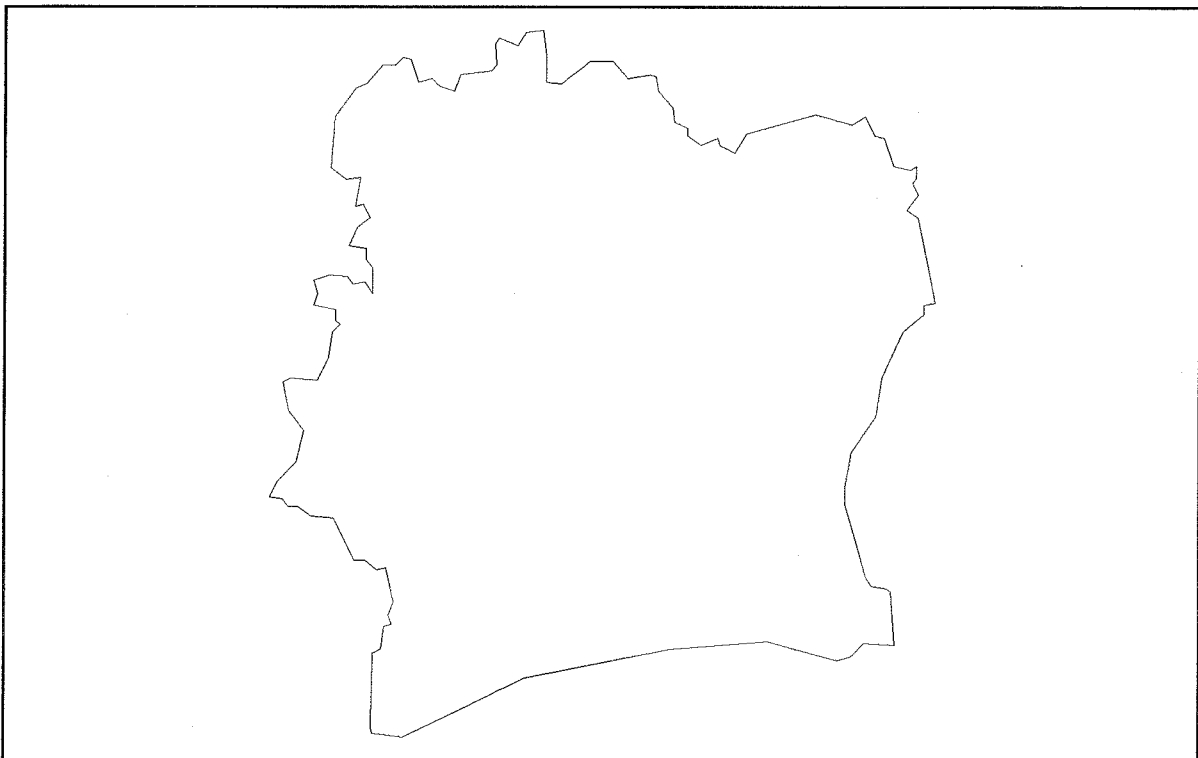


Country Report 4

DRAFT

Soil Reference Profiles of Côte d'Ivoire

Field and Analytical Data



Institut des Savannes
International Soil Reference and Information Centre

July 1994

Soil Reference Profiles of Côte d'Ivoire

Field and Analytical Data

Published by

Institut des Savannes

International Soil Reference and Information Centre

Compiled by Arie van Kekem (DLO-SC) and
Tom van de Ven (ISRIC)

Based upon fieldwork of

Arie van Kekem

(ISRIC)

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FOREWORD

Soil Reference Collection and Database of Côte d'Ivoire

The objective of this Country Report is to provide comprehensive field and analytical data of a number of reference soils representative for some major soil types of Côte d'Ivoire. The sites were carefully selected, described and sampled. Soil samples were analyzed by the ISRIC soil laboratory.

The sites are located near the village of Taï, in the West of the Côte d'Ivoire, near the Liberian border. The area east of Taï is one of the forest reserves of the Man and the Biosphere Project (MAB) of the United Nations Educational, Scientific and Cultural Organization (UNESCO). The collection and description of the soil monoliths has taken place in a joint project of UNESCO and ISRIC. The project's goal was to present results of pedological research in the various forest reserves of the Man and the Biosphere Programme in a uniform manner.

The first five sites were taken in a catena. The last two were selected because they, pedologically speaking, take up intermediate positions in the catena.

International Soil Reference Collection and Database

The International Soil Reference and Information Centre (ISRIC), founded in 1966 as an initiative of the International Society of Soil Science (ISSS) has a mandate to collect and disseminate scientific knowledge about soils for the purpose of a better understanding of their formation, characterization, classification, distribution and capability for sustained land use at local, national, and global scales. One of ISRIC's main objectives is to assemble soil profiles, soil samples and associated information to illustrate the units of the FAO-Unesco Soil Map of the World. To date, the world soil collection consists of over 800 reference soils from 60 countries, accompanied by soil and environmental data. The collection is supported by a soil map collection, soil reports library, a thin section collection and a slide collection.

The National Soil Reference Collection Programme (NASREC), supported by the Directorate General for International Cooperation of the Netherlands within the Action Plan of National Soil Policies of UNEP, and through ISRIC's own budget has been instrumental to achieve this objective.

The collected information of the reference soil profiles is stored in ISRIC's Soil Information System (ISIS), a database management system for storing and retrieving data on geology, geomorphology, hydrology, soil morphology, soil chemical and physical characteristics, and climate.

To disseminate its data, ISRIC has combined the different types of information into several publication series. Each series aims to address the varying needs of those working in one of many fields of research using soils data and soil related data. One of this series is the Country Reports.

The Country Reports, containing all ISRIC held data on soils and associated information of a specific country are generated by ISIS. Additional information on literature references, small scale maps, and a list of slides available in the ISRIC Slide Database is included. The country reports are jointly published by the national institution involved in the collection and ISRIC. A list of Country Reports (in press) is given on the back cover of this report. We are very pleased to release the draft Country Report of Côte d'Ivoire at the occasion of the XVth World Congress of Soil Science.

Dr. L.R. Oldeman, director ISRIC

Country Reports can be purchased through ISRIC or the national institution of the country concerned. Publications based on the Country Reports should explicitly indicate the information source. To order Country Reports please contact:

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Fax (31) (0)8370 24460
E-mail ISRIC@RCL.WAU.NL

SUMMARIZED INFORMATION OF REFERENCE SOILS CI001 TO CI007

ISIS_ID ¹⁾	FAO-74 ²⁾	FAO-88 ³⁾	ST-75 ⁴⁾	ST-92 ⁵⁾	PARENT MATERIAL	CLIM ⁶⁾	LANDFORM	LUT ⁷⁾ /VEGETATION	DRAINAGE CLASS	ALT. ⁸⁾
CI001	Ferric Acrisol	Ferric Acrisol	tropudult	Kandiudult	residual material	Aw	peneplain	evergreen forest	somewhat excessive	177
CI002	Ferric Acrisol	Ferric Acrisol	tropudult	Kandiudult	residual material	Aw	peneplain	closed forest	well	173
CI003	Plinthic Acrisol	Plinthic Acrisol	plinthudult	Kandiudult	residual material	Aw	peneplain	closed forest	well	165
CI004	Xanthic Ferralsol	Ferric Acrisol	haplorthox	Kandiudalf	residual material	Aw	peneplain	closed forest	moderately well	166
CI005	Eutric Gleysol	Eutric Fluvisol	tropaquept	Tropaquept	alluvium	Am	peneplain	closed forest	poor	155
CI006	Ferric Acrisol	Ferric Acrisol	tropudult	Kandiudult	residual material	Am	peneplain	arable farming	well	170
CI007	Plinthic Acrisol	Plinthic Acrisol	plinthudult	Kandiudult	residual material	Am	peneplain	closed forest	moderately well	165

1) ISIS Identification code

2) FAO-Unesco, 1974

3)

FAO-Unesco, 1988

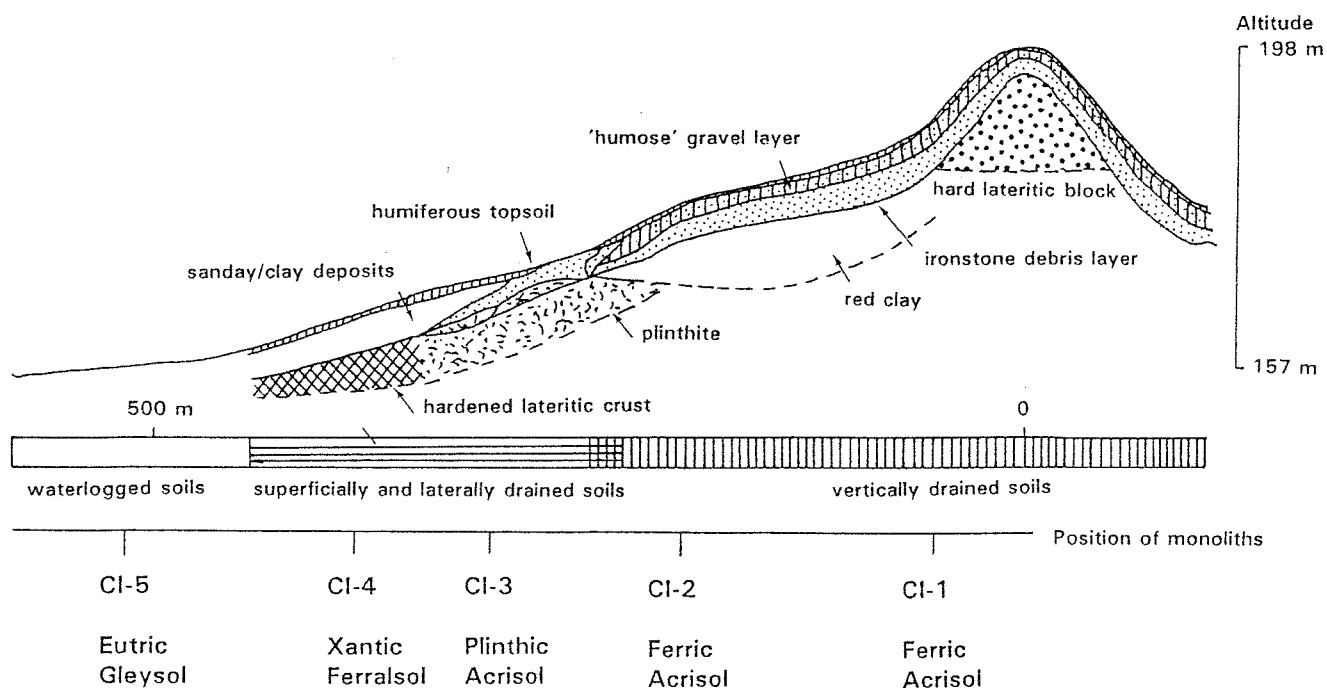
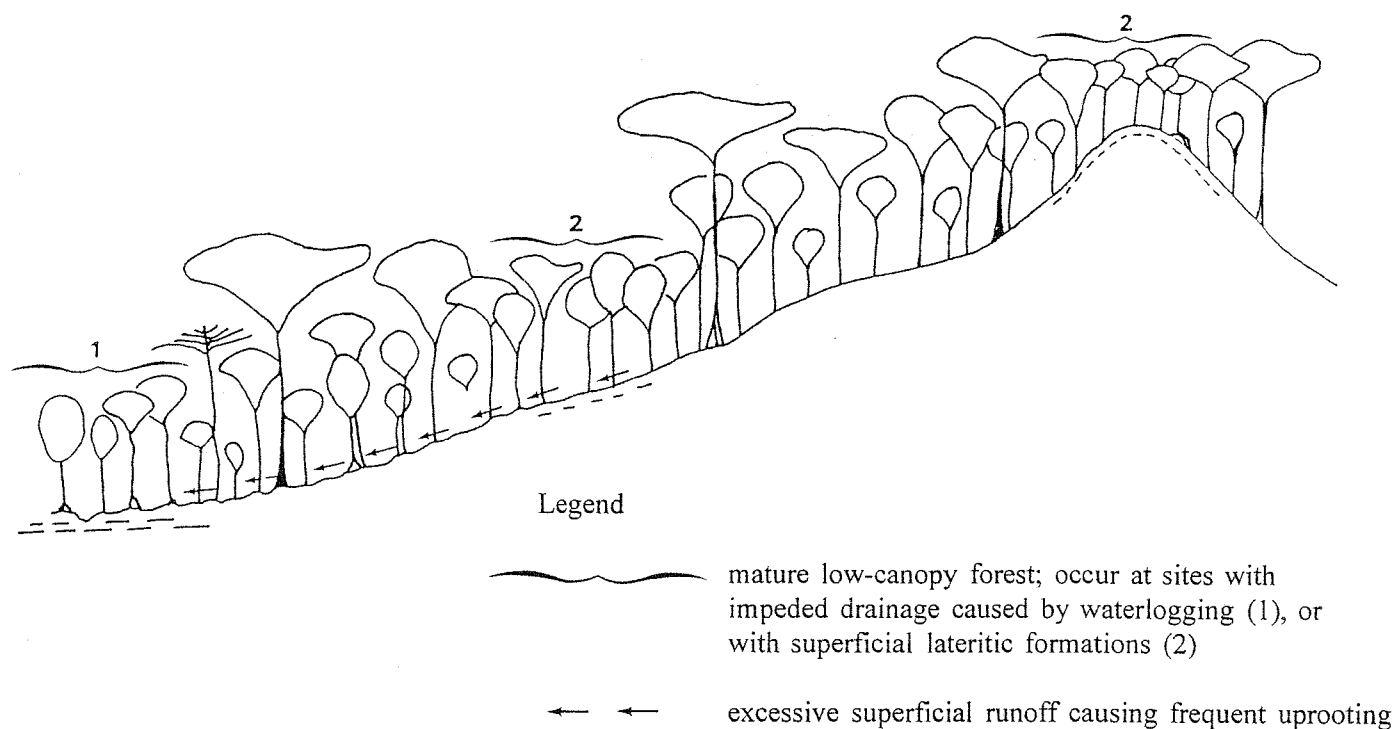
4) USDA Soil Taxonomy, 1975

