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LAND RESOURCE INVENTORY AND SOCIO-ECONOMIC STATUS OF FARM HOUSEHOLDS FOR WATERSHED PLANNING AND DEVELOPMENT

SANGANAHALLI (4B3D3N1c) MICROWATERSHED

Gubbi Taluk, Tumkur District, Karnataka

Karnataka Watershed Development Project – II

SUJALA – III

World Bank funded Project

ICAR – NATIONAL BUREAU OF SOIL SURVEY AND LAND USE PLANNING

ICAR - NBSS & LUP

WATERSHED DEVELOPMENT DEPARTMENT
GOVT. OF KARNATAKA, BANGALORE

About ICAR - NBSS&LUP

The ICAR-National Bureau of Soil Survey and Land Use Planning (ICAR-NBSS&LUP), Nagpur, a premier Institute of the Indian Council of Agricultural Research (ICAR), was set up during 1976 with the objective to prepare soil resource maps at national, state and district levels and to provide research inputs in soil resource mapping and its applications, land evaluation, land use planning, land resource management, and database management using GIS for optimising land use on different kinds of soils in the country.

The Bureau has been engaged in carrying out soil resource survey, agro-ecological and soil degradation mapping at the country, state and district levels for qualitative assessment and monitoring the soil health towards viable land use planning. The research activities have resulted in identifying the soil potentials and problems, and the various applications of the soil surveys with the ultimate objective of sustainable agricultural development. The Bureau has the mandate to correlate and classify soils of the country and maintain a National Register of all the established soil series. The Institute is also imparting in-service training to staff of the soil survey agencies in the area of soil survey, land evaluation and soil survey interpretations for land use planning. The Bureau in collaboration with Panjabrao Krishi Vidyapeeth, Akola is running post-graduate teaching and research programme in land resource management, leading to M.Sc. and Ph.D. degrees.

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PREFACE

In Karnataka, as in other Indian States, the livelihoods of rural people are intertwined with farming pursuits. Thechallenges in agriculture are seriously threatening the livelihood of a large number of farmers as they have been practicing farming in contextual factors beyond their control. Climatic factors are the most important ones and have become much more significant in recent times due to rapid climate changes induced by intensive anthropogenic activities affecting our ecosystem in multiple ways. Climate change has become the reality, it is happening and efforts to evolve and demonstrate climate resilient technologies have become essential. Due to the already over stressed scenario of agrarian sector, the climate change is resulting in manifold increase in the complexities, pushing the rural mass to face more and more unpredictable situations. The rising temperatures and unpredictable rainfall patterns are going to test seriously the informed decisions farmers have to make in order to survive in farming and sustain their livelihood.

It is generally recognized that impacts of climate change shall not be uniform across the globe. It is said that impact of climate change is more severe in South Asia. Based on the analysis of meteorological data, it is predicted that in India, there will be upward trend in mean temperature, downward trend in relative humidity, annual rainfall and number of wet days in a year. Also, in general, phenomena like erratic monsoon, spread of tropical diseases, rise in sea levels, changes in availability of fresh water, frequent floods, droughts, heat waves, storms and hurricanes are predicted. Each one of these adverse situations are already being experienced in various parts of India and also at the global level. Decline in agricultural productivity of small and marginal farmers becoming more vulnerable is already witnessed.

In Karnataka, more than 60 per cent of the population live in rural areas and depend on agriculture and allied activities for their livelihood. Though the state has achieved significant progress in increasing the yield of many crops, there is tremendous pressure on the land resources due to the growing and competing demands of various land uses. This is reflected in the alarming rate of land degradation observed. Already more than 50 per cent of the area is affected by various forms of degradation. If this trend continues, the sustainability of the fragile ecosystem will be badly affected. The adverse effects of change in the climatic factors are putting additional stress on the land resources and the farmers dependent on this.

The natural resources (land, water and vegetation) of the state need adequate and constant care and management, backed by site-specific technological interventions and investments particularly by the government. Detailed database pertaining to the nature of

the land resources, their constraints, inherent potentials and suitability for various land based rural enterprises, crops and other uses is a prerequisite for preparing location-specific action plans, which are in tune with the inherent capability of the resources. Any effort to evolve climate resilient technologies has to be based on the baseline scientific database. Then only one can expect effective implementation of climate resilient technologies, monitor the progress, make essential review of the strategy, and finally evaluate the effectiveness of the implemented programs. The information available at present on the land resources of the state are of general nature and useful only for general purpose planning. Since the need of the hour is to have site-specific information suitable for farm level planning and detailed characterization and delineation of the existing land resources of an area into similar management units is the only option.

ICAR-NBSS&LUP, Regional Centre, Bangalore has taken up a project sponsored by the Karnataka Watershed Development Project-II, (Sujala-III), Government of Karnataka funded by the World Bank under Component -1 Land Resource Inventry. This study was taken up to demonstrate the utility of such a database in reviewing, monitoring and evaluating all the land based watershed development programs on a scientific footing. To meet the requirements of various land use planners at grassroots level, the present study on "Land Resource Inventory and Socio Economic Status of Farm Households for Watershed Planning and Development of SanganahalliMicrowatershed, Gubbi Taluk and Tumakuru District, Karnataka" for integrated development was taken up in collaboration with the State Agricutural Universities, IISC, KSRSAC, KSNDMC as Consortia partners. The project provides detailed land resource information at cadastral level (1:7920 scale) for all the plots and socio-economic status of farm households covering thirty per cent farmers randomely selected representing landed and landless class of farmers in the micowatershed. The project report with the accompanying maps for the Microwatershed will provide required detailed database for evolving effective land use plan, alternative land use options and conservation plans for the planners, administrators, agricutural extention personnel, KVK officials, developmental departments and other land users to manage the land resources in a sustainable manner.

It is hoped that this database will be useful to the planners, administrators and developmental agencies working in the area in not only for formulating location specific developmental schemes but also for their effective monitoring at the village/watershed level.

Nagpur
Date: 02.07.2018

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PART-A

LAND RESOURCE INVENTORY

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EXECUTIVE SUMMARY

The land resource inventory of Sanganahalli Microwatershed was conducted using village cadastral maps and IRS satellite imagery on 1:7920 scale. The false colour composites of IRS imagery were interpreted for physiography and the physiographic delineations were used as base for mapping soils. The soils were studied in several transects and a soil map was prepared with phases of soil series as mapping units. Random checks were made all over the area outside the transects to confirm and validate the soil map unit boundries. The soil map shows the geographic distribution and extent, characteristics, classification, behaviour and use potentials of the soils in the microwartershed.

The present study covers an area of 513 ha in Gubbi taluk of Tumakuru district, Karnataka. The climate is semiarid and categorized as drought- prone with an average annual rainfall of 813 mm, of which about 466 mm is received during south –west monsoon, 196 mm during north-east and the remaining 151 mm during the rest of the year. Entire area is covered by soils. The salient findings from the land resource inventory are summarized briefly below.

- *The soils belong to 6 soil series and 12 soil phases (management units), and 4 land management units.*
- *The length of crop growing period is about 150 days starting from 3rd week of June to third week of November.*
- *From the master soil map, several interpretative and thematic maps like land capability, soil depth, surface soil texture, soil gravelliness, available water capacity, soil slope and soil erosion were generated.*
- *Soil fertility status maps for macro and micronutrients were generated based on the surface soil samples collected at every 250 m grid interval.*
- *Land suitability for growing 34 major agricultural and horticultural crops were assessed and maps showing the degree of suitability along with constraints were generated.*
- *Entire area is suitable for agriculture.*
- *About 99 per cent of the soils are moderately deep (75-100 cm) to very deep (>150 cm).*
- *About 5 per cent of the area has clayey soils at the surface and 93 per cent loamy soils.*
- *About 94 per cent of the area has non-gravelly soils and 4 per cent gravelly soils (15-35 % gravel).*
- *About 40 per cent has soils that are very low (<50mm/m) to low (51-100 mm/m) in available water capacity and 59 per cent medium (101-150 mm/m).*
- *About 70 per cent of the area has very gently sloping (1-3% slope) lands and 29 per cent area has nearly level (0-1%).*
- *Entire area in the microwatershed has slightly eroded (e1 Class) soils.*

- *An area of about 34 per cent has soils that are slightly acidic (pH 6.0-6.5), 34 per cent area moderately acid (pH 5.5-6.0), 26 per cent strongly acid (pH 5.0-5.5) and 5 per cent area neutral (pH 6.5-7.3).*
- *The Electrical Conductivity (EC) of the soils are dominantly <2 dsm^{-1} indicating that the soils are non-saline.*
- *About 66 per cent of the soils are medium (0.5-0.75%) in organic carbon and 33 per cent soils are low (<0.5%).*
- *Entire area is high (>57 kg/ha) in available phosphorus.*
- *About 13 per cent of the soils are low (<145 kg/ha), medium (145-337 kg/ha) in 74 per cent area and 12 per cent of the soils are high (>337 kg/ha) in available potassium.*
- *Available sulphur content is medium (10-20 ppm) in the entire microwatershed.*
- *Available boron is low (0.5 ppm) in about 93 per cent area and medium (0.5-1.0 ppm) in 6 per cent area.*
- *Available iron is sufficient (>4.5 ppm) in the entire microwatershed area.*
- *Available manganese and copper are sufficient in all the soils of the microwatershed.*
- *Available zinc is deficient (<0.6 ppm) in 22 per cent and sufficient (>0.6 ppm) in 77 per cent of soils in the microwatershed.*
- *The land suitability for 34 major crops grown in the microwatershed was assessed and the areas that are highly suitable (Class S1) and moderately suitable (Class S2) are given below. It is however to be noted that a given soil may be suitable for various crops but what specific crop to be grown may be decided by the farmer looking to his capacity to invest on various inputs, marketing infrastructure, market price and finally the demand and supply position.*

Land suitability for various crops in the Microwatershed

Crop	Suitability Area in ha (%)			Crop	Suitability Area in ha (%)	
	Highly suitable (S1)	Moderately suitable (S2)			Highly suitable (S1)	Moderately suitable (S2)
Sorghum	186 (36)	118 (23)		Guava	4(1)	185 (36)
Fodder Sorghum	186 (36)	118 (23)		Pomegranate	186 (36)	118 (23)
Maize	4(1)	182 (35)		Banana	186 (36)	118 (23)
Upland paddy	186 (36)	232 (45)		Jackfruit	186 (36)	321 (63)
Finger millet	186 (36)	114 (22)		Jamun	186 (36)	118 (23)
Red gram	186 (36)	118 (23)		Musambi	186 (36)	118 (23)
Horse gram	186 (36)	322 (63)		Lime	186 (36)	118 (23)
Field bean	186 (36)	118 (23)		Cashew	186(36)	322 (63)
Cowpea	186 (36)	118 (23)		Custard apple	186(36)	322 (63)
Groundnut	-	207 (40)		Amla	186 (36)	322 (63)
Sunflower	186 (36)	118 (23)		Tamarind	186 (36)	118 (23)
Onion	186 (36)	118 (23)		Marigold	186 (36)	204 (40)
Chilli	186 (36)	118 (23)		Chrysanthemum	186 (36)	204 (40)
Brinjal	186 (36)	118 (23)		Jasmine	186 (36)	204 (40)
Tomato	186 (36)	118 (23)		Coconut	4(1)	182 (35)
Mango	186 (36)	321 (63)		Arecanut	4(1)	182 (35)
Sapota	186 (36)	321 (63)		Mulbery	-	3906)

Apart from the individual crop suitability, a proposed crop plan has been prepared for the 4 identified LUCs by considering only the highly and moderately suitable lands for different crops and cropping systems with food, fodder, fibre and horticulture crops.

- *Maintaining soil-health is vital to crop production and conserve soil and land resource base for maintaining ecological balance and to mitigate climate change. For this, several ameliorative measures have been suggested to these problematic soils like saline/alkali, highly eroded, sandy soils etc.,*
- *Soil and water conservation treatment plan has been prepared that would help in identifying the sites to be treated and also the type of structures required.*
- *As part of the greening programme, several tree species have been suggested to be planted in marginal and submarginal lands, field bunds and also in the hillocks, mounds and ridges that would help in supplementing the farm income, provide fodder and fuel and generate lot of biomass. This would help in maintaining an ecological balance and also contribute to mitigating the climate change.*

Chapter 1

INTRODUCTION

Land is a scarce resource and basic unit for any material production. It can support the needs of the growing population, provided they use the land in a rational and judicious manner. But what is happening in many areas of the state is a cause for concern to everyone involved in the management of land resources at the grassroots level. The area available for agriculture is about 51 per cent of the total geographical area and more than 60 per cent of the people are still dependant on agriculture for their livelihood. The limited land area is under severe stress and strain due to increasing population pressure and competing demands of various land uses. Due to this, every year there is significant diversion of farm lands and water resources for non-agricultural purposes. Apart from this, due to lack of interest in farmers for farming, large tracts of cultivable lands are turning into fallows in many areas and this trend is continuing at an alarming rate.

Further, land degradation has emerged as a serious problem which has already affected about 38 lakh ha of cultivated area in the state. Soil erosion alone has degraded about 35 lakh ha. Almost all the uncultivated areas are facing various degrees of degradation, particularly soil erosion. Salinity and alkalinity has emerged as a major problem affecting more than 3.5 lakh ha in the irrigated areas of the state. Nutrient depletion and declining factor productivity is common in both rainfed and irrigated areas. The degradation is continuing at an alarming rate and there appears to be no systematic effort among the stakeholders to contain this process. In recent times, an aberration of weather due to climate change phenomenon has added another dimension leading to unpredictable situations to be tackled by the farmers.

In this critical juncture, the challenge before us is not only to increase the productivity per unit area which is steadily declining and showing a fatigue syndrome, but also to prevent or at least reduce the severity of degradation. If the situation is not reversed at the earliest, then the sustainability of the already fragile crop production system and the overall ecosystem will be badly affected in the state. The continued neglect and unscientific use of the resources for a long time has led to the situation observed at present in the state. It is a known fact and established beyond doubt by many studies in the past that the cause for all kinds of degradation is the neglect and irrational use of the land resources. Hence, there is an urgent need to generate a detailed site-specific farm level database on various land resources for all the villages/watersheds in a time bound manner that would help to protect the valuable soil and land resources and also to stabilize the farm production.

Therefore, the land resource inventory required for farm level planning is the one which investigates not only the surface but also consider the other parameters which are critical for productivity *viz.,* soils, climate, water, minerals and rocks, 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 each and every land holding can be prescribed.

The Land Resource Inventory is basically done for identifying the potential and problem areas, developing sustainable land use plans, estimation of surface run off and water harvesting potential, preparation of soil and water conservation plans, land degradation/desertification etc. The Bureau is presently engaged in developing an LRI methodology using high resolution satellite remote sensing data and Digital Elevation Model (DEM) data to prepare Landscape Ecological Units (LEU) map representing agro-ecosystem as a whole. The LEU is preferred over landform as the base map for LRI. LEU is the assemblage of landform, slope and land use. An attempt was made to upscale the soil resource information from 1:250000 and 1:50000 scale to the LEU map in Goa and other states. Later an attempt will be made to uplink the LRI data generated under Sujala-III Project to the Landscape Ecological Units (LEUs) map.

The land resource inventory aims to provide site specific database for Sanganahalli microwatershed in Gubbi Taluk, Tumakuru District, Karnataka State for the Karnataka Watershed Development Department. The database was generated by using cadastral map of the village as a base along with high resolution IRS LISS IV and Cartosat-1 merged satellite imagery.

The study was organized and executed by the ICAR- National Bureau of Soil Survey and Land Use Planning, Regional Centre, Bangalore under Generation of Land Resource Inventory Data Base Component-1 of the Sujala-III Project funded by the World Bank.

Chapter 2

GEOGRAPHICAL SETTING

2.1 Location and Extent

Tumakuru District popularly known as *Kalpataru Nadu* (famous for production of Coconuts) is located in the southeastern part of Karnataka State. The Sanganahalli microwatershed (Bangihalli subwatershed) is located in the southeastern part of Karnataka in Gubbi Taluk, Tumakuru District, Karnataka State (Fig.2.1). It comprises parts of Madhenahalli, Chelur, Harehalli and Sanganahalli villages. It lies between 13^0 26' and 13^0 27' North latitudes and 76^0 51' to $76^0$53' East longitudes and covers an area of 513 ha. It is about 71 km south of Tumakuru and is surrounded by Sanganahalli on the south, Madhenahalli on north, Chelur on the east and Harehalli on the southwestern side.

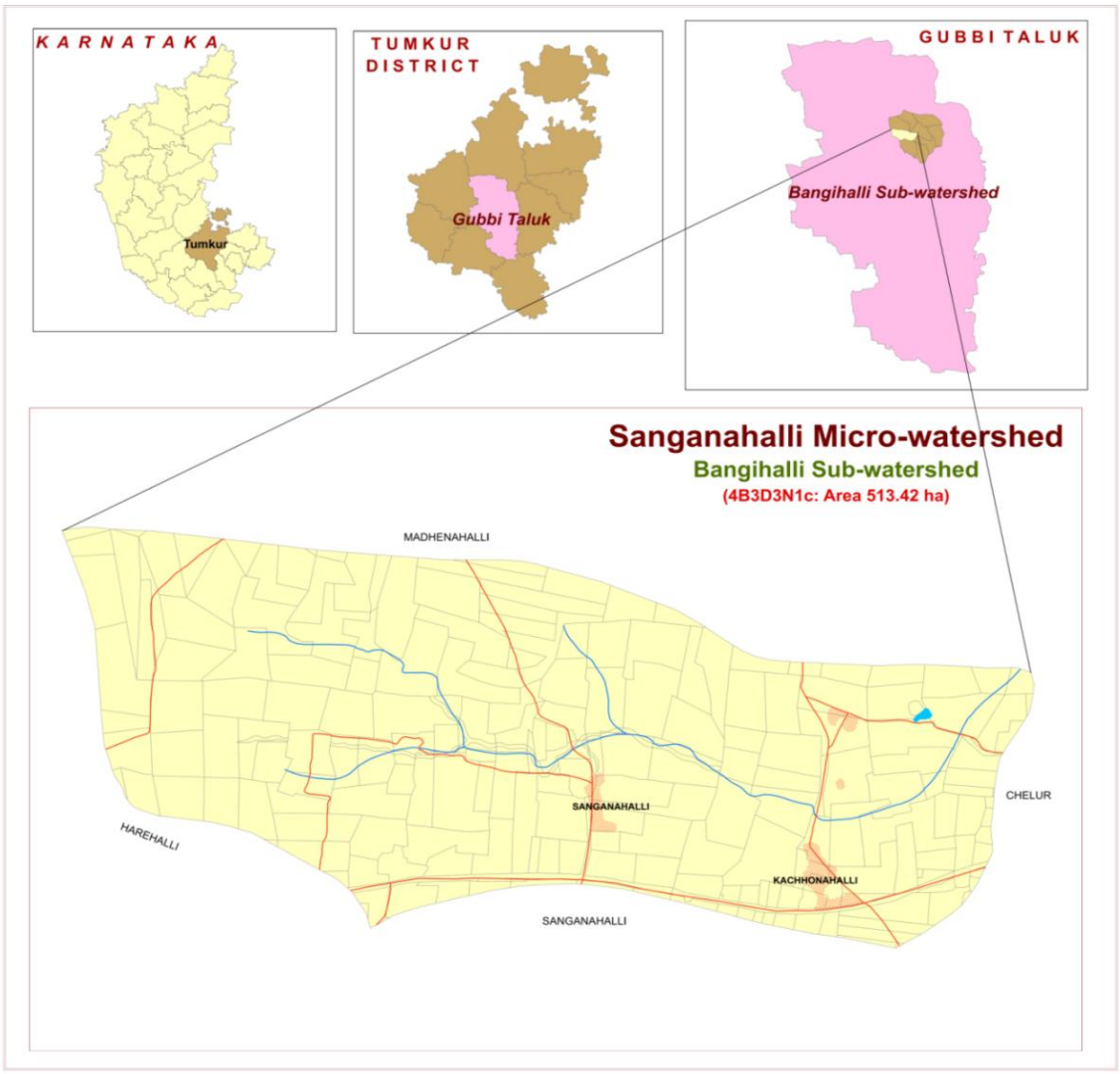


Fig. 2.1 Location map of Sanganahalli Microwatershed

2.2 Geology

Major rock formation observed in the microwatershed are of Archaean age and comprise of (Figs. 2.2 and 2.3) granite and granite gneiss. They are essentially pink to gray granite gneisses. The rocks are coarse to medium grained. They consist primarily of quartz, feldspar, biotite and hornblende. The gray granite gneisses are highly weathered, fractured and fissured upto a depth of about 10 m.

Fig. 2.2a Granite and granite gneiss rocks

Fig. 2.2b Granite rocks

2.3 Physiography

Physiographically, the area has been identified as Granite gneiss landscape based on geology. It has been further divided into three landforms *viz*; mounds/ ridges, uplands and lowlands based on slope and other relief features. They have been further subdivided into four physiographic units, *viz;* summits, side slopes, very gently sloping uplands and lowlands/valleys. The elevation ranges from 832-856 m. The mounds and ridges are mostly covered by rock outcrops.

2.4 Drainage

There are no perennial rivers flowing in Gubbi taluk. However, the area is drained by several small seasonal streams like Hosa *kaluve* which joins the river Shimsha along its course. Though, they are not perennial, during rainy season, they carry large quantities of rain water. The microwatershed area has only few small tanks which are not capable of storing water that flows during the rainy season. Due to this, the ground water recharge is very much affected in the villages. This is reflected in the failure of many bore wells in the villages. If the available rain water is properly harnessed by constructing new tanks and recharge structures at appropriate places in the villages, then the drinking and irrigation needs of the area can be easily met. The drainage network is dendritic to sub parallel.

2.5 Climate

The district falls under semiarid tract and is categorized as drought-prone with average annual rainfall of 813 mm (Table 2.1). Of the total rainfall, a maximum of 466 mm is received during south–west monsoon period from June to September, north-east monsoon from October to early December contributes about 196 mm and the remaining 151 mm is received during the rest of the year. The winter season is from December to February. During April and May, the temperatures reach up to 35°C and in December and January, the temperatures will go down to 20°C. Rainfall distribution is shown in Figure 2.4. The monthly average Potential Evapo-Transpiration (PET) is 110 mm and varies from a low of 73 mm in December to 152 mm in the month of April. The PET is always higher than precipitation in all the months except in the months of August, September and October. Generally, the Length of crop Growing Period (LGP) is 150 days and starts from 3rd week of June to third week of November.

Table 2.1 Mean Monthly Rainfall, PET, 1/2 PET in Gubbi Taluk, Tumakuru District

Sl. no.	Months	Rainfall	PET	1/2 PET
1	JAN	6.50	78.30	39.15
2	FEB	7.00	102.70	51.35
3	MAR	24.40	142.60	71.30
4	APR	40.50	151.60	75.80
5	MAY	72.50	149.70	74.85
6	JUN	78.50	121.10	60.55
7	JUL	99.20	107.60	53.80
8	AUG	119.70	105.80	52.90
9	SEP	168.30	101.20	50.60
10	OCT	141.90	100.20	50.10
11	NOV	47.00	85.00	42.50
12	DEC	7.30	73.00	36.50
Total		812.80	109.90	

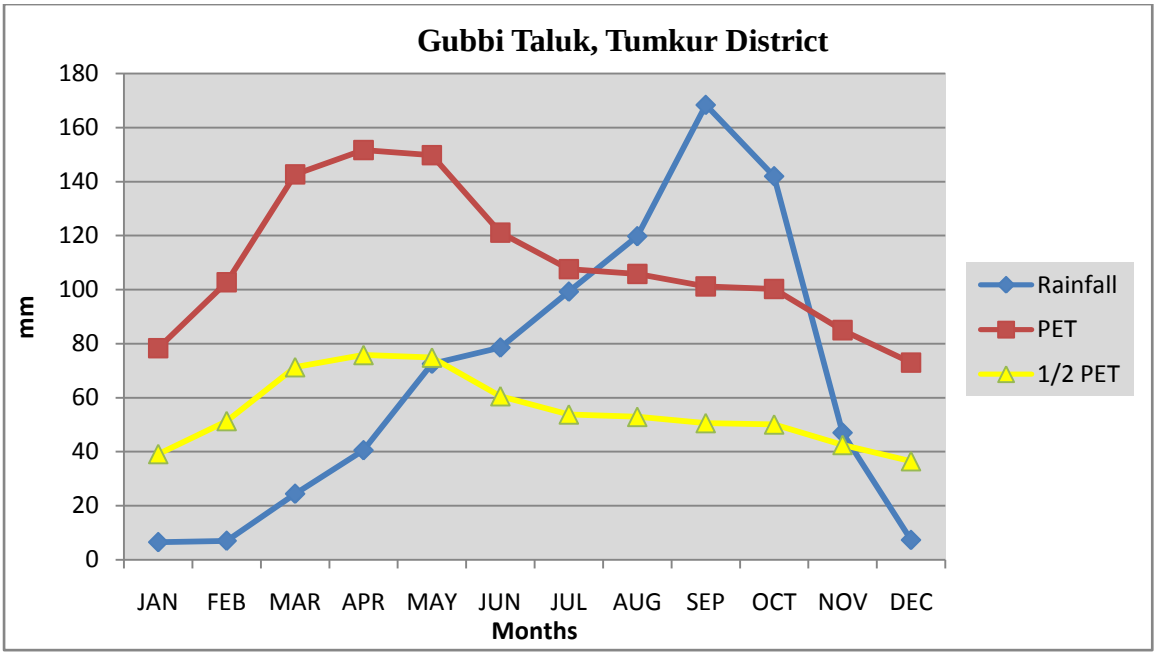


Fig 2.3 Rainfall distribution in Gubbi Taluk, Thumkur District

2.6 Natural Vegetation

The natural vegetation is sparse comprising few tree species, shrubs and herbs. The mounds, ridges and boulders occupy very sizeable areas which are under thin to moderately thick forest vegetation. Still, there are some remnants of the past forest cover which can be seen in patches in some ridges and hillocks in the microwatershed.

