eSoTer Project
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SoTerML: Soil and Terrain Markup Language

Annexe B: SoTerML Attributes Specification

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Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
SoTerUnit	**hypsometry**	Indication of the height above sea level of the local base leve	SOTER2009			
				E1	less than 10 m very low elevation	
				E2	10-50 m very low elevation	
				E3	50-100 m very low elevation	
				E4	100-200 m low elevation	
				E5	200-300 m low elevation	
				E6	300-600 m low elevation	
				E7	600-1000 m medium elevation	
				E8	1000-1500 m medium elevation	
				E9	1500-2000 m high elevation	
				E10	2000-3000 m high elevation	
				E11	3000-5000 m very high elevation	
				E12	greater than 5000 m extremely high elevation	
SoTerUnit	**majorLandform**	Major landforms as described foremost by their morphology, not as much by their genetic origin	SOTER2009			
				L	Level land	
				LP	Plain	
				LL	Plateau	
				LD	Depression	
				LF	Low-gradient foot slope	
				LV	Valley floor	
				S	Sloping land	
				SM	Medium gradient mountain	
				SH	Medium gradient hill	

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
				SE	Medium-gradient escarpment zone	
				SR	Ridges	
				SU	Mountainous highland	
				SP	Dissected plain	
				SV	Medium gradient valley	
				T	Steep land	
				TM	High-gradient mountain	
				TH	High-gradient hill	
				TE	High-gradient escarpment zone	
				TV	High-gradient valleys	
				C	Land with composite landforms	
				CV	Valley	
				CL	Narrow plateau	
				CD	Major depression	
SoTerUnit	**maximumElevation**	Absolute maximum elevation of the SOTER unit, in metres above sea level	SOTER2009			
SoTerUnit	**medianElevation**	Absolute median elevation of the SOTER unit, in metres above sea level	SOTER2009			
SoTerUnit	**medianSlope**	The median slope angle, as a percentage, prevailing in the terrain	SOTER2009			
SoTerUnit	**minimumElevation**	Absolute minimum elevation of the SOTER unit, in metres above sea level	SOTER2009			

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
SoTerUnit	**permanentWaterSurface**	Percentage of the SOTER-unit that is largely (over 15%) and permanently (more than 10 months per year) covered by water	SOTER2009			
SoTerUnit	**potentialDrainageDensity**	PDD; an index for the degree of dissection of the SoTerUnit	SOTER2009			
SoTerUnit	**reliefIntensity**	The median difference between the highest and lowest point within the terrain per specified distance (m/km)	SOTER2009			
SoTerUnit	**slopeClass**	A refining of slope classes compared to those used for major landforms	SOTER2009			
				WO	0-0.5% flat, wet	
				FO	0.5-0.2% flat	
				GO	2-5% gently undulating	
				UO	5-10% undulating	
				RO	10-15% strongly sloping	
				SO	15-30% moderately steep	
				TO	30-45% steep	
				VO	45-60% very steep	
				EO	greater than 60% extremely steep	

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
SoTerUnit	**yearOfDataCollection**	The year in which the original soil and terrain data were collected serves as the time stamp for each SOTER unit. Where the SOTER unit has been derived from several sources of information, it is advised to use the major source for dating it.	SOTER2009			
TerrainComponent Data	**depthOfGroundwater**	The depth of the mean ground water level over a number of years as experienced in the terrain component	SOTER2009			
TerrainComponent Data	**depthToBedrock**	The average depth to consolidated bedrock	SOTER2009			
TerrainComponent Data	**dominantSlope**	Dominant slope gradient of the terrain component	SOTER2009			
TerrainComponent Data	**durationOfFlooding**	Duration of the flooding of the terrain component in classes after FAO -1990	SOTER2009			
				1	Less than 1 day	
				2	1-15 days	
				3	15-30 days	
				4	30-90 days	
				5	90-180 days	
				6	180-360 days	
				7	Continuously	

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
TerrainComponent Data	**formOfSlope**	The form of the dominant slope (only entered if the dominant slope gradient exceeds 2%)	SOTER2009			
				U	Uniform slope	Uniform (straight) slope
				C	Concave	lower slope with decreasing gradient down slope
				V	Convex	upper slope with decreasing gradient upslope
				I	Irregular slope	Irregular (complex) slope
TerrainComponent Data	**frequencyOfFlooding**	Frequency of the natural flooding of the terrain component in classes after FAO (1990)	SOTER2009			
				N	None	
				D	Daily	
				W	Weekly	
				M	Monthly	
				A	Annually	
				B	Biennually	
				F	Once every 2-5 years	
				T	Once every 5-10 years	
				R	Rare (less than once in every 10 years)	
				U	Unknown	
TerrainComponent Data	**lengthOfSlope**	Estimated dominant length of slope	SOTER2009			
TerrainComponent Data	**startOfFlooding**	Month(s) during which flooding of the terrain component normally starts	SOTER2009			

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
TerrainComponent Data	**surfaceDrainage**	Surface drainage of the terrain component	SOTER2009			
				E	Extremely slow	water ponds at the surface and large part of the terrain are waterlogged for continuous periods of more than 30 days
				S	Slow	water drains slowly, but most of the terrain does not remain waterlogged for more than 30 days continuously
				W	Well	water drains well but not excessively, nowhere does the terrain remain waterlogged for a continuous period of more than 48 hours
				R	Rapid	excess water drains rapidly, even during periods of prolonged rainfall
				V	Very rapid	excess water drains very rapidly, the terrain does not support growth of short rooted plants even if there is sufficient rainfall
TerrainComponent Data	**textureOfNonConsolidatedParentMaterial**	The texture group of particles less than 2 mm of the non-consolidated parent material, or the parent material at 2m if the soil is deeply developed	SOTER2009			
				Y	Very clayey	more than 60 % clay
				C	Clayey	sandy clay, silty clay and clay texture classes
				L	Loamy	loam, sandy clay loam, clay loam, silt, silt loam and silty clay loam texture classes
				S	Sandy	loamy sand and sandy loam texture classe
				X	Extremely sandy	sand texture classes
ErosionDeposition	**areaAffected**	The area affected by erosion or deposition. Classes according to UNEPISRIC -1988	SOTER2009			
				1	0-5%	
				2	5-10%	
				3	10-25%	

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
				4	25-50%	
				5	≥ 50%	
ErosionDeposition	**degreeOfErosion**	Degree of erosion in classes after FAO (1990)	SOTER2009			
				S	Slight	Some evidence of loss of surface horizons Original biotic functions largely intact
				M	Moderate	Clear evidence of removal or coverage of surface horizons. Original biotic functions partly destroyed
				V	Severe	Surface horizons completely removed (with subsurface horizons exposed) or covered up by sedimentation of material from upslope. Original biotic functions largely destroyed
				E	Extreme	Substantial removal of deeper subsurface horizons (badlands). Complete destructio of original biotic functions
SoilComponent	**positionInTerrainComponent**	The relative position of the soil component within the terrain component	SOTER2009			
				H	High	interfluve, crest or higher part of the terrain component
				M	Middle	upper and middle slope or any other medium position within the terrain component
				L	Low	lower slope or lower part of the terrain component
				D	Lowest	depression, valley bottom or any other lowest part of the terrain component
				A	All	positions within the terrain component
SoilComponent	**revidesLegend**	The characterization of the soil component according to the Revised Legend (FAO-Unesco 1988b)	SOTER2009			

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
SoilComponent	**rootableDepth**	Estimated depth to which root growth is unrestricted by physical or chemical impediments - in classes after FAO (1990)	SOTER2009			
				V	Very shallow (less than 30 cm)	
				S	Shallow (30-50 cm)	
				M	Moderately deep (50-100 cm)	
				D	Deep (100-150 cm)	
				X	Very deep (greater than 150 cm)	
SoilComponent	**sensitivityToCapping**	The degree in which the soil surface has a tendency to capping and sealing (FAO 1990)	SOTER2009			
				N	None	no capping or sealing observed
				W	Weak	the soil surface has a slight sensitivity to capping. Soft or slightly hard crust less than 0.5 cm thick.
				M	Moderate	the soil has a moderate sensitivity to capping. Soft or slightly hard crust more than 0.5 cm thick, or hard crust less than 0.5 cm thick.
				S	Strong	the soil surface has a strong sensitivity to capping. Hard and very hard crust more than 0.5 cm thick.
SoilComponent	**surfaceRockiness**	The percentage coverage of rock outcrops in classes after FAO (1990)	SOTER2009			
				N	None (0%)	
				V	Very few (0-2%)	
				F	Few (2-5%)	
				C	Common (5-15%)	
				M	Many (15-40%)	

