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Study of Land Evaluation in Giddadapalya Microwatershed, Tumkur District

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Abstract

The present study was undertaken to characterize soils in Giddadapalya micro watershed, Tumkur District, located in the Southern dry zone of Karnataka. Cadastral map at 1:7920 scale was used as base map for the study. The satellite image along with toposheet was used for delineation of land forms and physiographic units. Horizon wise soil samples were collected from nineteen pedons and analyzed for important physical and chemical properties. The detailed soil characterization resulted in six soil series and twenty soil phases, which were evaluated for land capability classification and land suitability. Land capability classification was determined for these twenty soil phases which indicated LCC II classes with erosion and soil limitation. These soils had none to slight limitations with respect to slope, erosion, drainage, depth, texture, coarse fragments, $CaCO_3$, pH and organic carbon. The soil pH ranged from neutral to slightly alkaline. The soils were non saline and all pedons exhibited irregular trend in electrical conductivity. The organic carbon content ranged from medium to high. The distribution of exchangeable bases in soil exchange complex were in the order of Ca > Mg > Na> K like 14.4>12.2>0.56>0.12 meq/100g soil. The cation exchange capacity in this micro watershed varied from 14 to 54 c mol(p^+)/kg. The land suitability for major agriculture crops like finger millet, red gram, groundnut, castor and marigold and the database was used for suggesting appropriate cropping system suitable for the location, there by utilizing the land resource for the best suited crop. The agriculture crops such as finger millet, red gram, groundnut, castor and marigold are highly suitable for major part of Giddadapalya Micro watershed. Similarly the major horticulture crops such as Mango, Sapota, guava are highly suitable for major part of the micro watershed. Mango, Sapota and arecanut was suitable for 69.09 % area and coconut were suited for 72.05 % area.

Keywords: Land suitability map, LCC, Agriculture crops, Horticulture crops, watershed.

Introduction

The agro-climate and soil characteristics of any region largely determine the degree of success of any cropping enterprise. Though this fact is recognized widely, studies to generate quantified information on combined influence of agro-climate and soil characteristics on crop performance are scattered. Quantitative information on land evaluation helps in better land use planning as yield levels have to be higher to sustain the increasing non-farming population (Tang and Ranst 1998) [22].

Land Capability is the ‘‘quality’’ of land to produce common cultivated crops and pasture plants without deterioration over a long period of time (FAO, 1983) [3]. Wells (2001) [24-25] defined land capability as ‘‘the ability of land to support a particular type of use without causing permanent damage’’. Land capability classification categories are subdivided into capability classes and subclasses. The soil, as the main component of land capability classification system, takes into consideration soil limitations, risk of damage when soils are used, and the way in which soils respond to treatment. Capability classes range from Class I soils, which have few limitations for agriculture, to Class VIII soils, which are unsuitable for agriculture. The land capability classification provides a guide for the assess-ment of soil constraints and land management recommendations for use at a range of scales including state, catchment and the property planning level (Murphy, 2004) [8].

Land suitability evaluation is the process of determining the potential of the land for current and alternative uses and forms a pre-requisite for land use planning (Sehgal, 1995) [17]. It integrates soil characteristics with climate and land use. Soil-site characteristics determine the degree of suitability for land use and help in planning expansion of area under a particular crop. (Giri *et al.* 1994; Singh *et al*. 1998; Sharma *et al*. 2001) [5, 19, 18]. Studies relating soil and site characteristics and crop requirements form the basis for soil suitability evaluation and formulation of meaningful land use plan. Such studies in Tumkur district, in particular and

Karnataka state, in general, are scanty.

The National Horticulture Mission was launched in the country as a centrally sponsored programme in 2005 to promote horticulture development in different states. The programme aims at increasing the production and productivity of horticultural crops through adoption of improved technologies and area expansion of regionally adapted crops, the task was given to the horticultural departments of different states to promote area expansion, provide drip irrigation schemes and develop processing! cold storage facilities for horticulture development in potential areas till 2012, Horticultural crops, in general, are perennial in nature. Therefore, site selection plays an important role in their cultivation and sustained production. Plant nutrients, irrigation, plant protection and high labor costs demand high investments necessitating proper land suitability assessment so that returns for rupee invested are high, economical and profitable (Naidu *et al* 2009) [10].

Watershed management has been defined as rational utilization of land and water resources for optimum and sustained production with minimum hazards to natural resources. It essentially relates to soil and water conservation and leads to proper land use as per the capability or suitability of soils, protection of land against degradation, maintenance of soil fertility and increasing productivity from all land uses.

