

Reference soil Costa Rica 2: Umbrisol

Description

A 'raised bed' technique was applied some years ago, with the result that about 30 cm soil was put on top of the original profile. At present the site is drained with drain ditches. Brief description of the soil: Very deep, moderately well to well drained, dark brown sandy clay soil. Stratification of alluvial deposits well visible throughout the profile. The soil horizons (thickness and gravel content) varies at short distance. The four walls of the pit show different sequences. The wall from which the monoliths were taken, was described. Other walls had higher gravel content. Actual classification FAO (1988): Umbric Cambisol

Classification

WRB 2006:

Cambic Fluvic Umbrisol (Humic Endoeutric Drainic)
0-30 cm umbric horizon
45-135 cm cambic horizon
fluvic material

WRB 1998:

Humic Umbrisol
0-30 cm umbric horizon
45-135 cm cambic horizon
fluvic soil material
strongly humic properties

FAO-UNESCO-ISRIC 1988:

Fluvi- Humic Cambisol
0-30 cm umbric A horizon
45-135 cm cambic B horizon
fluvic properties
strongly humic

FAO-UNESCO 1974:

Humic Cambisol
0-30 cm umbric A horizon
45-135 cm cambic B horizon

Site description

General information:

Names of person(s) : Kauffman JH
who described the
profile
General description of : Carthago, Turrialba, CATIE
location of profile (e.g., Experimental Station, Montanha
town, province) Lote no.
Climate classification : Af
according to Köppen
Date : March 1991
Latitude / Longitude : N 9.88333333° / W -83.6639°

Physiography:

The altitude of the : 590 m asl
soil profile relative
to mean sea level,
specified in meters
Regional landform : intermontane basin
Topography of the : flat or almost flat
surrounding country
Physiographic Unit : terrace of Reventazón river
in the immediate
surrounding of the
site
The slope refers to : 1 %
the inclination of the
land immediately
surrounding the
site. The measured
or estimated slope
angle is specified to
the nearest per cent
The physiographic : flat
position of the site
where the profile is
located
Form of the slope :
surrounding the site
Slope Aspect of the :
site

Parent material:

Hydrology and drainage:

The main parent rock/ : sediment, unconsolidated material over which the soil has been formed (1st entry)

Mode of Accumulation : fluvial or deposition of parent material (1st entry)

Texture of parent : sandy clay material (1st entry)

Weathering status of : slightly solid rock (1st entry)

Resistance against : moderate weathering (solid rock) (1st entry)

Depth1 of lithological : cm boundary

The main parent rock/ : material over which the soil has been formed (2nd entry)

Resistance against : weathering (solid rock) (2nd entry)

Soil Depth; depth to : 150 cm which roots can easily penetrate throughout the year

Remarks on Parent : partly colluvial? Materials

Land use / vegetation:

Current land use at : high level arable farming the site

Major crops :

Main type of irrigation :

Rotation scheme :

Vegetation Type;The : natural vegetation at the site

Status of vegetation :

Remarks on Land Use : LANDUSE: Experimental fields / Vegetation CATIE

Depth of : cm groundwater table

Groundwater Top : cm

Groundwater Bottom : cm

Kind of groundwater : no groundwater table observed table

Top Stagnating : cm Layer

Bottom Stagnating : cm Layer

Runoff : slow

Estimated : moderate permeability (class) of least permeable part of the profile

Drainage Class : moderately well

To Drainage Class : well

Moisture conditions : 0-80 cm of the profile: dry from -to

Moisture conditions : 80-170 cm of the profile: moist from -to

Wet From - To : cm

Erosion and aggradation:

Soil erosion type (1st : entry)

Occurrence of soil : aggradation

Slope Stability :

Surface characteristics:

Microrelief type: small-scale : differences in relief in the direct vicinity of the site

Microrelief Height :

Rockiness : none

Stoniness : none

Average size of stones :

Shape of stones (on average) :

Cracks : no cracks observed

Slaking of aggregates by : no surface slaking/crusting observed tillage, rainfall or frost

Evidence of salt : non-saline

Evidence of alkali : non-alkaline

Nearest climate station:

Station : Turrialba iica
Country : Costa Rica
WMO Code : 78.77
Distance : 1 km S (very good)
Latitude / Longitude : N 9°53 / W 83°38