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
				A	Abundant (40-80%)	
				D	Dominant (≥ 80%)	
SoilComponent	**surfaceStoniness**	The percentage cover of coarse fragments (greater than 0.2 cm), completely or partly at the surface, in classes after FAO (1990)	SOTER2009			
				N	None (0%)	
				V	Very few (0-2%)	
				F	Few (2-5%)	
				C	Common (5-15%)	
				M	Many (15-40%)	
				A	Abundant (40-80%)	
				D	Dominant (≥ 80%)	
SoilComponent	**texturalClassOfTheTopsoil**	Codes and classes are given according to CEC (1985) and ESB (1998)	SOTER2009			
				X	Undefined	synthetical profile
				0	No texture	peat and organic soil layers
				1	Coarse	clay less than 18 % and sand greater than 65 %
				2	Medium	clay between 18 % and 35 % and less tha 15 % sand or clay less than 18 % and sand between 15 % and 65 %
				3	Medium fine	less than 35 % clay and less than 15 % sand
				4	Fine	clay between 35% and 60 %
				5	Very fine	greater than 60 % clay
ErosionDeposition	**typeOfErosionDeposition**	Characterization of the erosion or deposition type according to FAO (1990)	SOTER2009			
				N	No visible evidence of erosio	
				S	Sheet erosion	
				R	Rill erosion	

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
				G	Gully erosion	
				T	Tunnel erosion	
				P	Deposition by water	
				W	Water and wind erosion	
				L	Wind deposition	
				A	Wind erosion and deposition	
				D	Shifting sand	
				Z	Salt deposition	
				M	Mass movement (landslides)	
				U	Type of erosion unknown	
SoilComponent	**WRBLegend**	Each soil component is characterized according to the WRB legend, which is based on selected classes of the World Reference Base for Soil Resources (IUSS 2007; Spaargaren et al. 2009)	SOTER2009			
Profile	**drainage**	The present drainage of the soil component, in classes after FAO (1990)	SOTER2009			
				E	Excessively drained	Water is removed from the soil very rapidly
				S	Somewhat excessively drained	Water is removed from the soil rapidly drained
				W	Well drained	Water is removed from the soil readily bu not rapidly
				M	Moderately well drained	Water is removed from the soil somewha slowly during some periods of the year. The soils are wet for short periods within rooting depth
				I	Imperfectly drained	Water is removed slowly so that the soils are wet at shallow depth for a considerable period

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
				P	Poorly drained	Water is removed so slowly that the soils are commonly wet for considerable periods. The soils commonly have a shallow water table
				V	Very poorly drained	Water is removed so slowly that the soils are wet at shallow depth for long periods. The soils have a very shallow water table
Profile	**landUseAtProfileLocation**	Code for the land use at the location of the soil profile at time of description/sampling	SOTER2009			
				S	Settlement/industries	Residential, industrial use.
				SR	Residential use	Cities.
				SI	Industrial use	Industries.
				ST	Transport	Roads, railways etc.
				SC	Recreation	In use for recreation.
				SX	Excavations	Land used for excavations, quarries.
				A	Agriculture	Land used for cultivation of crops.
				AA	Annual field cropping	One or more crops harvested within one year. Land under temporary crops.
				AA1	Shifting cultivation	Agricultural systems that involve an alternation between cropping for a few years on selected and cleared plots and a lengthy period when the soil is rested. Th land is cultivated for less than 33% of the year.
				AA2	Fallow system cultivation	Agricultural systems that involve an alternation of cropping periods and fallow periods. The land is cultivated between 3 and 67% of the growing seasons; bush or grass fallow are typical.
				AA3	Ley system cultivation	Several years of arable cropping are followed by several years of grass and legumes utilized for livestock production.
				AA4	Rainfed arable cultivation	Agricultural systems where the land is cultivated in more than 67% of the growing seasons.

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
				AA5	Wet rice cultivation	Annual field cropping system for the production of wetland rice. Paddies with or without controlled water supply and drainage system. Plots are inundated during at least some part of the cropping period.
				AA6	Irrigated cultivation	Annual field cropping system with an artificial supply of water, in addition to rain.
				AP	Perennial field cropping	Land under perennial crops. Crops harvested more than one year after planting. Examples of perennial field crop are sugar-cane, bananas, pineapples and sisal.
				AP1	Non-irrigated cultivation	
				AP2	Irrigated cultivation	
				AT	Tree and shrub cropping	Crops harvested annually or perennially; trees or shrubs produce more than one crop. Examples of tree crops are oil-palm, rubber, cacao, coconuts and cloves; typical shrub crops are coffee and tea.
				AT1	Non-irrigated tree crop cultivation	
				AT3	Non-irrigated shrub crop cultivation	
				AT4	Irrigated shrub crop cultivation	
				H	Animal husbandry	Animal products.
				HE	Extensive grazing	Grazing on natural or semi-natural grassland or savanna vegetation.
				HE1	Nomadism	Systems in which the animal owners do not have a permanent place of residence. No regular cultivation practices. People move with herds.
				HE2	Semi-nomadism	Animal owners have a permanent place o residence where supplementary cultivation is practised. Herds are moved to distant grazing areas.

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
				HE3	Ranching	Grazing within well defined boundaries, movements less distant and higher management level as compared to semi-nomadism.
				HI	Intensive grazing	Stationary animal husbandry. Grazing on permanent/semi-permanent improved grassland systems.
				HI1	Animal production	
				HI2	Dairying	
				F	Forestry	Activities related to the production of wood. Exploitation of forest for wood, with reforestation. A commercial activity.
				FN	Exploitation of natural forest and woodland	Wood is extracted from natural forest and woodland for commercial purpose.
				FN1	selective felling	Only selected species are removed from the natural vegetation.
				FN2	clear felling	All natural vegetation is cleared after which the area is reforested. This land use system develops into a plantation forestry system.
				FP	Plantation forestry	Forested areas. Relatively high management level. Homogeneous tree stands.
				M	Mixed farming	Activities concerning cropping and forestry or animal husbandry are mixed.
				MF	Agro-forestry	Combination of agriculture and forestry (with reforestation).
				MP	Agro-pastoralism	Combination of agriculture and animal husbandry, also called transhumance (farmers with a permanent place of residence send their herds, tended by herdsman, for long periods of time to distant grazing areas).
				E	Extraction/collecting	Extraction of products from the environment.
				EV	exploitation of natural vegetation	Land used for extraction of wood or other products from the vegetation; for domestic use.
				EH	hunting and fishing	Extraction of animals or fish from ecosystem.

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
				P	Nature protection	No, or low intensity of use, but under management system; low level of interference with natural environment or ecosystem.
				PN	Nature and game preservation	
				PN1	Reserves	
				PN2	Parks	
				PN3	Wildlife management	
				PD	Degradation control	Degradation of land, in most cases further degradation, is not desirable and the land is protected.
				PD1	Non-interference	All uses of the land are prohibited.
				PD2	Interference	The land is managed. Works are implemented in order to stop degradation and limit the degradation risk.
				U	Unused	Not used and not managed.
Profile	**phase**	Phases can be introduced to reflect a potentially limiting factor for soil management related to surface or subsurface features of the terrain component, that are not specifically described in the classification of the WRB unit. The coding for phases is bases on selected classes of the Revised Legend (FAO and ISRIC 1989)	SOTER2009			
Profile	**profileDescriptionStatus**	The soil profile description status refers to the inferred quality of the soil description and the completeness of analytical data.	SOTER2009			