Considering the rapid growth of the world’s population, the dire needs for effective and efficient application of the croplands have been felt more than ever. Sustainable agriculture would be achieved if lands be categorized and utilized based upon their different uses (FAO, 1983) [3]. Remote sensing (RS) data are used for estimating biophysical parameters and indices besides cropping systems analysis and land-use and land-cover estimations. However, RS data alone cannot suggest crop suitability for an area unless the data are integrated with the site-specific soil and climate data. RS data can be used to delineate various physiographic units besides deriving ancillary information about site characteristics, slope, direction and aspect of the study area (Rao, *et al* 1996 & Panigrahy, 2006) [13, 12]. However, detailed information of soil profile properties is essential for initiating crop suitability evaluation. Hence, soil survey data are indispensable for generating a soil map of the given region, which helps in deriving crop suitability and cropping system analysis. RS data coupled with soil survey information can be integrated in the geographical information system (GIS) to assess crop suitability for various soil and biophysical conditions.

The best use for land is a function of crop requirements and soil/land characteristics. Detailed soil spatial information is, therefore, required for many land management application (Burrough, 1996) [1]. However, this information was lacking to take up proper planning in the study area. Hence, it is necessary to evaluate the soil in a given agro-ecological unit for crop production under defined management system. Accordingly, potentials and limitations of soils were assessed using field survey to support the evaluation. Land management practices that can control the processes of land degradation, and their efficiency in this respect, will largely govern sustainability of a given land use (Smyth and Dumanski, 1993) [20]. Hence, sustainable agriculture would be achieved if lands be categorized and utilized based upon their different uses (FAO, 1984) [4].

Delineation of suitable areas and identification of soil and climatic constraints for better management were attempted through the present study so that the information can serve as a base material for implementing the horticulture developmental programmes. The aim of this evaluation was to find out which parcels of land may best support the different horticulture crops commonly grown by the local farmer. The focus was on horticulture crops that can be used to alleviate poverty and improve nutrition in farm households, with the highest priority assigned to crops already well established in the area.

Materials and Method

Giddadapalya micro-watershed (Kalkere sub-watershed, Tumkur taluk, Tumkur district) is located at North latitude 13^{0}7’19.19" and 13^{0} 9‘17.99' and East longitude 77^{0} 3' 18"‘ and 77^{0} 4’ 22.79' covering an area of about 485 ha, bounded by Thimmanapalya, Niduvalalu, Narayanakere, Doddaguni, Gangonahalli and Sulekuppe Kavalu villages (Fig 1).

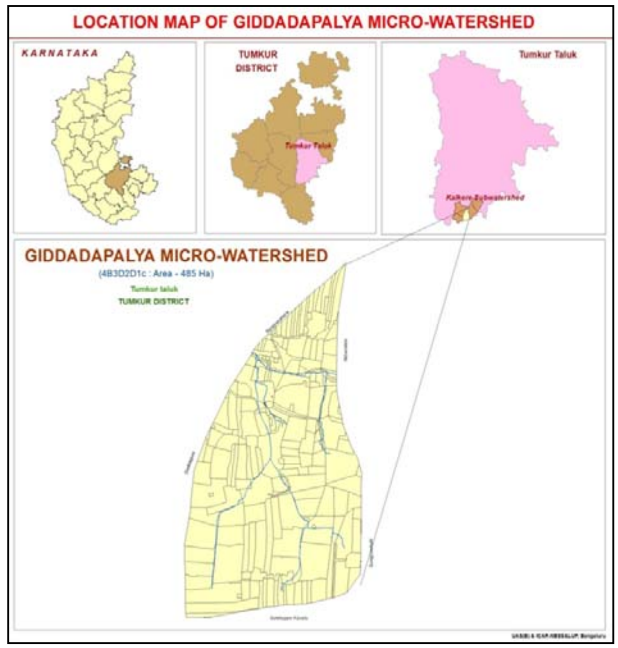

Fig 1

The micro-watershed is located in Central Karnataka plateau, hot, moist, semi-arid eco-sub region, Southern Plateau and Hill Region. The agro climatic zone 4 (Tumkur, Madhugiri, Pavagada, Kortagere, Chikkanayakanahalli and Sira) extends over all the six taluks of Tumkur district and four districts of Chitradurga, Davangere, Chickmagalur and Hassan. The total geographical area of the zone is about 19, 43, 830 ha of which 12, 93, 011 ha is under cultivation with 2, 51, 270 ha under irrigation. Most of the zone is at an elevation of 800-900m MSL in major areas, in remaining areas 450-800m MSL. Average annual rainfall of the zone ranges from 455.5 to 717.4 mm. The major soils are Red Sandy loams and shallow to deep black soil. The main cropping season is Kharif.

Soil description and physic-chemical determination

The study area was delineated with the help of toposheets of 1:50,000 scale and soil survey was carried out using base map on 1:7920 scales. Detailed traverse of the micro watershed was made to identify the major landforms like uplands and lowlands. 6 representative pedons were selected on different land forms, 20 soil phases were selected and were located in transects along the slope from the upper to lower slopes. The profiles were dug up to 150 cm depth or up to parent rock whichever was shallower, and studied for their morphological characteristics as per Soil Survey manual (Soil Survey

Division Staff, 1999) [16]. The horizon wise soil samples were collected, air dried and passed through 2 mm sieve and analyzed for particle size distribution following international pipette method (Richards, 1954). pH and electrical conductivity (EC) in 1:2.5 soil: water suspension (piper, 1966) [14]. Organic carbon content was estimated by Walkley and Black (1934) [23] method. The CEC and exchangeable cations were determined as described by Jackson (1958) [6]. Based on soil site characteristics and the crop requirements the soil suitability classes were developed as per the criteria suggested by Sys *et al.*, (1993) [21] and NBSS and LUP (1994) [11].