5)

USDA Soil Taxonomy, 1992

7) Land utilization type

8) Altitude in meters



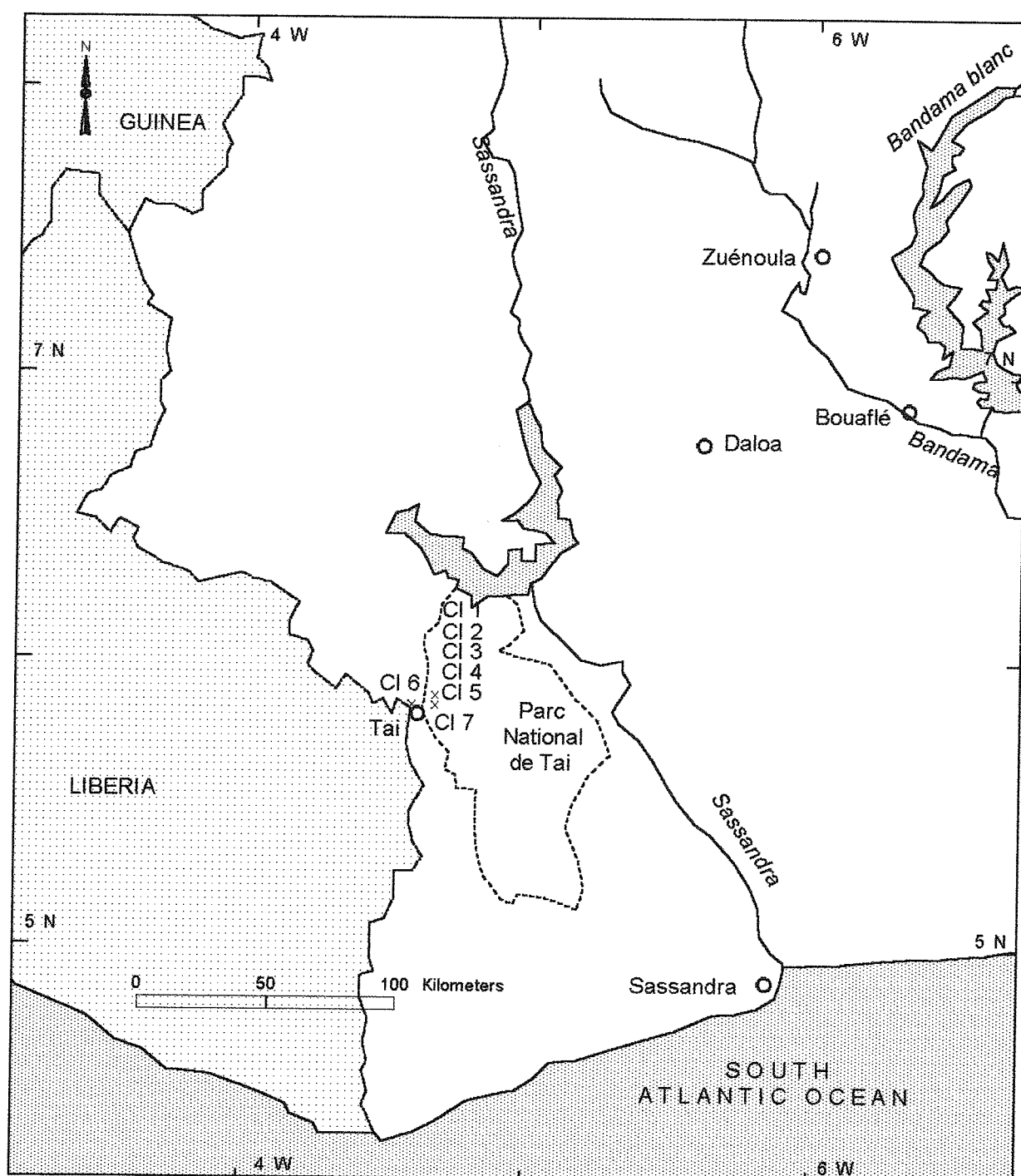
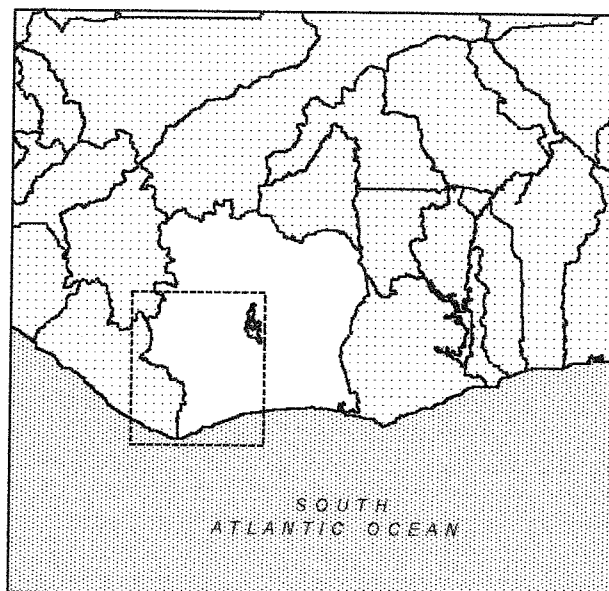
Slope profile of the CI001 - CI005 catena with toposequential soil series and predominanting drainage types. Soil horizons are after FRITSCH (1980, transect LS), figure from VOOREN (1985). Vertical scale is exaggerated.

REFERENCE SOILS OF CÔTE D'IVOIRE

- × Reference soil
- Town
- State boundary
- ~ River
- ▨ Ocean, lake

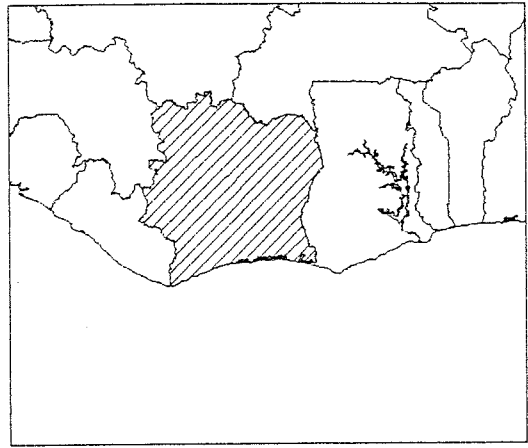
October 1995
Projection Lambert

The designation employed and the presentation of material in this map do not imply the expression of any opinion whatsoever on the part of ISRIC concerning the legal status of any country, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.



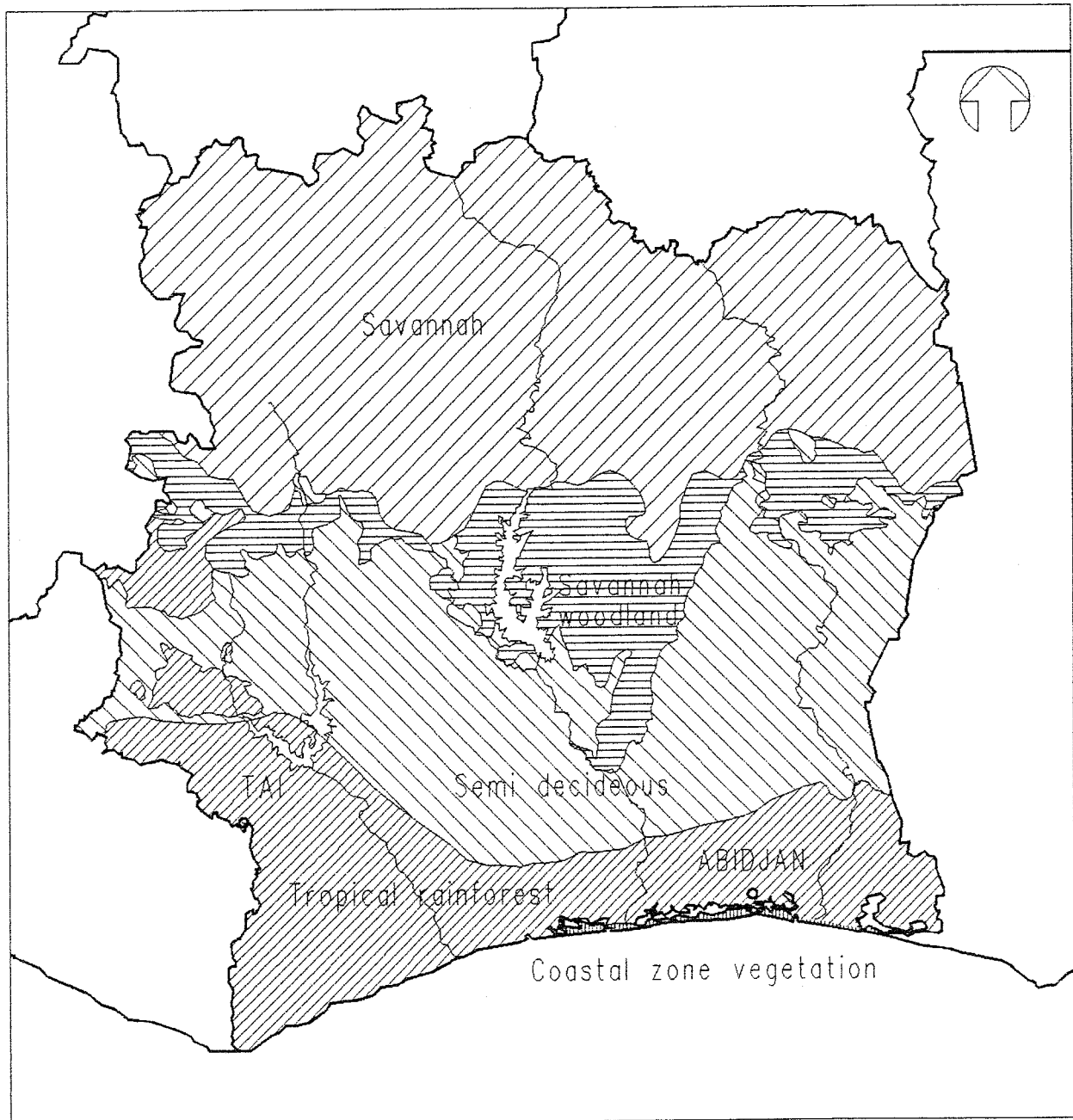
Côte d'Ivoire

- State boundary
- River
- o Town
- ▨ Vegetation zone



-9.05/11.32

-1.83/11.32



-9.05/3.85

-1.83/3.85

Scale 1:4,800,000 Projection Geographic May 1994

SOIL INFORMATION SHEETS

Generated by the ISRIC Soil Information System (ISIS, version 4.0)

FAO/UNESCO (1988) : Ferric Acrisol (1974 : Ferric Acrisol, stony phase)
 USDA/SCS SOIL TAXONOMY (1992) : Typic Kandiodult, clayey skeletal, oxidic, isohyperthermic (1975 : orthoxic tropodult)
 LOCAL CLASSIFICATION : Sol ferrallitique, fortement désaturé, remanié.

