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Morphological and soil site characteristics of tribal area in Dharni tahsil of Melghat region in Amravati district

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Abstract

The Present study was undertaken in Dharni tahsil of Maharashtra State during the year 2017-19. This area is also popularly known as Melghat region, which is located in the physiographic unit *i.e.* eroded valley with the elevation of 316 - 642 meters above mean sea level. *Korku* is the dominant tribes inhabited in this region and have small land holding adjoining to forest. The data on natural resources such as climate, soil-site characteristics and land use system aspect were collected. Twenty four spot were selected on different land use system based on single crop, double crop, scrub land and forestland fallow land. Dharni Tahasil received an annual rainfall ranges from 1350-1450 mm. Temperature varies from 34°C in summer to 21°C in winter. The soils were developed on weathered basalt. The soils were very gently to steep sloping with moderately to very severe erosion. The soils are dark reddish brown to dark brown with shallow to medium deep in depth and structure was angular blocky to sub angular blocky.

Keywords: Eroded valley, soil morphology, cropping system, Korku, Melghat

Introduction

Soils are vital natural resources and considered as integral part of the landscape. Maintaining soil in a state of high productivity and its rational use according to its potentiality on sustainable basis is indispensable in meeting the basic needs of life. However, it is a finite vital resource on whose proper use depend the life supporting systems of a country and socioeconomic development of the people. The sustainable use of soil resource requires an extensive knowledge about its genesis, morphology and other properties. The scientific study of morphology and soils site characteristic provides information on nature and type of soils, their constraints, potentials, capabilities and their suitability for various uses. Hilly areas are prone to soil degradation and pose several problems for agricultural productivity. However, the crop production and soil managements greatly differ with kind of soil and their physico-chemical behaviour. The term land includes broadly the climatic attributes and soil-site attributes which affect the land use. Land use is a kind of permanent and cyclic human interventions to satisfy human needs. It is a geographic concept e.g. rainfed agriculture, irrigated agriculture, forestry, recreation *etc.* The soil and site characteristics have great influence on the productivity of the land. Amongst these soil site characteristics such as colour, texture, parent material, structure, clay content and type of clay, depth of soil, soil reaction, erosion and drainage have direct influence on the potential productivity of the soils. At present productivity of the soil is observed to be reduced at a slow rate but in a continuous phase. Since the climatic attributes of the region are not changing at the faster rate, it is only the soil attributes which are causing reduction in the productivity. An in-depth study of the morphology and soil site characteristics will provide baseline information on the physical, and morphological properties of the soils. Therefore, to understand the soil site characteristics, proper planning for increasing the productivity of area, the present investigation is helpful to evaluate the climatic, morphological and soil site characteristics.

Material and Methods

The field study was carried out in the Dharni tahsil of Maharashtra on "Morphological and Soil site Characteristics in Melghat region of Maharashtra State".

The Dharni lies between 21°33' and 21°55' North latitudes and 77°53' and 77°78' East longitudes. This region boasts of thick forests spread over the Satpura mountain range. The forest has predominantly teak and bamboo. This area is located in the physiographic unit i.e. eroded valley. With help of profile location map of selected pedons for study of Dharni tahasil. The whole tribal area was traversed to identified different landform units to understand the soil heterogeneity as well as the present land use and land cover classes and on the bases of the visual observations Twenty Four (24) representative soil profile were selected as per soil survey manual (Soil Survey Division Staff, 2000) on different land use system based on single crop, double crop, triple crop, scrubland, forest land and fallow land in area for details soil profile study. The morphological characteristics were studied in the field itself, the horizon wise samples were collected for their analysis. The soil profiles were examined in the field for morphological characteristic as per the procedure given in IARI Manual (1971) and USDA Soil Survey Manual. Morphological characteristics of each horizon like depth, colour, texture, structure, consistence, calcareousness and roots *etc.* were recorded.

Results and Discussion

Sites characterization

The properties of soil are determined by environmental factors. Five dominant factors are often considered in the development of the various soils: (a) climate, (b) parent material (rocks and physical and chemical derivatives of same), (c) relief, (d) organisms (fauna and flora) and (e) time factor. Sites characteristics of different land use system were observed during ground truth collection. The data was collected from twenty four representative sites selected for profile sampling is presented in (Table-1) and their salient characteristics are discussed under following heads.