Land capability classification

The classification is based on the inherent soil characteristics, external land features and environmental factors that limit the use of land. Based on the susceptibility of soils to erosion (e), soils(s), topography (t) and drainage (d) limitations the study area was classified into different land capability classes. Arable lands that are fit for agriculture were grouped under I to IV and non-arable lands were grouped class VI to VIII, Criteria for the land capability classification (Klingebiel and Montgomery, 1996) was followed.

Land suitability classification

Soil site characteristic were studied for each parcel of land which is essential for generating land suitability. Soil-site suitability criteria developed for these crops (Naidu *et al*. 2006) [9] were used to categories lands as highly suitable (S1), moderately suitable (S2), marginally suitable (S3) and unsuitable (N) for production of these crops. Suitable (highly and moderately suitable) areas for these crops were delineated for crop area expansion. Soil site characteristics of the different phases (Table 3 & Fig 2) were matched with criteria for land suitability classification.

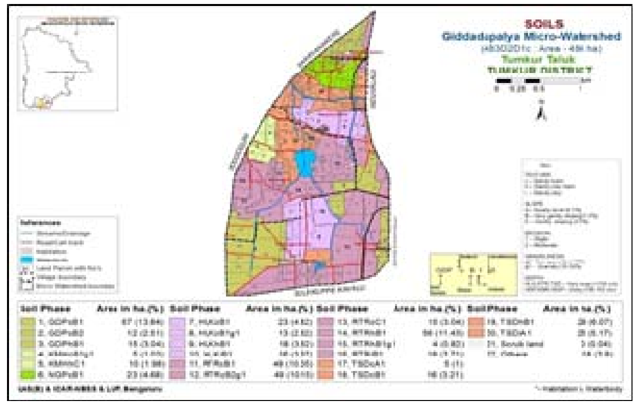

Fig 2: Soils of Giddadapalya Micro watershed

Delineation of the study area

Study area was delineated with the help of topographic map and watershed Atlas prepared by KSRSAC. Study area was extracted from the satellite imagery, permanent features like road, river, watershed boundary is extracted for preparation of base map. It is the base for preparation of thematic maps for different suitability classes for major crops.

Result and Discussion

Six soil series namely, Giddadapalya (GDP), Kumchahalli (KMH), Nagalapura (NGP), Hallikere (HLK), Ranatur (RTR) and Thimmasandra (TSD) were identified and mapped based on their morphological properties (Table - 1) and Physico-chemical properties (Table - 2).

Table 1: Soil morphological properties of Giddadapalya micro watershed

Horizon	Depth	Colour (Moist)	Sand	clay	Silt	Texture	Structure	Gravel (%)
Pedon 1 (Giddadapalya)								
Ap	0-17	5YR3/4	65.30	27.50	5.20	scl	1f sbk	<5
Bt1	17-42	2.5YR2.5/4	50.65	25.00	21.45	Scl	2m sbk	<5
Bt2	42-65	2.5YR2.5/4	54.30	24.30	21.00	scl	2m sbk	<5
Bt3	65-85	2.5YR2.5/4	44.05	42.80	10.75	Sc	2m sbk	<5
Bt4	85-109	2.5YR3/4	65.25	21.00	11.45	scl	2 f sbk	60
Bt5	109-133	2.5YR3/4	50.45	28.10	19.00	scl	2 f sbk	60
Bt6	133-155	2.5YR3/6	49.20	21.50	27.00	scl	2 f sbk	40
Pedon 2 (Kumchahalli)								
Ap	0-13	7.5YR3/4	56.51	22.00	20.35	scl	1 m Sbk	20
Bt1	13-32	2.5YR3/6	51.65	39.00	9.35	Sc	2 m Sbk	25
Bt2	32-59	2.5YR2.5/4	50.40	27.30	31.00	scl	2 m Sbk	30
Bt3	59-79	2.5YR2.5/3	53.90	12.50	30.60	Scl	2 m Sbk	20
BC	79-108	2.5YR2.5/3	43.75	29.56	24.25	Scl	2 m Sbk	20
Cr	108							
Pedon 3 (Nagalapura)								
Ap	0-16	5YR3/4	60.21	35.00	4.79	Sc	1 m Sbk	20
Bt1	16-27	5YR3/4	45.30	50.00	4.70	Sc	2 m Sbk	25
Bt2	27-49	5YR3/4	60.40	32.00	7.60	Scl	2 m Sbk	25
Bt3	49-73	5YR3/4	61.55	35.00	3.45	Sc	2 m Sbk	15
Bt4	73-104	5YR4/6	60.00	36.00	4.00	Sc	2 m Sbk	30
Bt5	104-136	5YR3/4	60.20	33.00	7.20	Sc	2 m Sbk	70
Bc	136-154							
Pedon 4 (Hallikere)								
Ap	0-17	5YR 3/3	62.80	34.80	1.00	Sc	1f sbk	<5
Bt1	17-41	5YR 3/4	46.50	46.50	4.65	Sc	2msbk	<5
Bt2	41-62	5YR 3/4	48.92	44.00	5.65	c	2 m sbk	<5
Bt3	62-84	5YR 3/4	49.00	35.00	14.85	c	2 m sbk	<5
Bt4	84-106	5YR 3/4	44.21	34.90	19.15	c	2 m sbk	<5
Bt5	106-131	5YR 3/4	46.30	34.80	16.70	c	2 m sbk	<5

