

## Reference soil Costa Rica 12: Andosol

### Description

Brief soil description: Very deep, well drained, brownish black over yellowish brown loamy soil. The upper 50 cm have a very high organic matter content. The soil has been formed in various superimposed volcanic ash deposits of the Turrialba volcano. The site has been used for many years for pasture, which has caused compaction of the upper 30 cm, as evidenced by slight mottling. At time of description, the land was being prepared for growing potatoes and later on beans, after which pasture will probably be reestablished. In the subsoil some very large pores are present, partly filled up with material from the A horizon.

### Classification

#### WRB 2006:

Umbric Silandic Andosol (Hyperdystric)  
0-53 cm umbric horizon  
53-150 cm cambic horizon  
andic properties

#### WRB 1998:

Pachi- Silic Andosol (Umbric Hyperdystric)  
0-150 cm silandic horizon  
0-53 cm umbric horizon

#### FAO-UNESCO-ISRIC 1988:

Pachi- Umbric Andosol  
0-53 cm umbric A horizon  
53-150 cm cambic B horizon  
andic properties

#### FAO-UNESCO 1974:

Humic Andosol  
0-53 cm umbric A horizon  
53-150 cm cambic B horizon  
exchange complex dominated by amorphous material  
thixotropy

### Site description

#### General information:

Names of person(s) who described the profile : Nieuwenhuysen J  
General description of location of profile (e.g., town, province) : Finca O.Casasola, 2.5km W of Santa Cruz de Turrialba, 75m E of house  
Climate classification according to Köppen : Af  
Date : November 1993  
Latitude / Longitude : N 9.96388888° / W -83.7522°

#### Physiography:

The altitude of the soil profile relative to mean sea level, specified in meters : 1650 m asl  
Regional landform : volcano  
Topography of the surrounding country : mountainous  
Physiographic Unit : SE slope of Turrialba volcano in the immediate surrounding of the site  
The slope refers to the inclination of the land immediately surrounding the site. The measured or estimated slope angle is specified to the nearest per cent : 5 %  
The physiographic position of the site where the profile is located : upper slope  
Form of the slope surrounding the site : convex  
Slope Aspect of the site : south-east

### Parent material:

The main parent rock/ : ejecta ash  
material over which  
the soil has been  
formed (1st entry)  
Mode of Accumulation : ejecta ash  
or deposition of parent  
material (1st entry)  
Texture of parent : sandy  
material (1st entry)  
Weathering status of : partially or moderately  
solid rock (1st entry)  
Resistance against : poor  
weathering (solid rock)  
(1st entry)  
Depth1 of lithological : cm  
boundary  
The main parent rock/ :  
material over which  
the soil has been  
formed (2nd entry)  
Texture of parent : sandy  
material (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 : andesitic ash  
Materials

### Land use / vegetation:

Current land use at : cultivated pasture  
the site  
Major crops :  
Main type of irrigation : no irrigation  
Rotation scheme : crop - grass rotation, lay  
Vegetation Type;The :  
natural vegetation at  
the site  
Status of vegetation :

### Surface characteristics:

Microrelief type: small-scale : level  
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

### Hydrology and drainage:

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 : rapid  
Flooding frequency : never  
Estimated : high  
permeability (class)  
of least permeable  
part of the profile  
Drainage Class : well  
To Drainage Class :  
Moisture conditions : cm  
of the profile: dry  
from -to  
Moisture conditions : 0-150 cm  
of the profile: moist  
from -to  
Wet From - To : cm

### Erosion and aggradation:

Soil erosion type (1st : sheet  
entry)  
Intensity of the soil : slight  
erosion type (1st  
entry)  
Occurrence of soil : absent  
aggradation  
Slope Stability : stable

