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TAXONOMY OF SOME SOLOMON ISLAND SOILS

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The main agricultural goal of soil classification and soil survey is the assessment of the land resource in terms of plant productivity. Information (i.e., agrotechnology) transfer is one of the processes used in the prediction of productivity. Information is transferred from experimental stations or farms to analogous areas as defined by soil (or land) classification. This method of predicting productivity is based on the hypothesis that if two soil sites are similar they will respond in a similar way to prescribed agricultural practices, e.g., crop varieties, management. The concept of similarity presents a major problem. Similar means being alike or approaching identity to some degree: the degree is variable and frequently unknown. Soil classification, whose role is to group similar soils together, lies at the heart of the matter.

The only classification that has so far achieved world-wide coverage is the FAO/UNESCO Soil Map of the World (FAO/UNESCO, 1974). Unfortunately, however, this legend applies to the accompanying maps at a scale of 1:5,000,000 and is therefore of limited practical use for small island nations. Soil Taxonomy (Soil Survey Staff, 1975) although it has not been applied universally, is gaining increasing acceptance (particularly in developing countries); because of the more extensive taxonomic hierarchy and potential for detailed soil surveys this system is much more useful for agricultural purposes. The differentiating characteristics used are quantitative and explicit at all levels in the multicategoric system, the majority of these characteristics being based on land use experience.

The Benchmark* Soils Project initiated by the University of Hawaii in 1974, has been testing the premise that soils belonging to the same soil family as defined in Soil Taxonomy are sufficiently

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*Benchmark soils are those that, because of their large extent, their key position in the classification system, or their occurrence in critical areas, are important to our understanding of soils.

similar to allow for successful transfer of agrotechnological information. The soil family is the fifth level of subdivision in Soil Taxonomy and has been described by Uehara (1978) as "a condensed statement of what we know about a soil". Full details of the transfer, variety and management experiments are given by Beinroth et al., (1980).

Once it has been demonstrated that management systems implemented successfully on a soil of a particular family can be transferred to another soil of that family, then an acceleration of agricultural development will occur. This will be accompanied by a decrease in the cost of the development.

There are many agricultural stations in the stations in the South Pacific Region (Leslie and Morrison, 1982) involved in research aimed at increasing food production. In many cases these stations have been selected to act as "soil windows" for the neighbouring areas and results of trials on these stations have been used to develop agricultural practices for the surrounding areas. It is likely that many of these stations, in the different Regional countries, have similar physical environments. Many research stations in the tropical areas outside the South Pacific also have similar environments (the identification of similar environments is made possible by soil surveys and soil classification). As a consequence research projects may have already been completed on a similar soil, for the same crop, at other stations either within or outside the Region. Thus a correlation of the soil resources of the agricultural research stations (initially within the Region and later with other areas) would provide a basis for communication and information exchange. Soil correlations would not eliminate the need for field experimentation but researchers would have the benefit, in many situations, of the results of others, e.g., once the major soil families in an area are known, experience elsewhere with soils of the same families can be used to determine which crops are likely to do well in that area. These crops would be trialled at the experiment station and local practices developed for communication to farmers of the area.

The aim of this project was to classify a number of soils from N. Guadalcanal, Solomon Islands at the family level according to Soil Taxonomy.

Sites were selected and the soils examined and described by Mr L.D.C. Chase of the Ministry of Home Affairs and National Development. Samples were despatched to Suva for laboratory investigation. Sampling and analyses were made using standard methods. Detailed descriptions and the analytical results are given in Appendix I.

One problem encountered in the classification was the interpretation of climatic data, particularly with respect to the soil moisture regime. Similar problems have been encountered in Fiji (Leslie et al., 1982) particularly when dealing with areas having a dry season where the monthly rainfall is about 100 mm. Computer analysis of the likely moisture regime is being carried out by the United States Department of Agriculture. Data available tend to indicate that most soils in N. Guadalcanal have an ustic moisture regime with the moisture control section being dry in some or all parts for 90 or more cumulative days in most years.

