish red (5YR 5/6, 4/8); textures are bouldery silt loams or bouldery clay loams; and boulders may range from many to profuse.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analysis shows the soil to moderately acid; organic carbon is medium in the topsoil (0-12 cm) and very low below; nitrogen is medium in the topsoil and low in the other horizons; available phosphorus is very low and phosphorus retention is medium; CEC is very high throughout the profile while % base saturation is low; exchangeable calcium values are high in the topsoil and medium below it; magnesium is very high; and potassium very low. The particle size family class is fine. The mineralogical class is mixed.
LABORATORY Nos:	USP LOL19A-C
SOIL LIMITATIONS:	Surface and profile boulders; many surface rock outcrops; profile shallowness; slope; very severe soil moisture deficits experience during the dry season; severe sheet and rill erosion potential; moderate soil acidity; and nutrient deficiencies of potassium and phosphorus.

Typifying Profile

SOIL NAME:	Vatukoula soils, moderately steep phase.
PROFILE No.:	LOL19
SITE LOCATION:	P74/III/5 Lololo Forest, Ba Province.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Concave midslope in moderately dissected rolling hill country.
PARENT MATERIAL:	Shallow colluvium derived from weathered basalt over *in situ* basalt rock .
SLOPE:	22°
ASPECT:	East
ELEVATION:	185 m
MICRORELIEF:	Even. Many basalt boulders on ground surface.
SITE VEGETATION:	Dense mission grass under 8 year old *Pinus caribaea*.
LAND USE:	Exotic forestry
DRAINAGE:	Well drained
EROSION:	None observed
DISTURBANCE:	None observed
LABORATORY Nos:	USP LOL19A-C

PROFILE DESCRIPTION

Ah	0-12 cm (12 cm)	Dry; moist dark brown (7.5YR 3/2) and dry brown (7.5YR 4/2) clay; strongly developed medium nut structure; friable; slightly sticky; non-plastic; many fine medium and coarse roots; many unweathered angular stones and boulders; distinct smooth boundary,
Bt	12-51 cm (39 cm)	Dry; moist and dry red (2.5YR 4/6) clay; strongly developed medium and coarse blocky structure; firm; very sticky; slightly plastic; many prominent dark red (2.5YR 3/6) clay skins; common stones and boulders; common fine medium and coarse roots; diffuse wavy boundary,
BC	51-106 cm+ (55 cm+)	Dry; moist red (2.5YR 4/8) and dry red (2.5YR 5/8) silt loam; massive breaking to weakly developed coarse blocky structure; firm non-sticky; non-plastic; many prominent dark reddish brown (2.5YR 3/4) clay skins; common boulders; common fine and medium roots.

Vatukoula

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Vatulele series**

REFERENCE: The Vatulele steepland rocky clay (65) defined by Twyford & Wright (1965) as a shallow dark grey or black gritty clay, sticky and firm to friable consistence, with generally weak structural development, and mapped on steepland areas of coralline limestone under a climate with a moderate dry season.

This central concept for Vatulele soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Lithic Haplustoll, clayey-skeletal, smectitic, isohyperthermic
(b) FAO: Haplic Kastanozem
(c) Twyford and Wright: Steepland soil related to or associated with nigrescent soils with a moderate dry season

INCLUDED MAPPING UNITS AND SYMBOLS:
Vatulele soils, very steep phase (77H)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Vatulele soils are extensive on Vatuelel Island and on almost all other coral islands where there a sheer cliffs in the landscape, often at the sea coast.
PARENT ROCK:	Cemented coralline limestone.
PARENT MATERIAL:	Cemented *in situ* rock.
PHYSIOGRAPHIC POSITION/LANDFORM:	All slope and landscape positions are predominantly in areas of limestone cliffs, highly pinnacled surfaces or where coralline rubble has accumulated on more gentle surfaces of limestone.
SLOPE CLASS AND RANGE OF SLOPES:	Very steep (>35°).
VEGETATION AND LAND USE:	Vau (*Hibiscus tiliaceus*) and vesi (*Elutsia bijuga*) dominated by calciole forest.
RANGE OF ELEVATION:	0-150 m
RAINFALL:	Annual average range: 1,800-2,400 mm; dry season range: 400-500 mm; wet season range: 1,400-1,800 mm.
TEMPERATURE:	Mean annual: 25.5°.
SOIL MOISTURE REGIME:	Ustic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Well drained
PERMEABILITY CLASS:	Rapid
FLOODING:	Never floods
EROSION:	Soil loss occurs on the steeper slopes following forest removal.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 20 cm of firm very dark grey (5YR hue) stony clay of very strongly developed nut structure, sticky and plastic when moist, with many limestone boulders (<10 cm) throughout. The lower boundary is a lithic contact and the surface horizon rests on hard *in situ* coralline limestone.
DIAGNOSTIC HORIZONS:	Mollic epipedon
RANGE OF PROFILE FEATURES:	Not applicable. Profiles show little variation to that described.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	Futuna series: Occur on more gentle sloping coralline surfaces, and have considerably fewer coral stones in the surface horizon, and structures are finer
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Only the surface horizon was analysed. It shows near neutral pH and medium organic carbon values. Exchangeable calcium (> 55 me.%), and % base saturation values are very high. Exchangeable magnesium is also very high with potassium high and sodium low. The fine earth fraction is dominated by clay, but with abundant stones meets criteria for the clayey-skeletal particle size family class. The mineralogical class is smectitic.
LABORATORY Nos:	SB9417
SOIL LIMITATIONS:	Shallowness; stoniness; occurrence on steeper slopes; abundance of limestone surface rock outcrops; severe soil moisture deficits experienced during the dry season; and alkalinity that may cause trace element deficiencies.

Typifying Profile

SOIL NAME:	Vatulele soils, very steep phase.
PROFILE No.:	VB19
SITE LOCATION:	Vanua Balavu Island, Lau Group Map I43 (Vanua Balavu) 178° 58' 72"E, 17° 19' 82"N.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Small (10 m) linear surface within limestone cliffs (8 m) of a Karst topography.
PARENT MATERIAL:	*In situ* cemented coralline limestone.
SLOPE:	36°
ASPECT:	North
ELEVATION:	60 m
MICRORELIEF:	Surface limestone boulders.
SITE VEGETATION:	Short calciole forest trees (2-3 m).
LAND USE:	Unused
DRAINAGE:	Well drained; rapid permeability; medium runoff.
EROSION:	None observed
DISTURBANCE:	None observed
LABORATORY Nos:	SB9417 A-B

PROFILE DESCRIPTION

Ah	0-20 cm (20 cm)	Dry; dark reddish brown (5YR 2/2), moist very dark grey (5YR 3/1) stony clay; firm; very firm *in situ*; sticky; plastic; very strongly developed coarse nut with medium nut and some cast granular structure; profuse roots; many casts with worm channels filled by 10YR 3/3 material; profuse limestone stones (< 10 cm); sharp wavy boundary (lithic contact),
R	25-55 cm+ (30 cm+)	White, weakly weathered *in situ* coralline limestone.

Vatulele

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Vatuma series**

REFERENCE: New soil series introduced in this survey to include deep dark coloured alluvial soils that develop in the smaller valleys draining base rich rocks under a climate with a strong dry season. Previously included with Sigatoka clay (7b) as defined by Twyford & Wright (1965). Named from Vatuma Creek in Nadi Forest, Western Viti Levu.

CLASSIFICATION:

(a) Soil Taxonomy: Fluventic Haplustoll, fine, mixed, isohyperthermic
(b) FAO: Haplic Kastanozem
(c) Twyford and Wright: Recent soil from alluvium with a strong dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Vatuma soils, flat to gently undulating phase (49A)
Vatuma soils, undulating phase (49B)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Vatuma soils occur in the smaller valley floors draining areas of basic rocks in western Viti Levu.
PARENT ROCK:	Rocks predominantly of basic composition.
PARENT MATERIAL:	Deep weak to moderately weathered alluvium.
PHYSIOGRAPHIC POSITION/LANDFORM:	Valley floors of small rivers and creeks in moderate to strongly dissected hill country.
SLOPE CLASS AND RANGE OF SLOPES:	Flat, to gently undulating (0-3°) and undulating (4-7°).
VEGETATION AND LAND USE:	Much under remnant forest species and unused. Elsewhere used for root crops and bananas.
RANGE OF ELEVATION:	50-400 m
RAINFALL:	Annual average range: 1,800-2,400 mm; dry season range: 400-500 mm; wet season range: 1,400-1,800 mm.
TEMPERATURE:	Mean annual: 25.5°C.
SOIL MOISTURE REGIME:	Ustic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Imperfectly drained
PERMEABILITY CLASS:	Moderately slow
FLOODING:	1 in 10 year return period for floods depositing minor amounts of fresh alluvium. Other floods are of short duration, related to high intensity storms and may occur 2-3 times during the dry season.
EROSION:	Accumulating soil. No erosion risk.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 25 cm of black clay loam, of moderately developed fine nut structure and very friable, overlying 12-15 cm of mixed very dark greyish brown and dark yellowish brown clay, of weakly developed medium blocky structure, friable, and slightly sticky and slightly plastic when moist, over more than 40 cm of brown clay, of weakly developed coarse blocky structure, with prominent dark greyish brown coatings to the peds, friable, and slightly sticky and plastic moist.
DIAGNOSTIC HORIZONS:	Mollic epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Not applicable. Only 2 profile descriptions made.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Near neutral pH becoming moderately alkaline (with free lime) below 38 cm depth. Nitrogen is very low, carbon is low in the top 25 cm dropping to very low below this depth. % base saturation is very high throughout the profile; CEC ranges high to very high and exchangeable calcium is very high (>31 me.%); potassium is low; and magnesium ranges between medium and high. Phosphorus is very low. Particle size family class is fine. Mineralogical class is mixed.
LABORATORY Nos:	USP ND05 A-C
SOIL LIMITATIONS:	Seasonal flooding; nutrient deficiencies (phosphorus, nitrogen) and subsoil alkalinity which may effect trace element status.

Typifying Profile

SOIL NAME:	Vatuma soils, flat to gently undulating phase.
PROFILE No.:	ND05
SITE LOCATION:	Nadi Forest, Vatuma catchment.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Narrow sloping valley in moderately dissected hill country.
PARENT MATERIAL:	Alluvium derived from basic and intermediate rocks.
SLOPE:	2°, 70 m length
ASPECT:	South
ELEVATION:	250 m
MICRORELIEF:	Flat planar surface.
SITE VEGETATION:	Complete ground cover of blue ratstail and other shrubs under tall (20 m) open forest remnants.
LAND USE:	Unused valley within a 3 year old pine forest.
DRAINAGE:	Imperfectly drained
EROSION:	None
DISTURBANCE:	None
LABORATORY Nos:	USP ND05 A-C

PROFILE DESCRIPTION

Ah	0-25 cm (25 cm)	Moist; moist, black (2.5YR N2/0) and rubbed very dark grey (5YR 3/1) clay loam; moderately developed very fine nut structure; non-sticky; non-plastic; very friable; common medium roots; diffuse smooth boundary,
AB	25-38 cm (13 cm)	Moist; moist, 50% very dark greyish brown (2.5Y 3/2) 50% dark yellowish brown (10YR 4/4) and rubbed very greyish brown (10YR 3/2) clay; weakly developed medium blocky structure, breaking to weak very fine nut structure; slightly sticky; slightly plastic; friable; few fine roots; diffuse smooth boundary,
Bw	88-78 cm+	wet; moist and rubbed brown (10YR 4/3) clay; weakly developed coarse blocky structure; slightly sticky; slightly plastic; friable; many prominent dark greyish brown (2.5Y 4/2) clay/organic coatings; few fine roots.

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Vatuvonu series**

REFERENCE: Vatuvonu sandy clay loam (17c) and Vatuvonu hill soils (17cH) defined by Twyford and Wright(1965) as developed from calcareous pumiceous rhyolitic tuffs, marls and agglomerates on easy rolling land under a climate with a strong dry season.

Forms part of the Dakadaka set. The central concept for Vatuvonu soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Lithic Ustorthent, coarse-loamy, mixed, isohyperthermic
(b) FAO: Eutric Regosol
(c) Twyford and Wright: Nigrescent soils with a strong dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Vatuvonu soils, undulating phase (143B)
Vatuvonu soils, easy rolling phase (143C)
Vatuvonu soils, rolling phase (143D)
Vatuvonu soils, strongly rolling phase (143E)
Vatuvonu soils, moderately steep phase (143F)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION: Vatuvonu soils occur only in north-eastern Vanua Levu along a stretch of coast between the mouth of the Labasa river and Udu point and on many of the offshore islands in the vicinity.

PARENT ROCK: Calcareous pumiceous rhyolitic tuffs and agglomerates.

PARENT MATERIAL: Shallow weathered *in-situ* rock..

PHYSIOGRAPHIC POSITION/LANDFORM: Convex backslopes and planar to concave midslopes in easy rolling country.

SLOPE CLASS AND RANGE OF SLOPES: Undulating (4-7°), easy rolling (8-11°), rolling (12-15°), strongly rolling (16-20°), and moderately steep (21-25°).

VEGETATION AND LAND USE: Vatuvonu series are not used extensively for agriculture owing to their shallow nature and the severe soil moisture deficits experienced during the dry season. They are more widely used for cassava, kumala and yams on the off shore islands but yields are often poor.

RANGE OF ELEVATION: 5-50 m

RAINFALL: Annual average range: 1,800-2,400 mm;
dry season range: 400-500 mm;
wet season range: 1,400-1,800 mm.

TEMPERATURE: Mean annual: 25.5°C.

SOIL MOISTURE REGIME: Ustic

SOIL TEMPERATURE REGIME: Isohyperthermic

SOIL DRAINAGE CLASS: Well drained

PERMEABILITY: Moderate to moderately rapid.

FLOODING: Never floods

EROSION: Moderate sheet and rill erosion potential.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 10cm of very dark grey fine sandy friable clay loam, of strong medium and fine nut structure, overlying white soft pumiceous tuff, becoming hard below 15cm(lithic contact). A profile on slopes >12^0 typically shows 10cm of dark grey stony sandy clay loam, overlying 15cm of pale yellowish grey very stony sandy clay loam, overlying 15cm of pale yellowish grey very stony sandy loam, over weathering pumiceous agglomerate, with a lithic contact encountered within 50cm of the surface.
DIAGNOSTIC HORIZONS:	Ochric epipedon, lithic contact
RANGE OF PROFILE FEATURES:	Not applicable. Only two profiles descriptions available.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analyses for the topsoil acid; nitrogen, carbon and C/N ratio values are all high; available phosphorous is very high; Both CEC and TEB values are high; exchangeable calcium and potassium values are high; and exchangeable magnesium is high. The particle size family class is coarse-loamy. The mineralogical family class is mixed.
LABORATORY NOS:	KRS 528
SOIL LIMITATIONS:	Profile shallowness; severe soil moisture deficits experienced during the dry season; strong soil acidity; and low available phosphorous.

Typifying Profile

SOIL NAME:	Vatuvonu soils, rolling phase.
PROFILE NO:	TW 528
SITE LOCATION:	Near Nukusa, north-east Vanua Levu.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Planar midslope
SLOPE:	13°
ASPECT:	North
ELEVATION:	24 m
MICRORELIEF:	Smooth even surface.
SITE VEGETATION:	Cultivated
LAND USE:	Cassava garden
DRAINAGE:	Well drained
EROSION:	Active sheet erosion.
DISTURBANCE:	Cultivated
LABORATORY Nos.:	KRS 528

PROFILE DESCRIPTION

Vatuvonu soils

Ap	0 - 10cm (10 cm)	Moist; very dark grey (10 YR 3/1) fine sandy clay loam; strongly developed fine and medium nut structure; friable; slightly sticky; slightly plastic; common fine and medium fibrous roots; sharp smooth bouldery,
C	10 - 15cm (5cm)	Moist; white(10YR 8/2) sandy loam; single grain; friable; distinct smooth boundary (lithic contact),
R	15 - 100cm+ (85cm+)	Dry; white(10 YR 8/2) massive extremely hard *in-situ* pumiceous tuff.

Vatuvonu

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Veisaru series**

REFERENCE: Veisaru clay (49a) defined by Twyford & Wright (1965) as a strongly mottled, moderately gleyed soil formed on alluvium derived mainly from rocks of intermediate composition (andesites) under a climate with a moderate to strong dry season.

Forms part of the Veisaru set.

The central concept for Veisaru soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Typic Tropaquept, fine, kaolinitic, isohyperthermic
(b) FAO: Dystric Gleysol
(c) Twyford and Wright: Gley soil related to latosols with a moderate to strong dry season

INCLUDED MAPPING UNITS AND SYMBOLS:
Veisaru soils (57)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Veisaru soils occur in small areas associated with Raviravi soils in western parts of Viti Levu.
PARENT ROCK:	Rocks of intermediate composition (mainly andesites).
PARENT MATERIAL:	Deep strongly weathered alluvium.
PHYSIOGRAPHIC POSITION/LANDFORM:	Small areas of alluvial outwash in the lowest part of the floodplain surface.
SLOPE CLASS AND RANGE OF SLOPES:	Flat to gently undulating (0-3°).
VEGETATION AND LAND USE:	Mainly under sugar cane. Formerly carried reed and short grass vegetation.
RANGE OF ELEVATION:	1-10 m
RAINFALL:	Annual average range: 1,800-2,400 mm; dry season range: 400-500 mm; wet season range: 1,400-1,800 mm.
TEMPERATURE:	Mean annual: 25.5°C.
SOIL MOISTURE REGIME:	Aquic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Poorly drained
PERMEABILITY CLASS:	Slow
FLOODING:	One in 20 year return period for floods depositing alluvium. Other floods two in one year return period. Water table can be at 50 cm depth during part of the wet season.
EROSION:	No erosion risk.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 18 cm of dark brown friable clay, of moderate medium granular structure overlying 50 cm red firm gritty clay, with strong white reticulate mottling and of moderate coarse blocky structure on at least 80 cm of reddish brown firm clay loam, of massive structure though showing weak coarse blocky structure when dry, with red and white mottling.
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Not applicable. Only two profile descriptions available.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analysis shows the soil to be extremely acid 0-71 cm and strongly acid below 71 cm; organic carbon and nitrogen are very low throughout the profile; very low available phosphorus; % base saturation is low in the topsoil (0-18 cm) and very low below; CEC is medium throughout; exchangeable calcium is low 0-18 cm and very low below 18 cm; magnesium is medium 0-18 cm and low in the other horizons; and potassium is low 0-71 cm and very low below 71 cm. The particle size family class is fine. The mineralogical class is kaolinitic.
LABORATORY Nos:	KRS R422-424
SOIL LIMITATIONS:	Susceptibility to flooding; high water table during the wet season (where not drained); slow permeability; poor internal drainage; clayey textures; soil acidity; and nutrient deficiencies of nitrogen and phosphorus.
ADDITIONAL COMMENTS:	Some analyses for Veisaru series show high pH; exchangeable calcium and magnesium; and base saturation due to massive amounts of coral sand applied during the 1940s.

Typifying Profile

SOIL NAME:	Veisaru soils
PROFILE No.:	322
SITE LOCATION:	East of the Ba river on Kings road 1 km north of Ba township.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Alluvial floodplain
PARENT MATERIAL:	Deep strongly weathered alluvium from andesitic tuffs.
SLOPE:	Flat
ASPECT:	Not applicable
ELEVATION:	5 m
MICRORELIEF:	Smooth
SITE VEGETATION:	Weeds and Pandanus.
LAND USE:	Unused (natural state).
DRAINAGE:	Poorly drained.
EROSION:	None observed
DISTURBANCE:	None observed
LABORATORY Nos:	KRS R422-424

PROFILE DESCRIPTION

Ah	0-18 cm (18 cm)	Moist; dark brown (7.5YR 3/2) clay; moderately developed medium granular structure; friable; slightly sticky; slightly plastic; many fine and medium fibrous roots; distinct smooth boundary,
Bw	18-71 cm (53 cm)	Moist; red (2.5YR 4/8) gritty clay; prominent white (5YR 8/1) reticulate mottling; moderately developed coarse blocky structure; firm; sticky; plastic; many white (5YR 8/1) specks throughout matrix; few fine fibrous roots; distinct smooth boundary,
BC	71-150 cm+ (79 cm+)	Moist; reddish brown (5YR 4/4) clay loam; abundant distinct white (5YR 8/1) and red (2.5YR 4/6) mottles; massive and soft when wet; weakly developed coarse blocky tending prismatic structure; dry; firm; sticky; plastic.

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Verevere series**

REFERENCE: Verevere sandy clay(17d) defined by Twyford and Wright (1965) as colluvial soil related to Vatuvonu soils(17c) and developed from calcareous pumiceous rhyolitic tuffs, marls and agglomerates under a climate with a strong dry season.

Forms part of the Dakadaka set.

The central concept for Verevere soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Typic Ustropept, fine, smectitic, isohyperthermic (147)
(b) FAO: Eutric Cambisol
(c) Twyford and Wright: Nigrescent soils with a strong dry season

INCLUDED MAPPING UNITS AND PHASES:

Verevere soils, flat to gently undulating phase (146A)
Verevere soils, undulating phase (146B) Verevere soils, easy rolling phase (146C)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Verevere soils are not extensive and occur on flattish land in narrow valleys amongst steep hills in the north-eastern coastal region of Vanua Levu.
PARENT ROCK:	Calcareous pumiceous rhyolitic tuffs and agglomerates and marls.
PARENT MATERIAL:	Shallow weathered colluvium over weathered *in-situ* rock.
PHYSIOGRAPHIC POSITION/LANDFORM:	Flattish land in narrow valleys and on toe slopes.
SLOPE CLASS AND RANGE OF SLOPES:	Flat to gently undulating(0 - 3^0), undulating(4-7^0) and easy rolling(8-11^0).
VEGETATION AND LAND USE:	Verevere series, although small in extent are valuable soils for subsistence farming: dalo, yams, etc, and also for rice crops.
RANGE OF ELEVATION:	2 - 40 m
ANNUAL RAINFALL RANGE:	Annual average range: 1,800-2,400 mm; dry season range: 400-500 mm; wet season range: 1,400-1,800 mm.
ANNUAL TEMPERATURE RANGE:	Mean annual: 26°C.
SOIL MOISTURE REGIME:	Ustic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Well drained
PERMEABILITY:	Moderately rapid
FLOODING:	Sites with slopes <1^0 flood for 2 -3 days on 3 to 4 occasions in normal years during the wet season.
EROSION:	Slight sheet and rill erosion potential on slopes >3^0.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 12cm of very dark grey friable to firm sandy clay of strong coarse nut structure, overlying 38cm of very dark grey brown, slightly stony clay, with pale yellow fragments of weathering parent material and a moderate medium nut structure, over weathering pale yellow and grey agglomerate.
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
TYPIFYING PROFILE:	TW 341
RANGE OF PROFILE FEATURES:	Not applicable. Only two profile descriptions available.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analysis shows the soil to be slightly acid in the top soil (0 - 12cm) and near neutral below it; organic carbon and nitrogen have medium values in the topsoil and are of very low values in the subsoil; C/N ratios are high throughout; low available phosphorous; % base saturation values are very high; TEB values are very high; CEC values are high; Exchangeable calcium and magnesium values are very high; and potassium values are high in the topsoil and of low value in the subsoil. The particle size family class is fine. The mineralogical family class is smectitic.
LABORATORY NOS:	KRS 512 - 513
SOIL LIMITATIONS:	Profile shallowness; severe soils moisture deficits experienced during the dry season; minor short duration flooding risk during the wet season on slopes $<2^0$; low phosphorous levels; and low reserves of nitrogen and potassium..

Typifying Profile

SOIL NAME:	Verevere soil, flat to gently undulating phase.
PROFILE NO:	TW 341
SITE LOCATION:	Yavai near Nukusa, Vanua Levu.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Valley floor
PARENT MATERIAL:	Weathered colluvium from rhyolitic tuffs.
SLOPE:	1°
ASPECT:	North
ELEVATION:	5 m
MICRORELIEF:	Smooth flattish surface.
SITE VEGETATION:	Miscellaneous grasses
LAND USE:	Rough grazing
DRAINAGE:	Well drained
EROSION:	Site of deposition.
DISTURBANCE:	None
LABORATORY NOS.:	KRS 512-513

PROFILE DESCRIPTION

Ah	0-12cm (12 cm)	Moist; very dark grey (10YR 3/1) sandy clay; strongly developed coarse nut structure; friable to firm; slightly sticky; slightly plastic; common fine and medium fibrous roots; distinct smooth boundary,
Bw	12-50 cm (38 cm)	Moist; very dark grey brown (10YR 3/2) slightly stony clay; moderately developed medium nut structure; friable to firm; slightly sticky; slightly plastic; few fine and very fine fibrous roots; few pale yellow (2.5YR 7/4) weathered stones; distinct smooth boundary,
C	50-100 cm+ (50 cm+)	Slightly moist; pale yellow (2.5YR 7/5) and grey (2.5YN 5/0) *in-situ* agglomerate.

Verevere

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Visa series**

REFERENCE: The Visa steepland stony clay (83a) defined by Twyford & Wright (1965) to include steepland soils related to humic latosols derived from basic and intermediate parent material under a climate with a very weak or no dry season. Visa in this survey is applied to moderate to strongly weathered soils in which profiles have both reddish and brownish coloured B horizons.

Forms part of the Visa set.

The original concept for Visa series is retained for the morphological and chemical properties but the previous restriction to steepland is applied in this survey to a wider range of slopes.

CLASSIFICATION:

(a) Soil Taxonomy: Typic Humitropept, fine, kaolinitic, isohyperthermic
(b) FAO: Dystric Cambisol
(c) Twyford and Wright: Humic Latosol with a very weak or no dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Visa soils, undulating phase (125B)
Visa soils, easy rolling phase (125C)
Visa soils, rolling phase (125D)
Visa soils, strongly rolling phase (125E)
Visa soils, moderately steep phase (125F)
Visa soils, steep phase (125G)
Visa soils, very steep phase (125H)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION: Visa soils are widely developed in Viti Levu and widespread throughout Verata and Naitasiri and also in the Wainimala, below the Monasavu Falls.