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
				1	Reference profile description	All essential elements or details are complete. The accuracy and reliability of the description, sampling and analysis permit the full characterization of all soil horizons to a depth of 125 cm, or more if required for classification, or down to a C or R horizon, which may be shallower.
				2	Routine profile description	No essential elements are missing from the description, sampling or analysis. The number of samples collected is sufficient to characterize all major soil horizons, but may not allow precise definition of all sub horizons. The profile depth is 80 cm or more, or down to a C or R horizon, which may be shallower.
				3	Incomplete description	Certain relevant elements are missing from the description, insufficient samples were taken, or the reliability of the analytical data does not permit a complete characterization of the soil. However, the description may still be useful for specific purposes and provides satisfactory indication of the nature of the soil at high levels of soil classification.
				4	Other descriptions	Essential elements are missing from the description, preventing a satisfactory soil characterization and classification; may still be useful in data scarce regions.
Profile	**profileLocationStatus**	The conditions from which the profile locations were derived; it is indicative for the accuracy of the profile location	SOTER2009			
				1	derived from GPS measurements	
				2	converted from DMS data, available up to seconds	
				3	converted from DMS data, available only up to minutes	
				4	converted from other sources (location description etc)	

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
Profile	**samplingDate**	The sampling date of the profile in MM/YYYY format	SOTER2009			
Profile	**vegetationAtProfileLocation**	Codes for the (largely undisturbed) vegetation at the location of the profile at time of description	SOTER2009			
				I	Closed forest	Formed by trees at least 5 m tall with thei crowns interlocking.
				IA	Mainly evergreen forest	The canopy is never without green foliage However, individual trees may shed their leaves for that period.
				IA1	Tropical ombrophilous forest (tropical rain forest)	Consisting mainly of broad-leaved evergreen trees, neither cold nor drought resistant. Truly evergreen, i.e. the forest canopy remains green all year though individual trees may be
				IA2	Tropical and subtropical evergreen seasonal forest	Consisting mainly of broad-leaved evergreen trees. Foliage reduction during the dry season noticeable, often as partia shedding of leaves.
				IA3	Tropical and subtropical semi-deciduous forest	Most of the upper canopy trees deciduou or drought-resistant; many of the understorey trees and shrubs evergreen and more or less sclerophyllous3.
				IA4	Subtropical ombrophilous forest	Forest with a dry season and more pronounced temperature differences between summer and winter than tropica ombrophilous forest.
				IA5	Mangrove forest	Composed almost entirely of evergreen sclerophyllous broad-leaved trees/shrubs with either stilt roots or pneumatophores
				IA6	Temperate and subpolar evergreen ombrophilous forest	Consisting mostly of truly evergreen hemi sclerophyllous trees and shrubs. Rich in epiphytes and herbaceous ferns.
				IA7	Temperate evergreen seasonal broad-leaved forest	Consisting mainly of hemi-sclerophyllous evergreen trees and shrubs, rich in herbaceous undergrowth.

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
				IA8	Winter-rain evergreen broad leaved sclerophyllous forest (Mediterranean forest)	Consisting mainly of sclerophyllous evergreen trees and shrubs, most of them showing rough bark. Herbaceous undergrowth almost lacking.
				IA9	Tropical and subtropical evergreen needle-leaved forest	Consisting mainly of needle-leaved evergreen trees. Broad-leaved trees may be present.
				IA10	Temperate and subpolar evergreen needle-leaved forest	Consisting mainly of needle-leaved or scale-leaved evergreen trees, but broad-leaved trees may be admixed.
				IB	Mainly deciduous forest	Majority of trees shed their foliage simultaneously in connection with the unfavourable season.
				IB1	Tropical and subtropical drought-deciduous forest	Unfavourable season mainly characterized by drought, in most cases winter-drought. Foliage is shed regularly every year. Most trees with relatively thick, fissured bark.
				IB2	Cold-deciduous forest with evergreen trees (or shrubs)	Unfavourable season mainly characterized by winter frost. Deciduous broad-leaved trees dominant, but evergreen species present.
				IB3	Cold-deciduous forest without evergreen trees	Deciduous trees absolutely dominant.
				IC	Extremely xeromorphic forest	Dense stand of xeromorphic phanerophytes such as bottle trees, tuft trees with succulent leaves and stem succulents. Undergrowth with shrubs of similar xeromorphic adaptations.
				IC1	Sclerophyllous-dominated extremely xeromorphic forest	Predominance of sclerophyllous trees.
				IC2	Thorn forest	Species with thorny appendices predominate.
				IC3	Mainly succulent forest	Tree-formed and shrub-formed succulent
				II	Woodland	Composed of trees at least 5 m tall with crowns not usually touching but with a coverage of at least 40%.
				IIA	Mainly evergreen woodland	The canopy is never without green foliage

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
				IIA1	Evergreen broad-leaved woodland	Mainly sclerophyllous trees and shrubs.
				IIA2	Evergreen needle-leaved forest	Mainly needle-leaved or scale-leaved.
				IIB	Mainly deciduous woodland	Majority of trees shed their foliage simultaneously in connection with the unfavourable season.
				IIB1	Drought deciduous woodland	Unfavourable season mainly characterized by winter-drought. Foliage is shed regularly every year. Most trees with relatively thick, fissured bark.
				IIB2	Cold-deciduous woodland with evergreen trees	Unfavourable season mainly characterized by winter frost. Deciduous broad-leaved trees dominant, but evergreen species present.
				IIB3	Cold-deciduous woodland without evergreen trees	Deciduous trees absolutely dominant.
				IIC	Extremely xeromorphic woodland	Open stand of xeromorphic phanerophytes such as bottle trees, tuft trees with succulent leaves and stem succulents. Undergrowth with shrubs of similar xeromorphic adaptations.
				IIC1	Sclerophyllous-dominated extremely xeromorphic woodland	Predominance of sclerophyllous trees.
				IIC2	Thorn woodland	Species with thorny appendices predominate.
				IIC3	Mainly succulent woodland	Tree-formed and shrub-formed succulent
				III	Scrub (shrubland or thicket)	Mainly composed of woody plants 0.5 to 5 m tall. Subdivisions: - Shrubland: most o the individual shrubs not touching each other; often grass undergrowth; -Thicket: individual shrubs interlocked
				IIIA	Mainly evergreen scrub	The canopy is never without green foliage However, individual shrubs may shed thei leaves.
				IIIA1	Evergreen broad-leaved shrubland (or thicket)	Mainly sclerophyllous shrubs.

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
				IIIA2	Evergreen needle-leaved and microphyllous shrubland (or thicket)	Mainly needle-leaved or scale-leaved shrubs.
				IIIB	Mainly deciduous scrub	Majority of shrubs shed their foliage simultaneously in connection with the un favourable season.
				IIIB1	Drought-deciduous scrub with evergreen woody plants admixed	
				IIIB2	Drought-deciduous scrub without evergreen woody plants admixed	
				IIIB3	Cold-deciduous scrub	
				IIIC	Extremely xeromorphic (subdesert) shrubland	Very open stands of shrubs with various xerophytic adaptations, such as extremely scleromorphic or strongly reduced leaves, green branches without leaves, or succulents stems, etc., some of them with thorns.
				IIIC1	Mainly evergreen subdesert shrubland	In extremely dry years some leaves and shoot portions may be shed.
				IIIC2	Deciduous subdesert shrubland	Mainly deciduous shrubs, often with a few evergreens
				VA1	Tall grassland with a tree synusia5 covering 10-40%	More or less like a very open woodland.
				VA2	Tall grassland with a tree synusia covering less than 10%	
				VA3	Tall grassland with a synusia of shrubs	
				VA4	Tall grassland with a woody synusia consisting mainly of tuft plants (usually palms)	
				VA5	Tall grassland practically without woody synusia	
				VB	Medium tall grassland	The dominant graminoid growth forms are 50 cm to 2 m tall. Forbs cover less than 50%.
				VB1	Medium tall grassland with a tree synusia covering 10-40%	

