

GUIDELINES FOR THE DESCRIPTION AND CODING OF SOIL DATA

**E.J. van Waveren
A.B. Bos**

**Revised edition
October 1995**



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SITE DESCRIPTION

General information

Ø = zero, write clearly on ISIS coding form

- ISIS_ID* ISRIC Monolith identification code. This code consists of ISO 3166 country code (see appendix I) + serial number referring to ISRIC's monolith collection. (given by ISIS supervisor) eg. NLØØ1
- Country* Entry country code according to ISO 3166 (See appendix I: international codes for names of countries)
- Date* Enter month and year of description . e.g. january 1993: 01 93
- Author(s)* The name(s) and initial(s) of the author(s) is given. (eg. Oldeman, L.R. or Van Baren, J.H.V.)
- Location* A description, as precise as possible. It is advisable to mention the administrative units, such as region, province, district, county or locality. Distance and direction of known village or city. The description of the location should be such that readers who are unfamiliar with the area are able to locate the position of the site.
Spelling of geographical names according to the Times Atlas of the world.

Add (photocopy of) detailed topographical map with location marked to set of "paper files".
- Latitude* Enter N or S / degrees / minutes / seconds.
- Longitude* Enter E or W / degrees / minutes / seconds.
- Altitude* In meters above sea level. When below sea level, add - (minus sign)

Parent material/Parent rock

Parent material is defined as the unconsolidated mineral or organic material from which the true soil develops.

Parent rock is defined as the rock mass from which the parent material is derived (PARKER (eds), 1984).

There is space available for a sequence of at most two types of parent material/rock. Use the descriptive part if more space is required (REMARKS).

MODE Mode of accumulation or deposition of parent material. (after USDA/SCS, 1979):

- A** alluvium
- E** eolian mixed/undifferentiated
- W** loess
- S** eolian sand
- H** volcanic ejecta
- L** lacustrine, inclusive fluvio and glacio lacustrine
- Y** estuarine sediments
- M** marine sediments
- C** colluvium: (Loose, incoherent deposits that are replaced principally by gravity and accumulated at the foot of slopes or cliffs)
- V** slope wash: (Soil and rock material that has been transported down a slope predominantly by unchanneled running water (sheet erosion))
- F** fluvio-glacial deposits
- I** ice-pushed materials
- G** glacial outwash: (Sand and gravel transported away from a glacier by streams of melting water and either deposited as a floodplain along a pre-existing valley bottom or broadcast over a preexisting plain in a form similar to an alluvial fan)
- T** glacial till: (Unsorted and unstratified drift consisting of a heterogeneous mixture of clay, sand, gravel and boulders which is deposited by and underneath a glacier. Also known as boulder clay, till, ice-laid drift)
- D** glacial drift: (All stratified deposits predominantly of glacial origin made in bodies of glacial melting water or in the sea.)
- O** organic sediments
- X** residual (in situ weathered) materials
- U** unconsolidated, unspecified
- R** solid rock
- B** man-made

DERIVED FROM Enter parent rock of which the parent material is derived. (based on USDA/SCS,1979).

Y0	mixed lithology and composition		
Y1	noncalcareous or acid rocks	Y2	calcareous rocks
Y3	mixed lithology, unspecified	Y4	igneous/metamorphic/sedimentary rocks
Y5	igneous/ metamorphic rocks	Y6	igneous/sedimentary rocks
Y7	metamorphic/sedimentary rocks		
W0	chemically highly weathered materials (reworked materials)	C0	conglomerate(unspecified)
W1	lateritic material	C1	non calcareous
W2	bauxitic material	C2	calcareous
I0	igneous rocks (unspecified)	I5	fine, unspecified
I1	coarse , unspecified	I6	fine, basic (e.g. basalt)
I2	coarse , basic	I7	fine, intermediate (e.g. andesite)
I3	coarse , intermediate(e.g. diorite)	I8	fine, acid(e.g. rhyolite)
I4	coarse , acid (e.g. granite)	I9	fine, ultrabasic
M0	metamorphic rocks (unspecified)	M5	schist/phyllite,unspecified
M1	gneiss, unspecified	M6	schist/phyllite,acidic
M2	gneiss, acidic	M7	schist/phyllite,basic
M3	gneiss, basic	M8	slate
M4	serpentinite	M9	quartzite
B0	sedimentary rocks, interbedded (unspecified)	B4	limestone/siltstone
B1	limestone/sandstone and shale	B5	sandstone/shale
B2	limestone/sandstone	B6	sandstone/siltstone
B3	limestone/shale	B7	shale/siltstone
A0	sandstone (unspecified)	A1	noncalcareous,unspecified

A2	arkosic (A sandstone in which much feldspar is present, ranging from products of granular desintegration of granite to partly sorted riverlaid or even marine deposits)	A3	graywacke (An argillaceous sandstone characterized by an abundance of unstable minerals and rock fragments and a fine grained clay matrix binding the larger particles)
A4	calcareous, unspecified		
HØ	shale (unspecified)	TØ	siltstone (unspecified)
H1	noncalcareous	T1	noncalcareous
H2	calcareous	T2	calcareous
LØ	limestone (unspecified)	L4	phosphatic
L1	chalk	L5	arenaceous (sandy)
L2	marble	L6	argillaceous
L3	dolomitic	L7	cherty
SØ	(other) sedimentary rocks (unspecified)	UØ	claystone (unspecified)
S1	marl, unspecified	U1	noncalcareous
S2	glauconite	U2	calcareous
PØ	pyroclasts, consolidated	EØ	pyroclasts,unconsolidated
P1	tuff, (unspecified) (consolidated equivalent of ash)	E1	ash, unspecified (unconsolidated pyroclasts, grainsize < 2mm)
P2	tuff,acidic	E2	ash,acidic
P3	tuff,basic	E3	ash,basic
P4	volcanic breccia, unspecified (Consolidated rock composed predominantly of angular volcanic particles over 2 mm)	E4	lapilli, unspecified (Unconsolidated pyroclasts, grainsize 2 - 64 mm)
P5	volcanic breccia,acidic	E5	lapilli,acidic
P6	volcanic breccia,basic	E6	lapilli,basic
P7	tuff breccia	E7	volcanic bombs (Unconsolidated pyroclasts, grainsize > 64 mm.
P8	scoria/cinders (Usually of mafic composition, highly inflated juvenile fragments, of volcanic origin having a much higher density than pumice (they readily sink in water))	P9	pumice (white or pale grey to brown highly vesicular volcanic rock, silicic to mafic glass foam which will commonly float on water)

K0	miscellaneous organic material	K4	wood fragments < 1m
K1	mossy material	K5	wood fragments > 1 m
K2	herbaceous material	K6	charcoal
K3	woody material		

TEXTURE Enter texture of parent material

SA	sandy	LO	loamy	ST	stony
SC	sandy clay	CL	clayey	MX	mixed
SI	silty	GR	gravelly	OR	organic

WEATHERING General characterization of status of weathering of solid rock:

- S slight
- P partial / moderate
- H high

RESISTANCE Resistance against weathering (solid rock only):

- V very high
- H high
- M moderate
- L low

REMARKS PARENT MATERIAL

Additional remarks parent material/rock up to 20 characters. If more space is required use general descriptive part.

DEPTH LITHOLOGICAL BOUNDARY

Enter depth of lithological boundary in cm.

EFFECTIVE SOIL DEPTH

Enter effective soil depth in cm. Effective soil depth is the depth to which roots can easily penetrate throughout the year.

Geomorphology

LANDFORM Enter regional landform. If necessary specify in general descriptive part.

Regional landforms (based on McDonald et al., 1984 and FAO, 1986))

MO mountain (unspecified)	Landform pattern of very high relief (greater than 300 m) with moderate to precipitous slopes and fixed erosional stream channels which are closely to very widely spaced and form a non-directional or diverging integrated tributary network.
HI hill (unspecified)	Landform pattern of high relief (90 - 300 m) with gently inclined to precipitous slopes. Fixed, shallow erosional stream channels, closely to very widely spaced, form a non-directional or convergent integrated tributary network.
HL low hill	Landform pattern of low relief (30 - 90 m) and gentle to very steep slopes, typically with fixed erosional stream channels, closely to very widely spaced, which form a non-directional or convergent integrated tributary pattern.
IN inselberg	A large steep-sided residual hill, knob, or mountain, generally rocky and bare, rising abruptly from an extensive, nearly lowland erosion surface in arid or semiarid regions.
VA valley (unspecified)	Areas of elongated shapes with nearly level and slightly concave topography entrenched between mountains.
BA basin (unspecified)	Geomorphic surfaces of low relief intensity with characteristically endoreic drainage patterns and in which accumulation processes are dominant.
IB intermontane basin	
BL badlands	Extremely rough, high, narrowly and steeply gullied topography in arid or semiarid areas that are horizontally bedded and have dry, loose soil.
MM man-made	
UP plain (unspecified)	Geomorphic surfaces of low relief intensity. Overall slopes less than 2 % with a definite direction and difference in elevation not more than 10 m

PU plateau	
PE peneplain	Landsurface of low elevation and slight relief produced in the late stages of denudation of a landmass.
AP alluvial plain (unspecified)	
AF floodplain	Characterized by frequently active erosion and aggradation by channelled or overbank stream flow. (frequent = average recurrence interval of 50 years or less)
AS stagnant alluvial plain	Alluvial plain on which erosion and aggradation by channelled and overbank stream flow is barely active or inactive because of reduced water supply, without apparent incision or channel enlargement that would lower the level of stream action.
AT alluvial terrace	Former flood plain, erosion and aggradation by channelled and overbank stream flow is barely active or inactive because of deepening or enlargement of the stream channel has lowered the level of flooding
AD delta	Floodplain projecting into a sea or lake, with slowly migrating deep alluvial channels.
PM piedmont features (unspecified)	Region at the foot of amountain or mountain range, more usually composed of fan material.
PA alluvial fans / bajada / sheetflood fans	Level (less than 1 % slope) to very gently inclined complex landform pattern of extremely low relief.
PP pediment	A piedmont surface formed from a combination of processes which are mainly erosional; the surface is chiefly bare rock but may have a veneer of alluvium or gravel.
PL pediplain	A rock-cut erosion surface formed by the coalescence of two or more pediments.
CP coastal plain	
CB beach ridge	
CF tidal flat	Level landform pattern with extremely low relief and slowly migrating deep alluvial stream channels.

CT	marine terrace	
LC	(fluvio) lacustrine plain	Level landform pattern with extremely low relief formerly occupied by a lake but now partly or completely dry.
PY	playa	A low, essentially flat part of a basin or other undrained area in an arid region.
GF	fluvioglacial plain	
GK	kame	Hill composed of sorted coarse water-laid glacial drift, largely sand and gravel, built into an impounded water body within stagnant ice or against the margin of an ice sheet.
GT	fluvioglacial terrace	
GO	outwash plain	
GP	glacial plain (till)	[till unstratified glacial drift deposited by ice and consisting of clay, silt, sand, gravel and boulders, intermingled in any proportion]
GM	moraine	
SP	sand plain	
DU	dune field	
VU	volcano	
CA	caldera	Rare landform pattern typically of very high relief and steep to precipitous slope, without stream channels or has fixed erosional channels forming a centripetal integrated tributary pattern.
LA	lava plain	Level to undulating landform pattern of very low to extremely low relief typically with widely spaced fixed erosional stream channels that form a non-directional integrated or interrupted tributary pattern.

TOPOGRAPHY Topography of the surrounding country (FAO, 1977):

- | | |
|------------------------------|--|
| F flat or almost flat | slopes < 2 % |
| U undulating | steepest slopes 2 - 8 % |
| R rolling | steepest slopes 8 - 16 % |
| H hilly | steepest slopes 16 - 30 %, range of elevation being moderate |
| S steeply dissected | steepest slopes > 30 %, range of elevation being moderate |
| M mountainous | topography has great range of elevation |

PHYSIOGRAPHIC UNIT Describe physiographic unit in the immediate surrounding of the site. Continue in general descriptive part if more space is required.