PARENT ROCK: Sedimentary rocks of intermediate and basic composition.

PARENT MATERIAL: Strongly weathered *in situ* sandstones and siltstones and sometimes as large rotational slump deposits.

PHYSIOGRAPHIC POSITION/LANDFORM: Crests, midslopes and toeslopes of hilly ridges.

SLOPE CLASS AND RANGE OF SLOPES: Undulating, 4-7°, easy rolling, 8-11°, rolling, 12-15°, strongly rolling, 16-20°, moderately steep, 21-25°, steep, 26-35°, and very steep (>35°).

VEGETATION AND LAND USE: Much still in indigenous forest. Elsewhere, cleared for grazing with introduced grasses or tree crops on the more gentle slopes.

RANGE OF ELEVATION: 10-150 m

RAINFALL: Annual average range: 3,200-4,800 mm;
dry season range: 800-1,600 mm;
wet season range: 1,800-2,800 mm.

TEMPERATURE: Mean annual: 24°C.

SOIL MOISTURE REGIME: Perudic

SOIL TEMPERATURE REGIME: Isohyperthermic

SOIL DRAINAGE CLASS: Well drained

PERMEABILITY CLASS: Moderate

FLOODING: Never floods

EROSION: Slump deposits of unknown age (probably following bush clearance) commonly occur. Moderate to severe sheet, rill and mass movement erosion potential on slopes following clearance of forest.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES: Typically soils of clayey texture in which dark brown A horizons overlie both brown and red coloured B horizons. Where 2 subdivisions of the B horizon are observed, the upper part is brown to dark brown (7.5YR hue) and in some profiles, up to 30% of the soil may be of red colours (5YR or 2.5YR hues). The lower B horizons are of reddish colour. The combined thickness of A and B horizons is between 50 and 100 cm.

The C horizon is weathered to reddish brown and pale brown colours. They have clayey textures, firm or friable consistence and lithological features of the parent rock are preserved. Roots penetrate the C horizon.

DIAGNOSTIC HORIZONS: Ochric epipedon, cambic horizon.

RANGE OF PROFILE FEATURES: Visa series have a Ah(Ap), Bw1, Bw2, C horizon sequence.

Soil textures include clays, clay loams, silty clay loams and sandy clay loams. A and B horizons have nut or blocky structures and their consistencies vary from very friable to firm.

A horizons are up to 20 cm thick and are of 7.5YR and 10YR hues.

Upper Bw horizons have dark brown or brown colours of 7.5YR hue and up to 30% of the horizon may be of reddish colour, of 5YR or 2.5YR hues. Lower Bw horizons have reddish colours of 5YR and 2.5YR hues and may include material of 7.5YR hue. In some profiles only a single Bw horizon is identified and includes material of both brownish and reddish colours.

The combined thickness of A and B horizons varies between 50 cm and over 1 m.

VARIANTS: None recognised

SIMILAR SOILS AND DISTINGUISHING FEATURES: Sote series: B horizons are entirely red or yellowish red (5YR and 2.5YR hues).

Lobau series: B horizons are entirely of brownish colours (7.5YR and 10YR hues).

GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES: Strongly to moderately acid soil with % base saturation values varying from medium in the upper horizons to low values at depth. Exchangeable calcium, medium - varying to low; magnesium, high or very high; sodium, medium; and potassium low in topsoils and very low in the subsoils.

The particle size family class is fine.

The mineralogical class is kaolinitic.

LABORATORY Nos: KRS T1425-1428 (inclusive)

SOIL LIMITATIONS: On sloping land subject to moderate to severe erosion where vegetation removed; strong soil acidity; and nutrient deficiencies of phosphorus and nitrogen.

Typifying Profile

SOIL NAME:	Visa soils, steep phase.
PROFILE No.:	N105
SITE LOCATION:	Refer soil map of Nadururloulou Agricultural Research Station (Palmer, 1992). Grid reference - Sheet Viti Levu 4 (1:50 000) 601E 122N.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Planar midslope of a hilly ridge.
PARENT MATERIAL:	Strongly weathered marine sandstone and siltstone.
SLOPE:	32°
ASPECT:	South
ELEVATION:	25 m
MICRORELIEF:	Smooth
SITE VEGETATION:	Grasses
LAND USE:	Unused, site is adjacent to food gardens.
DRAINAGE:	Well drained
EROSION:	No profile evidence, but surface evidence of downslope movement of topsoil in the area.
DISTURBANCE:	Cultivated in the past.
LABORATORY Nos:	KRS 1425-1428 (inclusive)

PROFILE DESCRIPTION

Ap	0-11 cm (11 cm)	Brown to dark brown (7.5YR 4/4) clay; friable; stickly; plastic; moderately developed fine nut structure; a few small strongly weathered stones; many fine roots; indistinct wavy boundary,
Bw1	11-30 cm (19 cm)	Strong brown (7.5YR 4/6) clay; friable; sticky; plastic; moderately developed fine nut structure; a few small and medium sized strongly weathered stones; many fine roots; indistinct irregular boundary,
Bw2	30-60 cm (30 cm)	strong brown (7.5YR 5/6) and yellowish red (5YR 5/8) clay loam; friable; sticky; plastic; moderately developed fine nut structure; a few small and medium sized strongly weathered stones; few fine roots; distinct irregular boundary,
C	60-100 cm (40+ cm)	Yellowish red (5YR 5/8), red (2.5YR 4/8) and very pale brown (10YR 7/4) clay loam; firm; massive; this horizon is very strongly weathered parent rock and has numerous iron/manganese oxide veins up to 5 mm thick along former fracture and joints in the rock; a few fine roots.

Note: Bw2 horizon absent in some parts of pit.

Visa

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Vitawa series**

REFERENCE: Vitawa steepland sandy stony clay (93a) defined by Twyford & Wright (1965) as steepland soils formed under a climate with a strong dry season from acid andesite and dacite rocks.

Forms part of the Vitawa set.

The central concept as defined for Vitawa soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Typic Haplustalf, fine, smectitic, isohyperthermic
(b) FAO: Orthic Luvisol
(c) Twyford and Wright: Steepland soil associated with red yellow podzolic soils with a strong dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Vitawa soils, moderately steep phase (163F)
Vitawa soils, steep phase (163G)
Vitawa soils, very steep phase (163H)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Vitawa soils are developed on the Vitawa hills west of Rakiraki in northern Viti Levu.
PARENT ROCK:	Acid andesite or dacite.
PARENT MATERIAL:	Shallow colluvium over strongly weathered *in situ* rock.
PHYSIOGRAPHIC POSITION/LANDFORM:	Planar and convex backslopes and midslopes in moderate and strongly dissected hill country.
SLOPE CLASS AND RANGE OF SLOPES:	Moderately steep (21-26°), steep (27-35°), and very steep (>35°).
VEGETATION AND LAND USE:	Unused or used for extensive grazing (gasau dominant pasture). Elsewhere planted in *Pinus caribaea*.
RANGE OF ELEVATION:	30-250 m
RAINFALL:	Annual average range: 1,800-2,400 mm; dry season range: 400-500 mm; wet season range: 1,400-1,800 mm.
TEMPERATURE:	Mean annual: 25.5°C.
SOIL MOISTURE REGIME:	Ustic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Moderately well drained.
PERMEABILITY CLASS:	Moderate
FLOODING:	Never floods
EROSION:	Have suffered some past erosion due to repeated burning. Have moderate to severe sheet and rill erosion potential.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 10 cm of very dark greyish brown clay loam of strongly developed medium nut structure with crumb, and very friable, overlying 12 cm of strong brown and dark brown clay loam, of weak to moderately developed nut with granular structure, friable, and commonly with a few stones, overlying 20 cm of strong brown stony clay loam, of weakly developed blocky structure breaking to crumb with yellowish red clay cutans to peds, overlying 30 cm of yellowish red silty clay loam, of massive structure breaking to crumb and single grain, friable to firm, with many stones and clay cutans to peds on massive varicoloured *in situ* rock.
DIAGNOSTIC HORIZONS:	Ochric epipedon, argillic horizon.
RANGE OF PROFILE FEATURES:	Not applicable. Only 2 profile descriptions made.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analyses show the soil to be strongly acid 0-23 cm and slightly acid pH below this; carbon and nitrogen values are low in the A horizon and have very low values in all other horizons; available phosphorus is very low; % base saturation is very high; CEC is high; exchangeable magnesium is extremely high; sodium is medium; exchangeable calcium is medium in the A horizon and of low values in other horizons; and potassium is low 0-23 cm and very low below this. The particle size family class is fine. The mineralogical class is smectitic.
LABORATORY Nos:	USP NB15A-E
SOIL LIMITATIONS:	Past sheet erosion resulting in relatively thin topsoils; slope; very severe soil moisture deficits during the dry season; moderate to severe sheet and rill erosion potential; strong soil acidity in surface horizons; and nutrient deficiencies of nitrogen, phosphorus and potassium.

Typifying Profile

SOIL NAME:	Vitawa soils, moderately steep phase.
PROFILE No.:	NB15
SITE LOCATION:	PSP P74/1/5 Nabou Forest, Nadroga Province.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Convex midslope in strongly dissected hill country.
PARENT MATERIAL:	Colluvium over strongly weathered *in situ* acid andesite.
SLOPE:	25°, length 75 m
ASPECT:	South-west
ELEVATION:	80 m
MICRORELIEF:	Flat
SITE VEGETATION:	Mission grass, Miscenthus and guava under 8 year old *Pinus caribaea*.
LAND USE:	Exotic forestry
DRAINAGE:	Moderately well drained.
EROSION:	Past slight sheet erosion.
DISTURBANCE:	Erosion in part of the surface horizon.
LABORATORY Nos:	USP NB15A-E

PROFILE DESCRIPTION

Vitawa soils, moderately steep phase

Ah	0-11 cm (11 cm)	Slightly moist; moist very dark greyish brown (10YR 3/2), rubbed dark brown (10YR 3/3) clay loam; strongly developed medium nut structure with moderate fine and medium crumb structure; very friable; slightly sticky; non-plastic; many medium roots; distinct smooth boundary,
ABt	11-23 cm (12 cm)	Slightly moist; moist 50% strong brown (7.5YR 5/6) 50% dark brown (7.5YR 3/2) rubbed dark brown (7.5YR 3/2) clay loam; weak to moderately developed nut structure with weak fine granular and crumb structure; friable; slightly sticky; non-plastic; many medium roots; few strongly weathered subrounded stones; indistinct smooth boundary,
Bt1	23-43 cm (20 cm)	Slightly moist; moist strong brown (7.5YR 5/8) and rubbed dark brown (7.5YR 4/4) stony clay loam; weakly developed medium blocky structure breaking to weak medium crumb structure; friable; slightly sticky; non-plastic; few faint yellowish red (5YR 4/6) clay coatings; common medium and coarse roots; many strongly weathered subangular stones; indistinct smooth boundary,
Bt2	43-75 cm (32 cm)	Slightly moist; moist 50% yellowish red (5YR 5/8) 50% yellowish red (5YR 4/6) and rubbed yellowish red (5YR 4/8) stony silty clay loam; massive breaking to single grain; friable to firm; non-sticky; non-plastic; common distinct yellowish red (5YR 4/6) clay coatings to stones; common fine and medium roots; profuse strongly weathered angular stones (fractured *in situ* rock); sharp wavy boundary,

C	75-105 cm+ (30 cm+)	Slightly moist; moist 85% white (5YR 8/1) 15% yellowish red (5YR 5/8) and rubbed very pale brown (10YR 7/4) fine sandy clay loam; massive breaking to single grain; friable to firm; non-sticky; non-plastic; common prominent yellowish red (5YR 4/6) clay coatings to rock fissures; few fine roots; *in situ* rock.

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Volivoli series**

REFERENCE: The Volivoli sand (3a) defined by Twyford & Wright (1965) as a recent soil developed on stabilized dunes of high quartz content under a climate with a moderate to strong dry season.

Forms part of the Volivoli set.

This central concept for Volivoli series is retained for this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Ustic Humitropept, sandy, siliceous, isohyperthermic
(b) FAO: Humic Cambisol
(c) Twyford and Wright: Recent soil from brownish sands of high quartz content with a strong to moderate dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Volivoli soils, flat to gently undulating phase (11A)
Volivoli soils, undulating phase (11B)
Volivoli soils, easy rolling phase (11C)
Volivoli soils, rolling phase (11D)
Volivoli soils, strongly rolling phase (11E)
Volivoli soils, moderately steep phase (11F)
Volivoli soils, steep phase (11G)
Volivoli soils, very steep phase (11H)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION: Developed on material brought down by the Sigatoka river and deposited in the open sea, and which the prevailing winds and currents have driven ashore west of the river mouth.

PARENT ROCK: Rocks of a high quartz content.

PARENT MATERIAL: Coarse textured sediments derived predominantly from rocks of acidic composition.

PHYSIOGRAPHIC POSITION/LANDFORM: Easy rolling stabilized sand dunes. Slopes predominantly convex.

SLOPE CLASS AND RANGE OF SLOPES: All slope classes from flat to gently undulating (0-3°) to very steep (>35°).

VEGETATION AND LAND USE: Extensively cultivated for kumala, peanuts and sugar cane.

RANGE OF ELEVATION: 2-10 m

RAINFALL: Annual average range: 1,800-2,400;
dry season range: 400-500 mm;
wet season range: 1,400-1,800 mm.

TEMPERATURE: Mean annual: 25.5°C.

SOIL MOISTURE REGIME: Ustic

SOIL TEMPERATURE REGIME: Isohyperthermic

SOIL DRAINAGE CLASS: Somewhat excessively drained.

PERMEABILITY CLASS: Very rapid

FLOODING: Never floods

EROSION: Slight wind and sheet erosion at times of cultivated fallow.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 15 cm of very dark greyish brown coarse sand, of very weakly developed medium nutty structure or single grain, and loose overlying 60 cm of dark brown quartzose coarse sand, of single grain and loose consistence, overlying more than 70 cm of dark yellowish brown coarse sand, of single grain and very friable consistence.
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Not applicable. Only 2 profile descriptions made.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Slightly acid soils; nitrogen and carbon values are very low and the C/N ratio is high; % base saturation is medium; values for CEC and exchangeable calcium, magnesium and sodium are low, with very low values for potassium. The particle size family class is sandy. The mineralogy class is siliceous.
LABORATORY Nos:	KRS D1748-1749 (inclusive)
SOIL LIMITATIONS:	Somewhat excessively drained, very low water holding capacities such that severe soil moisture deficits are experienced during the dry season, thin embryonic topsoils, a susceptibility to wind erosion (saltation) and sheet erosion when cultivated on slopes >2°. Have very low organic matter status, nutrient deficiencies of potassium and nitrogen.

Typifying Profile

SOIL NAME:	Volivoli soils, flat to gently undulating phase.
PROFILE No.:	SC1
SITE LOCATION:	0.5 km due west of Vunavutu village west of the Sigatoka River.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Convex backslope on stabilized sand dune.
PARENT MATERIAL:	Weakly weathered quartz rich dune sands.
SLOPE:	3°
ASPECT:	North
ELEVATION:	5 m
MICRORELIEF:	Smooth
SITE VEGETATION:	Kumala
LAND USE:	Intensive market gardening.
DRAINAGE:	Somewhat excessively drained.
EROSION:	None observed
DISTURBANCE:	Cultivated
LABORATORY Nos:	KRS D1748-1749 (inclusive)

PROFILE DESCRIPTION

Ap	0-15 cm (15 cm)	Dry; moist very dark greyish brown (10YR 3/2) coarse sand; loose to very friable; single grain; many fine fibrous roots; indistinct smooth boundary,
BC1	15-76 cm (61 cm)	Dry; moist dark brown (10YR 3/3) coarse sand; single grain; common fine fibrous roots in upper 15 cm; distinct smooth boundary,
BC2	76-150 cm+	Slightly moist; moist dark yellowish brown (10YR 3/4) coarse sand; very friable; single grain.

Volivoli

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Vuna series**

REFERENCE: Vuna rocky stony clay loam (23b) and Vuna hill soils (23bH) defined by Twyford & Wright (1965) as latosolic soils from young bouldery olivine basalt flows developed under a climate with a weak dry season. Forms part of the Waiqere set.

The central concept for Vuna soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Typic Fluvudand, medial over medial-skeletal, isohyperthermic
(b) FAO: Stony Vitric Andosol
(c) Twyford and Wright: Latosolic soil with a weak dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Vuna soils, easy rolling phase (85C)
Vuna soils, rolling phase (85D)
Vuna soils, strongly rolling phase (85E)
Vuna soils, moderately steep phase (85F)
Vuna soils, steep phase (85G)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION: Occurs in southwestern Taveuni on the leeward side of the island from Nasinu Estate to South Cape. A small area occurs near Nasau Estate northeastern sector of the island.

PARENT ROCK: Basalt

PARENT MATERIAL: Weakly weathered *in situ* subrecent bouldery 'aa' lava.

PHYSIOGRAPHIC POSITION/LANDFORM: Uneven lava surfaces of the volcanic ringplains.

SLOPE CLASS AND RANGE OF SLOPES: All slope classes from easy rolling (8-11°) through to steep (26-35°).

VEGETATION AND LAND USE: Mainly used for coconuts with undergrazing for beef cattle.

RANGE OF ELEVATION: 0-600 m

RAINFALL: Annual average range: 3,000-5,200 mm;
dry season range: 800-3,000 mm;
wet season range: 2,000-3,200 mm.

TEMPERATURE: Mean annual: 24°C.

SOIL MOISTURE REGIME: Udic/perudic

SOIL TEMPERATURE REGIME: Isohyperthermic

SOIL DRAINAGE CLASS: Well drained to somewhat excessively drained.

PERMEABILITY CLASS: Rapid

FLOODING: Never floods

EROSION: Slight to moderate sheet erosion potential on slopes >11°.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Mostly have a rocky and very bouldery surface. The profile typically shows 25 cm of black very friable stony and bouldery clay loam, of strongly developed granular structure, overlying 30 cm of dark brown very friable bouldery loamy medium sand on 60 cm or more broken basalt rock and boulders with some soil material in the interstices. The fine earth fraction is non-plastic and non-sticky but smeary when moist.
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Not applicable. Profiles show little variation to that described above.
VARIANTS:	Natobu series (Umbric Vitrandept, ashy-skeletal, isohyperthermic) defined in the detailed soil survey of Tutu Estate (Shepherd & Neall 1975) as an extremely bouldery soil with a thin very friable black gravelly very fine sandy loam topsoil with abundant to profuse subangular stones and boulders overlying very dark greyish brown and dark brown loose gravelly coarse sand, of single grain structure and with profuse stones and boulders, over dark brown loose stony very coarse sand with profuse angular boulders.
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analysis shows the soil to be slightly acid; organic carbon is medium in the topsoil (0-20 cm) and of low value below; low available phosphorus and very high phosphorus retention; % base saturation medium; CEC very high in the topsoil and medium below; exchangeable calcium and magnesium are high in the topsoil and medium below; and potassium is low in the topsoil and very low below it. The particle size family class is medial over medial-skeletal.
LABORATORY Nos:	USP TAV102A-B
SOIL LIMITATIONS:	Slope; bouldery and rocky ground surface making mechanical cultivation impossible; profile boulders and stoniness; rapid permeability; low available phosphorus and high phosphorus fixation; and low potassium.

Typifying Profile

SOIL NAME:	Vuna soils, easy rolling phase.
PROFILE No.:	TAV102
SITE LOCATION:	Vuna district, South Taveuni Island. 100 m north of coast road, halfway between Vatawiri and Kanacea.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Undulating topography on volcanic ringplain.
PARENT MATERIAL:	Weakly weathered basaltic 'aa' lava.
SLOPE:	9°
ASPECT:	South
ELEVATION:	8 m
MICRORELIEF:	Uneven, boulders on the surface.
SITE VEGETATION:	Coconut plantation, with ground cover of mile-a-minute, small crabgrass and ferns (Niphrolapsis sp.).
LAND USE:	Coconut (copra) production with undergrazing (beef cattle).
DRAINAGE:	Well drained
EROSION:	None observed
DISTURBANCE:	None observed
LABORATORY Nos:	USP TAV102A-B
COMMENTS:	NaF reaction: strong for all horizons.

PROFILE DESCRIPTION

Ah1	0-27 cm (27 cm)	Moist; black (10YR 2/1 stony clay loam; strongly developed medium granular structure; very friable; slightly sticky; common medium fibrous roots with a few large woody roots; many boulders (subangular and elongated) on surface and throughout the horizon; distinct smooth boundary,
Ah2	27-60 cm (33 cm)	Moist; dark brown (10YR 3/3) loamy medium sand with some grits and a few boulders; weakly developed medium granular structure; very friable; non-sticky; slightly smeary when wet; few large fibrous roots; diffuse smooth boundary,
C	60+ cm	Moist; broken basalt fragments (>10 cm diameter) with traces of soil, material in intersticies; basaltic material is dense and non-vesicular.

Vuna

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Vunatoto series**

REFERENCE: Vunatoto steepland sandy clay(92b) defined by Twyford and Wright(1965) as formed from granite under a climate with a moderate dry season.

Forms part of the Sarowaqa set.

The central concept for Vunatoto soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Typic Eutropept, coarse-silty, mixed, isohyperthermic
(b) FAO: Eutric Cambisol
(c) Twyford and Wright: Steepland soil related to or associated with red-yellow podzolic soils with a moderate dry season.

INCLUDED MAPPING UNITS AND PHASES:

Vunatoto soils, rolling phase (162D)
Vunatoto soils, strongly rolling phase (162E)
Vunatoto soils, moderately steep phase (162F)
Vunatoto soils, steep phase (162G)
Vunatoto soils, very steep phase (162H)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Vunatoto soils occur on the road from Nadi to the Nausori highlands and in the upper Sigatoka valley about the Lato Creek.
PARENT ROCK:	Granite and silicified marls.
PARENT MATERIAL:	Moderately weathered *in-situ* rock.
PHYSIOGRAPHIC POSITION/LANDFORM:	Planar and convex surfaces occupying most slope positions in steep country.
SLOPE CLASS AND RANGE OF SLOPES:	Rolling (12-15°), strongly rolling (16-20°), moderately steep(21 - 25°), steep (26 - 35°) and very steep (35°).
VEGETATION AND LAND USE:	Formally used for subsistence food gardens followed by long fallows but now rarely used except for rough grazing. Burnt frequently.
RANGE OF ELEVATION:	30-600 m
RAINFALL:	Annual average range: 2,000-3,000 mm; dry season range: 700-1,200 mm; wet season range: 1,400-2,500 mm.
TEMPERATURE:	Mean annual: 24.5°C.
SOIL MOISTURE REGIME:	Udic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Well drained
PERMEABILITY:	Moderate
FLOODING:	Never floods
EROSION:	Moderate to severe sheet and rill erosion potential.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 30cm of very dark greyish brown very friable clay loam of strong fine nut structure overlying 30cm of dark yellowish brown and yellowish red very firm bouldery clay of weak medium nut structure, with profuse strongly weathered subrounded boulders on vari coloured (dark yellowish brown, black and pale yellow) *in-situ* bouldery clay parent material.
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
TYPIFYING PROFILE:	VS 29
RANGE OF PROFILE FEATURES:	Not applicable. Only 2 profile descriptions available.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Soil chemistry reasonable except for low phosphorus. Soil physical status is spoilt by a rather high silt content.
LABORATORY NOS:	FACL 9411758 - 9411759
SOIL LIMITATIONS:	Only the excessive slope, dryness and low phosphorus level, apart from erosion hazard due to silt over 50% content.

Typifying Profile

SOIL NAME:	Vunatoto soils, moderately steep phase.
PROFILE NO:	VS 29
SITE LOCATION:	Balenabelo, Nadroga, West bank of main river 2.5km NE of Vatukarasa bridge .

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Convex midslope in steepland.
PARENT MATERIAL:	*In-situ* marl
SLOPE:	25°
ASPECT:	South-west
ELEVATION:	168 m
MICRORELIEF:	Undulations from small land slippages.
SITE VEGETATION:	Mission grass, reeds, vaivai.
LAND USE:	Rough grazing
DRAINAGE:	Well drained
EROSION:	Minor soil creeps.
DISTURBANCE:	Small slips and rocks.
LABORATORY NOS.:	FACL 9411758, 9411759

PROFILE DESCRIPTION

Ah	0 -30cm (30 cm)	Moist; very dark greyish brown (10YR 3/2) clay loam; strongly developed very fine nut structure; very friable; slightly sticky; non plastic; abundant fine roots; sharp irregular boundary,
B*w*	30 - 60cm (30 cm)	Moist; dark yellowish brown(10YR 3/4) and yellowish red (5YR4/6) bouldery silt loam; weakly developed medium nut structure; sticky; slightly plastic; very firm; abundant fine roots; profuse strongly weathered subrounded boulders; diffuse irregular boundary,
BC	60 - 120cm+ (60 cm)	Moist; dark yellowish brown(10YR 3/4) black (10YR 2/1) and pale yellow(5Y 8/3) bouldery silt loam; profuse strongly weathered boulders, i.e. weathered *in-situ* rock.

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Vunavutu series**

REFERENCE: New soil series introduced to include finer textured soils mapped in association with Volivoli series within a dune complex. Previously included with the Volivoli sand (3a) defined by Twyford & Wright (1965) but separated in this survey on the basis of higher clay content, mixed parent materials i.e. not exclusively from quartz sands, and better profile development.

Name derived from Vunavutu village on the west bank of the Vatueta tributary of the Sigatoka River 1 km due south of Sigatoka township.