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
				VB2	Medium tall grassland with a tree synusia covering less than 10%	
				VB3	Medium tall grassland with a synusia of shrubs	
				VB4	Medium tall grassland with an open synusia of tuft plants (usually palms)	
				VB5	Medium tall grassland practically without woody synusia	
				VC	Short grassland	The dominant graminoid growth forms are less than 50 cm tall. Forbs cover less than 50%.
				VC1	Short grassland with a tree synusia covering 10-40%	
				VC2	Short grassland with a tree synusia covering less than 10%	
				VC3	Short grassland with a synusia of shrubs	
				VC4	Short grassland with an open synusia of tuft plants (usually palms)	
				VC5	Short grassland practically without woody synusia	
				VC6	Short to medium tall mesophytic grassland	
				VC7	Graminoid tundra	
				VD	Forb vegetation	Mainly forbs, graminoid cover less than 50%.
				VD1	Tall forb communities	Dominant forb growth forms are more than 1 m tall.
				VD2	Low forb communities	Dominant forb growth forms are less thar 1 m tall.
				VE	Hydromorphic fresh-water vegetation	
				VE1	Rooted fresh-water communities	

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
				VE2	Free floating fresh-water communities	
Horizon	**abundanceOfCoarseFragments**	Abundance of any rock or mineral fragments in the horizon, in classes of volume% of rock or mineral fragments (greater than 2 mm) in the soil matrix (FAO, 1990)	SOTER2009			
				N	None (0%)	
				V	Very few (0-2%)	
				F	Few (2-5%)	
				C	Common (5-15%)	
				M	Many (15-40%)	
				A	Abundant (40-80%)	
				D	Dominant (≥ 80%)	
Horizon	**abundanceOfMineralConcretions**	Classes of volume percentages of concretions and/or mineral nodules in the soil matrix after (FAO 2006; FAO and ISRIC 1990)	SOTER2009			
				N	None (0%)	
				V	Very few (0-2%)	
				F	Few (2-5%)	
				C	Common (5-15%)	
				M	Many (15-40%)	
				A	Abundant (40-80%)	
				D	Dominant (≥ 80%)	
Horizon	**abundanceOfMottles**	The abundance of mottles in the horizon	SOTER2009			
				N	None (0%)	
				V	Very few (0-2%)	
				F	Few (2-5%)	
				C	Common (5-15%)	

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
				M	Many (15-40%)	
				A	Abundant (greater than 40%	
Horizon	**AlOxalateExtractable**	The Al fraction, in weight %, extractable in oxalate acid.	SOTER2009			
Horizon	**bulkDensity**	The bulk density	SOTER2009			
Horizon	**CECSoil**	The cation exchange capacity of the soil at pH 7.0	SOTER2009			
Horizon	**clay**	Weight% of particles less than 0.002 mm (clay) in fine earth fraction	SOTER2009			
Horizon	**clayMineralogy**	The dominant type of mineral in the clay fraction	SOTER2009			
				AL	Allophane	
				CH	Chloritic	
				IL	Illitic	
				IN	Interstratified or mixed	
				KA	Kaolinitic	
				MO	Montmorilonitic	
				SE	Sesquioxidic	
				VE	Vermiculitic	
Horizon	**coarseSand**	Weight% of particles 1.0-0.5 mm (coarse sand) in fine earth fraction	SOTER2009			
Horizon	**distinctnessOfTransition**	Abruptness of horizon boundary to underlying horizon (FAO, 1990)	SOTER2009			

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
				A	Abrupt (0-2 cm)	
				C	Clear (2-5 cm)	
				G	Gradual (5-15 cm)	
				D	Diffuse (≥ 15 cm)	
Horizon	**dryColour**	The Munsell colours of the dry soil matrix	SOTER2009			
Horizon	**EC**	The electrical conductivity determined in a 1:x soil-water mixture, in dS/m.	SOTER2009			
Horizon	**ECE**	The electrical conductivity of saturation extract	SOTER2009			
Horizon	**exchangeableAcidity**	The Exchangeable acidity, as determined in 1M KCl	SOTER2009			
Horizon	**exchangeableAl**	The Exchangeable Al+++	SOTER2009			
Horizon	**exchangeableCa**	The Exchangeable Ca++	SOTER2009			
Horizon	**exchangeableK**	The Exchangeable K+	SOTER2009			
Horizon	**exchangeableMg**	The Exchangeable Mg++	SOTER2009			
Horizon	**exchangeableNa**	The Exchangeable Na+	SOTER2009			

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
Horizon	**FeDithioniteExtractable**	The Fe fraction, in weight %, extractable in dithionite citrate.	SOTER2009			
Horizon	**FeOxalateExtractable**	The Fe fraction, in weight %, extractable in oxalate acid.	SOTER2009			
Horizon	**fineSand**	Weight% of particles 0.25-0.1 mm (fine sand) in fine earth fraction	SOTER2009			
Horizon	**gradeOfStructure**	Grade of structure, defined according to FAO (1990)	SOTER2009			
				N	Structureless	apedal soil with no observable aggregation or no orderly arrangement of natural planes of weakness (massive or single grain)
				W	Weak	soil with poorly formed indistinct peds, that are barely observable in place even i dry soil, breaks up into very few intact peds, many broken peds and much apeda material
				M	Moderate	soil with well-formed distinct peds, durable and evident in disturbed soil that produces many entire peds, some broken peds and little apedal material
				S	Strong	soil with durable peds that is clearly evident in undisturbed (dry) soil, which breaks up mainly into entire peds
Horizon	**gypsum**	The gypsum content	SOTER2009			
Horizon	**horizon**	Characterization of diagnostic horizons is according to the World Reference Base for Soil Resources 2nd edition (IUSS 2006, 2007).	WRB2007			

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
				Albic		The albic horizon (from Latin albus, white) is a light-coloured subsurface horizon from which clay and free iron oxides have been removed, or in which the oxides have been segregated to the extent that the colour of the horizon is determined by the colour of the sand and silt particles rather than by coatings on these particles It generally has a weakly expressed soil structure or lacks structural development altogether. The upper and lower boundaries are normally abrupt or clear. The morphology of the boundaries is variable and sometimes associated with albeluvic tonguing. Albic horizons usually have coarser textures than the overlying or underlying horizons. However, with respect to an underlying spodic horizon, this difference may only be slight. Many albic horizons are associated with wetnes and contain evidence of reducing conditions.
				Anthraquic		An anthraquic horizon (from Greek anthropos, human, and Latin aqua, water) is a human-induced surface horizon that comprises a puddled layer and a plough pan.
				Anthric		An anthric horizon (from Greek anthropos, human) is a moderately thick, dark-coloured surface horizon that is the result of long-term cultivation (ploughing, liming, fertilization, etc.).

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
				Argic		The argic horizon (from Latin argilla, white clay) is a subsurface horizon with distinctly higher clay content than the overlying horizon. The textural differentiation may be caused by: • an illuvial accumulation of clay; • predominant pedogenetic formation of clay in the subsoil; • destruction of clay in the surface horizon; • selective surface erosion of clay; • upward movement of coarser particles due to swelling and shrinking; • biological activity; • a combination of two or more of these different processes. Sedimentation of surface materials that are coarser than the subsurface horizon may enhance a pedogenetic textural differentiation. However, a mere lithological discontinuity, such as may occur in alluvial deposits, does not qualify as an argic horizon. Soils with argic horizons often have a specific set of morphological, physico-chemical and mineralogical properties other than a mere clay increase. These properties allow various types of argic horizons to be distinguished and their pathways of development to be traced (Sombroek, 1986).
				Calcic		The calcic horizon (from Latin calx, lime) is a horizon in which secondary calcium carbonate (CaCO3) has accumulated in a diffuse form (calcium carbonate present only in the form of fine particles of less than 1 mm, dispersed in the matrix) or as discontinuous concentrations (pseudomycelia, cutans, soft and hard nodules, or veins). The accumulation may be in the parent material or in subsurface horizons, but it can also occur in surface horizons. If the accumulation of soft carbonates becomes such that all or most of the pedological and/or lithological structures disappear and continuous concentrations of calcium carbonate prevail, a hypercalcic qualifier is used.