Bt6	131-155	5YR 4/6	46.30	27.00	25.00	c	2 m sbk	20
Pedon 5 (Ranatur)								C
Ap	0-15	7.5YR 3/4	76.70	15.00	7.00	Sl	1 f sbk	<5
Bt1	15-32	2.5YR2.5/3	56.00	37.50	5.15	Sc	2 m sbk	<5
Bt2	32-47	2.5YR2.5/3	44.55	45.00	8.45	Sc	2 m sbk	<5
Bt3	47-67	2.5YR2.5/3	43.00	47.50	8.25	c	2 m sbk	<5
Bt4	67-90	2.5YR2.5/4	39.70	47.50	11.20	c	2 m sbk	<5
Bt5	90-101	2.5YR 3/6	38.95	45.00	13.35	c	2 m sbk	<5
Bt6	101-146	5YR 3/4	35.10	50.00	12.90	c	2 m sbk	<5
Bt7	146-160	5YR 3/4	39.00	35.00	23.80	c	2 m sbk	<5
Pedon 6 (Timmasandra) (Lowland)								
Ap	0-27	10YR4/3	44.21	34.90	19.15	c	2 msbk	<5
Bw1	27-40	10YR3/3	46.50	46.50	4.65	c	2 m sbk	<5
Bw2	40-63	10YR4/1	48.92	44.00	5.65	c	2 m sbk	<5
Bw3	63-96	10YR4/2	49.00	35.00	14.85	c	2 m sbk	<5
Bw4	96-118	10YR5/1	44.21	34.90	19.15	c	2 m sbk	<5
Bw5	118-150	10YR5/1	49.80	39.00	9.20	sc	2 m sbk	<5

Table 2: Soil chemical properties of Giddadapalya micro watershed

	Depth	**pH**	**EC**	**OC**	**K**	**Na**	**Ca**	**Mg**	**CEC**
	cm		**dS/m**	**%**	**Meq/100g**				
Pedon 1	0-17	6.37	0.49	0.96	0.08	0.41	2.80	1.40	14.00
Giddadapalya	17-42	6.53	0.92	0.80	0.05	0.12	6.10	0.60	34.00
	42-65	7.00	0.76	0.84	0.05	0.56	6.90	1.70	24.00
	65-85	7.07	0.81	0.92	0.05	0.11	7.70	2.20	20.00
	85-109	7.21	0.69	0.68	0.05	0.13	5.90	1.80	34.00
	109-133	7.26	0.64	0.66	0.04	0.13	5.00	2.00	22.00
	133-155	7.07	0.74	0.64	0.04	0.14	6.40	1.70	22.00
Pedon 2	0-13	7.00	0.12	0.56	0.19	0.03	9.40	6.40	16.02
Kumchahalli	13-32	7.38	0.13	0.32	0.22	0.03	9.60	6.90	16.75
	32-59	7.70	0.15	0.32	0.34	0.07	9.90	6.30	16.61
	59-79	7.96	0.16	0.22	0.46	0.09	11.90	7.80	20.24
	79-108	7.52	0.16	0.10	0.21	0.06	6.70	4.40	11.36
	108	7.00	0.12	0.56	0.19	0.03	9.40	6.40	16.02
Pedon 3	0-16	8.11	0.24	0.48	0.16	0.21	12.20	5.80	18.37
Nagalapura	16-27	8.25	0.40	0.40	0.26	0.24	13.10	8.20	21.80
	27-49	8.72	0.41	0.24	0.32	0.35	16.10	7.80	24.57
	49-73	8.43	0.41	0.20	0.31	0.27	14.00	6.30	20.88
	73-104	8.51	0.46	0.12	0.34	0.30	15.60	7.50	23.74
	104-136	8.11	0.24	0.48	0.16	0.21	12.20	5.80	18.37
Pedon 4	0-17	6.62	0.71	0.71	0.12	0.25	13.20	6.40	19.65
Hallikere	17-41	6.08	0.60	0.60	0.04	0.23	15.41	7.20	23.58
	41-62	6.05	0.53	0.53	0.04	0.27	15.80	7.80	24.00
	62-84	6.50	0.26	0.46	0.03	0.40	14.10	7.12	20.36
	84-106	6.53	0.36	0.36	0.04	0.21	15.90	7.70	24.12
	106-131	6.48	0.23	0.23	0.03	0.22	16.20	7.50	29.85
	131-155	6.41	0.32	0.12	0.04	0.26	16.20	8.20	26.98
Pedon 5	0-15	6.45	0.93	0.48	0.08	0.23	7.90	3.50	9.65
Ranatur	15-32	6.40	0.38	0.40	0.10	0.24	6.60	3.60	10.30
	32-47	6.50	0.33	0.38	0.09	0.43	12.40	6.20	12.65
	47-67	6.69	0.30	0.34	0.07	0.44	8.60	4.20	15.38
	67-90	6.76	0.28	0.24	0.07	0.37	10.30	5.30	18.68
	90-101	6.84	0.34	0.24	0.08	0.50	14.20	7.82	22.55
	101-146	6.69	0.42	0.44	0.08	0.45	13.12	6.20	20.36
	146-160	6.77	0.45	0.40	0.07	0.42	14.70	8.10	21.25
Pedon 6	0-27	7.66	0.26	0.92	0.10	0.17	9.40	3.50	20.00
Timmasandra	27-40	8.06	0.31	0.76	0.10	0.17	11.60	4.90	44.00
	40-63	8.13	0.34	0.44	0.12	0.20	14.40	6.20	50.00
	63-96	8.22	0.34	0.52	0.19	0.21	12.50	6.80	56.00
	96-118	8.21	0.35	0.48	0.22	0.27	13.40	7.70	52.00
	118-150	8.24	0.31	0.20	0.30	0.36	13.70	7.80	54.00