POSITION OF SITE Enter physiographic position of the site:

- | | | |
|-----------------------|------------------------------|------------------------------|
| C crest | L lower slope | V open depression |
| U upper slope | S slope (unspecified) | D depression (closed) |
| M middle slope | F flat | |

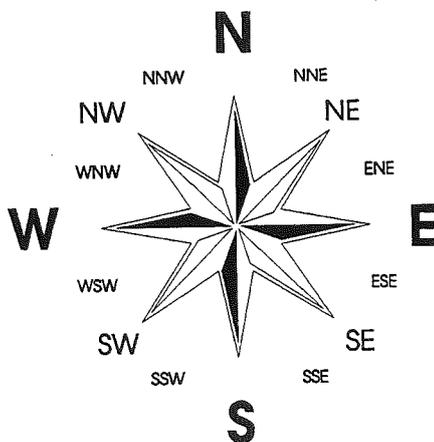
Slope characteristics

SLOPE GRADIENT Enter slope gradient of the land immediately surrounding the site (in %).

SLOPE FORM Form of the slope surrounding the site:

- | | | |
|--|--|---------------------|
| V convex (with a curved surface like the outside of a ball) | C concave (curved inwards like the inner surface of a ball) | U undulating |
| S straight | X complex (irregular) | |

SLOPE ASPECT Aspect (exposure) of site: N, NNE, NE, ENE, E,, NNW.



Microrelief

Small-scale differences in relief within the immediate vicinity (radius of 50 m) of the site. (based upon FAO, 1986)

Microrelief formed by soil erosion is excluded from this item and described under denudational-aggradational processes.

- | | |
|---|---|
| V level | |
| D dimples or cradle - knoll: | depressions and associated mounds left by uprooted trees (dimple = slight hollow in surface, cradle = , knoll = small round hill or mound, |
| W coppice mounds: | wind blown material accumulated and stabilized around plants |
| K knobs | Low hill of solid rock (characteristic of produced by glaciation |
| F frost polygons | Patterned ground formed by freeze-thaw (sorting pebbles into polygonal patterns with fine-textured centres |
| G gilgai | Typical microrelief of clay soils that have a high coefficient of expansion when the water content changes. It is a succession of closed microbasins and micromounds on a practically horizontal surface or microvalleys and microridges along the slope. |
| M mounds (termites) | hillock built up by human or animal activity. |
| N animal tracks | |
| L levee, artificial: | due to digging and cleaning of drainage and irrigation canals |
| S slick spots or scabby spots | |
| T terracettes | Small terraces on slopes resulting either from soil creep or trampling by hoofed animals. |
| R ripples | Wave-like over sandy or coarse silty materials by wind or waterflow. |
| H holes and galleries due to burrowing animals | |
| A terracing, artificial | |

PATTERN

- | | | |
|----------------------------|-----------------|---------------------|
| Ø none | L linear | R reticulate |
| C closed depression | | I isolated |

HEIGHT Enter variation in height in cm.

Surface characteristics

ROCK OUTCROPS Enter rock outcrop class (FAO, 1977):

Ø	nil, positive statement	
LR	little rocky	less than 2% rock exposed
FR	fairly rocky	exposures roughly 10-35 m apart, coverage 2-10%
RO	rocky	exposures roughly 10-35 m apart, coverage 10-25%
VR	very rocky	exposures roughly 3.5-10 m apart, coverage 25-50%
ER	extremely rocky	exposures up to 3.5 m apart, coverage 50-90%
OU	outcrop	coverage over 90%

STONINESS Enter surface stoniness class (FAO, 1977):

Ø	nil, positive statement	
WS	very few stones	
FS	fairly stony	coverage 0.01 - 0.1 %
ST	stony	coverage 0.1 - 3 %
VS	very stony	coverage 3 - 15 %
ES	exceedingly stony	coverage 15 - 90 %
RU	rubble land	

STONE SIZE Enter average size of stones in cm

S	(sub)rounded	B	angular blocky
A	angular irregular	P	platy, flat

CRACKING

Ø	nil, positive statement	
C	(small) cracks	width < 1 cm or depth < 50 cm
L	large cracks	width > 1 cm or depth > 50 cm

SLAKING/CRUSTING Slaking of aggregates by tillage, rainfall or frost (USDA/SCS,1979):

- Ø** nil, positive statement
- P** partly slaked, round smooth aggregates
- S** slaked: sorted sand/silt, some clay films
- C** capped, crust on drying

Enter thickness and nature of crust/seal in profile description.

ALKALI/SALT Evidence of alkali/salt (USDA,1951). The classification given below is used to describe evidence of salt as well as evidence of alkali:

- Ø** soils free of excess alkali or salt. Practically no crops are inhibited by, or show evidence of injury from excess salts or alkali
- S** soils slightly affected by salt or alkali. The growth of sensitive crops is inhibited but that of salt tolerant crops may not be.
- M** soils moderately affected by salt or alkali. Crop growth is inhibited and no crop does well
- R** soils strongly affected by salt or alkali. Only a few kinds of plants survive

If conductivity measurements and/or analytical data are available the following classes can be recognized:

	class	alkali (ESP)	salt (mS/cm)
Ø	nil	0 - 5	0 - 4
S	slight	5 - 15	4 - 8
M	moderate	15 - 25	8 - 15
R	strong	> 25	> 15

Hydrology

KIND Indicate kind of water table (USDA, 1979):

N	no water table observed	W	groundwater table
F	flooded	A	apparent
P	perched:	The water table of a saturated layer of soil which is separated from an underlying saturated layer by an unsaturated layer (vadose water)	

DEPTH Enter depth of water table in cm below surface.

FLUCTUATION Enter (estimated values of) upper and lower limits of the water table in cm

SLOW PERMEABLE LAYER Enter upper and lower limits of slow permeable or stagnating layer in cm. Enter **N** if no slow permeable layer is observed.

PERMEABILITY Estimated permeability of least permeable part of the profile:

S	slow
M	moderate
H	high

Quantitative data are recorded in general descriptive part

FLOODING FREQUENCY Indicate flooding frequency, if necessary specify in general descriptive part (FAO, 1986):

N	nil, positive statement	Y	yearly
D	daily	I	irregular
M	monthly		

NATURE Nature of flood water:

S	saline	X	oxiginated
B	brackish	W	still or stagnant
F	fresh		

Enter additional information (e.g. time and duration of flooding in general descriptive part)

<i>RUN OFF</i>	Estimated run off:		
P	ponded	M	medium
V	very slow	R	rapid
S	slow	A	very rapid

DRAINAGE CLASS (FAO, 1977), intergrades are indicated by a combination of both class codes: e.g. 34 = class 3 to 4.

- Ø very poorly drained; water is removed from the soil so slowly that the water table remains at or on the surface the greater part of the time. Soils of this drainage class usually occupy level or depressed sites and are frequently ponded.
- 1 poorly drained; water is removed so slowly that the soil remains wet for a large part of the time. The water table is commonly at or near the surface during a considerable part of the year. Poorly drained conditions are due to a high water table, to a slowly permeable layer within the profile, to seepage, or to a combination of these conditions
- 2 imperfectly drained; water is removed from the soil slowly enough to keep it wet for significant periods but not all of the time. Imperfectly drained soils commonly have a slowly permeable layer within the profile, a high water table, additions through seepage or a combination of these conditions
- 3 moderately well drained; water is removed from the soil somewhat slowly, so that the profile is wet for a small but significant part of the time. Moderately well drained soils commonly have a slowly permeable layer within or immediately below the solum, a relatively high water table, additions of water through seepage or some combination of these conditions
- 4 well drained; water is removed from the soil readily but not rapidly. Well drained soils commonly retain optimum amounts of moisture for plant growth after rains or additions of irrigation water
- 5 somewhat excessively drained; water is removed from the soil rapidly. Many of these soils have little horizon differentiation and are sandy and very porous
- 6 excessively drained; water is removed from the soil very rapidly. Excessively drained soils are commonly lithosols or lithosolic and may be steep, very porous or both

Moisture conditions profile:

- DRY* Profile dry from .. to ... (cm)
MOIST Profile moist from ... to(cm)
WET Profile wet from to..... (cm)

Denudation and aggradation (based upon FAO, 1986)

Indicate nature and intensity of processes at the site and its surroundings (the physiographic unit). If there are any discrepancies between the site and the land surrounding the site, the site data should be entered here. All other information should be entered in the general descriptive part.(based upon FAO, 1986)

EROSION DEGREE Enter intensity of each type of soil erosion. Here the intensity is only described in general terms. If more accurate data are available it should be entered in the general descriptive part.

- | | | | |
|----------|-----------------------|----------|-------------------------|
| O | no erosion | M | moderate erosion |
| S | slight erosion | R | severe erosion |

EROSION TYPE Enter soil erosion type. There is space available for 2 types:

- | | |
|----------|--|
| S | sheet erosion |
| R | rill erosion: depth < 30 cm; completely smoothed by normal cultivation |
| G | gully erosion: depth > 30 cm; not smoothed by normal cultivation |
| W | wind erosion |

SOIL AGGRADATION Indicate occurrence of recent soil aggradation (McDONALD et al.,1984):

- | | |
|----------|--|
| Ø | nil, positive statement |
| N | not apparent |
| P | present, specify in General remarks |

SLOPE STABILITY Indicate present stability of slope:

- | | | |
|----------|-------------------------|---|
| N | stable | no evidence of recent mass movements |
| M | locally unstable | creep, locally shallow earth/soil slides,flows |
| H | highly unstable | major part of slope is affected by shallow and deep slides /flows etc. |

Land use and Vegetation

Describe present land use or vegetation at the **immediate surroundings of the site**. Use REMARKS for additional information on present land use/vegetation. Use the general descriptive part to add information on past land use/vegetation, or to describe deviating land use/vegetation types close to the site in the same physiographic unit.