Apart from the continuing deforestation, the presence of large population of goats, sheep and other cattle in the microwatershed is causing vegetative degradation of whatever little vegetation left in the area. The uncontrolled grazing has left no time for the regeneration of the vegetative cover. This leads to the accelerated rate of erosion on the hill slopes resulting in the formation of deep gullies in the foot slopes that eventually result in the heavy siltation of tanks and reservoirs in the microwatershed.

Fig. 2.4 Natural vegetation of Sanganahalli Microwatershed

2.7 Land Utilization

About 64 per cent area (Table 2.2) in Gubbi taluk is cultivated at present. An area of about 4 per cent is currently barren. Forests occupy an area of about 8 per cent. Most of the mounds, ridges and bouldery areas have very poor vegetative cover. Major crops grown in the area are Ragi, Groundnut, Maize, Sorghum, Redgram, Horse gram, Sunflower, Field bean, Cowpea, Mango, Banana, Mulberry and plantation crops like Coconut, Banana and Arecanut. The cropping intensity is 116 per cent in the taluk. While carrying out land resource inventory, the land use/land cover particulars are collected from all the survey numbers and a current land use map of the Sanganahalli microwatershed is prepared. The current land use map generated shows the arable and non-arable lands, other land uses and different types of crops grown in the area (Fig 2.6). The different crops and cropping systems adopted in the microwatershed is presented in Figures 2.6.a &b. Simultaneously, enumeration of wells (bore wells and open wells) and existing conservation structures in the microwatershed are made and their location in different survey numbers is located on the cadastral map. Map showing the location of wells and other water bodies in Sanganahalli microwatershed is given in Fig.2.7.

Table 2.2 Land Utilization in Gubbi Taluk

Sl. No.	Agricultural land use	Area (ha)	Per cent
1.	Total geographical area	122057	-
2.	Total cultivated area	78418	64.24
3.	Area sown more than once	12934	-
4.	Cropping intensity	-	116.49
5.	Trees and grooves	2811	2.30
6.	Forest	10090	8.26
7.	Cultivable wasteland	2731	2.23
8.	Permanent Pasture land	3850	3.15
9.	Barren land	4971	4.07
10.	Non- Agriculture land	17390	14.24

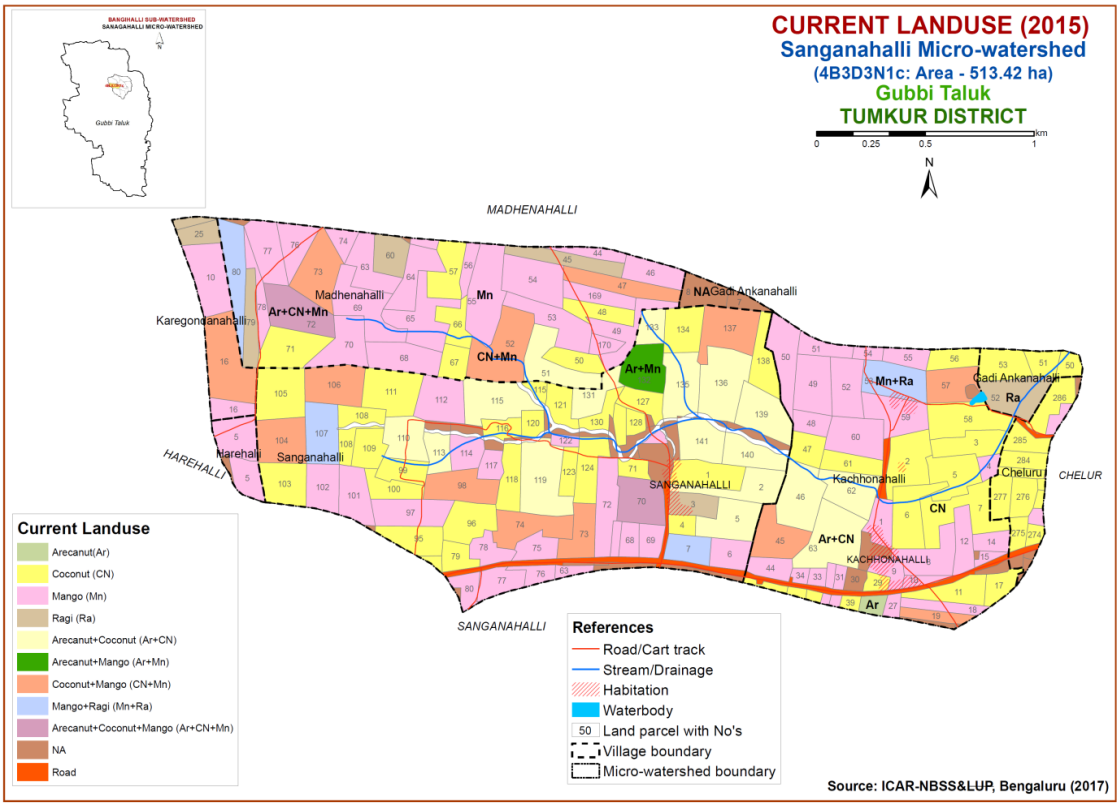


Fig. 2.5 Current Land Use – Sanganahalli Microwatershed

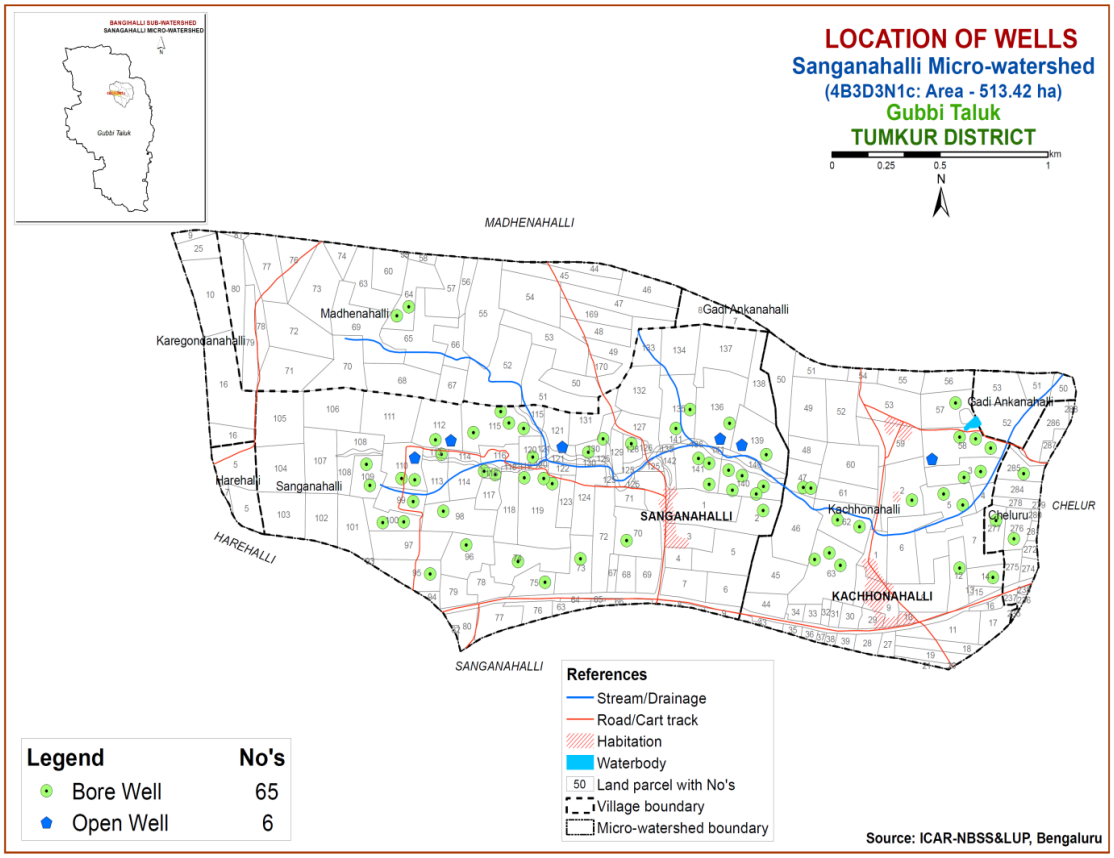


Fig. 2.6 Location of Wells - Sanganahalli Microwatershed

Fig.2.7.a Different crops and cropping systems in Sanganahalli Microwatershed

Fig.2.7.b Different crops and cropping systems in Sanganahalli Microwatershed

Chapter 3

SURVEY METHODOLOGY

The purpose of land resource inventory is to delineate similar areas (soil series and phases), which respond or expected to respond similarly to a given level of management. This was achieved in Sanganahalli microwatershed by the detailed study of all the soil characteristics (depth, texture, colour, structure, consistence, coarse fragments, porosity, soil reaction, soil horizons etc.) and site characteristics (slope of the land, erosion, drainage, occurrence of rock fragments etc.). This is followed by grouping of similar areas based on soil-site characteristics into homogeneous (management units) units, and showing extent and their geographic distribution on the microwatershed cadastral map. The detailed survey at 1:7920 scale was carried out in an area of 513 ha. The methodology followed for carrying out land resource inventory was as per the guidelines given in Soil Survey Manual (IARI, 1971; Soil Survey Staff, 2006; Natarajan *et al.,* 2015) which is briefly described below.

3.1 Base Maps

The detailed survey of the land resources occurring in the microwatershed was carried out by using digitized cadastral map as a base. The cadastral map shows field boundaries with their survey numbers, location of tanks, streams and other permanent features of the area (Fig. 3.1). Apart from the cadastral map, remote sensing data products from Cartosat-1 and LISS IV merged at the scale of 1:7920 were used in conjunction with the cadastral map to identify the landscapes, landforms and other surface features. The imagery helped in the identification and delineation of boundaries between hills, uplands and lowlands, water bodies, forest and vegetated areas, roads, habitations and other cultural features of the area (Fig. 3.2). The cadastral map was overlaid on the satellite imagery (Fig. 3.3) that helps to identify the parcel boundaries and other permanent features in the field. Apart from cadastral maps and images, toposheets of the area (1:50,000 scale) were also used for initial traversing, identification of geology, landscapes, landforms, drainage features, present land use and also for selection of transects in the microwatershed.

3.2 Image Interpretation for Physiography

False Colour Composites (FCCs) of Cartosat-I and LISS-IV merged satellite data covering the microwatershed area was visually interpreted using image interpretation elements along with the geology map and all the available collateral data with local knowledge. The delineated physiographic boundaries were transferred on to a cadastral map overlaid on satellite imagery. Physiographically, the area has been identified as granite gneiss landscape and is divided into landforms such as ridges, mounds, uplands and valleys based on slope and other relief features. They were further subdivided into physiographic/ image interpretation units based on image characteristics. The image interpretation legend for physiography is given below.

Image Interpretation Legend for Physiography

G- Granite gneiss landscape

G1			Hills/ Ridges/ Mounds
	G11		Summits
	G12		Side slopes
		G121	Side slopes with dark grey tones
G2			Uplands
	G21		Summits
	G22		Gently sloping uplands
		G221	Gently sloping uplands, yellowish green (eroded)
		G222	Gently sloping uplands, yellowish white (severely eroded)
	G23		Very gently sloping uplands
		G231	Very gently sloping uplands, yellowish green
		G232	Very gently sloping uplands, medium green and pink
		G233	Very gently sloping uplands, pink and green (scrub land)
		G234	Very gently sloping uplands, medium greenish grey
		G235	Very gently sloping uplands, yellowish white (eroded)
		G236	Very gently sloping uplands, dark green
		G237	Very gently sloping uplands, medium pink (coconut garden)
		G238	Very gently sloping uplands, pink and bluish white (eroded)
	G24		Valleys/ lowlands
		G241	Valleys, pink tones
		G242	Valleys gray mixed with pink tones

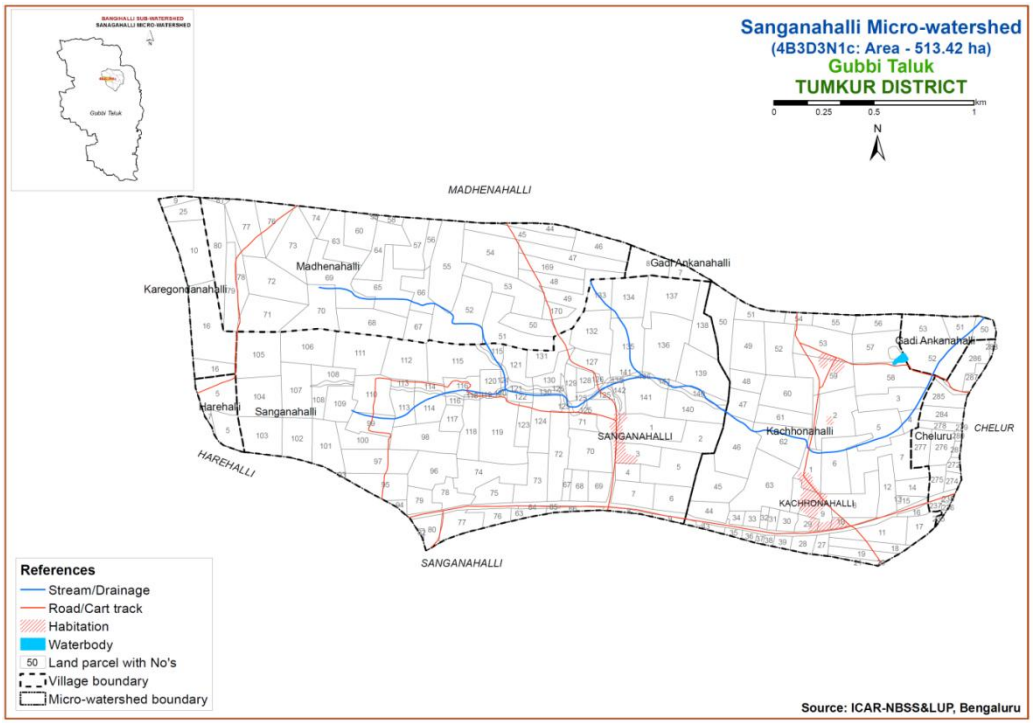


Fig 3.1 Scanned and Digitized Cadastral map of Sanganahalli Microwatershed

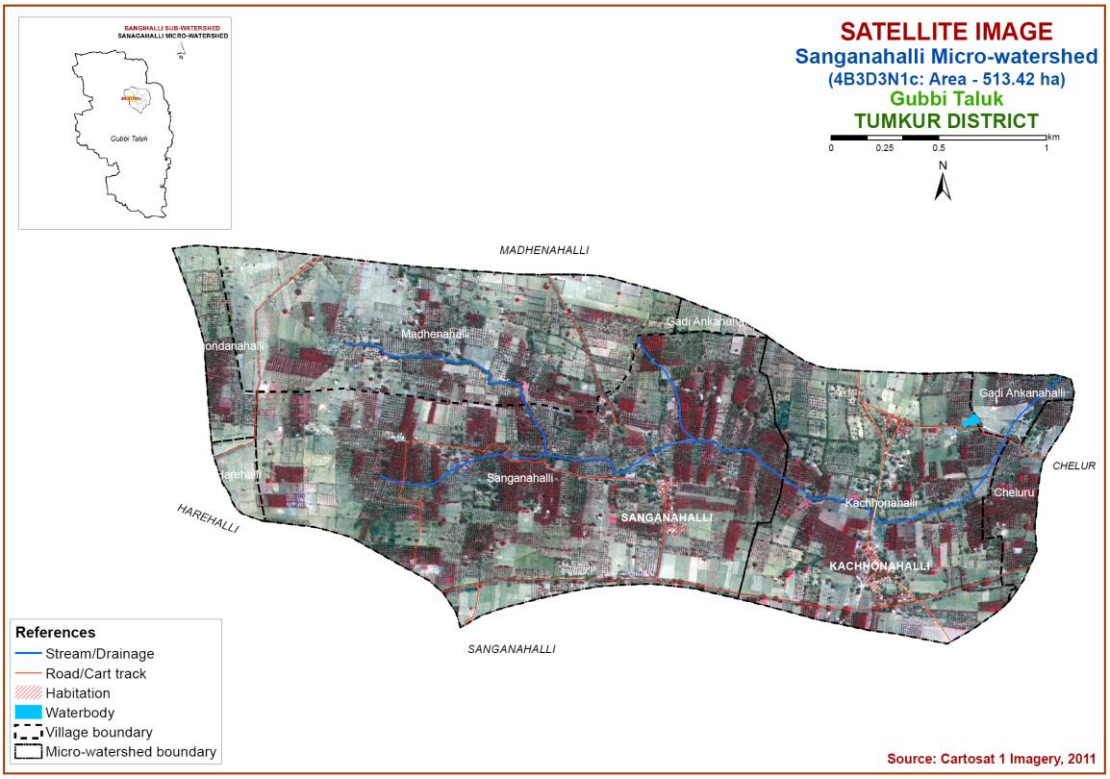


Fig.3.2 Satellite Image of Sanganahalli Microwatershed

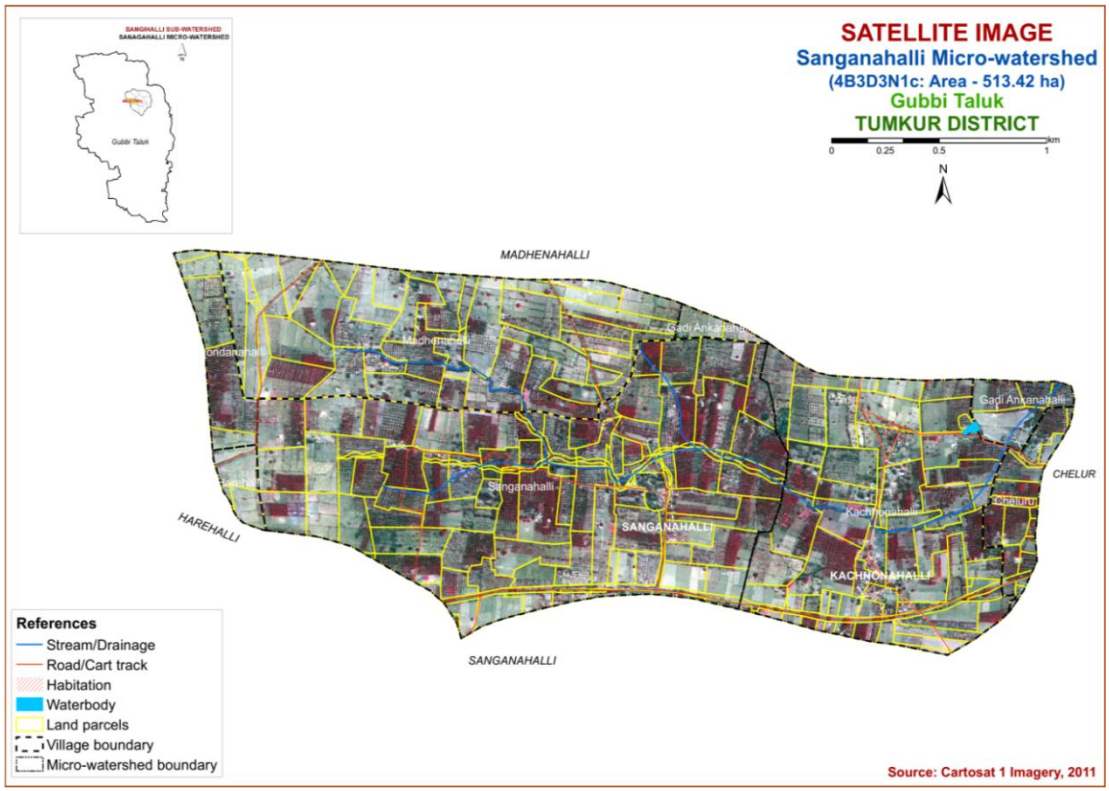


Fig.3.3 Cadastral map overlaid on IRS PAN+LISS IV merged imagery of Sanganahalli Microwatershed

3.3 Field Investigation

The field boundaries and survey numbers given on the cadastral sheet were located on the ground by following permanent features like roads, cart tracks, *nallas*, streams, tanks etc., and wherever changes were noticed, they were incorporated on the microwatershed cadastral map. Preliminary traverse of the microwatershed was carried out with the help of cadastral map, imagery and toposheets. While traversing, landforms and physiographic units identified were checked and preliminary soil legend was prepared by studying soils at few selected places. Then, intensive traversing of each physiographic unit like hills, ridges, uplands and valleys was carried out. Based on the variability observed on the surface, transects (Fig. 3.4) were selected across the slope covering all the landform units in the microwatershed (Natarajan and Dipak Sarkar, 2010).

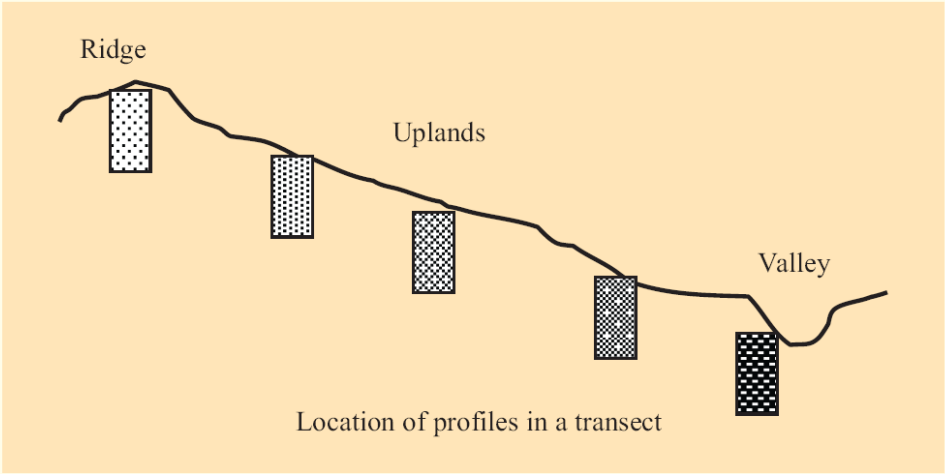


Fig: 3.4. Location of profiles in a transect

In the selected transect, soil profiles (Fig. 3.4) were located at closely spaced intervals to take care of any change in the land features like break in slope, erosion, gravel, stones etc. In the selected sites, profiles (vertical cut showing the soil layers from surface to the rock) were opened up to 200 cm or to the depth limited by rock or hard substratum and studied in detail for all their morphological and physical characteristics. The soil and site characteristics were recorded for all profile sites on a standard proforma as per the guidelines given in USDA Soil Survey Manual (Soil Survey Staff, 2012). Apart from the transect study, profiles were also studied at random, almost like in a grid pattern, outside the transect areas.