DIAGNOSTIC CRITERIA
 FAO (1988) : Diagnostic horizons : ochric A, argic B
 : Diagnostic properties : ferric properties
 USDA/SCS (1992) : Diagnostic horizons : kandic horizon
 : Soil moisture regime : udic

Classification remarks : Extremely deep, somewhat excessively drained, red, very gravelly clay soil derived from Precambrian migmatites. The forest surface has a very thin, rapidly decomposing, litter layer and a what irregular surface.

LOCATION : Tai Forest reserve, Parcille Vooren, Layon LS2
 Latitude : 5°53' 0'' N Longitude : 7°20' 0'' W Altitude : 177 (m.a.s.l.)
 AUTHOR(S) : Van Kekem, A.J. Date (mm.yy) : 2.84

GENERAL LANDFORM : peneplain Topography : rolling
 PHYSIOGRAPHIC UNIT : slope of dissected peneplain
 SLOPE Gradient : 10% Aspect : SW Form : convex
 POSITION OF SITE : upper slope
 MICRO RELIEF Kind : termite mounds Height (cm) : 60
 SURFACE CHAR. Rock outcrop : nil Stoniness : nil
 Cracking : nil Slaking/crusting : nil
 Salt : nil Alkali : nil
 SLOPE PROCESSES Soil erosion : nil

PARENT MATERIAL 1 : residual material derived from : metamorphic rock
 Texture :
 Remarks : Precambr. migmatite

WATER TABLE Depth(cm) : Kind : no watertable observed
 DRAINAGE : somewhat excessive
 PERMEABILITY : No slow permeable layer(s) cm
 MOISTURE CONDITIONS PROFILE : 0 - 160 cm moist

VEGETATION Type : evergreen forest Status : primary
 Landuse/vegetation remarks : Tropical forest, national park

ADDITIONAL REMARKS :
 PARENT ROCK: Hard, rich in biotite, with a high mineralogical content of kaolinite, iron and aluminium (hydr-)oxides.
 Precambrian basement system.

ADDITIONAL NOTES ON PROFILE DESCRIPTION:
 0 - 3 to 4 types of leaves, various stages of decomposition;
 Gravel: concretions, ironstone; from 0-70cm angular; from 70cm+ spherical.

CLIMATE :		Köppen: Aw												
Station: TAI		5 52 N/ 7 28 W			0 m a.s.l			5 km W of site			Relevance: very good			
		No. years of record												
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
EA Piche	mm	48	53	55	47	40	32	31	31	35	37	32	31	470
precipitation	mm	21	65	148	170	216	269	124	132	293	240	108	47	1833
T max	°C	31.9	32.8	33.0	32.9	31.6	29.7	28.5	29.6	30.3	31.1	31.2	30.3	31.1
T min	°C	20.2	21.4	21.5	21.8	22.0	21.6	20.8	20.9	21.4	21.8	21.1	20.3	21.2

PROFILE DESCRIPTION :

Ahcs 0 - 7 cm. dark brown (7.5 YR 3.0/4.0, moist) very gravelly sandy loam; moderate fine to medium subangular blocky structure; slightly sticky, slightly plastic, friable; many very fine to fine interstitial pores and few micro to fine, tubular pores; many fine roots and coarse roots; dominant medium spherical hard ferruginous concretions; very few medium quartz fragments; pH(field): 5.0; clear smooth boundary to

BACS 7 - 20 cm. yellowish red (5 YR 5.0/8.0, moist) very gravelly sandy clay loam; moderate fine to medium subangular blocky structure; sticky, plastic, friable; many very fine to fine interstitial pores and few micro to fine, tubular pores; common fine roots and coarse roots; dominant medium spherical hard ferruginous concretions; very few medium quartz fragments; gradual smooth boundary to

Bcs1 20 - 45 cm. 3.5 YR 4.0/8.0, moist very gravelly clay; moderate medium angular blocky structure; sticky, plastic, friable; pressure cutans on rock fragments; many very fine to fine interstitial pores and few micro to very fine, tubular pores; few fine roots; dominant medium spherical hard ferruginous concretions; very few medium quartz fragments; pH(field): 4.9; diffuse smooth boundary to

Bcs2	45 - 115 cm.	red (2.5 YR 4.0/8.0, moist) very gravelly clay; moderate medium angular blocky structure; sticky, plastic, friable; pressure cutans on rock fragments; common very fine to fine interstitial pores and few micro to very fine, tubular pores; few very fine roots; dominant medium spherical hard ferruginous concretions; very few medium quartz fragments; gradual smooth boundary to
Bcs3	115 - 135 cm.	red (2.5 YR 4.0/6.0, moist) slightly gravelly clay; moderate fine subangular blocky structure; sticky, plastic, friable; pressure cutans on rock fragments; common to many, very fine to fine tubular pores; few very fine roots; few medium spherical hard ferruginous concretions and few large spherical hard ferruginous concretions; clear smooth boundary to
2Bws	135 - 160 cm.	slightly gravelly clay; moderate fine to very fine angular blocky structure; sticky, plastic, friable; broken thin clay and sesquioxides cutans; few very fine tubular pores; few very fine roots; very few medium spherical hard ferruginous concretions;

ANALYTICAL DATA :

Hor. no.	Top - Bot	>2 mm	2000 1000	500 250	250 100	100 50	TOT SAND	50 20	20 2	TOT SILT	<2 µm	DISP	BULK DENS	pF- 0.0	1.0	1.5	2.0	2.3	2.7	3.4	4.2
1	0 - 7	76	5	3	17	29	13	67	9	5	14	19	5.3	-	-	-	-	-	-	-	-
2	7 - 20	75	3	2	12	23	11	50	10	7	16	33	14.5	-	-	-	-	-	-	-	-
3	20 - 45	77	4	3	8	13	8	34	9	7	16	50	27.2	-	-	-	-	-	-	-	-
4	50 - 70	75	5	2	4	7	4	21	6	8	14	65	0.5	-	-	-	-	-	-	-	-
5	80 - 100	71	5	2	4	6	4	22	6	10	16	63	0.5	-	-	-	-	-	-	-	-
6	115 - 135	8	1	1	4	6	4	17	10	16	26	57	0.0	1.37	49	47	44	41	40	39	34
7	135 - 150	7	1	1	3	6	4	15	10	18	28	58	0.0	-	-	-	-	-	-	-	-

Hor. no.	pH- H2O	-- KCl	CaCO3 %	ORG- C %	MAT. N %	EXCH Ca	CAT. Mg	----- K	----- Na	----- sum	EXCH H+Al	AC. Al	CEC soil	----- clay	----- OrgC	----- ECEC	BASE SAT %	Al SAT %	EC 2.5 mS/cm
1	5.9	4.8	-	3.11	0.16	5.3	1.0	0.1	0.0	6.4	0.1	0.0	8.9	46	10.9	6.5	72	0	0.16
2	4.9	3.8	-	1.32	0.01	0.8	0.5	0.0	0.1	1.4	1.2	1.1	5.1	15	4.6	2.6	27	22	0.05
3	4.4	3.6	-	1.05	0.02	0.0	0.2	0.0	0.1	0.3	2.9	2.7	5.9	12	3.7	3.2	5	46	0.03
4	4.6	3.7	-	0.68	0.07	0.0	0.2	0.0	0.0	0.2	2.9	2.4	5.3	8	2.4	3.1	4	45	0.02
5	4.7	3.8	-	0.40	-	0.0	0.1	0.0	0.0	0.1	2.1	2.0	3.9	6	1.4	2.2	3	51	0.02
6	4.6	3.8	-	0.26	-	0.0	0.1	0.0	0.2	0.3	2.2	2.0	3.9	7	0.9	2.5	8	51	0.02
7	4.7	3.8	-	0.21	-	0.0	0.0	0.0	0.0	0.0	2.3	2.3	3.5	6	0.7	2.3	0	66	0.02

remarks (hor. 1 - 5): el.comp. of clay fr. avail. in labfiles

remarks (hor. 6) : el.comp. of clay fr. avail. in labfiles; Part.Size after defer.

remarks (hor. 7) : el.comp. of clay fr. avail. in labfiles

ELEMENTAL COMPOSITION OF TOTAL SOIL (in weight %) AND MOLAR RATIOS

Hor. no.	SiO2	Al2O3	Fe2O3	CaO	MgO	K2O	Na2O	TiO2	MnO2	P2O5	IGN. LOSS	SiO2/ Al2O3	SiO2/ Fe2O3	SiO2/ R2O3	Al2O3/ Fe2O3
1	75.9	7.2	7.7	0.22	0.08	0.04	-	0.78	0.03	0.06	8.3	17.9	26.2	10.6	1.5
2	70.1	11.8	8.6	0.01	0.08	0.05	-	1.05	0.02	0.05	7.5	10.1	21.7	6.9	2.2
3	60.0	18.1	11.5	0.00	0.10	0.06	-	1.36	0.03	0.07	9.5	5.6	13.9	4.0	2.5
4	49.2	23.3	14.2	0.00	0.09	0.05	-	1.50	0.03	0.08	11.1	3.6	9.2	2.6	2.6
5	49.4	23.8	13.9	0.00	0.11	0.05	-	1.44	0.03	0.06	10.7	3.5	9.5	2.6	2.7
6	48.3	26.0	12.5	0.00	0.10	0.08	-	1.47	0.03	0.05	10.9	3.2	10.3	2.4	3.3
7	49.4	25.9	11.9	0.00	0.10	0.09	-	1.44	0.03	0.06	10.9	3.2	11.1	2.5	3.4

CLAY MINERALOGY (1 very weak,..., 8 very strong) / EXTRACTABLE Fe Al Si Mn (by AMM. OXALATE(o), Na DITHIONITE(d) & PYROPHO(p))

Hor.

no.	MI	VE	CH	SM	KA	HA	ML	QU	FE	GI	GO	HE	Fe(o)	Al(o)	Si(o)	Fe(d)	Al(d)	Fe(p)	Al(p)	Pret	pHNaF
1	-	-	3	-	8	-	-	-	-	4	4	-	0.23	0.07	0.01	2.66	0.36	-	-	-	-
2	-	-	3	-	8	-	-	-	-	4	4	-	0.36	0.09	0.01	3.67	0.57	-	-	-	-
3	-	-	3	-	8	-	-	-	-	4	4	-	0.22	0.11	0.01	4.37	0.79	-	-	-	-
4	-	-	4	-	8	-	-	-	-	4	4	-	0.18	0.12	0.02	5.53	0.92	-	-	-	-
5	-	-	4	-	8	-	-	-	-	4	4	-	0.18	0.12	0.02	5.30	0.82	-	-	-	-
6	-	-	4	-	8	-	-	-	-	4	4	-	0.13	0.09	0.02	5.21	0.69	7.29	0.87	-	-
7	-	-	3	-	8	-	-	-	-	4	4	-	0.13	0.10	0.03	5.44	0.74	-	-	-	-

FAO/UNESCO (1988) : Ferric Acrisol (1974 : Ferric Acrisol, stony phase)
 USDA/SCS SOIL TAXONOMY (1992) : Typic Kandiodult, clayey skeletal, oxidic, isohyperthermic (1975 : orthoxic tropodult)
 LOCAL CLASSIFICATION : Sol ferrallitique, fortement désaturé, remanié.

DIAGNOSTIC CRITERIA
 FAO (1988) : Diagnostic horizons : ochric A, argic B
 : Diagnostic properties : ferric properties
 USDA/SCS (1992) : Diagnostic horizons : kandic horizon
 : Soil moisture regime : udic

Classification remarks : A well drained extremely deep red, strongly gravelly clay soil (180cm) on irregular forest floor with high biological activity (ants, termites, earthworms) and excessively gravelly surface.