The soils have been classified as follows:

TG	Typic Ustipsamment, mixed, isohyperthermic
TB	Typic Ustipsamment, mixed, isohyperthermic
KB	Fluventic Haplustoll, fine clayey, mixed, isohyperthermic
MT	Entic Chromudert, fine clayey, montmorillonitic, isohyperthermic
KGA	Udic Paleustalf, very fine clayey, mixed, isohyperthermic
KGB	Rhodic Paleustalf, very fine clayey, mixed, isohyperthermic

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APPENDIX I

SOIL DESCRIPTIONS AND ANALYSES

Pedon TG

Classification:	Typic Ustipsamment, mixed, isohyperthermic
Location:	Dodo Creek Research Station, North Guadalcanal, Solomon Islands. 9° 26'S, 160° 6'E.
Physiographic Position:	Beach plain approximately 400 m from sea: surrounding land form flat: elevation < 5m a.m.s.l.
Topography:	Planar
Drainage:	Excessively well drained
Vegetation:	Fire-maintained grassland with Pennisetum polystachyon, Mimosa invisa and Chamaelia sebastian
Parent Material:	Mineral beach sand derived from basic volcanic rocks
0-16 cm	very dark grey (10 YR 3/1), barry sand; moderate medium crumb structure; soft (dry); common fine roots; diffuse wavy boundary,
16-40 cm	very dark greyish brown (10 YR 3/2), sand; structureless; loose; few fine roots; diffuse wavy boundary,
40-112 cm	light olive brown (2.5Y 5/4), sand; structureless; loose; few fine roots; clear smooth boundary,
112-143 cm	no dominant colour - many different sand grain colours including black, green and white, coarse sand; structureless; loose; no roots; gradual smooth boundary,
143-150 cm	colour as horizon above, gravelly coarse sand, structureless; loose; no roots

Pedon TG

Sample Depth (cm)	pH H_2O	pH KCl	NaF	C %	N %	C:N	Ext. P (ppm)	P Retention %	15 Bar Moisture Retention %
0-16	6.1	5.1	9.3	2.26	0.17	13	98	5	5.5
16-40	7.0	5.2	9.2	1.00	0.09	11	88	28	4.3
40-75	7.4	4.9	7.9	0.25	0.05	5	139	17	3.7
75-112	7.3	5.1	7.9	0.24	0.01	11	160	0	3.4
112-143	6.3	5.3	7.9	0.11	<0.01		134	0	2.4

Sample Depth (cm)	CEC (pH 7.0)	Σ Bases	% BS	Ca	Mg	K	Na	Exch. Al	Sand %	Silt %	Clay %
0-16	15.1	10.7	71	9.0	1.1	0.4	0.2	0	97	3	0
16-40	10.8	9.5	88	7.8	1.3	0.2	0.2	0	96	4	0
40-75	9.8	10.0	(100)	7.8	1.8	0.2	0.2	0	98	2	0
75-112	11.4	11.4	100	8.4	2.3	0.3	0.4	0	98	2	0
112-143	9.9	10.4	(100)	7.4	2.1	0.4	0.5	0	100	0	0

Pedon TB

Classification:	Typic Ustipsamment, mixed, isohyperthermic
Location:	Dodo Creek Research Station, North Guadalcanal, Solomon Islands. 9° 26'S, 160° 6'E
Physiographic Position:	Edge of beach swale depression, approximately 400 m from sea: surrounding land form - concave slope leading to tidal creek below site, convex slope leading to grassland beach plain above site; < 5m a.m.s.l.
Topography:	Smooth 5° slope with crab holes and mounds below site
Drainage:	Somewhat excessively well drained; groundwater at approximately 150 cm, varying with tide.
Vegetation:	Secondary forest, with Hibiscus tiliaceus, Prenna corymbosa, Barringtonia racemosa, Alpinia purpurata, Piper sp., and Derru sp.
Parent Material:	Mineral beach sand derived from basic volcanic rocks
0-20 cm	very dark greyish brown (10 YR 3/2), leamy sand; weak medium crumb structure; loose; many roots; clear irregular boundary,
20-80 cm	light olive brown (2.5Y 5/4), sand; structureless; loose; 15 cm diameter round patch of 10 YR in this horizon, probably infilling of former root channel, or crab hole; few medium and coarse roots; clear smooth boundary,
80-150 cm	light olive brown (2.5Y 5/4), coarse sand; structureless; loose; few roots; clear smooth boundary,
150 cm+	no dominant colour, many different sand grain colour, in olive, black, green; structureless; non-sticky, non-plastic