Slope

Slope angle and slope length are features of the topography that governs the amount of water that runs off or enter in a soil. Microrelief is slight irregularities of a land surface causing variations in elevation amounting to no more than a few feet. Microrelief creates micro climates in a small area which in turn influence soil properties intensely. The microrelief is primarily characteristic by slopes, which affect crops yield. In general, it was observed that, the slope of Dharni tahsil soils range from very gently slopes (1-3%) to moderately steep sloping (15-30%). As the slope decreased the depth of soil increased, erosion reduced and texture become

finer. Vice-versa, as the slope increases, the erosion increase and results in shallow, stony and have weakly developed profile and horizons. It is due to accelerated erosion that removes surface materials before it has the time to develop. These results are in confirmation with Kumar and Tripathi (1987) [9].

Erosion

In general clay soils exhibit high runoff potential than the silt or sandy soils. The variation depends on slopes, depth, surfaces condition and infiltration characteristics of the soils, as well as nature of vegetation cover and rainfall conditions. Erosion reduces the depth of soils due to heavy or continuous rainfall which eroded the soils particles from upper position to lower position along with some nutrients. The erosion mainly depends upon slope or topographic units, if slope is greater erosion will more. The area of Dharni tahasil occupied by different erosion classes presented in [Table-1]. It was observed that erosion classes were medium to rapid erosion conditions, where the slope is very gently then the erosion was slightly but as the slope increase to steeply then erosion was also increasing to very sever, therefore erosion is important sites characteristic which govern by slope of an area, vegetation cover, rainfall and soil characteristics.

Drainage

The drainage conditions of an area are reflected in soil colour and depth of their occurrence in a soil profile. The data pertaining to soil drainage conditions for individual pedon is given in [Table-1]. The soils developed on higher topography (more than 15- 30 % slope) have nil drainage condition (P₂, P₁₁, P₁₂, P₁₇ and P₂₀). while the soils on very gently to gently sloping landscape are well to moderately well drained (P₁, P₃, P₄, P₅, P₆, P₇, P₈, P₉, P₁₀, P₁₃, P₁₄, P₁₅, P₁₆, P₁₈, P₁₉, P₂₁, P₂₂, P₂₃ and P₂₄). The high clay contains and dominance of montomorillonite imparts poor drainage condition in majority of black soil. Gupta *et al.* (1991) [5]

Morphological properties

Soil morphology is the study of soils and their description under field conditions. Soils are studied, examined and analysed in the field and in laboratory. Each horizon was carefully observed, studied and described in respect to various morphological characteristics of pedon like soil depth, soil colour, soil texture and structure discussed in this section. The data regarding soil morphological properties of the study area is presented in (Table-2).

Table 1: Soil-site characteristics of Dharni tahasil

Sr. No.	Pedonwise Location	Farming System	Soil Depth (cm)	Slope (%)	Drainage Class	Erosion Class	Parent Material	Flooding	Stoniness Surface Covered (%)	Ground Water Depth (m)	Land Use System/Crops
1	P-3. Jambukara	Single crop	66	1-3	Moderately Well	Moderate	Weathered basalt	Slight	3-15	>10	Soybean + Pigeonpea
2	P-8. Bairagad	Single crop	109	1-3	Moderately Well	Slight	Weathered basalt	Nil to slight	<3	>10	Sorghum+ Pigeonpea
3	P-10. Kakramal	Single crop	88	1-3	Moderately Well	Slight	Weathered basalt	Nil to slight	<3	>10	Sorghum+ Pigeonpea, Soybean
4	P-19. Ambadi	Single crop	80	1-3	Moderately Well	Slight	Weathered basalt	Nil to slight	<3	>10	Soybean + Pigeonpea
5	P-9. Sawalkheda	Single crop	100	1-3	Moderately Well	Moderate	Weathered basalt	Slight	3-15	>10	Sorghum+ Pigeonpea
6	P-4. Ghotia	Double crop	90	1-3	Moderately Well	Moderate	Weathered basalt	Slight	<3	<10	Soybean, Green gram-Wheat
7	P-1. Mangia	Double crop	68	1-3	Moderately Well	Moderate	Weathered basalt	Slight	3-15	<10	Soybean-Wheat, Citrus