LOCATION : Tai forest reserve
 Latitude : 5°53' 0'' N Longitude : 7°20' 0'' W Altitude : 173 (m.a.s.l.)
 AUTHOR(S) : Van Kekem, A.J. Date (mm.yy) : 2.84

GENERAL LANDFORM : peneplain Topography : rolling
 PHYSIOGRAPHIC UNIT : Slope of dissected peneplain
 SLOPE Gradient : 5% Aspect : SW Form : convex
 POSITION OF SITE : middle slope
 MICRO RELIEF Kind : termite mounds Pattern : isolated Height (cm) : 60
 SURFACE CHAR. Rock outcrop : nil Stoniness : nil
 Av.Size (cm) : 4
 Cracking : nil Slaking/crusting : nil
 SLOPE PROCESSES Soil erosion : slight sheet

PARENT MATERIAL 1 : residual material derived from : metamorphic rock
 Texture :
 Remarks : Saprolite

WATER TABLE Depth(cm) : Kind : no watertable observed
 DRAINAGE : well
 PERMEABILITY : high No slow permeable layer(s) cm
 FLOODING Frequency : nil Run off : slow
 MOISTURE CONDITIONS PROFILE : 0 - 80 cm moist

VEGETATION Type : closed forest Status : primary
 Landuse/vegetation remarks : Tropical lowland forest, national park

ADDITIONAL REMARKS :
 PARENT ROCK: Hard migmatite, rich in biotite; Precambrian Basement System.

ADDITIONAL NOTES ON PROFILE DESCRIPTION:
 O - 2 to 3 leaves thick (rapidly decomposing).
 Ahcs - nodules: with black patina.
 Bcs1 - color interior concretions: 5YR3/2; nodules: with black patina.
 Bcs2 - nodules: with black patina.
 2Bws - color interior concretions: 2.5YR4/6.
 Gravel: iron concretions up to 5cm in diameter, irregular.

CLIMATE :		Köppen: Aw												Relevance: very good	
Station: TAI		5 52 N/ 7 28 W		0 m a.s.l				5 km W of site							
		No. years of record													
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	
EA Piche	mm	48	53	55	47	40	32	31	31	35	37	32	31	470	
precipitation	mm	21	65	148	170	216	269	124	132	293	240	108	47	1833	
T max	°C	31.9	32.8	33.0	32.9	31.6	29.7	28.5	29.6	30.3	31.1	31.2	30.3	31.1	
T min	°C	20.2	21.4	21.5	21.8	22.0	21.6	20.8	20.9	21.4	21.8	21.1	20.3	21.2	

PROFILE DESCRIPTION :

Ahcs	0 - 10 cm.	dark brown (7.5 YR 3.0/4.0, moist) very gravelly sandy loam; weak fine subangular blocky structure; slightly sticky, slightly plastic, very friable; many micro to medium interstitial pores and many micro to medium, tubular pores; many fine roots and coarse roots; very frequent medium spherical hard ferruginous concretions and nodules; pH(field): 5.1; clear smooth boundary to
Bcs1	10 - 30 cm.	yellowish red (5 YR 5.0/6.0, moist) very gravelly sandy clay loam; moderate fine subangular blocky structure; sticky, plastic, friable; many micro to fine tubular pores and common fine to medium, interstitial pores; few fine roots; very frequent medium spherical hard ferruginous concretions and nodules; gradual smooth boundary to
Bcs2	30 - 80 cm.	red (2.5 YR 4.0/8.0, moist) very gravelly clay; moderate fine subangular blocky structure; sticky, plastic, friable; many very fine to fine tubular pores and many very fine to fine, interstitial pores; few fine roots; very frequent medium spherical hard ferruginous concretions and nodules; pH(field): 5.2; diffuse smooth boundary to
Bws	80 - 150 cm.	red (2.5 YR 4.0/6.0, moist) slightly gravelly clay; moderate fine angular blocky and moderate medium angular blocky structure; sticky, plastic, friable; few fine prominent clear mottles (10 YR 6.0/8.0); broken moderately thick clay and sesquioxides cutans; common very fine to fine interstitial pores and common very fine to fine, tubular pores; few fine roots; few medium angular hard ferruginous concretions and few medium angular hard argillaceous concretions; pH(field): 4.9;

ANALYTICAL DATA :

Hor. no.	Top - Bot	>2 mm	2000 1000	500 250	100 50	TOT SAND	50 20	TOT SILT	<2 µm	DISP	BULK DENS	pH	0.0	1.0	1.5	2.0	2.3	2.7	3.4	4.2
1	0 - 10	75	9	3	17	27	12	69	9	5	14	17	2.4	-	-	-	-	-	-	-
2	10 - 30	71	12	4	10	21	10	58	0	5	5	29	13.4	-	-	-	-	-	-	-
3	40 - 70	63	7	3	6	10	6	32	9	6	15	53	0.5	-	-	-	-	-	-	-
4	80 - 100	5	4	3	5	9	6	26	12	16	28	46	0.5	1.49	45	44	41	38	36	35
5	110 - 150	2	2	2	4	9	5	21	13	17	30	49	0.0	-	-	-	-	-	-	-

Hor. no.	pH- H2O	-- KCl	CaCO3 %	ORG- C %	MAT. N %	EXCH Ca	CAT. Mg	----	----	----	EXCH H+Al	AC. Al	CEC soil	----	----	----	BASE SAT %	Al SAT %	EC 2.5 mS/cm
						----	----	----	----	----	cmol(+)/kg	--	----	----	----	----	----	----	
1	5.6	4.2	-	3.45	0.22	3.3	1.3	0.2	0.3	5.1	0.4	0.2	9.6	56	12.1	5.5	53	2	0.14
2	4.7	3.8	-	1.08	0.09	0.2	0.3	0.1	0.2	0.8	1.4	1.1	5.4	19	3.8	2.2	15	20	0.06
3	4.6	3.8	-	0.79	0.06	0.0	0.1	0.0	0.2	0.3	2.0	1.8	5.1	10	2.8	2.3	6	35	0.03
4	4.6	3.8	-	0.43	0.04	0.0	0.1	0.0	0.2	0.3	2.1	1.8	5.1	11	1.5	2.4	6	35	0.03
5	4.5	3.7	-	0.22	-	0.0	0.1	0.0	0.1	0.2	2.3	1.8	4.8	10	0.8	2.5	4	38	0.03

ELEMENTAL COMPOSITION OF TOTAL SOIL (in weight %) AND MOLAR RATIOS

Hor. no.	SiO2	Al2O3	Fe2O3	CaO	MgO	K2O	Na2O	TiO2	MnO2	P2O5	IGN. LOSS	SiO2/Al2O3	SiO2/Fe2O3	SiO2/R2O3	Al2O3/Fe2O3
1	75.3	7.4	8.7	0.07	0.09	0.04	-	0.75	0.04	0.05	9.0	17.3	23.0	9.9	1.3
2	70.5	11.5	9.8	0.00	0.07	0.04	-	0.94	0.02	0.04	7.0	10.4	19.2	6.7	1.8
3	52.6	20.9	14.1	0.00	0.10	0.04	-	1.34	0.03	0.05	10.2	4.3	9.9	3.0	2.3
4	48.4	24.7	14.9	0.00	0.06	0.07	-	1.42	0.02	0.03	11.0	3.3	8.6	2.4	2.6
5	49.8	25.7	14.2	0.00	0.07	0.08	-	1.44	0.02	0.03	10.8	3.3	9.3	2.4	2.8

CLAY MINERALOGY (1 very weak, ..., 8 very strong) / EXTRACTABLE Fe Al Si Mn (by AMM. OXALATE(o), Na DITHIONITE(d) & PYROPHO(p))

Hor. no.	MI	VE	CH	SM	KA	HA	ML	QU	FE	GI	GO	HE	Fe(o)	Al(o)	Si(o)	Fe(d)	Al(d)	Fe(p)	Al(p)	Pret	pHNaF
1	-	-	2	-	8	-	-	-	-	3	4	-	0.23	0.08	0.01	3.50	0.31	-	-	-	-
2	-	1	3	-	8	-	-	-	-	3	4	-	0.37	0.14	0.02	3.72	0.42	-	-	-	-
3	-	-	3	-	8	-	-	-	-	3	4	-	0.22	0.18	0.03	5.69	0.70	-	1.00	-	-
4	-	-	3	-	8	-	-	-	-	3	4	-	0.15	0.15	0.02	6.14	0.65	-	1.00	-	-
5	-	-	3	-	8	-	-	-	-	2	4	-	0.14	0.17	0.03	5.87	0.53	-	-	-	-

FAO/UNESCO (1988) : Ferri-Plinthic Acrisol
 (1974) : Plinthic Acrisol, stony phase
 USDA/SCS SOIL TAXONOMY (1992) : Plinthic Kandudult, clayey skeletal, oxidic, isohyperthermic (1975 : plinthudult)
 LOCAL CLASSIFICATION : Sol ferrallitique, fortement désaturé, remanié.

DIAGNOSTIC CRITERIA
 FAO (1988) : Diagnostic horizons : ochric A, argic B
 : Diagnostic properties : plinthite
 USDA/SCS (1992) : Diagnostic horizons : kandic horizon
 : Soil moisture regime : udic

Classification remarks : A very deep (125-180 cm), well drained, yellowish brown, very gravelly clay soil with plinthite starting between a depth of 50 to 80 cm. Surface is an irregular forest floor with few termite mounds and high biological activity (termites, earthworms).

LOCATION : Tai forest reserve
 Latitude : 5°53' 0'' N Longitude : 7°20' 0'' W Altitude : 165 (m.a.s.l.)
 AUTHOR(S) : Van Kekem, A.J. Date (mm.yy) : 3.84

GENERAL LANDFORM : peneplain Topography : rolling
 PHYSIOGRAPHIC UNIT : slope of dissected peneplain
 SLOPE Gradient : 5% Aspect : SW Form : convex
 POSITION OF SITE : middle slope
 MICRO RELIEF Kind : termite mounds
 SURFACE CHAR. Rock outcrop : nil Stoniness : fairly stony
 Cracking : nil Slaking/crusting : nil
 SLOPE PROCESSES Soil erosion : moderate Aggradation : present

PARENT MATERIAL 1 : residual material derived from : metamorphic rock
 Texture :
 Remarks : Precambr. migmatite

WATER TABLE Depth(cm) : Kind : no watertable observed
 DRAINAGE : well
 PERMEABILITY : high No slow permeable layer(s) cm
 FLOODING Frequency : nil Run off : slow
 MOISTURE CONDITIONS PROFILE : 0 - 150 cm moist

VEGETATION Type : closed forest Status : primary
 Landuse/vegetation remarks : tropical lowland forest; national park

ADDITIONAL REMARKS :

PARENT ROCK: Hard, rich in biotite, with a high mineralogical content of kaolinite, iron and aluminium (hydr-)oxides.
 Precambrian basement system.

ADDITIONAL NOTES ON PROFILE DESCRIPTION:

A - also many coarse roots. Black patina on gravel.

BAcs - colour interior nodules: 2.5YR3/4. Black patina on gravel. Bcs - colour interior nodules: 2.5YR3/4.

2Bsqs - mottles and nodules: plinthite. Cutans: also clay-humus
 cutans in big pores.