## Nearest climate station:

Station : No representative climate station available for this site

## Profile description:

- Ah : very dark greyish brown (10YR 3/2, moist), loam, moderate very fine subangular blocky and moderate very fine and fine crumb, friable slightly sticky slightly plastic moderately smeary, common fine distinct clear mottles (7.5YR 4/6), no cutans, common very fine fine pores and few pores highly porous (>60 vol%), no inclusions, no fragments, frequent worm channels, non-cemented pans, clear wavy boundary to,
- 2Ah : very dark brown (10YR 2/2, moist), loam, moderate very fine subangular blocky and moderate fine crumb, very friable slightly sticky slightly plastic moderately smeary, oblique mottles, no cutans, many very fine fine pores and few pores highly porous (>60 vol%), no inclusions, very few medium gravel fresh andesitic fragments, few worm channels, non-cemented pans, clear wavy boundary to,
- 2Bw1 : dark yellowish brown (10YR 4/4, moist), loam, moderate very fine subangular blocky, friable slightly sticky slightly plastic moderately smeary, oblique mottles, no cutans, many very fine fine pores and few pores highly porous (>60 vol%), no inclusions, very few medium gravel fresh andesitic fragments, non-cemented pans, diffuse smooth boundary to,
- 2Bw2 : dark yellowish brown (10YR 4/4, moist), loam, moderate very fine angular blocky and moderate very fine subangular blocky, firm slightly sticky slightly plastic moderately smeary, oblique mottles, no cutans, many very fine fine pores and few pores highly porous (>60 vol%), no inclusions, very few medium gravel fresh andesitic very few fine gravel strongly weathered pumice/ash fragments, non-cemented pans,

## 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 (%)
0-26	-	1.5	1.8	3.6	14.1	13.8	34.8	8.4	23.6	32.0	33.2
26-53	-	1.2	2.0	4.0	14.0	9.7	30.9	12.8	34.4	47.2	21.9
53-100	-	1.4	2.1	4.5	10.2	8.8	27	27.6	21.2	48.8	24.2
100-150	-	1.0	3.1	6.9	13.9	7.7	32.6	35.4	9.4	44.8	22.6

### Water retention characteristics

Depth (cm)	Bulk Density (kg/dm <sup>3</sup> )	pF 0 (% w/v)	pF 1.0 (% w/v)	pF 1.5 (% w/v)	pF 2.0 (% w/v)	pF 2.3 (% w/v)	pF 2.7 (% w/v)	pF 3.4 (% w/v)	pF 4.2 (% w/v)	pF 2.5 (%)
0-26	0.510	76.0	74.9	73.6	69.4	66.1	62.1	45.2	36.2	-
26-53	0.485	75.8	75.8	71.1	66.9	64.0	61.0	49.5	37.9	-
100-53	0.436	78.4	77.7	74.5	71.4	69.3	66.9	57.0	48.9	-

### Other physical data

Depth (cm)	Bulk Density (kg/dm <sup>3</sup> )	Spec. Surf. Area (m <sup>2</sup> /g)	COLE (cm/cm)	Water Disp. Clay (%)	Clay (%)
0-26	-	-	-	4.9	33.2
26-53	-	-	-	8.6	21.9
53-100	-	-	-	6.8	24.2
100-150	-	-	-	-	22.6

## Chemical characteristics:

Depth (cm)	pH H <sub>2</sub> O	pH KCl	EC 1 : 2.5 (mS/cm)	CaCO <sub>3</sub> (%)	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)
0-26	: 4.8	4.5	0.24	-	13.67	1.27	11	-	-	2.8	1.0	0.4	1.3	5.5
26-53	: 5.9	5.3	0.02	-	7.07	0.56	13	-	-	1.8	0.3	0.1	0.1	2.3
53-100	: 6.2	5.8	0.02	-	4.85	0.46	11	-	-	1.6	0.3	0.1	0.1	2.1
100-150	: 6.4	6.0	0.02	-	3.90	0.37	11	-	-	1.6	0.7	0.1	0.1	2.5

Depth (cm)	CEC Soil (cmol/kg)	CEC Clay (cmol/kg)	CEC Org (cmol/kg)	ECEC (cmol/kg)	Base sat. (%)	Al sat. (%)	ESP (%)
0-26	: 52.7	159	47.8	-	10	-	2
26-53	: 50.0	228	24.7	-	5	-	0
53-100	: 64.8	268	17.0	-	3	-	0
100-150	: 72.5	321	13.7	-	3	-	0