8	P-13. Talai Diya	Double crop	120	1-3	Well	Moderate	Weathered basalt	Nil to slight	<3	>10	Cotton,Soybean + Pigeonpea -Wheat
9	P-14. RaniTambori	Double crop	105	1-3	Well	Moderate	Weathered basalt	Nil to Slight	3-15	>10	Cotton,Sorghum-Chickpea
10	P-15. Khdki Kalam	Double crop	81	1-3	Moderately Well	Moderate	Weathered basalt	Slight	<3	>10	Cotton,Green gram- Wheat, Chickpea
11	P-16. Sawalikheda	Double crop	53	3-5	Moderately Well	Moderate	Weathered basalt	Nil	3-15	>10	Sorghum,Paddy- Chickpea
12	P-22. Bijudhawdi	Double crop	53	3-5	Moderately Well	Moderate	Weathered basalt	Nil	3-15	>10	Cotton+Pigeonpea,Soybean-Wheat
13	P-23. Kusum kot	Double crop	90	1-3	well	Slight	Weathered basalt	Nil to Slight	<3	<10	Cotton+Pigeonpea,Soybean- Wheat
14	P-24. Chakarda	Double crop	7+	8-15	Nil	Sever	Weathered basalt	Nil	3-15	>10	Soybean,Maize-Wheat
15	P-5 .Nanduri	Triple crop	84	1-3	Moderately -well	Slight	Weathered basalt	Nil to Slight	<3	<10	Soybean- Wheat- Ground Nut
16	P-6. Kara	Triple crop	98	1-3	Moderately -well	Slight	Weathered basalt	Nil to slight	<3	>10	Soybean- Chickpea - Ground Nut
17	P-7. Kolapur	Triple crop	95	1-3	well	Slight	Weathered basalt	Nil to slight	<3	>10	Soybean-Wheat-Musk melon, Mango
18	P-18 Zilpi	Triple crop	63	1-3	Moderately -well	Slight	Weathered basalt	Nil to slight	3-15	>10	Cotton+Pigeonpea, Sorghum- Chickpea,Wheat-Ground Nut
19	P-21. Baru	Triple crop	37	3-5	Moderately -well	Moderate	Weathered basalt	Nil	3-15	>10	Cotton+Pigeonpea,Soybean- Chikpea,Wheat-Ground Nut
20	P-20. Chitri	Forest	38	15-30	Moderately -well	Very Severe	Weathered basalt	Nil	3-15	>10	Teak, Mahua and Bamboo
21	P-17. Sadrabadi	Scrub land	38	8-15	Moderately -well	Severe	Weathered basalt	Nil	3-15	>10	Scrub (Bamboo, Palas)
22	P-11 .Chipoli	Scrub land	41	8-15	Moderately -well	Severe	Weathered basalt	Nil	15-40	>10	Scrub (Ber,Crustard apple ,grass.)
23	P-2. Kotha	Scrub land	95	8-15	Moderately -well	Severe	Weathered basalt	Nil	15-40	>10	Scrub (Ber,Crustard apple,grass)
24	P-12. Takarkheda	Scrub land	54	15-30	Moderately -well	Very Severe	Weathered basalt	Nil	40-75	>10	Scrub (Ber,Crustard apple,grass)

Soil depth

The soil depth indicates the depth of the solum, which includes A and B horizons, occurring above the parent materials or hard rock at different topographic positions. The data presented in (Table- 2) showed that, the soils are shallow, medium and deep in depth. The soil depth at higher topographic area was shallow as compared to lower topographic position which was medium to deep in depth. These variations in depth on different physiographic positions are due to slope and degree of erosion which might have caused erosion in some places and deposition on the other places. These results are in confirmation with those reported by Nasre *et al.*, (2013) ^[11] reported that the soils developed on plateau top, escarpments, isolated hillocks and foot slopes are shallow whereas, soils on undulating lands, alluvial plains and valleys are deep indicating that the soil depth is related to slope and degree of erosion.

Soil texture

The texture is an expression to indicate the coarseness or fineness of the soil particles. In the field, texture is commonly determined by the sense of feel methods. The soils texture is directly affect soil properties like structure, porosity and consistence. The soils texture of the study area from clay to sandy clay loam. The soil textures of steep sloping area are in course materials while that of gently to moderately gently sloping area are finer materials, might be due to influence the dominance of erosion and velocity of runoff. It is observed that the fineness of the soil increases with the decreasing elevation. This may be due to various geomorphic processes operating in the area that arise movement of finer materials from higher to lower land. These results are in confirmation with those reported by Sreedhar Reddy and Naidu, (2016) ^[8].