CLASSIFICATION:

(a) Soil Taxonomy: Udic Haplustoll, loamy, mixed, isohyperthermic
(b) FAO: Haplic Kastanozem
(c) Twyford and Wright: Recent soil from coastal sands and alluvium with a strong dry season

INCLUDED MAPPING UNITS AND SYMBOLS:
Vunavutu soils (12)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Small area within the sand dune complex SW of Sigatoka township.
PARENT ROCK:	Acid rocks and calcareous siltstones and marls.
PARENT MATERIAL:	Mixed parent material comprising medium textured quartz-rich sediments and fine alluvia from calcareous rocks.
PHYSIOGRAPHIC POSITION/LANDFORM:	New flat planar swales within the sand dune complex.
SLOPE CLASS AND RANGE OF SLOPES:	Near flat (0-1°).
VEGETATION AND LAND USE:	Predominantly in sugar cane.
RANGE OF ELEVATION:	2-5 m
RAINFALL:	Annual average range: 1,800-2,400 mm; Dry season range: 400-500 mm; Wet season range: 1,400-1,800 mm.
TEMPERATURE:	Mean annual: 25.5°C.
SOIL MOISTURE REGIME:	Ustic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Well drained
PERMEABILITY CLASS:	Medium
FLOODING:	Floods annually during high intensity storms during the wet season. Water may pond for up to 7 days at these times.
EROSION:	No erosion risk.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 30 cm of black silty clay, of strongly developed coarse granular and medium blocky structure, firm, and sticky moist, overlying 45 cm of very dark greyish brown very fine sandy clay loam, of weakly developed prismatic structure breaking to strong blocky, firm, and sticky moist, overlying more than 50 cm of dark brown sandy clay, of strongly developed coarse blocky structure, firm and sticky.
DIAGNOSTIC HORIZONS:	Mollic epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Not applicable. Only 2 profile descriptions made.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Only the topsoil was sampled. It has near neutral pH. Organic carbon value is medium, nitrogen low and C/N ratio high. % base saturation is very high, CEC is high, exchangeable calcium and magnesium very high and sodium and potassium values medium. Particle size family class is loamy. The mineralogical class is mixed.
LABORATORY Nos:	KRS D2882
SOIL LIMITATIONS:	Susceptibility to short duration flooding during the wet season due to topographical position, high clay content that may cause difficulties in attaining a fine tilth due to the montmorillonitic clays i.e. tend to form coarse blocky aggregates on drying out. Have nitrogen deficiencies.

Typifying Profile

SOIL NAME:	Vunavutu soils
PROFILE No.:	SC3
SITE LOCATION:	300 m due west of Koromumu hospital 2 km along Queens Road from Sigatoka.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Planar floor of swale within dune complex.
PARENT MATERIAL:	Fine textured alluvium derived from calcareous rocks mixed with and overlying coarse textured quartz-rich dune sands.
SLOPE:	0°
ASPECT:	Not applicable
ELEVATION:	3 m
MICRORELIEF:	Smooth
SITE VEGETATION:	Sugar cane
LAND USE:	Intensive cane cropping.
DRAINAGE:	Well drained
EROSION:	None
DISTURBANCE:	Cultivated
LABORATORY Nos:	KRS D2882

PROFILE DESCRIPTION

Ah	0-30 cm (30 cm)	Moist; black (10YR 2/1) silty clay; firm; sticky; slightly plastic; strongly developed coarse granular and medium blocky structure; abundant fine fibrous roots; indistinct smooth boundary,
Bw1	30-76 cm (46 cm)	Moist; very dark greyish brown (10YR 3/2) very fine sandy clay loam; firm; sticky; slightly plastic; weakly developed medium prismatic structure breaking to strongly developed coarse blocky structure; indistinct smooth boundary,
Bw2	76-125 cm+ (49 cm+)	Moist; dark brown (10YR 3/3) sandy clay; firm; sticky; slightly plastic; strongly developed coarse blocky structure.

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Vunibau series**

REFERENCE: Vunibau loamy sand (3b) defined by Twyford & Wright (1965) as a recent soil from non-calcareous brownish sands of high quartz content developed on dunes and on the sand cays and bars under a climate with a weak dry season.

Forms part of the Volivoli set.

This control concept for Vunibau soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Typic Humitropept, sandy, siliceous, isohyperthermic
(b) FAO: Humic Cambisol
(c) Twyford and Wright: Recent soil from coastal sands with a weak dry season

INCLUDED MAPPING UNITS AND SYMBOLS:
Vunibau soils (9)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Vanibau soils are the counterpart of Volivoli soils in the wetter districts, mainly at the mouths of the Rewa and Navua rivers.
PARENT ROCK:	Rocks of acidic composition.
PARENT MATERIAL:	Deep quartzose dune sands.
PHYSIOGRAPHIC POSITION/LANDFORM:	Coastal dune and swale topography with an amplitude of 100-200 cm.
SLOPE CLASS AND RANGE OF SLOPES:	Flat to gently undulating (0-3°).
VEGETATION AND LAND USE:	Its main natural vegetation is littoral trees, like Barringtonia species. Elsewhere and predominant are inferior grasses and miscellaneous weeds and shrubs.
RANGE OF ELEVATION:	0.5-4 m
RAINFALL:	Annual average range: 3,200-4,800mm; dry season range: 800-1,600 mm; wet season range: 1,800-2,800 mm.
TEMPERATURE:	Mean annual: 24°C.
SOIL MOISTURE REGIME:	Udic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Very well drained.
PERMEABILITY CLASS:	Rapid
FLOODING:	Never floods
EROSION:	No erosion risk.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 15 cm of very dark greyish brown friable sandy loam, of moderately developed coarse granular structure with single grain, overlying 40 cm of brown to dark brown very friable loamy sand, of weakly developed medium blocky structure with single grain, overlying 70 cm of light yellowish brown loose sand, of single grain and with humus staining, overlying yellowish brown humus stained loose sand.
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Not applicable. Only 2 profile descriptions made.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analysis shows the soil reaction moderately acid to 125 cm becoming slightly acid below this; organic carbon is low in the topsoil (0-15 cm) and very low in the other horizons; nitrogen is very low; available phosphorus is low; % base saturation is low to 125 cm becoming high below this depth; CEC is medium in the topsoil becoming low below this; calcium and sodium show low values; potassium very low and magnesium is medium in the topsoil and below 125 cm and of low values in the other horizons. The particle size family class is sandy. The mineralogical class is siliceous.
LABORATORY Nos:	KRS D334-337
SOIL LIMITATIONS:	Rapid permeability, low waterholding capacity due to weak soil structures and sandy textures; may experience soil moisture deficits during the months May to October; moderate soil acidity; and nutrient deficiencies of nitrogen, potassium and phosphorus.

Typifying Profile

SOIL NAME:	Vunibau soils
PROFILE No.:	D029
SITE LOCATION:	Deuba Beach 500 m west of Deuba River mouth.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Fossil beach strand. Level top of low sandy ridge surrounded by level to gently undulating peat land.
PARENT MATERIAL:	Quartz rich dune sands.
SLOPE:	Flat
ASPECT:	Not applicable
ELEVATION:	2 m
MICRORELIEF:	Smooth
SITE VEGETATION:	Bush fallow - Vau, Guava etc.
LAND USE:	No evidence of recent use.
DRAINAGE:	Very well drained to the water table (at 155 cm).
EROSION:	None observed
DISTURBANCE:	None
LABORATORY Nos:	KRS D334-337

PROFILE DESCRIPTION

Ap	0-15 cm (15 cm)	Dry; moist very dark greyish brown (10YR 3/2) sandy loam; moderately developed coarse granular structure with some single grain; friable; many medium and coarse fibrous roots; indistinct smooth boundary,
Bw	15-51 cm (36 cm)	Dry; moist brown to dark brown (10YR 4/3) loamy sand; weakly developed medium blocky structure with single grain; very friable; common fine fibrous roots; diffuse smooth boundary,
C1	51-125 cm (74 cm)	Dry; moist light yellowish brown (10YR 6/4) sand; single grain; loose; humus staining; indistinct smooth boundary,
C2	125-160 cm+ (35 cm)	Moist; yellowish brown (10YR 5/4) sand; single grain; loose; some humus staining; iron staining along fossil root channels.

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Vunicibicibi series**

REFERENCE: New soil series introduced in this survey to include strongly weathered soils from *in-situ* basic rocks developed on plateaux with a Talasiga vegetation under a climate with a strong dry season. Previously included with Bua soils (35c) as defined by Twyford and Wright (1965) but separated on the basic of not having an argillic horizon (Vunicibicibi series have an oxic horizon) and having less red hues throughout all profiles.

Named from Vunicibicibi Estate near Dreketi, Bua province, Vanua Levu.

CLASSIFICATION:

(a) Soil Taxonomy: Anionic Acrustox, clayey, ferruginous, isohyperthermic
(b) FAO: Rhodic Feralsol
(c) Twyford and Wright: Ferruginous latosol with a strong dry season

INCLUDING MAPPING UNITS AND PHASES:

Vunicibicibi soils, flat to gently undulating phase (41A)
Vunicibicibi soils, undulating phase (41B)
Vunicibicibi soils, easy rolling phase (41C)
Vunicibicibi soils, rolling phase (41D)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	In association with Bua soils, Vunicibicibi soils develop over wide areas on the dry zones of both Viti Levu and Vanua Levu. In the latter island they are found throughout the lowlands of Macuata province and the northern part of Bua province.
PARENT ROCK:	Basalts and basic andesites.
PARENT MATERIAL:	Strongly weathered *in-situ* rock.
PHYSIOGRAPHIC POSITION/LANDFORM:	Planar flat surfaces and backslopes in gently undulating and rolling weakly dissected plateaux.
SLOPE CLASS AND RANGE OF SLOPES:	Flat to gently undulating (0-3°), undulating (4-7°), easy rolling (8-11°), and rolling (12-15°).
VEGETATION AND LAND USE:	Normally supports a talasiga vegetation of ferns and nokonoko. With fertilizer inputs used for sugarcane, pigeon pea and rainfed rice.
RANGE OF ELEVATION:	20-200 m
RAINFALL:	Annual average range: 1,800-2,400 mm; dry season range: 400-500 mm; wet season range: 1,400-1,800 mm.
TEMPERATURE:	Mean annual: 25.5°C.
SOIL MOISTURE REGIME:	Ustic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Well drained
PERMEABILITY CLASS:	Moderately rapid
FLOODING:	Never floods
EROSION:	Have experienced severe sheet and rill erosion in the past. Severe to very severe sheet and rill erosion potential on slopes >3°.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 17 cm of dark brown very friable gritty silt loam, of strong fine nut with some crumb structure, overlying 50 cm of strong brown friable to firm clay loam, of weak to moderate medium blocky structure breaking to crumb, over 75 cm or more of yellowish-red friable to firm clay loam, of weak to moderate medium blocky structure breaking to crumb. Most horizons have a few weakly weathered fine ironstone gravels.
DIAGNOSTIC HORIZONS:	Ochric epipedon, oxic horizon.
RANGE OF PROFILE FEATURES:	Not applicable. Only two profile descriptions made.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analysis shows the soil to be neutral in the topsoil, strongly acid below it and to be of variable charge. Prior to cultivation the Talasiga vegetation had been burnt in the area of the site and this is reflected in the anomalous chemistry for the topsoil (0-17 cm) viz, medium values for TEB and CEC, medium and high values for bases in particular potassium, and very high total phosphorous values on the topsoil. Subsoils show very low TEB and CEC values; very low values for all bases though % base saturation is very high throughout - though somewhat irrelevant in view of extremely low CEC's; and % aluminium saturation is most significant in the exchange complex in the subsoils.
LABORATORY Nos:	Q. DPI 11715-11717
SOIL LIMITATIONS:	Moderately rapid permeability; severe soil moisture deficits experienced during the dry season; moderate past sheet erosion and severe sheet and rill erosion potential; very strong acidity; variable charge; aluminium toxicity; and a low nutrient reserve that would be rapidly depleted under a cropping regime.

Typifying Profile

SOIL NAME:	Vunicibicibi soils
PROFILE No.:	NDLC 07
SITE LOCATION:	NLDC pigeon pea estate, Nasarowaqa, Bua province, Vanua Levu.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Convex crest position on slope of 200 m length on a weakly dissected plateau.
PARENT MATERIAL:	Strongly weathered basaltic rock.
SLOPE:	1°
ASPECT:	South
ELEVATION:	35 m
MICRORELIEF:	Smooth
SITE VEGETATION:	Pigeon pea (4 weeks old).
LAND USE:	Intensive mechanized pigeon pea cultivation.
DRAINAGE:	Well drained
EROSION:	Has experienced severe sheet erosion in the past.
DISTURBANCE:	Cultivated
LABORATORY Nos:	Q. DPI 11715-11717

PROFILE DESCRIPTION

Vunicibicibi soils

Ap	0-17 cm (17 cm)	Dry; dark brown (10YR 3/3) gritty silt loam; strongly developed fine nut structure; very friable; non sticky; non plastic; no roots; few unweathered subangular gravels; sharp smooth boundary,
Bw1	17-67cm (50 cm)	Slightly moist; strong brown (7.5YR 5/6) clay loam; weak to moderately developed medium blocky structure breaking to moderate fine and medium crumb structure; friable to firm; slightly sticky; non plastic; no roots; few unweathered subangular gravels; diffuse smooth boundary,
Bw2	67-142+ cm (75 cm+)	Slightly moist; yellowish-red (5YR 4/6) clay loam; weak to moderately developed medium blocky structure breaking to weak fine crumb structure; friable to firm; non sticky; non plastic; no roots.

Vunicibicibi

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Vunilagi series**

REFERENCE: A new soil series introduced in this study to include poorly drained soils with high water tables developed from 60-70 cm of dark brown clayey estuarine alluvium over shells and coral fragments.

Previously included with Dogo soils (55b) as defined by Twyford & Wright (1965) and closely correlates with Dogodamu or the reddish brown Dogo soil (56d) but differs in having dark brown grading to yellowish brown clays over coral fragments and shells at approximately 70 cm.

Name from Vunilagi Estate, Vanua Levu.

CLASSIFICATION:

(a) Soil Taxonomy: Typic Argiaquoll, clayey over loamy-skeletal, mixed, isohyperthermic
(b) FAO: Gleyic Phaeozem
(c) Twyford and Wright: Saline soil of the marine marsh

INCLUDED MAPPING UNITS AND SYMBOLS:
Vunilagi soils (15)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Vunilagi soils are of minor extent and occur in the wetter zones where the beach strand is wide, beach rock has often developed and estuarine alluvium and coralline materials are evenly mixed.
PARENT ROCK:	Basaltic andesite and reef coral.
PARENT MATERIAL:	Fine estuarine alluvium over coral fragments and shells.
PHYSIOGRAPHIC POSITION/LANDFORM:	Generally flat shallow depression on the coastal margins.
SLOPE CLASS AND RANGE OF SLOPES:	Flat to near level (0-2°).
VEGETATION AND LAND USE:	Generally under coconuts with undergrazing for cattle.
RANGE OF ELEVATION:	0.5-1.5 m
RAINFALL:	Annual average range: 3,200-4,800mm; dry season range: 800-1,600mm; wet season range: 1,800-2,800 mm.
TEMPERATURE:	Mean annual: 25.5°C
SOIL MOISTURE REGIME:	Aquic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Poorly drained
PERMEABILITY CLASS:	Slow
FLOODING:	Flooding occurs during high spring tides and from the overflow of creeks during high intensity storms.
EROSION:	None observed

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 15 cm of dark brown friable clay, of weakly developed medium blocky structure breaking to crumb overlying 14 cm of dark brown friable clay, of weakly developed medium blocky structure breaking to fine and very fine nut, overlying yellowish brown firm clay, of moderately developed medium blocky breaking to fine nut, with distinct clay and organic cutans to peds, overlying 25 cm of dark brown firm clay, of moderately developed medium and coarse blocky structure, with weathered gravels, coral shells and fragements and distinct dark brown clay cutans to peds, overlying dark greyish brown massive and friable dark greyish brown clay loam, with weakly weathered gravels, coral fragments and shells.
DIAGNOSTIC HORIZONS:	Mollic epipedon, argillic horizon.
RANGE OF PROFILE FEATURES:	Not applicable. Only 2 profile observations made.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Slightly alkaline in the Ah1 horizon and moderately alkaline in the underlying horizons; very low available phosphorus; organic carbon is medium in the Ah horizons, low in the Bt1 and C horizons, and very low in the Bt2; nitrogen is medium in the Ah and Bt1 horizons and low in the Bt2; exchangeable calcium is very high throughout the profile, magnesium is very high in all horizons except the Bt2 where it is high, potassium is medium in the Ah and Bt1 horizons and low in the remaining horizons, and sodium is very high throughout the profile; the TEB, % base saturation and CEC are very high throughout the profile; the sodium exchange ratio (SAR) varies from 2.07-3.15 and the % exchangeable sodium (ESP) varies from 5.87-12.89. The particle size family class is clayey over loamy-skeletal. The mineralogical class is mixed.
LABORATORY Nos:	KRS S2087-2091
SOIL LIMITATIONS:	Vunalagi series require drainage due to the comparatively high water table which is within 60 cm of the surface; flood damage during high spring tides and overflow from creeks during high intensity storms; soil salinity (via groundwater) causing sodium toxicity; nutrient deficiencies of nitrogen phosphorus and potassium; moderately alkalinity that may cause trace element deficiencies or imbalances; and the clayey textures and blocky structures that are not conducive to attaining a fine seed bed.

Typifying Profile

SOIL NAME:	Vunilagi soils
PROFILE No.:	V6
SITE LOCATION:	Approximately 30 m west of the north/south trending Vunilagi Estate road and midway Hibiscus Highway and coast.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Low lying gently grading depression.
PARENT MATERIAL:	From estuarine alluvium derived from basaltic andesite over coral fragments and shell beds.
SLOPE:	Flat surface
ASPECT:	Not applicable
ELEVATION:	1 m
MICRORELIEF:	Planar surface with smooth microrelief.
SITE VEGETATION:	Coconuts and pasture species.
LAND USE:	Coconut plantation (copra) and grazing.
DRAINAGE:	Poorly drained
EROSION:	None observed
DISTURBANCE:	Few wind-blown coconuts.
LABORATORY Nos:	KRS S2087-2091

PROFILE DESCRIPTION

Ah1	0-16 cm (16 cm)	Moist; dark brown (7.5YR 3/2) moist, and on ped faces, dusky red (2.5 YR 3/2) rubbed clay; friable; weakly developed medium blocky structure breaking to moderate very fine crumb structure; common very fine and fine roots; indistinct wavy boundary,
Ah2	16-30 cm (14 cm)	Very moist; dark brown (10YR 3/3) moist, on ped faces and rubbed clay; friable; weakly developed medium blocky structure breaking to moderately developed very fine and fine nutty structure; common very fine and fine roots; distinct wavy boundary,
Bt1	30-44 cm (14 cm)	Very moist; yellowish brown (10YR 5/6) moist, dark brown (10YR 3/3) on ped faces and dark yellowish brown (10YR 4/4) rubbed clay; few fine distinct yellowish brown (10YR 5/8) mottles; firm; moderately developed medium blocky structure breaking to very fine and fine nutty structure; common distinct dark brown (10YR 3/3) clay and organic coatings; few very fine roots; distinct wavy boundary,
Bt2	44-69 cm (25 cm)	Wet; dark brown (10YR 3/3) ped faces, dark yellowish brown (10YR 4/4) rubbed clay with common weakly weathered subangular gravels comprising both coral fragments and shells; firm; moderately developed medium and coarse blocky structure; common distinct dark brown (10YR 3/3) clay cutans; few very fine roots; indistinct wavy boundary,

Cg	69-90 cm+ (21 cm+)	Wet; dark greyish brown (2.5Y 4/2) clay loam with weakly weathered subangular gravels comprising both coral fragments and shells; friable; massive; no roots.

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Vurevure series**

REFERENCE: Vurevure peaty clay (47b) defined by Twyford & Wright (1965) as a moderately mottled, weakly to strongly gleyed soil associated with latosol soils and formed under a climate with a weak dry season.

Forms part of the Sawakasa set.

The central concept for Vurevure soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Typic Tropaquept, fine, mixed, non acid, isohyperthermic
(b) FAO: Eutric Gleysol
(c) Twyford and Wright: Gley soil related to latosols with a weak dry season

INCLUDED MAPPING UNITS AND SYMBOLS:
Vurevure soils (69)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	In small areas of Taveuni Island in particular back of the floodplains and bases of hills where it is virtually a colluvial soil.
PARENT ROCK:	Olivine basalt
PARENT MATERIAL:	Fine strongly gleyed colluvium.
PHYSIOGRAPHIC POSITION/LANDFORM:	Poorly drained small backswamps on floodplains and entrapped depressions below hills on the coastal margins.
SLOPE CLASS AND RANGE OF SLOPES:	Flat to gently undulating, 0-3°.
VEGETATION AND LAND USE:	Either in unused state supporting reeds and sedges or for rice cultivation.
RANGE OF ELEVATION:	0-3 m
RAINFALL:	Annual average range: 3,200-4,800 mm; dry season range: 800-1,600 mm; wet season range: 1,800-2,800 mm.
TEMPERATURE:	Mean annual: 24.5°C.
SOIL MOISTURE REGIME:	Aquic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Very poorly drained.
PERMEABILITY CLASS:	Very slow
FLOODING:	Water table at or near the surface for most of the year. Permanently flooded during the wet season.
EROSION:	No erosion risk.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 12 cm of fibrous peaty brown clay overlying more than 70 cm of peaty grey clay of massive structure.
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Not applicable. Only one profile description made.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	In view of the source of the parent material for Vurevure series are expected to be of high nutrient status.
LABORATORY Nos:	Not sampled for analysis.
SOIL LIMITATIONS:	Permanent high water for much of the year; very slow permeability, poor drainage and difficulties because of topographic position to drain these soils.

Typifying Profile

SOIL NAME:	Vurevure soils
PROFILE No.:	TW 41
SITE LOCATION:	Behind the beach strand (Naselesele soils) south east of Qeleni village, east Taveuni Island.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Swamp
PARENT MATERIAL:	Strongly gleyed fine textured colluvium derived from basaltic rocks.
SLOPE:	Flat
ASPECT:	Not applicable
ELEVATION:	2 m
MICRORELIEF:	Uneven (hummocky)
SITE VEGETATION:	Sedges and rushes.
LAND USE:	Unused (natural state).
DRAINAGE:	Very poorly drained.
EROSION:	None observed
DISTURBANCE:	None observed
LABORATORY Nos:	Not sampled for analysis.

PROFILE DESCRIPTION

Ah	0-12 cm (12 cm)	Wet; brown (10YR 5/3) fibrous peaty clay; massive; profuse fine and medium roots; soft; sticky; plastic; distinct smooth boundary,
BCg	12-90 cm+ (78+ cm)	Wet; grey (10YR 5/1) peaty clay; massive; common fine fibrous roots; soft; sticky; plastic.

Vurevure

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Vuya *series***

REFERENCE: The Vuya steepland bouldery clay (85a) defined by Twyford & Wright (1965) as soils derived from basic andesites and basalts under open forest under a climate with a moderate dry season.

This concept has been broadened to include a strong dry season and andesite parent materials otherwise the central concept for Vuya series is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Typic Rhodustult, clayey, mixed, isohyperthermic
(b) FAO: Dystric Nitosol
(c) Twyford and Wright: Humic latosol with a moderate to strong dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Vuya soils, undulating phase (185B)
Vuya soils, easy rolling phase (185C)
Vuya soils, rolling phase (185D)
Vuya soils, strongly rolling phase (185E)
Vuya soils, moderately steep phase (185F)
Vuya soils, steep phase (185G)
Vuya soils, very steep phase (185H)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION: Vuya soils are common in Bua and Macuata provinces of Vanua Levu; in a few places in north-central Kadavu and in Viti Levu they occur in the north-east and north-west of the island.

PARENT ROCK: Basalts, basic andesites and andesites.

PARENT MATERIAL: Strongly red weathered *in situ* rock.

PHYSIOGRAPHIC POSITION/LANDFORM: Steeper planar midslopes and backslopes, concave and sometimes convex midslopes and toeslopes in very strongly rolling hill country.

SLOPE CLASS AND RANGE OF SLOPES: Undulating (4-7°), easy rolling (8-11°), rolling (12-15°), strongly rolling (16-20°), moderately steep (21-25°), steep (26-35°) and very steep (>35°).

VEGETATION AND LAND USE: Generally unused. Cocoa on more gentle slopes and subsistence crops. Where unused is a tall open forest, including kulukulu, gaiga and rosawa.

RANGE OF ELEVATION: 10-250 m

RAINFALL: Annual average range: 1,800-2,400 mm;
dry season range: 400-500 mm;
wet season range: 1,400-1,800 mm.

TEMPERATURE: Mean annual: 25.5°C.

SOIL MOISTURE REGIME: Ustic

SOIL TEMPERATURE REGIME: Isohyperthermic

SOIL DRAINAGE CLASS: Moderately well to well drained.

PERMEABILITY CLASS: Moderate

FLOODING: Never floods

EROSION: Some sheet erosion. Potentially a highly erodible soil when the forest is cleared and under cultivation.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 20 cm of dark reddish brown friable clay, slightly sticky moist, and of strongly developed fine nut structure with common weakly weathered stones, overlying 65 cm of dark reddish brown firm clay of strongly developed blocky structure with clay cutans to peds, slightly plastic and sticky moist, with manganese concretions and manganese coatings to the many stones, overlying more than 30 cm of dark red massive gritty clay, sticky and plastic moist, with many stones and manganese coatings.
DIAGNOSTIC HORIZONS:	Ochric epipedon, argillic horizon.
RANGE OF PROFILE FEATURES:	Vuya series have a Ah(Ap), Bt, BC horizon sequence. The Ah horizon thickness ranges from 10-22 cm; its colours include dark reddish brown (2.5YR 2/4, 3/4) and dusky red (10R 3/3, 3/4); textures may be silty clay loam, silty clay, clay loam or clay; structures may be moderate or strong, fine or medium, nut or blocky; and there may or may not be weathered stones present. The Bt horizon thickness ranges from 35-70 cm; its colours include dark reddish brown (2.5YR 2/4, 3/4, 5YR 3/4), reddish brown (5YR 4/4, 5/4, 2.5YR 4/4, 5/4) and red (2.5YR 4/6, 4/8, 5/8); textures may be silty clay loam, silty clay, clay loam or clay and some may be bouldery or stony; structures are strong coarse or medium blocky commonly breaking to fine nut structure; clay cutans are few, common or many in abundance; and manganese coatings may be present or not. The BC horizon exceeds 30 cm in thickness; its colours include dark red (2.5YR 3/6), red (2.5YR 4/6, 4/8, 5/8) and weak red (10R 4/4, 5/4); textures are bouldery or stony silty clay loams or clay loams.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Moderately acid soils with low organic carbon values in topsoils and very low below the surface horizon. % base saturation is high for the latter but medium for subsoil horizons. The CEC values are at the low end of medium (<17 me.%). Exchangeable magnesium is high; sodium low; potassium medium in the topsoil and low in subsoils; and calcium low in the topsoil and very low below. The particle size family class is clayey. The mineralogical class is mixed.
LABORATORY Nos:	SB9416A-D
SOIL LIMITATIONS:	Slope where developed on slopes >15°; clayey textures; moderate soil moisture deficits during the dry season; moderate to very severe sheet and rill erosion potential on slopes >12°; moderate soil acidity; and nutrient deficiencies of nitrogen and phosphorus.