LAND UTILIZATION TYPE Indicate present land use type (LUT) . Use REMARKS to specify:

A	arable farming: unspecified
AH	arable farming: high level: intensive use of fertilizers and pesticides, high level of mechanization
AM	arable farming: medium level
AL	arable farming: low level: low inputs, low level of mechanization
X	mixed farming : unspecified
XH	mixed farming : high level
XM	mixed farming : medium level
XL	mixed farming : low level
PA	cultivated pasture
GR	(semi) natural grass land, grazed
SH	shrub land, grazed
WO	wood land, grazed
UR	urban land
NA	non agricultural land: surface mines, pit spoils etc.
AF	afforestation
VE	(semi) natural vegetation
FA	fallow

CROPS Indicate present or major crop. Use REMARKS to specify or enter additional crops:

CEREALS	CE	unspecified	CES	sorghum	
	CER	rice	CET	millet	
	CEW	wheat	CEX	other	
	CEM	maize			
ROOT CROPS	RT	unspecified	RTY	yam	
	RTC	cassava	RTT	taro	
	RTP	potatoes	RTX	other	
SUGAR CROPS	SUC	sugar cane			
	SUB	sugar beet			
VEGETABLES	VE	unspecified			
FODDER CROPS	FD	unspecified			
CONDIMENTS	CN	unspecified			
OIL/PROTEIN CROPS	OL	unspecified	OLB	castor bean	
	OLY	soya bean	OLH	chick pea	
	OLG	ground nut	OLU	sunflower	
	OLA	safflower	OLE	sesame	
	OLC	coconut	OLO	olive	
	OLI	oil palm	OLX	other	
	FIBRE CROPS	FB	unspecified	FBJ	jute
		FBC	cotton	FBR	rosella
FBK		kenaf	FBX	other	
FBS		sisal			
FRUIT CROPS	FR	unspecified	FRC	citrus	
	FRB	banana	FRG	grapes	
	FRD	date palm	FRX	other	
STIMULANTS	ST	unspecified	STC	coffee	
	STT	tea	STB	tobacco	
	STA	cocoa	STX	other	
MISCELLANEOUS	MSP	pyrethrum			
	MSR	rubber			
	MAN	annual crops, unspecified			
	MPE	perennial crops, unspecified			
	MXX	other			

IRRIGATION Enter main type of irrigation (FAO, 1986):

Ø	no irrigation, not relevant
S	seasonally irrigated, supplementary irrigation
C	continuously irrigated
P	paddy

ROTATION Enter rotation scheme, specify in REMARKS (FAO, 1986):

- Ø not relevant
- SS shifting
- SB shifting - long fallow bush
- SG shifting - long fallow grass
- CF crop rotation with current fallow
- CC crop rotation
- CG crop-grass rotation
- MO mono culture

IMPROVEMENTS Indicate any other land improvements, specify in REMARKS (FAO, 1986):

- Ø none
- IL levelling
- IC land clearing
- IT terracing
- ID draining
- IX other

VEGETATION TYPE Enter major vegetation type (FAO, 1986):

- closed forest
 - F unspecified
 - FE evergreen (mainly)
 - FS semi-deciduous
 - FD deciduous
 - FX extremely xeromorphic
- woodland (open stands of trees)
 - W unspecified
 - WE evergreen
 - WS semi-deciduous
 - WD deciduous
 - WX extremely xeromorphic
- shrub
 - S unspecified
 - SE evergreen
 - SS semi deciduous
 - SD deciduous
 - SX extremely xeromorphic (sub desert)
- dwarf shrub
 - D unspecified
 - DE evergreen
 - DS semi deciduous
 - DD deciduous
 - DX extremely xeromorphic (sub desert)
- herbaceous
 - DT tundra
 - H unspecified
 - HT tall grassland
 - HM medium tall grassland
 - HS short grassland
 - HF forb

VEGETATION STATUS Enter present status of vegetation (FAO, 1986):

- P** primary
- M** modified: altered as a result of new biotic factors
- C** cut over primary: some trees have been cut
- S** secondary
- D** degraded

REMARKS ON VEGETATION

Enter additional information on present vegetation (e.g. dominant species) and land use (e.g. additional crops). Up to 40 characters

GENERAL REMARKS ON SITE & PROFILE

Enter additional information on site and profile.

Remarks should start with a short field description consisting of

a) mandatory phrases:

> depth

very shallow < 20 cm

shallow 20 - 50 cm

moderately deep 50 - 100 cm

deep 100 - 150 cm

very deep > 150 cm

> drainage according to FAO drainage classes

> colour of subsoil according to Munsell soil colour names

> textural class of subsoil according to FAO textural triangle notation

> parent material

b) facultative phrases:

depending on the judgement of the author of the field description a selection of striking features should be given. Some examples:

> strongly deviating topsoil, either colour or texture

> strong mottling

> special structure

> etc.

1-example: moderately deep, imperfectly drained, dark grey loam, derived from alluvium; with a thick dark topsoil and strong mottling in the subsoil.

2-example: very deep, well drained, dark red clay, derived from basalt; massive porous structured throughout.

PHOTOGRAPHS / SLIDES

Enter subject and number of slides/photographs: (conform the codes used in the ISRIC SLIDE database.)

code	description	code	description
AP	aerial photographs	PE	people
BI	biological activity	PR	profile
CR	crops	PD	profile details
DI	diagrams	SU	surface characteristics
ER	erosion /conservation	TA	tables/text
LU	land use	VE	vegetation
LA	landscape	XX	other
MA	maps		

PROFILE DESCRIPTION

ISIS_ID ISRIC Monolith identification code. This code consists of ISO 3166 country code (see appendix I) + serial number referring to ISRIC's monolith collection. (given by ISIS supervisor) eg. NLØØ1

HORIZON NUMBER Enter serial number of horizon. Top horizon: serial number 1.0 . Use number 1,2,3,...,9,10 etc. Sub horizon can be entered: 2.1

DESIGNATION Enter horizon designation according to FAO (1977)
Enter AUGER in case the data are obtained by augering.

DEPTH Enter upper and lower limit of horizon in cm.

BOUNDARY Indicate width and topography of boundary with horizon below (FAO, 1977):

	Width		Topography
A	abrupt : < 2cm	S	smooth
C	clear : 2-5 cm	W	wavy: pockets wider than deep
G	gradual: 5-12 cm	I	irregular: pockets deeper than wide
D	diffuse: > 12cm	B	broken: boundary discontinuous wide

COLOUR The colour of the soil matrix material of each horizon is recorded in the moist condition (or both dry and moist condition, if possible) using the notations for hue, value and chroma as given in the Munsell Soil Color Charts (Munsell, 1975). If there is no dominant soil matrix colour, the horizon is described as mottled and two or more colours are given.

TEXTURE Enter estimated (field) texture (FAO, 1977).

		Fraction < 2 mm	
	SA sand	CSA	coarse sand
		MSA	medium sand
		FSA	fine sand
		VSA	very fine sand
LSA	loamy sand	CLSA	coarse loamy sand
		MLSA	medium loamy sand
		FLSA	fine loamy sand
		VLSA	very fine loamy sand
SAL	sandy loam	CSAL	coarse sandy loam
		MSAL	medium sandy loam
		FSAL	fine sandy loam
		VSAL	very fine sandy loam
L	loam	SICL	silty clay loam

SIL	silt loam	SAC	sandy clay
SI	silt	SIC	silty clay
SACL	sandy clay loam	C	clay
CL	clay loam		

Fraction 0.2 - 7.5 cm		Fraction 7.5 - 25 cm	
SG	slightly gravelly	SS	slightly stony 2-15%
GR	gravelly	ST	stony 15-50%
VG	very gravelly	VS	very stony 50-90%
GA	gravel	SO	stones > 90%

Fraction > 25 cm	
BO	bouldery 2 - 50 %
VB	very bouldery 50 - 90 %
BL	boulders > 90 %

ORGANIC MATTER Enter kind and rate of decomposition of organic matter. This item is normally used to describe O and H horizons. (Day(ed),1983; FAO, 1986).

Kind:

L	leaves	S	sphagnum	R	reeds, sedges
N	needles	M	other moss	H	herbaceous fragments
W	wood fragments	C	coprogenous earth	U	unspecified

Decomposition rate:

Ø	nil
S	slight : > 50% fibric or foliated material
M	moderate: 10-50% fibric/foliated material
H	high : < 10% fibric/foliated material

STRUCTURE When a soil contains aggregates of more than one grade, size, or form the different kinds of aggregates should be described separately. There is space for two types of soil aggregates. Enter largest type first (FAO, 1977).

Grade

Ø	structureless: that condition in which there is no observable aggregation or no definite orderly arrangement of natural lines of weakness. Massive if coherent; single grain if non coherent (see form). If the soil is coherent one of the following codes should be entered:
WC	structureless and weakly coherent
MC	structureless and moderately coherent
SC	structureless and strongly coherent.

WE weak: that degree of aggradation characterized by poorly formed indistinct peds that are barely observable in place. When disturbed, soil material that has this grade of structure breaks into a mixture of few entire peds, many broken peds, and much unaggregated material. If necessary for comparison, this grade may be subdivided into:

VW very weak

WM weak to moderate

MO moderate: that grade of structure characterized by well formed distinct peds that are moderately durable and evident but not distinct in undisturbed soil. Soil material of this grade, when disturbed, breaks down into a mixture of many distinct entire peds, some broken peds, and little unaggregated material.

ST strong: that grade of structure characterized by durable peds that are quite evident in undisplaced soil, that adhere weakly to one another, and that withstand displacement and become separated when the soil is disturbed. When removed from the profile, soil material of this grade of structure consists very largely of entire peds and include few broken peds and little or no unaggregated material. If necessary for comparison this grade may be subdivided into:

MS moderate - strong

VS very strong

Size

VF	very fine	FM	fine to medium	CO	coarse
FF	very fine to fine	ME	medium	CC	coarse to vety coarse
FI	fine	MC	medium to coarse	VC	very coarse

Form

PL	platy	AW	angular blocky (wedge shaped)	MA	massive
PR	prismatic			PM	porous massive
CL	columnar	GR	granular	SG	single grain
AB	angular blocky	CR	crumb	IR	irregular
SB	subangular blocky			RO	rock structure

CONSISTENCE *Consistence.*(FAO, 1977)

Consistence when dry:

LO	loose	noncoherent
SO	soft	soil mass is very weakly coherent and friable; breaks to powder or to individual grains under very slight pressure
SH	slightly hard	weakly resistant to pressure; easily broken between thumb and forefinger
HA	hard	moderately resistant to pressure; can be broken in the hands without difficulty but is barely breakable between thumb and forefinger
VH	very hard	very resistant to pressure; can be broken in the hands only with difficulty; not breakable between thumb and forefinger
EH	extremely hard	extremely resistant to pressure, can not be broken in the hands

Consistence when moist

LO	loose	noncoherent
VF	very friable	soil material crushes easily under very gentle pressure, but coheres when pressed together
FR	friable	soil material crushes easily under gentle to moderate pressure between thumb and forefinger
FI	firm	soil material crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable
VI	very firm	soil material crushes under strong pressure, barely crushable between thumb and forefinger
EF	extremely firm	soil material crushes only under very strong pressure; cannot be crushed between thumb and forefinger

Consistence when wet

a) Stickiness:

NS	nonsticky	after release of pressure, practically no soil material adheres to thumb or finger
SS	slightly sticky	after pressure, soil material adheres to both finger and thumb but comes off one or the other rather cleanly. It is not appreciably stretched when the digits are separated

ST	sticky	after pressure, soil material adheres to both thumb and finger and tends to stretch somewhat and pull apart rather than pulling free from either digit
VS	very sticky	after pressure, soil material adheres strongly to both forefinger and thumb and is decidedly stretched when they are separated
b) <i>Plasticity:</i>		
NP	non plastic	no wire is formable
SP	slightly plastic	wire formable but soil mass easily deformable.
PL	plastic	wire formable and much pressure required for deformation of the soil mass
VP	very plastic	wire formable and much pressure required for deformation of the soil mass

Other (after USDA, 1985):

WS	weakly smeary	under moderate strong force between thumb and forefinger the soil changes suddenly to fluid, the fingers skid and the soil smears, little or no free water remains on fingers
MS	moderately smeary	under moderate force between thumb and forefinger the soil changes suddenly to fluid, the fingers skid and the soil smears, some free water remains on fingers
SS	strongly smeary	under slight force between thumb and forefinger the soil suddenly changes to fluid, the fingers skid and the soil smears, free water is easily seen on fingers.
SF	slightly fluid	when a specimen is squeezed in the hand some material tends to flow between the fingers, but after full pressure is applied most of the residue is left in the hand
VF	very fluid	when a specimen is squeezed in the hand, soil material easily flows between the fingers and after full pressure is applied little or no residue is left in the hand.