Soil structure

Soil structure refers to the arrangement of primary soil

particles and their aggregates into a certain definite pattern. Soil structure is classified into three different classes on the basis of size, shape and grade respectively. This is most important properties of soil that influence the physical properties of soil. The surface of all pedons have sub angular blocky structure, whereas, subsurface has angular blocky structure The soil horizons forming pressure faces and slickensides have coarse, strong and angular blocky structures (Prasad *et al.*, 1989) ^[12]. (Table-2).

Soil colour

The colour of the soil is usually one of the most outstanding morphological characteristics used for identification. The relief, drainage, presence of organic matter *etc.* have direct as well as indirect influence on soil colour. The pedon P₂ is dusky red (2.5YR3/2) to dark red (2.5YR3/6), pedons P₁₁, P₁₂ P₁₇. P₂₁ P₂₂ and P₂₄ are dark reddish brown (5YR3/2) to reddish brown (5YR5/4), pedons P₁, P₂, P₃, P₄, P₅, P₆, P₇, P₈, P₉, P₁₀, P₁₃, P₁₄, P₁₅, P₁₆, P₁₈, P₁₉, P₂₀, and P₂₃ are very dark grey (10YR3/1) to yellowish brown (10YR5/8). Red and brown colour soils generally observed in high topography or elevation due to excesses drainage through high rainfall and black colour soils are found in lower topography or elevation. These results are in confirmation with those reported by Nasre *et al.* (2013) ^[11].

Soil consistence

Consistence is the behavior of soil under stress. This stress is commonly evidenced by feeling the soil manipulating by hand. The consistence of the soils varied from slightly hard to very hard (dry), friable to very friable (moist) and nonstick and non-plastic to very sticky and very plastic (wet). Presence of friable and non-sticky and non-plastic or slightly sticky and slightly plastic consistence might be due to negligible or very small amount of expanding clay minerals. These results are in confirmation with those reported by Devi P.A., *et al.*, 2015 ^[2].

Soil effervescence

Most of the soils in Dharni tahasil showed slight to strong effervescence (with 10% HCl) indicating that these soils are calcareous in nature, whereas pedons P₁₁, P₁₂, P₁₆, P₁₇, P₂₀ & P₂₁ do not showed any effervescences (with 10% HCl), indicating that these soils are non to slightly calcareous in nature. (Zalte *et al.*, 2019) [18]

Conclusion

The soils of Dharni Tahasil of eroded valley in Melghat

region developed on weathered basalt. These soils developed on higher topography having very gently to steep slopping are well to moderately well drained and may moderately to very savior erosion. Morphologically soils showed shallow, medium and deep depth having clay to sandy clay loam in texture and were angular blocky to sub angular blocky in structure. The soils are dark reddish brown to dark brown in colour. The consistency of moist soils varied from friable to very friable and non to strongly calcareous in nature.