Typifying Profile

SOIL NAME:	Vuya soils, rolling phase.
PROFILE No.:	VB18
SITE LOCATION:	Map 143 (Vanua Balavu) 178° 59' 15" E, 17° 18' 98" N. Vanua Balavu Island, Lau Group.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Concavo-convex toeslope.
PARENT MATERIAL:	Colluvium derived from andesitic rocks.
SLOPE:	14°
ASPECT:	East
ELEVATION:	20 m
MICRORELIEF:	Minor surface undulations.
SITE VEGETATION:	Scrub (3 m) and ground cover of grasses.
LAND USE:	Unused
DRAINAGE:	Moderately well drained; moderate permeability; medium runoff.
EROSION:	Some minor sheet erosion.
DISTURBANCE:	None observed
LABORATORY Nos:	SB9416A-D

PROFILE DESCRIPTION

Ah	0-20 cm (20 cm)	Dry; dusky red (10R 3/3) moist dark reddish brown (2.5YR 3/4) rubbed dark reddish brown with dark red (2.5YR 3/5) clay; friable; slightly sticky; non-plastic strongly developed medium with some fine nutstructure; abundant medium and fine roots; many casts; odd strongly weathered stone (<2 cm) indistinct regular boundary,
Bt	20-85 cm (65 cm)	Dry; dusky red dark reddish brown (2.5YR 3/3) moist and rubbed dark reddish brown (2.5YR 3/4) clay; firm; sticky; slightly plastic; strongly developed coarse blocky breaking to moderately developed medium nut; thin continuous clay cutans; few roots; few casts; many manganese iron concretions or black stones with coatings; few to many strongly weathered stones (2-5 cm); indistinct regular boundary,
BC	85-120 cm (35 cm+)	Dry; dark red (2.5YR 3/6) rubbed and moist dark reddish brown (2.5YR 3/4) gritty clay; firm; plastic; sticky; massive breaking to weakly developed medium blocky plus single grain; rare clay cutans; odd root; odd cast; many strongly weathered small stones possibly iron manganese concretions or stones coated with a thin layer of iron manganese material.

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Waibici series**

REFERENCE: Waibici clay (59a) and Waibici hill soils (59aH) defined by Twyford & Wright (1965) as upland soils from andesitic tuffs and marls, on rolling and hill land and formed under a climate with no dry season.

Forms part of the Waibici set.

The central concept for Waibici soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Oxic Dystropept, fine, mixed, isothermic
(b) FAO: Dystric Cambisol
(c) Twyford and Wright: Upland humic latosol with no dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Waibici soils, easy rolling phase (222C)
Waibici soils, rolling phase (222D)
Waibici soils, strongly rolling phase (222E)
Waibici soils, moderately steep phase (222F)
Waibici soils, steep phase (222G)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Restricted to the Nadrau plateau.
PARENT ROCK:	Andesitic tuffs and marls.
PARENT MATERIAL:	Strongly weathered *in situ* rock.
PHYSIOGRAPHIC POSITION/LANDFORM:	Undulating and rolling terrain on a broad plateau.
SLOPE CLASS AND RANGE OF SLOPES:	Easy rolling (8-11°), rolling (12-15°), strongly rolling (16-20°), moderately steep (21-25°), and steep (26-35°).
VEGETATION AND LAND USE:	Mixed forest of dakua (*Agathis vitiensi*), podocaps and broadleaf trees.
RANGE OF ELEVATION:	600-1050 m
RAINFALL:	Annual average range: 3,200-4,800 mm; dry season range: 600-800 mm; wet season range: 2,000-2,800 mm.
TEMPERATURE:	Mean annual: 18°C.
SOIL MOISTURE REGIME:	Perudic
SOIL TEMPERATURE REGIME:	Isothermic
SOIL DRAINAGE CLASS:	Well drained
PERMEABILITY CLASS:	Moderate
FLOODING:	Never floods
EROSION:	Moderate to severe sheet and rill erosion potential of forest cleared and cultivated (without conservation measure) on slopes >7°.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 30 cm dark brown very friable clay loam of strong fine and medium granular structure somewhat smeary moist, overlying 30 cm of reddish brown very friable clay loam, of weak fine granular structure somewhat smeary moist, on 60 cm or more of dark reddish brown very firm clay of weak coarse blocky structure tending massive.
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Waibici series have an Ah, Bw BC horizon sequence. The Ah horizon thickness ranges from 25 to 32 cm; its colours include reddish brown (5YR 4/3, 4/4 and dark brown (7.5YR 3/2, 4/4); textures are clay or clay loam; and structures are strong or moderate fine or medium nut or granular. The Bw horizon thickness ranges from 25 to 60 cm; its colours include reddish brown (5YR 4/4, 5/3, 5/4) and reddish yellow (5YR 6/6, 6/8); textures are clay or clayloam; consistence friable or very friable; and structures are moderate medium nut or blocky breaking to very fine granular and nut. The BC horizon thickness exceeds 50 cm; its colours include dark reddish brown (5YR 3/4) reddish brown (5YR 4/4, 5/4) and sometimes reddish yellow (5YR 6/6, 6/8); clay or clay loam textures; and structures medium.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analysis shows the soil to be extremely acid 0-60 cm and strongly acid below 60 cm; organic carbon and nitrogen have medium values in the topsoil (0-30 cm) and very low values below it; very low available phosphorus; % base saturation values are very low throughout; CEC is medium in the topsoil and low below 30 cm; exchangeable calcium and magnesium are low in the topsoil and very low below; and potassium values are very low throughout.
LABORATORY Nos:	KRS V695-697
SOIL LIMITATIONS:	Moderate to severe erosion potential on slopes >7°; soil acidity; and nutrient deficiencies of nitrogen, phosphorus and potassium.

Typifying Profile

SOIL NAME:	Waibici soils, undulating phase.
PROFILE No.:	VS114
SITE LOCATION:	Nadala Forest nursery.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Planar undulating surface in gently rolling land.
PARENT MATERIAL:	Strongly weathered in situ andesitic tuffs.
SLOPE:	4°
ASPECT:	West
ELEVATION:	720 m
MICRORELIEF:	Smooth
SITE VEGETATION:	Mahogany with ground cover of wild lemon, lantana, kuluva and coffee.
LAND USE:	Exotic forestry (mahogany).
DRAINAGE:	Well drained
EROSION:	None observed
DISTURBANCE:	None observed
LABORATORY Nos:	KRS V695-697

PROFILE DESCRIPTION

Waibici soils, undulating phase

Ah	0-30 cm (30 cm)	Moist; dark brown (7.5YR 3/2) clay loam; very strongly developed fine and medium granular structure; very friable; non-sticky; somewhat smeary; no stones; common very large pores; common fine fibrous and many medium woody roots; distinct smooth boundary,
Bw	30-60 cm (30 cm)	Moist; reddish brown (5YR 4/4) clay loam; moderate medium nut breaking to very weakly developed fine granular structure; very friable, somewhat smeary; common medium woody roots; diffuse wavy boundary,
BC	60-120 cm (60 cm)	Moist; dark reddish brown (5YR 3/4) clay; weakly developed coarse blocky structure tending massive; very firm; slightly sticky; few fine woody roots.

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Waibula series**

REFERENCE: Waibula sandy clay, loamy sand, sandy clay loam, clay loam and clay (6c) defined by Twyford & Wright (1965) as a recent alluvial soil of low quartz content (from basic rocks and mainly olivine, augite and magnetite) that floods occasionally and forms under a climate with a weak dry season.

Forms part of the Wainibuka set.

The central concept for Waibula soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Fluventic Hapludoll, fine-loamy, mixed, isohyperthermic
(b) FAO: Haplic Phaeozem
(c) Twyford and Wright: Recent soil from alluvium with a weak dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Waibula soils, flat to undulating phase (59A) Waibula soils, undulating phase (59B)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Occur in narrow strips in several places near the coast of Taveuni where rivers and creeks emerge and inland along river courses in the north-eastern part of the island.
PARENT ROCK:	Basalts
PARENT MATERIAL:	Weak to moderately weathered riverine alluvium.
PHYSIOGRAPHIC POSITION/LANDFORM:	Levees, floodplains and small terraces of small rivers and creeks. Commonly surfaces are undulating and uneven.
SLOPE CLASS AND RANGE OF SLOPES:	Flat to gently undulating (0-3°), and undulating (4-7°).
VEGETATION AND LAND USE:	Mainly used for coconuts, often with rough pastures beneath the palms grazed by cattle. They are also used for cocoa, coffee and subsistence crops (particularly yams) .
RANGE OF ELEVATION:	1-20 m
RAINFALL:	Annual average range: 3,000-5,200 mm; dry season range: 800-2,800 mm; wet season range: 2,000-3,000 mm.
TEMPERATURE:	Mean annual: 24.5°C.
SOIL MOISTURE REGIME:	Udic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Well drained
PERMEABILITY CLASS:	Moderate and moderately rapid.
FLOODING:	1 in 20 year return period for floods depositing fresh alluvia, and other floods are annual events generally dependent whether on levee, terrace or floodplain position .
EROSION:	No erosion hazard.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 25 cm of very dark greyish brown very friable coarse sandy loam of strongly developed medium and coarse nut structures, overlying more than 70 cm of very dark greyish brown very friable sandy clay loam of massive structure breaking to weak coarse prismatic and slightly sticky and plastic when moist. The subsoil commonly shows sedimentary layering of gravel or sand or pebble layers and the odd large basalt boulder is not uncommon.
DIAGNOSTIC HORIZONS:	Mollic epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Not applicable. Only 2 profile descriptions made. See variants.
VARIANTS:	Unnamed variant on levees: Floods more frequently. Profile comprises 25 cm of dark reddish grey slightly compacted loamy sand, slightly mottled dark red or dark grey over 50 cm of dark brown or dark reddish grey friable sandy clay loam of blocky structure on basalt stones and boulders. Unnamed variant on small older terraces: Profile comprises 45 cm of very dark grey friable clay with strong nut structure overlying 100 cm or more of brown friable clay of moderate coarse blocky structure, mottled grey and usually with the water table within the top 100 cm.
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analysis shows the soil to be moderately acid in the topsoil (0-30 cm) and slightly acid on the other horizons; organic carbon has very low values throughout; phosphorus retention is medium; CEC is medium for all horizons; exchangeable calcium is medium in the topsoil and there is free lime in the underlying horizons; magnesium is high; and potassium is of low values throughout. The particle size family class is fine-loamy. The mineralogical class is mixed.
LABORATORY Nos:	USP TAV106A-C
SOIL LIMITATIONS:	Susceptibility to flooding (frequency governed by landscape position); uneven surface commonly with basalt boulders across it; nutrient deficiency of potassium and possibly nitrogen.

Typifying Profile

SOIL NAME:	Waibula soils
PROFILE No.:	USP TAV106A-C
SITE LOCATION:	Waibula River valley, 100 m west of Waibula River bridge on the west coast road of Taveuni Island.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Alluvial floodplain
PARENT MATERIAL:	Mixed weakly weathered basaltic alluvium.
SLOPE:	Flat
ASPECT:	Not applicable
ELEVATION:	9 m
MICRORELIEF:	Gently undulating with sporadic boulders (up to 1 m diameter).
SITE VEGETATION:	Coconuts with ground cover of carpet grass.
LAND USE:	Coconut (copra) production.
DRAINAGE:	Well drained. Watertable at 150 cm.
EROSION:	None observed
DISTURBANCE:	None observed
LABORATORY Nos:	USP TAV106A-C
COMMENTS:	Allophane test. Weak positive in all horizons.

PROFILE DESCRIPTION

Ah	0-27 cm (27 cm)	Moist; very dark greyish brown (10YR 3/2) coarse sandy loam; strongly developed medium to coarse nut structure; very friable; non-sticky; non-plastic; many fine pores; common fine fibrous roots; distinct smooth boundary,
AB	27-30 cm (3 cm)	Moist; very dark greyish brwn (10YR 3/2) coarse sand; single grain; very friable; non-sticky; non-plastic; many fine fibrous roots; distinct sharp boundary,
Bw	30-110 cm (80 cm)	Moist; very dark greyish brown (10YR 3/2) sandy clay loam; several layers (up to 3 cm thick) of gravels and with a few rounded boulders; massive breaking to weakly developed coarse prismatic structure; very friable; slightly sticky and plastic when wet; common fine fibrous roots; distinct smooth boundary,
C	110+ cm	Rounded basaltic boulders with very dark greyish brown sand in intersticies.

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Waidina series**

REFERENCE: The Waidina clay (27b) and Waidina hill soils (27bH) defined by Twyford & Wright (1965), to include soils on easy rolling to moderately steep slopes derived from the Samabula and Verata soils by weathering and leaching. Formed from basic tuffs and marls under a climate with little or no dry season.

Forms part of the Sote set. The central concept for Waidina series is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Typic Eutropept, fine, kaolinitic, isohyperthermic
(b) FAO: Eutric Cambisol
(c) Twyford and Wright: Humic latosol with a very weak or no dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Waidina soils, undulating phase (129B)
Waidina soils, easy rolling phase (129C)
Waidina soils, rolling phase (129D)
Waidina soils, strongly rolling phase (129E)
Waidina soils, moderately steep phase (129F)
Waidina soils, steep phase (129G)
Waidina soils, very steep phase (129H)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Strongly rolling and dissected low hill country of ESE and SSE Viti Levu .
PARENT ROCK:	Tuffs and marls of basic and intermediate composition.
PARENT MATERIAL:	Moderately weathered slope colluvium over strongly weathered *in situ* rock.
PHYSIOGRAPHIC POSITION/LANDFORM:	Short backslopes and midslopes in strongly dissected hill country.
SLOPE CLASS AND RANGE OF SLOPES:	Undulating (4-7°), easy rolling (8-11°), rolling (12-15°), strongly rolling (16-20°), moderately steep (21-25°), steep (26-35°), and very steep (>35°).
VEGETATION AND LAND USE:	Generally improved pasture for dairying and cattle grazing (beef). Para grass with infestations of Navua sedge, tar weed, and yellow primrose
RANGE OF ELEVATION:	10-200 m
RAINFALL:	Annual average range: 3,200-4,800 mm; dry season range: 800-1,600 mm; wet season range: 1,800-2,800 mm.
TEMPERATURE:	Mean annual: 24°C.
SOIL MOISTURE REGIME:	Perudic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Moderately well drained.
PERMEABILITY CLASS:	Slow
FLOODING:	Never floods
EROSION:	Sheet erosion following surface pugging. Some small mass movement particularly on steeper slopes. Moderate and severe sheet, rill and soil creep erosion potential on slopes >11°.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically profiles show a thin distinct brown well structured topsoil; a transitional AB horizon with strong faunal activity; and a cambic B horizon of about 50-70 cm that overlie BC horizons that are generally stony. Topsoil textures are generally silt loam becoming silty clay loam in the cambic horizon. Subsoils generally weakly mottled.
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Waidina series have an Ah, AB, Bw, BC horizon sequence. The Ah horizon thickness ranges from 10 to 15 cm; its colours include very dark greyish brown (10YR 3/2), and dark brown (10YR 3/3, 4/3); textures are silt loam, silty clay loam and clay loam; and with or without stones. The AB horizon thickness ranges from 8 to 12 cm; its colours include brown (10YR 4/3), dark yellowish brown (10YR 4/4) and olive brown (2.5Y 4/4); textures are silty clay loam or clay loam; and with or without stones. The Bw horizon thickness ranges from 25 to 60 cm; its colours include yellowish brown (10YR 5/6, 5/8) and light olive brown (2.5Y 5/4, 5/6); textures are silty clay loam or clay loam; strong brown mottles may be few, common or many and medium or coarse; structures are weak or moderate, fine, medium or coarse, blocky or nut; and with or without stones. The BC horizon exceeds 50 cm; its colours are pale yellow (2.5Y 7/4, 8/4) and light yellowish brown (10YR 6/4); textures silty clay or silt loam; and firm or very firm consistence.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Moderately acid soils with medium to high % base saturation values; organic carbon values are medium in the topsoils but are very low in subsoils. Phosphorus status is very high to medium. The CEC is high to medium while exchangeable calcium, magnesium, potassium and sodium decrease from medium values in topsoils to low and very low in the subsoils. The particle size family class is fine. The mineralogical class is kaolinitic.
LABORATORY Nos:	SB9596 A-E
SOIL LIMITATIONS:	Slope; slow permeability; propensity to pug where grazed; potential soil erosion on slopes > 11°; moderate soil acidity; and nutrient deficiencies of nitrogen and phosphorus.

Typifying Profile

SOIL NAME:	Waidina soils, strongly rolling phase.
PROFILE No.:	KN16
SITE LOCATION:	Refer soil map of Koronivia Agricultural Research Station (Scale 1:3000) Leslie (1984).

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Convex midslope position in strongly rolling hill country.
PARENT MATERIAL:	Colluvium derived from marls and siltstones of basic and intermediate composition over marl.
SLOPE:	18° (15 m length)
ASPECT:	North-east
ELEVATION:	12 m
MICRORELIEF:	Forest dimples and terracettes.
SITE VEGETATION:	Para grass invaded by Navua sedge.
LAND USE:	Pasture for dairying.
DRAINAGE:	Moderately well drained.
EROSION:	None observed at site.
DISTURBANCE:	Terracettes through intensive cattle grazing.
LABORATORY Nos:	SB9596 A-E

PROFILE DESCRIPTION

Ah	0-14 cm (14 cm)	Slightly moist; brown (10YR 4/3) ped face; dark yellowish brown (10YR 4/4), rubbed silt loam; moderately developed fine nut plus weakly developed very fine nut structure; friable; non-sticky; non-plastic; many fine roots; few moderately weathered subangular gravels; indistinct smooth boundary,
AB	14-31 cm (17 cm)	Slightly moist; olive yellow (2.5Y 4/4), dark yellowish brown (10YR 5/4) ped face, yellowish brown (10YR 5/6) rubbed, silty clay loam; moderately developed fine nut plus moderately developed medium blocky structure; friable; non-sticky; non-plastic; many fine roots; few moderately weathered subangular gravels; indistinct smooth boundary,
Bw1	31-77 cm (46 cm)	Slightly moist; yellowish brown (10YR 5/6) and both ped face and rubbed, silty clay loam; many coarse, distinct strong brown (7.5YR 5/6) mottles; weakly developed coarse blocky breaking to weakly developed fine blocky structure; friable; slightly sticky; non-plastic; common medium roots; indistinct smooth boundary,
Bw2	77-99 cm (22 cm)	Slightly moist; yellowish brown (10YR 5/6), and both ped face and rubbed, silty clay loam; many coarse distinct strong brown (7.5YR 5/6) mottles; weakly developed coarse blocky structure breaking to single grain; firm; slightly sticky; non-plastic; few medium roots; common strongly weathered subrounded stones; distinct smooth boundary,

BC	99-119 cm (20 cm)	Slightly moist; yellowish brown (10YR 5/4), ped face, olive yellow (2.5Y 4/4), rubbed silt loam; many coarse distinct yellowish brown (10YR 5/6) mottles; massive; firm; non-sticky; non-plastic.

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Waidradra series**

REFERENCE: New soil series introduced in the soil survey of Waidradra Agricultural Research Station (Smith & Palmer 1984) to include imperfectly drained soils from riverine alluvium of basic and intermediate composition on floodplains of tributary river systems in the wet zone. Profiles have strongly mottled, grey clay loam topsoils with weakly developed strongly mottled, dark yellowish brown clay loam B horizons with sandy textured paleosols common.

Waidradra series would previously have been included with the Rewa set (4) as defined by Twyford and Wright (1965). The name is derived from Waidradra Creek that runs through the MAF Research Station of the same name.

CLASSIFICATION:

(a) Soil Taxonomy: Fluvaquentic Eutropept, fine, mixed, isohyperthermic
(b) FAO: Gleyic Cambisol
(c) Twyford and Wright: Recent soil from river alluvium with a very weak or no dry season

INCLUDED MAPPING UNITS AND SYMBOLS:
Waidradra soils (47)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Waidradra soils are developed in tributary valley floors that feed the major floodplains (Rewa soils) in south-east Viti Levu.
PARENT ROCK:	Predominantly rocks of basic and intermediate composition.
PARENT MATERIAL:	Moderate to strongly weathered riverine alluvium.
PHYSIOGRAPHIC POSITION/LANDFORM:	Surface of flat to undulating floodplain.
SLOPE CLASS AND RANGE OF SLOPES:	Flat to gently undulating (0-3°).
VEGETATION AND LAND USE:	Some areas still in forest. Where cleared used for grazing (para grass, navua sedge) or subsistence crops (yaqona, bananas).
RANGE OF ELEVATION:	10-75 m
RAINFALL:	Annual average range: 3,200-4,800 mm; dry season range: 800-1,600 mm; wet season range: 1,800-2,800 mm.
TEMPERATURE:	Mean annual: 24°C.
SOIL MOISTURE REGIME:	Perudic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Imperfectly drained
PERMEABILITY CLASS:	Moderately slow permeability.
FLOODING:	Frequent flooding; 1 year in 10 year return period for severe floods depositing 'fresh' alluvium, and 1 in 2 year return period for other floods.
EROSION:	No erosion risk.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 15-25 cm of grey clay loam with common strong brown and yellowish red mottles and of moderately developed fine nut structure overlying 25-40 cm of weakly developed dark yellowish brown clay loam with common strong brown and grey mottles. Buried A horizons are common and are dark brown sandy loams with massive to weak fine blocky structure. They overlie massive yellowish red, mottled yellowish brown and dark grey, clay loam C horizons.
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Waidradra series have a Ap, Bw, C, bAh, bBw horizon sequence. The Ap horizon thickness ranges from 15 to 25 cm; its colours include dark grey (5Y 4/1) and grey (5Y 5/1); structures are moderate or fine nut; consistence is firm or friable; and strong brown or yellowish red mottles vary between 2 and 20% in abundance. The Bw horizon thickness ranges from 25 to 40 cm; its colours include yellowish brown (10YR 4/4) and strong brown (7.5YR 5/6); consistence may be firm or friable; and strong brown light yellowish grey or brownish yellow mottles vary between 2 and 20% in abundance. The C horizon thickness ranges from 15 to 20 cm; and high chroma mottle vary from 5-25% in abundance. The bAh horizon thickness ranges from 5 to 10 cm; its colours are dark brown (7.5YR 4/5 or 3/2); textures range between sandy loam and sandy clay loam; and structures are massive or weak fine blocky. The bBw horizon exceeds 40 cm; its colours include strong brown (7.5YR 5/6), yellowish red (5YR 4/6) and brownish yellow (10YR 6/6); and brownish yellow, grey or light brownish grey mottles range between 2 and 20% in abundance.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	Wairau series. Occur on levees are coarser textured and less mottled.
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Moderately to strongly acid soils with high base status. Exchangeable calcium is high and magnesium very high throughout the profile. Potassium is very high in topsoils, but very low in all other horizons. Sodium is medium to low throughout the profile. Organic carbon values are low in topsoils and decreases irregularly with depth to very low levels. The particle size family class is fine. The clay mineralogical class is mixed.
LABORATORY Nos:	KRS T1767-1772
SOIL LIMITATIONS:	High susceptibility to flooding; trafficability will be severely reduced because of wetness during the wet season; soil acidity; and nutrient deficiency of potassium.

Typifying Profile

SOIL NAME:	Waidradra soils
PROFILE No.:	W68
SITE LOCATION:	Refer soil map of Waidradra Agricultural Research Station (Smith, 1992). Grid reference - Sheet: Viti Levu 13 (1:50 000) 419 E, 198 N.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Gently undulating floodplain.
PARENT MATERIAL:	Riverine alluvium derived from basic and intermediate rocks.
SLOPE:	Flat
ASPECT:	Not applicable
ELEVATION:	20 m
MICRORELIEF:	Smooth
SITE VEGETATION:	Navua sedge
LAND USE:	Grazing for cattle
DRAINAGE:	Imperfectly drained
EROSION:	None observed
DISTURBANCE:	Severe surface pugging by cattle.
LABORATORY Nos:	KRS T1767-1772

PROFILE DESCRIPTION

Ap	0-15 cm (15 cm)	Grey to dark grey (5Y 5/1-4/1) clay loam; friable; sticky; plastic; moderately developed fine nut structure; common medium distinct strong brown (7.5YR 4/6) and common fine distinct yellowish red (5YR 4/6) mottles; many fine roots; indistinct smooth boundary,
Bw	15-40 cm (25 cm)	Dark yellowish brown (10YR 4/4) clay loam; friable; sticky; plastic; weakly developed medium blocky structure; common fine distinct strong brown (7.5YR 5/8) and common fine faint light brownish grey (2.5Y 6/2) mottles; few fine roots; distinct smooth boundary,
C	40-56 cm (16 cm)	Yellowish red (5YR 5/6) clay loam; friable; sticky; plastic; massive; common fine distinct light yellowish brown to brownish yellow (10YR 6/5) mottles especially along root channels and pores; few fine roots; distinct wavy boundary,
bAh	56-61 cm (5 cm)	Dark brown to strong brown (7.5YR 4/5) and dark brown (7.5YR 3/2) sandy loam; friable; non-sticky; slightly plastic; massive to weak fine block structures; few fine roots; distinct wavy boundary,
bBw	61-100 cm (39 cm)	Strong brown (7.5YR 5/6) clay loam; friable; slightly sticky; plastic; weakly developed fine blocky structure; few fine faint very dark grey (7.5YR 3/0) and many medium distinct light yellowish brown to brownish yellow (10YR 6/5) mottles; few fine roots.