Climate data*:

dataType(Station)	nrecord	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Precipitation (mm)(Turrialba iica)	: 40	233	255	94	232	253	225	248	261	259	215	621	154	3050
Mean temperature (°C)(Turrialba iica)	: 21	20.8	20.9	21.6	22.2	22.9	22.8	22.6	22.6	22.8	22.6	22	21.1	22.1
Maximum temperature (°C)(Turrialba iica)	: 21	25.5	25.8	26.7	27.1	27.7	27.5	27	27.3	27.6	27.3	26.2	25.6	26.8
Minimum temperature (°C)(Turrialba iica)	: 21	16.4	16.2	17	17.7	18.5	18.7	18.6	18.4	18.5	18.3	18.1	17.2	17.8
Relative humidity (%) (Turrialba iica)	: 23	87	86	85	86	87	89	89	88	89	90	89	89	87.8
Pot. evapotranspiration (mm)(Turrialba iica)	: 11	20.8	21.2	21.4	22.3	23.8	24.1	23.7	23.7	23.8	23.7	23.3	21.7	22.8
Epot. - Frere, Popov (mm)(Turrialba iica)	: -	82	82	102	102	104	93	95	99	96	96	81	78	1110
Bright sunshine (%) (Turrialba iica)	: 11	41	44	43	42	41	33	31	36	36	42	37	39	38.8
Total global radiation (MJ/m²)(Turrialba iica)	: 23	503	499	601	560	582	503	488	531	541	548	463	458	523.1
Estimated global radiation (MJ/m²)(Turrialba iica)	: -	14.9	16.5	17.5	17.7	17.3	15.8	15.5	16.5	16.4	16.6	14.7	14.2	16.1
Windspeed (m/s, at 2m height)(Turrialba iica)	: -	0.7	0.7	0.9	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7

*Data are considered representative for site

Profile description:

- Ap 0-30 cm : dark brown (7.5YR 3/2, moist), sandy clay loam, moderate very fine subangular blocky, slightly hard very friable sticky slightly plastic, many very fine pores and few pores, clear smooth boundary to,
- Ahb 30-45 cm : very dark brown (7.5YR 2/2, moist), sandy clay loam, strong fine subangular blocky, hard firm sticky slightly plastic, common very fine pores and few pores, clear smooth boundary to,
- Bw1 45-80 cm : dark reddish brown (5YR 3/4, moist), sandy clay, moderate fine subangular blocky, hard friable sticky plastic, many very fine pores, gradual smooth boundary to,
- Bw2 80-110 cm : (dark) brown (10YR 4/3, moist), sandy clay loam, moderate very fine subangular blocky, friable sticky slightly plastic, many very fine pores and few pores, gradual wavy boundary to,
- Bg 110-135 cm : dark yellowish brown (10YR 4/4, moist), sandy clay, moderate fine subangular blocky, friable sticky slightly plastic, few medium distinct mottles, many very fine pores, abrupt smooth boundary to,
- Cg 135-170 cm : dark yellowish brown (10YR 4/4, moist), clay, weak fine subangular blocky, friable sticky plastic, many medium clear mottles, many very fine pores,

Physical

Particle size distribution:

Depth (cm)	Gravel (%)	Very Coarse Sand (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Very Fine Sand (%)	Total Sand (%)	Coarse Silt (%)	Fine Silt (%)	Total Silt (%)	Clay (%)
0-30	: 0	5.0	7.2	7.3	9.2	3.9	32.6	11.1	22.2	33.3	34.1
30-45	: 0	5.5	7.6	7.8	8.8	4.6	34.3	10.0	22.1	32.1	33.6
45-80	: 0	6.4	8.0	9.2	12.4	4.7	40.7	9.1	18.7	27.8	31.5
80-110	: 0	8.5	10.5	7.5	7.5	4.6	38.6	9.3	19.6	28.9	32.6
110-135	: 0	7.3	8.5	7.5	10.1	4.6	38	11.0	20.4	31.4	30.6
135-170	: 0	1.0	1.8	2.4	4.7	3.3	13.2	9.5	30.6	40.1	46.7

Other physical data

Depth (cm)	Bulk Density (kg/dm³)	Spec. Surf. Area (m²/g)	COLE (cm/cm)	Water Disp. Clay (%)	Clay (%)
0-30	: -	-	-	17.6	34.1
30-45	: -	-	-	19.3	33.6
45-80	: -	-	-	16.5	31.5
80-110	: -	-	-	3.6	32.6
110-135	: -	-	-	3.4	30.6
135-170	: -	-	-	1.8	46.7