Based on soil characteristics, the soils were grouped into different soil series. Soil series is the most homogeneous unit having similar horizons and properties and behaves similarly for a given level of management. Soil depth, texture, colour, kind of horizon and horizon sequence, amount and nature of gravel present, nature of substratum etc, were used as the major differentiating characteristics for identifying soil series occurring in the area. The differentiating characteristics used for identifying the soil series are given in Table 3.1. Based on the above characteristics, 6 soil series were identified in the Sanganahalli microwatershed.

Table 3.1 Differentiating Characteristics used for identifying Soil Series (Characteristics are of Series Control Section)

Soils of Granite gneiss Landscape							
Sl. No	**Soil Series**	**Depth (cm)**	**Colour (moist)**	**Texture (control section)**	**Gravel(%) (control section)**	**Horizon sequence**	**Calcareo-usness**
1	**Bidanagere (BDG)**	75-100	5YR3/3,3/4,4/3, 5/4 2.5YR3/4	scl-sc	35-60	Ap-Bt-Cr	-
2	**Balapur (BPR)**	100-150	2.5YR2.5/4,3/4	sc-c	>35	Ap-Bt-Cr	-
3	**HLK (Hallikere)**	>150	5YR 3/3,3/4 7.5YR 3/3,3/4	c	<15	Ap-Bt	-
4	**Ranatur (RTR)**	>150	2.5YR2.5/3, 2.5/4, 3/3,4/6	c	-	Ap-Bt	-
5	**NDL (Niduvalalu)**	>150	2.5YR2.5/3, 2.5/4,3/3,4/6	gsc	>35	Ap-Bt	-
Low land Series							
6	**TDG (Thondigere)**	>150	7.5YR3/3,3/4,4/6 10YR 3/3,4/3	sl,scl,sc	-	Ap-Bw-C	-

3.3 Soil Mapping

The area under each soil series was further separated into 12 soil phases and their boundaries delineated on the cadastral map based on the variations observed in the texture of the surface soil, slope, erosion, presence of gravel, stoniness etc. A soil phase is a subdivision of soil series based mostly on surface features that affect its use and management. The soil mapping units are shown on the map (Fig.3.5) in the form of symbols. During the survey number of profile pits, few minipits and a few auger bores representing different landforms occurring in the microwatershed were studied. In addition to the profile study, spot observations in the form of minipits, road cuts, terrace cuts etc., were also studied to validate the soil boundaries on the soil map. The soil map shows the geographic distribution of 12 mapping units representing 6 soil series occurring in the microwatershed. The soil map unit (soil legend) description is presented in Table 3.2. The soil phase map (management units) shows the distribution of 12 soil phases mapped in the microwatershed. Each mapping unit (soil phase) delineated on the map has similar soil and site characteristics. In other words, all the farms or survey numbers included in one phase will have similar management needs and have to be treated accordingly.

The 12 soil phases identified and mapped in the microwatershed were regrouped into 4 Land Use Classes (LUC's) for the purpose of preparing a Proposed Crop Plan for sustained development of the microwatershed. The database (soil phases) generated under LRI was utilized for identifying Land Use Classes (LUCs) based on the management needs. One or more than one soil site characteristic having influence on the management have been chosen for identification and delineation of LUCs. For Sanganahalli microwatershed, five soil and site characteristics, namely soil depth, soil texture, slope, erosion and gravel content have been considered for defining LUCs. The land use classes are expected to behave similarly for a given level of management.

3.4 Laboratory Characterization

Soil samples were collected from representative master profiles for each soil series for laboratory characterization by following the methods outlined in the Laboratory Manual (Sarma *et al*, 1987). Surface soil samples collected from farmer's fields (81 samples) for fertility status (major and micronutrients) at 250 m grid interval were analyzed in the laboratory (Katyal and Rattan, 2003). By linking the soil fertility data to the survey numbers through GIS, soil fertility maps were generated using Kriging method for the microwatershed.

Table 3.2 Soil map unit description of Sanganahalli Microwatershed (Soil Legend)

Soil No	Soil Series	Soil Phase	Mapping Unit Description	Area in ha (%)
SOILS OF GRANITE GNEISS LANDSCAPE				
	BDG	Bidanagere soils are moderately deep (75-100 cm), well drained, have dark reddish brown gravelly sandy clay loam to sandy clay soils occurring on very gently sloping uplands under cultivation		**114(22.25)**
1		BDGcB1	Sandy loam surface, slope 1-3%, slight erosion	77 (15.07)
2		BDGcB1g1	Sandy loam surface, slope 1-3%, slight erosion, gravelly (15-35%)	19(3.68)
3		BDGhB1	Sandy clay loam surface, slope 1-3%, slight erosion	18 (3.50)
	BPR	Balapur soils are deep (100-150 cm), well drained, have dark reddish brown to dark red gravelly sandy clay to clay soils occurring on very gently sloping uplands under cultivation		**3 (0.67)**
4		BPRcB1g1	Sandy loam surface, slope 1-3%, slight erosion, gravelly (15-35%)	3 (0.67)
	HLK	Hallikere soils are very deep (>150 cm), well drained, have dark brown to dark reddish brown clayey soils occurring on very gently sloping uplands under cultivation		**4(0.71)**
5		HLKhB1	Sandy clay loam surface, slope 1-3%, slight erosion	4 (0.71)
	RTR	Ranatur soils are very deep (>150 cm), well drained, have dark reddish brown to dark red clay soils occurring on very gently sloping uplands under cultivation		**182 (35.51)**
6		RTRcA1	Sandy loam surface, slope 0-1%, slight erosion	30 (5.88)
7		RTRcB1	Sandy loam surface, slope 1-3%, slight erosion	89 (17.42)
8		RTRhB1	Sandy clay loam surface, slope 1-3%, slight erosion	63 (12.21)
	NDL	Niduvalalu soils are very deep (>150 cm), well drained, have red to dark reddish brown gravelly sandy clay soils occurring on very gently sloping uplands under cultivation		**86 (16.74)**
9		NDLcB1	Sandy loam surface, slope 1-3%, slight erosion	73 (14.27)
10		NDLhB1	Sandy clay loam surface, slope 1-3%, slight erosion	13 (2.47)
	TDG	Thondigere soils are very deep (>150 cm), well drained, have dark brown to dark yellowish brown sandy loam to sandy clay soils occurring on very gently sloping lowlands under cultivation		**117 (22.94)**
11		TDGhA1	Sandy clay loam surface, slope 0-1%, slight erosion	90(17.61)
12		TDGiA1	Sandy clay surface, slope 0-1%, slight erosion	27 (5.33)
		Others	Habitation and water bodies	6 (1.18)

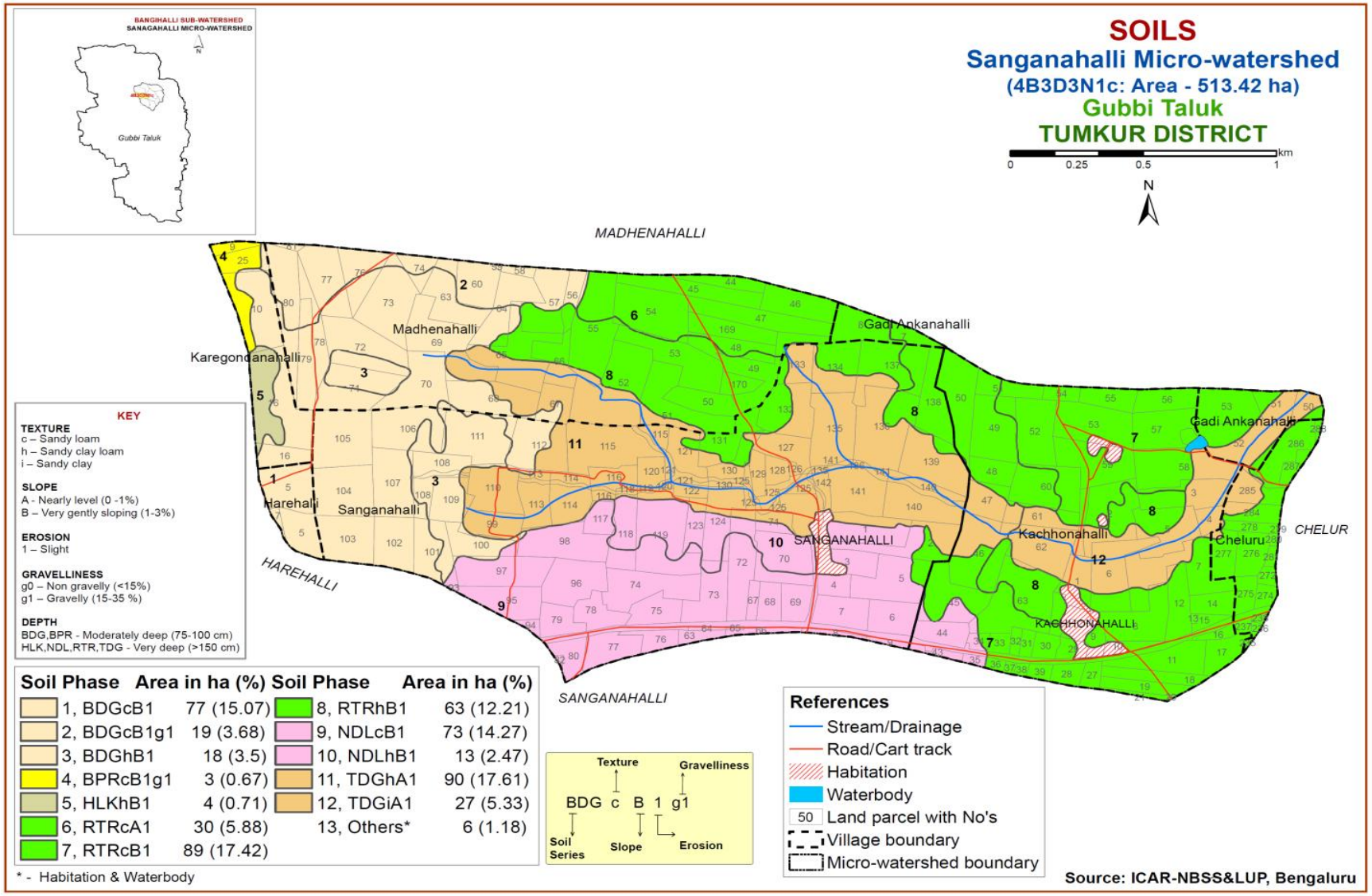


Fig 3.5 Soil Phase or Management Units Map - Sanganahalli Microwatershed

Chapter 4

THE SOILS

Detailed information pertaining to the nature, extent and their distribution of different kinds of soils occurring in Sanganahalli microwatershed is provided in this chapter. The microwatershed area has been identified as granite gneiss landscape based on geology. In all, 6 soil series are identified. Soil formation is the result of the combined effect of environmental and terrain factors that are reflected in soil morphology. In the granite gneiss landscape the soil formation is dominantly influenced by parent material, relief and climate.

A brief description of each of the 6 soil series identified followed by 12 soil phases (management units) mapped (Fig. 3.5) are furnished below. The soils in any one map unit differ from place to place in their depth, texture, slope, gravelliness, erosion or any other site characteristic that affect management. The soil phase map can be used for identifying the suitability of areas for growing specific crops or for other alternative uses and also for deciding the type of conservation structures needed. The detailed information on soil and site-characteristics like soil depth, surface soil texture, slope, erosion, gravelliness, AWC, LCC etc, with respect to each of the soil phase identified is given village/survey number wise for the microwatershed in Appendix-I.

4.1 Soils of Granite Gneiss Landscape

In this landscape, 6 soil series are identified and mapped. Brief description of each series identified is given below. Of these, Ranatur (RTR) series occupy a major area of about 182 ha (35%) followed by Thondigere (TDG) 117 ha (23%). The brief description of each soil series and number of phases identified in the microwatershed are given below. The mapping unit description (Soil Legend) of the soil phases identified and mapped under each series is given in Table 3.2.

4.1.1 Bidanagere (BDG) Series: Bidanagere soils are moderately deep (75-100 cm), well drained, have dark reddish brown gravelly sandy clay loam to sandy clay soils. They have developed from weathered granite gneiss and occur on very gently sloping uplands under cultivation.

The thickness of the solum ranges from 78 to 99 cm. The thickness of A horizon ranges from 12 to 19 cm. Its colour is in 2.5 YR and 5 YR hue with value 2 to 3 and chroma 3 to 4. The texture varies from sandy clay loam to sandy clay with 10 to 20 per cent gravel. The thickness of B horizon ranges from 68 to 85 cm. Its colour is in 5 YR and 2.5 YR hue with value 3 to 5 and chroma 3 to 4. Its texture is gravelly sandy clay to sandy clay loam with gravel content of 35-60 per cent. The available water capacity is very low (<50 mm/m). Three phases were identified and mapped.

Landscape and Soil Profile Characteristics of Bidanagere (BDG) Series

4.1.2 Balapur (BPR) Series: Balapur soils are deep (100-150 cm), well drained, have dark reddish brown to dark red gravelly sandy clay to clay soils. They are developed from weathered granite gneiss and occur on very gently to gently sloping uplands.

The thickness of the solum ranges from 102 to 147 cm. The thickness of A horizon ranges from 12 to 17 cm. Its colour is in 5 YR and 2.5 YR hue with value and chroma 3 to 4. The texture ranges from loamy sand to sandy clay with 15 to 50 per cent gravel. The thickness of B horizon ranges from 90 to 132 cm. Its colour is in 2.5 YR hue with value 2.5 to 3 and chroma 4 to 6. Texture is sandy clay to clay with 35 to 50 per cent gravel. The available water capacity is low (51-100 mm/m). Only one phase was identified and mapped.

Landscape and Soil Profile Characteristics of Balapur (BPR) Series

4.1.3 Hallikere (HLK) Series: Hallikere soils are very deep (>150 cm), well drained, have dark brown and dark reddish brown clayey soils. They have developed from granite gneiss and occur on nearly level to very gently sloping uplands. The Hallikere series has been tentatively classified as a member of the fine, mixed, isohyperthermic family of Typic Paleustalfs.

The thickness of the solum is more than 150 cm. The thickness of A horizon ranges from 11 to 14 cm. Its colour is in 7.5 YR and 5 YR hue with value 3 to 4 and chroma 3 to 4. The texture varies from sandy loam to sandy clay loam. The thickness of B horizon is more than 150 cm. Its colour is in 7.5 YR and 5 YR hue with value and chroma 3 to 4. Its texture is clay. The available water capacity is high (150-200 mm). Only one phase was identified and mapped.

Landscape and Soil Profile Characteristics of Hallikere (HLK) Series

4.1.4 Ranatur (RTR) Series: Ranatur soils are very deep (> 150 cm), well drained, have dark reddish brown to dark red clayey soils. They have developed from weathered granite gneiss and occur on very gently sloping uplands. The Ranatur series has been tentatively classified as a member of the fine, mixed, isohyperthermic family of Rhodic Paleustalfs.

The thickness of the solum is more than 150 cm. The thickness of A horizon ranges from 8 to 14 cm. Its colour is in 5 YR and 2.5 YR hue with value 2.5 to 4 and chroma 3 to 6. The texture varies from sandy loam to sand clay. The thickness of B horizon is more than 150 cm. Its colour is in 2.5 YR hue with value 2.5 to 3 and chroma 3 to 6. Its texture is clay. The available water capacity is medium (101-150 mm/m). Three phases were identified and mapped.

Landscape and soil profile characteristics of Ranatur (RTR) Series

4.1.5 Niduvalalu (NDL) Series: Niduvalalu soils are very deep (>150 cm), well drained, have dark red and dark reddish brown sandy clay soils. They have developed from granite gneiss and occur on nearly level to very gently sloping uplands under cultivation.

The thickness of the solum is more than 150 cm. The thickness of A-horizon ranges from 11 to 15 cm. Its colour is in 5 YR hue with value 3 to 4 and chroma 4 to 6. The texture varies from sandy loam to sandy clay loam with 10 to 30 per cent gravel. The thickness of B-horizon ranges from 150 to 160 cm. Its colour is in 2.5 YR and 5 YR hue with value 2.5 to 4 and chroma 4 to 6. Its texture is sandy clay and ranges from sandy loam to sandy clay loam with 20 to 75 per cent gravel. The available water capacity is low (50-100 mm/m). Two phases were identified and mapped.

Landscape Soil Profile Characteristics of Niduvalalu (NDL) Series

4.1.6 Thondigere (TDG) : Thondigere soils are very deep (>150 cm), well drained, have dark brown to dark yellowish brown, sandy, loamy sand, sandy clay loam and sandy clay stratified soils. They have developed from alluvio- colluvium and occur on nearly level to very gently sloping lowlands under cultivation.

The thickness of the solum ranges from 150-200 cm. The thickness of A horizon ranges from 12 to 19 cm. Its colour is in 10 YR, 5 YR and 7.5 YR hue with value 3 to 4 and chroma 4. The texture is sandy clay loam. The thickness of B horizon is more than 150 cm. Its colour is in 10 YR and 7.5 YR hue with value 3 to 4 and chroma 3 to 6. Its texture is sand, loamy sand, sandy clay loam, sandy clay and clay. The available water capacity is medium (101-150 mm/m).Two phases were indentified and mapped.

Landscape and soil profile characteristics of Thondigere (TDG) Series

Chapter 5

INTERPRETATION FOR LAND RESOURCE MANAGEMENT

The most important soil and site characteristics that affect the land use and conservation needs of an area are land capability, soil depth, soil texture, coarse fragments, available water capacity, soil slope, soil erosion, soil reaction etc. These are interpreted from the data base generated through land resource inventory and several interpretative and thematic maps are generated. These would help in identifying the areas suitable for growing crops and, soil and water conservation measures and structures needed thus helping to maintain good soil health for sustained crop production. The various interpretative and thematic maps generated are described below.

5.1 Land Capability Classification

Land capability classification is an interpretative grouping of soil map units (soil phases) mainly based on inherent soil characteristics, external land features and environmental factors that limit the use of land for agriculture, pasture, forestry, or other uses on a sustained basis (IARI, 1971). The land and soil characteristics used to group the land resources in an area into various land capability classes, subclasses and units are

Soil characteristics: Depth, texture, gravelliness, calcareousness.

Land characteristics: Slope, erosion, drainage, rock outcrops.

Climate: Total rainfall and its distribution, and length of crop growing period.

The land capability classification system is divided into land capability classes, subclasses and units based on the level of information available. Eight land capability classes are recognized. They are

Class I: They are very good lands that have no limitations or very few limitations that restrict their use.

Class II: They are good lands that have minor limitations and require moderate conservation practices.

Class III: They are moderately good lands that have moderate limitations that reduce the choice of crops or that require special conservation practices.

Class IV: They are fairly good lands that have very severe limitations that reduce the choice of crops or that require very careful management.

Class V: Soils in these lands are not likely to erode, but have other limitations like wetness that are impractical to remove and as such not suitable for agriculture, but suitable for pasture or forestry with minor limitations.

Class VI: The lands have severe limitations that make them generally unsuitable for cultivation, but suitable for pasture or forestry with moderate limitations.

Class VII: The lands have very severe limitations that make them unsuitable for cultivation, but suitable for pasture or forestry with major limitations.

Class VIII: Soil and other miscellaneous areas (rock lands) that have very severe limitations that nearly preclude their use for any crop production, but suitable for wildlife, recreation and installation of wind mills.

The land capability subclasses are recognised based on the dominant limitations observed within a given land capability class. The subclasses are designated by adding a lower case letter like 'e', 'w', 's', or 'c' to the class numeral. The subclass "e" indicates that the main hazard is risk of erosion, "w" indicates drainage or wetness as a limitation for plant growth, "s" indicates shallow soil depth, coarse or heavy textures, calcareousness, salinity/alkalinity or gravelliness and "c" indicates limitation due to climate.

The land capability subclasses have been further subdivided into land capability units based on the kinds of limitations present in each subclass. Ten land capability units are used in grouping the soil map units. They are stony or rocky (0), erosion hazard (slope, erosion) (1), coarse texture (sand, loamy sand, sandy loam) (2), fine texture (cracking clay, silty clay) (3), slowly permeable subsoil (4), coarse underlying material (5), salinity/alkali (6), stagnation, overflow, high ground water table (7), soil depth (8) and fertility problems (9). The capability units thus identified have similar soil and land characteristics that respond similarly to a given level of management. The soils of the microwatershed have been classified upto land capability subclass level.

The 12 soil map units identified in the Sanganahalli microwatershed are grouped under 2 land capability classes and 2 land capability subclasses. Entire area in the microwatershed is suitable for agriculture (Fig. 5.1).

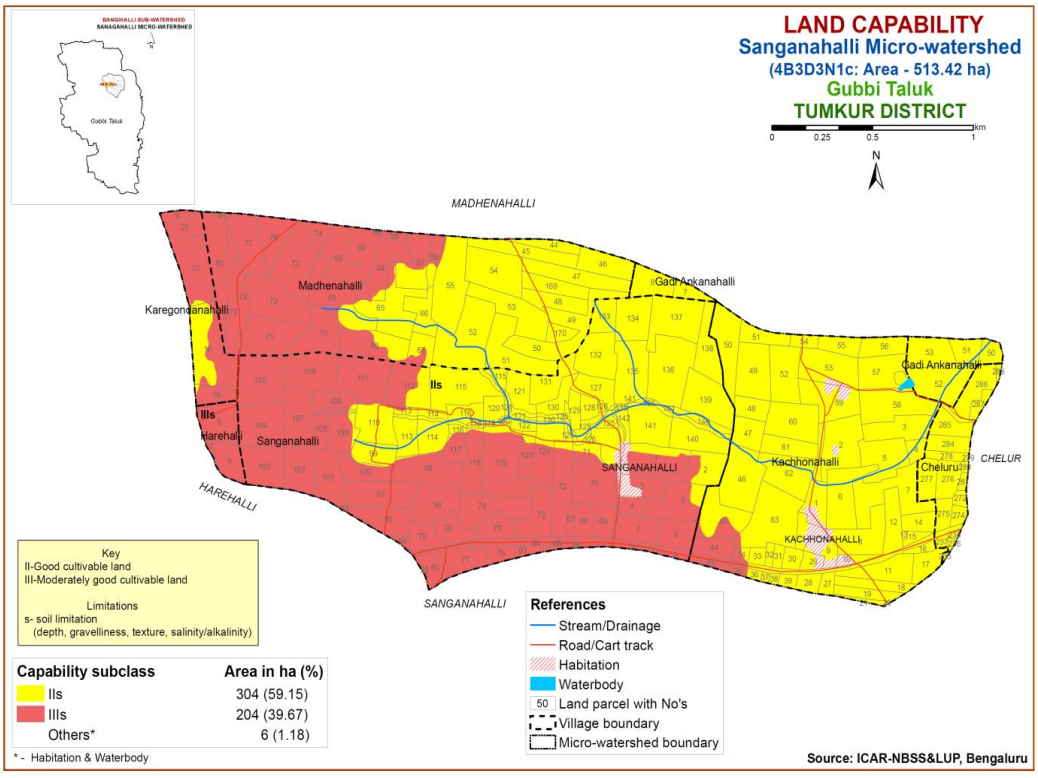


Fig. 5.1 Land Capability map of Sanganahalli Microwatershed

Good cultivable lands (Class II) cover an area of about 304 ha (59%) and are distributed in the central, northern, western and eastern part of the microwatershed with minor problem of soil. Moderately good cultivable lands (Class III) cover an area of about 204 ha (40%) and are distributed in the northwestern, southern and western part of the microwatershed with moderate problem of soil.

5.2 Soil Depth

Soil depth refers to the depth of the soil occurring above the parent material or hard rock. The depth of the soil determines the effective rooting depth for plants and in accordance with soil texture, mineralogy and gravel content, the capacity of the soil column to hold water and nutrient availability. Soil depth is one of the most important soil characteristic that is used in differentiating soils into different soil series. The soil depth classes used in identifying soils in the field are very shallow (<25 cm), shallow (25-50 cm), moderately shallow (50-75 cm), moderately deep (75-100 cm), deep (100-150 cm) and very deep (>150 cm). They were used to classify the soils into different depth classes and a soil depth map was generated. The area extent and their geographical distribution in the microwatershed is given in Fig. 5.2.