Table 2: Morphological characteristics of soil in Dharni Tahasil

Horizon	Depth (cm)	Boundary		Matrix Colour	Texture	Effervescences	Structure			Consistence			Roots		Additional notes
		D	T				S	G	Ty	D	M	W	S	Q	
Pedon-1: Mangia- <i>Fine clayey, smectitic, hyperthermic, Vertic Haplustepts</i>															
Ap	0-19	c	s	10YR 3/1	c	-	m	2	sbk	sh	fr	ssps	f	c	Cracks (0.5-1 cm) up to 40 cm
Bw1	19-47	c	w	10YR 3/2	c	e	m	2	sbk	h	fi	sp	m	f	PF
Bw2	47-68	-	-	10YR 5/6	c	es	m	3	abk	vh	fi	vsvp	-	-	PF
Pedon-2: Kotha- <i>Loamy, smectitic, hyperthermic, Typic Haplustepts</i>															
A	0-18	c	s	2.5YR 3/4	cl	-	m	2	sbk	sh	fr	ssps	f	c	Cracks (0.5-1 cm)
Bw1	18-49	c	w	2.5YR 3/3	cl	e	m	2	sbk	sh	fr	sp	c	f	
Bw2	49-77	g	w	2.5YR 3/4	l	es	m	2	abk	h	fi	vsvp	vf	f	
Bw3	77-95	-	-	2.5YR 3/6	c	es	m	3	abk	h	fi	vsvp	-	-	
Pedon-3: Jambukara- <i>Loamy, smectitic, hyperthermic, Vertic Haplustepts</i>															
Ap	0-15	c	s	10YR 3/3	cl	-	m	2	sbk	sh	fr	ssps	f	m	Cracks (0.5-1 cm) up to 25 cm.
Bw1	15-42	g	w	10YR 3/4	cl	e	m	2	sbk	sh	fr	ssps	vf	f	PF
Bw2	42-66	-	-	10YR 3/2	cl	es	m	2	abk	h	fi	sp	-	-	PF
Pedon-4: Ghotia - <i>Fine loamy, mixed, hyperthermic, Vertic Haplustepts</i>															
Ap	0-21	c	s	10YR 5/4	cl	-	m	2	sbk	sh	fr	ssps	f	c	Cracks (0.5-1 cm) up to 53 cm
Bw1	21-53	g	w	10YR 3/1	cl	e	m	2	sbk	sh	fr	ssps	vf	f	PF
Bw2	53-90	-	-	10YR 3/2	scl	es	m	2	abk	h	fi	sp	-	-	PF
Pedon-5: Nanduri- <i>Fine Clayey smectitic, hyperthermic, Vertic Haplustepts</i>															
Ap	0-19	c	s	10YR 3/1	c	-	m	2	sbk	sh	fr	ssps	f	m	Cracks(0.5-2.0 cm) up to 60 cm
Bw1	19-49	c	w	10YR 3/1	c	e	m	2	sbk	sh	fr	sp	f	f	PF
Bw2	49-78	g	s	10YR 3/2	c	es	m	3	abk	h	fi	vsvp	vf	f	PF
Bw3	78-84	-	-	10YR 3/2	c	ev	m	3	abk	vh	fi	vsvp	-	-	
Horizon	Depth (cm)	Boundary		Matrix colour	Texture	Effervescences	Structure			Consistence			Roots		Additional notes
Pedon-6: Kara- <i>Fine clayey, smectitic, hyperthermic, Typic Haplusterts</i>															
Ap	0-16	g	s	10YR 3/1	c	e	m	2	sbk	sh	fr	ssps	vf	f	Cracks (0.2-2.0 cm) up to 55 cm.
Bw	16-42	c	s	10YR 3/2	c	es	m	2	sbk	sh	fr	sp	vf	f	PF
Bss1	42-79	g	w	10YR 3/2	c	es	m	3	abk	h	fi	vsvp	-	-	SS
Bss2	79-98	-	-	10YR 3/1	c	ev	m	3	abk	vh	fi	vsvp	-	-	SS
Pedon-7: Kolupur- <i>Fine clayey, smectitic, hyperthermic, Typic Haplusterts</i>															
Ap	0-21	g	s	10YR 3/2	c	e	m	2	sbk	sh	fr	vsps	f	m	Cracks (0.2-2.0cm) up to 50 cm.
Bw	21-47	c	s	10YR 3/3	c	es	m	2	sbk	sh	fr	vsps	f	f	PF
Bss1	47-76	g	s	10YR 3/2	c	ev	m	3	abk	h	fi	vsvp	f	f	SS
Bss2	76-95	-	-	10YR 3/1	c	ev	m	3	abk	h	fi	vsvp	-	-	SS
Pedon-8: Bairagad- <i>Fine clayey, smectitic, hyperthermic, Typic Haplusterts</i>															
Ap	0-22	g	s	10YR 4/1	c	e	m	2	sbk	sh	fr	ssps	f	m	Cracks (0.2-2.0 cm) up to 40 cm.
Bw	22-54	c	s	10YR 3/1	c	es	m	2	sbk	sh	fr	sp	f	f	PF
Bss1	54-95	g	s	10YR 3/2	c	es	m	2	abk	h	fi	vsvp	f	f	SS
Bss2	95-109	-	-	10YR 3/1	c	ev	m	3	abk	vh	fi	vsvp	-	-	SS
Pedon-9: Sawalkheda- <i>Fine clayey, smectitic, hyperthermic, Vertic Haplustepts</i>															
Ap	0-18	c	s	10YR 3/2	c	e	m	2	sbk	sh	fr	ssps	f	f	Cracks(0.2-1 cm) up to 35 cm.
Bw1	18-48	c	s	10YR 3/1	c	es	m	2	abk	h	fi	sp	f	f	PF
Bw2	48-83	g	w	10YR 5/4	c	es	m	3	abk	vh	fi	vsvp	f	f	PF
Bw3	83-100	-	-	10YR 3/3	c	ev	m	3	abk	vh	fi	vsvp	-	-	