CLIMATE :		Köppen: Aw												
Station: TAI		5 52 N/ 7 28 W			0 m a.s.l			5 km W of site			Relevance: very good			
		No. years of record												
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
EA Piche	mm	48	53	55	47	40	32	31	31	35	37	32	31	470
precipitation	mm	21	65	148	170	216	269	124	132	293	240	108	47	1833
T max	°C	31.9	32.8	33.0	32.9	31.6	29.7	28.5	29.6	30.3	31.1	31.2	30.3	31.1
T min	°C	20.2	21.4	21.5	21.8	22.0	21.6	20.8	20.9	21.4	21.8	21.1	20.3	21.2

PROFILE DESCRIPTION :

O	0 - 1 cm.	leaves, highly decomposed;;
A	1 - 11 cm.	dark brown (10 YR 4.0/3.0, moist) slightly gravelly loamy sand; strong fine subangular blocky structure; non sticky, non plastic, very friable; many micro to medium tubular pores and many micro to medium, interstitial pores; many fine roots and coarse roots; few medium spherical hard ferruginous nodules; pH(field): 4.4; clear smooth boundary to
BACs	11 - 25 cm.	yellowish brown (10 YR 5.0/6.0, moist) very gravelly sandy loam; moderate fine subangular blocky structure; slightly sticky, slightly plastic, very friable; many very fine to fine tubular pores and many very fine to fine, interstitial pores; few fine roots; very frequent medium spherical hard ferruginous nodules; gradual irregular boundary to
Bcs	25 - 66 cm.	yellowish brown (10 YR 5.0/8.0, moist) very gravelly clay; moderate fine to very fine angular blocky to moderate fine to very fine subangular blocky structure; sticky, plastic, friable; patchy clay and sesquioxides cutans; many fine to medium tubular pores and many fine to medium, interstitial pores; few fine roots; very frequent medium spherical hard ferruginous nodules; very few very fine weathered quartz fragments; pH(field): 4.8; clear irregular boundary to
Bsq	66 - 151 cm.	yellowish brown (10YR 5.0/8.0, moist) slightly gravelly clay; weak to moderate fine to very fine angular blocky structure; sticky, plastic, friable; many coarse distinct clear mottles (2.5YR 3.0/6.0); patchy clay and sesquioxides cutans; many very fine to fine discontinuous exped-inped tubular pores and few medium to coarse, exped interstitial pores; few fine roots; few medium spherical hard ferruginous nodules; very few medium angular quartz fragments; pH(field): 4.5;

ANALYTICAL DATA :

Hor. no.	Top - Bot	>2 mm	2000 1000	1000 500	500 250	250 100	100 50	TOT SAND	50 20	20 2	TOT SILT	<2 µm	DISP	BULK DENS	pH- 0.0	1.0	1.5	2.0	2.3	2.7	3.4	4.2
1	0 - 10	3	3	4	21	37	14	79	9	3	12	9	2.4	1.48	39	36	29	21	18	15	9	8
2	10 - 20	56	6	3	16	32	14	71	9	4	13	16	5.8	-	-	-	-	-	-	-	-	-
3	30 - 60	70	8	4	9	16	8	45	7	7	13	42	28.1	-	-	-	-	-	-	-	-	-
4	100 - 130	-	3	3	6	10	5	26	9	17	26	48	0.5	1.44	45	43	42	39	38	37	1	28

Hor. no.	pH- H2O	-- KCl	CaCO3 %	ORG- C %	MAT. N %	EXCH Ca	CAT. Mg	----	----	----	EXCH H+Al	AC. Al	CEC soil	----	----	----	BASE ECEC	AL SAT	EC 2.5 mS/cm
1	4.5	3.6	-	1.78	0.09	0.6	0.2	0.1	0.1	1.0	1.1	0.7	6.2	67	6.2	2.1	16	11	0.29
2	4.7	3.8	-	0.89	0.08	0.4	0.0	0.0	0.1	0.5	1.3	0.9	4.7	30	3.1	1.8	11	19	0.03
3	5.1	3.9	-	0.91	0.07	0.4	0.1	0.0	0.1	0.6	1.1	0.7	7.5	18	3.2	1.7	8	9	0.03
4	5.0	3.9	-	0.43	0.03	0.4	0.2	0.0	0.1	0.7	1.3	0.9	6.2	13	1.5	2.0	11	15	0.02

remarks (hor. 1 - 4): el.comp. of clay fr. avail. in labfiles

ELEMENTAL COMPOSITION OF TOTAL SOIL (in weight %) AND MOLAR RATIOS

Hor. no.	SiO2	Al2O3	Fe2O3	CaO	MgO	K2O	Na2O	TiO2	MnO2	P2O5	IGN. LOSS	SiO2/ Al2O3	SiO2/ Fe2O3	SiO2/ R2O3	Al2O3/ Fe2O3
1	88.4	3.4	2.2	0.00	0.05	0.03	-	0.31	0.01	0.01	3.8	44.1	107	31.2	2.4
2	84.4	6.0	4.0	0.00	0.06	0.03	-	0.49	0.01	0.02	4.0	23.9	56.2	16.8	2.4
3	64.8	16.5	8.6	0.02	0.09	0.07	-	0.96	0.01	0.02	8.2	6.7	20.1	5.0	3.0
4	52.5	22.9	12.0	0.00	0.08	0.06	-	1.11	0.01	0.02	9.9	3.9	11.6	2.9	3.0

CLAY MINERALOGY (1 very weak,..., 8 very strong) / EXTRACTABLE Fe Al Si Mn (by AMM. OXALATE(o), Na DITHIONITE(d) & PYROPHO(p))

Hor. no.	MI	VE	CH	SM	KA	HA	ML	QU	FE	GI	GO	HE	Fe(o)	Al(o)	Si(o)	Fe(d)	Al(d)	Fe(p)	Al(p)	Pret	pHNaF
1	-	2	2	-	8	-	-	-	-	3	3	-	0.11	0.05	0.01	1.80	0.16	-	-	-	-
2	-	2	3	-	8	-	-	-	-	3	3	-	0.21	0.07	0.01	1.39	0.20	-	-	-	-
3	-	2	2	-	8	-	-	-	-	3	3	-	0.26	0.12	0.01	3.85	0.56	-	-	-	-
4	-	1	2	-	8	-	-	-	-	2	3	-	0.23	0.14	0.03	5.43	0.64	-	-	-	-

PROFILE DESCRIPTION :

Ah	0 - 8 cm.	yellowish brown (10 YR 5.0/4.0, moist) sandy loam; moderate fine to very fine subangular blocky structure; non sticky, non plastic, very friable; many micro to fine interstitial pores and many micro to fine, tubular pores; many very fine to coarse roots; pH(field): 4.6; gradual smooth boundary to
Bws1	8 - 30 cm.	yellowish brown (10 YR 5.0/6.0, moist) sandy clay loam; weak fine subangular blocky structure; slightly sticky, plastic, friable; many very fine to fine interstitial pores and many very fine to fine, tubular pores; few fine roots and medium roots; few charcoal fragments; gradual smooth boundary to
Bws2	30 - 50 cm.	yellowish brown (10 YR 5.0/8.0, moist) sandy clay loam; moderate very fine angular blocky into weak very fine subangular blocky structure; sticky, plastic, friable; many very fine to fine tubular pores and many very fine to fine, interstitial pores; few fine roots and medium roots; few charcoal fragments; pH(field): 4.6; diffuse smooth boundary to
Bws3	50 - 80 cm.	yellowish brown (10 YR 5.0/8.0, moist) clay; moderate medium angular blocky into weak very fine subangular blocky structure; sticky, plastic, friable; few fine faint clear mottles (5YR 4.0/6.0); common to many, fine to very fine interstitial pores and common to many, fine to very fine, tubular pores; few fine roots and medium roots; very few small spherical hard ferruginous concretions; no fragments; pH(field): 4.6; abrupt irregular boundary to
Bms	80 - 110 cm.	yellowish brown (10 YR 5.0/8.0, moist) very gravelly clay; massive structure; sticky, plastic; few very fine to fine discontinuous vesicular pores; few fine roots and medium roots; dominant medium irregular hard ferruginous concretions and dominant large irregular hard ferruginous concretions; very few fine quartz fragments;

ANALYTICAL DATA :

Hor. no.	Top	-	Bot	>2 mm	2000 1000	1000 500	500 250	250 100	100 50	TOT SAND	50 20	20 2	TOT SILT	<2 µm	DISP	BULK DENS	pF- 0.0	---	---	---	---	---	---	---	---	---
																		1.0	1.5	2.0	2.3	2.7	3.4	4.2		
1	0	-	8	-	1	4	22	38	13	77	8	5	13	11	3.8	-	-	-	-	-	-	-	-	-	-	
2	8	-	30	-	1	3	17	30	12	61	11	6	16	23	11.2	1.56	37	37	32	27	24	21	16	15		
3	30	-	50	-	1	2	13	24	11	51	11	6	17	32	18.9	1.54	39	38	34	30	28	26	22	20		
4	50	-	80	-	2	3	12	20	10	46	12	6	18	37	4.6	1.47	43	41	37	32	30	28	23	21		
5	80	-	110	54	5	3	9	15	8	40	13	9	22	38	0.0	-	-	-	-	-	-	-	-	-		

Hor. no.	pH- H2O	-- KCl	CaCO3 %	ORG- C %	MAT. N %	EXCH Ca	CAT. Mg	---- K	---- Na	sum	EXCH H+Al	AC. Al	CEC soil	----- clay	OrgC	ECEC	BASE SAT %	Al SAT %	EC 2.5 mS/cm
1	4.3	3.8	-	0.93	0.07	0.2	0.2	0.1	0.0	0.5	-	-	2.3	22	3.3	0.5	22	-	0.13
2	4.4	3.8	-	0.65	0.06	0.0	0.2	0.0	0.0	0.2	-	-	3.0	13	2.3	0.2	7	-	0.05
3	4.4	3.8	-	0.50	0.04	0.0	0.1	0.0	0.0	0.1	-	-	3.2	10	1.8	0.1	3	-	0.03
4	4.5	3.8	-	0.47	0.02	0.0	0.1	0.0	0.0	0.1	-	-	2.8	8	1.6	0.1	4	-	0.03
5	4.7	4.0	-	0.38	-	0.0	0.1	0.0	0.0	0.1	-	-	3.0	8	1.3	0.1	3	-	0.02

remarks (hor. 1) : el.comp. of clay fr. avail. in labfiles

remarks (hor. 2) : el.comp. of clay fr. avail. in labfiles

remarks (hor. 3 - 4) : el.comp. of clay fr. avail. in labfiles

remarks (hor. 5) : el.comp. of clay fr. avail. in labfiles; Part.Size after defer.

ELEMENTAL COMPOSITION OF TOTAL SOIL (in weight %) AND MOLAR RATIOS

Hor. no.	SiO2	Al2O3	Fe2O3	CaO	MgO	K2O	Na2O	TiO2	MnO2	P2O5	IGN. LOSS	SiO2/ Al2O3	SiO2/ Fe2O3	SiO2/ R2O3	Al2O3/ Fe2O3
1	91.4	3.8	1.3	0.00	0.06	0.03	-	0.33	0.00	0.00	3.0	40.8	187	33.5	4.6
2	84.9	8.2	2.4	0.00	0.07	0.04	-	0.57	0.00	0.01	4.4	17.6	94.2	14.8	5.4
3	78.3	11.1	3.1	0.00	0.07	0.05	-	0.71	0.00	0.01	5.4	12.0	67.2	10.2	5.6
4	76.3	13.4	4.0	0.00	0.08	0.05	-	0.83	0.00	0.01	6.1	9.7	50.8	8.1	5.3
5	64.2	17.4	8.4	0.00	0.08	0.05	-	1.03	0.01	0.02	7.9	6.3	20.3	4.8	3.2

CLAY MINERALOGY (1 very weak, ..., 8 very strong) / EXTRACTABLE Fe Al Si Mn (by AMM. OXALATE(o), Na DITHIONITE(d) & PYROPHO(p))

Hor. no.	MI	VE	CH	SM	KA	HA	ML	QU	FE	GI	GO	HE	Fe(o)	Al(o)	Si(o)	Fe(d)	Al(d)	Fe(p)	Al(p)	Pret	pHNaF
1	-	-	3	-	8	-	-	-	-	3	3	-	0.10	0.00	0.00	0.70	0.20	-	-	-	-
2	-	-	3	-	8	-	-	-	-	3	3	-	0.10	0.10	0.00	1.20	0.30	-	-	-	-
3	-	-	4	-	8	-	-	-	-	3	3	-	0.10	0.10	0.00	1.60	0.40	-	-	-	-
4	-	-	4	-	8	-	-	-	-	3	3	-	0.10	0.10	0.00	1.80	0.40	-	-	-	-
5	-	-	4	-	8	-	-	-	-	3	3	-	0.10	0.10	0.00	4.30	0.60	-	-	-	-

FAO/UNESCO (1988) : Eutric Fluvisol (1974 : Eutric Gleysol)
 USDA/SCS SOIL TAXONOMY (1992) : Aeric Tropaquest, coarse loamy, kaolinitic, isohyperthermic (1975 : typic tropaquest)
 LOCAL CLASSIFICATION : Sol hydromorphe

DIAGNOSTIC CRITERIA
 FAO (1988) : Diagnostic horizons : ochric A, cambic B
 : Diagnostic properties : fluvic properties
 USDA/SCS (1992) : Soil moisture regime : aquic

Classification remarks : A poorly drained, deep soil (80-125 cm) with a porous massive structure, slightly coherent, below 37 cm. There are oxidation mottles almost throughout the profile. Along roots there are often "mottles" of organic matter. At 100-105 cm a layer of coarse quartz gravels (1-5 cm) is present. The soil surface has a thin layer of rapidly decomposing litter, and shows - due to moderate splash and rainwash erosion - patches of deposited fine bleached sand (0,5 cm of depth).