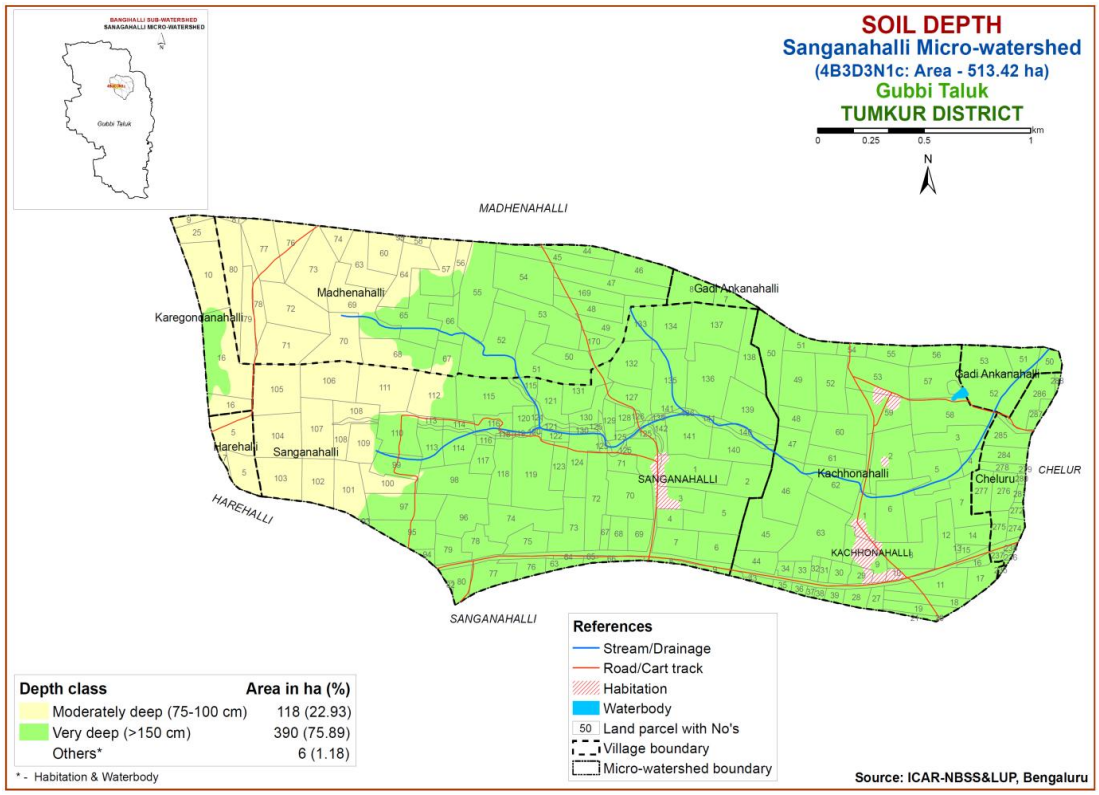


Fig. 5.2 Soil Depth map of Sanganahalli Microwatershed

Moderately deep (75-100 cm) soils occupy an area of about 118 ha (23%) and are distributed in the western and northwestern part of the microwatershed. Very deep (>150 cm) soils cover maximum area of 390 ha (76%) and are distributed in the major part of the microwatershed.

Entire area in the microwatershed is most productive with respect to soil rooting depth where all climatically adapted annual and perennial crops can be grown are very deep (>150 cm depth) and moderately deep (75-100cm).

5.3 Surface Soil Texture

Texture is an expression to indicate the coarseness or fineness of the soil as determined by the relative proportion of primary particles of sand, silt and clay. It has a direct bearing on the structure, porosity, adhesion and consistence. The surface layer of a soil to a depth of about 25 cm is the layer that is most used by crops and plants. The surface soil textural class provides a guide to understanding soil-water retention and availability, nutrient holding capacity, infiltration, workability, drainage, physical and chemical behaviour, microbial activity and crop suitability. The textural classes used for LRI were used to classify and a surface soil texture map was generated. The area extent and their geographical distribution in the microwatershed is shown in Figure 5.3.

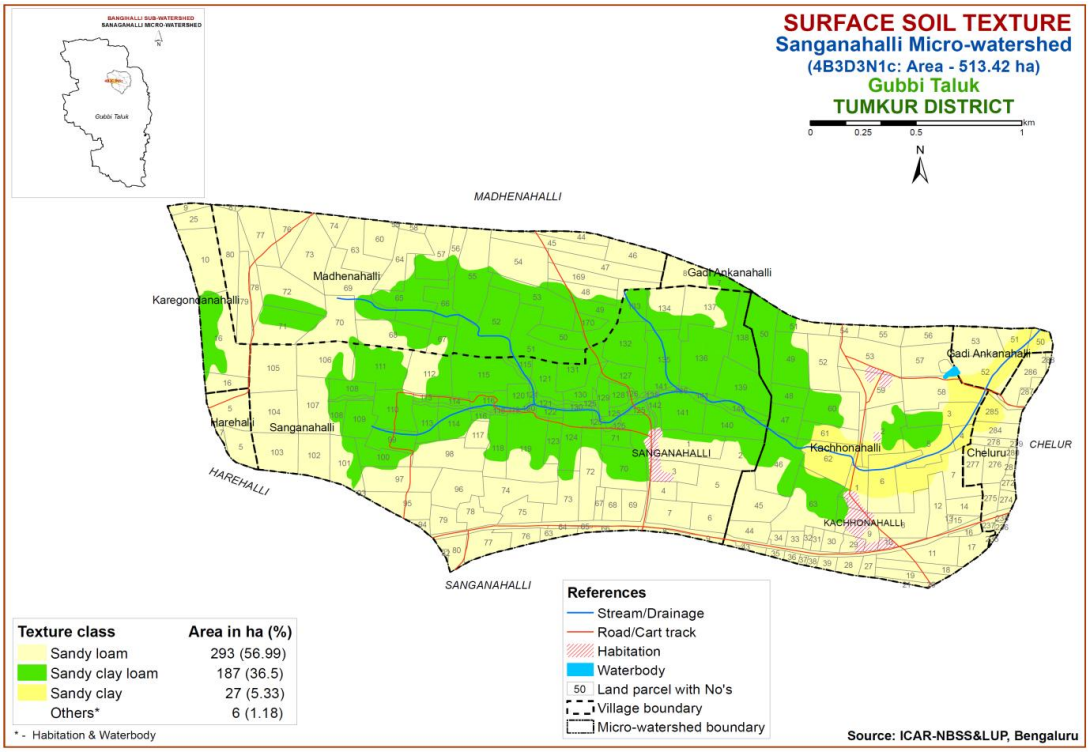


Fig. 5.3 Surface Soil Texture map of Sanganahalli Microwatershed

Maximum area of about 480 ha (93%) has soils that are loamy at the surface. They are distributed in all parts of the microwatershed and an area of 27 ha (5%) has soils that are clayey at the surface and are distributed in the northeastern part of the microwatershed (Fig. 5.3).

The productive lands (5%) with respect to surface soil texture are the clayey soils that have high potential for soil-water retention and availability, and nutrient retention and availability, but have more problems of drainage, infiltration, workability and other physical problems. The other most productive lands (93%) are loamy soils which also have high potential for AWC, nutrient availability but have no drainage or other physical problems.

5.4 Soil Gravelliness

Gravel is the term used for describing coarse fragments between 2 mm and 7.5 cm diameter and stones for those between 7.5 cm and 25 cm. The presence of gravel and stones in soil reduces the volume of soil responsible for moisture and nutrient storage, drainage, infiltration and runoff, and hinders plant growth by impeding root growth and seedling emergence, intercultural operations and farm mechanization. The gravelliness classes used in LRI were used to classify the soils and using these classes a gravelliness map was generated. The area extent and their geographic distribution in the microwatershed is shown in Figure 5.4.

Maximum area of about 485 ha (94%) is non gravelly (<15%) and distributed in all parts of the microwatershed. Gravelly (15-35%) soils covering an area of about 22 ha (4%) are distributed in the northwestern part of the microwatershed (Fig 5.4).

The problem soils (4%) that are gravelly (15-35%) where only short duration crops can be grown. The most productive soils (94%) that are non gravelly (<15%) are distributed in all parts of the microwatershed where all climatically adapted crops can be grown.

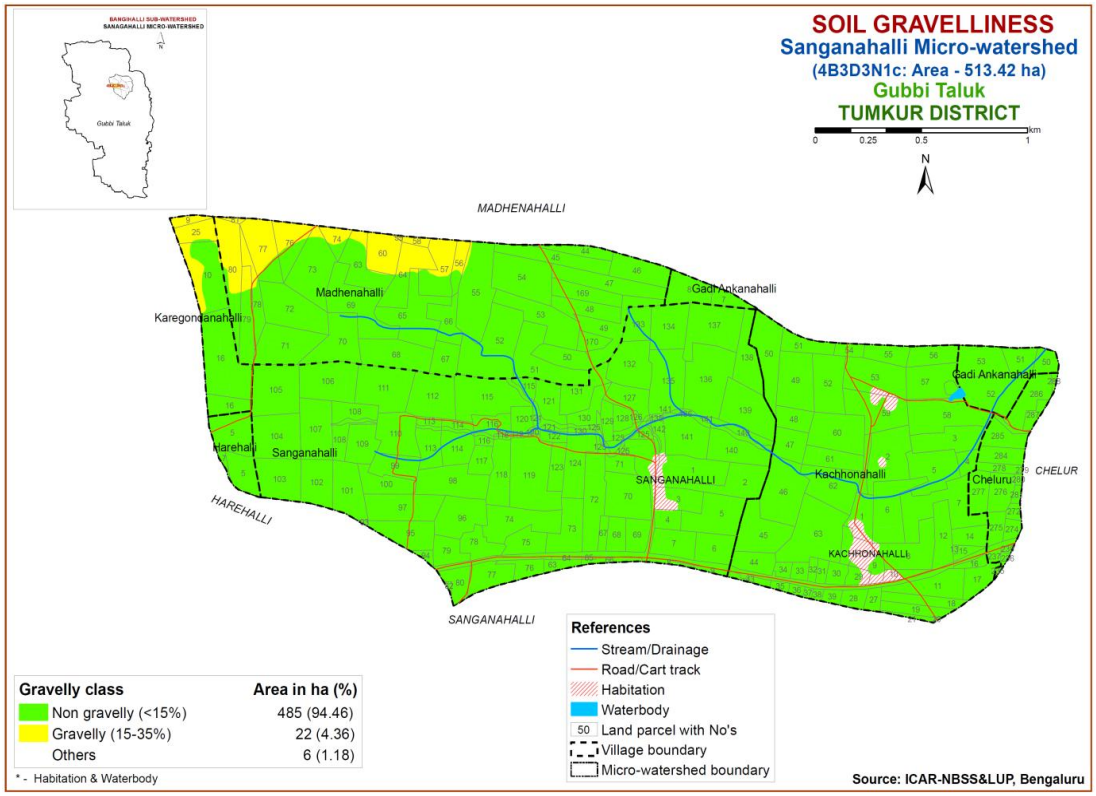


Fig. 5.4 Soil Gravelliness map of Sanganahalli Microwatershed

5.5 Available Water Capacity

The soil available water capacity (AWC) is estimated based on the ability of the soil column to retain water between the tensions of 0.33 and 15 bar in a depth of 100 cm or the entire solum if the soil is shallower. The AWC of the soils (soil series) as estimated by considering the soil texture, mineralogy, soil depth and gravel content (Sehgal *et al.*,

1990) and accordingly the soil map units were grouped into five AWC classes *viz*, very low (<50 mm/m), low (50-100 mm/m), medium (100-150 mm/m), high (150-200 mm/m) and very high (>200 mm/m) and using these values, an AWC map was generated. The area extent and their geographic distribution of different AWC classes in the microwatershed is given in Figure 5.5.

An area of about 114 ha (22%) in the microwatershed has soils that are very low (<50 mm/m) in available water capacity and are distributed in the western and northwestern part of the microwatershed. An area of about 89 ha (17%) are low (51-100 mm/m) in available water capacity and are distributed in the southern and northwestern part of the microwatershed. Maximum area of about 304 ha (59%) is medium (101-150 mm/m) in available water capacity and are distributed in the major part of the microwatershed

About 203 ha (40%) area in the microwatershed has soils that are problematic with regard to available water capacity. Here, only short or medium duration crops can be grown and the probability of crop failure is very high. These areas are best put to other alternative uses. The most productive lands cover about 59 per cent area where all climatically adapted long duration crops can be grown successfully.

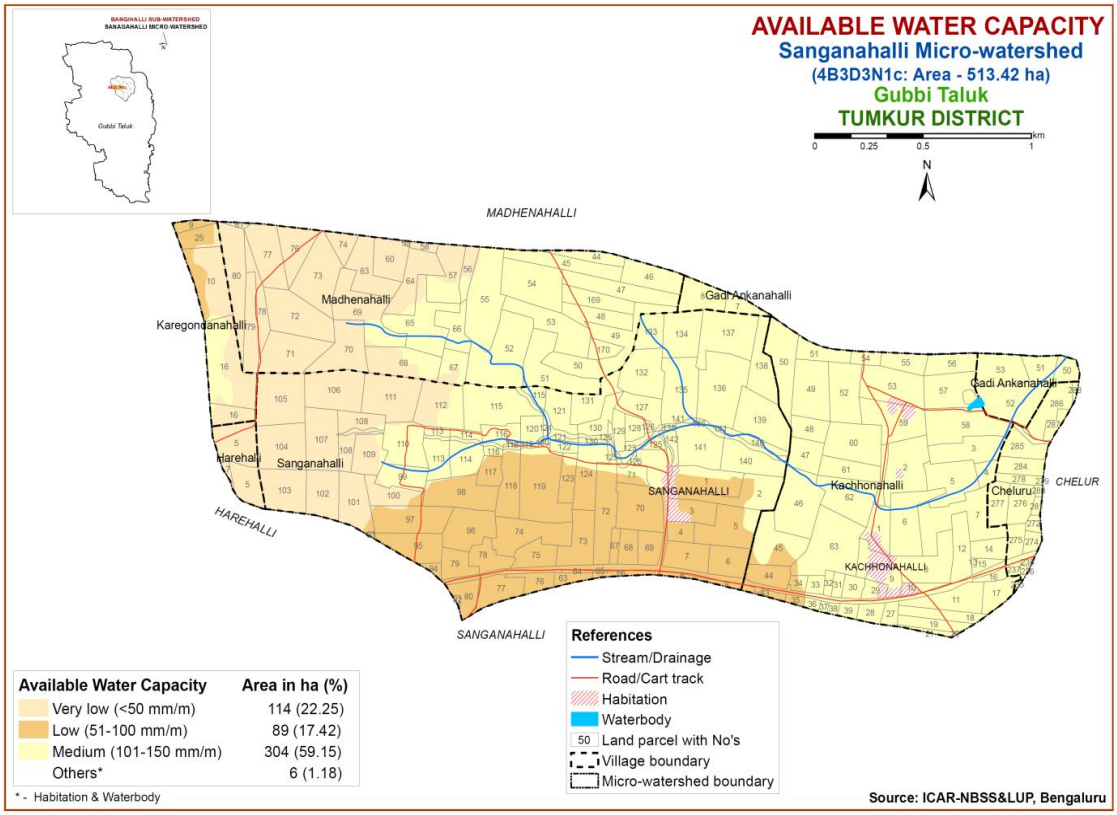


Fig. 5.5 Soil Available Water Capacity map of Sanganahalli Microwatershed

5.6 Soil Slope

Soil slope refers to the inclination of the surface of the land. It is defined by gradient, shape and length, and is an integral feature of any soil as a natural body. Slope is considered important in soil genesis, land use and land development. The length and

gradient of slope influences the rate of runoff, infiltration, erosion and deposition. The soil map units were grouped into four slope classes and a slope map was generated showing the area extent and their geographic distribution in the microwatershed (Fig. 5.6).

Major area of about 359 ha (70%) falls under very gently sloping (1-3% slope) lands and is distributed in the major part of the microwatershed and an area of about 148 ha (29%) is under nearly level (0-1% slope) and distributed in the northern, central and northeastern part of the microwatershed.

Entire area in the microwatershed has soils that have high potential in respect of soil slopes. In these areas, all climatically adapted annual and perennial crops can be grown without much soil and water conservation and other land development measures.

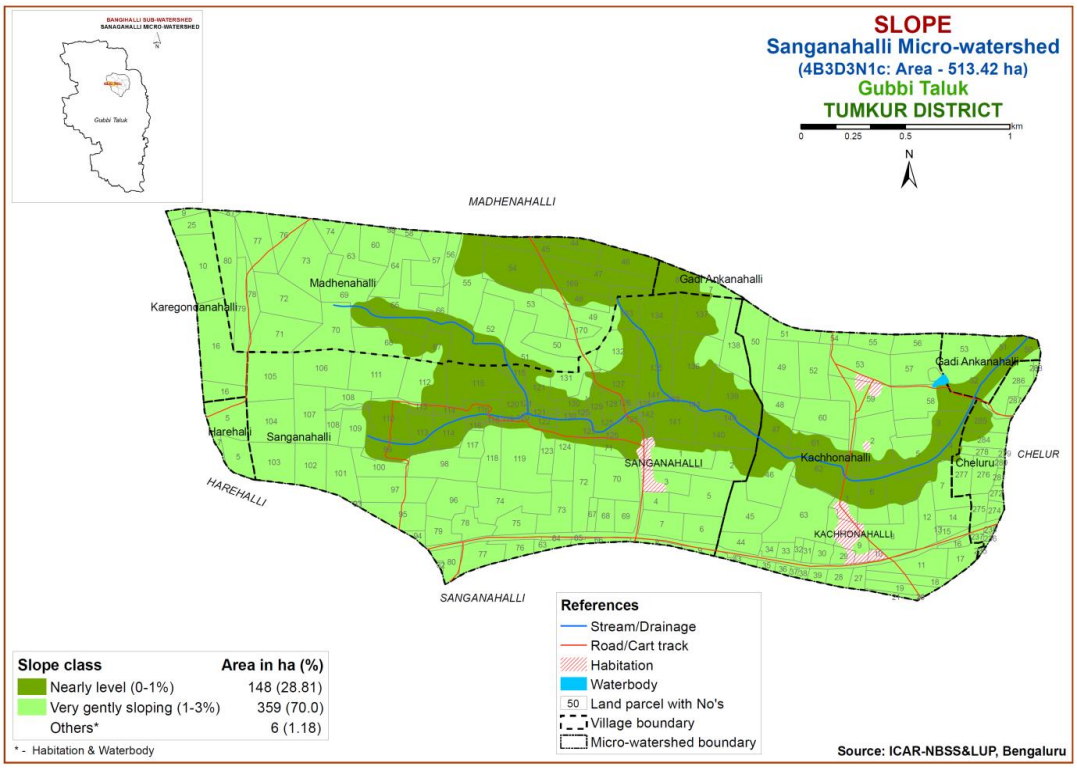


Fig. 5.6 Soil Slope map of Sanganahalli Microwatershed

5.7 Soil Erosion

Soil erosion refers to the wearing away of the earth's surface by the forces of water, wind and ice involving detachment and transport of soil by raindrop impact. It is used for accelerated soil erosion resulting from disturbance of the natural landscape by burning, excessive grazing and indiscriminate felling of forest trees and tillage, all usually by man. The erosion classes showing an estimate of the current erosion status as judged from field observations in the form of rills, gullies or a carpet of gravel on the surface are recorded. Four erosion classes, viz, slight erosion (e1), moderate erosion (e2), severe erosion (e3) and very severe erosion (e4) are recognized. The soil map units were grouped into different erosion classes and a soil erosion map generated. The area extent and their spatial distribution in the microwatershed is given in Figure 5.7.

Entire area in the microwatershed is slightly eroded (e1 Class) soils.

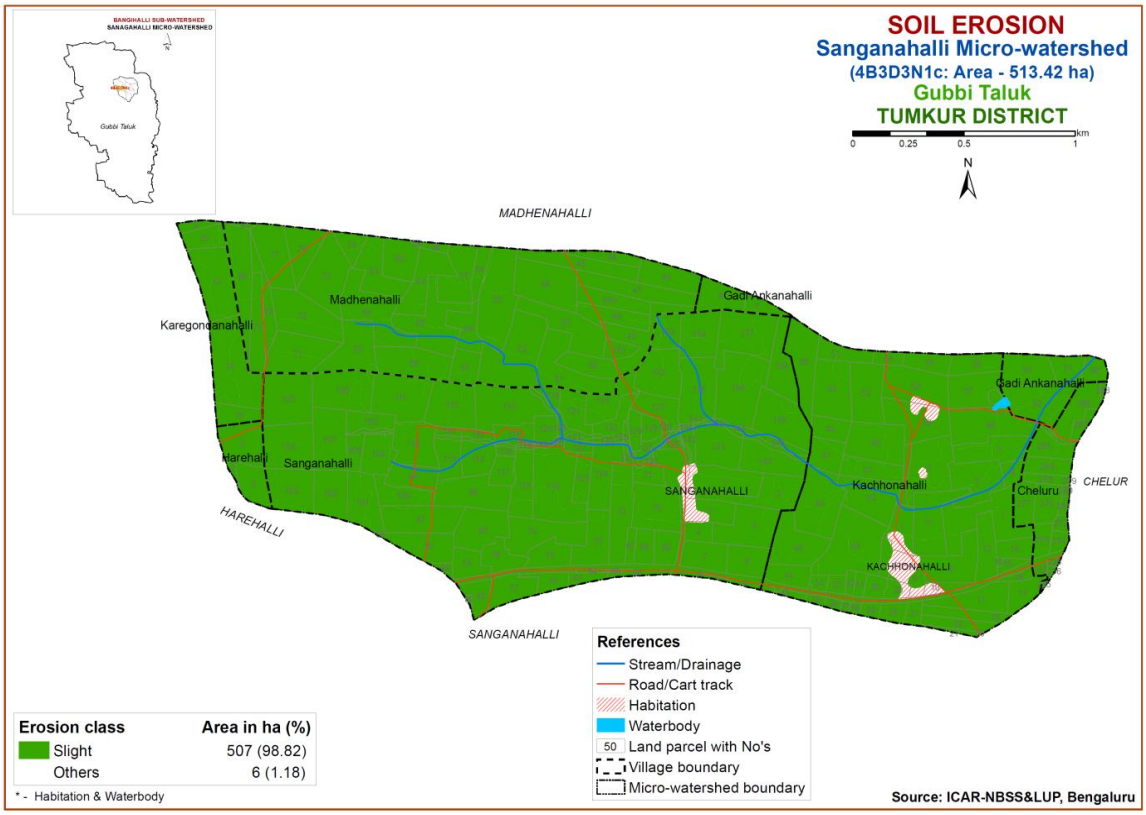


Fig. 5.7 Soil Erosion map of Sanganahalli Microwatershed

Chapter 6

FERTILITY STATUS

Soil fertility plays an important role in increasing crop yield. The adoption of high yielding varieties that require high amounts of nutrients has resulted in deficiency symptoms in crops and plants due to imbalanced fertilization and poor inherent fertility status as the area is characterised by low rainfall and high temperatures. Hence, it is necessary to know the fertility (macro and micro nutrients) status of the soils of the watersheds for assessing the kind and amount of fertilizers required for each of the crop intended to be grown. For this purpose, the surface soil samples collected from the grid points (one soil sample at every 250 m interval) all over the microwatershed through land resource inventory in the year 2015 were analysed for pH, EC, organic carbon, available phosphorus and potassium, and for micronutrients like zinc, boron, copper, iron and manganese, and secondary nutrient sulphur.

Soil fertility data generated has been assessed and individual maps for all the nutrients for the microwatershed have been generated using Kriging method under GIS. The village/survey number wise fertility data for the microwatershed is given in Appendix-II.

6.1 Soil Reaction (pH)

The soil analysis of the Sanganahalli microwatershed for soil reaction (pH) showed that an area of about 26 ha (5%) is neutral (pH 6.5-7.3) and are distributed in the central part of the microwatershed. Maximum area of 176 ha (34%) is slightly acid (pH 6.0-6.5) and are distributed in the western and central part of the microwatershed. An area of 173 ha (34%) is moderately acid (pH 5.5-6.0) and are distributed in the southern, northern, northwestern and central part of the microwatershed. An area of about 134 ha (26%) is strongly acid (pH 5.0-5.5) and are distributed in the northwestern, northeastern and eastern part of the microwatershed (Fig. 6.1). Thus, major soils in the microwatershed are acid in reaction.

6.2 Electrical Conductivity (EC)

The Electrical Conductivity of the soils of the entire microwatershed area is <2 dSm^{-1} (Fig 6.2) and as such the soils are nonsaline.

