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Major soils of Tropical Humid Region: A case study at Elamdesam block, Idukki district, Kerala

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ABSTRACT

Ultisols, Inceptisols and Alfisols are the major soils encountered in the Elamdesam block. Loamy or clay loam soils are found in high hills forest land due to the weathering of rocks under forest cover. High in organic matter, with a dark brown surface and a brown subsurface. Whereas soils in low hills and midlands plinthites form the underlying layers, surface brown to reddish brown subsurface in colour, with sandy clay to clay texture. Gravels are present in some parts of the area. Generally, soils are well drained, shallow to very deep, fine to medium and weak to moderate subangular blocky structure, slightly sticky to sticky and slightly plastic to plastic, very strongly acidic, high to very high in organic matter. Soils are classified as *Ustic Haplohumults, Humic Dystrustepts, Lithic Dystrustepts, Ustic Kandihumults, and Oxyaquic Haplustalfs* in the tropical humid regions of Kerala. Soil acidity, aluminium saturation, and low bases and washing out of the Ap horizon limit the crop production.

Keywords: Major soils, characteristics, distribution, tropical humid region, series

1. INTRODUCTION

Tropical humid region naturally receives heavy rainfall of about 3462 to 3602 mm with Ustic soil moisture regime and has a mean annual temperature that varies between 21 ^{o}C to 27 ^{o}C with Iso hyperthermic soil temperature regime. The length of the dry period is two to two and a half months, with more than 80 per cent cropping period. These heavy rainfalls highly influence soil genesis and formation through different soil-forming processes. Heavy rainfall mainly influences on washing out of the Ap horizon and leaching of bases, resulting in soil acidity and aluminium saturation, which limits the crop production in tropical humid regions of Kerala. Thus, a detailed soil survey was taken at the Elamdesam block, having a total geographical area of 29,127.16 ha, which belongs to Thodupuza taluk, Idukki district, to study and identify the major soils of the block and also to know the soil constraints and potential farm planning. Agro-ecological zones are foothills and high hills, and the agro-ecological units 12 and 14 i.e. southern and central foot hills and southern high hills,

respectively. The agro-ecological subunits 12.1 to 14.5 which are forests, denudational hills, lateritic terrain and lateritic valley. Agro-ecological sub-region (AESR) is 19.2, i.e., central and South Sahyadris, hot, moist Subhumid to Humid eco-subregion. Elamdesam block is divided into seven panchayats. Block has rocks of Archaean age. The main rocks encountered are charnockites and granite gneiss. The land resource inventory on 1:10,000 scale investigates all the parameters which are critical for productivity *viz.,* soils, site characteristics like slope, erosion, gravelliness and stoniness, climate, water, topography, geology, hydrology, vegetation, crops, land use pattern, animal population, socio-economic conditions, infrastructure, marketing facilities and various schemes and developmental works of the government etc. From the data collected at farm level, the specific problems and potentials of the area can be identified and highlighted, conservation measures required for the area can be planned on a scientific footing, suitability of the area for various uses can be worked out and finally viable and sustainable land use options suitable for every land holding can be prescribed.

2. Major Soils of Elamdesam Block, Tropical Humid Region: Characteristics and Distribution

There are twelve soil series identified and mapped in the Elamdesam block (Table 1 and Figure 1). All the series formed from charnockites, granites and gneisses and or its colluvium and alluvium in uplands, midlands and lowlands. Midlands and uplands together occupy the highest area of 12924.79 ha (44.37 %), followed by forest, which occupies 8256.48 ha (28.35 %). Lowlands occupy 4308.12 ha (14.79 %), and foothills and high hills occupy 1517.58 ha (5.21 %). Granite gneisses occupy more area than charnockites in the landform. The foothills granites and gneisses cover 1229.48 ha, whereas the foothills charnockites cover 288.10 ha. Midlands and uplands granites and gneisses dominated (9821.08 ha) over charnockite landform (3103.71 ha). Among 12 series identified, Karimannoor-2 series belongs to lowlands occupied by dominant soils of 4308.12 ha, followed by series Vellanchara (3726.25 ha) of the Midlands and uplands. The Arcade series of charnockite landform occupied the lowest area of 288.10 ha (Chandrakala et al., 2017 and 2018).