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
				Cambic		The cambic horizon (from Italian cambiare, to change) is a subsurface horizon showing evidence of alteration relative to the underlying horizons.
				Cryic		The cryic horizon (from Greek kryos, cold, ice) is a perennially frozen soil horizon in mineral or organic materials.
				Duric		The duric horizon (from Latin durus, hard) is a subsurface horizon showing weakly cemented to indurated nodules or concretions cemented by silica (SiO2), presumably in the form of opal and microcrystalline forms of silica (durinodes). Durinodes often have carbonate coatings that have to be removed with HCl before slaking the durinodes with potassium hydroxide (KOH).
				Ferralic		The ferralic horizon (from Latin ferrum, iron, and alumen, alum) is a subsurface horizon resulting from long and intense weathering in which the clay fraction is dominated by low-activity clays and the silt and sand fractions by highly resistant minerals, such as (hydr)oxides of Fe, Al, Mn and titanium (Ti).
				Ferric		The ferric horizon (from Latin ferrum, iron) is one in which segregation of Fe, or Fe and manganese (Mn), has taken place to such an extent that large mottles or discrete nodules have formed and the intermottle/internodular matrix is largely depleted of Fe. Generally, such segregation leads to poor aggregation of the soil particles in Fe-depleted zones and compaction of the horizon.
				Folic		The folic horizon (from Latin folium, leaf) is a surface horizon, or a subsurface horizon occurring at shallow depth, that consists of well-aerated organic material.

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
				Fragic		The fragic horizon (from Latin frangere, to break) is a natural non-cemented subsurface horizon with pedality and a porosity pattern such that roots and percolating water penetrate the soil only along interped faces and streaks. The natural character excludes plough pans and surface traffic pans.
				Fulvic		The fulvic horizon (from Latin fulvus, dark yellow) is a thick, dark-coloured horizon at or near to the surface that is typically associated with short-range-order minerals (commonly allophane) or with organo-aluminium complexes. It has a low bulk density and contains highly humified organic matter that shows a lower ratio of humic acids to fulvic acids compared with the melanic horizon.
				Gypsic		The gypsic horizon (from Greek gypsos) is a commonly non-cemented horizon containing secondary accumulations of gypsum (CaSO4.2H2O) in various forms. If the accumulation of gypsum becomes such that all or most of the pedological and/or lithological structures disappear and continuous concentrations of gypsum prevail, a hypergypsic qualifier is used.
				Histic		The histic horizon (from Greek histos, tissue) is a surface horizon, or a subsurface horizon occurring at shallow depth, that consists of poorly aerated organic material.
				Hortic		A hortic horizon (from Latin hortus, garden) is a human-induced mineral surface horizon that results from deep cultivation, intensive fertilization and/or long-continued application of human and animal wastes and other organic residues (e.g. manures, kitchen refuse, compost and night soil).
				Hydragric		A hydragric horizon (from Greek hydor, water, and Latin ager, field) is a human-induced subsurface horizon associated with wet cultivation.

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
				Irragric		The irragric horizon (from Latin irrigare, to irrigate, and ager, field) is a human-induced mineral surface horizon that builds up gradually through continuous application of irrigation water with substantial amounts of sediments, and which may include fertilizers, soluble salts organic matter, etc.
				Melanic		The melanic horizon (from Greek melas, black) is a thick, black horizon at or near the surface, which is typically associated with short-range-order minerals (commonly allophane) or with organo-aluminium complexes. It has a low bulk density and contains highly humified organic matter that shows a lower ratio of fulvic acids to humic acids compared with the fulvic horizon.
				Mollic		The mollic horizon (from Latin mollis, soft) is a thick, well-structured, dark-coloured surface horizon with a high base saturation and a moderate to high content of organic matter.
				Natric		The natric horizon (from Arabic natroon, salt) is a dense subsurface horizon with distinct higher clay content than the overlying horizon or horizons. It has a high content in exchangeable Na and/or Mg.
				Nitic		The nitic horizon (from Latin nitidus, shiny) is a clay-rich subsurface horizon. It has moderately to strongly developed polyhedric structure breaking to flat-edged or nutty elements with many shiny ped faces, which cannot or can only partially be attributed to clay illuviation.
				Petrocalcic		A petrocalcic horizon (from Greek petros, rock, and Latin calx, lime) is an indurated calcic horizon that is cemented by calcium carbonate and, in places, by calcium and some magnesium carbonate. It is either massive or platy in nature, and extremely hard.

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
				Petroduric		A petroduric horizon (from Greek petros, rock, and Latin durus, hard), also known as duripan or dorbank (South Africa), is a subsurface horizon, usually reddish or reddish brown in colour, that is cemented mainly by secondary silica (SiO2, presumably opal and microcrystalline forms of silica). Air-dry fragments of petroduric horizons do not slake in water, even after prolonged wetting. Calcium carbonate may be present as accessory cementing agent.
				Petrogypsic		A petrogypsic horizon (from Greek petros rock, and gypsos) is a cemented horizon containing secondary accumulations of gypsum (CaSO4.2H2O).
				Petroplinthic		A petroplinthic horizon (from Greek petros, rock, and plinthos, brick) is a continuous, fractured or broken layer of indurated material, in which Fe (and in cases also Mn) is an important cement and in which organic matter is either absent or present only in traces.
				Pisoplinthic		A pisoplinthic horizon (from Latin pisum, pea, and Greek plinthos, brick) contains nodules that are strongly cemented to indurated with Fe (and in some cases also with Mn).
				Plaggic		A plaggic horizon (from Dutch plag, sod) is a black or brown human-induced mineral surface horizon that has been produced by long-continued manuring. In medieval times, sod and other materials were commonly used for bedding livestock and the manure was spread on fields being cultivated. The mineral materials brought in by this kind of manuring eventually produced an appreciably thickened horizon (in places as much as 100 cm or more thick) that is rich in organic carbon. Base saturation is typically low.

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
				Plinthic		A plinthic horizon (from Greek plinthos, brick) is a subsurface horizon that consists of an Fe-rich (in some cases also Mn-rich) humus-poor mixture of kaolinitic clay (and other products of strong weathering, such as gibbsite) with quartz and other constituents, and which changes irreversibly to a layer with hard nodules, a hardpan or irregular fragments on exposure to repeated wetting and drying with free access of oxygen.
				Salic		The salic horizon (from Latin sal, salt) is a surface or shallow subsurface horizon that contains a secondary enrichment of readily soluble salts, i.e. salts more soluble than gypsum (CaSO4.2H2O; log Ks = -4.85 at 25 °C).
				Sombric		A sombric horizon (from French sombre, dark) is a dark-coloured subsurface horizon containing illuvial humus that is neither associated with Al nor dispersed by Na.
				Spodic		The spodic horizon (from Greek spodos, wood ash) is a subsurface horizon that contains illuvial amorphous substances composed of organic matter and Al, or of illuvial Fe. The illuvial materials are characterized by a high pH-dependent charge, a relatively large surface area and high water retention.
				Takyric		A takyric horizon (from Turkic languages takyr, barren land) is a heavy-textured surface horizon comprising a surface crust and a platy structured lower part. It occurs under arid conditions in periodically flooded soils.
				Terric		A terric horizon (from Latin terra, earth) is a human-induced mineral surface horizon that develops through addition of earthy manures, compost, beach sands or mud over a long period of time. It builds up gradually and may contain stones, randomly sorted and distributed.

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
				Thionic		The thionic horizon (from Greek theion, sulphur) is an extremely acid subsurface horizon in which sulphuric acid is formed through oxidation of sulphides.
				Umbric		The umbric horizon (from Latin umbra, shade) is a thick, dark-coloured surface horizon with a low base saturation and a moderate to high content of organic matter.
				Vertic		The vertic horizon (from Latin vertere, to turn) is a clayey subsurface horizon that, as a result of shrinking and swelling, has slickensides and wedge-shaped structural aggregates.
				Voronic		The voronic horizon (from Russian voronoj, black) is a special type of mollic horizon. It is a deep, well-structured, blackish surface horizon with a high base saturation, a high content of organic matter and a high biological activity.
				Yermic		The yermic horizon (from Spanish yermo, desert) is a surface horizon that usually, but not always, consists of surface accumulations of rock fragments (desert pavement) embedded in a loamy vesicula layer that may be covered by a thin aeolian sand or loess layer.
Horizon	**horizonDesignation**	Master horizon with subordinate characteristics according to the rules given ir the Procedures Manual	SOTER2009			
Horizon	**lowerHorizonBoundary**	The average depth in cm of the lower boundary of each horizon	SOTER2009			

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
Horizon	**material**	Diagnostic soil materials are intended to reflect (partly) the properties of the original parent materials, in which pedogenetic processes have not yet been very active, so they have only slightly influenced the soil and have not lead to significant changes.	WRB2007			
				Artefacts		Artefacts (from Latin ars, art, and facere, to make) are solid or liquid substances that are: 1. one or both of the following: a. created or substantially modified by humans as part of an industrial or artisanal manufacturing process; or b. brought to the surface by human activity from a depth where they were not influenced by surface processes, with properties substantially different from the environment where they are placed; and 2. have substantially the same properties as when first manufactured, modified or excavated. Examples of artefacts are bricks, pottery, glass, crushed or dressed stone, industrial waste, garbage, processed oil products, mine spoil and crude oil.
				CalcaricMaterial		Calcaric material (from Latin calcarius) effervescences strongly with 1 M HCl in most of the fine earth. It applies to material that contains 2 percent or more calcium carbonate equivalent.
				ColluvicMaterial		Colluvic material (from Latin colluvio, mixture) is formed by sedimentation through human-induced erosion. It normally accumulates in foot slope positions, in depressions or above hedge walls. The erosion may have taken place since Neolithic times.
				FluvicMaterial		Fluvic material (from Latin fluvius, river) refers to fluviatile, marine and lacustrine sediments that receive fresh material at regular intervals or have received it in the recent past40.