6.3 Organic Carbon

The soil organic carbon (an index of available Nitrogen) content in the microwatershed is medium (0.5-0.75%) covering a maximum area of about 340 ha (66%) and is distributed in the major part of the microwatershed. It is low (<0.5%) in an area of about 168 ha (33%) and distributed in the northern and southern part of the microwatershed (Fig.6.3).

6.4 Available Phosphorus

Available phosphorus content is high (>57 kg/ha) in the entire microwatershed area (Fig 6.4).

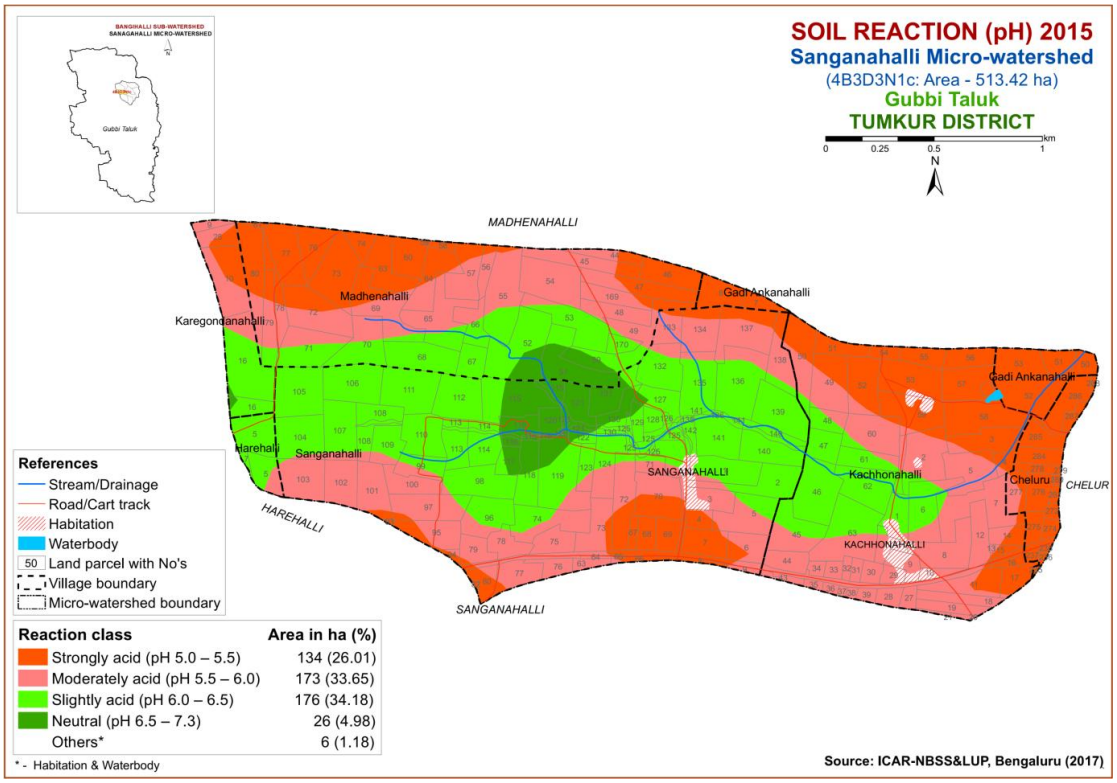


Fig.6.1 Soil Reaction (pH) map of Sanganahalli Microwatershed

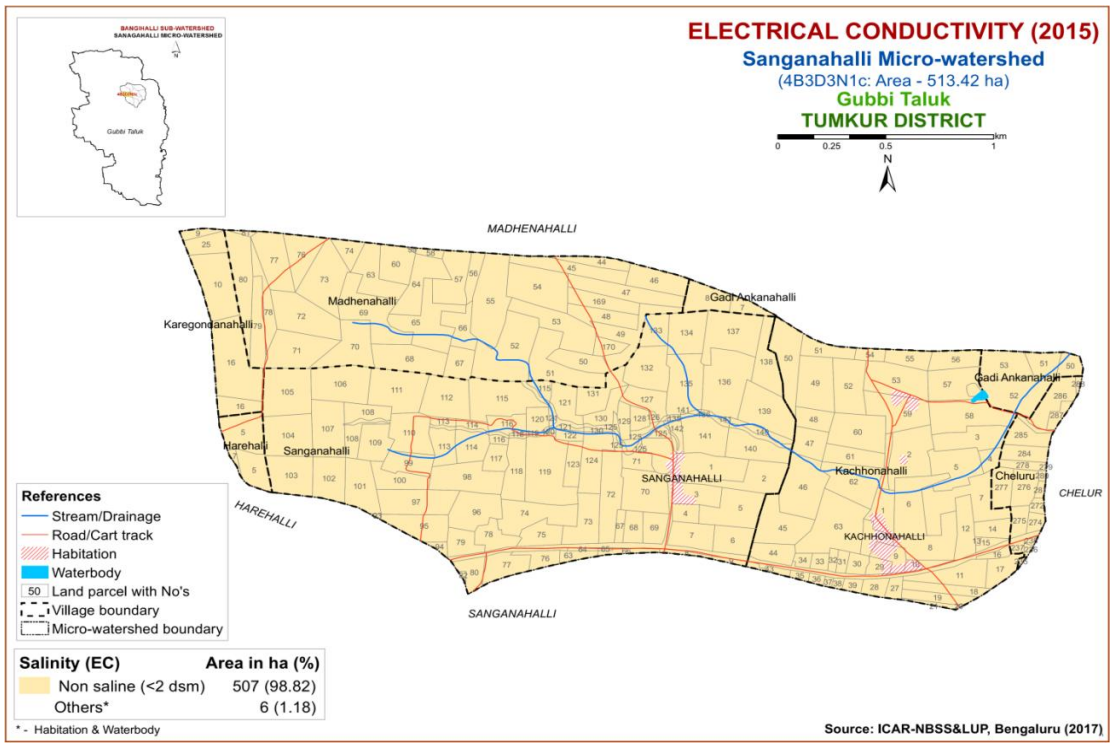


Fig.6.2 Electrical Conductivity (EC) map of Sanganahalli Microwatershed

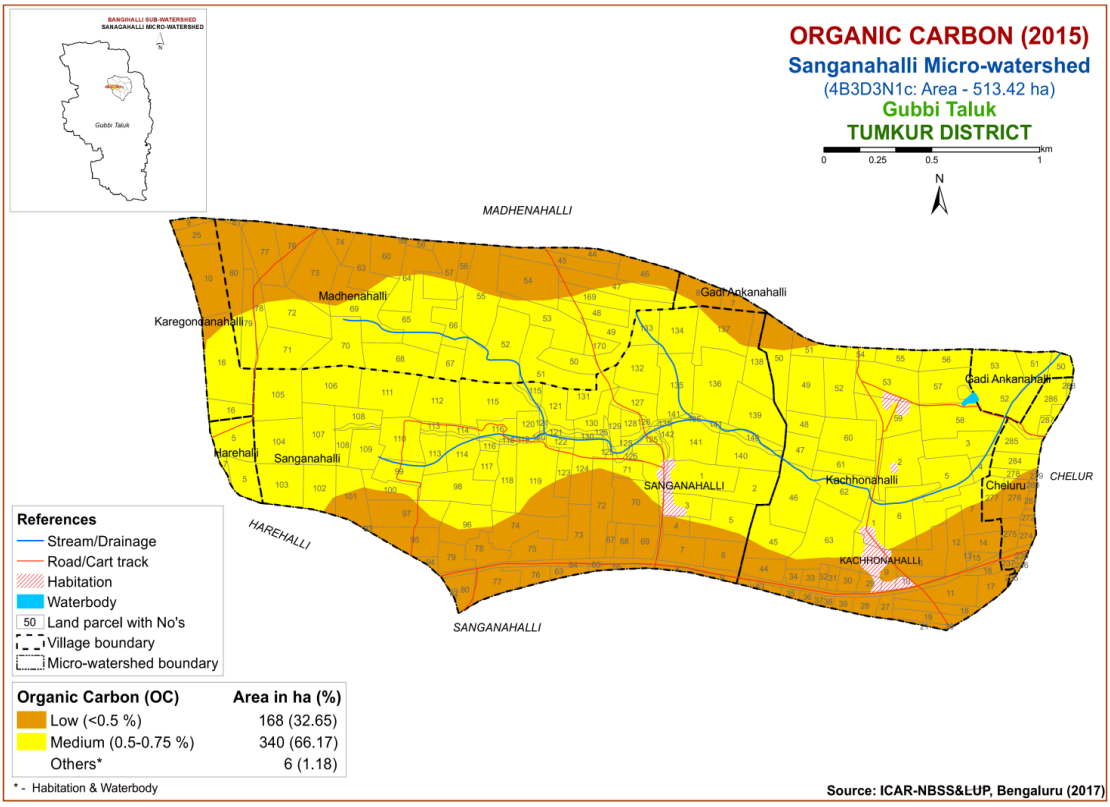


Fig.6.3 Soil Organic Carbon map of Sanganahalli Microwatershed

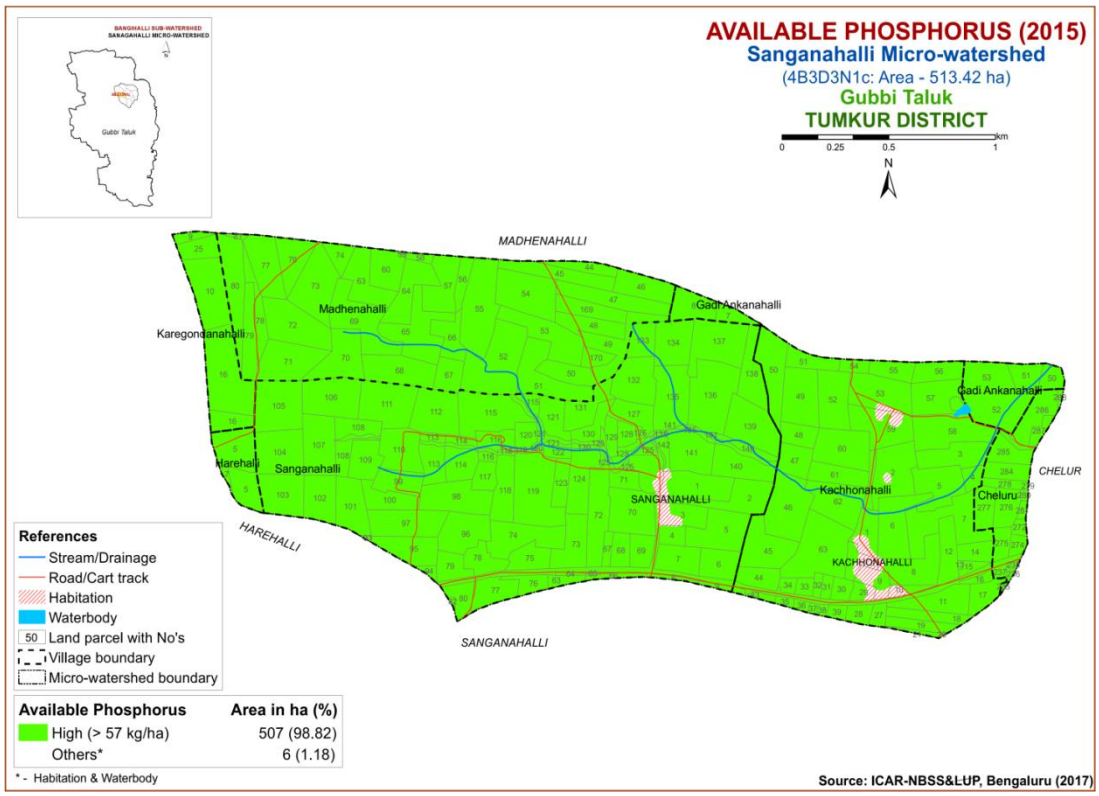


Fig.6.4 Soil Available Phosphorus map of Sanganahalli Microwatershed

6.5 Available Potassium

Available potassium content is medium (145-337 kg/ha) in maximum area of about 382 ha (74%) and is distributed in the major part of the microwatershed (Fig.6.5). High available potassium (>337 kg/ ha) is in an area of 60 ha (12%) and is distributed in the central part of the microwatershed. It is low in an area of 65 ha (13%) and is distributed in the eastern and northern part of the microwatershed.

6.6 Available Sulphur

Available sulphur content is medium (10-20 ppm) in the entire microwatershed (Fig. 6.6).

6.7 Available Boron

Available boron content is medium (0.5-1.0 ppm) in an area of 29 ha (6%) and maximum area of about 478 ha (93%) is low (<0.5 ppm) in available boron and is distributed in the major part of the microwatershed (Fig. 6.7).

6.8 Available Iron

Available iron content is sufficient (>4.5 ppm) in the entire area in the microwatershed (Fig 6.8).

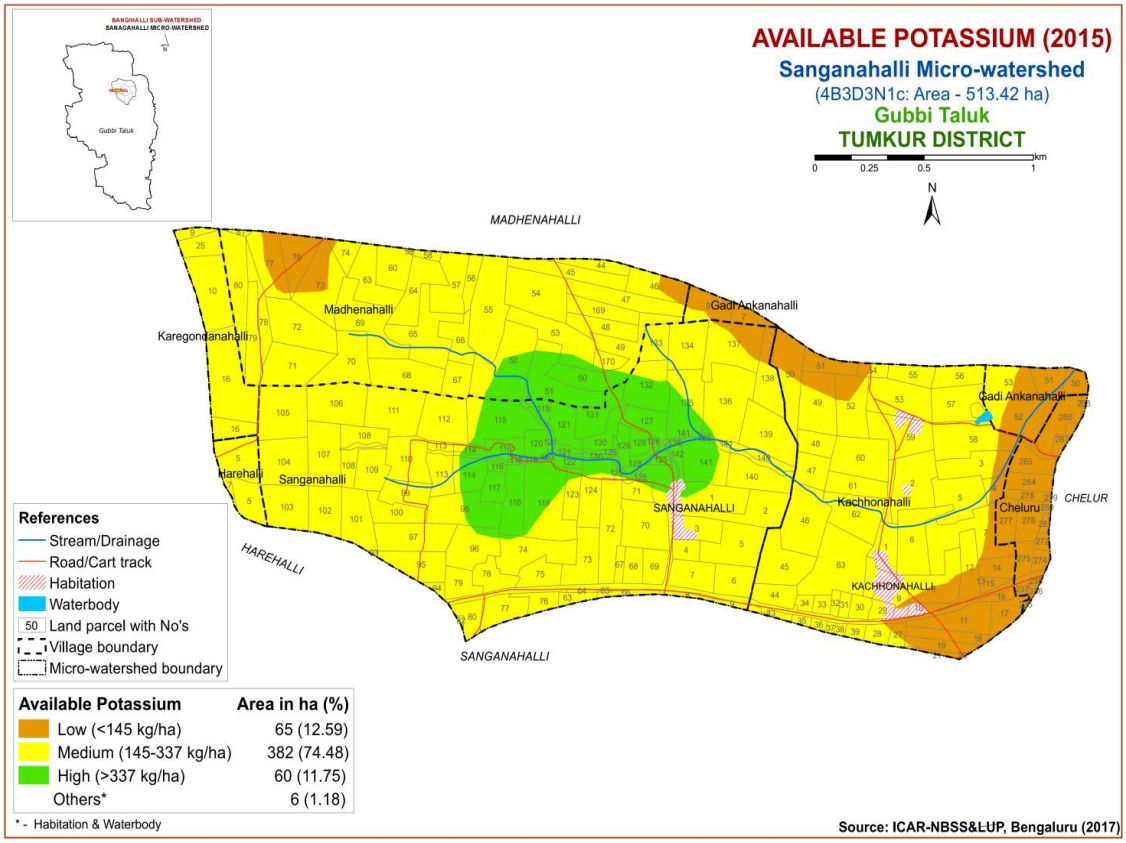


Fig.6.5 Soil Available Potassium map of Sanganahalli Microwatershed

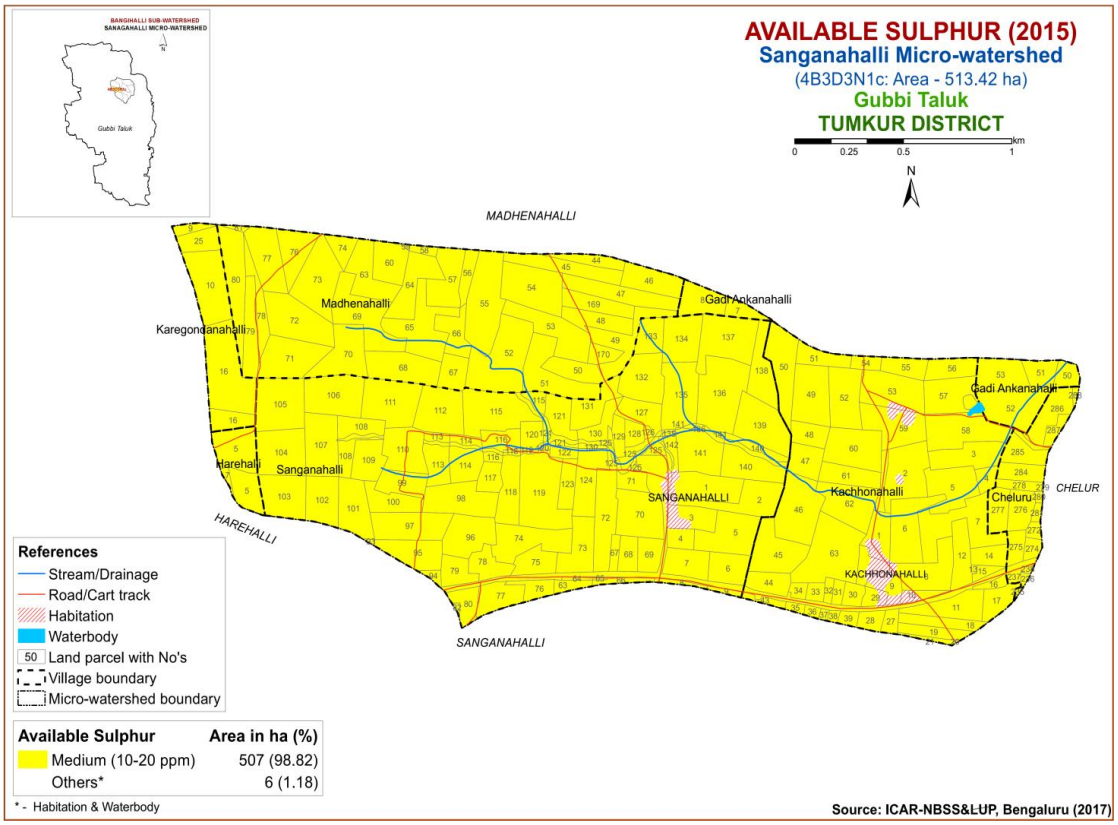


Fig.6.6 Soil Available Sulphur map of Sanganahalli Microwatershed

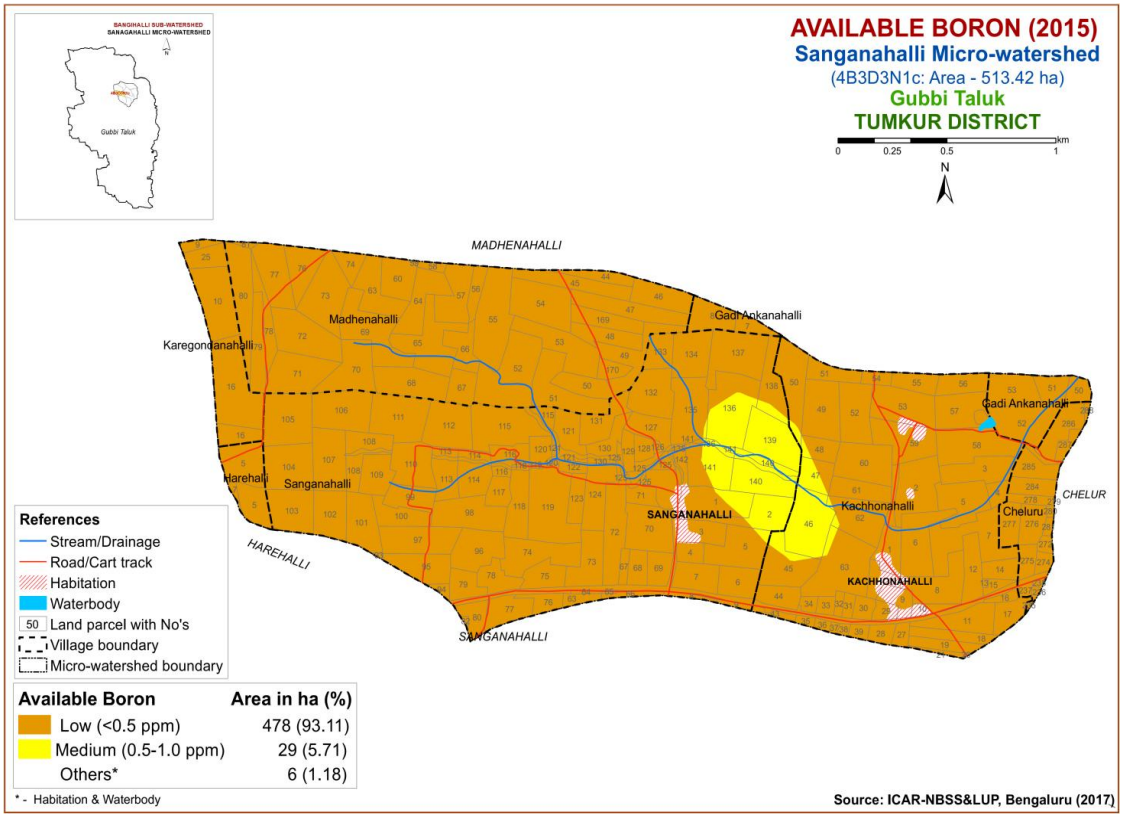


Fig.6.7 Soil Available Boron map of Sanganahalli Microwatershed

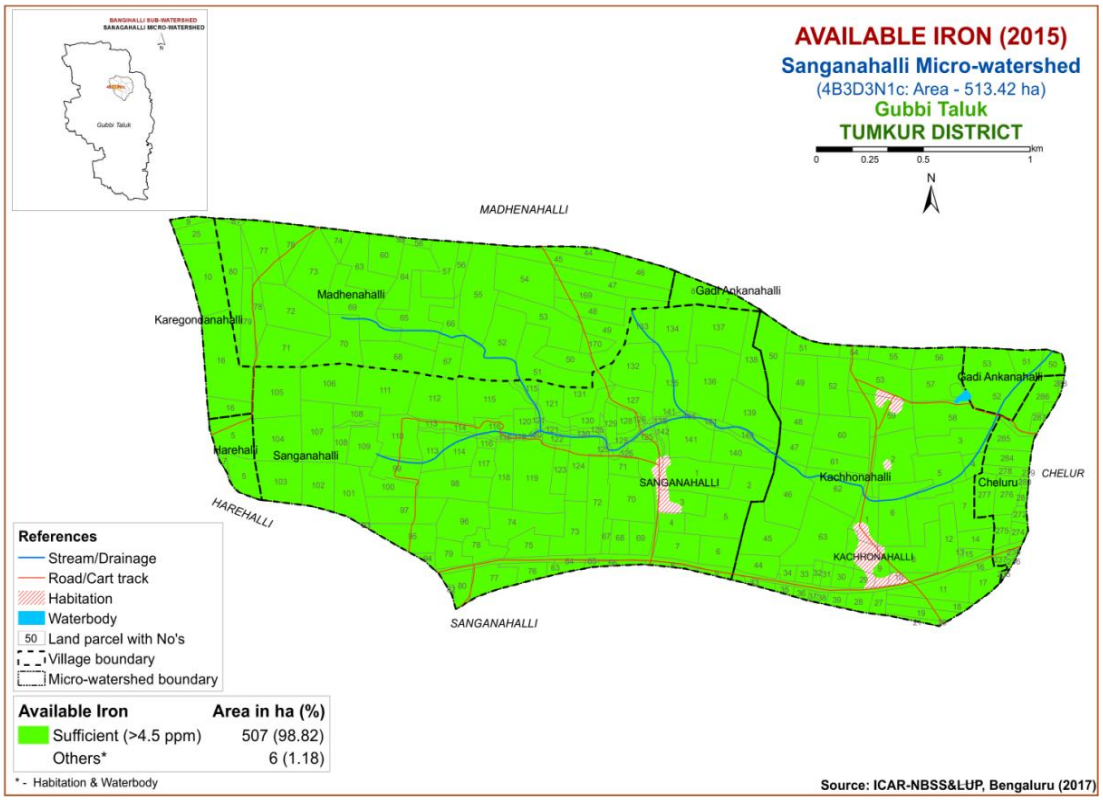


Fig.6.8 Soil Available Iron map of Sanganahalli Microwatershed

6.9 Available Manganese

Available manganese content is sufficient (>1.0 ppm) in the entire microwatershed area (Fig 6.9).