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Waikalou series**

REFERENCE: New soil series introduced to include poorly draining soils developed on fossil dune strands of sandy parent material derived from basic and intermediate rocks. The series were previously included with Deuba sandy loan (52b) as defined by Twyford & Wright (1965). Deuba series develop on sands derived from rocks of acidic composition i.e. high quartz content. It is for this reason of parent material difference that Waikalou series has been introduced in this survey although morphologically they resemble Deuba series in many respects.

The name is from Waikalou Creek 1 km east of Pacific Harbour

CLASSIFICATION:

(a) Soil Taxonomy: Aeric Tropaquept, sandy, mixed, isohyperthermic
(b) FAO: Eutric Gleysol
(c) Twyford and Wright: Gley soil related to latosols with no dry season

INCLUDED MAPPING UNITS AND SYMBOLS:
Waikalou soils (10)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Restricted to the old dune complexes on the Navua and Rewa deltas.
PARENT ROCK:	Predominantly rocks of basic and intermediate composition.
PARENT MATERIAL:	Sands brought down by the Rewa river, resorted and redeposited mainly by marine action.
PHYSIOGRAPHIC POSITION/LANDFORM:	Coastal dunes with weakly expressed ridge and swale topography.
SLOPE CLASS AND RANGE OF SLOPES:	Flat to near level (0-2°).
VEGETATION AND LAND USE:	Dalo, kumala and cassava subsistence crops.
RANGE OF ELEVATION:	1-2.5 m
RAINFALL:	Annual average range: 3,200-4,800 mm; dry season range: 800-1,600 mm; wet season range: 1,800-2,800 mm.
TEMPERATURE:	Mean annual: 24°C.
SOIL MOISTURE REGIME:	Aquic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Poorly drained
PERMEABILITY CLASS:	Rapid permeability to the water table.
FLOODING:	In normal years flooding may occur for up to 12 days on 2 to 3 occasions sometime during the wet season.
EROSION:	No erosion risk.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 10 cm of dark brown friable fine sandy clay loam, of moderately developed coarse granular structure, and sticky when moist, overlying 20 cm of dark yellowish brown mottled yellowish brown friable sandy loam, of moderately developed coarse blocky structure, and slightly sticky moist, overlying 60 cm of light reddish brown mottled yellowish brown friable loamy sand of weakly developed coarse nut structure over more than 30 cm of wet greenish grey sand.
RANGE OF PROFILE FEATURES:	Not applicable. The few profile descriptions made show little variation to that described above.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analyses show the soil to be slightly acid, though moderately acid in the 8-30 cm (Ap horizon); carbon and nitrogen values are medium in the Ap1 horizon, low in the Ap2, very low below this and the C/N ratio is medium; available phosphorus is very low; % base saturation is high except for the Ap horizon which gives medium values, and exchangeable magnesium follows the same trend and values; potassium is very low and sodium low throughout; and exchangeable calcium is medium in the Ap horizon (0-8 cm) and has low values below. The particle size family class is sandy. The mineralogical class is mixed.
LABORATORY Nos:	KRS D331-333 (inclusive)
SOIL LIMITATIONS:	Susceptibility to flooding; high seasonal water table; rapid permeability; low water holding capacity that results in short periods of soil moisture deficit in the period May to October; and nutrient deficiencies of phosphorus and potassium.

Typifying Profile

SOIL NAME:	Waikalou soils
PROFILE No.:	A1
SITE LOCATION:	Lokia

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Centre of fossil beach strand.
PARENT MATERIAL:	Estuarine sands derived from basic and intermediate rocks (i.e. quartz poor).
SLOPE:	Flat
ASPECT:	Not applicable
ELEVATION:	2 m
MICRORELIEF:	Small mounds and channels.
SITE VEGETATION:	Recently burnt. Bare ground being colonised by *Mimosa*.
LAND USE:	Secondary vegetation associated with garden cultivation (dalo, tavioka).
DRAINAGE:	Well drained above water table which was at 15 cm below the surface.
EROSION:	None observed
DISTURBANCE:	Cultivated in the past.
LABORATORY Nos:	KRS D331-333 (inclusive)

PROFILE DESCRIPTION

Waikalou soils

Ap1	0-8 cm (8 cm)	Moist; dark brown to brown (10YR 4/3) fine sandy clay loam; moderately developed coarse granular structure; friable; sticky; common fine fibrous roots; diffuse smooth boundary,
Ap2	8-30 cm (22 cm)	Wet; dark yellowish brown (10YR 4/4) sandy loam; few coarse distinct yellowish brown (10YR 5/6) mottles; moderately developed coarse blocky structure; friable; slightly sticky; few fine fibrous roots; distinct smooth boundary,
Bw	30-91 cm (61 cm)	Wet; light reddish brown (5YR 6/3) loamy sand; many coarse distinct yellowish brown (10YR5/6) mottles; weakly developed coarse nut structure; friable; non sticky; non plastic; distinct smooth boundary,
Cr	91-120cm+ (29 cm+)	Wet; greenish grey (5GY 6/1) non calcareous sand.

Waikalou

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Wailotua series**

REFERENCE: Wailotua steepland bouldery clay (64) defined by Twyford and Wright (1965) as formed from limestone under a climate with a weak dry season.

The central concept for Wailotua soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Typic Eutropept, clayey-skeletal, smectitic, isohyperthermic
(b) FAO: Eutric Cambisol
(c) Twyford and Wright: Steepland soil related to and associated with nigrescent soils with a weak dry season

INCLUDING MAPPING UNITS AND PHASES:

Wailotua soils, rolling phase (74D)
Wailotua soils, strongly rolling phase (74E)
Wailotua soils, moderately steep phase (74F)
Wailotua soils, steep phase (74G)
Wailotua soils, very steep phase (74H)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Wailotua soils develop mainly on small areas of limestone in Tailevu province near Wailotua village, Viti Levu.
PARENT ROCK:	Limestone
PARENT MATERIAL:	Weakly weathered *in-situ* rock.
PHYSIOGRAPHIC POSITION/LANDFORM:	Planar and convex slopes in strongly dissected hill country.
SLOPE CLASS AND RANGE OF SLOPES:	Rolling (12-15°), strongly rolling (16-20°), moderately steep (21-25°), steep (26-35°), and very steep (35-40°).
VEGETATION AND LAND USE:	Mostly under heavy forest but some of the easier spurs have been cleared and are being used for cassava and yaqona crops.
RANGE OF ELEVATION:	50-200 m
RAINFALL:	Annual average range: 3,000-5,200 mm; dry season range: 800-2,800 mm; wet season range: 2,000-3,000 mm.
TEMPERATURE:	Mean annual: 24.5°C.
SOIL MOISTURE REGIME:	Udic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Well drained
PERMEABILITY CLASS:	Moderate
FLOODING:	Never floods
EROSION:	Severe sheet erosion potential as forest cleared and continually cultivated.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 10 cm of dark brown friable bouldery silty clay loam of moderate coarse nut structure breaking to fine granular overlying 100 cm of dark yellowish brown friable to firm bouldery clay loam of moderate medium blocky with crumb structure on hard limestone.
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Not applicable. Only two profile descriptions made.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Wailotua soils appear fertile and of high base status and slightly alkaline. The particle size family class is clayey-skeletal. The mineralogy class is smectitic.
LABORATORY Nos:	Not sampled for analysis.
SOIL LIMITATIONS:	Jagged limestone outcrops, slope and likely trace element deficiencies.

Typifying Profile

SOIL NAME:	Wailotua soils, steep phase.
PROFILE No.:	DL45
SITE LOCATION:	Limestone landscape above Wailotua river at Waitamako.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Convex shoulder in steepland.
PARENT MATERIAL:	Weakly weathered *in-situ* limestone.
SLOPE:	35°
ASPECT:	East
ELEVATION:	100 m
MICRORELIEF:	Uneven and boulder strewn.
SITE VEGETATION:	Natural forest (salato, saswira, bauvudi, baka, dawa, vava).
LAND USE:	Unused
DRAINAGE:	Well drained
EROSION:	None
DISTURBANCE:	Surface subsidence and collapses due to subterranean drainage in the kaarst landscape.
LABORATORY Nos:	Not sampled for analysis.

PROFILE DESCRIPTION

Wailotua soils, steep phase

Ah	0-10 cm (10 cm)	Moist; dark brown (10YR 3/2) bouldery silty clay loam; moderately developed coarse nut structure breaking to fine granular; with crumb; friable to firm; slightly sticky; slightly plastic; abundant angular limestone boulders; few fine fibrous roots,
Bw	10-100 cm (90 cm)	Moist; dark yellowish brown (10YR 3/4) bouldery clay loam; moderately developed medium blocky structure breaking to granular with crumb; friable to firm; slightly sticky; slightly plastic; abundant angular limestone boulders; few fine fibrous roots.

Wailotua

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Wailulu series**

REFERENCE: Wailulu clay (60) and Wailulu hill soils (60H) defined by Twyford & Wright (1965) as upland soils from olivine basalt on undulating and rolling land and formed under a climate with a weak to moderate dry season.

Forms the Wailulu set.

In this survey Wailulu series are restricted to the udic soil moisture regime otherwise the central concept for Wailulu soils is retained.

CLASSIFICATION:

(a) Soil Taxonomy: Oxic Humitropept, fine, kaolinitic, isothermic
(b) FAO: Humic Cambisol
(c) Twyford and Wright: Upland humic latosol with a weak dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Wailulu soils, flat to undulating phase (225A)
Wailulu soils, undulating phase (225B)
Wailulu soils, easy rolling phase (225C)
Wailulu soils, rolling phase (225D)
Wailulu soils, strongly rolling phase (225E)
Wailulu soils, moderately steep phase (225F)
Wailulu soils, steep phase (225G)
Wailulu soils, very steep phase (225H)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION: Wailulu soils occur mainly in the Nausori highlands of Viti Levu.

PARENT ROCK: Olivine basalt

PARENT MATERIAL: Strongly weathered *in situ* rock.

PHYSIOGRAPHIC POSITION/LANDFORM: Rolling and undulating country in the uplands.

SLOPE CLASS AND RANGE OF SLOPES: All slope classes from flat to undulating (0-3°) to very steep (>35°).

VEGETATION AND LAND USE: Typically supports a vegetation of poor grasses, stunted mission grass and few poor shrubs and bracken. Used for rough grazing, exotic forestry and some subsistence cropping.

RANGE OF ELEVATION: 600 - 850 m

RAINFALL: Annual average range: 3,200-4,800 mm;
dry season range: 600-800 mm;
wet season range: 2,000-2,800 mm.

TEMPERATURE: Mean annual: 18°C.

SOIL MOISTURE REGIME: Udic/perudic

SOIL TEMPERATURE REGIME: Isothermic

SOIL DRAINAGE CLASS: Well drained

PERMEABILITY CLASS: Moderate

FLOODING: Never floods

EROSION: Moderate sheet and rill erosion potential where cultivated on slopes >7°.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 25 cm of red friable clay loam of moderate fine granular structure and occasionally having a few rounded boulders overlying 60 cm of yellowish red with patches of yellowish brown and brownish yellow firm clay, of weak coarse nut structure and with strongly weathered boulders on strong brown firm clay of weak coarse nut structure.
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Wailulu series have an Ah, Bw1, Bw2 horizon sequence. The Ah horizon thickness ranges from 15 to 28 cm; its colours include yellowish red (5YR 4/6, 4/8) or red (2.5YR 4/6, 4/8); textures may be clay or clay loam; structures are moderate or strong very fine nut or granular; and with or without boulders. The Bw1 horizon thickness ranges from 28 to 65 cm; its colours include yellowish red (5YR 4/6, 4/8, 5/6, 5/8); structure tends to be massive breaking to weak coarse nut or blocky; and with or without weathered boulders. The Bw2 horizon thickness ranges from 30 to 110 cm; its colours include strong brown (7.5YR 5/6, 5/8) or yellowish red (5YR 5/6, 5/8); consistence may be friable or very friable; textures may be clay, clay loam, silty clay loam or loam; and structures are weak coarse nut or blocky breaking to fine granular, crumb or nut; and with or without strongly weathered boulders.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analysis shows the soil to be strongly acid; organic carbon and nitrogen are of very low values throughout; very low available phosphorus; CEC values are medium; % base saturation values are very low throughout; and exchangeable calcium values are very low, magnesium low and potassium very low for all horizons.
LABORATORY Nos:	KRS V687-689 (inclusive)
SOIL LIMITATIONS:	Moderate erosion potential on slopes >7°; soil acidity; and nutrient deficiencies of nitrogen, potassium and phosphorus.

Typifying Profile

SOIL NAME:	Wailulu soils, strongly rolling phase.
PROFILE No.:	VS111
SITE LOCATION:	Lewa valleys, Karo-o uplands, central Viti Levu.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Short convex toeslope in rolling country.
PARENT MATERIAL:	Strongly weathered *in situ* olivine basalt.
SLOPE:	16° (10 m long)
ASPECT:	West
ELEVATION:	610 m
MICRORELIEF:	Uneven
SITE VEGETATION:	Just harvested for *Pinus caribaea* crop. Remaining vegetation includes guava, prickly solanum, mission grass.
LAND USE:	Exotic forestry
DRAINAGE:	Well drained
EROSION:	Has suffered topsoil losses through sheet erosion in the past..
DISTURBANCE:	None
LABORATORY Nos:	KRS V687-689 (inclusive)

PROFILE DESCRIPTION

Wailulu soils, strongly rolling phase

Ah	0-25 cm (25 cm)	Moist; red (2.5YR 4/8) clay loam; moderately developed fine granular structure; friable; slightly sticky; few medium rounded bounders; few fine pores; common fine fibrous roots; distinct smooth boundary,
Bw1	25-85 cm (60 cm)	Moist; yellowish red (5YR 4/6) clay; patches of yellowish brown (10YR 5/8) and brownish yellow (10YR 6/8); weakly developed coarse nut structure; firm; slightly sticky; plastic; many large strongly weathered olive (5Y 5/4, 4/4, 5/6) boulders; few fine tubular pores, diffuse wavy boundary,
Bw2	85-120cm (35 cm)	Moist; strong brown (7.5YR 4/6) clay; weakly developed coarse nut structure; friable; slightly sticky; many strongly weathered olive bounders.

Wailulu

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Waimaro series**

REFERENCE: The Waimaro clay (27c) and Waimaro hill soils (27cH) defined by Twyford and Wright (1965) as soils developed from non-calcareous andesitic tuffs etc. on rolling to steep country under a climate with a very weak or no dry season. They are considered to have developed from Waidina series by greater weathering and leaching.

Forms part of the Sote set. This central concept for Waimaro series is retained for this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Typic Humitropept, fine, kaolinitic, isohyperthermic
(b) FAO: Dystric Cambisol
(c) Twyford and Wright: Humic latosol with a very weak or no dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Waimaro soils, undulating phase (127B)
Waimaro soils, easy rolling phase (127C)
Waimaro soils, rolling phase (127D)
Waimaro soils, strongly rolling phase (127E)
Waimaro soils, moderately steep phase (127F)
Waimaro soils, steep phase (127G)
Waimaro soils, very steep phase (127H)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Waimaro soils occur extensively in close association with Sote and Lobau soils in south-east Viti Levu. They develop in a few locations at the base for the southern side of the main range in Vanua Levu between Nasavusavu and Fawn Harbour.
PARENT ROCK:	Sedimentary rocks of basic or intermediate composition.
PARENT MATERIAL:	Moderate to strongly weathered tuffs, marine siltstones and sandstones of basic and intermediate composition.
PHYSIOGRAPHIC POSITION/LANDFORM:	All slope positions between ridge crest and toeslope in moderately dissected hill country.
SLOPE CLASS AND RANGE OF SLOPES:	Undulating (4-7°), easy rolling (8-11°), rolling (12-15°), strongly rolling (16-20°), moderately steep (21-25°), steep (26-35°), and very steep (>35°).
VEGETATION AND LAND USE:	Indigenous forest with dominant species of salato, yaro, dibi, ota, loa, vau, wavuka and dawa.
RANGE OF ELEVATION:	70-350 m
RAINFALL:	Annual average range: 3,200-4,800 mm; dry season range: 800-1600 mm; wet season range: 1,800-2,800mm.
TEMPERATURE:	Mean annual: 24°C.
SOIL MOISTURE REGIME:	Perudic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Well drained
PERMEABILITY CLASS:	Moderately slow
FLOODING:	Never floods

EROSION: Some slumping and surface erosion (sheet, rilling) where vegetation removed or disturbed.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES: Typically shows a very thin dark brown friable clay or clay loam topsoil, of strongly developed fine to medium nut structure overlying 50-70 cm of friable brown becoming yellowish red with depth, clayey well expressed B horizon that has moderate to strong blocky structure.

The C horizons are massive red clays and may have fragments of tuff or sandstone throughout

DIAGNOSTIC HORIZONS: Ochric epipedon, cambic horizon.

RANGE OF PROFILE FEATURES: Waimaro series have a Ah, Bw1, Bw2, (Bw3), C horizon sequence.

The Ah horizon thickness ranges from 4 to 10 cm; its colours are dark brown (7.5YR 3/2, 4/2); textures are lay loam or clay; and structures are moderate or strong, fine or medium blocky.

The Bw1 horizon thickness ranges from 10-30 cm; its colours are brown (7.5YR 4/4, 4/6); they are mottle free and have a few high chroma mottles; and structures include strong fine or medium blocky.

The Bw2 (and/or Bw3) horizon thickness ranges from 20 to 40 cm; its colours include reddish brown (5YR 4/4), yellowish red (5YR 5/8), red (2.5YR 5/8) and dark yellowish brown (10YR 4/4); textures may be stony clay or clay; and with or without weathered parent material fragments; and structures are weak or moderate medium or coarse blocky.

The C horizon thickness ranges from 30 to 40 cm; its colours include red (10R 4/6; 2.5YR 5/6 and 5/8) and yellowish red (5YR 5/6); textures are clay or stony clay; and with or without weathered parent material fragments.

VARIANTS: Some unmappable shallow and moderately deep soils where strongly weathered sandstone occurs within 15-45 cm and 45-90 cm of the soil surface respectively.

SIMILAR SOILS AND DISTINGUISHING FEATURES: None recognised

GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES: Strongly acid soils of low base status. Exchangeable calcium and magnesium values are high in topsoils, while potassium and sodium levels are medium. All cations are low to very low in subsurface horizons. Organic carbon is high in topsoils, medium in Bw1 horizons, but very low in all other horizons.

The particle size family class is fine.

The clay mineralogical class is kaolinitic.

LABORATORY Nos: KRS T1750-1754 (inclusive)

SOIL LIMITATIONS: Moderate to severe physical limitations of slope and erosion risk if forest removed and cultivated; some soils have limitations of shallow rooting depth; clayey textures will inhibit attainment of a fine tilth; strong soil acidity; and nutrient deficiencies of phosphorus and potassium.

Typifying Profile

SOIL NAME:	Waimaro soils, undulating phase.
PROFILE No.:	W53
SITE LOCATION:	Refer soil map of Waidradra Agricultural Research Station (Smith, 1992). Grid reference - Sheet: Viti Levu 13 (1:50 000) 422E 182N.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Ridge crest in moderately dissected hill country.
PARENT MATERIAL:	Strongly weathered sandstone.
SLOPE:	4°
ASPECT:	North-east
ELEVATION:	145 m
MICRORELIEF:	Flat surface overall with tendency to be convex.
SITE VEGETATION:	Main canopy is approximately 15 m in height comprising salato, yaro, dibi, vau, wavuka, and davua. Ground cover includes regenerating seedlings of foregoing.
LAND USE:	Unused. Forest in near natural condition.
DRAINAGE:	Well drained
EROSION:	None observed
DISTURBANCE:	None observed
LABORATORY Nos:	KRS T1750-1754 (inclusive)

PROFILE DESCRIPTION

Ah	0-4 cm (4 cm)	Dark brown (7.5YR 3/2) clay loam; strongly developed very fine nut and crumb structure; friable; slightly sticky, plastic; abundant fine roots; distinct smooth boundary,
Bw1	4-15 cm (11 cm)	Brown (7.5YR 4/4) clay; strongly developed very fine and fine blocky structure; friable; sticky, plastic, many fine roots; indistinct wavy boundary,
Bw2	15-38 cm (23 cm)	Reddish brown (5YR 4/4) ped face and matrix (2.5YR 4/4) clay; moderately developed medium and coarse blocky structure; friable; sticky, plastic; common fine roots; indistinct wavy boundary,
Bw3	38-62 cm (24 cm)	Weak red (10R 4/4) clay; weakly developed medium and coarse block structure; friable; sticky, plastic; few fine roots; indistinct wavy boundary,
C	62-100 cm (38 cm)	Red (10R 4/6) clay; massive; friable; sticky, plastic; abundant moderately weathered subangular sandstone stones; few fine roots.

Waimaro

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Wainibuka series**

REFERENCE: Wainibuka sandy clay loam etc. (6a) defined by Twyford & Wright (1965) as formed on alluvium of low quartz content (from basic rocks) under a climate with a weak dry season.

The central concept for Wainibuka soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Fluventic Hapludoll, fine, smectitic, isohyperthermic
(b) FAO: Haplic Phaeozem
(c) Twyford and Wright: Recent soil from river alluvium with weak to moderate dry season

INCLUDED MAPPING UNITS AND SYMBOLS:
Wainibuka soils (26)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Wainibuka soils include all freely drained alluvial soils along the banks of the Wainibuka river of north-east Viti Levu.
PARENT ROCK:	Predominantly basic and intermediate rocks.
PARENT MATERIAL:	Deep fine textured alluvium.
PHYSIOGRAPHIC POSITION/LANDFORM:	High terraces
SLOPE CLASS AND RANGE OF SLOPES:	Flat to gently undulating (0-3°).
VEGETATION AND LAND USE:	Sugar cane, a wide range of horticultural and root crops, and rice.
RANGE OF ELEVATION:	20-100 m
RAINFALL:	Annual average range: 2,500-3,500 mm; dry season range: 800-1,500 mm; wet season range: 1,400-2,000 mm.
TEMPERATURE:	Mean annual: 25°C.
SOIL MOISTURE REGIME:	Udic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Well drained
PERMEABILITY CLASS:	Moderately rapid
FLOODING:	1 in 15 year return period for floods depositing small amounts of fresh alluvium.
EROSION:	No erosion risk.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES: Typically shows 20 cm of very dark grey firm clay, of moderately fine nut and crumb structure overlying 20 cm of brown friable clay, of moderately developed medium blocky structure and with dark greyish brown humus coatings to the ped faces, overlying 25 cm of very dark greyish brown friable clay; a buried topsoil, of moderately developed fine blocky structure and with dark grey humus coatings to the ped faces, overlying 15 cm of brown firm clay of moderately developed blocky structure overlying another buried topsoil of some 25 cm and with features similar to the paleosol described above over more 10 cm of dark yellowish brown firm clay.

DIAGNOSTIC HORIZONS: Mollic epipedon, cambic horizon.

RANGE OF PROFILE FEATURES: Wainibuka series have a Ap, B1, bAh, bBw, 2bAb, 2Bw horizon sequence.

The Ap horizon thickness ranges from 20-40 cm; its colours include very dark greyish brown (10YR 3/2) and brown (10YR 4/3); structure may be moderate medium crumb and nut or blocky; and there may be dark greyish brown (10YR 4/2) coatings to the peds.

The Bw horizon thickness ranges from 14 to 50 cm; its colours include brown (10YR 4/3) or dark yellowish brown (10YR 4/4); textures are clay or clay loam; structures are massive or moderately developed medium blocky; and there are normal humus coatings to the peds.

The bAh horizon thickness ranges from 10-36 cm; its colours include dark brown (10YR 3/3) to very dark grey (2.5Y 3/0); and structures are massive or fine or medium blocky.

VARIANTS: Wainibuka mottled variant. A typical profile is:

Ap	0-27 cm	Very dark greyish brown (10YR 3/2) clay; friable; sticky; plastic; many fine pores; moderately developed medium nut and crumb structure; abundant fine roots; distinct wavy boundary,
Bw	27-50 cm	Dark yellowish brown (60%) and very dark greyish brown (40%) worm mixed clay; firm; sticky; plastic; moderately developed medium nut structure; distinct wavy boundary,
bAh	50-60 cm	Very dark greyish brown (10YR 3/2) clay; many medium distinct dark yellowish brown (10YR 3/6) mottles; firm; sticky; plastic; weakly developed coarse blocky structure; distinct wavy boundary,
bBw1	60-73 cm	Dark yellowish brown (10YR 3/4) clay; many very dark greyish brown (10YR 3/2) humus coatings on ped faces; firm; sticky; plastic; weakly developed coarse blocky structure; distinct wavy boundary,
bBw	273-99 cm	Dark yellowish brown (10YR 4/4) clay; few fine faint yellowish brown (10YR 4/4) mottles; few very dark greyish brown (10YR 3/2) humus coatings on ped faces; firm; sticky; plastic.

This mottled variant may have slightly more soil limitations to deeper rooting plants than the well drained phase, as the mottles indicate the subsoil remains wet for a longer period than the well drained phase.

SIMILAR SOILS AND DISTINGUISHING FEATURES: None recognised

GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES: Analysis shows carbon decreases irregularly with depth and remains above 0.6% at 1.25 m; very high cation exchange capacity and % base saturation values; exchangeable calcium is high throughout the profile, magnesium very high, sodium medium, and potassium is very high in the topsoil but decreasing to very low with depth.