Pedon TB

Sample Depth (cm)	pH H_2O	KCl	NaF	C %	N %	C:N	Ext. P (ppm)	P Retention %	15 Bar Moisture Retention %
0-11	6.9	5.9	8.2	2.87	0.18	22	92	3	5.8
20-50	7.2	5.0	8.1	0.21	0.03	10	105	3	4.1
50-80	7.8	5.2	8.0	0.12	0.01	12	115	3	4.3
80-120	7.3	5.2	7.8	0.03	<0.01		136	0	4.0
120-150	7.5	5.0	7.8	0.02	<0.01		110	3	4.6

Sample Depth (cm)	CEC (pH 7.0)	Σ Bases	% BS	Ca	Mg	K	Na	Exch. Al	Sand %	Silt %	Clay %
0-11	14.4	14.1	98	11.3	2.3	0.4	0.1	0	96	4	0
20-50	15.5	12.9	83	8.9	2.3	1.6	0.1	0	97	3	0
50-80	15.0	15.5	(100)	11.4	2.8	1.1	0.2	0	98	2	0
80-120	14.5	14.0	97	10.4	2.9	0.7	0.4	0	100	0	0
120-150	19.3	18.7	97	13.0	4.9	0.4	0.4	0	100	0	0

Pedon KB

Classification:	Fluventic Haplustoll, fine clayey, mixed, isohyperthermic
Location:	West of Kongga Trail, opposite old village site, North Guadalcanal, Solomon Islands. 9° 29'S, 160° 4'E
Physiographic Position:	Valley bottom, at bottom of long moderate slope on gently sloping valley floor. Elevation < 35m a.m.s.l.
Topography:	Smooth 3° slope
Drainage:	Well drained
Vegetation:	Secondary forest containing Canarium indicum, Pometia pinnata, Canarga oderata, Myristica sp., bamboo and wild gingers
Parent Material:	Colluvium from valley sides
0-28 cm	very dark grey (10 YR 3/1), clay loam; moderate very fine sub-angular blocky structure; friable to firm; few small Mn concretions; many roots; gradual smooth boundary,
28-42 cm	very dark greyish brown (10 YR 3/2), clay; moderate very fine sub-angular blocky structure; firm; very many small Mn concretions; few roots; clear smooth boundary,
42-52 cm	dark greyish brown (10 YR 4/2), clay; moderate very fine sub-angular blocky structure; friable to firm; few small Mn concretions; few roots; patchy thin cutans (?); gradual smooth boundary,
52-90 cm	brown to dark brown (7.5 YR 4/2), clay; moderate fine sub-angular blocky structure; many small Mn concretions; firm; few roots; clear smooth boundary,
90-120 cm	brown to dark brown (7.5 YR 4/2), clay; weak medium sub-angular blocky structure; very firm; few small Mn concretions; few roots,
120 cm+	many rounded unweathered stones below 120 cm

Pedon KB

Sample Depth (cm)	pH H_2O	pH KCl	pH NaF	C %	N %	C:N	Ext. P (ppm)	P Retention %	15 Bar Moisture Retention %
0-28	5.8	4.7	8.9	3.12	0.25	12	9	24	26.8
28-42	5.9	4.7	8.0	1.24	0.08	15	4	21	17.9
42-50	5.6	4.6	8.3	1.16	0.08	15	4	60	19.7
50-90	5.8	4.6	8.2	1.02	0.06	17	4	25	20.8
90-120	5.5	4.6	8.3	1.12	0.08	14	4	28	18.5

Sample Depth (cm)	CEC (pH 7.0)	Σ Bases	% BS	Ca	Mg	K	Na	Exch. Al	Sand %	Silt %	Clay %
0-28	29.6	20.4	69	12.3	7.8	0.2	0.1	0	60	31	9
28-42	20.6	11.0	53	6.5	4.2	0.2	0.1	0	60	23	17
42-50	19.8	12.5	63	6.8	5.3	0.2	0.2	<0.1	59	26	15
50-90	18.8	11.6	62	6.6	4.7	0.1	0.2	0.3	67	18	15
90-120	19.1	10.6	55	6.7	3.4	0.1	0.4	0.3	60	24	16