The soils of Giddadapalya (GDP) series were deep, well drained, occurring on very gently to gently sloping uplands derived from granite gneiss characterized by occurrence of 30-60 percent gravels after 60cm depth, with sandy clay loam to sandy clay texture having dark red (2.5YR 3/6) to dark reddish brown (2.5YR 3/4) in color. Kumchahalli (KMH) soil series which derived from granite gneiss occurring on very gently sloping uplands were deep (100-150cm), well drained, sandy clay surface texture and sandy clay subsurface texture and surface color is dark brown (7.5YR 3/4) and in subsurface colour varies from dark red (2.5YR3/6) to dark reddish brown (2.5YR2.5/3). Soils of Nagalapura (NGP) series occurring on uplands were deep, well drained derived from Granite gneiss, sandy clay loam texture in surface and in subsurface it is sandy clay loam, yellowish red (5YR4/6) to dark reddish brown (5YR 3/4) in color. Hallikere (HLK) soil series which derived from granite gneiss occurring on very gently sloping uplands were very deep (>150cm), well drained, sandy clay in surface texture and clay in subsurface texture, yellowish red (5.4R 4/6) to dark reddish brown in (5YR 3/3, 3/4) in color. Ranatur (RTR) soil series which occur on nearly level to very gently sloping uplands soils were very deep, well drained, presence of clay in subsurface horizon, dark red (2.5YR 3/6) to dark reddish brown (2.5YR 3/4, 5YR 3/4) color were observed. Thimmasandra (TSD) soil series which occur on nearly level to very gentle slope in low land soils were very deep in depth, showed the presence of clay in sub surface texture.

The coarse fractions are showing the dominance in all the pedons because of partial weathered upper surface and in the mid stage of soil formation process. The coarser fractions dominate in all the profiles which could be largely due to silicaceous nature which are formed from granite gneiss parent material (Dutta *et al*, 2001) [2].

The physical and chemical characteristics of the soils are presented in Table 1. The cation exchange capacity (CEC) varied from 9.65 to 54.00 meq/100g soil. The increased CEC is due to translocation of clay from elluvial horizon to illuvial horizon shows the accumulation of clay fraction in subsurface horizon. The organic carbon content ranged from 0.10 to 0.96 per cent. The content was higher in soils occurring on hill or hill slopes owing to better vegetative cover. The pH varied from 6.05 to 8.72 and was found to increase as the slope flattened due to the lower rainfall and cropping systems and type of PM. Similarly, the electrical conductivity ranged from 0.12 to 0.93 Ds m^{-1} because these pedons are in upland. The Exchangeable cations were in the range of Ca > Mg > Na> K like 16.2>8.2>0.56>0.45 meq/100g soil, respectively.

Land capability classification

Based on the soil site characteristics of the study area, the soils were classified for land capability classes (Fig 3). These soil phases were grouped in to land capability class II. The soil phases in Giddadapalya micro watershed belongs to land capability class II having one subclass. The LCC class IIs occupied 418 ha (86.01 %) of the study area and class IIes occupied 50 ha (10.18 %) of the study area. These soils had none to slight limitations ranging from slope, erosion, drainage, depth, texture, coarse fragments, $CaCO_3$, pH, organic carbon.