Table 1: Identified soil series of Elamdesam block, mapping units and area

Series Name	Series name	Mapping units	Area (ha)	Percentage (%)
Ptk	Pattekudi	01,02	716.71	2.46
Kbk	Kambaka Kanam	03	512.77	1.76
Acd	Arcade	04	288.10	0.99
Vnp	Vannappuram	05, 06, 07	1463.43	5.02
Vlc	Vellanchara	08, 09, 10,11	3726.25	12.79
Kmn1	Karimannor-1	12, 13, 14, 15	2051.72	7.04
Ckz	Chinikuzhi	16, 17, 18	1536.99	5.28
Nys	Neyyessery	19, 20, 21	1042.69	3.58
Kdy	Kudayathoor	22, 23, 24	2107.0	7.0

Adm	Adurmala	25, 26	454.29	1.56
Acr	Ancheri	27, 28	541.98	1.86
Kmn2	Karimannoor-2	29, 30, 31	4308.12	14.79
	Forest		8256.48	28.35
	Habitation		1589.15	5.46
	Waterbody		531.04	1.82
Total			29127.16	100.00

2.1. Soils of foothills (300-600 m above MSL) and high hills (>600 m above MSL)

2.2.1 Soils of Granite- gneiss landform

2.2.1.1: Pattekudi series/soils: The Pattekudi series is a member of the loamy mixed, isohyperthermic family of Ustic Haplohumults (Figure 2). Typically, Pattekudi soils have dark brown, extremely acid, sandy clay loam A horizon and dark brown, reddish brown, yellowish red, extremely acid, strongly acid, very strongly acid, sandy clay loam and sandy loam B horizon. They have developed from granite-gneiss and occur on very steep slopes of >33 per cent at foothills (300-600 m above MSL) and high hills (>600 m above MSL), and occupy around 2.46 per cent of the total geographical area. The thickness of the solum ranges from 150 to 160 cm. The A horizon is 16 to 18 cm thick. Its colour is in the hue 7.5YR, value and chroma 3 to 4. The texture is sandy clay loam to sandy clay. The thickness of the B horizon ranges is 134 to 142 cm. Its colour is in hue 5YR to 7.5YR, value 3 to 4, chroma 3 to 6. Texture is sandy clay loam to sandy clay. Gravel ranges from 10 to 30 per cent. Cutans are present in subsoils.