The particle size family class is fine.

The mineralogical class is smectitic.

LABORATORY Nos: KRS T1430-1435

SOIL LIMITATIONS: Slight limitation of heavy texture; infrequent flooding; slow subsoil permeability; in some areas imperfect drainage; and experience soil moisture deficits for short periods during the dry season.

Typifying Profile

SOIL NAME: Wainibuka soils

PROFILE No.: DP1

SITE LOCATION: See soil map of Dobuilevu Agricultural Research Station (McLeod, 1992).

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM: High alluvial terrace surface.

PARENT MATERIAL: River alluvium derived from rocks of mixed mineralogies.

SLOPE: Flat

ASPECT: Not applicable

ELEVATION: 53 m

MICRORELIEF: Uneven due to recent cultivation.

SITE VEGETATION: Experimental trial for yams.

LAND USE: Agricultural field trials.

DRAINAGE: Well drained

EROSION: None observed

DISTURBANCE: Annual cultivation

LABORATORY Nos: KRS T1430-1435

PROFILE DESCRIPTION

Ap	0-20 cm (20 cm)	Very dark grey (10YR 3/1) clay; firm; sticky; plastic few fine pores; moderately developed medium crumb and fine nut structure; many fine roots; distinct wavy boundary,
Bw	20-39 cm (19 cm)	Brown (10YR 4/3) clay; humus coatings of dark greyish brown (10YR 4/2 + 3/2) on ped faces; friable; sticky; plastic; abundant fine and coarse pores; moderately developed medium blocky structure; many fine roots; distinct wavy boundary,
bAh	39-68 cm (29 cm)	Very dark greyish brown (10YR 3/2) clay; many dark grey (10YR 3/1) humus coatings on peds; firm *in situ*; friable in hand; sticky; plastic; abundant fine medium and coarse pores; moderately developed fine blocky structure; few fine roots; distinct wavy boundary,

bBw	68-83 cm (15 cm)	Brown (10YR 4/3) clay to clay loam; dark greyish brown (10YR 4/2) humus coatings on peds; firm *in situ;* slightly sticky; plastic; abundant coarse to fine pores; moderately developed medium blocky breaking to fine blocky structure; few fine roots; distinct wavy boundary,
2bAh	83-108 cm (25 cm)	Very dark greyish brown (10YR 3/2) clay; firm *in situ;* sticky; plastic; abundant pores of all sizes; moderately developed medium blocky breaking to fine blocky structure; few fine roots; distinct wavy boundary,
2bBw	108-120+ cm (12+ cm)	Dark yellowish brown (10YR 4/4) clay; firm *in situ;* sticky; plastic; abundant pores of all sizes; moderately developed medium blocky structure.

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Wainikai series**

REFERENCE: New soil series introduced in the soil survey of Naduruloulou Agricultural Research Station (Palmer & Smith 1984) to include very poorly drained soils with a shallow layer of fibric peat, constituting a histic epipedon overlying fine textured alluvium and colluvium.

The soil was previously included with the Nausori clay (45d) by Twyford & Wright (1965). Adoption of Soil Taxonomy requires that these soils be separated from Nausori series since they classify as Entisols, whereas Nausori series are Inceptisols

The name Wainikai comes from a stream that runs near the eastern boundary of Naduruloulou Agricultural Research Station into the Rewa River.

CLASSIFICATION:

(a) Soil Taxonomy: (Histic) Hydraquent, fine, kaolinitic, non-acid, isohyperthermic
(b) FAO: Humic Gleysol
(c) Twyford and Wright: Gley soil with a very weak or no dry season

INCLUDED MAPPING UNITS AND SYMBOLS:
Wainikai soils (68)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Occurs in the distributary valleys to the major river systems of Navua and Rewa in ESE and SSE Viti Levu .
PARENT ROCK:	Rocks of basic and intermediate composition.
PARENT MATERIAL:	Between 20 and 40 cm of fibric peat, derived from reeds, sedges and grasses on fine textured alluvium and colluvium.
PHYSIOGRAPHIC POSITION/LANDFORM:	Swamp land and floors of valleys.
SLOPE CLASS AND RANGE OF SLOPES:	Flat. (0°)
VEGETATION AND LAND USE:	Some areas used for cattle grazing. Grasses - mainly Para grass and Navua sedge. Some small trees and shrubs.
RANGE OF ELEVATION:	3-20 m
RAINFALL:	Annual average range: 3,200-4,800 mm; dry season range: 800-1,600 mm; wet season range: 1,800-2,800 mm.
TEMPERATURE:	Mean annual: 24.5°C.
SOIL MOISTURE REGIME:	Aquic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Very poorly drained.
PERMEABILITY CLASS:	Moderate
FLOODING:	Water table at or near surface for much of year. Major flooding from rivers and streams possibly one year in five.

EROSION:	No erosion risk.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	A shallow layer (20-40 cm) of dark brown fibric peat overlies gleyed mineral horizons of clayey texture. A dark coloured A horizon may occur in the upper part of the mineral soil and this rests on dark grey varying to greenish grey C horizons which may have mottling of high chroma. Water table at or near the surface for much of the year. The mineral horizons are soft and unconsolidated and have n values >1.0.
DIAGNOSTIC HORIZONS:	Histic epipedon
RANGE OF PROFILE FEATURES:	Wainikai series have an Of, A, Cr1, Cr2, 2Ab horizon sequence. Water table too high to allow pits to be dug. Features from auger observations are: The Of horizon thickness ranges between 20 and 40 cm The Ah horizon (where they occur) range in thickness from 15-25 cm; and textures vary from loam, silt loam or silty clay loam. The Cr horizons are thicker than 50 cm; colours vary from 10YR hues to 5Y, 5GY and 5BG hues; mottles are up to 50% and are brownish or yellowish brown of 7.5YR or 10YR hues; and textures are either clay or silty clay. The buried A horizon may or may not be present.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	Batiki series: A similar soil in most respects but has no histic epipedon at the surface.
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Soils are strongly acid in Of (and Ah) horizons and are moderately acid in C horizons. The particle size family class is fine. The mineralogy class is kaolinitic.
LABORATORY Nos:	KRS T1377-1381 (inclusive)
SOIL LIMITATIONS:	The water table at or near the surface for much of the year. Soft and unconsolidated nature of the soil.

Typifying Profile

SOIL NAME:	Wainikai soils
PROFILE No:	N7
SITE LOCATION:	See soil map of Naduruloulou Agricultural Research Station (Palmer, 1992). Grid reference - Sheet: Viti Levu 14 (1:50 000) 603E 126N.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Swamp margin, below hilly ridge.
PARENT MATERIAL:	25 cm fibric peat over fine textured colluvium and alluvium.
SLOPE:	0°
ASPECT:	Not applicable
ELEVATION:	10 m
MICRORELIEF:	Flat and even.
SITE VEGETATION:	Para grass and Navua sedge.
LAND USE:	Cattle grazing
DRAINAGE:	Very poorly drained.
EROSION:	None observed
DISTURBANCE:	None observed
LABORATORY Nos:	KRS T1377-1391 (inclusive)

PROFILE DESCRIPTION

Wainikai soils

Of	0-25 cm (25 cm)	Dark brown (7.5YR 3/2) fibric peat; wet; abundant slightly decomposed leaves, stems and roots of grasses and sedges; no structure; abundant fine live roots; distinct boundary,
Ah	25-45 cm (20 cm)	Dark greyish brown (10YR 4/2) clay loam; wet; slightly sticky; plastic; massive; some poorly decomposed roots; many live roots; indistinct boundary,
Cr1	45-85 cm (40 cm)	Olive grey (5Y 5/2) clay with common (5%) medium distinct grey to light grey (5Y 6/1) and many (30%) medium prominent brown to strong brown (7.5YR 5/5) mottles; wet; sticky; plastic; massive; no roots; distinct boundary,
Cr2	85-100cm (15 cm)	Greenish grey (5BG 6/1) clay with common (5%) medium distinct brownish yellow (10YR 6/6) and few (2%) fine distinct very dark grey (10YR 3/1) mottles; wet; sticky; plastic; massive; distinct boundary,
bAh	100-125cm	Brown to dark brown (7.5YR 4/2) silty clay loam; wet; slightly sticky; plastic.

Wainikai

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Wainikavou series**

REFERENCE: New soil series introduced in this survey to include strongly weathered soils developed from acidic rocks and formed on terrace remnants under a climate with a weak or no dry season. Wainikavou series would previously have been included with Koronivia soils (38) as defined by Twyford and Wright (1965).

Named from Wainikavou falls, a tributary of the Navua River.

CLASSIFICATION:

(a) Soil Taxonomy: Epiaquic Tropohumult, fine, kaolinitic, isohyperthermic
(b) FAO: Humic Acrisol
(c) Twyford and Wright: Red yellow podzolic soil with a weak or no dry season

INCLUDING MAPPING UNITS AND PHASES:

Wainikavou soils, flat to gently undulating phase (33A)
Wainikavou soils, gently undulating phase (33B)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Wainikavou soils are of small area and occur only in flattish surfaces inland of the central south-east coast of Viti Levu between Namuka Harbour and Busa Bay.
PARENT ROCK:	Rocks of acidic composition.
PARENT MATERIAL:	Deep strongly weathered 'old' alluvium.
PHYSIOGRAPHIC POSITION/LANDFORM:	Weakly dissected terrace remnant.
SLOPE CLASS AND RANGE OF SLOPES:	Flat to near level to gently undulating (0-3°), and undulating (4-7°).
VEGETATION AND LAND USE:	Under indigenous forest.
RANGE OF ELEVATION:	35-100 m
RAINFALL:	Annual average range: 3,200-4,800 mm; dry season range: 800-1,600 mm; wet season range: 1,800-2,800 mm.
TEMPERATURE:	Mean annual: 24°C.
SOIL MOISTURE REGIME:	Ustic (perudic)
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Imperfectly drained
PERMEABILITY CLASS:	Moderately slow
FLOODING:	No flood risk.
EROSION:	No erosion risk.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 25 cm of yellowish brown friable silty clay loam, of moderate medium nut structure, commonly with clay coatings to ped faces in the lower part, overlying 40 cm of strong brown mottled pale yellow and yellowish red firm clay loam of weak coarse blocky structure, with distinct clay cutans to ped faces, overlying 30 cm of yellowish brown mottled pale yellow firm clay, of massive structure breaking to blocky with clay cutans to ped faces over more than 40 cm of strong brown mottled pale yellow firm clay.
DIAGNOSTIC HORIZONS:	Umbric epipedon, argillic horizon.
RANGE OF PROFILE FEATURES:	VS03
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analysis shows the soil to be strongly acid in all horizons; carbon values are low in the topsoil (0-10 cm), and very low in the other horizons; nitrogen is low 0-23 cm and very low below this depth; C/N ratios are medium; available phosphorus is extremely lo; CEC is medium; % base saturation is very low throughout; exchangeable calcium is very low, sodium low, potassium very low, and magnesium medium in the topsoil and of low values in the other horizons. The particle size family class is clayey. The mineralogical class is kaolinitic.
LABORATORY Nos:	KRS V109-113
SOIL LIMITATIONS:	Subsoil waterlogging and some surface ponding of water during the wet season; poor trafficablilty when moist; imperfect internal drainage; moderately slow permeability; strong soil acidity; and severe nutrient deficiencies of nitrogen, phosphorus and potassium.

Typifying Profile

SOIL NAME:	Wainikavou soils, flat to gently undulating phase.
PROFILE No.:	VS03
SITE LOCATION:	Wainikavou Creek, 2 km south of Naimasimasi village, south Viti Levu.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Near flat terrace like planted surface 12 m above contemporary floodplain.
PARENT MATERIAL:	Strongly weathered 'old' alluvium veneer overlying strongly weathered rock of acidic composition.
SLOPE:	2°
ASPECT:	North
ELEVATION:	90 m
MICRORELIEF:	Even
SITE VEGETATION:	Indigenous forest
LAND USE:	Unused
DRAINAGE:	Imperfectly drained
EROSION:	None observed
DISTURBANCE:	None observed
LABORATORY Nos:	KRS V109-113

PROFILE DESCRIPTION

Ah1	0-10 cm (10 cm)	Moist; yellowish brown (10YR 5/6) silt loam; moderately developed fine and medium nut structure; friable; abundant fine and very fine roots; distinct smooth boundary,
Ah2	10-23 cm (13 cm)	Moist; yellowish brown (10YR 5/6) silty clay loam; moderately developed medium blocky structure; firm; common distinct strong brown (7.5YR 5/6) clay coatings; few very fine roots; distinct smooth boundary,
Bt1	23-62 cm (39 cm)	Moist; strong brown (7.5YR 5/6) clay loam; common fine distinct pale yellow (5Y 7/3) mottles with patches of yellowish red (5YR 5/6) mottles; weakly developed coarse blocky structure; firm; slightly sticky; slightly plastic; common distinct strong brown (7.5YR 5/8) clay coating; very few fine roots; distinct smooth boundary,
Bt2	62-91 cm (29 cm)	Moist; yellowish brown (10YR 5/6) clay; many medium prominent pale yellow (5Y 7/3) mottles; massive breaking to weakly developed coarse blocky structure; firm; sticky; plastic; many distinct yellowish brown (10YR 5/6) clay coating; no roots; distinct smooth boundary,
Bt3	91-125cm	Moist; strong brown (7.5YR 5/8) clay; profuse coarse prominent pale yellow mottles; massive breaking to weakly developed coarse blocky structure; firm; sticky; plastic; many distinct yellowish brown (10YR 5/6) clay coatings; no roots.

Wainikavou

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Wainikoro series**

REFERENCE: Wainikoro clay and sandy clay (42b) and Wainikoro hill soils (426H) defined by Twyford & Wright (1965) as forming under a climate with a strong dry season from quartzose tuffs on rolling and hilly land.

The central concept for Wainikoro soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Typic Kandiustult, clayey, kaolinitic, isohyperthermic
(b) FAO: Orthic Acrisol
(c) Twyford and Wright: Red yellow podzolic soil with a strong dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Wainikoro soils, easy rolling phase (140C)
Wainikoro soils, rolling phase (140D)
Wainikoro soils, strongly rolling phase (140E)
Wainikoro soils, moderately steep phase (140F)
Wainikoro soils, steep phase (140G)
Wainikoro soils, very steep phase (140H)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION: While not extensive in area, Wainikoro soils are best represented in Viti Levu in Nadroga. They are more extensive in Vanua Levu, particularly in the vicinity of the Wainikoro Valley.

PARENT ROCK: Tuffaceous rocks of acidic composition.

PARENT MATERIAL: Strongly weathered *in situ* rock with some colluvial cover.

PHYSIOGRAPHIC POSITION/LANDFORM: All slope positions in flattish, rolling land to steepland.

SLOPE CLASS AND RANGE OF SLOPES: Easy rolling (8-11°), rolling (12-15°), strongly rolling (16-20°), moderately steep (21-25°), steep (16-35°), and very steep (>35°).

VEGETATION AND LAND USE: Originally under forest which has now been replaced by talasiga vegetation in the unused state. Where developed under sugar cane, rainfed rice, pulses and to a limited extent pineapple.

RANGE OF ELEVATION: 10-300 m

RAINFALL: Annual average range: 1,800-2,400 mm;
dry season range: 400-500 mm;
wet season range: 1,400-1,800 mm

TEMPERATURE: Mean annual: 25.5°C.

SOIL MOISTURE REGIME: Ustic

SOIL TEMPERATURE REGIME: Isohyperthermic

SOIL DRAINAGE CLASS: Well drained

PERMEABILITY CLASS: Moderate

FLOODING: Never floods

EROSION: Have experienced past erosion and retain at moderate to severe erosion (sheet and rill) potential particularly on slopes >3°.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 13 cm of dark reddish brown fine sandy clay loam, of weak to moderately developed nut with crumb structure, very friable, and sticky when moist, overlying 60 cm red fine sandy clay, of weakly developed medium and coarse blocky structure that breaks easily to crumb, friable, sticky when moist, and with dark reddish brown iron/manganese coatings, overlying more than 30 cm of red fine sandy clay loam, of weakly developed medium blocky structure breaking easily to crumb and single grain, friable, slightly sticky moist, and with dark reddish brown coatings.
DIAGNOSTIC HORIZONS:	Ochric epipedon, argillic horizon.
RANGE OF PROFILE FEATURES:	Not applicable. Only two soil profiles described.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analyses show strongly acid pH; nitrogen and carbon values are very low; very low available phosphorus; % base saturation is medium; CEC very low; exchangeable calcium low in the topsoil and very low below, magnesium low and potassium very low.
LABORATORY Nos:	USP NB19A-C
SOIL LIMITATIONS:	Low soil moisture holding capacity and moderate permeability results in severe soil moisture deficits during the dry season; past soil erosion and severe potential for sheet and rill erosion under cultivation on slopes >2°; strongly acid; and nutrient deficiencies of nitrogen, potassium and phosphorus.

Typifying Profile

SOIL NAME:	Wainikoro soils, easy rolling phase.
PROFILE No.:	NB19
SITE LOCATION:	P74/I/13 Nabou Forest.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Planar toeslope in rolling country.
PARENT MATERIAL:	Deep colluvium derived from rocks predominantly of acid composition.
SLOPE:	11°, length 100 m
ASPECT:	North-east
ELEVATION:	50 m
MICRORELIEF:	Flat
SITE VEGETATION:	Nokonoko, mission grass and bracken under 8 year old *Pinus caribaea*.
LAND USE:	Exotic forestry
DRAINAGE:	Well drained
EROSION:	None observed
DISTURBANCE:	None
LABORATORY Nos:	USP NB19A-C

PROFILE DESCRIPTION

Wainikoro soils, easy rolling phase

Ah	0-13 cm (13 cm)	Slightly moist; moist and rubbed dark reddish brown (5YR 3/4) fine sandy clay loam; weak to moderately developed fine nut structure with moderate medium crumb structure; very friable; sticky; non-plastic; few, fine and medium roots; distinct wavy boundary,
Bt1	13-73 cm (60 cm)	Slightly moist; moist red (2.5YR 5/8) and rubbed red (2.5YR 4/6) fine sandy clay; weakly developed medium and coarse blocky structure breaking to medium crumb structure; friable; sticky; non-plastic; few distinct dark reddish brown (5YR 2/2) iron/manganese coatings; few fine and medium roots; diffuse smooth boundary,
Bt2	73-103 cm+	Slightly moist; moist red (2.5YR 5/8) and rubbed red (30 cm+)(2.5YR 4/6) fine sandy clay loam; weakly developed medium blocky structure breaking to single grain; friable; slightly sticky; non-plastic; few distinct dark reddish brown (5YR 2/2) iron/manganese coatings; no roots.

Wainikoro

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Wainivesi series**

REFERENCE: Wainivesi clay (44d) defined by Twyford & Wright (1965) as a strongly mottled, moderately gleyed soil found on old terraces of mixed basic and intermediate alluvium. They are gley soils related to latosols formed under a climate with no dry season.

Forms part of the Navua set.

This concept for Wainivesi series has been retained for this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Fluventic Eutropept, fine, kaolinitic, isohyperthermic
(b) FAO: Eutric Cambisol
(c) Twyford and Wright: Gley soil related to latosols with no dry season

INCLUDED MAPPING UNITS AND SYMBOLS:
Wainivesi soils (28)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Wainivesi soils occur in the Wainivesi valley in Tailevu and in the area of the upper Rewa and Wainimala junction.
PARENT ROCK:	Basic and intermediate rocks.
PARENT MATERIAL:	Deep older alluvium
PHYSIOGRAPHIC POSITION/LANDFORM:	Depressions and hollows on river terraces.
SLOPE CLASS AND RANGE OF SLOPES:	Flat to gently undulating (0-3°).
VEGETATION AND LAND USE:	Originally under dense forest, most all cleared and sown into improved pastures for dairying.
RANGE OF ELEVATION:	15-40 m
RAINFALL:	Annual average range: 3,200-4,800 mm; dry season range: 800-1,600 mm; wet season range: 1,800-2,800 mm.
TEMPERATURE:	Mean annual: 24°C.
SOIL MOISTURE REGIME:	Udic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Imperfectly drained
PERMEABILITY CLASS:	Slow
FLOODING:	Floods depositing sediment have a 1 in 25 year return period. Other floods have a 1 in 5 year return period.
EROSION:	Accumulating soil. No erosion risk.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 20 cm of dark brown mottled yellow red clay loam, of moderately developed medium granular structure, friable with common weakly weathered gravels, overlying 25 cm of dark yellow brown gritty clay loam, of massive structure breaking to coarse nutty structure, firm with manganese concretions, overlying 30 cm of dark yellowish brown gritty clay loam, of massive structure breaking to coarse blocky and with common manganese concretions and weakly weathered gravels, overlying more than 50 cm of yellowish brown or yellowish red mottled reddish yellow gritty clay or gritty loam of massive structure breaking to coarse blocky, very firm and commonly with gravels.
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Not applicable. Only 3 profile descriptions made.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Moderately acid soil; profiles show an irregular decrease of carbon with depth, nitrogen is overall very low and there are some very high C/N ratios in some horizons; high % base saturation; high CEC in the top 50 cm with calcium (high) dominant in the exchange complex; exchangeable potassium is very low below 25 cm; and available phosphorus is very low.
LABORATORY Nos:	KRS T001-005 (inclusive)
SOIL LIMITATIONS:	Frequent flooding; low pH and nutrient deficiency (potassium and phosphorus).

Typifying Profile

SOIL NAME:	Wanivesi soils
PROFILE No.:	K5
SITE LOCATION:	Adjacent Soso Creek, 6 chains south of Wainawaga-Nabukahika Road. South central Viti Levu.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Slightly concave depression on high river terrace.
PARENT MATERIAL:	Older alluvia derived from basic and intermediate rocks.
SLOPE:	3°
ASPECT:	West
ELEVATION:	30 m
MICRORELIEF:	Smooth
SITE VEGETATION:	Trees (yaro, sisisi, vau, sa, torawaw), shrubs (bibi, koster's curse), and some ground ferns, mosses, vines and epiphytes.
LAND USE:	Secondary forest
DRAINAGE:	Imperfectly drained
EROSION:	None observed
DISTURBANCE:	None
LABORATORY Nos:	KRS T001-005 (inclusive)

PROFILE DESCRIPTION

Wainivesi soils

O1	3-3 cm (3 cm)	Mat of decomposing leaves from surrounding trees and shrubs,
Ah	0-23 cm (23 cm)	Moist; dark brown (10YR 3/3) clay loam; few distinct coarse yellowish red (5YR 4/8) mottles; moderately developed medium granular structure; friable; common weakly weathered gravels; many fine fibrous and coarse woody roots; distinct smooth boundary,
AC	23-46 cm (23 cm)	Moist; dark yellow brown (10YR 4/4) gritty clay loam; massive breaking to weakly developed coarse nut structure; firm; common fine manganese concretions; many fine fibrous and coarse woody roots; distinct smooth boundary,
C	46-76 cm (30 cm)	moist; dark yellow brown (10YR 4/4) gritty clay loam; massive breaking to weak coarse blocky structure; very firm; common fine manganese concretions; many small and large weakly weathered gravels; few fine fibrous roots; distinct smooth boundary,
bBC1	76-122cm (46 cm)	Moist; yellowish brown (10YR 5/8) gritty clay; massive breaking to weak coarse blocky structure; very firm; few weakly weathered fine gravels; few fine fibrous roots; sharp smooth boundary,

bBC2	122-140cm+ (18 cm+)	Moist; yellowish brown (10YR 5/8) gritty loam; many yellowish red (5YR 5/8) and reddish yellow (5YR 6/8) mottle streaks; massive breaking to weak coarse blocky structure; very firm; many sand particles; few very fine fibrous roots.

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Wainunu series**

REFERENCE: Wainunu gravelly silty clays and loams (28a) and Wainunu hill soils (28aH) defined by Twyford & Wright as soils developed on flattish or undulating land from basalts and basic tuffs under a climate with no dry season. Forms part of the Wainunu set.