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%)
0-26	: -	96	-	-	1.65	2.88	0.77	-	-	-	-	-
26-53	: -	98	-	-	1.35	5.06	1.86	-	-	-	-	-
53-100	: -	98	-	-	1.63	6.53	2.80	-	-	-	-	-
100-150	: -	98	-	-	1.58	7.90	3.42	-	-	-	-	-

Depth (cm)	P Olsen (mg/kg)	P Bray (mg/kg)	pH CaCl <sub>2</sub>	CaSO <sub>4</sub> .2H <sub>2</sub> O (%)
0-26	: 7.2	-	-	-
26-53	: 1.4	-	-	-
53-100	: 0.5	-	-	-
100-150	: 0.5	-	-	-

## Clay mineralogy:

Depth (cm)	Kaolinite	Mica / illite	Vermiculite	Chlorite	Sme c	Halloysite	Mixed layer	Quartz	Feldspar	Gibbsite	Goethite	Hematite
0-26	: very weak	-	-	-	-	-	weak	-	-	-	-	-
26-53	: very weak	-	-	-	-	-	weak	-	-	-	-	-
53-100	: very weak	-	-	-	-	-	weak	-	-	-	-	-
100-150	: very weak	-	-	-	-	-	weak	-	-	-	-	-

## Source of analyzing procedures:

Laboratory Attribute	Description	Proc. ref
ISRIC Al o	Al; Atomic Absorption Spectrometry	12-2
ISRIC Base sat.	Calculation; Sum of Exchangeable Cations (Na, K, Ca, Mg) / CEC soil	labmanual
ISRIC Bulk Density	Soil density excluding mass liquid, including interparticle space	18-3
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 CaCO <sub>3</sub> 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	Fe o	Fe; Atomic Absorption Spectrometry	12-2
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	Mixed-layer	Mixed layer minerals; relative abundance scale 0 - 7	16-1
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 emprical 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	P Olsen	Phosphate in 0.5 M NaHCO <sub>3</sub> extract (Olsen); Colorimetry	14-2
ISRIC	P Retention	P-retention; P by Colorimetry	14-4
ISRIC	pF 0	Moisture content of soil in a ring sample at tension of 0.1 kPa head of water	18-3
ISRIC	pF 1.0	Moisture content of soil in a ring sample at tension of 1 kPa head of water	18-3
ISRIC	pF 1.5	Moisture content of soil in a ring sample at tension of 3.2 kPa head of water	18-3
ISRIC	pF 2.0	Moisture content of soil in a ring sample at tension of 10 kPa head of water	18-3
ISRIC	pF 2.3	Moisture content of soil in a ring sample at tension of 20 kPa head of water	18-3
ISRIC	pF 2.7	Moisture content of soil in a ring sample at tension of 50 kPa head of water	18-3
ISRIC	pF 3.4	Moisture content of soil in a ring sample at tension of 250 kPa head of water	18-3
ISRIC	pF 4.2	Moisture content of soil in a ring sample at tension of 1.5 MPa head of water	18-3
ISRIC	pH H <sub>2</sub> O	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 CaCO <sub>3</sub> and organic matter	3-4.6
ISRIC	Sand; 0.25 - 0.10 mm	Fraction by sieving; after removal CaCO <sub>3</sub> and organic matter	3-4.6
ISRIC	Sand; 0.5 - 0.25 mm	Fraction by sieving; after removal CaCO <sub>3</sub> and organic matter	3-4.6
ISRIC	Sand; 1.0 - 0.5 mm	Fraction by sieving; after removal CaCO <sub>3</sub> and organic matter	3-4.6
ISRIC	Sand; 2.0 - 0.05 mm	Total sand fractions by sieving; after removal CaCO <sub>3</sub> and organic matter	3-5
ISRIC	Sand; 2.0 - 1.0 mm	Fraction by sieving; after removal CaCO <sub>3</sub> 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 CaCO <sub>3</sub> 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 CaCO <sub>3</sub> and organic matter, dispersion and sedimentation	3-4.7
ISRIC	Sum cations	Sum of Exchangeable Cations (Ca, Mg, Na, K) with 1 M ammonium acetate at pH 7	9-
ISRIC	Water 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)** : Hydrandept loamy isothermic

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