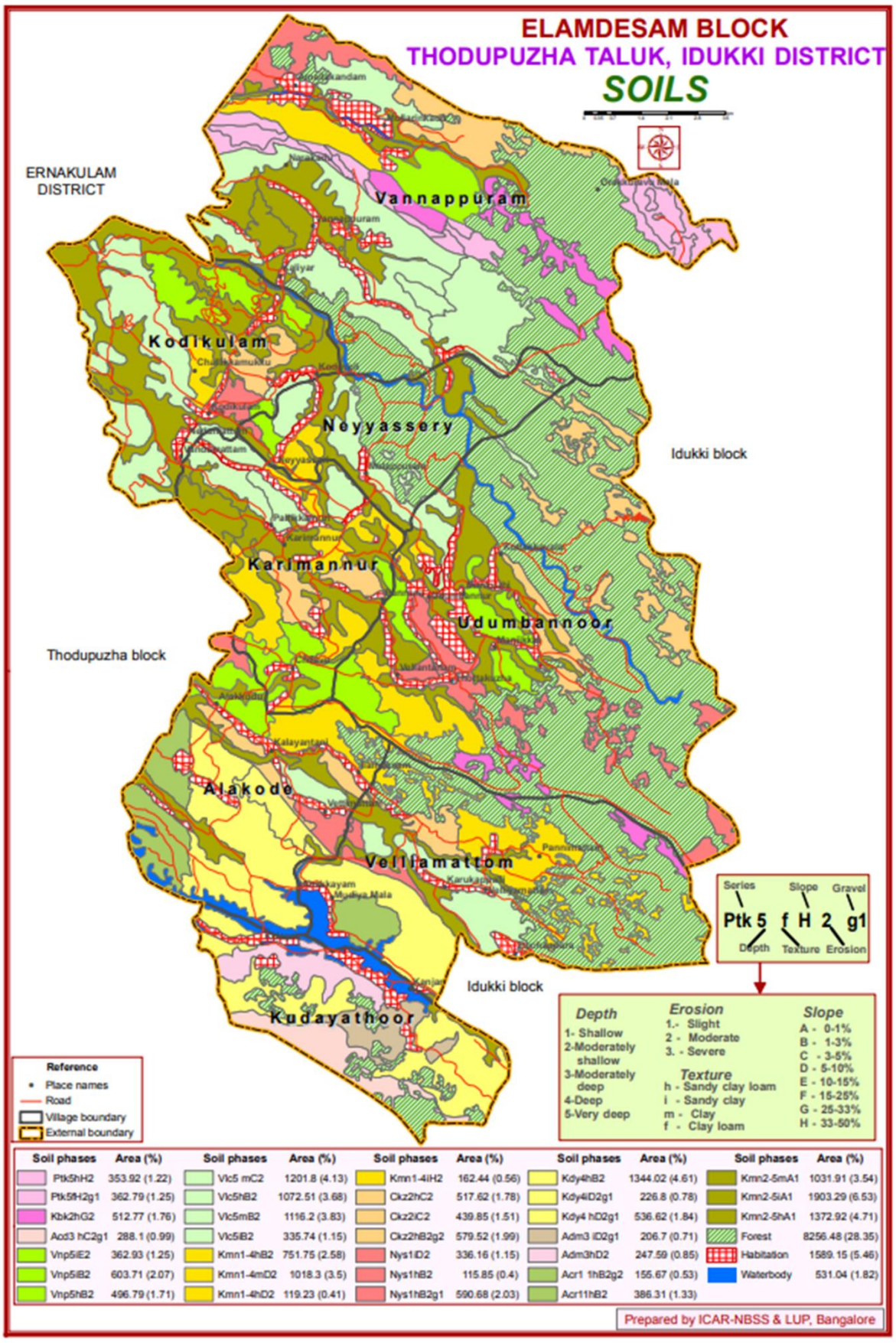

Figure 1: Soils of Elamdesam block, Tropical humid region, Kerala

Figure 2: Landscape and Soil Profile of Pattekudi Series / soils

2.2.1.2: Kambaka Kanam series/ soils: Kambaka Kanam series is a member of the loamy mixed isohyperthermic family of Humic Dystrustepts. Typically, Kambaka Kanam soils have a dark brown, Very Strongly acid, sandy clay loam A horizon; a dark brown, extremely acid, sandy clay loam B horizon. They have developed from Granite-gneiss and occur on steep slopes of 25-33 per cent at foothills (300-600m above MSL) and high hills (>600 m above MSL) and occupy around 1.76 per cent of the total geographical area. The thickness of the solum is 54 cm. The A horizon is 16 cm thick. Its colour is in the hue 7.5YR, value 3 and chroma 2. The texture is sandy clay loam. The thickness of the B horizon is 40 cm. Its colour is in hue 7.5YR, value 3 and chroma 3 to 4. The texture is sandy clay loam.

2.2.2 Soils of Charnockite landform

2.2.2.1: Arcade series/soils: Arcade series is a member of the loamy skeletal mixed isohyperthermic family of Humic Dystrustepts (Figure 3). Typically, Arcade soils have a dark reddish brown, strongly acid, sandy clay loam A horizon; dark reddish brown and brown, strongly acid and very strongly acid, sandy clay loam B horizon. They have developed from Charnockite and occur on the gentle slope of 3 - 5 per cent at foothills (300-600 m above MSL) and high hills (>600 m above MSL) and occupy around 0.99 per cent of the total geographical area. The thickness of the solum ranges from 59 to 86 cm. The A horizon is 13 to 15 cm thick. Its colour is in the hue 5YR to 7.5YR, value 3 and chroma 2 to 4. The texture is sandy clay loam. The gravel content ranges from 20 to 35 per cent. The thickness of B horizon is 44 to 73 cm. Its color is in hue 5YR to 7.5YR, value 3 to 4 and chroma 3 to 6. The texture is sandy clay loam. The gravel content ranges from 25 to 35 per cent.