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
				GypsiricMaterial		Gypsiric material (from Greek gypsos) is mineral material that contains 5 percent or more gypsum (by volume).
				LimnicMaterial		Limnic material (from Greek limnae, pool) includes both organic and mineral materials that are: 1. deposited in water by precipitation or through action of aquatic organisms, such as diatoms and other algae; or 2. derived from underwater and floating aquatic plants and subsequently modified by aquatic animals.
				MineralMaterial		In mineral material (from Celtic mine, mineral), the soil properties are dominated by mineral components.
				OrganicMaterial		Organic material (from Greek organon, tool) consists of a large amount of organi debris that accumulates at the surface under either wet or dry conditions and in which the mineral component does not significantly influence the soil properties.
				OrnithogenicMaterial		Ornithogenic material (from Greek ornithos, bird, and genesis, origin) is material with strong influence of bird excrement. It often has a high content of gravel that has been transported by birds.
				SulphidicMaterial		Sulphidic material (from English sulphide) is a waterlogged deposit containing S, mostly in the form of sulphides, and only moderate amounts of calcium carbonate.
				TechnicHardRock		Technic hard rock (from Greek technikos, skilfully made or constructed) is consolidated material resulting from an industrial process, with properties substantially different from those of natural materials.

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
				TephricMaterial		Tephric material (from Greek tephra, pile ash) consists either of tephra, i.e. unconsolidated, non- or only slightly weathered pyroclastic products of volcanic eruptions (including ash, cinders, lapilli, pumice, pumice-like vesicular pyroclastics, blocks and volcanic bombs), or of tephric deposits, i.e. tephra that has been reworked and mixed with material from other sources. This includes tephric loess, tephric blown sand and volcanogenic alluvium.
Horizon	**mediumSand**	Weight% of particles 0.5-0.25 mm (medium sand) in fine earth fraction	SOTER2009			
Horizon	**moistColour**	The Munsell colours of the moist soil matrix	SOTER2009			
Horizon	**moisturePerTension**	Moisture in different tensions	SOTER2009			
Horizon	**natureOfMineralConcretions**	The nature of mineral nodules and concretions according to general classes of the dominant constituents (FAO 2006; FAO and ISRIC 1990)	SOTER2009			
				R	Residential rock fragment	
				Q	Silica (siliceous)	
				F	Iron (ferruginous)	
				M	Manganese (manganiferous)	
				I	Iron-manganese (sesquioxides)	
				K	Carbonates (calcareous)	
				G	Gypsum (gypsiferous)	
				S	Salt (saline)	

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
				U	Sulphur (sulphurous)	
				N	Not known	
Horizon	**organicCarbon**	The content of organic carbon in g/kg of the soil layer (desirable for the A horizon or the first 25 cm, whatever is deeper).	SOTER2009			
Horizon	**particleSizeClass**	The particle size class as derived from the particle size analysis results.	SOTER2009			
				S	Sand	
				LS	Loamy sand	
				SL	Sandy loam	
				SIL	Silty loam	
				SI	Silt	
				L	Loam	
				SCL	Sandy clay loam	
				CL	Clay loam	
				SICL	Silty clay loam	
				SC	Sandy clay	
				SIC	Silty clay	
				C	Clay	
Horizon	**PAvailable**	The available P-content of the soil in mg/Kg.	SOTER2009			
Horizon	**pHH2O**	The pH as determined in the supernatant suspension of a 1:2.5 soil-water mixture	SOTER2009			
Horizon	**pHKCl**	The pH as determined in the supernatant suspension of a 1:2.5 soil-1 M KCl	SOTER2009			

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
Horizon	**PhosphateRetention**	Phosphate retention	SOTER2009			
Horizon	**property**	Diagnostic property characterization uses the definitions described in the World Reference Base for Soil Resources (IUSS 2007).	WRB2007			
				AbruptTexturalChange		An abrupt textural change (from Latin abruptus) is a very sharp increase in clay content within a limited depth range.
				AlbeluvicTonguing		The term albeluvic tonguing (from Latin albus, white, and eluere, to wash out) is connotative of penetrations of clay- and Fe-depleted material into an argic horizon When peds are present, albeluvic tongues occur along ped surfaces.

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
				Andic		Andic properties (from Japanese an, dark, and do, soil) result from moderate weathering of mainly pyroclastic deposits However, some soils develop andic properties from non-volcanic materials (e.g. loess, argillite and ferralitic weathering products). The presence of short-range-order minerals and/or organc metallic complexes is characteristic for andic properties. These minerals and complexes are commonly part of the weathering sequence in pyroclastic deposits (tephric soil material vitric properties andic properties). Andic properties may be found at the soil surface or in the subsurface, commonly occurring as layers. Many surface layers with andic properties contain a high amount of organic matter (more than 5 percent), are commonly very dark coloured (Munsell value and chroma, moist, are 3 or less), have a fluffy macrostructure and, in some places, a smeary consistence. They have a low bulk density and commonly have a silt loam or finer texture. Andic surface layers rich in organic matter may be very thick, having a thickness of 50 cm or more (pachic characteristic) in some soils. Andic subsurface layers are generally somewhat lighter coloured. Andic layers may have different characteristics, depending on th type of the dominant weathering process acting upon the soil material. They may exhibit thixotropy, i.e. the soil material changes, under pressure or by rubbing, from a plastic solid into a liquefied stage and back into the solid condition. In perhumid climates, humus-rich andic layers may contain more than twice the water content of samples that have been oven-dried and rewetted (hydric characteristic). Two major types of andic properties are recognized: one in which allophane and similar minerals are predominant (the sil-andic type); and one in which Al complexed by organic acids

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
				Andic		prevails (the alu-andic type). The sil-andic property typically gives a strongly acid to neutral soil reaction, while the alu-andic property gives an extremely acid to acid reaction.
				Aridic		The term aridic properties (from Latin aridus, dry) combines a number of properties that are common in surface horizons of soils occurring under arid conditions and where pedogenesis exceeds new accumulation at the soil surface by aeolian or alluvial activity.
				ContinuousRock		Continuous rock is consolidated material underlying the soil, exclusive of cementec pedogenetic horizons such as petrocalcic, petroduric, petrogypsic and petroplinthic horizons. Continuous rock is sufficiently consolidated to remain intact when an air dried specimen 25–30 mm on a side is submerged in water for 1 hour. The material is considered continuous only if cracks into which roots can enter are on average 10 cm or more apart and occupy less than 20 percent (by volume) of the continuous rock, with no significant displacement of the rock having taken place.
				Ferralic		Ferralic properties (from Latin ferrum, iron, and alumen, alum) refer to mineral soil material that has a relatively low CEC. It also includes soil materials that fulfil th requirements of a ferralic horizon except texture.
				Geric		Geric properties (from Greek geraios, old) refer to mineral soil material that has a very low ECEC or even acts as an anion exchanger.
				GleyicColourPattern		Soil materials develop a gleyic colour pattern (from Russian gley, mucky soil mass) if they are saturated with groundwater (or were saturated in the past, if now drained) for a period that allows reducing conditions to occur (this may range from a few days in the tropics to a few weeks in other areas).