6.10 Available Copper

Available copper content is sufficient (>0.2 ppm) in the entire microwatershed area (Fig 6.10).

6.11 Available Zinc

Available zinc content is deficient (<0.6 ppm) in an area of 111 ha (22%) and are distributed in the northwestern, southern and northeastern part of the microwatershed and major area of 396 ha (77%) is sufficient (>0.6 ppm) and are distributed in the major part of the microwatershed (Fig 6.11).

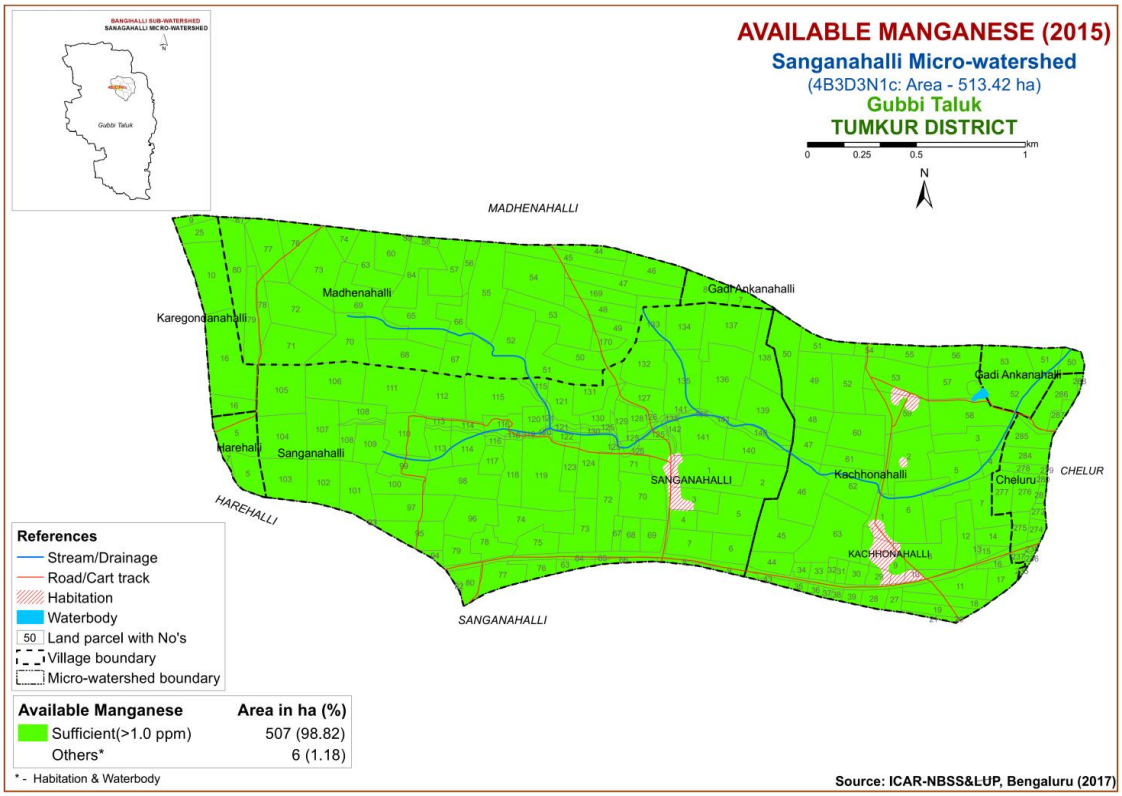


Fig.6.9 Soil Available Manganese map of Sanganahalli Microwatershed

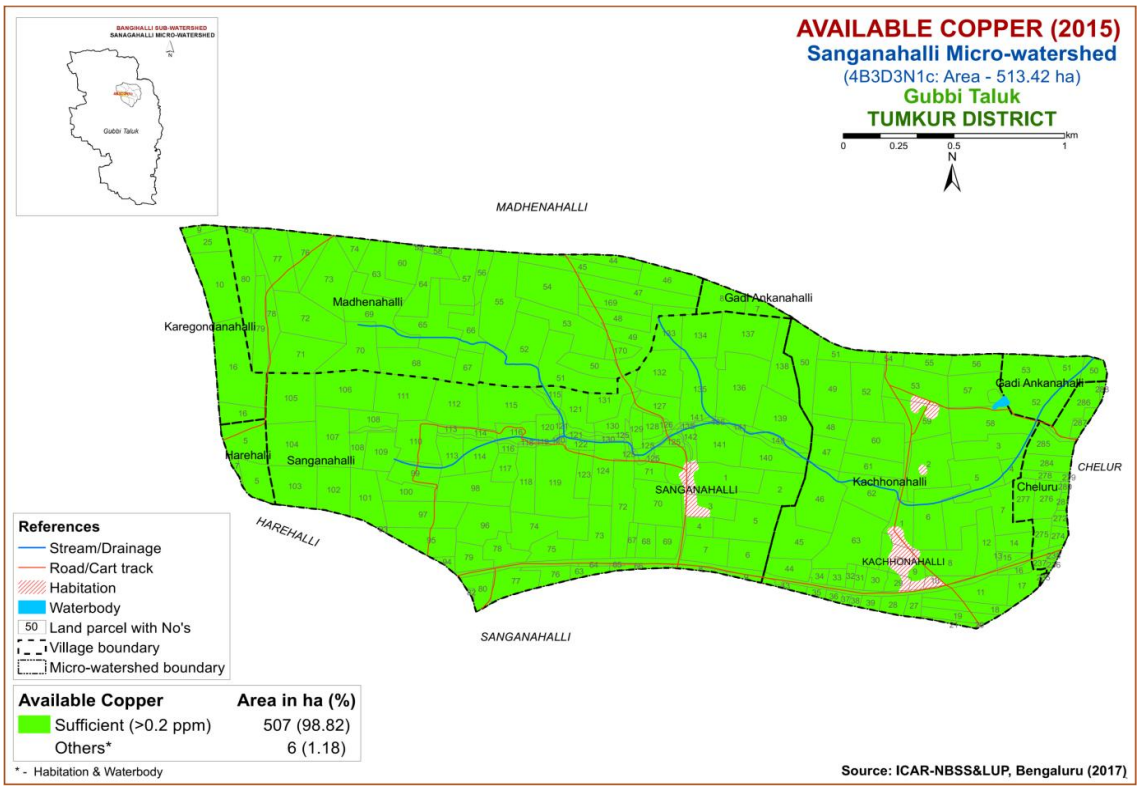


Fig.6.10 Soil Available Copper map of Sanganahalli Microwatershed

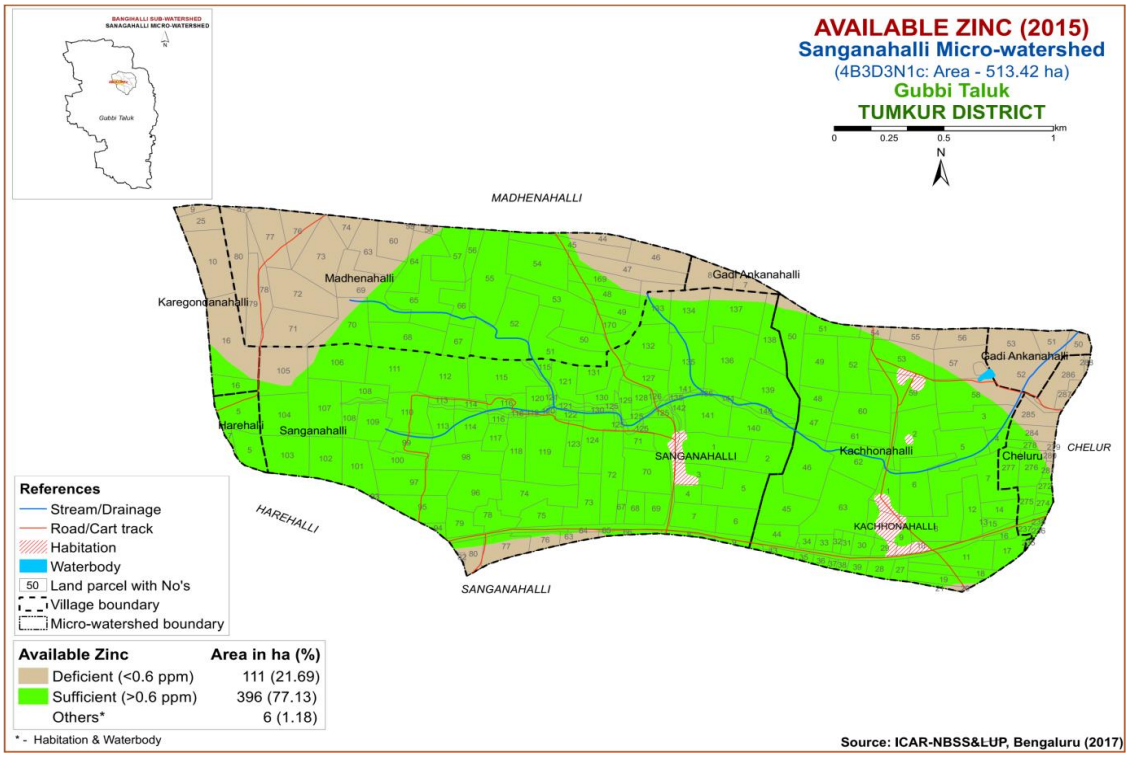


Fig.6.11 Soil Available Zinc map of Sanganahalli Microwatershed

Chapter 7

LAND SUITABILITY FOR MAJOR CROPS

The soil and land resource units (soil phases) of Sanganahalli microwatershed were assessed for their suitability for growing food, fodder, fibre and other horticulture crops by following the procedure as outlined in FAO, 1976 and 1983. Crop requirements were developed for each of the crop from the available research data and also by referring to Naidu *et. al.* (2006) and Natarajan *et. al* (2015). The crop requirements were matched with the soil and land characteristics (Table 7.1) to arrive at the crop suitability. In FAO land suitability classification, two orders are recognized. Order S- Suitable and Order N- Not suitable. The orders have classes, subclasses and units. Order-S has three classes, class S1- Highly Suitable, class S2- Moderately Suitable and class S3- Marginally Suitable. Order N has two classes, N1- Currently not Suitable and N2- Permanently not Suitable. There are no subclasses within the class S1 as they will have very minor or no limitations for crop growth. Classes S2 and S3 are divided into subclasses based on the kinds of limitations encountered. The limitations that affect crop production are 'c' for erratic rainfall and its distribution and length of growing period (LGP), 'e' for erosion hazard, 'r' for rooting condition, 't' for lighter or heavy texture, 'g' for gravelliness or stoniness, 'n' for nutrient availability, 'l' for topography, 'm' for moisture availability, 'z' for calcareousness and 'w' for drainage. These limitations are indicated as lower case letters to the class symbol. For example, moderately suitable lands with the limitations of soil depth and erosion are designated as S2re. For the microwatershed, the soil mapping units were evaluated and classified up to subclass level.

Using the above criteria, the soil map units of the microwatershed were evaluated and land suitability maps for 34 major annual and perennial crops were generated. The detailed information on the kind of suitability of each of the soil phase for the crops assessed are given village/ survey number wise for the microwatershed in Appendix-III.

7.1 Land Suitability for Sorghum (*Sorghum bicolor*)

Sorghum is one of the major crops grown in Karnataka in an area of 10.47 lakh ha in Bijapur, Gulbarga, Raichur, Bidar, Belgaum, Dharwad, Bellary, Chitradurga, Mysore and Tumakuru districts. The crop requirements for growing sorghum (Table 7.2) were matched with the soil-site characteristics (Table 7.1) of the soils of the microwatershed and a land suitability map for growing sorghum was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.1.

An area of about 186 ha (36%) is highly suitable (Class S1) for growing sorghum and are distributed in the northern, northeastern and eastern part the microwatershed. An area of about 118 ha (23%) is moderately suitable (Class S2) for growing sorghum and are distributed in the central and northeastern part the microwatershed.

Table 7.1 Soil-Site Characteristics of Sanganahalli Microwatershed

Soil Map Units	Climate (P) (mm)	Growing period (Days)	Drai-nage Class	Soil depth (cm)	Soil texture		Gravelliness		AWC (mm/m)	Slope (%)	Erosion	pH	EC	ESP	CEC [Cmol (p^+)kg^{-1}]	BS (%)
					Surf-ace	Sub-surface	Surface (%)	Subsurface (%)								
BDGcB1	813	150	WD	75-100	sl	scl-sc	-	35-60	<50	1-3	slight	6.24	0.06	0.35	3.76	52.56
BDGcB1g1	813	150	WD	75-100	sl	scl-sc	15-35	35-60	<50	1-3	slight	6.24	0.06	0.35	3.76	52.56
BDGhB1	813	150	WD	75-100	scl	scl-sc	-	35-60	<50	1-3	slight	6.24	0.06	0.35	3.76	52.56
BPRcB1g1	813	150	WD	100-150	sl	sc-c	15-35	>35	51-100	1-3	slight	6.64	0.03	0.51	5.45	63.48
HLKhB1	813	150	WD	>150	scl	c	-	<15	>200	1-3	slight	-	-	-	-	-
RTRcA1	813	150	WD	>150	sl	c	-	-	101-150	0-1	slight	5.08	0.03	2.06	9.21	50.5
RTRcB1	813	150	WD	>150	sl	c	-	-	101-150	1-3	slight	5.08	0.03	2.06	9.21	50.5
RTRhB1	813	150	WD	>150	scl	c	-	-	101-150	1-3	slight	5.08	0.03	2.06	9.21	50.5
NDLcB1	813	150	WD	>150	sl	sc	-	>35	150-200	1-3	slight	-	-	-	-	-
NDLhB1	813	150	WD	>100	scl	sc	-	>35	150-200	1-3	slight	-	-	-	-	-
TDGhA1	813	150	WD	>150	scl	s,ls,sl,scl,sc	-	-	101-150	0-1	slight	7.02	0.05	1.44	5.77	100
TDGiA1	813	150	WD	>150	sc	s,ls,sl,scl,sc	-	-	101-150	0-1	slight	7.02	0.05	1.44	5.77	100

*Symbols and abbreviations are according to Field Guide for LRI under Sujala-III Project, Karnataka

They have minor limitations of texture. Marginally suitable lands (Class S3) for growing sorghum occupy major area of about 203 ha (40%) and occur in the western, northwestern and southern part of the microwatershed. They have moderate limitations of rooting depth and gravelliness.

Table 7.2 Crop suitability criteria for Sorghum

Crop requirement		Rating			
Soil –site characteristics	**Unit**	**Highly suitable(S1)**	**Moderately suitable(S2)**	**Marginally suitable(S3)**	**Not suitable (N)**
Slope	%	2-3	3-8	8-15	>15
LGP	Days	120-150	120-90	<90	
Soil drainage	Class	Well to mod. Well drained	imperfect	Poorly/excessively	V.poorly
Soil reaction	pH	6.0-8.0	5.5-5.9 8.1-8.5	<5.5 8.6-9.0	>9.0
Surface soil texture	Class	c, cl, sicl, sc	l, sil, sic	sl, ls	s, fragmental skeletal
Soil depth	cm	100-75	50-75	30-50	<30
Gravel content	% vol.	5-15	15-30	30-60	>60
Salinity (EC)	dSm^{-1}	2-4	4-8	8-10	>10
Sodicity (ESP)	%	5-8	8-10	10-15	>15

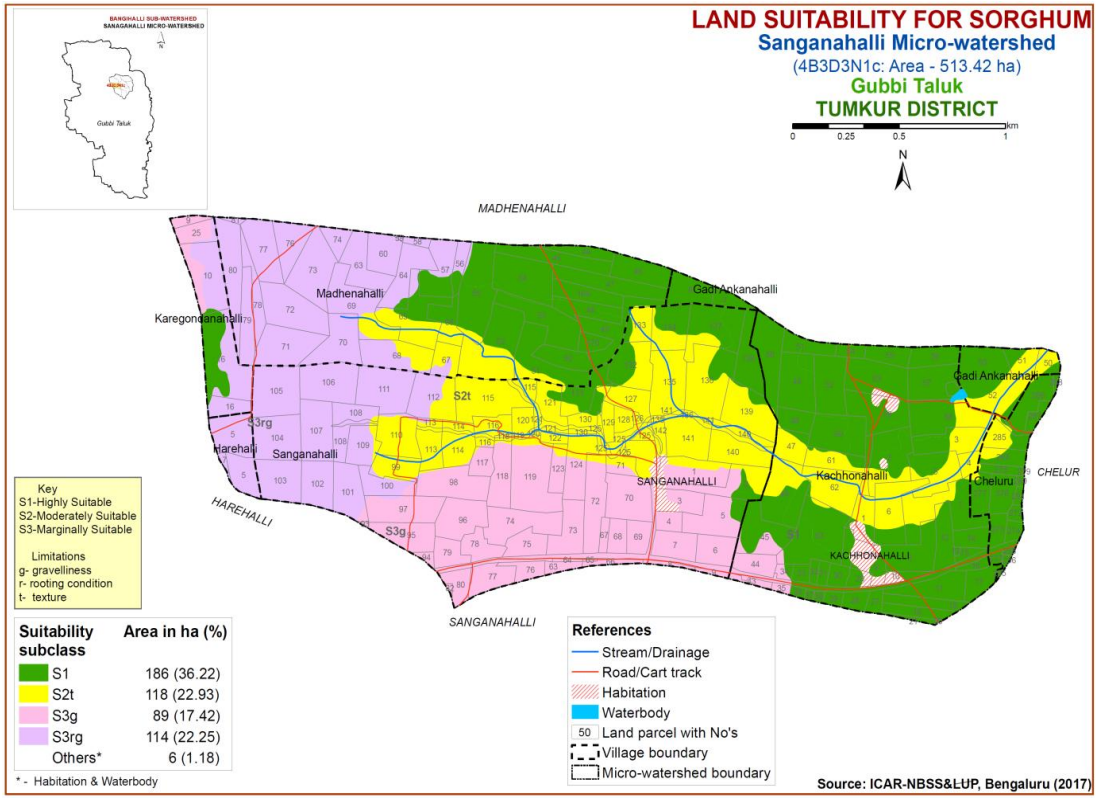


Fig. 7.1 Land Suitability map of Sorghum

7.2 Land Suitability for Fodder Sorghum (*Sorghum bicolor*)

Fodder Sorghum is one of the major fodder crops grown in South Karnataka in Tumakuru, Chikkaballapur, Mysore, Mandya, Bengaluru Rural and Kolar districts. The crop requirements for growing Fodder sorghum (Table 7.3) were matched with the soil-site characteristics (Table 7.1) of the soils of the microwatershed and a land suitability map for growing fodder sorghum was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.2.

Table 7.3 Crop suitability criteria for Fodder Sorghum

Crop requirement		Rating			
Soil –site characteristics	**Unit**	**Highly suitable(S1)**	**Moderately Suitable(S2)**	**Marginally suitable (S3)**	**Not suitable(N)**
Slope	%	2-3	3-8	8-15	>15
LGP	Days	120-150	120-90	<90	
Soil drainage	Class	Well to mod. Well drained	imperfect	Poorly/excessively	V.poorly
Soil reaction	pH	6.0-8.0	5.5-5.9,8.1-8.5	<5.5,8.6-9.0	>9.0
Surface soil texture	Class	c, cl, sicl, sc	l, sil, sic	sl, ls	s,fragmental skeletal
Soil depth	cm	100-75	50-75	30-50	<30
Gravel content	%vol.	5-15	15-30	30-60	>60
Salinity (EC)	dSm^{-1}	2-4	4-8	8-10	>10
Sodicity (ESP)	%	5-8	8-10	10-15	>15

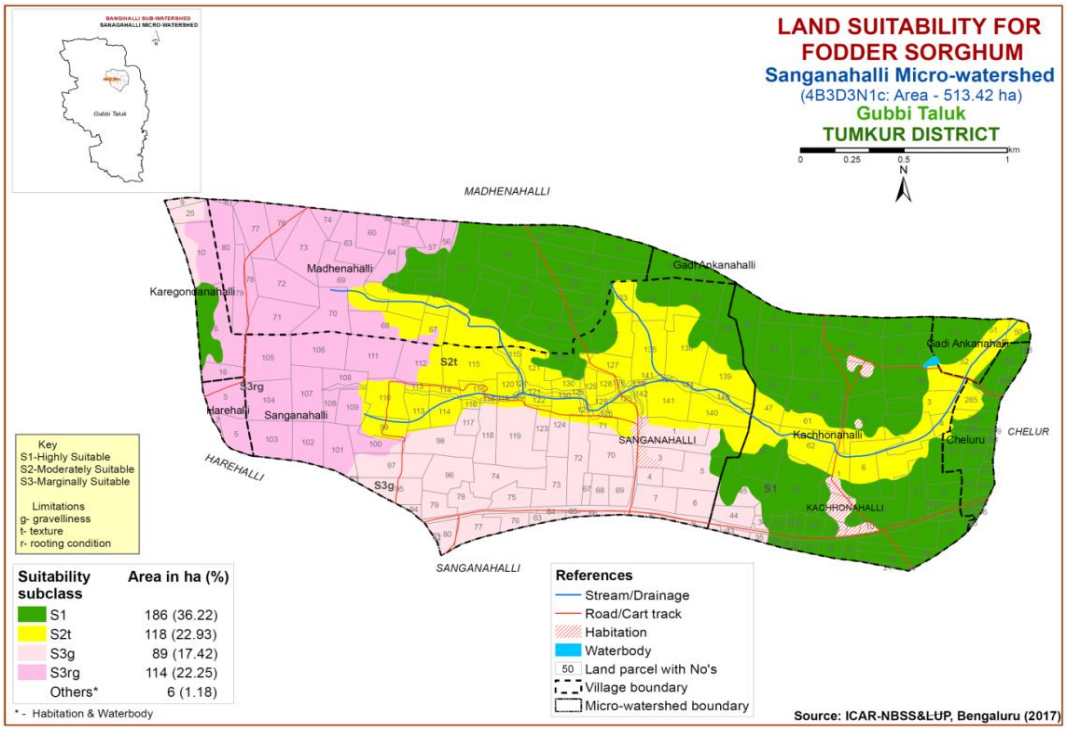


Fig. 7.2 Land Suitability map of Fodder Sorghum

An area of about 186 ha (36%) is highly suitable (Class S1) for growing fodder sorghum and are distributed in the northern, northeastern and eastern part the microwatershed. An area of about 118 ha (23%) is moderately suitable (Class S2) for growing fodder sorghum and are distributed in the central and northeastern part the microwatershed. They have minor limitation of texture. Marginally suitable lands (Class S3) for growing fodder sorghum occupy major area of about 203 ha (40%) and occur in the western, northwestern and southern part of the microwatershed. They have moderate limitations of rooting depth and gravelliness.

7.3 Land Suitability for Maize (*Zea mays*)

Maize is one of the most important food crop grown in an area of 13.37 lakh ha in almost all the districts of the State. The crop requirements for growing maize (Table 7.4) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing maize was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.3.

A very small area of about 4 ha (1%) is highly suitable (Class S1) for growing maize and is distributed in the eastern part of the microwatershed. An area of about 182 ha (35%) is moderately suitable (Class S2) and are distributed in the northern, northeastern and eastern part the microwatershed. They have minor limitation texture. Marginally suitable lands (Class S3) for growing maize occupy major area of about 321 ha (63%) and occur in the major part of the microwatershed and have moderate limitations of rooting depth, texture and gravelliness.