PORES Description of individual pores. There is space for two types of pores. For size and quantity also intergrades may be entered. Intergrades are indicated

with the codes of both classes. Enter the code of the class with the lowest value first:

e.g PORE type 1:

few	F
few to common	F C
very fine	V
fine to medium	F M

If more space is required use general descriptive part

Quantity:

Ø	none	C	common: 50-200/dm ³
F	few :1-50 /dm ³	M	many : >200/dm ³

Size:

I	micro : < 0.1 mm	C	coarse: 5-10 mm
V	very fine: 0.1-1 mm	A	very coarse: >10 mm
F	fine:1-2 mm	T	fine to coarse
M	medium : 2-5 mm	X	micro to very coarse

Form:

V	vesicular: approx. spherical or ellipsoidal in shape, not appreciably elongated in any direction.
I	interstitial: irregular in shape, with inward curved faces, bounded by angular or curved surfaces or adjacent mineral grains or peds or both.
T	tubular: more or less cylindrical

Orientation (applied to tubular pores)

V	vertical	O	oblique
H	horizontal	R	random

	<i>Continuity</i>		<i>distribution</i>
C	continuous	I	inped
D	discontinuous	E	exped
B	both inped / exped		

POROSITY Total porosity (CANSIS,1982):

H	highly porous : > 60% by volume
M	moderately porous: 40-60%
S	slightly porous : < 40%

ROOTS There is space for two types of roots, if more space is required use descriptive part.

Quantity (CANSIS,1982):

Ø	nil	positive statement	
F	few	very fine/fine roots	1 -10 /dm³
		medium/coarse roots	1 /dm³
C	common	very fine/fine roots	10 - 100 /dm³
		medium roots	1 - 10 /dm³
		coarse roots	1 - 5 /dm³
M	many	very fine/fine roots	> 100/dm³
		medium roots	> 10/dm³
		coarse roots	> 5/dm³

Size:

V	very fine	diameter < 1 mm
F	fine	diameter 1 - 2 mm
M	medium	diameter 2 - 5 mm
C	coarse	diameter > 5 mm
X	all	very fine to coarse

Location (USDA,1981):

C	in cracks
M	in mat at top of horizon
P	between peds
S	matted around stones or gravel
T	throughout

CaCO₃ The content of calcium carbonate (tested with 10% hydrochloric acid). The reaction to acid can be expected to be more vigorous in sandy material than in fine textured material having the same carbonate content.

Agent:

H	HCl 10 %
U	HCl, unspecified strength

Class:

Ø	non calcareous	no visible reaction
S	slightly calcareous	slight reaction; scarcely visible, but detectable to ear
R	calcareous	strong reaction; bubbles in simple layer
V	strongly calcareous	violent reaction; foamy, bubbles in many layers

Location:

T	throughout	N	on nodules
S	on ped faces	C	in channels and holes
L	locally		

pH Enter field determined pH and indicate the method used in the general descriptive part.

MOTTLES There is space for 2 entries (FAO, 1977):

Abundance

Ø	none, positive statement	C	common: 2-20%
F	few: <2%	M	many : >20%

Size

F	fine: < 5 mm	C	coarse: > 15 mm
M	medium: 5 - 15 mm	H	heterogeneous

Contrast

F	faint	indistinct mottles are evident and recognizable only with close examination. Soil colours in both matrix and mottles have closely related hues and chromas
D	distinct	although not striking the mottles are readily seen. The hue value and chroma of the matrix are easily distinguished from those of the mottles. They may vary as much as one or two hues or several units in chroma or value
P	prominent	the conspicuous mottles are obvious and mottling is one of the outstanding features of the horizon. Hue, chroma and value may be several units apart

Sharpness of boundary:

D	diffuse:	> 2mm
C	clear:	< 2mm
S	sharp	

Enter moist colour of mottles (notation see COLOUR):

CUTANS Cutans/surface features.

Quantity/abundance (FAO, 1977):

Ø	none	
P	patchy	small scattered patches of cutan
B	broken/common	cutans cover largest part of peds
C	continuous/abundant	cutans cover entire peds

Thickness (FAO, 1977):

F	thin (faint)	fine sand grains are readily apparent in the cutan, bridges between cutans are weak, thickness microscopic
M	moderate (distinct)	fine sand grains are enveloped in the cutan and their outlines are indistinct
T	thick (prominent)	surface of the cutan is smooth showing no outlines of fine sand grains, strong bridges between larger grains

Kind:

C	clay	H	humus
F	clay / sesquioxides	M	Mn-hydr. / ox
U	clay / humus	Z	soluble salts
S	sesquioxides	Q	silica
P	slickensides	X	unspecified
R	pressure		

Location:

PE	ped faces (unspecified)	HP	horizontal ped faces
VP	vertical ped faces	ZP	hor. / vert. ped faces
CO	top columns	GR	grains
UP	upper surfaces peds	NO	nodules
BR	bridges between sand grains	BP	bottom plates
LP	lower surfaces peds	RC	root channels / pores
TH	throughout	CR	cracks
RO	rock fragments		

INCLUSIONS Inclusions of pedogenetic origin. There is space for two entries (FAO, 1986).

Quantity:

Ø	none	Q	frequent:	15 - 40 %
V	very few: < 5% by volume	R	very frequent:	40-80 %
F	few: 5-15%	D	dominant:	> 80 %

Type:

U	unspecified		
C	concretions	T	crystals
N	nodules	S	soft segregations
P	pedodes: (= A spheroidal, discrete glaebole with a hollow interior, often with a drusy lining of crystals like that of a geode.)		

Size:

P	powdery		M	medium	2 - 10 mm
S	small	< 2 mm	L	large	> 10 mm
Hardness:					
S	soft				
H	hard				
Shape:					
S	spherical		T	thread like	
I	irregular		D	dendritic	
A	angular		C	cylindrical	
Composition:					
K	calcareous		F	ferrigenous	
C	argilleous		M	manganiferous	
G	gypsiferous		Z	saline	
Q	siliceous		U	unspecified	

ROCK Rock and primary mineral fragments. There is space for two entries.

Quantity:

Ø	none		Q	frequent	10 - 40 % by volume
V	very few	< 5 % by volume	R	very frequent	40 - 60 % by volume
F	few	5 - 15 % by volume	D	dominant	> 80 % by volume

Size:

V	very fine:	< 2 mm	C	coarse	7.5 - 12 cm
F	fine:	0.2 - 1 cm	A	very coarse	12 - 25 cm
M	medium:	1 - 7.5 cm	E	extremely coarse:	> 25 cm

Degree of weathering:

F	fresh
W	(slightly) weathered
S	strongly weathered

Nature/composition: descriptive up to 15 characters. If more space is required use general descriptive part.

PANS This item includes compact and hardened uncemented as well as indurated horizons. There is space for one entry only. If more space is required use general descriptive part (FAO, 1986)

Kind:

P	plough pan		F	fragipan
K	petrocalcic			
L	iron stone(indurated plinthite)		I	iron pan (other than indurated plinthite)
Y	gypsum pan		D	duripan
X	other, explain in General Remarks		S	salt pan

Cementation:(Day(ed),1983;USDA/SCS,1981;FAO, 1986)

Ø	non cemented	
W	weakly cemented	the wet cemented soil is brittle and hard but can be broken by hands
S	strongly cemented	the wet cemented soil is too hard to be broken by hands, but it is easily broken with a hammer
I	indurated	the wet cemented soil is brittle and so strongly cemented that a sharp blow of a hammer is required to break it

Continuity:

C	continuous
D	discontinuous
B	broken

Structure:

M	massive	P	pisolitic
V	vesicular	N	nodular
L	platy		

BIOLOGICAL ACTIVITY

Biological activity: There is space for two major types. If more space is required use the General Remarks.

Abundance:

Ø	nil	Q	frequent
F	few	R	very frequent

Kind:

M	mounds	S	shells
K	krotovinas	P	coprogenic elements
W	worm channels	R	termite channels
Y	mycelium	A	mammal channels
C	sclerotium	X	channels, unspecified,
T	pedotubules (unspecified)		explain in General Remarks

CLASSIFICATION

FAO/UNESCO (1974)

FAO soil unit Enter soil unit code (see appendix II).

Phase Enter phase:

ST	stony	X	fragipan
PE	petric	MQ	duripan
MK	petrocalcic	Z	saline
LI	lithic	SO	sodic
MY	petrogypsic	CE	cerrado
PH	phreatic	MS	petroferriic

SOIL TAXONOMY (USDA/SCS,1975)

Great group Enter great group code (see appendix IV).

Sub group Enter sub group code (see appendix IV).

Other diagnostic criteria according to FAO/UNESCO (1974) and USDA/SCS (1975).

Diagnostic horizons Enter diagnostic horizons. There is space for three entries:

AL	albic	PC	petrocalcic	AN	anthropic
AG	agric	PG	petrogypsic	HI	histic
AR	argillic	PL	placic	MO	mollic
CL	calcic	SA	salic	OC	ochric
CA	cambic	SO	sombric	UM	umbric
GY	gypsic	SP	spodic	PL	plaggen
NA	natric	SU	sulfuric	DU	duripan
FR	fragipan	OX	oxic		

Diagnostic criteria Enter (other) diagnostic criteria. There is space for two entries:

AT	abrupt textural change	LI	lithic contact
AL	albic material	MO	mottles with chroma < 2
AM	exchange complex dom. by amorphous material	NV	n - value
CL	paralithic contact	PF	permafrost
CF	petroferric contact	SQ	plinthite
CO	COLE	SL	slickensides
DU	durinodes	SC	smeary consistence
FA	ferralic properties	K	soft powdery lime
FE	ferric properties	SU	sulfidic material
GL	gilgai	TA	takyric
OR	high organic matter in B	TX	thixotropy
SA	high salinity	IR	thin iron pan
HY	hydromorphic properties	TO	tonguing
IF	interfingering	VE	vertic properties
		WE	weatherable minerals

Local classification Local classification or soil name. Descriptive space 80 characters. If more space is required use general description

FAO/UNESCO (1988)

FAO soil unit Enter soil unit code (see appendix III).
Enter soil sub unit code (see appendix III).

Phase Enter phase:

ST	stony	X	fragipan
PE	petric	MQ	duripan
MK	petrocalcic	Z	saline
LI	lithic	SO	sodic
MY	petrogypsic	CE	cerrado
PH	phreatic	MS	petroferric

Enter diagnostic horizons. There is space for three entries:

AL	albic E	GY	gypsic	PG	petrogypsic
AR	argic B	HI	histic H	SP	spodic B
CC	calcic	MO	mollic A	SU	sulfuric
CA	cambic	NA	natric B	UM	umbric A
FA	ferralic B	OC	ochric A	DU	duripan
FI	fimic A	PC	petrocalcic		

Enter (other) diagnostic criteria. There is space for two entries:

AT	abrupt textural change	OS	organic soil materials
AD	andic properties	PF	permafrost
CS	calcereous	SQ	plinthite
CC	calcaric	SP	salic properties
CR	continuous hard rock	SL	slickensides
FA	ferralic properties	SC	smeary consistence
FE	ferric properties	SO	sodic properties
FL	fluvic properties	K	soft powdery lime
GE	geric properties	SH	strongly humic
GW	gleyic properties	SF	sulfidic materials
GP	gypsiferous	TO	tonguing
IF	interfingering	VE	vertic properties
NI	nitic properties	WE	weatherable minerals

SOIL TAXONOMY (USDA/SCS, 1992)

Great group Enter great group code (see appendix V).

Sub group Enter sub group code (see appendix V).

Texture Enter texture class (see appendix VI).

Mineralogy Enter mineralogy class (see appendix VI).

STR Enter soil temperature regime:

PG	pergelic	HT	hyperthermic
CR	cryic	IF	isofrigid
FR	frigid	IM	isomesic
ME	mesic	IT	isothermic
TH	thermic	IH	isohyperthermic

SMR Enter soil moisture regime:

AQ	aquic	UD	udic
PQ	peraquic	PU	perudic
AR	aridic	US	ustic
TO	torric	XE	xeric

Other diagnostic criteria according to USDA/SCS (1992).