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
				LithologicalDiscontinuity		Lithological discontinuities (from Greek lithos, stone, and Latin continuare, to continue) are significant changes in particle-size distribution or mineralogy that represent differences in lithology within a soil. A lithological discontinuity can also denote an age difference.
				ReducingConditions		Reducing conditions (from Latin reducere show one or more of the following: 1. a negative logarithm of the hydrogen partia pressure (rH) of less than 20; or 2. the presence of free Fe2+, as shown on a freshly broken and smoothed surface of a field-wet soil by the appearance of a strong red colour after wetting it with a 0.2-percent α,α, dipyridyl solution in 10-percent acetic acid37; or 3. the presence of iron sulphide; or 4. the presence of methane.
				SecondaryCarbonates		The term secondary carbonates (from Latin carbo, coal) refers to lime, precipitated in place from the soil solutio rather than inherited from a soil parent material. As a diagnostic property, it should be present in significant quantities
				StagnicColourPattern		Soil materials develop a stagnic colour pattern (from Latin stagnare, to stagnate) if they are, at least temporarily, saturated with surface water (or were saturated in the past, if now drained) for a period long enough that allows reducing conditions to occur (this may range from a few days in the tropics to a few weeks in other areas)
				Vertic		Soil material with vertic properties (from Latin vertere, to turn) has one or both of the following: 1. 30 percent or more clay throughout a thickness of 15 cm or more and one or both of the following: a. slickensides or wedge-shaped aggregates; or b. cracks that open and close periodically and are 1 cm or more wide; or 2. a COLE of 0.06 or more averaged over depth of 100 cm from the soil surface.

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
				Vitric		Vitric properties (from Latin vitrum, glass) apply to layers with volcanic glass and other primary minerals derived from volcanic ejecta and which contain a limited amount of short-range-order minerals or organo-metallic complexes.
Horizon	**PTotal**	The total P-content of the soi in mg/Kg.	SOTER2009			
Horizon	**silt**	Weight% of particles 0.05-0.002 mm (silt) in fine earth fraction	SOTER2009			
Horizon	**sizeOfCoarseFragments**	Size of dominant rock or mineral fragments in classes (FAO, 1990)	SOTER2009			
				F	Fine gravel (0.2-0.6 cm)	
				M	Medium gravel (0.6-2 cm)	
				C	Coarse gravel (2-6 cm)	
				S	Stones (6-20 cm)	
				B	Boulders (20-60 cm)	
				L	Large boulders (greater than 60 cm)	
Horizon	**sizeOfMineralConcretions**	Size of dominant concretions and/or nodules (FAO 2006; FAO and ISRIC 1990)	SOTER2009			
				V	Very fine (less than 2 mm)	
				F	Fine (2-6 mm)	
				M	Medium (6-20 mm)	
				C	Coarse (≥ 20 mm)	
Horizon	**sizeOfMottles**	Size classes of individual mottles	SOTER2009			
				V	Very fine (less than 2 mm)	
				F	Fine (2-6 mm)	

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
				M	Medium (6-20 mm)	
				C	Coarse (≥ 20 mm)	
Horizon	**sizeOfStructureElements**	Size of structure elements, defined according to FAO (1990)	SOTER2009			
				V	Very fine	
				F	Fine	
				M	Medium	
				C	Coarse	
				X	Very coarse	
				E	Extremely coarse	
Horizon	**solubleCa**	The soluble Ca++ content of the saturated paste	SOTER2009			
Horizon	**solubleCl**	The soluble Cl- content of the saturated paste	SOTER2009			
Horizon	**solubleCO3**	The soluble CO3	SOTER2009			
Horizon	**solubleHCO3**	The soluble HCO3	SOTER2009			
Horizon	**solubleK**	The soluble K+ content of the saturated paste	SOTER2009			
Horizon	**solubleMg**	The soluble Mg++ content of the saturated paste	SOTER2009			
Horizon	**solubleNa**	The soluble Na+ content of the saturated paste	SOTER2009			

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
Horizon	**solubleSO4**	The soluble SO4	SOTER2009			
Horizon	**totalCarbon**	The content of total organic carbon	SOTER2009			
Horizon	**totalCarbonateEquivalent**	The content of carbonates	SOTER2009			
Horizon	**totalNitrogen**	The content of total N	SOTER2009			
Horizon	**totalSand**	Weight% of particles 2.0-0.05 mm (sand) in fine earth fraction. The total sand fraction, either as an absolute value, or as the sum of the subfractions.	SOTER2009			
Horizon	**typeOfStructure**	Type of structure, defined according to FAO (1990)	SOTER2009			
				P	Platy	particles arranged around a generally horizontal plane
				R	Prismatic	prisms with rounded caps
				C	Columnar	prisms with rounded caps
				A	Angular blocky	bounded by plains intersecting at largely sharp angles
				S	Subangular blocky	mixed rounded and plane faces with vertices mostly rounded
				G	Granular	spheroidical or polyhedral, relatively non-porous
				B	Crumb	spheroidical or polyhedral, porous
				M	Massive	no structure visible, coherent porous (apedal soil)
				N	Single grain	no structure, individual grains
				W	Wedge shaped	structure in horizons with slickensides

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
				K	Rock structure	includes fine stratification in unconsolidated materials to unweatherec minerals in saprolite (consolidated rocks)
Horizon	**upperHorizonBoundary**	The average depth in cm of the upper (top) boundary of each horizon	SOTER2009			
Horizon	**veryCoarseSand**	Weight% of particles 2.0-1.0 mm (very coarse sand) in fine earth fraction	SOTER2009			
Horizon	**veryFineSand**	Weight% of particles 0.1-0.05 mm (very fine sand) in fine earth fraction	SOTER2009			
SourceMap	**maximumLatitude**	The maximum latitude (Y-coordinate) of the source map, in decimal degrees. Latitudes in the southern hemisphere are negative	SOTER2009			
SourceMap	**maximumLongitude**	The maximum longitude (X-coordinate) of the source map, in decimal degrees. Longitudes in the western hemisphere are negative	SOTER2009			
SourceMap	**minimumLatitude**	The minimum latitude (Y-coordinate) of the source map, in decimal, degrees. Latitudes in the southern hemisphere are negative	SOTER2009			

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
SourceMap	**minimumLongitude**	The minimum longitude (X-coordinate) of the source map, in decimal degrees. Longitudes in the western hemisphere are negative	SOTER2009			
Laboratory	**name**	The name of the laboratory, in full.	SOTER2009			
SourceMap	**scale**	The scale of the source map as the denominator of a representative	SOTER2009			
SourceMap	**title**	The title of the source map	SOTER2009			
SourceMap	**typeOfSourceMap**	The type of source map	SOTER2009			
				S	Pure soil map	
				M	Morpho-pedological map (soil landscapes)	
				O	Other map	
SourceMap	**year**	The year of publication of the source map	SOTER2009			
ParentMaterial	**parentMaterial**	Enumeration of lithology codes associated to parent material (of TerrainComponent) or dominant parent material (of SoTerUnit) also known as General/Surface Lithology in SOTER2002	SOTER2009			
				I	Igneous rock	
				IA	Acid igneous rock	
				IA1	Granite	

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
				IA2	Grano-diorite	
				IA3	Quartz-diorite	
				IA4	Rhyiolite	
				II	Intermediate igneous rock	
				II1	Andesite, trachyte, phonolite	
				II2	Diorite-syenite	
				IB	Basic igneous rock	
				IB1	Gabbro	
				IB2	Basalt	
				IB3	Dolerite	
				IU	Ultrabasic igneous rock	
				IU1	Peridotite	
				IU2	Pyroxenite	
				IU3	Ilmenite, magnetite, ironstone, serpentine	
				IP	Pyroclastic	
				IP1	Tuff, tuffite	
				IP2	Volcanic scoria/breccia	
				IP3	Volcanic Ash	
				IP4	Ignimbrite	
				M	Metamorphic rock	
				MA	Acid metamorphic rock	
				MA1	Quartzite	
				MA2	Gneiss, migmatite	
				MA3	Slate, phyllite, (pellitic rocks)	
				MA4	Schist	
				MB	Basic metamorphic rock	
				MB1	Slate, phyllite (pelitic rocks)	
				MB2	Schist	
				MB3	Gneiss rich in ferro-magnesian minerals	