Chemical characteristics:

Depth (cm)	pH H ₂ O	pH KCl	EC 1:2.5 (mS/cm)	CaCO ₃ (%)	Org. C (%)	Org. N (%)	C/N	Exch. Acid (cmol/kg)	Exch. Al (cmol/kg)	Ca (cmol/kg)	Mg (cmol/kg)	K (cmol/kg)	Na (cmol/kg)	Sum Cations (cmol/kg)
0-30	: 5.3	4.2	0.04	-	2.54	0.23	11	1.0	0.7	5.5	1.0	0.7	0.0	7.2
30-45	: 5.7	4.6	0.03	-	2.45	0.23	11	-	-	9.2	1.4	0.4	0.0	11.0
45-80	: 5.8	4.7	0.04	-	0.78	0.06	13	-	-	6.3	1.1	0.5	0.1	8.0
80-110	: 5.9	4.8	0.03	-	0.33	0.04	8	-	-	6.5	1.1	0.1	0.1	7.8
110-135	: 6.0	4.9	0.03	-	0.22	0.03	7	-	-	6.7	0.7	0.2	0.1	7.7
135-170	: 5.9	4.9	0.02	-	0.26	0.06	4	-	-	6.9	2.1	0.3	0.2	9.5

Depth (cm)	CEC Soil (cmol/kg)	CEC Clay (cmol/kg)	CEC Org (cmol/kg)	ECEC (cmol/kg)	Base sat. (%)	Al sat. (%)	ESP (%)
0-30	: 18.6	55	8.9	-	39	4	0
30-45	: 19.4	58	8.6	-	57	-	0
45-80	: 13.9	44	2.7	-	58	-	1
80-110	: 13.1	40	1.2	-	60	-	1
110-135	: 13.1	43	0.8	-	59	-	1
135-170	: 13.5	29	0.9	-	70	-	1

Depth (cm)	pH NaF	P Retention (%)	OD OE	Melanic Index	Fe o (wt%)	Al o (wt%)	Si o (wt%)	Fe d (wt%)	Al d (wt%)	Fe p (wt%)	Al p (wt%)	C p (wt%)
0-30	-	-	-	-	0.82	0.65	0.17	-	-	-	-	-
30-45	-	-	-	-	0.90	0.61	0.15	-	-	-	-	-
45-80	-	-	-	-	0.68	0.53	0.17	-	-	-	-	-
80-110	-	-	-	-	0.41	0.52	0.19	-	-	-	-	-
110-135	-	-	-	-	0.52	0.46	0.16	-	-	-	-	-
135-170	-	-	-	-	0.37	0.30	0.09	-	-	-	-	-

Clay mineralogy:

Depth (cm)	Kaolinite	Mica / illite	Vermiculite	Chlorite	Smec	Halloysite	Mixed layer	Quar	Feldspar	Gibbsite	Goethite	Hematite
0-30	medium to strong	-	-	-	-	-	-	-	very weak	weak	weak	-
30-45	medium to strong	-	-	-	weak	-	-	-	very weak	weak	weak	-
45-80	medium to strong	-	-	-	weak	-	-	-	very weak	weak	weak	-
80-110	medium to strong	-	-	-	-	-	-	-	very weak	weak	weak	-
110-135	medium to strong	-	-	-	-	-	-	-	very weak	weak	weak	-
135-170	medium to strong	-	-	-	weak	-	-	-	very weak	weak	weak	-

Source of analyzing procedures:

Laboratory Attribute	Description	Proc. ref
ISRIC Al o	Al; Atomic Absorption Spectrometry	12-2
ISRIC Al sat.	Calculation; Exchangeable Al / (exchangeable bases+Al+H) or Al / CEC	11.1.4-1.4.3
ISRIC Base sat.	Calculation; Sum of Exchangeable Cations (Na, K, Ca, Mg) / CEC soil	labmanual
ISRIC C / N	Calculation; Organic Carbon / Organic Nitrogen	labmanual
ISRIC Ca	Exchangeable bases with 1 M ammonium acetate at pH 7; Ca by atomic absorption spectrometry	9-4 and 9-5.3
ISRIC CEC Clay	Calculation; ((CEC soil - CEC org.m.)/ clay %)*100	9-6.3
ISRIC CEC Org	CEC organic matter; expert estimate for charge per unit C	9-6.3
ISRIC CEC Soil	CEC; with index cation in buffered solution pH7	9-4 and 9-5.3.3
ISRIC Clay; < 0.002 mm	Fraction by Pipette analysis; after removal CaCO3 and organic matter, dispersion and sedimentation	3-4.7
ISRIC EC 1 : 2.5	Electro Conductivity of a soil / water (1:2.5) suspension	4-1.4 and 13-4
ISRIC ESP	Calculation; (Exchangeable Na / CEC soil) * 100	9-6.3
ISRIC Exch. Acid	Extraction by 1 M KCl; titration with NaOH	11.1.4-1.4.2
ISRIC Exch. Al	Extraction by 1 M KCl; Al by atomic absorption spectrometry	11.1.4-1.4.3
ISRIC Fe o	Fe; Atomic Absorption Spectrometry	12-2
ISRIC Feldspar	Feldspar; relative abundance scale 0 - 7	16-1