AA	anthraquic conditions	LE	linear extensibility
AB	abrupt textural change	NV	n value
AL	albic materials	PC	paralithic contact
AN	andic soil properties	PE	permafrost
AQ	aquic conditions	PF	petroferric contact
AS	anthric saturation	PL	plinthite
CO	coefficient of linear extensibility	SB	sequum and bisequum
DR	durinodes	SC	soft powdery lime
EN	endosaturation	SF	sulfidic materials
EP	episaturation	SL	slickensides
IF	interfingering of albic materials	SP	spodic materials
LC	lithic contact	WM	weatherable minerals

ANALYTICAL METHODS

- 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 1M ammonium acetate pH7 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 1M pH7; washed with ethanol 80% and then leached with ammonium acetate 1M pH7. 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 (KH₂PO₄ + 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 1M 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 SO₄ 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.

REFERENCE:

ISRIC, Technical Paper no.9 (4th ed., 1993)
Procedures for soil analysis. Edited by L.P. van Reeuwijk.

CLIMATE

KÖPPEN Enter climate classification according to Köppen: (Trewartha, 1968)

Af	tropical wet climate
Af	tropical monsoon climate
Aw	tropical "wet-and-dry" climate (savanna)
BW	arid (desert) climate
BS	semi-arid (steppe) climate
Cf	mild temperate rainy climate with no distinct dry season
Cw	mild temperate rainy climate with dry winters
Cs	mild temperate rainy climate with dry summers
Df	cold snow-forest climate with humid winters
Dw	cold snow-forest climate with dry winters
ET	polar tundra climate
EF	polar perpetual frost climate

Other lower case characters used, with:

A climates

w'	rainfall maximum in autumn
w''	two distinct rainfall maxima
s	dry season during high-sun period
i	temperature range between warmest and coolest month < 5°C

B climates

h	hot climate
k	cool climate
k'	cold climate
s	dry summers
w	dry winters
n	frequent fog

C climates

a	hot summers
b	cool summers
i	temperature range between warmest and coolest month < 5°C
x	rainfall maximum late spring; drier in late summer
n	frequent fog

D climates

d	extremely cold winter month
f, s, w, a, b, c:	see C climate

Entry of climatic data: on the description form is space for data of climatic variables recorded on one single climate station. The ISIS database itself has no limitations in number of stations or number of variables per station.

STATION ISRIC Climatic Station identification code. This code consists of ISO 3166 country code (see appendix I) + C (for climate) + serial number (given by ISIS supervisor)

Enter name of climate station; up to 20 characters.

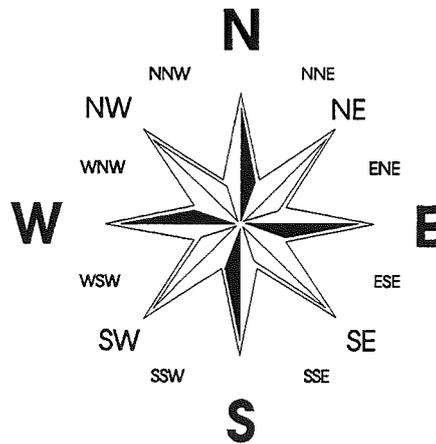
LATITUDE Latitude of station. Enter: N or S / degrees / minutes.

LONGITUDE Longitude of station. Enter: E or W / degrees / minutes.

ALTITUDE Enter altitude of station in m.a.s.l.; when below sea level, enter - (minus sign)

DISTANCE Enter distance in km between site and climate station.

DIRECTION Enter direction site --> climate station:



RELEVANCE Relevance of station's data to soil site (DAY (ed),1983):

V very good: site of station is identical to soil site

G good: site of station and soil site are sufficiently similar to allow for macro and intermediate levels of climatic interpretations

M moderate: sufficiently similar to allow for macro climatic interpretations

P poor: no reliable climatic interpretations possible

CLIMATIC DATA

Enter mean monthly and annual figures for each variable.

DATA KIND Enter kind of variable:

CODE SHOULD BE ENTERED EXACTLY AS LISTED BELOW

T	mean temperature in degrees Celsius		
Ti	minimum temperature	Ta	maximum temperature
P	precipitation in mm	Pd	number of rain days
E	potential evapotranspiration in mm		
Et	Thornthwaite	Ep	Penman
Ef	Frere, Popov	Eb	Blaney-Criddle
Ea	Papadakis	Eu	Turc
A	Actual evaporation in mm		
Ao	Class A pan	Ac	Colorado pan
Ap	Piche		
H	Relative humidity	e	Vapour pressure in mbar
n	hours of bright sunshine hrs/day	nN	percentage bright sunshine %
R	total global radiation MJ.m ⁻² .day ⁻¹	Re	estimated total global radiation MJ.m ⁻² .day ⁻¹
U	wind speed in m/sec at 2 m height	xa, xb, etc	specify in general remarks

If the wind speed is measured at different height, it should be corrected to wind speed at 2 m height with the following factor:(Doorenbos and Pruitt, 1975)

Measuring height(m):	0.5	1	1.5	2	3	4	5	6	8	10
Correction factor:	1.3	1.1	1.0	1.0	0.9	0.8	0.8	0.8	0.8	0.8
	5	5	6		3	8	5	3	1	0

$$1\text{MJ.m}^{-2} = 23.885\text{cal/cm}^{-2} = 23.885 \text{ langley}$$

$$= 27.778\text{mWhr.cm}^{-2}$$

$$= 0.404\text{mm water}$$

If variable and/or method of recording is not included in the table: give a full description of variable and/or method in descriptive part.

PERIOD Number of years of record.

Appendix I ISO 3166 Country Codes

AF	Afghanistan	DJ	Djibouti
AL	Albania	DM	Dominica
DZ	Algeria	DO	Dominican Republic
AS	American Samoa	TP	East Timor
AD	Andorra	EC	Ecuador
AO	Angola	EG	Egypt
AI	Anguilla	SV	El Salvador
AQ	Antarctica	GQ	Equatorial Guinea
AG	Antigua and Barbuda	EE	Estonia
AR	Argentina	ET	Ethiopia
AM	Armenia	FK	Falkland Islands
AW	Aruba	FO	Faroe Islands
AU	Australia	FJ	Fiji
AT	Austria	FI	Finland
AZ	Azerbaijan	FR	France
BS	Bahamas	GF	French Guiana
BH	Bahrain	PF	French Polynesia
BD	Bangladesh	TF	French Southern Territories
BB	Barbados	GA	Gabon
BE	Belgium	GM	Gambia
BZ	Belize	GE	Georgia
BJ	Benin	DE	Germany Federal Republic of
BT	Bhutan	GH	Ghana
BO	Bolivia	GI	Gibraltar
BW	Botswana	GR	Greece
BV	Bouvet Island	GL	Greenland
BR	Brazil	GD	Grenada
IO	British Indian Ocean Territory	GP	Guadeloupe
BN	Brunei Darussalam	GU	Guam
BG	Bulgaria	GT	Guatemala
BF	Burkina Faso	GN	Guinea
BU	Burma	GW	Guinea-Bissau
BI	Burundi	GY	Guyana
BY	Belarus	HT	Haiti
CM	Cameroon	HM	Heard and McDonald Islands
CA	Canada	HN	Honduras
CV	Cape Verde	HK	Hong Kong
KY	Cayman Islands	HU	Hungary
CF	Central African Republic	IS	Iceland
TD	Chad	IN	India
CL	Chile	ID	Indonesia
CN	China	IR	Iran Islamic Republic of
CX	Christmas Island	IQ	Iraq
CC	Cocos Islands	IE	Ireland
CO	Colombia	IL	Israel
CG	Congo	IT	Italy
CK	Cook Islands	JM	Jamaica
CR	Costa Rica	JP	Japan
HR	Croatia	JO	Jordan
CU	Cuba	KH	Kampuchea, democratic
CY	Cyprus	KZ	Kazakhstan
CS	Czechoslovakia		
CI	Côte d'Ivoire		
DK	Denmark		

KE	Kenya	PE	Peru
KI	Kiribati	PH	Philippines
KR	Korea, Republic of	PN	Pitcairn
KP	Korea, Democratic Peoples Republic	PL	Poland
		PT	Portugal
KW	Kuwait	PR	Puerto Rico
KG	Kyrgystan	QA	Qatar
LA	Lao People's Democratic Rep.	RE	Reunion
		RO	Romania
LB	Lebanon	RU	Russian Federation
LS	Lesotho	RW	Rwanda
LR	Liberia	LC	Saint Lucia
LY	Libyan Arab Jamahiriya	WS	Samoa
		SM	San Marino
LI	Liechtenstein	ST	Sao Tome and Principe
LT	Lithuania		
LU	Luxembourg	SA	Saudi Arabia
MO	Macau	SN	Senegal
MG	Madagascar	SC	Seychelles
MW	Malawi	SL	Sierra Leone
MY	Malaysia	SG	Singapore
MV	Maldives	SB	Solomon Islands
ML	Mali	SO	Somalia
MT	Malta	ZA	South Africa
MH	Marshall Islands	ES	Spain
MQ	Martinique	LK	Sri Lanka
MR	Mauritania	SH	St.Helena
MU	Mauritius	KN	St.Kitts and Nevis
MX	Mexico	PM	St.Pierre and Miquelon
FM	Micronesia		
MD	Moldova, Republic of	VC	St.Vincent and the Grenadines
MC	Monaco		
MN	Mongolia	SD	Sudan
MS	Montserrat	SR	Suriname
MA	Morocco	SJ	Svalbard and Jan Mayen
MZ	Mozambique		
NA	Namibia	SZ	Swaziland
NR	Nauru	SE	Sweden
NP	Nepal	CH	Switzerland
NL	Netherlands	SY	Syrian Arab Republic
AN	Netherlands Antilles	TW	Taiwan, Province China
NT	Neutral Zone		
NC	New Caledonia	TJ	Tajikistan
NZ	New Zealand	TZ	Tanzania, United Republic of
NI	Nicaragua		
NE	Niger	TH	Thailand
NG	Nigeria	TG	Togo
NU	Niue	TK	Tokelau
NF	Norfolk Island	TO	Tonga
MP	Northern Mariana Islands	TT	Trinidad and Tobago
		TN	Tunisia
NO	Norway	TR	Turkey
OM	Oman	TM	Turkmenistan
PK	Pakistan	TC	Turks and Caicos Islands
PW	Palau		
PA	Panama	TV	Tuvalu
PG	Papua New Guinea	SU	Ussr
PY	Paraguay	UG	Uganda

UA	Ukraine	WF	Wallis and Futuna Islands
AE	United Arab Emirates	EH	Western Sahara
GB	United Kingdom	YE	Yemen
US	United States	YU	Yugoslavia
UY	Uruguay	ZR	Zaire
UM	US. Minor Outlying Islands	ZM	Zambia
SU	Ussr (glinka)	ZW	Zimbabwe
UZ	Uzbekistan		
VU	Vanuatu		
VA	Vatican City State		
VE	Venezuela		
VN	Viet Nam		
VG	Virgin Islands (U.K.)		
VI	Virgin Islands (U.S.)		