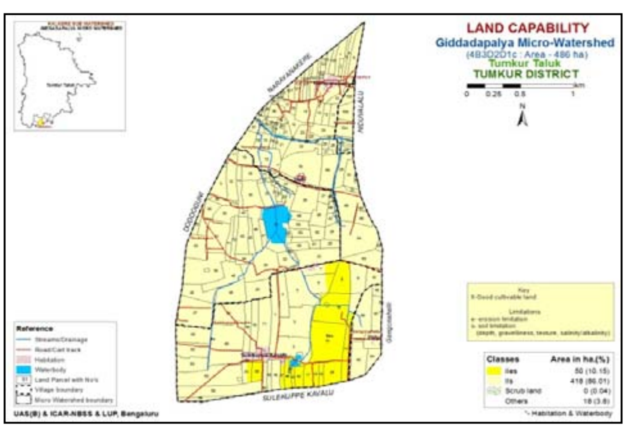

Fig 3: Land capability classification

Land Suitability Assessment for major Agriculture and Horticulture crops

Land suitability is the fitness of a given type of land for a defined use. The land may be considered in its present condition or after improvement. The process of land suitability classification is the appraisal and grouping of specific areas of land in terms of their suitability for defined uses. The framework at its origin permits complete freedom in determining the number of classes within each order. However, it has been recommended to use only three classes within order S and two classes within order N. The class will be indicated by an Arabic number in sequence of decreasing suitability within the order and thereof (Naidu *et al* 2006) [9].

The evaluation class for the crops' suitability ranges from highly suitable to permanently not suitable. This is due to the different condition that the crops require for their developments in the local area in question. Land suitability assessment for Horticulture crops in Giddadapalya (4B3D2D1c) Micro watershed Tumkur (Taluk) Tumkur (Dist) presented in table 3.

Suitability of land for ragi, red gram, ground nut, castor and marigold in Giddadapalya micro watershed showed that about 72.09 per cent of area (351 ha) is highly suitable (Fig 4, 5, 6 7 & 8). The gravels, rooting depth, topography and wetness constraints made 117 ha of land (24.07 %) moderately suitable for cultivation of these crops with the limitation of gravelliness. Most of the crops in this micro watershed is highly suitable because of soil depth, texture, topography and rainfall.