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
				MB4	Metamorphic limestone (marble)	
				MB5	Amphibolite	
				MB6	Eclogite	
				MU	Ultrabasic metamorphic	
				MU1	Serpentine, greenstone	
				S	Sedimentary rock	
				SC	Clastic sediments	
				SC1	Conglomerate, breccia	
				SC2	Sandstone, greywacke, arkose	
				SC3	Siltstone, mudstone, claystone	
				SC4	Shale	
				SC5	Ironstone	
				SO	Organic (sedimentary rock)	
				SO1	Limestone, other carbonate rocks	
				SO2	Marl and other mixtures	
				SO3	Coals, bitumen and related rocks	
				SE	Evaporites	
				SE1	Anhydrite, Gypsum	
				SE2	Halite	
				U	Unconsolidated	
				UR	Weathered residum	
				UR1	Bauxite, laterite	
				UF	Fluvial	
				UF1	sand and gravel	
				UF2	silt and loam	
				UF3	clay	
				UL	lacustrine	

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
				UL1	sand	
				UL2	silt and clay	
				UM	marine and estuarine	
				UM1	sand	
				UM2	clay and silt	
				UC	colluvial	
				UC1	slope deposits	
				UC2	slope deposits	
				UE	aeolian	
				UE1	loess	
				UE2	sands	
				UG	glacial	
				UG1	morainic deposits	
				UG2	glaciofluvial sands	
				UG3	glaciofluvial gravel	
				UK	kryogenic	
				UK1	periglacial rock debris	
				UK2	periglacial solifluction materials	
				UO	organic	
				UO1	rainwater-fed moor peat	
				UO2	groundwater-fed bog peat	
				UA	anthropogenic	
				UA1	redeposited natural material	
				UA2	industrial/artisanal deposits	
				UU	unspecified	
				UU1	unspecified sediments	
horizonDesignation	**masterHorizon**	Master horizon with subordinate characteristics according to the rules given below (for more details see FAO, 1990).	SOTER2009			

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
				H	H horizon/layer.	Layer dominated by organic material, formed from accumulations of(partially) undecomposed organic material at the soil surface, which may be under water. All H horizons are saturated with water fo prolonged periods, or were once saturated butare now artificially drained. An H horizon may be on top of mineral soils or at any depth beneath the surface it is buried.
				O	O horizon/layer.	Layer dominated by organic material, consisting of (partially) undecomposed litter, such as leaves, twigs, moss etc., which has accumulated on the surface. They may be on top of either mineral or organic soils. An O horizon are not saturated with water for prolonged periods. The mineral fraction of such material is only asmall percentage of the volume of the material and generally is much less than half the weight. An O horizon may be at the surface of a minera soil or at any depth beneath the surface if it is buried.
				A	A horizon.	Mineral horizon which formed at the surface or below an O horizon, and in which all or much of the original rock structure has been obliterated. The A horizon is characterised by one or more o the following: - properties resulting from cultivation, pasturing, or similar kinds of disturbance; or and not displaying properties characteristic of an E horizon (see below); - a morphology which is different from the underlying B or C horizon, resulting from processes related to the surface (e.g. vertisols).

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
				E	E horizon.	Mineral horizon, in which the main feature is a loss of silicate clay, iron, aluminum, or some combination of these, leaving a concentration of sand and silt particles, and in which all or much of the original rock structure has been obliterated. An E horizon is most commonly differentiated from an underlying B horizon by colour of higher value or lower chroma, or both; by coarser texture; or by a combination of these. Although an E horizon is usually near the surface, below an O or A horizon and above a B horizon, the symbol E may be used without regard to position in the profile for any horizon that meets the requirements, and that has resulted from soil genesis.
				B	B horizon.	A B horizon has formed below an A, E, O or H horizon, and has as dominant feature the obliteration of all or much of the original rock structure, together with one or acombination of the following: - illuvial concentration, alone or in combination, o silicate clay, iron, aluminum, humus, carbonates, gypsum or silica; - evidence o removal of carbonates; - residual concentration of sesquioxides; coating of sesquioxides that make the horizon conspicuously lower in value, higher inchroma, or redder in hue than overlying and underlying horizons without apparen illuviation of iron; - alteration that forms silicate clay or liberates oxides or both an that forms a granular, blocky or prismatic structure if volume changes accompany the changes in moisture content, or - brittleness.

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
				C	C horizon/layer.	A horizon or layer, excluding hard bedrock, that is little affected by pedogenetic processes and lacks properties of H, O, A, E or B horizons. Most are mineral layers, but some siliceous or calcareous layers (e.g. shells, coral and diatomaceous earth) are included. Sediments, saprolite and unconsolidated bedrock and other geological materials that commonly slake within 24 hours are included as C layers. Some soils form in highly weathered material that is considered a C horizon if i does not meet the requirements of an A, or B horizon.
				R	R layer.	Hard rock underlying the soil. Air dry chunks of an R layer will not slake within 24 hours if placed into water.
				I	I Layer	Ice lenses and wedges that contain at leas 75% ice (by volume) and that distinctly separate organic or mineral layers in the soil.
				L	L Layer	Sediments deposited in a body of water (sub-aqueous) and composed of both organic and inorganic materials, also known as limnic material.
				W	Water Layer	Water layers in soils or water submerging soils, either permanently or cyclic within the time frame of 24 hours.
horizonDesignation	**subordinateCharacteristics**	Subordinate distinctions and features within master horizons are indicated with lower case letters used as suffixes. (see FAO, 1990 for more details).	SOTER2009			
				a	highly decomposed organic material	
				b	buried genetic horizon	
				c	concretions or nodules	
				d	dense layer (In combination with L Layer); diatomaceous earth	

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
				e	moderately decomposed organic material	
				f	frozen soil	
				g	strong gleying	
				h	accumulation of organic matter	
				i	slickensides (in mineral soils) or slightly decomposed organic material (in organic soils)	
				j	jarosite mottling	
				k	accumulation of carbonates	
				l	capillary fringe mottling	
				m	cementation or induration	
				n	accumulation of sodium	
				o	residual accumulation of sesquioxides	
				p	ploughing or other disturbance	
				q	accumulation of silica	
				r	strong reduction	
				s	illuvial accumulation of sesquioxides	
				t	accumulation of silicate clay	
				u	occurrence of plinthite	
				v	occurrence of plinthite	
				w	development of colour or structure	
				x	fragipan character	
				y	accumulation of gypsum	
				z	accumulation of salts more soluble than gypsum	
				at	evidence of cryoturbation	

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
colourOfMottles	**chroma**	The factor chroma of the color in Munsell protocol	SOTER2009			
colourOfMottles	**hue**	The factor hue of the color in Munsell protocol	SOTER2009			
colourOfMottles	**value**	The factor value of the color in Munsell protocol	SOTER2009			
dryColour	**chroma**	The factor chroma of the color in Munsell protocol	SOTER2009			
dryColour	**hue**	The factor hue of the color in Munsell protocol	SOTER2009			
dryColour	**value**	The factor value of the color in Munsell protocol	SOTER2009			
moistColour	**chroma**	The factor chroma of the color in Munsell protocol	SOTER2009			
moistColour	**hue**	The factor hue of the color in Munsell protocol	SOTER2009			
moistColour	**value**	The factor value of the color in Munsell protocol	SOTER2009			
moisturePerTension	**tension**	Tension applied in which the moisture is measured	SOTER2009			

Source Element	Attribute Name	Arrtibute Description	Reference	Value - Short Term	Value - Full Term	Value Description
tension	**moisture**	The measured moisture under the specified tension	SOTER2009			
startOfFlooding	**startingMonth**	The month (number) during which flooding of the terrain component normally starts	SOTER2009			

Notes:

- For SoTerUnit and Laboratory source elemnts, an attribute called ISOCountryCode is assigned which is not listed above. This is an enumerated attribute, according ISO-3166 country codes.

- In the above list, the source elements starting with uppercase letters represent a SoTerML class, and the lowercase ones represent a parent attribute (for establishin sub-attribute mechanism of SoTerML)