A	ACRISOLS	I	LITHOSOL
Af	ferric acrisol	I	lithosol
Ag	gleyic acrisol	J	FLUVISOLS
Ah	humic acrisol	Jc	calcaric fluvisol
Ao	orthic acrisol	Jd	dystric fluvisol
Ap	plinthic acrisol	Je	eutric fluvisol
		Jt	thionic fluvisol
B	CAMBISOLS	K	KASTANOZEM
Bc	chromic cambisol	Kh	haplic kastanozem
Bd	dystric cambisol	Kk	calcic kastanozem
Be	eutric cambisol	Kl	luvic kastanozem
Bf	ferralic cambisol	L	LUVISOLS
Bg	gleyic cambisol	La	albic luvisol
Bh	humic cambisol	Lc	chromic luvisol
Bk	calcic cambisol	Lf	ferric luvisol
Bv	vertic cambisol	Lg	gleyic luvisol
Bx	gelic cambisol	Lk	calcic luvisol
		Lo	orthic luvisol
C	CHERNOZEMS	Lp	plinthic luvisol
Cg	glossic chernozem	Lv	vertic luvisol
Ch	haplic chernozem	M	GREYZEMS
Ck	calcic chernozem	Mg	gleyic greyzem
Cl	luvic chernozem	Mo	orthic greyzem
		N	NITOSOLS
D	PODZOLUVISOLS	Nd	dystric nitosol
Dd	dystric podzoluvisol	Ne	eutric nitosol
De	eutric podzoluvisol	Nh	humic nitosol
Dg	gleyic podzoluvisol	O	HISTOSOLS
		Od	dystric histosol
E	RENDZINAS	Oe	eutric histosol
E	rendzina	Ox	gelic histosol
		P	PODZOLS
F	FERRALSOLS	Pf	ferric podzol
Fa	acric ferralsol	Pg	gleyic podzol
Fh	humic ferralsol	Ph	humic podzol
Fo	orthic ferralsol	Pl	leptic podzol
Fp	plinthic ferralsol	Po	orthic podzol
Fr	rhodic ferralsol	Pp	placic podzol
Fx	xanthic ferralsol	Q	ARENOSOLS
		Qa	albic arenosol
G	GLEYSOLS	Qc	cambic arenosol
Gc	calcaric gleysol	Qf	ferralic arenosol
Gd	dystric gleysol	Ql	luvic arenosol
Ge	eutric gleysol		
Gh	humic gleysol		
Gm	mollic gleysol		
Gp	plinthic gleysol		
Gx	gelic gleysol		
H	PHAEZEM		
Hc	calcaric phaeozem		
Hg	gleyic phaeozem		
Hh	haplic phaeozem		
Hi	luvic phaeozem		

R
Rc
Rd
Re
Rx

REGOSOLS
calcaric regosol
dystric regosol
eutric regosol
gelic regosol

S
Sg
Sm
So

SOLONETZ
gleyic solonetz
mollic solonetz
orthic solonetz

T
Th
Tm
To
Tv

ANDOSOLS
humic andosol
mollic andosol
ochric andosol
vitric andosol

U
U

RANKERS
ranker

V
Vc
Vp

VERTISOLS
chromic vertisol
pellic vertisol

W
Wd
We
Wh
Wm
Ws
Wx

PLANOSOLS
dystric planosol
eutric planosol
humic planosol
mollic planosol
solodic planosol
gelic planosol

X
Xh
Xk
Xl
Xy

XEROSOLS
haplic xerosol
calcic xerosol
luvic xerosol
gypsic xerosol

Y
Yh
Yk
Yl
Yt
Yy

YERMOSOLS
haplic yermosol
calcic yermosol
luvic yermosol
takyric yermosol
gypsic yermosol

Z
Zg
Zm
Zo
Zt

SOLONCHAKS
gleyic solonchak
mollic solonchak
orthic solonchak
takyric solonchak

AC	Acrisols	CMo	Ferralic Cambisol
ACf	Ferric Acrisol	CMu	Humic Cambisol
ACg	Gleyic Acrisol	CMv	Vertic Cambisol
ACh	Haplic Acrisol	CMx	Chromic Cambisol
ACp	Plinthic Acrisol		
ACu	Humic Acrisol	FL	Fluvisols
		FLc	Calcaric Fluvisol
AL	Alisols	FLd	Dystric Fluvisol
ALf	Ferric Alisol	FLe	Eutric Fluvisol
ALg	Gleyic Alisol	FLm	Mollic Fluvisol
ALh	Haplic Alisol	FLs	Salic Fluvisol
ALj	Stagnic Alisol	FLt	Thionic Fluvisol
ALp	Plinthic Alisol	FLu	Umbric Fluvisol
ALu	Humic Alisol		
		FR	Ferralsols
AN	Andosols	FRg	Geric Ferralsol
ANg	Gleyic Andosol	FRh	Haplic Ferralsol
ANh	Haplic Andosol	FRp	Plinthic Ferralsol
ANi	Gelic Andosol	FRr	Rhodic Ferralsol
ANm	Mollic Andosol	FRu	Humic Ferralsol
ANu	Umbric Andosol	FRx	Xanthic Ferralsol
ANz	Vitric Andosol		
		GL	Gleysols
AR	Arenosols	GLa	Andic Gleysol
ARa	Albic Arenosol	GLd	Dystric Gleysol
ARb	Cambic Arenosol	GLE	Eutric Gleysol
ARc	Calcaric Arenosol	GLi	Gelic Gleysol
ARg	Gleyic Arenosol	GLk	Calcic Gleysol
ARh	Haplic Arenosol	GLm	Mollic Gleysol
ARi	Luvic Arenosol	GLt	Thionic Gleysol
ARo	Ferralic Arenosol	GLu	Umbric Gleysol
		GR	Greyzems
AT	Anthrosols	GRg	Gleyic Greyzem
ATa	Aric Anthrosol	GRh	Haplic Greyzem
ATc	Cumulic Anthrosol		
ATf	Fimic Anthrosol	GY	Gypsisols
ATu	Urbic Anthrosol	GYh	Haplic Gypsisol
		GYk	Calcic Gypsisol
CH	Chernozems	GYl	Luvic Gypsisol
CHg	Gleyic Chernozem	GYp	Petric Gypsisol
CHh	Haplic Chernozem		
CHk	Calcic Chernozem	HS	Histosols
CHI	Luvic Chernozem	HSf	Fibric Histosol
CHw	Glossic Chernozem	HSi	Gelic Histosol
		HSI	Folic Histosol
CL	Calcisols	HSs	Terric Histosol
CLh	Haplic Calcisol	HSt	Thionic Histosol
CLi	Luvic Calcisol		
CLp	Petric Calcisol	KS	Kastanozems
		KSh	Haplic Kastanozem
CM	Cambisols	KSk	Calcic Kastanozem
CMc	Calcaric Cambisol	KSl	Luvic Kastanozem
CMd	Dystric Cambisol	KSy	Gypsic Kastanozem
CMe	Eutric Cambisol		
CMg	Gleyic Cambisol		
CMi	Gelic Cambisol		

LP	Leptosols	PZ	Podzols
LPd	Dystric Leptosol	PZb	Cambic Podzol
LPe	Eutric Leptosol	PZc	Carbic Podzol
LPi	Gelic Leptosol	PZf	Ferric Podzol
LPk	Rendzic Leptosol	PZg	Gleyic Podzol
LPm	Mollic Leptosol	PZh	Haplic Podzol
LPq	Lithic Leptosol	PZi	Gelic Podzol
LPu	Umbric Leptosol		
LV	Luvissols	RG	Regosols
LVa	Albic Luvisol	RGc	Calcaric Regosol
LVf	Ferric Luvisol	RGd	Dystric Regosol
LVg	Gleyic Luvisol	RGe	Eutric Regosol
LVh	Haplic Luvisol	RGi	Gelic Regosol
LVj	Stagnic Luvisol	RGu	Umbric Regosol
LVk	Calcic Luvisol	RGy	Gypsic Regosol
LVv	Vertic Luvisol		
LVx	Chromic Luvisol	SC	Solonchaks
LX	Lixisols	SCg	Gleyic Solonchak
LXa	Albic Lixisol	SCh	Haplic Solonchak
LXf	Ferric Lixisol	SCi	Gelic Solonchak
LXg	Gleyic Lixisol	SCK	Calcic Solonchak
LXh	Haplic Lixisol	SCm	Mollic Solonchak
LXj	Stagnic Lixisol	SCn	Sodic Solonchak
LXp	Plinthic Lixisol	SCy	Gypsic Solonchak
NT	Nitisols	SN	Solonetz
NTh	Haplic Nitisol	SNg	Gleyic Solonetz
NTr	Rhodic Nitisol	SNh	Haplic Solonetz
NTu	Humic Nitisol	SNj	Stagnic Solonetz
		SNk	Calcic Solonetz
		SNm	Mollic Solonetz
		SNy	Gypsic Solonetz
PD	Podzoluvisols	VR	Vertisols
PDd	Dystric Podzoluvisol	VRd	Dystric Vertisol
PDe	Eutric Podzoluvisol	VRe	Eutric Vertisol
PDg	Gleyic Podzoluvisol	VRk	Calcic Vertisol
PDi	Gelic Podzoluvisol	VRy	Gypsic Vertisol
PDj	Stagnic Podzoluvisol		
PH	Phaeozems		
PHc	Calcaric Phaeozem		
PHg	Gleyic Phaeozem		
PHh	Haplic Phaeozem		
PHj	Stagnic Phaeozem		
PHi	Luvic Phaeozem		
PL	Planosols		
PLd	Dystric Planosol		
PLe	Eutric Planosol		
PLi	Gelic Planosol		
PLm	Mollic Planosol		
PLu	Umbric Planosol		
PT	Plinthosols		
PTa	Albic Plinthosol		
PTd	Dystric Plinthosol		
PTe	Eutric Plinthosol		
PTu	Humic Plinthosol		

Subunit

AA	Anthraqui	MA	Mazi
AB	Albi	MH	Mollihumu
AC	Alcali	MO	Molli
AD	Aridi	NI	Niti
AK	Acri	NY	Nudiyermi
AL	Ali	OR	Orthi
AP	Abrupti	OT	Orthothioni
AR	Areni	PA	Pachi
BA	Bathi	PE	Pelli
CA	Calcari	PF	Petroferri
CH	Chromi	PG	Petrogypsi
DU	Duri	PK	Petrocalci
DY	Dystri	PL	Placi
EU	Eutri	PN	Plani
FE	Ferri	PS	Petrosali
FH	Fibrihisti	PT	Petri
FL	Fluvi	RH	Rhodi
FR	Fragi	RP	Rupti
GE	Geli	SA	Sali
GL	Gleyi	SI	Silti
GR	Geri	SO	Sodi
GS	Glossi	SQ	Plinthi
GU	Grumi	ST	Stagni
GY	Gypsi	TH	Terrihisti
HI	Histi	TK	Takyri
HU	Humi	UH	Umbrihumu
KA	Calci	UM	Umbri
LI	Lithi	VE	Verti
LM	Lamelli	VT	Veti
LU	Luvi	XA	Xanthi
LX	Lixi	YE	Yermi

a	ALFISOL	dos	salorthid
aq	aqualf	e	ENTISOL
aqw	albaqualf	eq	aquent
aqd	duraqualf	eqc	cryaquent
aqf	fragiaqualf	eqv	fluvaquent
aqg	glossaqualf	eqa	haplaquent
aqn	natraqualf	eqw	hydraquent
aqo	ochraqualf	eqs	psammaquent
aqi	plinhaqualf	eqi	sulfaquent
aqt	tropaqualf	eqt	tropaquent
aqm	umbraqualf	er	arent
ab	boralf	er	arent
abo	cryoboralf	ev	fluent
abe	eutroboralf	evc	cryofluent
abf	fragiboralf	evp	torrifluent
abg	glossoboralf	evt	tropofluent
abn	natriboralf	evd	udifluent
abb	paleboralf	evu	ustifluent
ad	udalf	evx	xerofluent
adc	agrudalf	eo	orthent
adi	ferrudalf	eoc	cryorthent
adf	fragiudalf	eop	torriorthent
agf	fraglossudalf	eot	troporthent
adg	glossudalf	eod	udorthent
ada	hapludalf	eou	ustorthent
adn	natrudalf	eox	xerorthent
adb	paleudalf	es	psamment
adt	tropudalf	esc	cryopsamment
au	ustalf	esz	quartzipsamment
aud	durustalf	esp	torriipsamment
aua	haplustalf	est	tropopsamment
aun	natrustalf	esd	udipsamment
aub	paleustalf	esu	ustipsamment
aul	plinthustalf	esx	xeropsamment
aur	rhodustalf	h	HISTOSOL
ax	xeralf	hi	fibrist
axd	durixeralf	hib	borofibrist
axa	haploxeralf	hic	cryofibrist
axn	natrixeralf	hil	luvifibrist
axb	palexeralf	him	medifibrist
axl	plinthoxeralf	his	sphagnofibrist
axr	rhodoxeralf	hit	tropofibrist
d	ARIDISOL	hl	folist
dr	argid	hlb	borofolist
drd	durargid	hlc	cryofolist
dra	haplargid	hlt	tropofolist
drj	nadurargid	he	hemist
drn	natrargid	heb	borohemist
drb	paleargid	hec	cryohemist
do	orthid	hel	luvihemist
dok	calciorthid	hem	medihemist
dom	camborthid	hei	sulfihemist
dod	durorthid	heo	sulfohemist
dog	gypsiorthid	het	trophemist
dob	paleorthid		