Table 7.4 Crop suitability criteria for Maize

Crop requirement		**Rating**			
Soil–site characteristics	**Unit**	**Highly suitable(S1)**	**Moderately suitable(S2)**	**Marginally suitable(S3)**	**Not suitable(N)**
Slope	%	<3	3.5	5-8	
LGP	Days	>100	100-80	60-80	
Soil drainage	Class	Well drained	Mod. to imperfectly	Poorly/excessively	V.poorly
Soil reaction	pH	5.5-7.5	7.6-8.5	8.6-9.0	
Surface soil texture	Class	l, cl, scl, sil	sl, sicl, sic	c(s-s), ls	s,fragmental
Soil depth	cm	>75	50-75	25-50	<25
Gravel content	%vol.	<15	15-35	35-50	>50
Salinity (EC)	dSm^{-1}	<1.0	1.0-2.0	2.0-4.0	
Sodicity (ESP)	%	<10	10-15	>15	

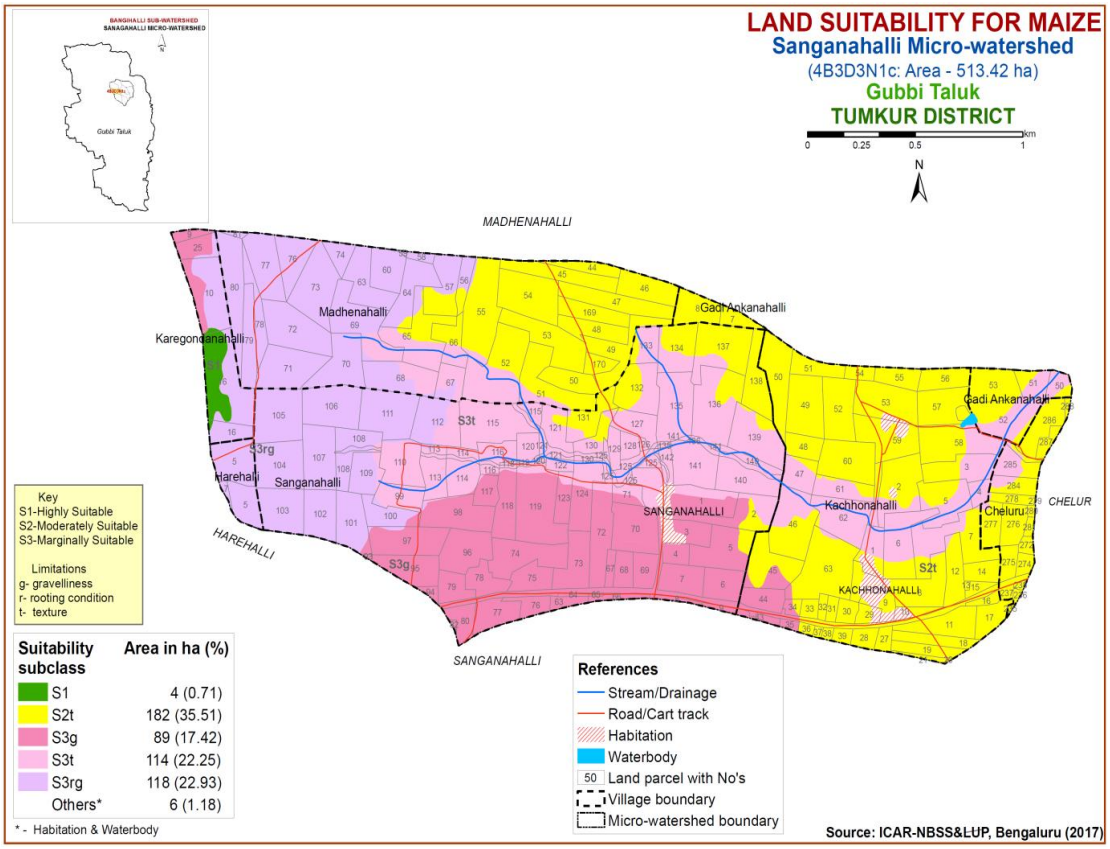


Fig. 7.3 Land Suitability map of Maize

7.4 Land Suitability for Upland Paddy (*Oryaza Sativa*)

Upland paddy is one of the most important food crop grown in an area of 13.26 lakh ha in major parts of the district of the State under rainfed condition. The crop requirements for growing Upland paddy (Table 7.5) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing Upland paddy was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.4.

Table 7.5 Land suitability criteria for Upland paddy

Crop requirement		Rating			
Soil –site characteristics	**Unit**	**Highly suitable(S1)**	**Moderately Suitable(S2)**	**Marginally suitable(S3)**	**Not suitable(N)**
Slope	%	1-3	1-3	3-5	>5
Soil drainage	class	Well to mod.	poorly	Very poorly	
Soil reaction	pH	5.5-6.5	6.5-7.3 4.5-5.4	7.3-8.4	>8.4
Surface soil texture	Class	c, sic, cl, sicl, sc	scl, sil, l	sl, ls	s
Soil depth	cm	>75	50-75	25-50	<25
Gravel content	% vol.	<15	15-35	35-60	60-80

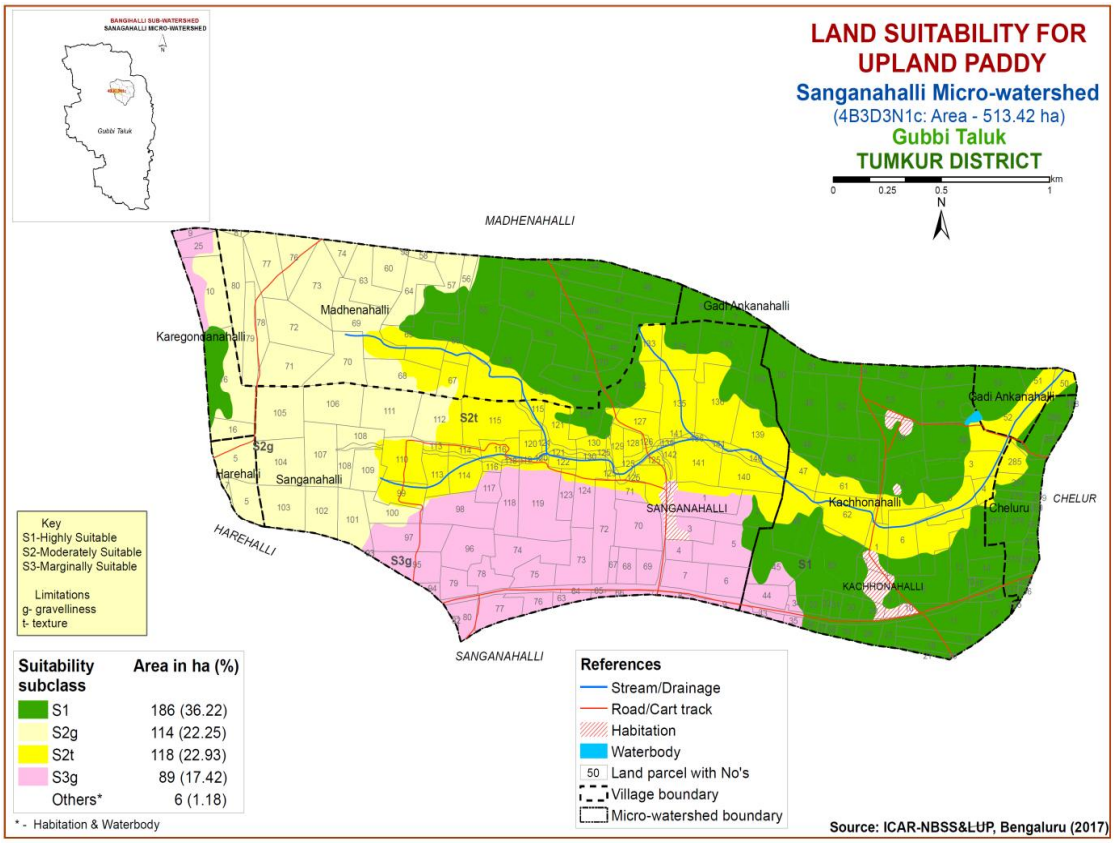


Fig. 7.4 Land Suitability map of Upland paddy

An area of about 186 ha (36%) is highly suitable (Class S1) for growing Upland paddy and are distributed in the northern, northeastern and eastern part the microwatershed. An area of about 232 ha (45%) is moderately suitable (Class S2) for growing upland paddy and are distributed in the major part of the microwatershed. They have minor limitations of texture. Marginally suitable lands (Class S3) for growing Upland paddy occupy an area of about 89 ha (17%) and occur in the northwestern and southern part of the microwatershed. They have moderate limitations of gravelliness.

7.5 Land Suitability for Finger millet (*Eleusine Coracana*)

Finger millet is one of the most important food crop grown in an area of 7.08 lakh ha in almost all the districts of south Karnataka. The crop requirements for growing Finger millet (Table 7.6) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing Finger millet was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.5.

An area of about 186 ha (36%) is highly suitable (Class S1) for growing Finger millet and are distributed in the northern, northeastern and eastern part the microwatershed. An area of about 114 ha (22%) is moderately suitable (Class S2) for growing Finger millet and are distributed in the central and northeastern part of the microwatershed. They have minor limitation of gravelliness. Marginally suitable lands (Class S3) for growing Finger millet occupy major area of about 207 ha (40%) and occur in the western, northwestern and southern part of the microwatershed. They have moderate limitations of gravelliness and texture.

Table 7.6 Land suitability criteria for Finger millet

Crop requirement		Rating			
Soil –site characteristics	**Unit**	**Highly suitable(S1)**	**Moderately Suitable(S2)**	**Marginally suitable(S3)**	**Not suitable(N)**
Slope	%	<3	3-5	5-10	>10
LGP	Days	>110	90-110	60-90	<60
Soil drainage	class	Well to mod. drained	Imperfectly drained	Poorly/excessively	V. poorly
Soil reaction	pH	5.5-7.3	7.3-8.4	8.4-9.0	>9.0
Surface soil texture	Class	l,sil,sl,cl, sicl,scl	sic, c, sc	ls, s,c >60%	
Soil depth	cm	>75	50-75	25-50	<25
Gravel content	%vol.	<15	15-35	35-60	>60
Salinity (ECe)	dSm^{-1}	<1.0	1.0-2.0	2.0-4.0	
Sodicity (ESP)	%	<10	10-15	15-25	>25

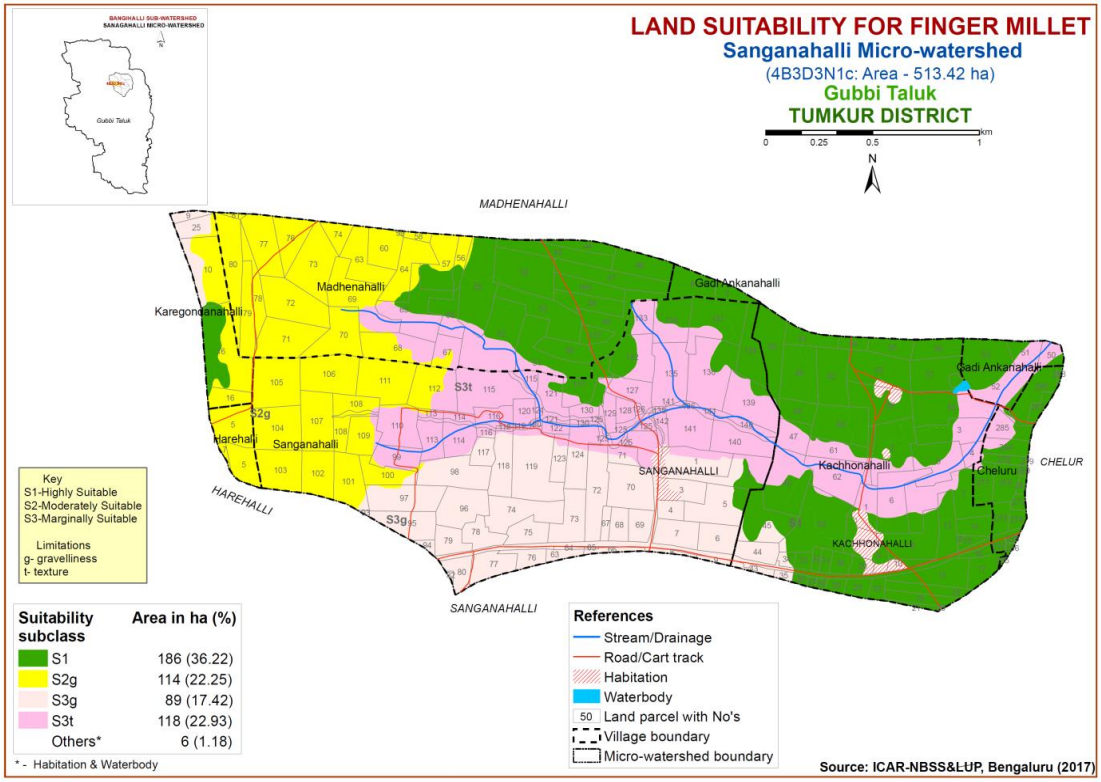


Fig. 7.5 Land Suitability map of Finger millet

7.6 Land Suitability criteria for Red gram (*Cajanus Cajan)*

Red gram is one of the most important pulse crop grown in an area of 7.28 lakh ha in almost all the districts of the State. The crop requirements for growing Red gram (Table 7.7) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing red gram was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.6.

Table 7.7 Land suitability criteria for Red gram

Crop requirement		Rating			
Soil –site characteristics	**Unit**	**Highly suitable(S1)**	**Moderately Suitable(S2)**	**Marginally suitable(S3)**	**Not suitable (N)**
Slope	%	<3	3-5	5-10	>10
LGP	Days	>210	180-210	150-180	<150
Soil drainage	Class	Well drained	Mod. well drained	Imperfectly drained	Poorly drained
Soil reaction	pH	6.5-7.5	5.0-6.5,7.6-8.0	8.0-9.0	>9.0
Sub Surface soil texture	Class	l, scl, sil, cl, sl	sicl, sic, c(m)	ls	
Soil depth	cm	>100	75-100	50-75	<50
Gravel content	% vol.	<15	15-35	3-60	>60
Salinity (EC)	dS m^{-1}	<1.0	1.0-2.0	>2.0	
Sodicity (ESP)	%	<10	10-15	>15	

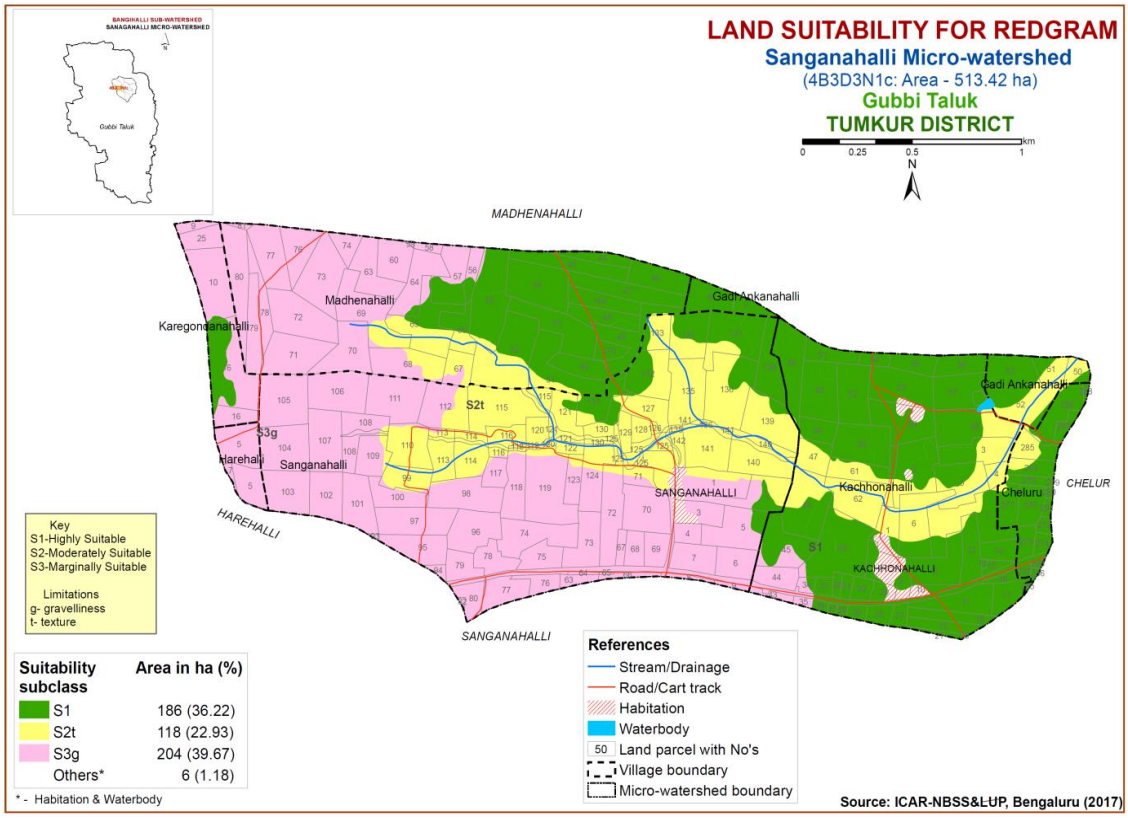


Fig. 7.6 Land Suitability map of Redgram

An area of about 186 ha (36%) is highly suitable (Class S1) for growing Red gram and are distributed in the northern, northeastern and eastern part the microwatershed. An area of about 118 ha (23%) is moderately suitable (Class S2) for growing Red gram and are distributed in the central and northeastern part the microwatershed. They have minor limitation of texture. Marginally suitable lands (Class S3) for growing Red gram occupy major area of about 204 ha (40%) and occur in the western, northwestern and southern part of the microwatershed. They have moderate limitation of gravelliness.

7.7 Land Suitability for Horse gram (*Macrotyloma uniflorum*)

Horse gram is one of the most important pulse crop grown in an area of 1.8 lakh ha in almost all the districts of the State. The crop requirements for growing horse gram were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing horse gram (Table 7.8) was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.7.

Table 7.8 Land suitability criteria for Horse gram

Crop requirement		Rating			
Soil –site characteristics	**Unit**	**Highly Suitable(S1)**	**Moderately Suitable(S2)**	**Marginally Suitable (S3)**	**Not suitable(N)**
Slope	%	<3	3-5	5-10	>10
LGP	Days				
Soil drainage	Class	Welldrained/mod. well drained	imperfectly drained	Poorly drained	Very Poorly drained
Soil reaction	pH	6.0-8.5	8.5-9.0,5.5-5.9	9.1-9.5,5.0-5.4	>9.5
Surface soil texture	Class	l, sl, scl, cl, sc	ls, sic, sicl, c, ls	Heavy clays (>60%)	-
Soil depth	cm	50-75	25-50	<25	-
$CaCO_3$ in root zone	%vol.	<15	15-25	25-30	>30
Salinity (ECe)	dSm^{-1}	<1.0	1.0-2.0	>2.0	
Sodicity (ESP)	%	<10	10-15	>15	-

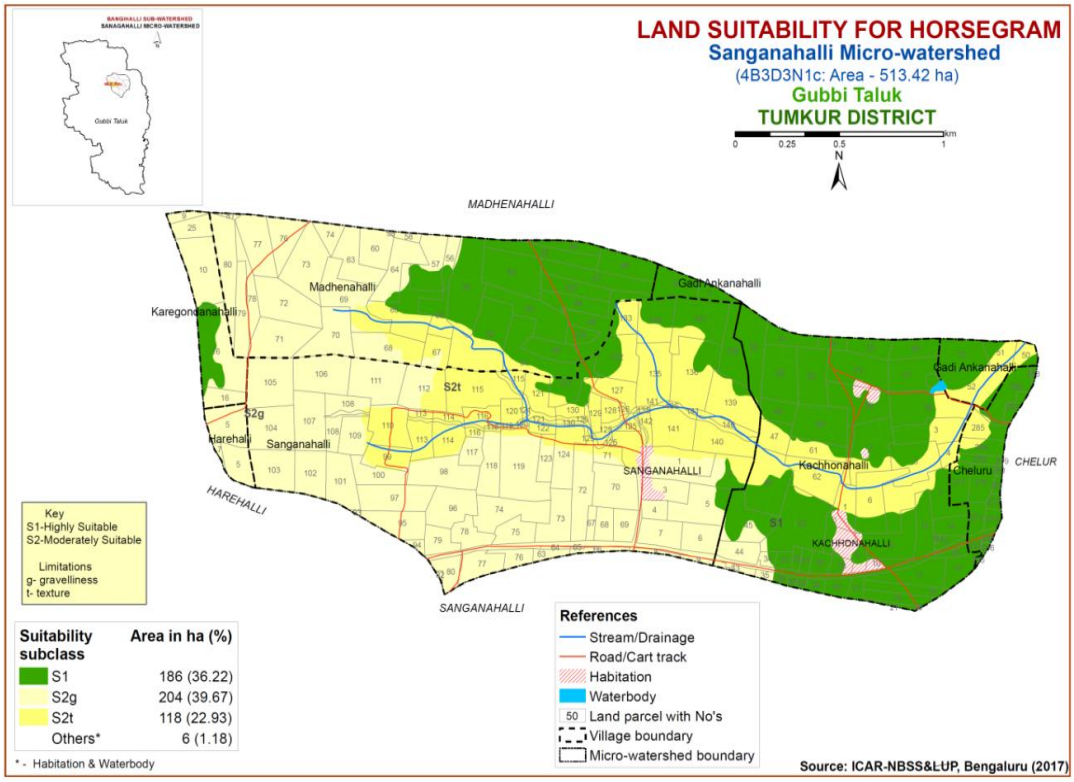


Fig. 7.7 Land Suitability map of Horse gram

An area of about 186 ha (36%) is highly suitable (Class S1) for growing horse gram and are distributed in the northern, northeastern and eastern part the microwatershed. Major area of about 322 ha (63%) is moderately suitable (Class S2) for growing horse gram and are distributed in the central and northeastern part the microwatershed. They have minor limitations of gravelliness and texture.

7.8 Land Suitability for Field Bean (*Dolichos lablab*)

Field Bean is one of the most important pulse crop grown in an area of 0.59 lakh ha in almost all the districts of the State. The crop requirements (Table 7.9) for growing field bean were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing field bean was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Fig. 7.8.

Table 7.9 Land suitability criteria for Field Bean

Crop requirement		Rating			
Soil –site characteristics	**Unit**	**Highly Suitable(S1)**	**Moderately Suitable(S2)**	**Marginally Suitable(S3)**	**Not Suitable(N)**
Slope	%	<3	3-5	5-10	>10
LGP	Days	>120	90-120	70-90	<70
Soil drainage	Class	Well drained/ mod.welldrained	imperfectly drained	Poorly drained	Very Poorly drained
Soil reaction	pH	6.0-8.5	8.5-9.0,5.5-5.9	9.1-9.5,5.0-5.4	>9.5
Sub Surface soil texture	Class	l, sl, scl, cl, sc	sic, sicl, c	Heavy clays (>60%), ls	s
Soil depth	cm	>75	50-75	25-50	<25
$CaCO_3$ in root zone	%vol.	<15	15-35	35-50	>50
Salinity (EC)	dSm^{-1}	<1.0	1.0-2.0	>2.0	
Sodicity (ESP)	%	<10	10-15	15-20	>20

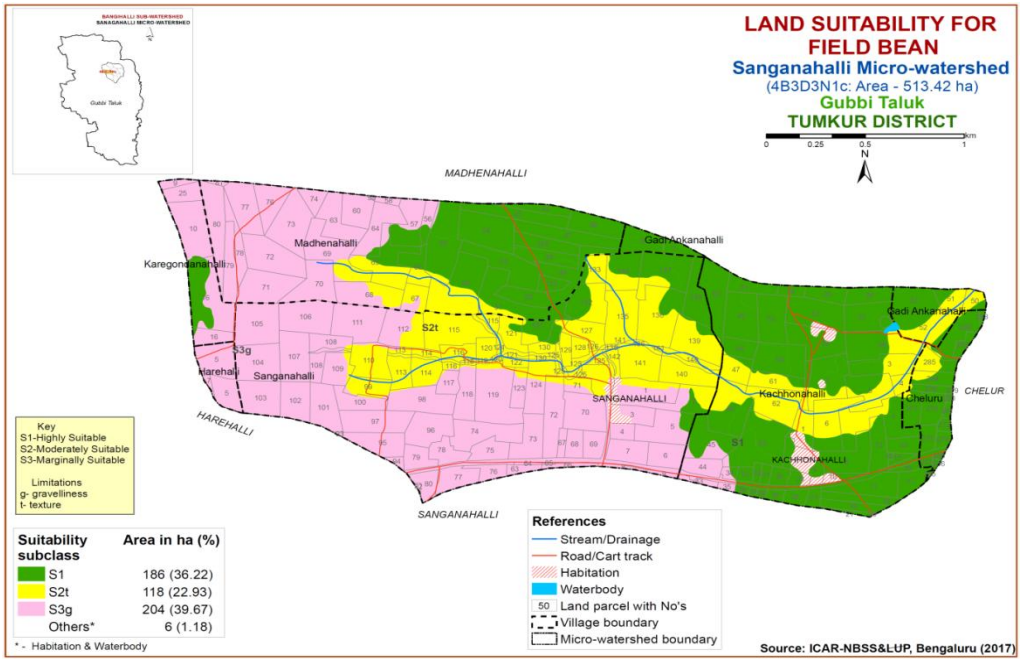


Fig. 7.8 Land Suitability map of Field bean

An area of about 186 ha (36%) is highly suitable (Class S1) for growing field bean and are distributed in the northern, northeastern and eastern part the microwatershed. An area of about 118 ha (23%) is moderately suitable (Class S2) for growing field bean and are distributed in the central and northeastern part the microwatershed. They have minor limitation of texture. Marginally suitable lands (Class S3) for growing field bean occupy major area of about 204 ha (40%) and occur in the western, northwestern and southern part of the microwatershed. They have moderate limitation of gravelliness.