The central concept for Wainunu soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Oxic Humitropept, very-fine, ferruginous, isohyperthermic
(b) FAO: Humic Cambisol
(c) Twyford and Wright: Humic latosol with no dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Wainunu soils, flat to gently undulating phase (173A)
Wainunu soils, undulating phase (173B)
Wainunu soils, easy rolling phase (173C)
Wainunu soils, rolling phase (173D)
Wainunu soils, strongly rolling phase (173E)
Wainunu soils, moderately steep phase (173F)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Wainunu soils are of limited extent in south-east Viti Levu. They develop mainly in the Wainunu district of Vanua Levu.
PARENT ROCK:	Basalt and tuffaceous rocks of basic composition.
PARENT MATERIAL:	Deep strongly weathered *in situ* rock.
PHYSIOGRAPHIC POSITION/LANDFORM:	Planar and convex surfaces in all slope positions on broad undulating surfaces and relict plateaux.
SLOPE CLASS AND RANGE OF SLOPES:	Flat to gently undulating (0-3°), undulating (4-7°), easy rolling (8-11°), rolling (12-15°), strongly rolling (16-20°), and moderately steep (21-25°).
VEGETATION AND LAND USE:	Indigenous forest. Where forest cleared used for subsistence crops (two years cropping followed by a long bush fallow).
RANGE OF ELEVATION:	50-300 m
RAINFALL:	Annual average range: 3,200-4,800 mm; dry season range: 800-1,600 mm; wet season range: 1,800-2,800 mm.
TEMPERATURE:	Mean annual: 24°C.
SOIL MOISTURE REGIME:	Udic (perudic)
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Well drained
PERMEABILITY CLASS:	Moderate to moderately slow.
FLOODING:	Never floods
EROSION:	Moderate sheet and rill erosion potential on slopes > 3° when forest cleared and cultivated.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 15 cm of dark yellowish brown very friable humic clay loam; of strong fine crumb and granular structure, overlying 15 cm of dark brown firm silty clay, of weak fine columnar structure breaking to weak fine nut, sticky when moist, overlying 30 cm of reddish brown very firm clay, of moderate coarse columnar structure breaking to medium nut, overlying more than 60 cm of yellowish red very firm clay, of strong very coarse columnar structure breaking to finer blocky, and sticky when moist.
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Wainunu series have an Ah, Bw1, Bw2 Bw3 horizon sequence. The Ah horizon thickness ranges from 15-20 cm; its colours include dark yellowish brown (10YR 5/4, 4/4), dark brown (10YR 3/3, 7.5YR 3/2, 4/4); textures include silty clay; clay, clay loam, silt loam, and sandy clay loam; consistence may be very friable or friable; and structures include weak, moderate or strong fine or medium nut or granular. The Bw1 horizon thickness ranges from 12-25 cm; its colours include dark brown (7.5YR 3/2, 4/2, 4/4), reddish brown (5YR 4/3, 4/4, 5/4) and dark reddish brown (5YR 3/4); its textures may be sandy clay, silty clay, clay loam or clay; structures vary moderate or strong, fine or medium; blocky, nut or columnar; and with or without gravels. The Bw2 horizon thickness ranges from 25 to 35 cm; its colours include reddish brown (5YR 4/4, 5/4) and yellowish red (5YR 4/6, 5/6, 5/8); textures range as for the Bw1 horizon; and structures are weak or moderate, fine, medium or coarse nut blocky or columnar. The Bw3 horizon exceeds 50 cm in thickness; its colours include yellowish red (5YR 4/6, 5/6, 5/8) and red (2.5YR 4/6, 4/8, 5/8); textures range as for the Bw1 horizon; structures include moderate or strong, medium, coarse or very coarse blocky or columnar; and with or without weathered gravels or boulders.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analysis shows soil to be extremely acid in the topsoil (0-16 cm) and strongly acid in the other horizons; organic carbon has medium values in the topsoil, low 16-30 cm and very low values below these; nitrogen medium in the topsoil and low below; very low available phosphorus with high phosphorus retention; % base saturation medium throughout the profile; TEB and CEC have low values in the topsoil and very low values in the other horizons; exchangeable calcium is very low; magnesium and potassium have medium values in the topsoil; low 16-30 cm and very low below; and aluminium is significant in the exchange complex. The particle size family class is very-fine. The mineralogical class is ferruginous.
LABORATORY Nos:	KRS U459-462 (inclusive)
SOIL LIMITATIONS:	Clayey textures; moderately slow permeability; soil erosion potential on slopes >3° when forest cleared and cultivated; strong soil acidity; nutrient deficiencies of phosphorus and nitrogen; high phosphorus fixation; and probable aluminium toxicity.

Typifying Profile

SOIL NAME:	Wainunu soils, flat to gently undulating phase.
PROFILE No.:	TEA005
SITE LOCATION:	Wainunu District, Western Vanua Levu.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Convex midslope on plateau 'like' surface on flat country.
PARENT MATERIAL:	Weathered *in situ* basalt.
SLOPE:	2°, length 50 m
ASPECT:	South
ELEVATION:	250 m
MICRORELIEF:	Flat
SITE VEGETATION:	Indigenous forest
LAND USE:	Unused
DRAINAGE:	Well drained
EROSION:	None observed
DISTURBANCE:	None observed
LABORATORY Nos:	KRS U459-462 (inclusive)

PROFILE DESCRIPTION

Ah	0-16 cm (16 cm)	Moist; dark yellowish brown (10YR 4/4) humic clay loam; very friable; strongly developed fine crumb structure plus moderate very fine granular structure; abundant fine roots; distinct smooth boundary,
Bw1	16-30 cm (14 cm)	Moist; dark brown (7.5YR 4/4) silty clay; very firm; sticky; slightly plastic; moderately developed fine columnar structure breaking to weak fine nut structure; many medium roots; distinct smooth boundary,
Bw2	30-60 cm (30 cm)	Moist; reddish brown (5YR 4/4) clay; very firm; slightly sticky; slightly plastic; moderately developed coarse columnar structure breaking to weak medium nut structure; common medium roots; indistinct smooth boundary,
Bw3	60-120 cm (60 cm+)	Moist; yellowish red (5YR 4/6) moist and reddish brown (5YR 4/4) rubbed clay; very firm; sticky; slightly plastic; strongly developed very coarse columnar structure breaking to moderate medium blocky structure; few medium roots.

Wainunu

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Waioba series**

REFERENCE: Waioba steepland loam and bouldery loam (80a) defined by Twyford & Wright (1965) as a latosolic steepland soil from young volcanic ash developed under a climate with a weak dry season.

Forms part of the Ravilevu set.

The central concept for Waioba soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Hypic Thaptic Fulvudand, hydrous, isohyperthermic
(b) FAO: Humic Andosol
(c) Twyford and Wright: Steepland soil related to or associated with latosolic soils with a weak dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Waioba soils, steep phase (88G)
Waioba soils, very steep phase (88H)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	On steeper slopes to the west and southwest of the central core to Taveuni Island.
PARENT ROCK:	Basalt
PARENT MATERIAL:	Deep young volcanic ash overlying basalt flow rocks at depth.
PHYSIOGRAPHIC POSITION/LANDFORM:	Steepland on the volcanic ringplains.
SLOPE CLASS AND RANGE OF SLOPES:	Steep (26-35°) and very steep (>35°).
VEGETATION AND LAND USE:	Small areas are under coconut but the majority of Waioba series are under forest. Small area has been cleared for subsistence crops (yagona, bananas, root crops) or cocoa.
RANGE OF ELEVATION:	0-600 m
RAINFALL:	Annual average range: 3,000-5,500 mm; dry season range: 800-3,000 mm; wet season range: 2,000-3,200 mm.
TEMPERATURE:	Mean annual: 24°C.
SOIL MOISTURE REGIME:	Udic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Well drained
PERMEABILITY CLASS:	Moderately rapid
FLOODING:	Never floods
EROSION:	Commonly some soil creep and slight sheet erosion under forest. Very severe soil erosion potential if forest cleared and intensively cultivated.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically a deep very friable volcanic ash soil with very dark grey loam topsoil of strong fine and very fine nut structure, overlying 40 cm of very friable dark yellowish brown clay loam of weak medium and fine nut structure over 30 cm or more of firm massive dark brown gravelly loam with many weathered subrounded boulders.
DIAGNOSTIC HORIZONS:	Umbric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Waioba series have an Ah, Bw1, Bw2, C horizon sequence. The Ah horizon thickness ranges from 45-50 cm; their colours include very dark brown (10YR 2/2) and very dark grey (10YR 3/1); textures are loams or clay loams. The Bw1 horizon thickness ranges from 19 to 67 cm; its colours include dark yellowish brown (10YR 3/4, 4/4) and dark brown (10YR 3/3, 4/3); and textures are either clay loams or fine sandy clay loams. The Bw2 horizon thickness ranges in thickness from 25 to 35 cm and shows little variation in all other properties.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analysis shows the soil to be slightly acid in the Ah1 and Bw2 horizons and near neutral in Ah2 and Bw1; low available phosphorus and very high phosphorus retention; organic carbon is medium in the Ah1 horizon, low in Ah2 and Bw1, and very low in the Bw2; nitrogen is high in the Ah1 horizon, low in Ah2 and Bw1 and very low below these; % base saturation is medium in the Ah horizons and Bw1 and low in the Bw2; CEC is high in the Ah horizons and medium in the Bw horizons; potassium is low and very low throughout.
LABORATORY Nos:	KRS S2974-2977; SBT285A-C; M1A-B
SOIL LIMITATIONS:	Slope; susceptibility to erosion when forest cleared; very high phosphorus fixation and low available phosphorus; and a high 15 bar water content that may induce a certain degree of instability due to the loss of structural cohesion brought about by ground vibrations (earthquakes, vehicles, etc.).

Typifying Profile

SOIL NAME:	Waioba soils, steep phase.
PROFILE No.:	T8
SITE LOCATION:	Tutu Estate, 0.75 km upland and east from Tutu chapel.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Hillslope in weakly dissected hill country. Midslope position.
PARENT MATERIAL:	Moderately weathered very thick basaltic ash over old basalt lava flows.
SLOPE:	28° (200 m long)
ASPECT:	West
ELEVATION:	290 m
MICRORELIEF:	Forest dimpled
SITE VEGETATION:	Indigenous forest canopy underplanted with cocoa and with ground cover of miscellaneous grasses, weeds and vines.
LAND USE:	Cocoa production
DRAINAGE:	Well drained
EROSION:	Slight soil creep.
DISTURBANCE:	None
LABORATORY Nos:	KRS S2974-2977 SBT285A-C M1A-B
COMMENTS:	NaF reaction: Faint to moderate; moderate; strong; and strong for the 4 horizons below.

PROFILE DESCRIPTION

Ah1	0-18 cm (18 cm)	Moist; very dark brown (10YR 2/2) loam; very friable; slightly sticky; slightly plastic; strongly developed fine and very fine nut structure; abundant fine roots; few weakly weathered subrounded stones from basalt; distinct wavy boundary,
Ah2	18-48 cm (30 cm)	Moist; very dark greyish brown (10YR 3/2) loam; very friable; slightly sticky; slightly plastic; strongly developed fine and very fine nut structure; many fine roots; few weakly weathered subrounded stones from basalt; indistinct irregular boundary,
Bw1	48-88 cm (40 cm)	Moist; dark yellowish brown (10YR 3/4) clay loam; very friable; slightly sticky; plastic; weakly developed medium nut structure breaking to weakly developed very fine nut; common fine roots; few weakly weathered subrounded stones from basalt; indistinct wavy boundary,
Bw2	88-115 cm (27 cm)	Moist; dark brown (10YR 3/3) clay loam; friable; slightly sticky; plastic; moderately developed coarse blocky breaking to moderately developed fine nut structure; few distinct dark brown (10YR 3/3) clay cutans; few very fine roots; few weakly weathered subrounded stones from basalt.

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Waioru series**

REFERENCE: Waioru steepland stony and gritty clay (80d) defined by Twyford & Wright (1965) as latsolic steepland soils 'from older basalt flows than those of the Karo soils' and formed under a climate with a weak dry season.

They form part of the Ravilevu set.

The central concept for Waioru soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Typic Humitropept, clayey over loamy-skeletal, halloysitic, isohyperthermic
(b) FAO: Humic Cambisol
(c) Twyford and Wright: Steepland soil related to or associated with latosolic soils with a weak dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Waioru soils, steep phase (102G)
Waioru soils, very steep phase (102H)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Occurs along the west coast of Taveuni from Soqulu Estate in the south to Mua Estate in the north and in the northeast (Qeleni district).
PARENT ROCK:	Basalt
PARENT MATERIAL:	Moderately weathered ash and *in situ* rock.
PHYSIOGRAPHIC POSITION/LANDFORM:	All slope positions on steepland.
SLOPE CLASS AND RANGE OF SLOPES:	Steep (26-35°) and very steep (>35°).
VEGETATION AND LAND USE:	Mainly used for coconuts and subsistence crops (dalo, cassava, kumala, yaqona).
RANGE OF ELEVATION:	0-600 m
RAINFALL:	Annual average range: 3,200-4,800 mm; dry season range: 800-1,600 mm; wet season range: 1,800-2,800 mm.
TEMPERATURE:	Mean annual: 24.5°C.
SOIL MOISTURE REGIME:	Udic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Well drained
PERMEABILITY CLASS:	Moderate
FLOODING:	Never floods
EROSION:	Evidence of soil creep. Severe sheet and rill erosion potential when forest cleared and cultivated.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows a moderately thick dark reddish brown friable silty clay loam topsoil that overlies a thin dark reddish brown firm and compact silty clay loam subsoil with many moderately weathered subrounded boulders which grades in a dark reddish brown firm silt loam with abundant moderately weathered subrounded boulders.
DIAGNOSTIC HORIZONS:	Umbric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Profile features can be variable particularly in regard to the depth of the A horizon which may vary from 15 to 80 cm and to the degree of topsoil stoniness and their proximity to the surface. Also, for subsoils the number of stones which may vary from few to many. Some profiles are redder than that described. This is due to parent material colour rather than more advanced weathering.
VARIANTS:	Soils showing similar morphological features to Waioru soils but having a shallower profile occur within the mapping unit and are considered a shallow variant of Waioru series. These occur where a significant amount of erosion has probably taken place particularly on very steep slopes.
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analysis shows the soil to be moderately acid; organic carbon is low in the Ah1 horizon and very low in the other horizons; nitrogen is low in the Ah1 and Ah2 horizons and very low in the other horizons; available phosphorus is very low in the Ah horizons, low in the Bw, and medium in the C horizon but phosphorus retention is very high in all horizons; % base saturation is medium throughout the profile; CEC is medium; TEB is medium in the Ah1 and low in the other horizons; calcium is low throughout the profile; and potassium is very low. The particle size family class is clayey over loamy-skeletal. The mineralogical class is halloysitic.
LABORATORY Nos:	KRS S2941-2946 SBT292A-F M2A-E
SOIL LIMITATIONS:	Slope; susceptibility to erosion; clayey textures; soil acidity; nutrient deficiencies of nitrogen, phosphorus and potassium; and very high phosphorus fixation properties.

Typifying Profile

SOIL NAME:	Waioru soils, very steep phase.
PROFILE No.:	T78
SITE LOCATION:	Adjacent Vorani Stream 1.5 km north of Tutu Chapel, Tutu Estate Taveuni Island.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Convex midslope in strongly dissected steepland.
PARENT MATERIAL:	Moderately weathered ash and *in situ* rock.
SLOPE:	37°
ASPECT:	South-west
ELEVATION:	210 m
MICRORELIEF:	Forest dimples
SITE VEGETATION:	Dryland scrub
LAND USE:	Unused. Abandoned subsistence garden.
DRAINAGE:	Well drained
EROSION:	Slight soil creep.
DISTURBANCE:	None recognised
LABORATORY Nos:	KRS S2941-2946 SBT292A-F M2A-E
COMMENTS:	NaF reaction: weak; very weak; very weak; weak and weak for the 5 horizons described and sampled.

PROFILE DESCRIPTION

Ah1	0-23 cm (23 cm)	Slightly moist; dark brown (7.5YR 3/2) silty clay loam; friable; sticky; plastic; strongly developed fine nut plus strongly developed very fine nut structure; many very fine roots; few weakly weathered subangular basalt stones; distinct irregular boundary,
Ah2	23-43 cm (20 cm)	Slightly moist; dark brown (7.5YR 3/2) silty clay loam; friable; sticky; very plastic; moderately developed medium nut plus moderately developed fine nut structure; common faint dark brown (7.5YR 3/2) organic and clay cutans; common very fine roots; few moderately weathered subangular basalt stones; diffuse boundary,
Ah3	43-79 cm (36 cm)	Slightly moist; dark brown (7.5YR 3/2) silty clay loam; firm; sticky; very plastic; moderately developed fine nut plus moderately developed very fine nut structure; common distinct dark brown (7.5YR 3/2) clay cutans; common very fine roots; common moderately weathered subrounded basalt stones; diffuse boundary,

Bw	79-97 cm (18 cm)	Slightly moist; dark reddish brown (5YR 3/2) silty clay loam; firm; sticky; very plastic; moderately developed medium nut plus moderately developed fine nut structure; common distinct dark brown (7.5YR 3/2) clay cutans; few very fine roots; abundant moderately weathered subrounded basalt boulders; diffuse boundary,
C	97-110 cm (13 cm)	Moist; dark reddish brown (5YR 3/2) bouldery silt loam; firm; sticky; very plastic; moderately developed coarse blocky breaking to moderately developed medium nut structure; few very fine roots; abundant moderately weathered subrounded basalt boulders.

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Waiqere series**

REFERENCE: Waiqere loam (23a) and Waiqere hill soils (23aH) defined by Twyford & Wright (1965) as latosolic soils from young basaltic ash formed under a climate with no dry season.

They form part of the Waiqere set. The central concept for Waiqere soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Acrudoxic Hapludand, medial, isohyperthermic
(b) FAO: Humic Andosol
(c) Twyford and Wright: Latosolic soil with no dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Waiqere soils, easy rolling phase (87C)
Waiqere soils, rolling phase (87D)
Waiqere soils, strongly rolling phase (87E)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION: Widespread on rolling country adjacent to and on the lee side of scoriae cones from Soqulu estate south to the southern tip of Taveuni Island and in the lowland central part (again surround scoriae cones) to the north of the island.

PARENT ROCK: Basalt

PARENT MATERIAL: Deep young volcanic ash overlying basalt flow rocks at depth.

PHYSIOGRAPHIC POSITION/LANDFORM: Rolling land on the volcanic ringplains.

SLOPE CLASS AND RANGE OF SLOPES: Easy rolling (8-11°), rolling (12-15°) and strongly rolling (16-20°).

VEGETATION AND LAND USE: Originally forest covered: this has been much destroyed and replaced by coconut plantations and in the early days of European settlement, by pastures. Predominantly copra estates with undergrazing by beef cattle or reverted to tantana and light forest.

RANGE OF ELEVATION: 0-350 m

RAINFALL: Annual average range: 3,000-5,000 mm;
dry season range: 800-3,000 mm;
wet season range: 2,000-3,200 mm.

TEMPERATURE: Mean annual: 24°C.

SOIL MOISTURE REGIME: Udic

SOIL TEMPERATURE REGIME: Isohyperthermic

SOIL DRAINAGE CLASS: Well drained

PERMEABILITY CLASS: Moderately rapid

FLOODING: Never floods

EROSION: Moderate to severe sheet erosion potential if cultivated. The surface boulders negate extensive cultivation.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 9 cm of very dark brown friable slightly stony friable loam or sandy clay loam of strongly developed fine or very fine nut structure overlying 30 cm of dark brown very friable fine sandy loam of massive structure, breaking to fine nut or blocky overlying 50 cm of dark reddish brown very friable silt loam or fine sandy loam commonly of single grain or weak fine blocky structure, overlying a dark reddish brown to black coarse sand ash bed. The chief characteristics are their sandiness or grittiness, their friability and lack of stickiness and plasticity.
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Waiqere series have an Ah1, Ah2, Bw1, Bw2, C1, C2 horizon sequence. The Ah horizon thickness ranges from 8 to 20 cm; their colours include very dark grey (5YR 3/1), dark reddish brown (5YR 3/2) and very dark brown (10YR 2/2); textures are silt loam, silty clay loam or sandy clay loam; structures are moderate or strong fine or very fine nut; and grits and fine stones may or may not be present. The Bw horizon thickness ranges from 25 to 35 cm; their colours include dark reddish brown (5YR 3/2, 3/3) or dark brown (10YR 3/3, 7.5YR 3/2); textures vary between clay loam, silt loam, sandy loam; and structures may be massive breaking to single grain (for sandy textures) or weak or moderate fine or medium nut or blocky; and grits and fine stones may or may not be present. The C horizon thickness exceeds 30 cm; their colours are dark reddish brown (5YR 3/3, 3/4) reddish brown (5YR 4/3) or black (5YR 2/1); textures are sand, loamy sand or sandy loam; and they may be slightly gritty or stony.
VARIANTS:	Unnamed more weathered variant typically shows 30 cm of dark brown friable to firm silt loam of massive structure, on 60 cm of dark brown very friable silty clay loam of massive structure overlying reddish weathering basalt grits.
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analysis shows the topsoil (0-7 cm) to be strongly acid and moderately acid in the other horizons; organic carbon is high 0-15 cm, medium 15-45 cm and very low below these; nitrogen is very high 0-15 cm, high 15-27 cm, and medium below; C/N ratios are low; low available phosphorus and extremely high phosphorus retention; % base saturation is very low; CEC is very high 0-45 cm and high in the other horizons; exchangeable calcium and potassium are on the low side throughout; and magnesium high in the upper part of the profile dropping to very low values with depth.
LABORATORY Nos:	USP TAV2A-E
SOIL LIMITATIONS:	Moderately rapid permeability; high friability that creates erosion hazard if intensively cultivated; soil acidity; and nutrient deficiencies of potassium and phosphorus combined with high phosphorus fixation.

Typifying Profile

SOIL NAME:	Waiqere soils, easy.
PROFILE No.:	TAV2
SITE LOCATION:	Deliavuna area, southwest Taveuni Island.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Volcanic ringplain
PARENT MATERIAL:	Basaltic ash
SLOPE:	Flat site on an 8° slope.
ASPECT:	South
ELEVATION:	300 m
MICRORELIEF:	Even
SITE VEGETATION:	Coconuts, and ground cover of para and guinea grass.
LAND USE:	Coconut (copra) production with under grazing (beef cattle).
DRAINAGE:	Well drained
EROSION:	None observed
DISTURBANCE:	None observed
LABORATORY Nos:	USP TAV2A-E

PROFILE DESCRIPTION

Ah1	0-7 cm (7 cm)	Moist; very dark grey (5YR 3/1) silt loam; weak medium blocky structure breaking to moderate fine nut; friable, slightly plastic; abundant fine roots; distinct smooth boundary,
Ah2	7-15 cm (8 cm)	Moist; dark reddish brown (5YR 3/2) silt loam; weak medium blocky structure breaking to nut; moderate fine friable; abundant fine roots; distinct smooth boundary,
Bw1	15-27 cm (12 cm)	Moist; dark reddish brown (5YR 3/3) clay loam; moderately developed medium blocky structure breaking to moderate fine nut; friable; many fine roots; indistinct smooth boundary,
Bw2	27-45 cm (18 cm)	Moist; dark reddish brown (5YR 3/4) silt loam; weakly developed fine structure; friable but compact in places; few fine roots; indistinct smooth boundary,
C1	45-61 cm (16 cm)	Moist; reddish brown (5YR 4/3) sandy loam; very friable; single grain; few fine roots; distinct smooth boundary,
C2	61+ cm	Ash bed.

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Waisava series**

REFERENCE: New soil series introduced in the detailed soil survey of Dobuilevu Agricultural Research Station (McLeod, 1992) to recognise colluvial soils that form on accumulating toeslopes below slopes on which Dobuilevu series occur. Waisava series have a finer particle size class and poorer internal drainage than Dobuilevu series. Previously included with Matawailevu clay and stony clay (13b) as defined by Twyford & Wright (1965).

The name is derived from Waisava Creek, which is a tributary of Veitiri Creek, northeast of Dobuilevu Agricultural Research Station.

CLASSIFICATION:

(a) Soil Taxonomy: Fluventic Hapludoll, fine, smectitic, isohyperthermic
(b) FAO: Haplic Phaeozem
(c) Twyford and Wright: Nigrescent soil with a weak to moderate dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Waisava soils, flat to gently undulating phase (132A)
Waisava soils, undulating phase (132B)
Waisava soils, easy rolling phase (132C)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Waisava soils develop in association with Dobuilevu and Matawailevu soils in Ra province of Viti Levu.
PARENT ROCK:	Tuffaceous rocks of basic composition.
PARENT MATERIAL:	Moderately weathered colluvium.
PHYSIOGRAPHIC POSITION/LANDFORM:	Convex toeslopes
SLOPE CLASS AND RANGE OF SLOPES:	Gently undulating (3°) to easy rolling (12°).
VEGETATION AND LAND USE:	Mainly in pasture. Elsewhere sugar cane, subsistence root crops and rainfed rice.
RANGE OF ELEVATION:	25-80 m
RAINFALL:	Annual average range: 2,500-3,500 mm; dry season range: 700-1,500 mm; wet season range: 1,600-2,800 mm.
TEMPERATURE:	Mean annual: 25°C.
SOIL MOISTURE REGIME:	Udic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Imperfectly drained
PERMEABILITY CLASS:	Moderate to slow.
FLOODING:	Never floods
EROSION:	Very slight sheet erosion potential on slopes >5°.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows a thick black firm clayey topsoil which overlies 35 cm of dark greyish brown weakly mottled clay with many humus cutans to the ped faces. At about 1 m an olive brown sandy clay loam with dark greenish mottles and humus cutans is encountered.
DIAGNOSTIC HORIZONS:	Mollic epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Waisava series have a Ap, BA, Bw, Bg horizon sequence. The Ap horizon ranges in thickness from 35 to 50 cm; its colours vary from very dark grey (10YR 3/1) to black (2.5Y 2/0); textures are clay or clay loam; and structures are moderate or strong medium or fine nut. The BA horizon thickness ranges from 28-35 cm; its colours include dark greyish brown (10YR 4/2) and very dark greyish brown (2.5Y 3/2); and textures range between clay and loamy sand. The Bg horizon colours include very dark greyish brown (10YR 3/2) and olive brown (2.5Y 4/4); textures range between clay and loamy sand; and structures are massive or weak coarse platy.
VARIANTS:	Unnamed variant for profiles with topsoils that exceed 60 cm in thickness.
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analysis shows organic carbon values are low decreasing to very low with depth; CEC and % base saturation values are very high; exchangeable magnesium and calcium are very high, sodium medium, and potassium low. The particle size family class is fine. The mineralogical class is smectitic.
LABORATORY Nos:	KRS T1465-1469
SOIL LIMITATIONS:	Slight limitation of slope; moderate limitation of heavy texture and slow subsoil permeability; slight sheet erosion potential on slopes >3° under continual cultivation; slight soil moisture deficits during the dry season; and nutrient deficiencies of potassium and phosphorus.

Typifying Profile

SOIL NAME:	Waisava soils, undulating phase.
PROFILE No.:	DP9
SITE LOCATION:	See soil map of Dobuilevu Research Station (McLeod, 1992).