ha	saprist	m	MOLLISOL
har	borosaprist	mw	alboll
hac	cryosaprist	mwr	argialboll
ham	medisaprist	mwn	natralboll
hat	troposaprist	mq	aquoll
		mqr	argiaquoll
i	INCEPTISOL	mqq	calciaquoll
in	andept	mqc	cryaquoll
inc	cryandept	mqd	duraquoll
ind	durandept	mqa	haplaquoll
iny	dystrandept	mqn	natraquoll
ine	eutrandept	mb	boroll
inw	hydrandept	mbr	argiboroll
inp	placandept	mbk	calciboroll
inv	vitrandept	mbc	cryoboroll
iq	aquept	mba	haploboroll
iqn	andaquept	mbn	natriboroll
iqc	cryaquept	mhb	paleboroll
iqf	fragiaquept	mbv	vermiboroll
iqx	halaquept	mr	rendoll
iqu	haplaquept	mr	rendoll
iqh	humaquept	md	udoll
iqp	placaquept	mdr	argiudoll
iql	plinthaquept	mda	hapludoll
iqs	sulfaquept	mdb	paleudoll
iqt	tropaquept	mdv	vermudoll
io	ochrept	mu	ustoll
ioc	cryochrept	mur	argiustoll
iod	durochrept	muk	calciustoll
ioy	dystrochrept	mud	durustoll
ioe	eutrochrept	mua	haplustoll
iof	fragiochrept	mun	natrustoll
iou	ustochrept	mub	paleustoll
iox	xerochrept	muv	vermustoll
ig	plaggept	mx	xeroll
ig	plaggept	mrx	argixeroll
it	tropept	mxx	calcixeroll
ity	dystropept	mxd	durixeroll
ite	eutropept	mxa	haploxeroll
ith	humitropept	mxn	natrixeroll
its	sombritropept	mxb	palexeroll
itu	ustropept		
im	umbrept	o	OXISOL
imc	cryumbrept	oq	aquox
imf	fragiumbrept	oqq	gibbsiaquox
ima	haplumbrept	oqo	ochraquox
imx	xerumbrept	oql	plinthaquox
		oqm	umbraquox
		oh	humox
		ohk	acrohox
		ohg	gibbsihumox
		oha	haplohumox
		ohs	sombrihumox

oo
ook
ooe
oog
ooa
oos
oom
op
op
ou
ouk
oue
oua
ous

s
sq
sqc
sqd
sqf
sqa
sqp
sqs
sqt
si
si
sh
shc
shf
sha
shp
sht
so
soc
sof
soa
sop
sot

orthox
acrorthox
eutrorthox
gibbsiorthox
haplorthox
sombriorthox
umbriorthox
torrox
torrox
ustox
acrustox
eutrustox
haplustox
sombriustox

SPODOSOL
aquod
cryaquod
duraquod
fragiaquod
haplaquod
placaquod
sideraquod
tropaquod
ferrod
ferrod
humod
cryohumod
fragihumod
haplohumod
placohumod
tropohumod
orthod
cryorthod
fragiorthod
haplorthod
placorthod
troporthod

u
uq
uqw
uqf
uqo
uqb
uql
uqt
uqm
uh
uha
uhb
uhl
uhs
uht
ud
udf
uda
udb
udl
udr
udt

uu
uua
uub
uul
uur
ux
uxa
uxb

v
vp
vp
vd
vdr
vdl
vu
vur
vul
vx
vxr
vxl

ULTISOL
aquult
albaquult
fragiaquult
ochraquult
paleaquult
plinhaquult
tropaquult
umbraquult
humult
haplohumult
palehumult
plinthohumult
sombrihumult
tropohumult
udult
fragiudult
hapludult
paleudult
plinhudult
rhodudult
tropudult

ustult
haplustult
paleustult
plinthustult
rhodustult
xerult
haploxerult
palexerult

VERTISOL
torrert
torrert
udert
chromudert
pelludert
ustert
chromustert
pellustert
xerert
chromoxerert
pelloxerert

Subgroup prefixes

AB
AB04
AB08
AB10
AB14
AB16
AE
AE03
AE05
AE06

abruptic
abruptic aridic
abruptic cryic
abruptic haplic
abruptic udic
abruptic xerollic
aeric
aeric arenic
aeric grossarenic
aeric mollic

AE08
AE09
AE10
AE12
AL
AL02
AL04
AL08
AL10
AL12

aeric humic
aeric tropic
aeric umbric
aeric xeric
albaquic
albaquultic
albic
albic glossic
alfic
alfic arenic

AL13	alfic aneptic	CR	crylic
AL16	alfic lithic	CR1Ø	crylic lithic
AN	andic	CR14	crylic pachic
ANØ1	aneptic	CU	cumulic
ANØ3	andaquic	CUØ2	cumulic udic
ANØ6	andic dystric	CUØ4	cumulic ultic
AN11	aneptic glossoboric	DU	durargidic
AN22	andic ustic	DUØ2	duric
AN24	andaqueptic	DUØ8	durixerollic
AN3Ø	anthropic	DU1Ø	durixerollic lithic
AQ	aqualfic	DU11	durochreptic
AQØ2	aquentic	DU12	durorthidic
AQØ4	aqueptic	DU14	durorthidic xeric
AQØ6	aquic	DYØ2	dystric
AQØ8	aquic arenic	DYØ3	dystric entic
AQ14	aquic duric	DYØ4	dystric fluventic
AQ16	aquic durorthidic	DYØ6	dystric lithic
AQ18	aquic dystric	DYØ8	dystropeptic
AQ24	aquic haplic	EN	entic
AQ26	aquic lithic	ENØ2	entic lithic
AQ31	aquic psammentic	ENØ6	entic ultic
AQ34	aquollic	EP	epiaquic
AQ36	aquultic	EP1Ø	epiaquic orthoxic
AR	arenic	EU	eutric
ARØ2	arenic aridic	EUØ2	eutrochreptic
ARØ3	arenic orthoxic	EUØ4	eutropeptic
ARØ4	arenic plinthaquic	FE	ferrudalfic
ARØ6	arenic plinthic	FI	fibric
ARØ8	arenic rhodic	FIØ2	fibric terric
AR1Ø	arenic ultic	FLØ2	fluvaquentic
AR14	arenic umbric	FLØ6	fluventic
AR16	arenic ustalfic	FL12	fluventic umbric
AR18	arenic ustollic	FR1Ø	fragiaquic
AR22	argiaquic	FR18	fragic
AR24	argiaquic xeric	GLØ2	glossaquic
AR26	argic	GLØ4	glossic
AR28	argic lithic	GL1Ø	glossic udic
AR3Ø	argic pachic	GL12	glossic ustollic
AR32	argic vertic	GL14	glossoboralfic
AR34	aridic	GL16	glossoboric
AR36	aridic calcic	GR	grossarenic
AR42	aridic duric	GRØ1	grossarenic entic
AR5Ø	aridic pachic	GRØ4	grossarenic plinthic
AR52	aridic petrocalcic	HA	haplaquodic
BO	boralfic	HAØ1	haplaquic
BOØ2	boralfic lithic	HAØ2	haplic
BOØ4	boralfic udic	HAØ5	haplohumic
BOØ6	borollic	HAØ7	haploxerollic
BOØ8	borollic glossic	HAØ9	hapludic
BO1Ø	borollic lithic	HA12	hapludollic
BO12	borollic vertic	HA16	haplustollic
CA	calcic	HE	hemic
CAØ4	calcic pachic	HEØ2	hemic terric
CAØ6	calciorthidic	HI	histic
CA1Ø	calcixerollic	HIØ2	histic lithic
CA2Ø	cambic	HIØ6	histic pergelic
CH	chromic	HU	humic
CHØ6	chromudic	HUØ2	humic lithic

HU05	humic pergelic	PS	psammaquentic
HU06	humoxic	PS02	psammentic
HU10	humaqueptic	QU	quartzipsammentic
HY	hydric	RE	rendollic
HY02	hydric lithic	RH	rhodic
LE	leptic	RU02	ruptic-alfic
LI	limnic	RU09	ruptic-lithic
LI02	lithic	RU11	ruptic-lithic entic
LI04	lithic mollic	RU15	ruptic-lithic xerochreptic
LI06	lithic ruptic-alfic	RU17	ruptic-ultic
LI07	lithic ruptic-argic	RU19	ruptic-vertic
LI08	lithic ruptic-entic xerollic	SA	salorthidic
LI09	lithic ruptic-entic	SA02	sapric
LI10	lithic udic	SA04	sapric terric
LI11	lithic ruptic-xerorthentic	SI	sideric
LI12	lithic ultic	SO04	sombrihumic
LI13	lithic ruptic-ultic	SP	sphagmic
LI14	lithic umbric	SP02	sphagmic terric
LI15	lithic ruptic-xerochreptic	SP04	spodic
LI16	lithic ustic	SU	sulfic
LI18	lithic ustollic	TE	terric
LI20	lithic vertic	TH04	thapto-histic
LI22	lithic xeric	TH06	thapto-histic tropic
LI24	lithic xerollic	TO	torrertic
MO	mollic	TO02	torrifluventic
NA06	natric	TO04	torriorthentic
OC	ochreptic	TO06	torripsammentic
OR	orthidic	TO10	torroxic
OR01	orthic	TR	tropaquodic
OR02	orthoxic	TR02	tropeptic
OX	oxic	TR04	tropic
PA	pachic	AA	typic
PA02	pachic udic	UD	udertic
PA04	pachic ultic	UD01	udalfic
PA06	paleorthidic	UD02	udic
PA08	paleustollic	UD03	udollic
PA10	palexerollic	UD05	udorthentic
PA20	paralithic vertic	UD10	udoxic
PE	pergelic	UL	ultic
PE01	pergelic ruptic-histic	UM	umbreptic
PE02	pergelic sideric	UM02	umbric
PE04	petrocalcic	US	ustalfic
PE06	petrocalcic ustalfic	US02	ustertic
PE08	petrocalcic ustollic	US04	ustic
PE14	petrocalcic xerollic	US06	ustochreptic
PE16	petroferric	US08	ustollic
PE20	petrogypsic	US12	ustoxic
PK	placic	VE	vermic
PK10	plaggeptic	VE02	vertic
PK12	plaggic	XE	xeralfic
PL	plinthaquic	XE02	xerertic
PL04	plinthic	XE04	xeric
PL06	plinthudic	XE08	xerollic

Appendix V Codes Soil Taxonomy (USDA/SCS) 1992. Orders, suborders and great groups.