Pedon MT

Classification:	Entic Chromudert, fine clayey, montmorillonitic, isohyperthermic
Location:	Tenaru Research Sub-station, North Guadalcanal, Solomon Islands. 9° 26'S, 160° 4'E
Physiographic Position:	Alluvial plain in flat country with no microtopography. Elevation < 50m a.m.s.l.
Topography:	Planar
Drainage:	Imperfectly drained, profile moist throughout, groundwater below 150 cm
Vegetation:	Secondary forest, with Terminalia sp., Eugenia tierneyana, Calophyllum kajewskii, Hibiscus tiliaceus, Kleinhovia hospita, Timonius timon and bamboo
Parent Material:	Alluvium derived largely from calcareous rocks
0-11 cm	dark reddish brown (5 YR 2/2); clay; strong medium sub-angular blocky, structure; firm; many roots; clear smooth boundary,
11-60 cm	brown (10 YR 5/3), clay; moderate medium sub-angular blocky structure; friable to firm; very few small knobby $CaCO_3$ concretions and few small and large shell fragments; common medium and coarse roots; clear smooth boundary,
60-77 cm	very dark grey (10 YR 3/1), clay; moderate medium sub-angular blocky structure; friable to firm; very few small charcoal fragments, and patches of yellowish red weathering rock, no nodules or shell fragments; few medium roots; clear smooth boundary,
77-120 cm	brown (10 YR 5/3), clay; very weak prismatic structure breaking into moderate medium sub-angular blocky; firm; few small shell fragments and many hard knobbly $CaCO_3$ concretions, increasing with depth
Comments	high montmorillinite content suspected. Many sling ped faces, probably pressure faces, not cutans. No cracks in soil under forest. However, when exposed to sun these soils develop cracks and marked surface self-mulching i.e., develop vertic properties. 60-77 horizon is burned

Pedon MT

Sample Depth (cm)	pH H_2O	pH KCl	pH NaF	C %	N %	C:N	Ext. P (ppm)	P Retention %	15 Bar Moisture Retention %
0-11	7.4	6.6	8.4	7.45	0.48	16	184	21	38.4
11-16	8.5	7.0	10.0	0.53	0.10	5	136	35	29.1
60-77	8.5	6.9	10.0	0.42	0.03	14	118	34	29.2
77-120	8.8	7.1	10.0	0.44	0.01	44	110	42	27.8

Sample Depth (cm)	CEC (pH 7.0)	Σ Bases	% BS	Ca	Mg	K	Na	Exch. Al	Sand %	Silt %	Clay %
0-11	73.2	--------Free Lime--------			7.1	0.7	0.4	0	60	28	12
11-16	49.9	"			8.4	0.2	0.9	0	38	31	31
60-77	51.1	"			10.5	0.2	1.5	0	25	37	38
77-120	45.5	"			9.8	0.2	1.5	0	42	29	29

Pedon KGA

Classification:	Udic Paleustalf, very fine clayey, mixed, isohyperthermic
Location:	East (approximately 200 m) of Kongga Trail, next to experimental plots, North Guadalcanal, Solomon Islands. 9° 29'S, 160° 7'E
Physiographic Position:	Near edge of terrace surface with moderately sloping gully to west and level terrace surface to east; < 50m a.m.s.l.
Topography:	Flat site with subdued mound and hollow microrelief associated with grass mounds
Drainage:	Moderately well drained with groundwater below 140 cm
Vegetation:	Fire maintained grassland oversown with Stylosanthes sp. and lightly grazed by cattle. Pennisetum polystachyon dominant
Parent Material:	Conglomerates of Quaternary Honiara beds
0-5 cm	very dark greyish brown (10 YR 3/2); loam; moderate fine crumb structure; friable; very many fine roots; smooth abrupt boundary,
5-11 cm	very dark greyish brown (10 YR 3/2), gravel (Mn concretions); structureless; very friable; many fine roots; smooth abrupt boundary,
11-70 cm	yellowish red (5 YR 5/8), clay; strong brown (7.5 YR 5/6) on ped surfaces; weak medium sub-angular blocky structure; firm; very few small Mn concretions and fresh mineral fragments (quartz ?); few fine roots; smooth diffuse boundary,
70-140 cm	yellowish red (5 YR 5/8), clay; strong brown and yellowish brown on ped surfaces; weak medium sub-angular blocky structure; firm; many weathering stones and boulders - colours include black, red, white and blue, possibly patchy moderately thick cutans (difficult to distinguish from ped surface colours, possibly caused by gleying); rare roots