Horizon	Depth (cm)	Boundary		Matrix colour	Texture	Effervescences	Structure			Consistence			Roots		Additional notes
		D	T				S	G	Ty	D	M	W	S	Q	
Pedon-10: Kakramal- <i>Fine loamy, smectitic, hyperthermic, Typic Haplustepts</i>															
Ap	0-19	c	s	10YR 4/2	cl	e	m	2	sbk	sh	fr	ssps	f	c	
A	19-44	c	w	10YR 3/1	cl	e	m	2	sbk	sh	fr	ssps	f	f	
Bw1	44-72	g	w	10YR 3/2	cl	es	m	2	sbk	h	fi	sp	vf	f	
Bw2	72-88	-	-	10YR 3/2	c	ev	m	2	abk	vh	fi	vsvp	-	-	
Pedon-11: Chipoli- <i>Fine loamy, smectitic, hyperthermic, Typic Ustorthents</i>															
A	0-20	c	s	5YR 3/2	l	-	m	1	sbk	sh	fr	ssps	f	m	
AC	20-41	g	w	5YR 3/4	scl	-	m	2	sbk	sh	fr	ssps	f	f	
Cr	41-64	-----Weathered Basalt-----													
Pedon-12: Takarkheda- <i>Fine Loamy-skeletal, smectitic, hyperthermic Typic Ustorthents</i>															
A	0-20	c	s	5YR 3/2	l	-	m	1	sbk	sh	Fr	ssps	f	f	

AC	20-54	-	-	5YR 3/4	scl	-	m	2	sbk	sh	Fr	ssps	vf	f	
Pedon-13: Talai Diya-Fine, smectitic, hyperthermic Typic Haplusterts															
Ap	0-19	g	s	10YR 4/2	c	e	m	1	sbk	sh	fr	ssps	f	m	Cracks (0.2-2 cm)
Bw1	19-44	c	s	10YR 3/2	c	es	m	2	sbk	h	fr	sp	f	f	PF
Bw2	44-78	g	s	10YR 3/2	c	ev	m	2	abk	h	fi	vsvp	vf	f	PF
Bss1	78-100	g	w	10YR 3/1	c	ev	m	3	abk	vh	fi	vsvp	-	-	SS
Bss2	100-120	-	-	10YR 3/1	c	ev	m	3	abk	vh	fi	vsvp	-	-	SS
Pedon-14: Ranitambhori - Fine, smectitic, hyperthermic Typic Haplusterts															
Ap	0-18	c	s	10YR 3/2	c	e	m	1	sbk	sh	fr	ssps	f	m	Cracks (0.2-1cm) upto 50 cm.
Bw	18-38	c	s	10YR 3/2	c	es	m	2	abk	h	fr	ssps	c	c	PF
Bss1	38-81	g	w	10YR 3/1	c	e	m	3	abk	vh	fi	vsvp	c	f	SS
Bss2	81-105	-	-	10YR 3/1	c	ev	m	3	abk	vh	fi	vsvp	-	-	SS