LOCATION : Tai forest reserve, Bas-fond
 Latitude : 5°53' 0'' N Longitude : 7°20' 0'' W Altitude : 155 (m.a.s.l.)
 AUTHOR(S) : Van Kekem, A.J. Date (mm.yy) : 1.85

GENERAL LANDFORM : peneplain Topography : rolling
 PHYSIOGRAPHIC UNIT : floodplain in diss. peneplain
 SLOPE Gradient : 4% Aspect : NE Form : concave
 POSITION OF SITE : middle slope
 MICRO RELIEF Kind :
 SURFACE CHAR. Rock outcrop : nil Stoniness : nil
 Cracking : nil Slaking/crusting : nil
 SLOPE PROCESSES Soil erosion : moderate sheet Aggradation : present

PARENT MATERIAL 1 : alluvium derived from : metamorphic rock
 Texture :
 Remarks : Precambr.Base.system

WATER TABLE Depth(cm) : Kind :
 Estimated highest level : 40 Estimated lowest level : 80
 DRAINAGE : poor
 PERMEABILITY : high No slow permeable layer(s) cm
 FLOODING Frequency : irregular Run off : slow
 MOISTURE CONDITIONS PROFILE : 0 - 120 cm moist

VEGETATION Type : closed forest Status : primary
 Landuse/vegetation remarks : Tropical lowland forest; national park

CLIMATE : Köppen: Am
 Station: TAI 5 52 N/ 7 28 W 0 m a.s.l 5 km W of site Relevance: very good

		No. years of record	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
EA Piche	mm	48	53	55	47	40	32	31	31	35	37	32	31	470	
precipitation	mm	21	65	148	170	216	269	124	132	293	240	108	47	1833	
T max	°C	31.9	32.8	33.0	32.9	31.6	29.7	28.5	29.6	30.3	31.1	31.2	30.3	31.1	
T min	°C	20.2	21.4	21.5	21.8	22.0	21.6	20.8	20.9	21.4	21.8	21.1	20.3	21.2	

PROFILE DESCRIPTION :

A	0 - 12 cm.	dark brown (10 YR 4.0/3.0, moist) loamy sand; very fine to moderate medium subangular blocky structure; non sticky, non plastic, very friable; many micro to fine tubular pores and many micro to fine, interstitial pores; many very fine to coarse roots; gradual irregular boundary to
Bw	12 - 37 cm.	light yellowish brown (10 YR 6.0/4.0, moist) sandy loam; weak fine subangular blocky structure; slightly sticky, non plastic, very friable; few fine faint diffuse mottles (7.5 YR 5.0/8.0); many micro to fine tubular pores; common very fine to coarse roots; gradual smooth boundary to
BCg	37 - 50 cm.	very pale brown (10 YR 7.0/3.0, moist) sandy loam; weakly coherent porous massive structure; slightly sticky, slightly plastic, very friable; common fine distinct diffuse mottles (5 Y 7.0/7.0) and many fine distinct clear mottles (7.5 YR 5.0/8.0); common micro to fine tubular pores ; few fine roots and medium roots; clear smooth boundary to
Cr1	50 - 75 cm.	light gray (5 Y 7.0/1.0, moist) sandy loam; weakly coherent porous massive structure; slightly sticky, slightly plastic, very friable; common fine prominent clear mottles (7.5 YR 5.0/8.0); common micro to very fine tubular pores; few fine roots and medium roots; gradual smooth boundary to
Cr2	75 - 100 cm.	10 Y 8.0/1.0, moist sandy loam; weakly coherent porous massive structure; slightly sticky , slightly plastic, very friable; few fine distinct diffuse mottles (10 YR 6.0/6.0); few micro to very fine tubular pores; few very fine roots and few fine roots; clear smooth boundary to
Cr3	100 - 120 cm.	10 Y 7.0/1.0, moist slightly gravelly sandy clay loam; weakly coherent porous massive structure; slightly sticky, slightly plastic, very friable; few fine mottles; common very fine to fine tubular pores; nil roots; few coarse quartz fragments;

ANALYTICAL DATA :

Hor. no.	Top - Bot	>2 mm	2000 1000 500 250 100 50 SAND	TOT 50 20 2 SILT	<2 µm	DISP	BULK DENS	pF- 0.0 1.0 1.5 2.0 2.3 2.7 3.4 4.2
1	0 - 10	-	0 5 25 33 15 77	8 5 13	10	1.8	-	- - - - - - - -
2	10 - 35	-	0 7 26 29 12 73	7 5 12	15	5.3	-	- - - - - - - -
3	40 - 50	-	1 6 25 29 12 72	7 7 13	15	8.2	1.59	36 35 31 27 24 22 15 13
4	50 - 75	-	1 8 27 28 10 74	6 5 11	14	10.9	1.61	33 32 28 24 22 20 14 13
5	75 - 100	-	2 9 28 26 9 73	6 5 11	16	12.9	1.63	35 34 31 27 25 23 17 16
6	100 - 120	-	2 8 21 17 6 54	6 16 21	25	19.9	-	- - - - - - - -

Hor. no.	pH- H2O	-- KCl	CaCO3 %	ORG- C %	MAT. N %	EXCH Ca	CAT. Mg	----	----	----	EXCH H+Al	AC. Al	CEC soil	----	----	----	BASE SAT %	Al SAT %	EC 2.5 mS/cm
						----	----	----	----	--	cmol(+)/kg	--	----	----	----	----	----	----	
1	4.2	3.7	-	1.57	0.08	1.2	0.2	0.1	0.3	1.8	1.1	0.7	4.7	48	5.5	2.9	38	15	0.14
2	4.4	3.9	-	1.18	0.02	1.4	0.2	0.0	0.1	1.7	1.2	0.7	3.2	22	4.1	2.9	53	22	0.08
3	4.7	4.0	-	0.82	0.03	1.0	0.2	0.1	0.3	1.6	0.8	0.4	3.0	20	2.9	2.4	53	13	0.06
4	4.6	3.9	-	0.25	-	1.0	0.1	0.0	0.1	1.2	0.8	0.4	1.6	11	0.9	2.0	75	25	0.04
5	4.7	3.9	-	0.27	-	1.0	0.1	0.0	0.1	1.2	0.8	0.4	4.0	25	0.9	2.0	30	10	0.03
6	4.7	3.8	-	0.23	-	1.4	0.3	0.0	0.2	1.9	1.6	1.1	3.3	13	0.8	3.5	58	33	0.03

remarks (hor. 1 - 6): el.comp. of clay fr. avail. in labfiles; Part.Size after defer.

ELEMENTAL COMPOSITION OF TOTAL SOIL (in weight %) AND MOLAR RATIOS

Hor. no.	SiO2	Al2O3	Fe2O3	CaO	MgO	K2O	Na2O	TiO2	MnO2	P2O5	IGN. LOSS	SiO2/ Al2O3	SiO2/ Fe2O3	SiO2/ R2O3	Al2O3/ Fe2O3
1	93.1	3.4	0.4	0.00	0.04	0.05	-	0.17	0.00	0.01	3.6	46.5	620	43.2	13.3
2	88.9	5.4	0.5	0.00	0.04	0.05	-	0.23	0.00	0.01	3.6	27.9	473	26.4	16.9
3	91.0	5.8	0.6	0.00	0.04	0.05	-	0.26	0.00	0.01	3.2	26.6	404	25.0	15.2
4	91.6	5.5	0.4	0.00	0.03	0.05	-	0.24	0.00	0.00	2.5	28.3	610	27.0	21.6
5	89.4	6.7	0.4	0.00	0.04	0.04	-	0.27	0.00	0.00	2.9	22.6	595	21.8	26.3
6	76.6	15.7	0.7	0.00	0.05	0.06	-	0.43	0.00	0.01	6.1	8.3	291	8.1	35.2

CLAY MINERALOGY (1 very weak,..., 8 very strong) / EXTRACTABLE Fe Al Si Mn (by AMM. OXALATE(o), Na DITHIONITE(d) & PYROPHO(p))

Hor. no.	MI	VE	CH	SM	KA	HA	ML	QU	FE	GI	GO	HE	Fe(o)	Al(o)	Si(o)	Fe(d)	Al(d)	Fe(p)	Al(p)	Pret	pHNaF
1	1	-	3	-	8	-	-	2	-	-	-	-	0.10	0.04	0.00	0.10	0.04	-	-	-	-
2	-	-	3	-	8	-	-	2	-	-	-	-	0.18	0.06	0.00	0.16	0.05	-	-	-	-
3	-	-	3	-	8	-	-	2	-	-	-	-	0.18	0.04	0.00	0.15	0.03	-	-	-	-
4	-	-	3	-	8	-	-	2	-	-	-	-	0.05	0.03	0.00	0.16	0.02	-	-	-	-
5	-	-	3	-	8	-	-	2	-	-	-	-	0.02	0.03	0.00	0.01	0.01	-	-	-	-
6	-	-	3	-	8	-	-	2	-	-	-	-	0.02	0.03	0.00	0.01	0.02	-	-	-	-

FAO/UNESCO (1988) : Ferri-Ferric Acrisol (1974 : Ferric Acrisol)
 USDA/SCS SOIL TAXONOMY (1992) : Typic Kandudult, clayey, oxidic, isohyperthermic (1975 : orthoxic tropudult)
 LOCAL CLASSIFICATION : Sol ferrallitique, moyennement désaturé, remanié.

DIAGNOSTIC CRITERIA
 USDA/SCS (1992) : Soil moisture regime : udic
 FAO (1974) & USDA (1975) : Diagnostic horizons : ochric, argillic
 : Diagnostic properties : ferric properties
 : Soil moisture regime : udic

Classification remarks : A gravelly, very deep soil (125-180 cm), derived from gneiss rich in biotite. Fragments of parent material can be found in CB horizon (30 % soil, 70 % parent material). The land is used for agriculture; the mesorelief shows yam mounds (about 50 cm high), slightly affected by rill erosion.

LOCATION : 500 m E of Zambekro
 Latitude : 5°51' 0'' N Longitude : 7°25'30'' W Altitude : 170 (m.a.s.l.)
 AUTHOR(S) : Van Kekem, A.J. Date (mm.yy) : 1.85

GENERAL LANDFORM : peneplain Topography : rolling
 PHYSIOGRAPHIC UNIT : slope low hill in diss.penepl.
 SLOPE Gradient : 8% Aspect : NNE Form : convex
 POSITION OF SITE : upper slope
 MICRO RELIEF Kind : Pattern : isolated Height (cm) : 50
 SURFACE CHAR. Rock outcrop : nil Stoniness : nil
 Cracking : nil Slaking/crusting : partly slaked
 SLOPE PROCESSES Soil erosion : slight rill

PARENT MATERIAL 1 : residual material derived from : gneiss
 Texture :
 Remarks : Precambrian

WATER TABLE Depth(cm) : Kind : no watertable observed
 DRAINAGE : well
 PERMEABILITY : high No slow permeable layer(s) cm
 FLOODING Frequency : nil Run off : medium
 MOISTURE CONDITIONS PROFILE : 0 - 150 cm moist

LAND USE : arable farming; Crops : yams

ADDITIONAL REMARKS :
 MICRO RELIEF: Yam mounds: diameter 75 cm.