Pedon KGA

Sample Depth (cm)	pH H_2O	pH KCl	pH NaF	C %	N %	C:N	Ext. P (ppm)	P Retention %	15 Bar Moisture Retention %
0-5	5.2	4.4	8.2	1.89	0.15	18	6	21	9.6
5-11	5.9	4.9	8.1	1.40	0.08	18	4	25	14.7
11-40	5.6	4.2	8.0	0.45	0.08	6	2	49	28.1
40-70	6.2	4.3	8.1	0.26	0.05	5	2	60	30.0
70-140	6.1	4.6	8.1	0.10	<0.01		2	51	31.2

Sample Depth (cm)	CEC (pH 7.0)	Σ Bases	% BS	Ca	Mg	K	Na	Exch. Al	Sand %	Silt %	Clay %
0-5	10.2	3.6	35	2.2	1.2	0.1	0.1	2.1	75	22	3
5-11	11.8	3.3	28	1.2	1.0	<0.1	0.1	<0.1	90	5	5
11-40	19.0	7.8	41	4.9	2.7	<0.1	0.2	5.3	23	30	47
40-70	20.5	10.4	51	6.5	3.6	<0.1	0.3	0.3	52	17	31
70-140	27.0	15.0	56	10.5	4.2	<0.1	0.3	0.2	20	32	48

Pedon KGB

Classification:	Rhodic Paleustalf, very fine clayey, mixed, isohyperthermic
Location:	West (approximately 100 m) of Kongga Trail opposite old village, North Guadalcanal, Solomon Islands. 9° 29'S, 160° 7'E
Physiographic Position:	Mid-slope of terrace margin; < 40m a.m.s.l.
Topography:	Smooth 12° slope
Drainage:	Moderately well drained; groundwater below 140 cm
Vegetation:	Fire-maintained grassland, including Themeda australis (dominant), Stylosanthes sp., Pennisetum polystachyon, sedges and ferns
Parent Material:	Conglomerates of Quaternary Honiara beds
0-12 cm	very dark grey (10 YR 3/1), loam; strong very fine sub-angular blocky structure; friable; very many fine roots; clear smooth boundary,
12-30 cm	very dark grey (10 YR 3/1), gravel (Mn concretions); structureless; loose; few rounded unweathered stones; few roots; gradual smooth boundary,
30-110 cm	red (2.5 YR 4/6), clay; dark greyish brown (10 YR 4/2) on ped surfaces; moderate coarse prismatic structure breaking into moderate sub-angular blocky, with dark greyish brown on ped surfaces and root channels; very firm; few roots; diffuse smooth boundary,
110-140 cm	red (2.5 YR 4/6), clay; massive; few weathering stones; extremely firm
Comment:	cutans not evident under hand lens, but ped surface colours cause difficulties of identification

Pedon KGB

Sample Depth (cm)	pH H_2O	pH KCl	pH NaF	C %	N %	C:N	Ext. P (ppm)	P Retention %	15 Bar Moistur Retention %
0-12	5.8	4.4	7.7	2.54	0.24	11	7	23	19.8
12-30	6.2	4.9	7.8	0.29	0.08	4	4	40	16.5
30-80	7.1	5.2	8.9	0.26	0.04	6	3	49	31.1
80-110	7.4	5.1	8.3	0.14	0.03	5	1	42	31.7
110-140	6.4	5.0	8.1	0.04	0.01	4	1	35	18.5

Sample Depth (cm)	CEC (pH 7.0)	Σ Bases	% BS	Ca	Mg	K	Na	Exch. Al	Sand %	Silt %	Clay %
0-12	16.2	7.8	48	4.9	2.4	0.2	0.3	0.5	70	27	3
12-30	15.0	5.5	37	3.3	1.8	0.1	0.3	0	75	21	4
30-80	22.1	10.9	49	7.2	3.2	0.1	0.4	0	64	13	23
80-110	25.7	13.9	54	8.8	3.5	0.2	0.4	0	40	16	44
110-140	20.2	13.5	67	9.4	3.8	<0.1	0.3	0	26	18	56