Horizo	Depth (cm)	Boundary		Matrix colour	Texture	Effervescences	Structure			Consistence			Roots		Additional notes
		D	T				S	G	Ty	D	M	W	S	Q	
Pedon-15: Khadki Kalam- Fine clay loam, smectitic, hyperthermic Vertic Haplusterts															
Ap	0-20	g	s	10YR 4/3	cl	e	m	2	sbk	sh	fr	ssps	m	c	Cracks (0.2-2cm)
A	20-46	c	s	10YR 3/2	cl	e	m	2	sbk	h	fi	sp	c	c	PF
Bw1	46-70	g	w	10YR 3/2	cl	es	m	2	abk	vh	fi	vsvp	c	f	PF
Bw2	70-81	-	-	10YR 3/1	c	ev	m	3	abk	vh	fi	vsvp	-	-	
Pedon-16: Sawalikheda- Clay (skeletal), smectitic, hyperthermic, Typic Ustorthents															
Ap	0-18	c	s	10YR 4/3	cl	-	m	1	sbk	sh	vfr	ssps	f	m	
AC	18-53	-	-	10YR 3/6	c	-	m	2	sbk	h	fr	ssps	vf	f	
Pedon-17: Sadrabadi - Loamy, smectitic, hyperthermic, Typic Ustorthents															
A	0-18	c	s	5YR 4/4	l	-	m	1	sbk	sh	vfr	ssps	f	m	
AC	18-38	-	-	5YR 4/4	scl	-	m	2	sbk	sh	fr	ssps	f	f	
Pedon-18: Zilpi- Fine clayey, smectitic, hyperthermic, Typic Haplusterts															
Ap	0-17	g	s	10YR 4/2	c	e	m	1	sbk	sh	fr	ssps	f	m	Cracks (0.2-1cm) up to 52 cm
Bw1	17-46	c	s	10YR 3/2	c	es	m	2	sbk	h	fi	sp	f	f	
Bw2	46-63	-	-	10YR 4/3	c	es	m	3	abk	vh	fi	vsvp	f	f	
Pedon-19: Ambadi - Fine clayey, smectitic, hyperthermic, Typic Haplusterts															
Ap	0-17	g	s	10YR 3/2	c	e	m	1	sbk	sh	fr	ssps	f	m	Cracks (0.2-2 cm)
Bw	17-32	c	s	10YR 4/3	c	es	m	2	sbk	h	fr	sp	f	f	
Bss1	32-52	g	w	10YR 3/2	c	es	m	3	abk	vh	fi	vsvp	vf	f	SS
Pedon-20: Chitri- Clayey -skeletal, smectitic, hyperthermic, Typic Ustorthent															
A	0-18	c	s	10YR 5/8	c	-	m	1	sbk	sh	fr	ssps	f	c	
AC	18-38	-	-	10YR 5/4	c	-	m	2	sbk	sh	fr	ssps	c	c	

Horizon	Depth (cm)	Boundary		Matrix colour	Texture	Effervescences	Structure			Consistence			Roots		Additional notes
		D	T				S	G	Ty	D	M	W	S	Q	
Pedon-21: Baru - Fine, smectitic, hyperthermic, Typic Ustorthents															
Ap	0-15	w	s	5YR3/3	cl	-	m	1	sbk	sh	vfr	ssps	f	m	
AC	15-37	-	-	5YR5/4	cl	-	m	2	sbk	h	fr	ssps	-	-	
Pedon-22: Biju Dhawdi- Fine, Loamy, smectitic, hyperthermic, Typic Ustorthents															
Ap	0-22	c	s	10YR3/3	cl	-	m	2	sbk	sh	fr	ssps	f	m	
AC	22-53	-	-	5YR3/4	cl	e	m	2	sbk	sh	fr	ssps	f	f	
Cr	53-80	----- Weathered Basalt -----													
Pedon-23: Kusumkot - Fine, clayey, smectitic, hyperthermic, Typic Haplusterts															
Ap	0-18	g	s	10YR4/3	c	e	m	1	sbk	sh	fr	ssps	f	m	Cracks(0.2-2 cm)
Bw	18-42	c	s	10YR4/2	c	es	m	2	sbk	h	fi	sp	f	f	PF
Bss	42-90	-	-	10YR3/2	c	ev	m	3	abk	vh	fi	vsvp	f	f	SS
Pedon-24: Chakarda- Fine, smectitic, hyperthermic, Typic Ustorthents															
Ap	0-7	c	s	5YR4/2	l	e	f	1	sbk	sh	fr	ssps	f	m	
Cr	7+	-----weathered basalt-----													

Abbreviations are according to Soil Survey Manual (Soil Survey Divisions Staff, 1998)

Boundary: D - Distinctness; c - clear; g - gradual; T - topography; s - smooth; w - wavy. Texture: c - clay; sic - silty clay; cl - clay loam, l-loam, scl-sandy clay loam. Effervescences: e - slight effervescence; es - strong effervescence; ev - violent effervescence. Structure: S-size: m - medium, c-coarse; G-grade: 1-weak; 2-moderate; 3-strong; T-type: sbk-sub angular blocky, abk-angular blocky. Consistence: D= dry; h-hard, sh-slightly hard, eh-externally hard, vh-very hard; M-moist; fr-friable; vfr-very friable; W=wet; ns-non sticky, ss-slightly sticky, s-sticky, vs-very sticky, np-non plastic, p-plastic, vp-very plastic, ps-slightly plastic. Roots: quantity ; f-few (< 1per cent), c- common, m- many; size- vf-very fine, f-fine, m-medium, c- coarse.

Abbreviations : PF- Pressure faces ;SS- Slickensides

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