CLIMATE :		Köppen: Am												
Station: TAI		5 52 N/ 7 28 W				0 m a.s.l				3 km WNW of site				Relevance: very good
		No. years of record												
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
EA Piche	mm	48	53	55	47	40	32	31	31	35	37	32	31	470
precipitation	mm	21	65	148	170	216	269	124	132	293	240	108	47	1833
T max	°C	31.9	32.8	33.0	32.9	31.6	29.7	28.5	29.6	30.3	31.1	31.2	30.3	31.1
T min	°C	20.2	21.4	21.5	21.8	22.0	21.6	20.8	20.9	21.4	21.8	21.1	20.3	21.2

PROFILE DESCRIPTION :

Ap	0 - 11 cm.	7.5 YR 4.0/3.0, moist slightly gravelly sandy loam; moderate fine to very fine subangular blocky structure; slightly sticky, non plastic, very friable; many micro to medium exped-inped tubular pores and many micro to medium, exped-inped interstitial pores; many very fine roots and medium roots; few small spherical hard ferruginous concretions; gradual smooth boundary to
AB	11 - 20 cm.	strong brown (7.5 YR 4.0/6.0, moist) slightly gravelly sandy loam; moderate fine subangular blocky structure; slightly sticky, slightly plastic, very friable; many micro to fine tubular pores and many micro to fine, interstitial pores; common very fine roots and medium roots; few small spherical hard ferruginous concretions; few charcoal fragments; gradual smooth boundary to
Bws	20 - 70 cm.	5 YR 5.0/7.0, moist very gravelly sandy clay loam; moderate very fine angular blocky to subangular blocky structure; sticky, plastic, friable; cutans on rock fragments; many micro to fine exped-inped tubular pores and many micro to fine, exped-inped interstitial pores; few very fine roots and fine roots; very frequent medium spherical hard ferruginous concretions; very few medium weathered quartz fragments and very few coarse strongly weathered schists fragments; gradual smooth boundary to
BC	70 - 110 cm.	yellowish red (5 YR 5.0/8.0, moist) slightly gravelly clay; moderate fine to very fine subangular blocky to angular blocky structure; sticky, plastic, friable; cutans on rock fragments; many micro to very fine exped-inped tubular pores and many micro to very fine, exped-inped interstitial pores; few very fine roots and fine roots; few medium weathered quartz fragments and few medium strongly weathered schists fragments; diffuse irregular boundary to
CB	110 - 150 cm.	yellowish red (5 YR 5.0/8.0, moist) slightly gravelly clay; weak fine subangular blocky and rock structure; sticky, plastic, friable; many micro to fine exped-inped tubular pores and many micro to fine, exped-inped interstitial pores; few very fine roots and fine roots; very few medium weathered quar.,mica,iron fragments;

ANALYTICAL DATA :

Hor. no.	Top - Bot	>2 mm	2000 1000	500 250	250 100	100 50	TOT SAND	50 20	20 2	TOT SILT	<2 µm	DISP	BULK DENS	pH-	0.0	1.0	1.5	2.0	2.3	2.7	3.4	4.2
1	0 - 10	4	10	19	21	24	7	81	2	4	6	14	7.8	-	-	-	-	-	-	-	-	-
2	10 - 20	7	10	16	18	23	7	74	2	4	6	20	10.0	-	-	-	-	-	-	-	-	-
3	20 - 70	59	17	14	12	14	4	62	3	4	7	31	22.2	1.51	42	40	33	26	22	19	15	14
4	70 - 100	15	9	10	10	13	5	48	2	11	13	39	0.5	1.27	49	48	43	38	36	34	27	26
5	120 - 150	95	-	-	-	-	-	-	-	-	-	-	0.0	-	-	-	-	-	-	-	-	-

Hor. no.	pH- H2O	-- KCl	CaCO3 %	ORG- C %	MAT. N %	EXCH Ca	CAT. Mg	----- K	----- Na	sum	EXCH AC. H+Al	AC. Al	CEC soil	----- clay	----- OrgC	----- ECEC	BASE SAT %	Al SAT %	EC 2.5 mS/cm
1	5.0	4.0	-	1.12	0.07	2.0	0.2	0.1	0.0	2.3	0.7	0.2	4.6	33	3.9	3.0	50	4	0.05
2	4.6	3.8	-	0.91	0.08	1.0	0.1	0.1	0.2	1.4	1.1	0.7	4.4	22	3.2	2.5	32	16	0.04
3	4.7	3.9	-	0.49	0.03	1.0	0.0	0.0	0.1	1.1	1.0	0.7	3.2	10	1.7	2.1	34	22	0.03
4	4.8	4.0	-	0.45	-	0.8	0.1	0.0	0.0	0.9	1.0	0.7	1.6	4	1.6	1.9	56	44	0.03
5	4.8	4.0	-	0.39	-	-	-	-	-	-	-	-	-	-	1.4	-	-	-	0.03

remarks (hor. 1 - 5): el.comp. of clay fr. avail. in labfiles; Part.Size after defer.

ELEMENTAL COMPOSITION OF TOTAL SOIL (in weight %) AND MOLAR RATIOS

Hor. no.	SiO2	Al2O3	Fe2O3	CaO	MgO	K2O	Na2O	TiO2	MnO2	P2O5	IGN. LOSS	SiO2/ Al2O3	SiO2/ Fe2O3	SiO2/ R2O3	Al2O3/ Fe2O3
1	88.1	5.2	2.1	0.00	0.04	0.04	-	0.27	0.00	0.02	3.9	28.8	112	22.9	3.9
2	86.7	7.0	2.6	0.00	0.05	0.04	-	0.34	0.00	0.03	4.4	21.0	88.8	17.0	4.2
3	75.8	12.1	5.4	0.00	0.04	0.05	-	0.52	0.00	0.03	5.9	10.6	37.4	8.3	3.5
4	63.1	19.8	7.5	0.00	0.04	0.07	-	0.77	0.00	0.04	8.7	5.4	22.4	4.4	4.1
5	60.6	20.6	7.5	0.00	0.03	0.05	-	0.78	0.00	0.04	9.0	5.0	21.5	4.1	4.3

CLAY MINERALOGY (1 very weak,..., 8 very strong) / EXTRACTABLE Fe Al Si Mn (by AMM. OXALATE(o), Na DITHIONITE(d) & PYROPHO(p))

Hor. no.	MI	VE	CH	SM	KA	HA	ML	QU	FE	GI	GO	HE	Fe(o)	Al(o)	Si(o)	Fe(d)	Al(d)	Fe(p)	Al(p)	Pret	pHNaF
1	-	1	2	-	8	-	-	-	-	3	4	-	0.10	0.00	0.00	1.00	0.20	-	-	-	-
2	-	1	2	-	8	-	-	-	-	3	4	-	0.10	0.10	0.00	1.40	0.20	-	-	-	-
3	-	1	2	-	8	-	-	-	-	3	4	-	0.10	0.10	0.00	3.00	0.40	-	-	-	-
4	-	2	2	-	8	-	-	-	-	3	4	-	0.10	0.10	0.00	4.30	0.50	-	-	-	-
5	-	2	2	-	8	-	-	-	-	3	4	-	0.10	0.10	0.00	4.80	0.50	-	-	-	-

FAO/UNESCO (1988) (1974)	: Plinthic Acrisol		
USDA/SCS SOIL TAXONOMY (1992)	: Plinthic Acrisol, stony phase		
LOCAL CLASSIFICATION	: Acrudoxic Plinthic Kandiodult, clayey, oxidic, isohyperthermic		(1975 : plinthudult)
	: Sol ferrallitique, fortement désaturé, remanié.		
DIAGNOSTIC CRITERIA	FAO (1988)	: Diagnostic horizons : ochric A, argic B	
		: Diagnostic properties : plinthite	
	USDA/SCS (1992)	: Soil moisture regime : udic	
Classification remarks	: A very deep (125-180 cm), moderately well drained, strong brown gravelly clay soil. Plinthite starting at 60 cm depth. With high biological activity (termites, ants, earthworms).		
LOCATION	: 800 m E after bridge over Audrenisrou, Tai Research Station		
AUTHOR(S)	Latitude : 5°51' 0'' N	Longitude : 7°20' 0'' W	Altitude : 165 (m.a.s.l.)
	: Van Kekem, A.J.		Date (mm.yy) : 3.84
GENERAL LANDFORM	: peneplain	Topography : rolling	
PHYSIOGRAPHIC UNIT	: Dissected peneplain		
SLOPE	Gradient : 3%	Aspect : E	Form : convex
POSITION OF SITE	: middle slope		
MICRO RELIEF	Kind : termite mounds	Pattern : isolated	
SURFACE CHAR.	Rock outcrop : nil	Stoniness : nil	
	Cracking : nil	Slaking/crusting : nil	
SLOPE PROCESSES	Soil erosion : nil	Aggradation : nil	
PARENT MATERIAL	1 : residual material	derived from : metamorphic rock	
	Texture :		
Remarks	: Precambr. migmatite		
WATER TABLE	Depth(cm) :	Kind : no watertable observed	
DRAINAGE	: moderately well		
PERMEABILITY	: high	No slow permeable layer(s) cm	
FLOODING	Frequency : nil	Run off : medium	
MOISTURE CONDITIONS PROFILE	: 0 - 150 cm moist		
VEGETATION	Type : closed forest	Status : primary	
Landuse/vegetation remarks	: Tropical lowland forest; national park		
CLIMATE : Station: TAI	Köppen: Am 5 52 N/ 7 28 W	0 m a.s.l	5 km W of site
	No. years of record	Jan	Feb
		Mar	Apr
		May	Jun
		Jul	Aug
		Sep	Oct
		Nov	Dec
		Annual	
EA Piche	mm	48	53
precipitation	mm	55	47
T max	°C	40	32
T min	°C	31	31
		35	37
		32	31
		47	1833
		31.9	32.8
		33.0	32.9
		31.6	29.7
		28.5	29.6
		30.3	31.1
		31.2	30.3
		20.2	21.4
		21.5	21.8
		22.0	21.6
		20.8	20.9
		21.4	21.8
		21.1	20.3
		21.2	21.2
PROFILE DESCRIPTION :			
Ah	0 - 7 cm.	dark brown (10 YR 4.0/3.0, moist) sandy clay loam; moderate fine subangular blocky structure; sticky, plastic, friable; many very fine to medium interstitial pores and many very fine to medium, tubular pores; many very fine to coarse roots; clear smooth boundary to	
BA	7 - 18 cm.	yellowish brown (10 YR 5.0/8.0, moist) gravelly sandy clay loam; moderate fine subangular blocky structure; sticky, plastic, friable; patchy cutans on rock fragments; common very fine to medium interstitial pores and common very fine to medium, tubular pores; many very fine to coarse roots; very few medium spherical hard ferruginous nodules; very few fine quartz fragments and medium quartz fragments; clear wavy boundary to	
Bcs	18 - 35 cm.	strong brown (7.5 YR 5.0/8.0, moist) very gravelly clay; moderate fine subangular blocky structure; sticky, plastic, friable; broken thin clay and sesquioxides cutans on rock fragments; common very fine to fine interstitial pores and common very fine to fine, tubular pores; common very fine roots and fine roots; very frequent medium spherical hard ferruginous nodules; very few fine quartz fragments and charcoal fragments; clear irregular boundary to	
Bws	35 - 60 cm.	strong brown (7.5 YR 5.0/8.0, moist) gravelly clay; moderate fine angular blocky to subangular blocky structure; sticky, plastic, friable; broken thin clay and sesquioxides cutans; common fine tubular pores and common very fine interstitial pores; few very fine roots and fine roots; frequent medium irregular hard ferruginous nodules and very frequent medium irregular hard argillaceous nodules; gradual smooth boundary to	
Bsq1	60 - 85 cm.	yellowish brown (10 YR 5.0/8.0, moist) slightly gravelly clay; moderate fine to very fine angular blocky to subangular blocky structure; sticky, plastic, friable; many mottles (5YR 5.0/8.0); broken thin clay and sesquioxides cutans on pedfaces; few very fine tubular pores and common very fine interstitial pores; few very fine roots and fine roots; very frequent medium irregular soft argillaceous nodules and ferruginous nodules; gradual smooth boundary to	

Bsq2 85 - 150 cm. strong brown (7.5 YR 5.0/8.0, moist) clay; moderate fine to very fine angular blocky to subangular blocky structure; sticky, plastic, friable; common medium faint diffuse mottles (10 YR 5.0/6.0) and many coarse prominent clear mottles (2.5 YR 4.0/6.0); broken thin clay and sesquioxides cutans on pedfaces; many very fine to fine tubular pores and many very fine to fine, interstitial pores; few very fine roots and fine roots; very frequent large irregular soft argillaceous nodules and ferruginous nodules; few quartz fragments;

ANALYTICAL DATA :