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Concave toeslope of short convex slope in strongly rolling country.
PARENT MATERIAL:	Colluvium from moderately weathered basic and intermediate tuffs.
SLOPE:	4°
ASPECT:	East
ELEVATION:	55 m
MICRORELIEF:	Hoof pugged surface.
SITE VEGETATION:	Batiki grass dominant pasture.
LAND USE:	Grazing
DRAINAGE:	Imperfectly drained
EROSION:	None observed
DISTURBANCE:	Cultivated in the past.
LABORATORY Nos:	KRS T1465-1469

PROFILE DESCRIPTION

Ap1	0-31 cm (31 cm)	Black (2.5Y 2/0) clay; few fine distinct dark brown (7.5YR 3/0) mottles along root channels; firm; moderately sticky; plastic; moderately developed medium nut breaking to fine nut and crumb structure; very few pores; abundant fine roots; distinct wavy boundary,
Ap2	31-45 cm (14 cm)	Near black (2.5Y 2/0) clay loam; firm; moderately sticky; plastic; massive; few pores; many fine roots; distinct wavy boundary,
BA	45-73 cm (28 cm)	Dark greyish brown (10YR 4/2) clay; abundant distinct very dark grey and grey (10YR 4/1 + 3/1) humus coatings and mottles; firm; moderately sticky; plastic; massive; many fine pores; many fine roots; indistinct wavy boundary,
Bw	73-105 cm (32 cm)	Dark greyish brown (10YR 4/2) clay; few fine faint dark yellowish brown (10YR 4/3) mottles; firm; sticky; plastic; massive; few fine pores; many dark grey (10YR 4/1) humus coatings on ped faces and down cracks; few fine roots; distinct wavy boundary,
Bg	105-113 cm (8 cm)	Olive brown (2.5Y 5/4) sandy clay loam; few fine distinct fine dark greenish grey (5GY 4/1) mottles; firm; moderately sticky; slightly plastic; massive; very few pores; very dark grey (10YR 4/1) humus coatings on ped faces; no roots.

Waisava

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Yakita series**

REFERENCE: Yakita sandy clay (15b) defined by Twyford & Wright (1965) as a colluvial soil related Nalotu series and derived from siliceous marl under a climate with a moderate dry season.

Forms part of the Nalotu set.

The central concept for Yakita soils is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Typic Dystropept, very-fine, kaolinitic, isohyperthermic
(b) FAO: Dystric Cambisol
(c) Twyford and Wright: Nigrescent soil with a moderate dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Yakita soils, undulating phase (153B)
Yakita soils, easy rolling phase (153C)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Occurs in a small area in the immediate vicinity of Yakita village, Kadavu Island.
PARENT ROCK:	Siliceous marl
PARENT MATERIAL:	Deep strongly weathered colluvium.
PHYSIOGRAPHIC POSITION/LANDFORM:	Concave toeslopes and lower midslopes in flattish to easy rolling land.
SLOPE CLASS AND RANGE OF SLOPES:	Undulating (4-7°) and easy rolling (8-11°).
VEGETATION AND LAND USE:	Have been used in the past for irrigated dalo gardens but now virtually unused and supports a strong thicket of vaivai. It has also been mined in the past for pottery clay.
RANGE OF ELEVATION:	20-200 m
RAINFALL:	Annual average range: 3,200-4,000 mm; dry season range: 800-1,600 mm; wet season range: 1,800-2,800 mm.
TEMPERATURE:	Mean annual: 24°C.
SOIL MOISTURE REGIME:	Udic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Somewhat imperfectly drained.
PERMEABILITY CLASS:	Moderately slow
FLOODING:	Never floods
EROSION:	Slight sheet and rill erosion potential on slopes >7°.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 18 cm of black firm sandy very heavy clay, of strong fine blocky structure and sticky and very plastic moist, overlying 13 cm of very dark grey mottled pinkish grey firm to friable very heavy clay, of strong fine blocky structure and sticky and very plastic when moist, overlying 30 cm of varicoloured very strongly mottled pink, red and dark grey firm heavy clay, of strong fine blocky structure on strongly mottled clay with fragments of weathered tuff.
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Not applicable. Only one profile description available.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Though not analysed these soils are expected by strongly acid, of moderate base status, and low in phosphorus, nitrogen and potassium.
LABORATORY Nos:	Not sampled for analysis.
SOIL LIMITATIONS:	Very clayey textures combined with high plasticity when moist; strong acidity; nutrient deficiencies of nitrogen, phosphorus, and potassium; and soil moisture deficits experienced during the dry season.

Typifying Profile

SOIL NAME:	Yakita soils, easy rolling phase.
PROFILE No.:	TW 89
SITE LOCATION:	On the coast west of Naqalotu village, Kadavu Island.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Concave toeslope
PARENT MATERIAL:	Colluvium from siliceous marl.
SLOPE:	10°
ASPECT:	North
ELEVATION:	25 m
MICRORELIEF:	Uneven
SITE VEGETATION:	Thicket of vaivai.
LAND USE:	Largely unused. Has been mined for pottery clay.
DRAINAGE:	Somewhat imperfectly drained.
EROSION:	None observed
DISTURBANCE:	None
LABORATORY Nos:	Not sampled for analysis.

PROFILE DESCRIPTION

Ah	0-18 cm (18 cm)	Moist; black (5YR 2/1) sandy very heavy clay; strongly developed fine blocky structure; firm; sticky; very plastic; common fine and medium fibrous roots; distinct smooth boundary,
Bw1	18-30 cm (12 cm)	Moist; very dark grey (5YR 3/1) very heavy clay; common distinct pinkish grey (5YR 6/2) mottles; strongly developed fine blocky structure firm to friable; sticky; very plastic,
Bw2	30-60 cm (30 cm)	Moist; varicoloured and very strongly mottled pink (5YR 7/4), red (2.5YR 5/6) and dark grey (5YR 4/1) - in a reticulate pattern; clay; strongly developed fine blocky structure breaking to coarse granules; firm; slightly sticky; very plastic,
BC	on	Compact strongly mottled clay with fragments of weathering tuff.

Yakita

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Yako series**

REFERENCE: Yako clay (16b) and Yako hill soils (16bH) defined by Twyford & Wright (1965) as slightly degraded heavy clays from marls and calcareous tuffs developed under a climate with a strong dry season.

Forms part of the Moto set.

This concept for Yako series is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Entic Haplustoll, fine, smectitic, isohyperthermic
(b) FAO: Haplic Kastanozem
(c) Twyford and Wright: Nigrescent soil with a strong dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Yako soils, undulating phase (120B)
Yako soils, easy rolling phase (120C)
Yako soils, rolling phase (120D)
Yako soils, strongly rolling phase (120E)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Yako soils are extensive on undulating and rolling land in the Nadi, Lautoka and Ba districts of west and north Viti Levu.
PARENT ROCK:	Calcareous tuffaceous rocks and marls.
PARENT MATERIAL:	Weakly weathered *in situ* rock.
PHYSIOGRAPHIC POSITION/LANDFORM:	Rolling ridge crests and convex backslopes and midslopes in strongly rolling hill country.
SLOPE CLASS AND RANGE OF SLOPES:	All slope phases from undulating through to strongly rolling (4-20°).
VEGETATION AND LAND USE:	In unused state support only a poor cover of grasses, reeds, guava and pandanus. Elsewhere, in spite of soil shallowness, Yako series are used extensively for sugar cane, maize, pulses and cassava.
RANGE OF ELEVATION:	10-100 m
RAINFALL:	Annual average range: 1,800-2,400 mm; dry season range: 400-500 mm; wet season range: 1,400-1,800 mm.
TEMPERATURE:	Mean annual: 25.5°C.
SOIL MOISTURE REGIME:	Ustic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Well drained
PERMEABILITY CLASS:	Moderately rapid
FLOODING:	Never floods
EROSION:	Due to past history of repeated burning, Yako soils have been severely sheet eroded, and have a severe sheet and rill erosion potential.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 10 cm of dark greyish brown friable clay of moderately developed medium granular structure, hard when dry, on 15 cm of dark brown friable clay loam with a weakly developed coarse nut structure, breaking to fine granular which overlies grey tuffs.
DIAGNOSTIC HORIZONS:	Mollic epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Not applicable. Only 2 profile descriptions made.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Only the surface horizon (0-30 cm) was sampled and analysis shows the soil to be moderately alkaline; organic carbon and nitrogen values are low and the C/N ratio is medium; CEC, TEB and % base saturation all have extremely high values; exchangeable magnesium and sodium values are high, potassium medium and calcium extremely high. The particle size family class is fine. The mineralogical class is smectitic.
LABORATORY Nos:	KRS U129
SOIL LIMITATIONS:	Profile shallowness; very low water holding capacity; severe soil moisture deficits in the dry season; and severe past and potential soil erosion.

Typifying Profile

SOIL NAME:	Yako soils, undulating phase.
PROFILE No.:	37/10/B
SITE LOCATION:	Adjacent Queens highway <1 km on the Suva side of Korovuto Village, Nadi.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Convex backslope
PARENT MATERIAL:	Weakly weathered *in situ* calcareous fine sandstone (tuff).
SLOPE:	5°
ASPECT:	North-west
ELEVATION:	20 m
MICRORELIEF:	Smooth
SITE VEGETATION:	Sugar cane
LAND USE:	Intensive sugar cane production.
DRAINAGE:	Well drained
EROSION:	Severe past topsoil losses through sheet erosion.
DISTURBANCE:	Cultivated
LABORATORY Nos:	KRS U129

PROFILE DESCRIPTION

A	0-30 cm (30 cm)	Moist; very dark greyish brown (10YR 3/2) stony clay loam; strongly developed medium granular structure; friable; sticky; plastic; common angular weakly weathered stones; many fine fibrous roots; sharp smooth boundary (paralithic contact),
CA	30-60 cm (30 cm+)	Moist; light grey (10YR 7/1) fractured *in situ* rock; infill of surface soil along fissures.

Yako

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Yaqara series**

REFERENCE: The Yaqara clay and mottled clay (20d) defined by Twyford & Wright (1965) as the associated colluvial/alluvial soils derived from Rabulu and Tavua soils - both of which develop on *in situ* basalt rock. They are found in the 'dry' zone of western Viti Levu.

They form part of the Tavua set.

The central concept of Tavua is retained in this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Kanhaplic Haplustalf, fine, kaolinitic, isohyperthermic
(b) FAO: Eutric Nitosol
(c) Twyford and Wright: Nigrescent soil with a strong dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Yaqara soils, flat to undulating phase (199A)
Yaqara soils, undulating phase (199B)
Yaqara soils, easy rolling phase (199C)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Develops on gentle terrain below slopes on which Tavua and Rabulu soils occur in the north and west of Viti Levu.
PARENT ROCK:	Basalt flow rocks
PARENT MATERIAL:	Deep strongly weathered alluvium/colluvium.
PHYSIOGRAPHIC POSITION / LANDFORM:	Gently sloping to easy rolling valley floors (underfit) in moderately dissected hill country).
SLOPE CLASS AND RANGE OF SLOPES:	Flat to undulating through all slope classes to easy rolling (0-11°).
VEGETATION AND LAND USE:	Sugar cane and where grazed nadi blue grass, wire grass, mission grass and *Desmodium heterophyllum*. Elsewhere, inferior grasses, miscellaneous weeds and guava.
RANGE OF ELEVATION:	20 - 130 m
RAINFALL:	Annual average range: 1,800-2,400 mm; dry season range: 400-500 mm; wet season range: 1,400-1,800 mm.
TEMPERATURE:	Mean annual: 25.5°C.
SOIL MOISTURE REGIME:	Ustic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Moderately well drained to well drained.
PERMEABILITY CLASS:	Moderately rapid
FLOODING:	No flooding
EROSION:	None observed

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows <15 cm dark reddish brown topsoils with dominantly silty clay loam textures and with strongly developed fine and medium blocky structures, overlying deep (>70 cm) dark reddish brown (2.5YR and 5YR hues) Bt horizons with silty clay textures of moderately developed fine prismatic structure breaking to blocky or nut structure, generally stone free, and with well expressed clay coatings to ped faces.
DIAGNOSTIC HORIZONS:	Ochric epipedon; argillic horizon.
RANGE OF PROFILE FEATURES:	(From 4 detailed descriptions; with 6 additional auger observations): The Ah horizon thickness varies from 8-15 cm; colours include 5YR 3/1, 3/2 and 3/3; and textures range from clay loam to silty clay loam. The Bt1 and Bt2 horizon thicknesses vary from 40-60 cm; colours include 2.5YR 4/4, 4/6, 4/8, 5 YR 3/4, 4/4, and 4/6; structures are fine prismatic, blocky or nut; often with rare stones (strongly weathered); and of friable or firm consistence. The Bt3 horizon thickness exceeds 40 cm; colours include 5YR 3/4, 2.5YR 4/4 and 4/6; textures range from clay loam to silty clay; and few or many stones (all strongly weathered) may be present.
VARIANTS:	Not recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Moderately acid soil of high base status; magnesium values are very high and sodium has medium values for all horizons; calcium is medium in the topsoil and low in other horizons; potassium is generally very low; organic carbon medium in topsoils and very low in subsoils.
LABORATORY Nos:	KRS R2651-2655 (inclusive); SB9685 A-E
SOIL LIMITATIONS:	Moderate soil moisture deficits experienced during the dry season; clayey textures that can inhibit a fine tilth when cultivated; minor nutrient deficiencies of phosphorus and potassium.

Typifying Profile

SOIL NAME:	Yaqara clay, easy rolling phase.
PROFILE No.:	N36
SITE LOCATION:	See Soil Map of Nawaicoba Agricultural Research Station (Leslie, 1984).

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Planar valley bottom.
PARENT MATERIAL:	Weathered colluvium from basalts.
SLOPE:	3°
ASPECT:	Not applicable
ELEVATION:	88 m
LANDFORM:	Valley floor in weakly dissected hill country.
TOPOGRAPHY:	Gently undulating
MICRORELIEF:	Flat
PARENT MATERIAL:	Colluvium derived from red weathered basalts.
SITE VEGETATION:	Nadi blue grass, mission grass and *D. Hiterophyllum.*
LAND USE:	Grazing for cattle.
DRAINAGE:	Well drained
EROSION:	None. An accumulating site.
DISTURBANCE:	None observed
LABORATORY Nos:	KRS R2651-2655 (inclusive); SB9685 A-E

PROFILE DESCRIPTION

Ah	0-10 cm (10 cm)	Moist; dark reddish brown (5YR 3/3) silty clay loam; strongly developed fine and medium blocky structure breaking to strong very fine nut structure; very friable; sticky; plastic; many very fine roots; indistinct smooth boundary,
Bt1	10-22 cm (12 cm)	Moist; ped face dark reddish brown (YR 3/4), moist reddish brown (2.5YR 4/4) and rubbed red (2.5YR 4/6) silty clay; moderately developed fine and medium blocky structure breaking to moderate very fine nut structure; friable; very sticky; plastic; common faint dark reddish brown (5YR 3/4) clay coatings; many very fine roots; indistinct smooth boundary,
Bt2	22-57 cm (35 cm)	Moist; moist red (2.5YR 4/6) , ped fact dark reddish brown (5YR 3/4) and rubbed red 2.5YR 4/8) silty clay; moderately developed fine prismatic structure breaking to moderate very fine nut structure; friable; very sticky; plastic; common distinct dark reddish brown (5YR 3/4) clay coatings; common very fine roots; diffuse smooth boundary,

Bt3	57-97 cm (40 cm+)	Moist; reddish brown (2.5YR 4/4), ped face dark reddish brown (5YR 3.4) and rubbed red (2.5YR 4/6) silty clay; moderately developed fine prismatic structure breaking to moderate very fine nut structure; firm; very sticky; plastic; common distinct dark reddish brown (5YR 3/4) clay coatings; few very fine roots; few very strongly weathered subrounded gravels.

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Yasawa series**

REFERENCE: The Yasawa sand (1a) defined by Twyford & Wright (1965) as a recent soil from white calcareous sands developed under a climate with a strong to moderate dry season. In some places the coral sands are underlain by hard coral limestones at variable depths.

This central concept for Yasawa soils is retained for this survey.

CLASSIFICATION:

(a) Soil Taxonomy: Typic Ustipsamment, carbonitic, isohyperthermic
(b) FAO: Arenosol
(c) Twyford and Wright: Recent soil from coastal sands with a strong dry season

INCLUDED MAPPING UNITS AND SYMBOLS:
Yasawa soils (7)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Widespread on the coastal margins in the 'dry zones' where mangrove swamps have not developed.
PARENT ROCK:	Coralline reef deposits.
PARENT MATERIAL:	Calcareous sands comprising in the main comminuted coral but commonly with small amounts of grey pumice gravels.
PHYSIOGRAPHIC POSITION/LANDFORM:	Coastal beach strand and narrow discontinuous coastal strips in areas devoid of mangrove.
SLOPE CLASS AND RANGE OF SLOPES:	Level to near level (0-2°) dominantly flat.
VEGETATION AND LAND USE:	Natural state comprises littoral trees, especially Barringtonia species, Dilo and Vau and coconuts. Normally extensively planted in coconut with other crops (cassava, pawpaw, bananas) that are low yielding and show nutrient deficiencies. Kumala grows well.
RANGE OF ELEVATION:	0.5-2.5 m
RAINFALL:	Annual average range: 1,800-2,400 mm; dry season range: 400-500 mm; wet season range: 1,400-1,800 mm.
TEMPERATURE:	Mean annual: 25.5°C.
SOIL MOISTURE REGIME:	Ustic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Excessively drained
PERMEABILITY CLASS:	Rapid permeability
FLOODING:	Slow surface runoff due to rapid permeability and excellent internal drainage properties. Never floods.
EROSION:	Can experience some topsoil losses and surface scouring when over-ridden by storm waves associated with hurricanes.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 10-15 cm of black or dark brown loose medium sand, often single grain but may have very weak fine nut and crumb structure, overlying loose white sand, of single grain or grades to the latter by a thin horizon (5-10 cm) of pale yellow humus stained loose sand, overlying more than 100 cm of loose sand commonly with coral stones, charcoal flecks and some pumiceous gravels.
DIAGNOSTIC HORIZONS:	Ochric epipedon
RANGE OF PROFILE FEATURES:	Yasawa series have an Ah, C1, C2 horizon sequence. The Ah horizon thickness ranges 10-15 cm; colours may be black (10YR 2/1), very dark brown (10YR 2/2) dark brown (10YR 3/3) or very dark greyish brown (10YR 3/2); textures vary fine sand, medium sand or coarse sand; and structures are either single grain, or weakly developed fine nut or granular. The C1 horizon thickness ranges from 5-30 cm; colours may be yellowish brown (10YR 5/6, 5/8) or brownish yellow (10YR 6/6, 6/8); and coral stones may or may not be present. The C2 horizon exceeds 100 cm in thickness; colours may be white (10YR 8/1, 8/2) or very pale brown (10YR 7/3, 7/4, 8/3, 8/4); textures may be fine, medium or coarse sand; and coral stones, gravels and boulders may or may not be present.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	Nukunuku series: Deeper surface horizon (mollic epipedon), thin B horizon development of yellow-brown and weak blocky structure. Overall a much better developed soil
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Moderately alkaline, very low organic carbon values, high base status with calcium and magnesium values high. Potassium and iron values are very low. Particle size class is dominantly medium sand with coarse sand with coral stones and pumiceous gravels in the C horizons. The mineralogical class is carbonitic.
LABORATORY Nos:	SB9390A-B
SOIL LIMITATIONS:	Excessively drained, very low water holding capacities such that severe soil moisture deficits can be experienced during the dry season, thin topsoils, high susceptibility to erosion (scouring) and crop damage from the sea during hurricane events. Very low organic matter status, nutrient deficiencies of potassium and phosphorus and in view of alkaline pH likely trace element deficiencies.

Typifying Profile

SOIL NAME:	Yasawa soils
PROFILE No.:	LK7
SITE LOCATION:	Lakeba Island, Lau Group. Map I iii (Lakeba) 447600E 114300N.

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Linear storm beach ridge.
PARENT MATERIAL:	Comminuted coralline sands.
SLOPE:	Even
ASPECT:	South
ELEVATION:	2 m
MICRORELIEF:	Smooth
SITE VEGETATION:	Coconuts with ground cover of grasses dominated by Mimosa.
LAND USE:	Copra production
DRAINAGE:	Excessively drained, rapid permeability, slow runoff.
EROSION:	None observed
DISTURBANCE:	None observed
LABORATORY Nos:	SB9390A-B

PROFILE DESCRIPTION

Ap	0-10 cm (10 cm)	Dry; dark brown to brown (10YR 4/3), moist, very dark greyish brown (10YR 3/2) medium sand; loose; non-sticky; non-plastic; single grain; abundant fine and medium roots; distinct wavy boundary,
C	10-61 cm+ (51 cm+)	Dry; very pale brown (10YR 7/4), moist, pale brown (10YR 7/3) medium sand; loose; non-sticky; non-plastic; single grain; many coarse roots; coral stones up to 10 cm; charcoal flecks; common pumice stones (305 cm).

Yasawa

SOIL TAXONOMIC UNIT DESCRIPTION

Reference/classification

SOIL NAME: **Yavuna series**

REFERENCE: Yavuna sandy loam and sandy clay loam (40b) and Yavuna hill soils (40bH) as defined by Twyford & Wright (1965) as grey and yellowish brown soils from granite on rolling and hilly land, usually under grass and formed under a climate with a moderate dry season.

This central concept for Yavuna soils is retained in this survey with the added qualification that Yavuna soils are restricted to the ustic moisture regime

CLASSIFICATION:

(a) Soil Taxonomy: Typic Ustropept, sandy-skeletal, siliceous, isohyperthermic
(b) FAO: Dystric Cambisol
(c) Twyford and Wright: Red yellow podzolic soil with a strong dry season

INCLUDED MAPPING UNITS AND SYMBOLS:

Yavuna soils, undulating phase (164B)
Yavuna soils, easy rolling phase (164C)
Yavuna soils, rolling phase (164D)
Yavuna soils, strong rolling phase (164E)

Environmental Factors

GEOGRAPHICAL DISTRIBUTION:	Yavuna soils occur in south-west Viti Levu, in particularly along the road from Nadi to the Nausori highlands.
PARENT ROCK:	Granite
PARENT MATERIAL:	Weakly weathered *in situ* rock.
PHYSIOGRAPHIC POSITION/LANDFORM:	Ridge crests, convex backslopes and midslopes in easy rolling and weakly dissected hill land.
SLOPE CLASS AND RANGE OF SLOPES:	Undulating (4-7°), easy rolling (8-11°), rolling (12-15°) and strongly rolling (16-20°).
VEGETATION AND LAND USE:	Supports very poor fern and mission grass vegetation in the natural state, and used for rough grazing. Sugar cane cultivation has been attempted in places with very poor productivity attained.
RANGE OF ELEVATION:	15-100 m
RAINFALL:	Annual average range: 1,800-2,400 mm; dry season range: 400-500 mm; wet season range: 1,400-1,800 mm.
TEMPERATURE:	Mean annual: 25°C.
SOIL MOISTURE REGIME:	Ustic
SOIL TEMPERATURE REGIME:	Isohyperthermic
SOIL DRAINAGE CLASS:	Well drained
PERMEABILITY CLASS:	Moderately rapid
FLOODING:	Never floods
EROSION:	Have experienced topsoil losses through sheet erosion induced by repeated burning. Have a moderate to severe sheet and rill erosion potential.

Morphological and Chemical Properties

CHARACTERISTIC PROFILE FEATURES:	Typically shows 7 cm of very dark grey to dark grey silt loam, of strongly developed coarse nut structure that breaks easily to fine nut with crumb, and hard to dig, overlying 20 cm of grey gritty sandy loam of very weakly developed very fine nut structure, slightly hard dry, slightly plastic moist and with many quartz fragments, over grey, reddish yellow, and dark yellowish brown massive and weathering *in situ* rock
DIAGNOSTIC HORIZONS:	Ochric epipedon, cambic horizon.
RANGE OF PROFILE FEATURES:	Not applicable. Only 2 profile descriptions made.
VARIANTS:	None recognised
SIMILAR SOILS AND DISTINGUISHING FEATURES:	None recognised
GENERAL CHEMICAL, PHYSICAL & MINERALOGICAL PROPERTIES:	Analyses show the soil to be slightly acid; carbon values are very low; nitrogen has a low value in the A horizon and very low below; low available phosphorus; % base saturation is high in the a horizon, drops to medium in the AC and rises to high again in the C horizon; CEC is medium 0-7 cm and low below; exchangeable magnesium is medium, potassium is very low, and calcium has medium value for the topsoil and low values below. The particle size family class is sandy-skeletal. The mineralogical class is siliceous.
LABORATORY Nos:	Not sampled for analysis.
SOIL LIMITATIONS:	Very low water holding capacities; very severe soil moisture deficits experienced during the dry season; past erosion and moderate sheet and rill erosion potential; nutrient deficiencies of nitrogen, potassium and phosphorus .

Typifying Profile

SOIL NAME:	Yavuna soils, strongly rolling phase.
PROFILE No.:	TR53
SITE LOCATION:	Midway between top of Yavuna Road and Yavuna Creek below; near Yavuna Village and FPC Planning Unit 12 (Nadi Forest).

SITE INFORMATION

POSITION IN LANDSCAPE/LANDFORM:	Convex backslope
PARENT MATERIAL:	*In situ* weathering granite (Tonalite).
SLOPE:	19°
ASPECT:	West
ELEVATION:	25 m
MICRORELIEF:	Smooth
SITE VEGETATION:	Mission grass
LAND USE:	Unused
DRAINAGE:	Well drained
EROSION:	Debris slides in vicinity.
DISTURBANCE:	None
LABORATORY Nos:	Not sampled for analysis.

PROFILE DESCRIPTION

Yavuna soils, strongly rolling phase

Ah	0-7 cm (7 cm)	Dry; very dark grey (10YR 3/1) to dark grey (10YR 4/1) and very dark grey (7.5YR N3/0) moist silt loam; strongly developed coarse nut structure breaking to weak very fine nut structure; slightly hard dry; non-sticky; non-plastic; very porous; many fine, medium and coarse roots; distinct wavy boundary,
Bw	7-24 cm (17 cm)	Dry; grey (10YR 5/1) and dark grey (10YR 4/1) moist gritty sandy loam; very weakly developed very fine nut structure; slightly hard dry; non-sticky; slightly plastic; many quartz fragments; many fine vesicular pores; common fine, medium and coarse roots; distinct irregular boundary,
C	24-48 cm+ (24 cm+)	Coarsely variegated reddish yellow (7.5YR 8/6) and dark yellowish brown (10YR 4/4) dry weathered *in situ* rock; massive breaking to single grain; many fine and medium vesicular pores; common fine roots.