Figure 3: Landscape and Soil Profile of Arcade Series / soils

2.2. Soils of Midlands/ Uplands (< 300 m above MSL)

2.2.1 Soils of Granite- gneiss landform

2.2.1.1: Vannappuram series/soils: The Vannappuram series is a member of the clayey mixed isohyperthermic family of Ustic Haplohumults (Figure 4). Typically, Vannappuram soils have a dark brown, extremely acidic, clay A horizon and dark brown, dark reddish brown, extremely acidic, very strongly acidic, sandy clay and clay loam B horizon. They have developed from granite-gneiss and occur on very gentle to rolling slopes of 1 to 15 per cent at midlands/ uplands (<300 m above MSL) and occupy around 5.02 per cent of the total geographical area. The thickness of the solum ranges from 150 to 175 cm. The A horizon is 10 to 17 cm thick. Its colour is in the hue 5YR to 7.5YR, value 3 to 4and chroma 2 to 4. The texture is sandy clay. The thickness of the B horizon ranges is 135 to 163 cm. Its colour is in hue 5YR to 7.5YR, value 3 to 5, chroma 3 to 6. The texture is sandy clay and clay loam. Cutans are present in subsoils.

2.2.1.2: Vellanchara series: Vellanchara series is a member of the clayey kaolinitic isohyperthermic family of Ustic Kandihumults (Figure 5). Typically, Vellanchara soils have yellowish red, strongly acid, sandy clay A horizon; yellowish red to red, very strongly acid to strongly acid, sandy clay, clay loam, clay B horizons. They have developed from granite-gneiss and occur on very gentle to gentle slopes of 1 to 5 per cent at midlands/ uplands (<300 m above MSL) and occupy around 12.79 per cent of the total geographical area. The thickness of the solum ranges from 150 to 210 cm. The A horizon is 13 to 20 cm thick. Its colour is in the hue 5YR to 7.5YR, value 3 to 5 and chroma 3 to 6. The texture is sandy clay, sandy clay loam and clay. The gravel content ranges from 5 to 30 per cent. The thickness of the B horizon ranges is 130 to 194 cm. Its colour is in hue 2.5YR to 7.5YR, value 3 to 5 and chroma 4 to 8. The texture is sandy clay, clay loam, clay and sandy clay loam. The gravel content ranges from 20 to 35 per cent. Cutans are present in subsoils.

Figure 4: Landscape and Soil Profile of Vannappuram Series/ soils

2.2.1.3: Karimannor1 series/ soils: The Karimannoor-1 series is a member of the clayey mixed isohyperthermic family of Ustic Haplohumults (Figure 6). Typically, Karimannoor-1 soils have Reddish brown, very strongly acid, sandy clay A horizon and Reddish brown, Yellowish red, Red, strongly to very strongly acid, sandy clay B horizon. They have developed from granite-gneiss and occur on very gentle to moderate and very steep slopes of 1 to >33 per cent at midlands/ uplands (<300 m above MSL) and occupy around 7.04 per cent of the total geographical area. The thickness of the solum ranges from 100 to 115 cm. The A horizon is 16 to 20 cm thick. Its colour is in the hue 5YR to 7.5YR, value 3 to 4and chroma 2 to 4. The texture is sandy clay and sandy clay loam. The gravel content ranges from 20-25 per cent. The thickness of the B horizon ranges is 86 to 95 cm. Its colour is in hue 5YR to 7.5YR, value 3 to 4, chroma 3 to 6. The texture is sandy clay and sandy clay loam. The gravel content ranges from 30-35 per cent. Cutans are present in subsoils.