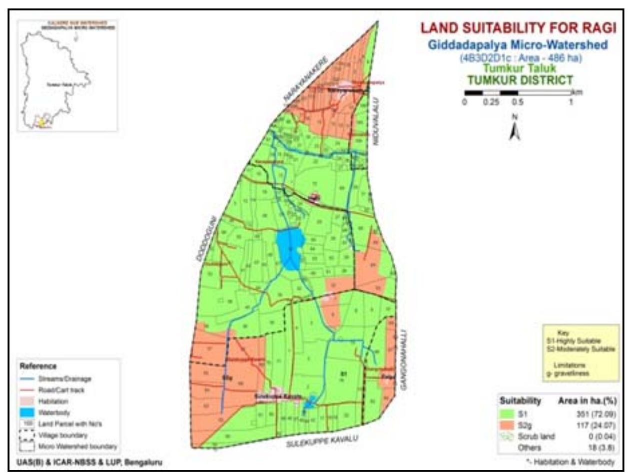

Fig 4: Land suitability for Fingermillet

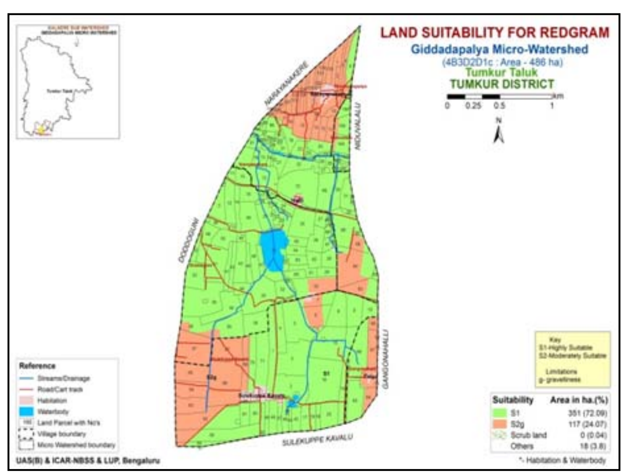

Fig 5: Land suitability for Redgram

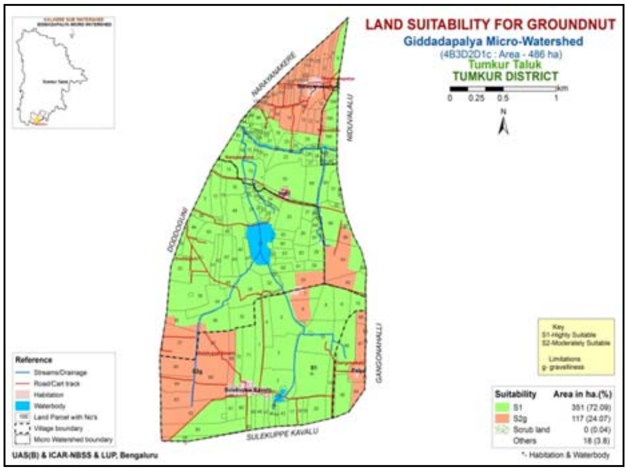

Fig 6: Land suitability for Ground nut

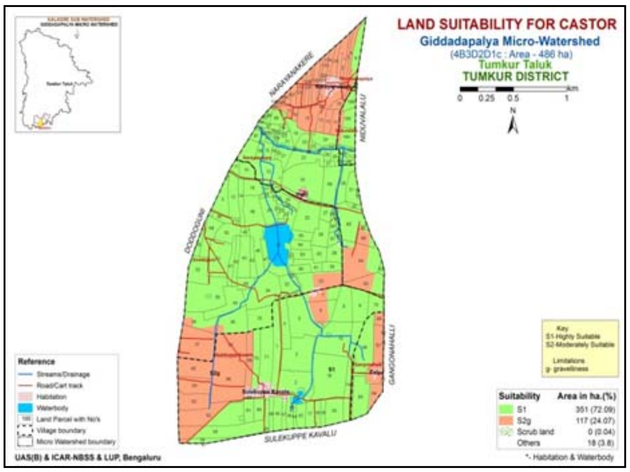

Fig 7: Land suitability for Castor

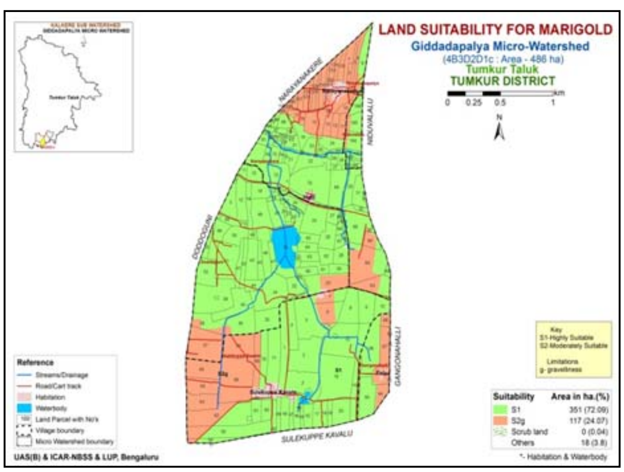

Fig 8: Land suitability for Marigold

Land suitability for mango (*Mangifera indica*)

Mango is a major fruit crop of the tropics and subtropics, it is the king of fruits and grows under temperature of 21-25 ^{o}C and rainfall of at least 600 mm per year. The crop is intolerant to saline conditions. Mango requires deep soils with good drainage not necessarily fertile but can thrive in a wide range of soil types. The suitability of land for mango in Giddadapalya micro watershed showed in the Fig 9.

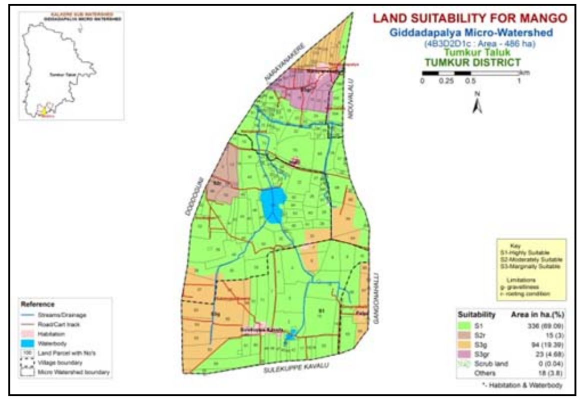

Fig 9: Soil site suitability of Mango

Land suitability for sapota (*Manilkhara achras*)

Sapota, a crop of tropical region, needs warm (10-38 ^{0}C) and humid (70 % relative humidity) climate and it flowers and fruits throughout the year. Sapota being a hardy tree can be grown on a wide range of soils. Soil should be well drained without any hard pan. Deep and porous soils are preferred. The most ideal soils are deep alluvium, sandy loams, red Laterite and medium black soil. The suitability of land for Sapota in Giddadapalya micro watershed indicated in the Fig 10.