Hor. no.	Top	Bot	>2 mm	2000 1000	1000 500	500 250	250 100	100 50	TOT SAND	50 20	20 2	TOT SILT	<2 µm	DISP	BULK DENS	pF- 0.0	----	----	----	----	----	----	----	----
																	1.0	1.5	2.0	2.3	2.7	3.4	4.2	
1	0	7	7	7	15	17	19	8	66	5	6	11	23	6.2	-	-	-	-	-	-	-	-	-	
2	7	15	29	12	13	13	14	7	60	5	7	12	29	14.1	1.41	45	44	40	36	35	32	15	13	
3	15	30	63	11	9	9	13	7	49	4	8	12	39	22.3	-	-	-	-	-	-	-	-	-	
4	40	60	47	12	10	9	10	5	45	3	9	12	44	7.0	-	-	-	-	-	-	-	-	-	
5	60	85	40	7	9	7	8	4	34	4	11	15	51	0.5	1.36	47	46	42	38	37	35	31	30	
6	90	110	55	8	9	7	6	4	34	5	13	18	48	0.0	1.30	50	49	46	43	42	40	30	27	
7	120	150	85	1	5	5	6	4	22	8	21	30	48	0.5	-	-	-	-	-	-	-	-	-	

Hor. no.	pH-H2O	--KCl	CaCO3 %	ORG-C %	MAT-N %	EXCH Ca	CAT. Mg	----- K	----- Na	----- sum	EXCH H+Al	AC. Al	CEC soil	----- clay	----- OrgC	ECEC	BASE SAT %	Al SAT %	EC 2.5 mS/cm
1	5.4	4.7	-	1.75	0.13	3.9	1.1	0.1	0.1	5.2	0.1	0.0	6.9	30	6.1	5.3	75	0	0.18
2	5.2	4.3	-	1.34	0.11	1.8	0.8	0.0	0.0	2.6	0.3	0.0	5.3	18	4.7	2.9	49	0	0.07
3	4.8	3.9	-	0.97	0.09	0.0	0.2	0.0	0.1	0.3	1.3	0.9	3.5	9	3.4	1.6	9	26	0.03
4	4.7	3.9	-	0.59	0.05	0.0	0.1	0.0	0.0	0.1	1.2	0.7	2.6	6	2.1	1.3	4	27	0.02
5	4.8	4.0	-	0.60	0.05	0.0	0.1	0.0	0.0	0.1	1.2	0.7	2.3	5	2.1	1.3	4	30	0.02
6	4.8	4.0	-	0.46	0.05	0.0	0.2	0.0	0.0	0.2	1.2	0.7	2.3	5	1.6	1.4	9	30	0.02
7	4.9	4.0	-	0.31	-	0.0	0.2	0.0	0.1	0.3	1.2	0.7	2.1	4	1.1	1.5	14	33	0.02

remarks (hor. 1 - 7): el.comp. of clay fr. avail. in labfiles; Part.Size after defer.

ELEMENTAL COMPOSITION OF TOTAL SOIL (in weight %) AND MOLAR RATIOS

Hor. no.	SiO2	Al2O3	Fe2O3	CaO	MgO	K2O	Na2O	TiO2	MnO2	P2O5	IGN. LOSS	SiO2/Al2O3	SiO2/Fe2O3	SiO2/R2O3	Al2O3/Fe2O3
1	79.8	8.3	4.0	0.10	0.07	0.02	-	0.51	0.02	0.02	6.9	16.3	53.1	12.5	3.3
2	67.7	15.1	7.0	0.00	0.04	0.00	-	0.75	0.01	0.01	8.1	7.6	25.7	5.9	3.4
3	74.7	11.1	5.5	0.04	0.06	0.01	-	0.62	0.02	0.01	7.4	11.4	36.2	8.7	3.2
4	64.3	17.7	8.3	0.00	0.06	0.00	-	0.80	0.01	0.01	8.4	6.2	20.6	4.7	3.3
5	61.9	20.6	8.0	0.00	0.03	0.00	-	0.83	0.01	0.01	9.4	5.1	20.6	4.1	4.0
6	58.6	22.4	8.2	0.00	0.05	0.00	-	0.90	0.01	0.01	9.8	4.4	19.0	3.6	4.3
7	55.4	24.4	8.4	0.00	0.03	0.00	-	0.92	0.01	0.01	10.3	3.9	17.6	3.2	4.6

CLAY MINERALOGY (1 very weak, ..., 8 very strong) / EXTRACTABLE Fe Al Si Mn (by AMM. OXALATE(o), Na DITHIONITE(d) & PYROPHO(p))

Hor. no.	MI	VE	CH	SM	KA	HA	ML	QU	FE	GI	GO	HE	Fe(o)	Al(o)	Si(o)	Fe(d)	Al(d)	Fe(p)	Al(p)	Pret	pHNaF
1	-	3	2	-	8	-	-	-	2	4	-	-	0.30	0.10	0.00	2.10	0.20	-	-	-	-
2	-	2	3	-	8	-	-	-	2	4	-	-	0.40	0.10	0.00	2.20	0.30	-	-	-	-
3	-	1	3	-	8	-	-	-	2	4	-	-	0.30	0.10	0.00	3.20	0.40	-	-	-	-
4	-	-	4	-	8	-	-	-	2	4	-	-	0.10	0.10	0.00	4.80	0.50	-	-	-	-
5	-	-	4	-	8	-	-	-	2	4	-	-	0.20	0.10	0.00	4.10	0.50	-	-	-	-
6	-	-	4	-	8	-	-	-	2	4	-	-	0.10	0.10	0.00	4.80	0.60	-	-	-	-
7	-	-	3	-	8	-	-	-	2	4	-	-	0.10	0.10	0.00	4.20	0.50	-	-	-	-

ANNEX 1 REFERENCES

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ANNEX 2 FIELD METHODS

The soils were described in the field according to ISRIC's Guidelines for the description and coding of soil data (Van Waveren & Bos, 1988; 1994). These guidelines follow closely those for soil description given by FAO (1977, 1990). Soil columns were taken for monolith preparation using the methods described by Van Baren & Bomer (1979). In addition, disturbed and undisturbed samples are collected for physical, chemical and mineralogical analyses and for thin section preparation, where possible using the guidelines for the sampling of soil horizons for a soil reference collection (NASREC Newsletter no. 1 (March, 1991).

Of all sites slides and photographs were taken showing the landscape, vegetation, land use, soil profile and important profile details. Furthermore, data were collected with each pedon on climate, land use history, crops and crop yields, soil management practices, etc.

Soils are classified according to the FAO-Unesco Legend of the Soil Map of the World (1974) and its Revised Legend (FAO-Unesco-ISRIC, 1988). Soil subunit modifiers ("third level") were added using the guidelines described by Nachtergaele *et al.* (1994). In addition soils were given their classification according to Soil Taxonomy (Soil Survey Staff, 1975; 1992), and, if available, the local classification.

All data are stored in ISIS version 4.0 (ISRIC, 1994), ISRIC's soil pedon data management system for personal computers. The information given on the soil data sheets in this publication have been generated from the ISIS files.

ANNEX 3 ANALYTICAL METHODS

Abstract from ISRIC TP 9 (Van Reeuwijk (ed.), 1993).

Preparation

Each sample is air-dried, cleaned, crushed (not ground), passed through 2 mm sieve, homogenized. Moisture content is determined at 105° C.

pH H₂O

(1:2.5): 20 g of soil is shaken with 50 ml of deionised water for 2 hours, electrode in upper part of suspension.

pH-KCl

likewise but shaken with 1 M KCl.

EC

(1:2.5): Conductivity of pH-H₂O suspension.

Particle-size distribution

Soil is treated with 15% hydrogen peroxide overnight in the cold, then on waterbath at about 80°C. Then boiled on hot plate for 1 hour. Washings until dispersion. Dispersing agent is added (20 ml solution of 4% Na-hexametaphosphate and 1% soda) and suspension shaken overnight. Suspension sieved through 50 µm sieve. Sand fraction remaining on sieve dried and weighed. Clay and silt determined by pipetting from sedimentation cylinder.

Water-dispersable clay

Pipetting after shaking 20 g of soil overnight (16 hours) with deionized water.

Exchangeable bases and CEC

Percolation with 1 M ammonium acetate pH 7 using automatic extractor.

(If EC > 0.5mS pre-leaching with ethanol 80%). Cations are determined in the leachate by AAS.

CEC: saturation with sodium acetate 1 M pH 7; washed with ethanol 80% and then leached with ammonium acetate 1 M pH 7. Na determined by FES.

Exchangeable acidity and Aluminium

The sample is extracted with 1 M KCl solution and the exchange acidity (H + Al) titrated with NaOH. Al is measured by AAS.

Carbonate

Piper's procedure. Sample is treated with dilute acid and the residual acid is titrated.

Organic carbon

Walkley-Black procedure. The sample is treated with a mixture of potassium dichromate and sulphuric acid at about 125°C. The residual dichromate is titrated with ferrous sulphate. The result expressed in % carbon (because of incomplete oxidation a correction factor of 1.3 is applied).

Total nitrogen

Micro-Kjeldahl. Digested in H₂SO₄ with Se as catalyst. Then ammonia is distilled, trapped in boric acid and titrated with standard acid.

P-Bray 1

Phosphate is extracted with a mixture of 0.025 M HCl + 0.03 M NH₄F and determined colorimetrically.

P-Olsen

Phosphate is extracted with 0.5 M NaHCO₃ solution pH 8.5 and determined colorimetrically.

P-Retention

Blakemore et al. Shaken with (KH_2PO_4 + NaAc) solution, 1000 mg/L P pH 4.6 for 16 hours.

Determination of residual P colorimetrically after centrifuging.

pH-NaF

To 1g of soil 50 ml of NaF 1 M is added and stirred for 1 minute.

Reading pH by continuous stirring exactly 2 minutes after adding NaF solution.

Extractable Iron, Aluminium, Manganese and Silicon

All determinations by AAS.

1. "Free" (Fe, Al, Mn): Holmgren Shaken with sodium citrate (17%) + sodium dithionite (1.7%) solution for 16 hours.
2. "Active" (Fe, Al, Si): Shaken with acid ammonium acetate 0.2 M pH 3 for 4 hours in the dark.
3. "Organically bound" (Fe, Al): Shaken with sodium pyrophosphate 0.1 M for 16 hours.

Clay mineralogy

Clay is separated as indicated for particle-size analysis.

about 10-20 mg of clay is brought on porous ceramic tile by suction and analyzed using a Philips diffractometer.

Soluble salts

Measuring pH, EC, cations and anions in water extracts.

1. 1:5 extract. Shaking 30 g of fine earth + 150 ml of water for 2 hours.
2. saturation extract. Adding to 200-1000 g fine earth just enough water to saturate the sample. Standing overnight.

After filtration Ca, Mg, Na, K are measured by AAS. Cl with the Chlorocounter and SO_4 turbidimetrically.

Gypsum

To 10 g of fine earth 100 ml of water is added, shaken overnight and centrifuged.

Precipitation by adding acetone. Precipitate redissolved in water and determination of Ca by AAS.

Elemental composition

The fine earth is dried, ignited and fused with lithium tetraborate.

The formed bead is analyzed by X-ray fluorescence spectroscopy.

Moisture retention

Moisture determinations on undisturbed core samples in silt box (pF1.0;1.5;2.0) and kaolinite box (pF2.3;2.7) respectively and on disturbed samples in high pressure pan (pF3.4;4.2).

Bulk density obtained from dry weight of core sample.

Country Reports¹
(ISSN: 1381-5571)

No.	Country	No. of soils	No.	Coutry	No. of soils
1	Cuba	22	15	Gabon	6
2	P.R. of China	51	16	Ghana	in prep.
3	Turkey	15	17	Philippines	6
4	Côte d'Ivoire	7	18	Zimbabwe	13
5	Thailand	13	19	Spain	20
6	Colombia	18	20	Italy	17
7	Indonesia	48	21	Greece	in prep.
8	Ecuador	in prep.	22	India	in prep.
9	Brazil	28	23	Kenya	in prep.
10	Peru	21	24	Mali	in prep.
11	Nicaragua	11	25	Nigeria	in prep.
12	Costa Rica	12	26	Mozambique	in prep.
13	Zambia	11	27	Botswana	in prep.
14	Uruguay	10	28	Malaysia	18

¹ as of June 1995