Figure 5: Landscape and Soil Profile of Vellanchara Series/ soils

Figure 6: Landscape and Soil Profile of Karimannor1 Series/ soils

2.2.1.4: Chinikuzhi series/soils: The Chinikuzhi series is a member of the fine loamy mixed isohyperthermic family of Humic Dystrustepts (Figure 7). Typically, Chinikuzhi soils have a dark brown, very strongly acid, sandy clay loam A horizon and dark brown, brown, very strongly acid, sandy clay loam, sandy clay B horizon. They have developed from granite-gneiss and occur on very gentle to gentle slopes of 1 to 5 per cent at Midlands/ Uplands (<300 m above MSL) and occupy around 5.28 per cent of the total geographical area. The thickness of the solum ranges from 60 to 72 cm. The A horizon is 27 to 40 cm thick. Its colour is in the hue 5YR to 7.5YR, value 3 to 4 and chroma 1 to 6. The texture is sandy clay loam, clay loam and sandy clay. The thickness of the B horizon ranges is 30 to 43 cm. Its colour is in hue 2.5YR to 7.5YR, value 3 to 4, chroma 3 to 6. Texture is sandy clay loam, sandy clay and clay.

Figure 7: Landscape and Soil Profile of Chinikuzhi Series/ soils

2.2.1.5: Neyyessery series/ soils: The Neyyessery series is a member of the loamy mixed isohyperthermic family of Lithic Dystrustepts (Figure 8). Typically, Neyyessery soils have Reddish brown, very strongly acid, sandy clay loam A horizon and Reddish brown, Yellowish red, very strongly acid, strongly acid, sandy clay loam B horizon. They have developed from granite-gneiss and occur on gentle to moderate slopes of 1 to 10 per cent at midlands/ uplands (<300 m above MSL) and occupy around 3.58 per cent of the total geographical area. The thickness of the solum ranges from 28 to 46 cm. The A horizon is 10 to 16 cm thick. Its colour is in the hue 5YR to 7.5YR, value 3 to 4 and chroma 2 to 4. The texture is sandy clay loam, sandy loam and sandy clay. The gravel content ranges from 25 to 35 per cent. The thickness of the B horizon ranges is 15 to 33 cm. Its colour is in hue 5YR to 7.5YR, value 3 to 4, chroma 2 to 4. The texture is sandy clay loam and sandy clay. The gravel content ranges from 15 to 35 per cent.

Figure 8: Landscape and Soil Profile of Neyyessery Series/ soils

2.2.2. Soils of the Charnockite landform

2.2.2.1: Kudayathor series/ Soils: The Kudayathoor series is a member of the loamy mixed isohyperthermic family of Ustic Haplohumults (Figure 9). Typically, Kudayathoor soils have Reddish brown, moderately acid, clay loam A horizon and Reddish brown, Dark reddish brown, Yellowish red, strongly acid, clay loam, sandy clay, sandy clay loam, sandy loam B horizon. They have developed from charnockite and occur on very gentle to moderate slopes of 1 to 10 per cent at midlands/ uplands (<300 m above MSL) and occupy around 7.0 per cent of the total geographical area. The

thickness of the solum ranges from 102 to 142 cm. The A horizon is 12 to 14 cm thick. Its colour is in the hue 5YR to 10YR, value 3 to 5 and chroma 2 to 4. The texture is sandy clay, sandy clay loam and clay loam. The gravel content ranges from 15-35 per cent. The thickness of the B horizon ranges is 92 to 126 cm. Its colour is in hue 2.5YR to 10YR, value 3 to 4, chroma 3 to 6. Texture is sandy clay, sandy clay loam, clay loam and clay. The gravel content ranges from 10-35 per cent. Cutans are present in subsoils.