ISRIC	Gibbsite	Gibbsite; relative abundance scale 0 - 7	16-1
ISRIC	Goethite	Goethite; relative abundance scale 0 - 7	16-1
ISRIC	Gravel	Fraction from field sample, after drying, crushing, sieving	1-1
ISRIC	K	Exchangeable bases with 1 M ammonium acetate at pH 7; K by flame atomic emission spectrometry	9-6.1
ISRIC	Kaolinite	Kaolinite; relative abundance scale 0 - 7	16-1
ISRIC	Mg	Exchangeable bases with 1 M ammonium acetate at pH 7; Mg by atomic absorption spectrometry	9-4 and 9-5.3
ISRIC	Na	Exchangeable bases with 1 M ammonium acetate at pH 7; Na by flame atomic emission spectrometry	9-4 and 9-5.3
ISRIC	Organic Carbon	Wet combustion of organic matter by potassium dichromate and sulphuric acid at about 125 degrees Celcius. Residual dichromate is back titrated against ferrous sulphate. To compensate for incomplete destruction an empirical correction factor of 1.3 is applied	5
ISRIC	Organic Nitrogen	Organic Matter is digested in sulphuric acid (and hydrogen peroxide) with selenium as catalyst. Nitrogen is converted to ammonium sulphate. The solution is made alkaline and ammonia is distilled off. The evolved ammonia is trapped in boric acid and titrated with standardized acid solution	6
ISRIC	pH H2O	pH electrode; in supernatant suspension	4-1
ISRIC	pH KCl	In supernatant suspension; potentiometrically	4-1
ISRIC	Sand; 0.10 - 0.05 mm	Fraction by sieving; after removal CaCO3 and organic matter	3-4.6
ISRIC	Sand; 0.25 - 0.10 mm	Fraction by sieving; after removal CaCO3 and organic matter	3-4.6
ISRIC	Sand; 0.5 - 0.25 mm	Fraction by sieving; after removal CaCO3 and organic matter	3-4.6
ISRIC	Sand; 1.0 - 0.5 mm	Fraction by sieving; after removal CaCO3 and organic matter	3-4.6
ISRIC	Sand; 2.0 - 0.05 mm	Total sand fractions by sieving; after removal CaCO3 and organic matter	3-5
ISRIC	Sand; 2.0 - 1.0 mm	Fraction by sieving; after removal CaCO3 and organic matter	3-4.6
ISRIC	Si o	Si; Atomic Absorption Spectrometry	12-2
ISRIC	Silt; 0.02 - 0.002 mm	Fraction by Pipette analysis ; after removal CaCO3 and organic matter, dispersion and sedimentation	3-4.7
ISRIC	Silt; 0.05 - 0.002 mm	Calculation; Sum fractions Silt 0.05 - 0.02 mm	3-4.7
ISRIC	Silt; 0.05 - 0.02 mm	Fraction by Pipette analysis ; after removal CaCO3 and organic matter, dispersion and sedimentation	3-4.7
ISRIC	Smectite	Smectite; relative abundance scale 0 - 7	16-1
ISRIC	Sum cations	Sum of Exchangeable Cations (Ca, Mg, Na, K) with 1 M ammonium acetate at pH 7	9-
ISRIC	Water		
ISRIC	Dispersable Clay	Fraction by Pipette analysis; without any pretreatment	3-8

*ref: no labmanual available, link to presumable used analytical methode

Other classification

USDA-SCS (1975) : Eutropept loamy mixed isohyperthermic
Classification (other) :
 Serie Instituto