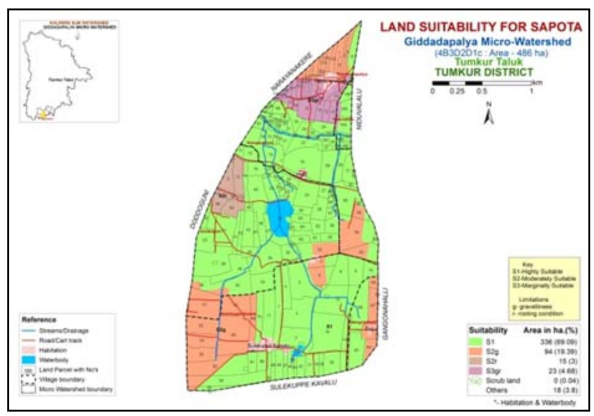

Fig 10: Soil site suitability of Sapota

Land suitability for Guava (*Psidium guajava*)

Guava tolerates a soil pH of 4.5-8.2. Maximum concentration of its feeding roots is present up to 25 cm soil depth. Thus, the top soil should be quite rich to provide enough nutrients for accelerating new growth which bears fruits. The suitability of Giddadapalya micro watershed for guava showed in the Fig 11.

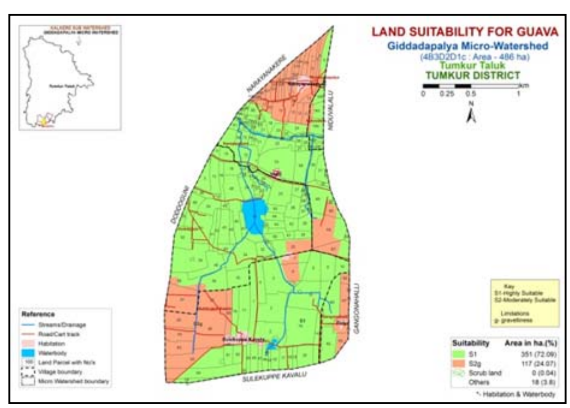

Fig 11: Soil site suitability of Guava

Land suitability for Arecanut

Arecanut grows under varying climatic condition and different soil types. The suitability of land for arecanut in giddadapalya micro watershed indicated that about 72.09 % of area (351 ha) is highly suitable and 24.07 % of the area (117 ha) is moderately suitable due to limitations like gravelliness (Fig 12).

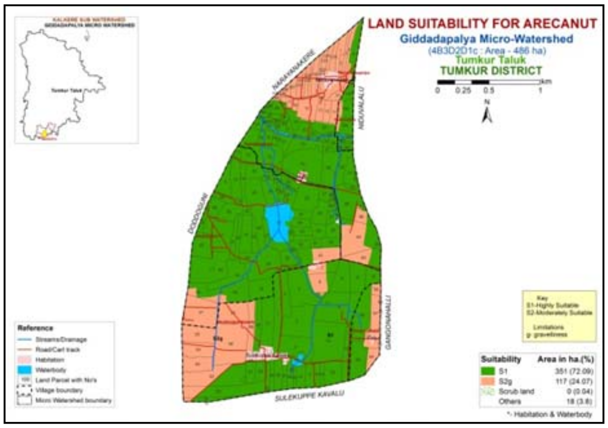

Fig 12: Soil site suitability of Areca nut

Land suitability for Coconut (*Cocos nucifera*)

Coconut grows under varying climatic condition and soil types. The rainfall required is 2000 mm per year. The suitability of land for coconut in Giddadapalya micro watershed indicated in the Fig 13. The main constraints are topography and rooting depth in moderately suitable soils. Sub surface gravels, topography are the main constraints in marginally suitable land.

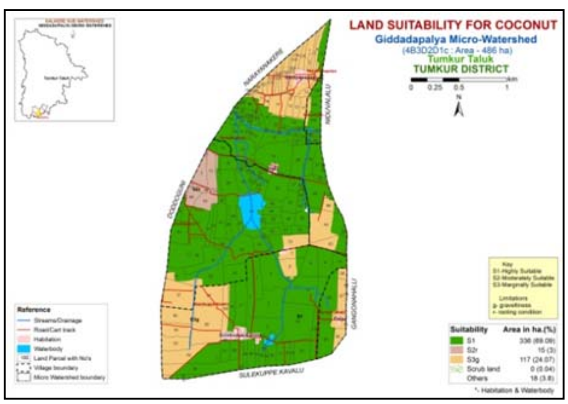

Fig 13: soil site suitability of coconut

Conclusion

The formation of the diverse group of soils can be attributed to the variation in topography, depth, gravelliness, erosion, leaching, sedimentation and other pedogenic processes modified by water table. Hence, this study reveals that the land suitability for major agricultural crops in Giddadapalya micro watershed could be classified from the suitability view point; class S1 (highly suitable) covering 72.05 % area, moderately suitable land (24.07 % area) with gravel limitation.

The major soils of the micro watershed are Red Sandy loams and shallow to deep black soil. Loam soils occupy 277 ha (56.97 %) of the area. The soils showing very deep (>150 cm) accounting for 336 ha (69.09 %) of area followed by deep (100-150 cm) soils. Moderately shallow soils need *in –situ* management of soil and water conservation measures to sustain crop yield and good for growing horticulture crops. From the present micro watershed identification and delineation of suitable areas for mango, sapota and guava crops in major fruit crop growing districts of Tumkur based on land suitability evaluation could serve as the basis of effectively implementing horticulture development programmes in the state.

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