A	Histosol	C	Andisol
AA	Folist	CA	Aquand
AAA	Cryofolist	CAA	Cryaquand
AAB	Tropofolist	CAB	Placaquand
AAC	Borofolist	CAC	Duraquand
AAD	Medifolist	CAD	Vitraqund
AB	Fibrist	CAE	Melanaquand
ABA	Sphagnofibrist	CAF	Epiaquand
ABB	Cryofibrist	CAG	Endoaquand
ABC	Borofibrist	CB	Cryand
ABD	Tropofibrist	CBA	Gelicryand
ABE	Luvifibrist	CBB	Melanocryand
ABF	Medifibrist	CBC	Fulvicryand
AC	Hemist	CBD	Hydrocryand
ACA	Sulfohemist	CBE	Vitricryand
ACB	Sulfihemist	CBF	Haplocryand
ACC	Luvihemist	CC	Torrand
ACD	Cryohemist	CCA	Vitritorrand
ACE	Borohemist	CD	Xerand
ACF	Tropohemist	CDA	Vitrixerand
ACG	Medihemist	CDB	Melanoxerand
AD	Saprist	CDC	Haploxerand
ADA	Sulfosaprist	CE	Vitrand
ADB	Sulfisaprist	CEA	Ustivitrant
ADC	Cryosaprist	CEB	Udivitrant
ADD	Borosaprist	CF	Ustand
ADE	Troposaprist	CFA	Durustand
ADF	Medisaprist	CFB	Haplustand
B	Spodosol	CG	Udand
BA	Aquod	CGA	Placadand
BAA	Cryaquod	CGB	Durudand
BAB	Alaquod	CGC	Melanudand
BAC	Fragiaquod	CGD	Fulvudand
BAD	Placaquod	CGE	Hydrudand
BAE	Duraquod	CGF	Hapludand
BAF	Epiaquod	D	Oxisol
BAG	Endoaquod	DA	Aquox
BB	Cryod	DAA	Acraquox
BBA	Placocrod	DAB	Plinthaquox
BBB	Duricryod	DAC	Eutraquox
BBC	Humicryod	DAD	Haplaquox
BBD	Haplocryod	DB	Torrox
BC	Humod	DBA	Acrotorrox
BCA	Placohumod	DBB	Eutrotorrox
BCB	Durihumod	DBC	Haplotorrox
BCC	Fragihumod	DC	Ustox
BCD	Haplohumod	DCA	Sombriustox
BD	Orthod	DCB	Acrustox
BDA	Placorthod	DCC	Eustrustox
BDB	Durorthod	DCD	Kandiustox
BDC	Fragiorthod	DCE	Haplustox
BDD	Alorthod	DD	Perox
BDE	Haplorthod	DDA	Sombriperox
		ddb	Acroperox
		DDC	Eutroperox

DDD	Kandiperox	G	Ultisol
DDE	Haploperox	GA	Aquult
DE	Udox	GAA	Plinthaquult
DEA	Sombriudox	GAB	Fragiaquult
DEB	Acrudox	GAC	Albaquult
DEC	Eutrudox	GAD	Kandiaquult
DED	Kandiudox	GAE	Kanhaplaquult
DEE	Hapludox	GAF	Paleaquult
		GAG	Umbraquult
E	Vertisol	GAH	Epiaquult
EA	Aquert	GAI	Endoaquult
EAA	Salaquert	GB	Humult
EAB	Duraquert	GBA	Sombrihumult
EAC	Natraquert	GBB	Plinthohumult
EAD	Calciaquert	GBC	Kandihumult
EAE	Dystraquert	GBD	Kanhaplohumult
EAF	Epiaquert	GBE	Palehumult
EAG	Endoaquert	GBF	Haplohumult
EB	Cryert	GC	Udult
EBA	Humicryert	GCA	Plinthudult
EBB	Haplocryert	GCB	Fragiudult
EC	Xerert	GCC	Kandiudult
ECA	Durixerert	GCD	Kanhapludult
ECB	Calcixerert	GCE	Paleudult
ECC	Haploxerert	GCF	Rhodudult
ED	Torrert	GCG	Hapludult
EDA	Salitorrert	GD	Ustult
EDB	Gypsitorrert	GDA	Plinthustult
EDC	Calcitorrert	GDB	Kandiustult
EDD	Haplotorrert	GDC	Kanhaplustult
EE	Ustert	GDD	Paleustult
EEA	Dystrustert	GDE	Rhodustult
EEB	Salustert	GDF	Haplustult
EEC	Gypsiustert	GE	Xerult
EED	Calciustert	GEA	Palexerult
EEE	Haplustert	GEB	Haploxerult
EF	Udert		
EFA	Dystrudert	H	Mollisol
EFB	Hapludert	HA	Alboll
		HAA	Natralboll
F	Aridisol	HAB	Argialboll
FA	Argid	HB	Aquoll
FAA	Nadurargid	HBA	Cryaquoll
FAB	Durargid	HBB	Duraquoll
FAC	Natrargid	HBC	Natraquoll
FAD	Paleargid	HBD	Calciaquoll
FAE	Haplargid	HBE	Argiaquoll
FB	Orthid	HBF	Epiaquoll
FBA	Salorthid	HBG	Endoaquoll
FBB	Paleorthid	HC	Rendoll
FBC	Durorthid	HD	Xeroll
FBD	Gypsiorthid	HDA	Durixeroll
FBE	Calciorthid	HDB	Natrixeroll
FBF	Camborthid	HDC	Palexeroll
		HDD	Calcixeroll
		HDE	Argixeroll
		HDF	Haploxeroll
		HE	Boroll

HEA	Paleboroll	IE	Udalf
HEB	Cryoboroll	IEA	Agrudalf
HEC	Natriboroll	IEB	Natrudalf
HED	Argiboroll	IEC	Ferrudalf
HEE	Vermiboroll	IED	Fraglossudalf
HEF	Calciboroll	IEE	Glossudalf
HEG	Haploboroll	IEF	Fragiudalf
HF	Ustoll	IEG	Kandiudalf
HFA	Durustoll	IEH	Kanhapludalf
HFB	Natrustoll	IEI	Paleudalf
HFC	Paleustoll	IEJ	Rhodudalf
HFD	Calciustoll	IEK	Hapludalf
HFE	Argiustoll		
HFF	Vermustoll	J	Inceptisol
HFG	Haplustoll	JA	Aquept
HG	Udoll	JAA	Sulfaquept
HGA	Paleudoll	JAB	Placaquept
HGB	Calciudoll	JAC	Halaquept
HGC	Argiudoll	JAD	Fragiaquept
HGD	Vermudoll	JAE	Cryaquept
HGE	Hapludoll	JAF	Plinthaquept
		JAG	Tropaquept
I	Alfisol	JAH	Humaquept
IA	Aqualf	JAI	Epiaquept
IAA	Plinthaqualf	IAJ	Endoaquept
IAB	Duraqualf	JB	Plaggept
IAC	Natraqualf	JC	Tropept
IAD	Fragiaqualf	JCA	Humitropept
IAE	Kandiaqualf	JCB	Sombritropept
IAF	Glossaqualf	JCC	Ustropept
IAG	Albaqualf	JCD	Eutropept
IAH	Umbraqualf	JCE	Dystropept
IAI	Epiaqualf	JD	Ochrept
IAJ	Endoaqualf	JDA	Sulfochrept
IB	Boralf	JDB	Fragiochrept
IBA	Paleboralf	JDC	Durochrept
IBB	Fragiboralf	JDD	Cryochrept
IBC	Natriboralf	JDE	Ustochrept
IBD	Cryoboralf	JDF	Xerochrept
IBE	Eutroboralf	JDG	Eutrochrept
IBF	Glossoboralf	JDH	Dystrochrept
IC	Ustalf	JE	Umbrept
ICA	Durustalf	JEA	Fragiumbrept
ICB	Plinthustalf	JEB	Cryumbrept
ICC	Natrustalf	JEC	Xerumbrept
ICD	Kandiustalf	JED	Haplumbrept
ICE	Kanhaplustalf		
ICF	Paleustalf	K	Entisol
ICG	Rhodustalf	KA	Aquent
ICH	Haplustalf	KAA	Sulfaquent
ID	Xeralf	KAB	Hydraquent
IDA	Durixeralf	KAC	Cryaquent
IDB	Natrixeralf	KAD	Psammaquent
IDC	Fragixeralf	KAE	Fluvaquent
IDD	Plinthoxeralf	KAF	Epiaquent
IDE	Rhodoxeralf	KAG	Endoaquent
IDF	Palexeralf	KB	Arent
IDG	Haploxeralf	KBA	Ustarent

KBB	Xerarent	KDB	Xerofluent
KBC	Torriarent	KDC	Ustifluent
KBD	Udarent	KDD	Torrifluent
KC	Psamment	KDE	Tropofluent
KCA	Cryopsamment	KDF	Udifluent
KCB	Torripsamment	KE	Orthent
KCC	Quartzipsamment	KEA	Cryorthent
KCD	Tropopsamment	KEB	Torriorthent
KCE	Ustipsamment	KEC	Xerorthent
KCF	Xeropsamment	KED	Troporthent
KCG	Udipsamment	KEE	Ustorthent
KD	Fluvent	KEF	Udorthent
KDA	Cryofluent		

Appendix VI Codes Soil Taxonomy (USDA/SCS) for texture and mineralogy.

Texture

005	ashy	036	fragmental
007	ashy over cindery	150	gravelly
008	ashy over loamy	068	loamy
013	ashy over loamy-skeletal	072	loamy over sandy or sandy-skeletal
009	ashy-skeletal	050	loamy skeletal
003	cindery	054	loamy-skeletal over clayey
006	cindery over loamy	051	loamy-skeletal over fragmental
017	cindery over medial	052	loamy-skeletal over sandy
015	cindery over medial-skeletal	070	loamy sandy
004	cindery over sandy or sandy-skeletal	065	loamy to sandy
114	clayey	010	medial
122	clayey over fine-silty	012	medial over cindery
116	clayey over fragmental	014	medial over clayey
124	clayey over loamy	016	medial over fragmental
120	clayey over loamy-skeletal	018	medial over loamy
118	clayey over sandy or sandy-skeletal	020	medial over loamy-skeletal
056	clayey-skeletal	022	medial over sandy or sandy-skeletal
058	clayey-skeletal over sandy	024	medial over thixotropic
080	coarse-loamy	011	medial-skeletal
086	coarse-loamy over clayey	062	sandy
082	coarse-loamy over fragmental	063	sandy or sandy-skeletal
084	coarse-loamy over sandy or sandy-skeletal	066	sandy over clayey
088	coarse-silty	064	sandy over loamy
094	coarse-silty over clayey	044	sandy skeletal
092	coarse-silty over sandy or sandy-skeletal	047	sandy-skeletal over clayey
126	fine	046	sandy-skeletal over loamy
115	fine clayey	026	thixotropic
096	fine-loamy	028	thixotropic over fragmental
102	fine-loamy over clayey	034	thixotropic over loamy
098	fine-loamy over fragmental	032	thixotropic over loamy skeletal
100	fine-loamy over sandy or sandy-skeletal	030	thixotropic over sandy or sandy-skeletal
106	fine-silty	027	thixotropic-skeletal
112	fine-silty over clayey	134	very fine
108	fine-silty over fragmental		
110	fine silty over sandy or sandy-skeletal		

Mineralogy

04	calcareous	30	marly
05	carbonatic	32	micaceous
09	chloritic	34	mixed
07	clastic	35	mixed (calcareous)
08	coprogenous	37	montmorillonitic
10	diatomaceous	38	montmorillonitic (calcareous)
12	ferrihumic	40	oxidic
14	ferritic	42	sepiolitic
18	gibbsitic	44	serpentinitic
20	glauconitic	46	siliceous
22	gypsic	50	vermiculitic
24	halloysitic		
26	illitic		
27	illitic (calcareous)		
28	kaolinitic		

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