2.2.2.2. Adurmala series/soils: The Adurmala series is a member of the clayey kaolinite isohyperthermic family of Ustic Haplohumults (Figure 10). Typically, Adurmala soils have reddish brown, strongly acid, sandy clay loam A horizon and Yellowish red, strongly acid, moderately acid, sandy clay loam, clay loam B horizon. They have developed from charnockite and occur on moderate slopes of 5 to 10 per cent at midlands/ uplands (<300 m above MSL) and occupy around 1.56 per cent of the total geographical area. The thickness of the solum ranges from 82 to 99 cm. The A horizon is 11 to 19 cm thick. Its colour is in the hue 5YR to 7.5YR, value and chroma 3 to 4. The texture is sandy clay and sandy clay loam. The thickness of the B horizon ranges is 71 to 81 cm. Its colour is in hue 2.5YR to 5YR, value 3 to 4, chroma 3 to 8. Texture is sandy clay, sandy clay loam and clay loam. Cutans are present in subsoils.

Figure 9: Landscape and Soil Profile of Kudayathor Series/ soils

2.2.2.3. Ancheri series/ soils: The Ancheri series is a member of the Sandy mixed isohyperthermic family of lithic Ustorthents (Figure 11). Typically, Ancheri soils have a dark brown, strongly acid, sandy loam A horizon and a dark brown, moderately acid, sandy loam B horizon. They have developed from charnockite and occur on very gentle slopes of 1 to 3 per cent at midlands/ uplands (<300 m above MSL) and occupy around 1.86 per cent of the total geographical area. The A horizon is 32 to 45 cm thick. Its colour is in the hue 5YR to 7.5YR, value 3 to 4 and chroma 2 to 6. The texture is sandy loam, sandy clay loam and clay loam.

2.3. Soils of Lowlands (paddy lands)/ Valley plain

2.3.1: Karimannoor-2 series/ soils: Karimannoor-2 series is a member of the fine, mixed, isohyperthermic family of Oxyaquic Haplustalfs (Figure 12). Typically, Karimannoor-2 soils have a dark brown, very strongly acid, sandy clay A horizon; dark yellowish brown, yellowish brown, dark gray, extremely acid, very strongly acid and strongly acid clay loam, sandy clay loam, clay B horizons. They have developed from low areas of narrow inter-hill basins of foothill regions on nearly level slopes of 0 to 1 per cent and occupy around 14.79 per cent of the total geographical area. The thickness of the solum ranges from 105 to 150 cm. The A horizon is 14 to 16 cm thick. Its colour is in the hue 10YR, value 4 and chroma 2 to 4. The texture is clay loam, sandy clay and clay. The thickness of the B horizon ranges is 91 to 136 cm. Its colour is in hue 7.5YR to 10YR, value 4 to 5, chroma 4 to 6. Texture is sandy clay, clay loam and clay. Water stagnation is there in sub soils.

Figure 10: Landscape and Soil Profile of Adurmala Series/soils

Figure 11: Landscape and Soil Profile of Ancheri Series/ soils

Figure 12: Landscape and Soil Profile of Karimannoor2 Series

3. CONCLUSION

Ultisols, Inceptisols and Alfisols are the major soils that occur in the tropical humid region. Heavy rainfall caused the washing out of the Ap horizon, leaching of bases, soil acidity and aluminium saturation, which limits the crop production. Midlands and uplands together occupy the highest area of 12924.79 ha (44.37 %). Midlands and uplands granites and gneisses dominated (9821.08 ha) over charnockite landform (3103.71 ha). Karimannoor-2 series/soils belong to lowlands occupied by dominant soils of 4308.12 ha, followed by series Vellanchara (3726.25 ha) of the Midlands and uplands.

4. REFERENCES

Chandrakala, M., Srinivasan, R, Anil Kumar, K. S., Nair, K. M., Sunil P. Maske, Ramesh Kumar, S. C., Srinivas, S., Rajendra Hegde, Singh, S. K., 2017. Land Resource Inventory of Elamdesom block, Idukki district, Kerala on 1:10000 scale for optimal agricultural land use planning, using geo-spatial techniques. NBSS Publ. No.1049, NBSS&LUP, Nagpur, p1-128.

Chandrakala M., Srinivasan R., Kumar A. K. S., Sujatha K., Ramesh M., Hegde R., Singh S. K., Nirmala H. R., 2018, Characterisation and classification of rubber growing soils of Kerala, India, Current Journal of Applied Science and Technology., 32(1): 1-12.