7. 9 Land Suitability for Cowpea (*Vigna radiata*)

Cowpea is one of the most important pulse crop grown in an area of 0.80 lakh ha in almost all the districts of the State. The crop requirements for growing cowpea were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing cowpea was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Fig. 7.9.

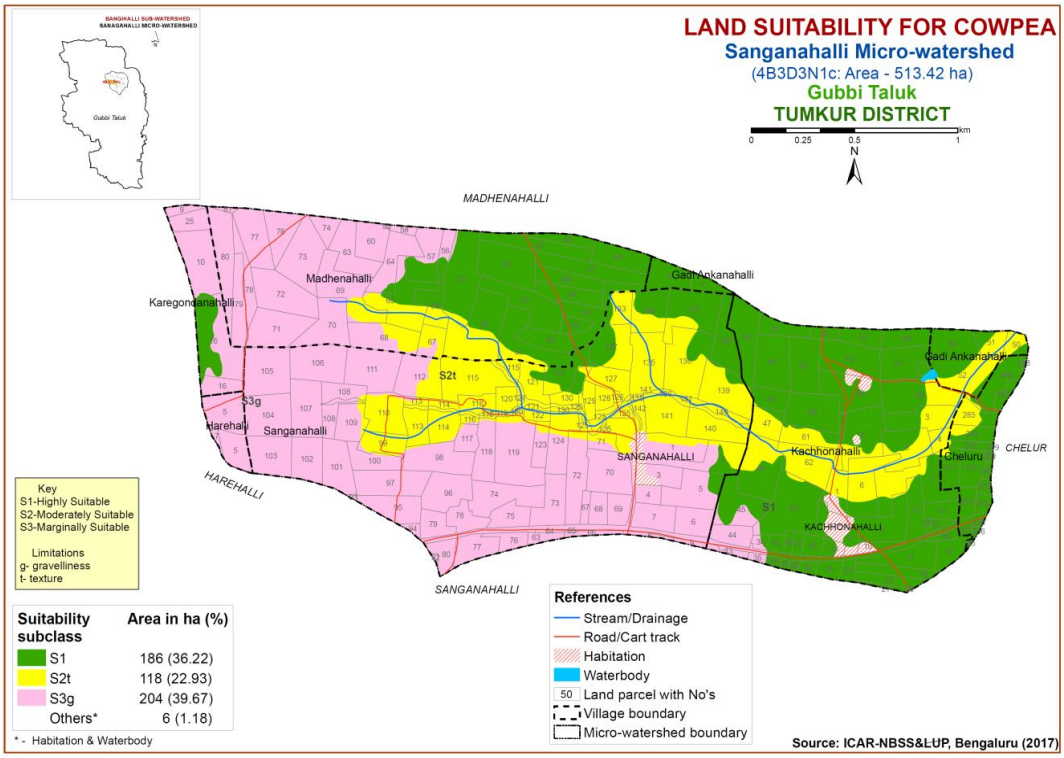


Fig. 7.9 Land Suitability map of Cowpea

An area of about 186 ha (36%) is highly suitable (Class S1) for growing cowpea and are distributed in the northern, northeastern and eastern part the microwatershed. An area of about 118 ha (23%) is moderately suitable (Class S2) for growing cowpea and are distributed in the central and northeastern part the microwatershed. They have minor limitation of texture. Marginally suitable lands (Class S3) for growing cowpea occupy major area of about 204 ha (40%) and occur in the western, northwestern and southern part of the microwatershed. They have moderate limitation of gravelliness.

7.10 Land Suitability for Groundnut (*Arachis hypogaea*)

Groundnut is one of the major oilseed crop grown in an area of 6.54 lakh ha in Karnataka in most of the districts either as rainfed or irrigated crop. The crop requirements for growing groundnut (Table 7.10) were matched with the soil-site characteristics (Table 7.1) of the soils of the microwatershed and a land suitability map for growing groundnut was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.10.

Table 7.10 Crop suitability criteria for Groundnut

Crop requirement		Rating			
Soil–site characteristics	**unit**	**Highly suitable(S1)**	**Moderately suitable(S2)**	**Marginally suitable(S3)**	**Not suitable (N)**
Slope	%	<3	3-5	5-10	>10
LGP	Days	100-125	90-105	75-90	
Soil drainage	Class	Well drained	Mod. Well drained	Imperfectly drained	Poorly drained
Soil reaction	pH	6.0-8.0	8.1-8.5,5.5-5.9	>8.5, <5.5	
Surface soil texture	Class	l, cl, sil, sc, sicl	sc, sic, c,	s, ls, sl c (>60%)	s, fragmental
Soil depth	cm	>75	50-75	25-50	<25
Gravel content	%vol.	<35	35-50	>50	
$CaCO_3$ in root zone	%	high	Medium	low	
Salinity (EC)	dSm^{-1}	<2.0	2.0-4.0	4.0-8.0	
Sodicity (ESP)	%	<5	5-10	>10	

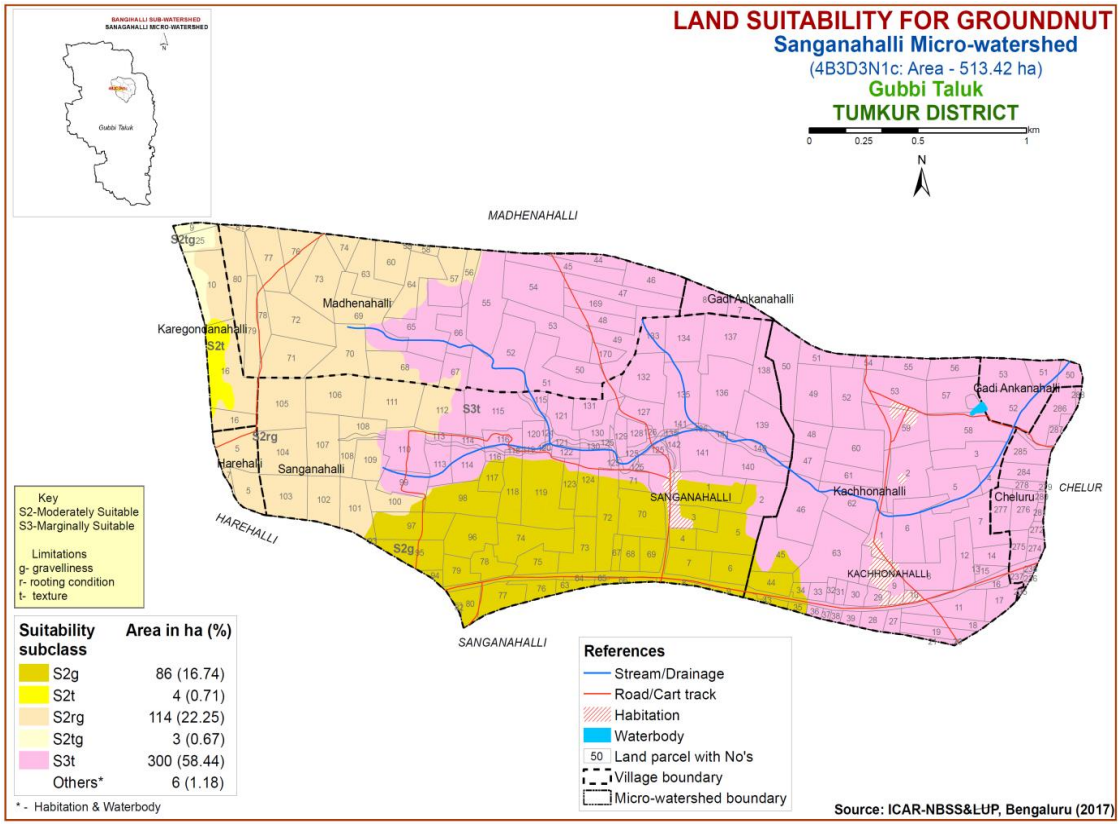


Fig. 7.10 Land Suitability map of Groundnut

An area of about 207 ha (40%) is moderately suitable (Class S2) for growing groundnut and are distributed in the western and southern part of the microwatershed. They have minor limitations of gravelliness, texture and rooting depth. Marginally suitable lands (Class S3) for growing groundnut occupy major area of about 300 ha (58%) and occur in the major part of the microwatershed. They have moderate limitation of texture.

7.11 Land Suitability for Sunflower (*Helianthus annus*)

Sunflower is one of the most important oilseed crop grown in an area of 3.56 lakh ha in the State in all the districts. The crop requirements for growing sunflower (Table 7.11) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing sunflower was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.11.

Highly suitable (Class S1) lands for growing sunflower occupy an area of about 186 ha (36%) and are distributed in the northern, northeastern and eastern part the microwatershed. An area of about 118 ha (23%) is moderately suitable (Class S2) for growing sunflower and are distributed in the central and northeastern part the microwatershed. They have minor limitation of texture. Marginally suitable lands (Class S3) for growing sunflower occupy major area of about 203 ha (40%) and occur in the western, northwestern and southern part of the microwatershed. They have moderate limitations of gravelliness and rooting depth.

Table 7.11 Crop suitability criteria for Sunflower

Crop requirement		Rating			
Soil–site characteristics	**unit**	**Highly suitable(S1)**	**Moderately suitable(S2)**	**Marginally suitable (S3)**	**Not suitable (N)**
Slope	%	<3	3-5	5-10	>10
LGP	Days	>90	80-90	70-80	<70
Soil drainage	Class	Well drained	Mod. well rained	Imperfectly drained	Poorly drained
Soil reaction	pH	6.5-8.0	8.1-8.55.5-6.4	8.6-9.0;4.5-5.4	>9.0<4.5
Surface soil texture	Class	l, cl, sil, sc	scl, sic, c,	c (>60%), sl	ls, s
Soil depth	cm	>100	75-100	50-75	<50
Gravel content	%vol.	<15	15-35	35-60	>60
Salinity (EC)	dSm^{-1}	<1.0	1.0-2.0	>2.0	
Sodicity (ESP)	%	<10	10-15	>15	

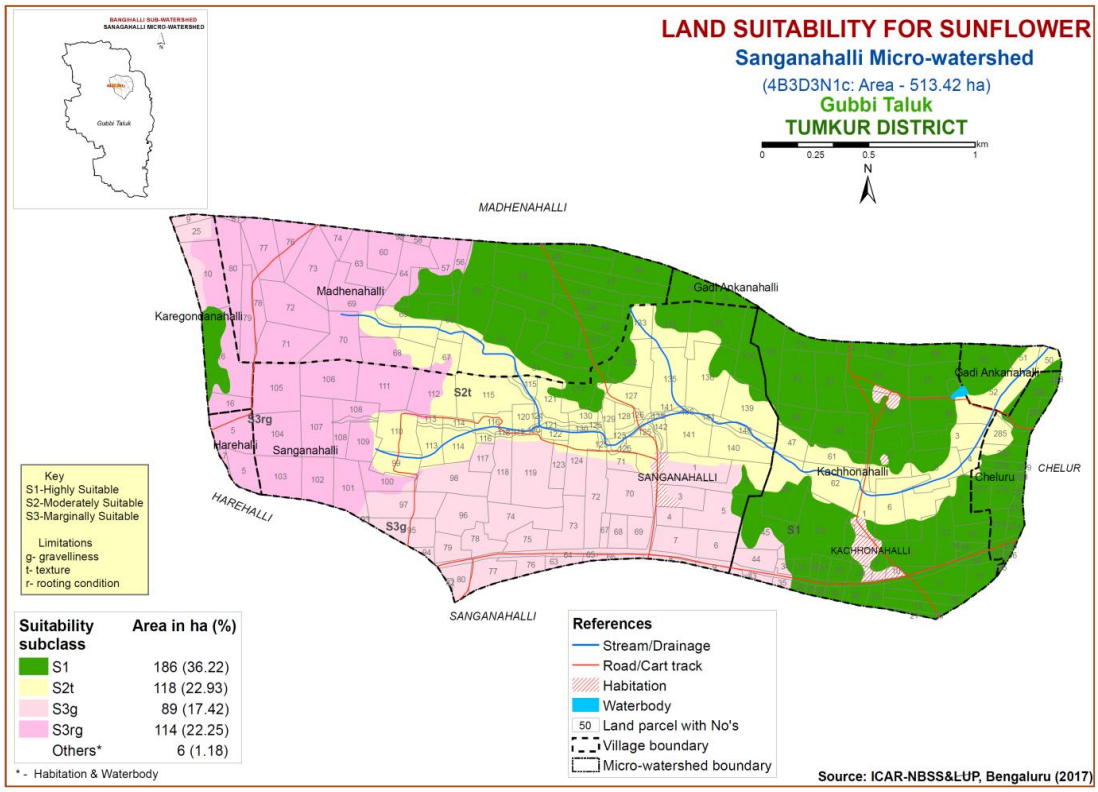


Fig. 7.11 Land Suitability map of Sunflower

7.12 Land Suitability for Onion (*Allium cepa*)

Onion is one of the most important vegetable crop grown in Raichur, Dharwad, Belgaum, Gulbarga, Bijapur, Bidar, Bellary, Chitradurga and Tumakuru districts. The crop requirements for growing onion (Table 7.12) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing onion was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.12.

An area of about 186 ha (36%) is highly suitable (Class S1) for growing onion and are distributed in the northern, northeastern and eastern part the microwatershed. An area of about 118 ha (23%) is moderately suitable (Class S2) for growing onion and are distributed in the central and northeastern part the microwatershed. They have minor limitation of texture. Marginally suitable lands (Class S3) for growing onion occupy major area of about 204 ha (40%) and occur in the western, northwestern and southern part of the microwatershed. They have moderate limitation of gravelliness.

Table 7.12 Land suitability criteria for Onion

Crop requirement		Rating			
Soil–site characteristics	**unit**	**Highly suitable(S1)**	**Moderately suitable(S2)**	**Marginally suitable(S3)**	**Not suitable (N)**
Mean temperature in growing season	^{0}c	20-30	30-35	35-40	>40
Slope	%	<3	3-5	5-10	>10
Soil drainage	Class	Well drained	Moderately /imperfectly	Poor drained	Very poorly drained
Soil reaction	pH	6.5-7.3	7.3-7.8,5.0-5.4	7.8-8.4,<5.0	>8.4
Surface soil texture	Class	scl, sil, sl	sc, sicl,c (red soil)	sc, c (black soil)	ls
Soil depth	cm	>75	50-75	25-50	<25
Gravel content	%vol.	<15	15-35	35-60	60-80
Salinity (ECe)	dSm^{-1}	<1.0	1.0-2.0	2.0-4.0	<4
Sodicity (ESP)	%	<5	5-10	10-15	>15

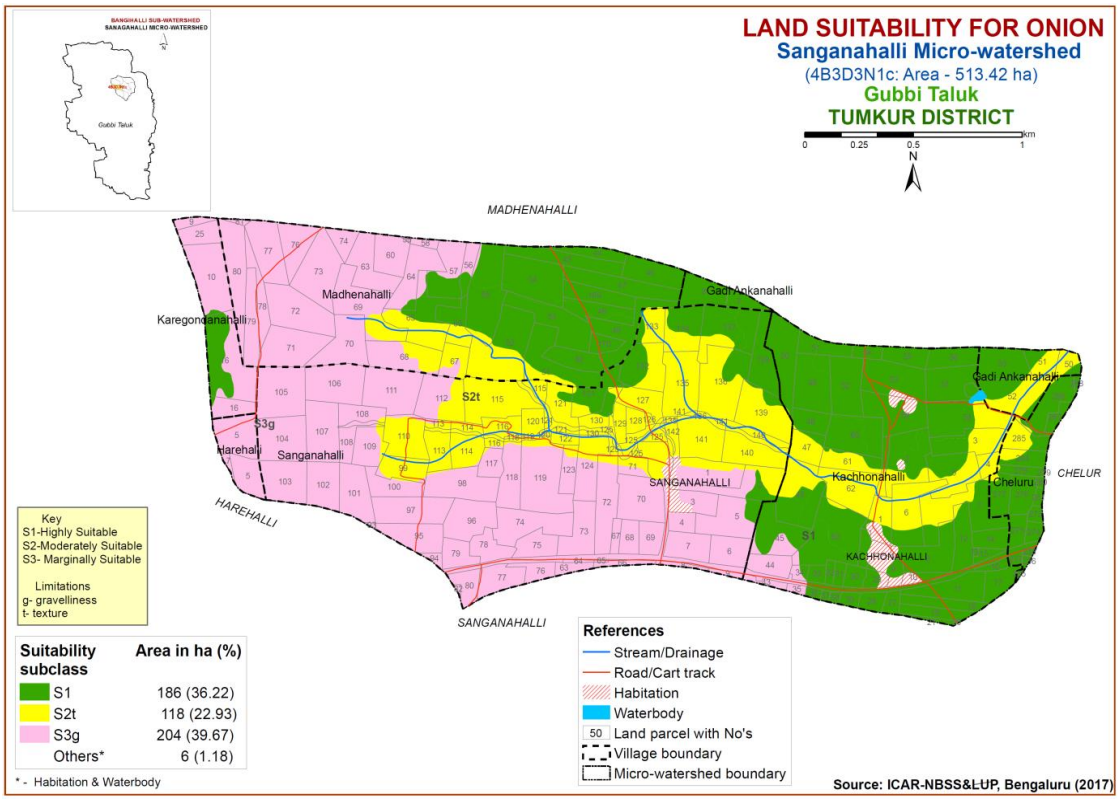


Fig. 7.12 Land Suitability map of Onion

7.13 Land Suitability for Chilli (*Capscicum annuum L.*)

Chilli is one of the most important commercial spice crop grown in an area of 0.42 lakh ha in the State in all the districts. The crop requirements for growing Chilli (Table 7.13) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing Chilli was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.13.

Highly suitable (Class S1) lands for growing Chilli occupy an area of about 186 ha (36%) and are distributed in the northern, northeastern and eastern part the microwatershed. An area of about 118 ha (23%) is moderately suitable (Class S2) for growing Chilli and are distributed in the central and northeastern part the microwatershed. They have minor limitation of texture. Marginally suitable lands (Class S3) for growing Chilli occupy major area of about 204 ha (40%) and occur in the western, northwestern and southern part of the microwatershed. They have moderate limitation of gravelliness.

Table 7.13 Land suitability criteria for chilli

Crop requirement		Rating			
Soil–site characteristics	**unit**	**Highly suitable(S1)**	**Moderately Suitable(S2)**	**Marginally suitable (S3)**	**Not suitable(N)**
Slope	%	<3	3-5	5-10	
LGP	Days	>150	120-150	90-120	<90
Soil drainage	class	Well drained	Mod. to imperfectly drained	Poor drained/excessively	Very poorly drained
Soil reaction	pH	6.0-7.0	7.1-8.0	8.1-9.0,5.0-5.9	>9.0
Surface soil texture	Class	l, scl, cl, sil	sl, sc, sic,c(m/k)	c(ss), ls, s	
Soil depth	cm	>75	50-75	25-50	<25
Gravel content	% vol.	<15	15-35	>35	
Salinity (ECe)	dsm^{-1}	<1.0	1.0-2.0	2.0-4.0	<4
Sodicity (ESP)	%	<5	5-10	10-15	

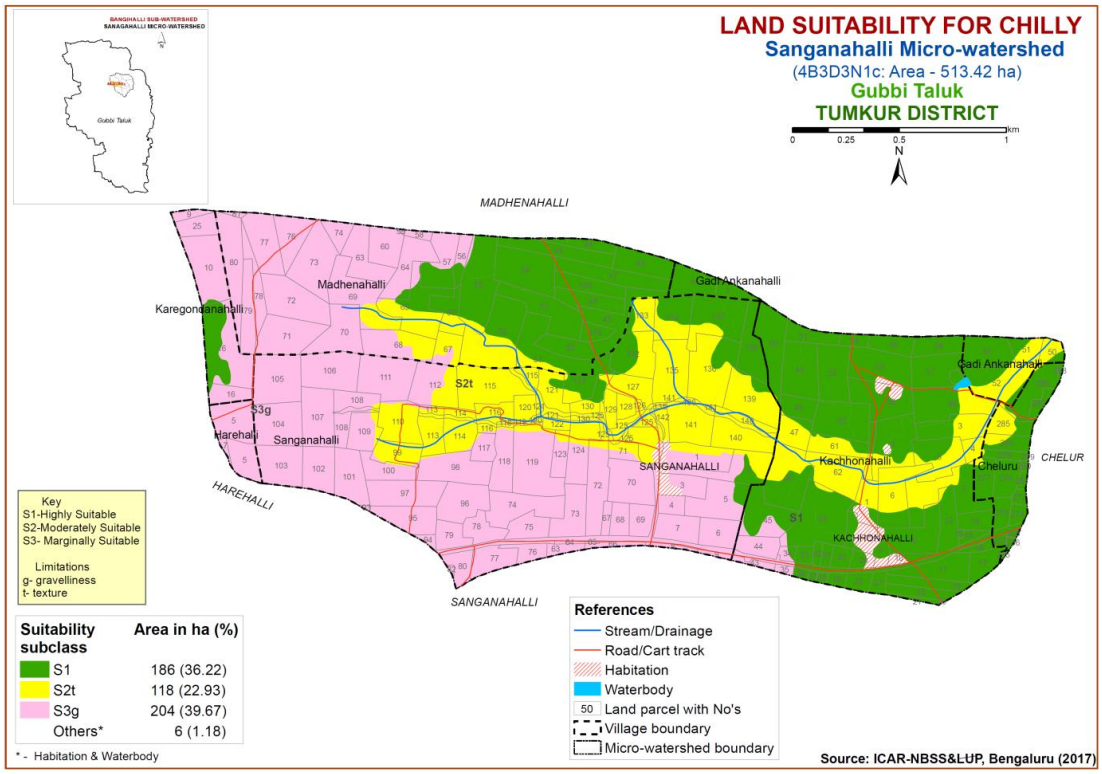


Fig. 7.13 Land Suitability map of Chilli

7.14 Land Suitability for Brinjal (*Solanum melongena*)

Brinjal is the most important vegetable crop grown in all the districts. The crop requirements for growing Brinjal (Table 7.14) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing Brinjal was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.14.

An area of about 186 ha (36%) is highly suitable (Class S1) for growing Brinjal and are distributed in the northern, northeastern and eastern part the microwatershed. An area of about 118 ha (23%) is moderately suitable (Class S2) for growing Brinjal and are distributed in the central and northeastern part the microwatershed. They have minor limitation of texture. Marginally suitable lands (Class S3) for growing Brinjal occupy major area of about 204 ha (40%) and occur in the western, northwestern and southern part of the microwatershed. They have moderate limitation of gravelliness.

Table 7.14 Land suitability criteria for Brinjal

Crop requirement			Rating			
Soil–site characteristics		Unit	Highly suitable(S1)	Moderately suitable(S2)	Marginally suitable(S3)	Not suitable(N)
Soil aeration	Soil drainage	Class	Well drained	Moderately well drained	Poorly drained	V. Poorly drained
Nutrient availability	Texture	Class	sl, scl, cl, sc	c (red)	ls, c (black)	-
	pH	1:2.5	6.0-7.3	7.3-8.4,5.5-6.0	8.4-9.0	>9.0
Rooting conditions	Soil depth	cm	>75	50-75	25-50	<25
	Gravel content	%vol.	<15	15-35	35-60	>60
Erosion	Slope	%	0-3	3-5	5-10	>10

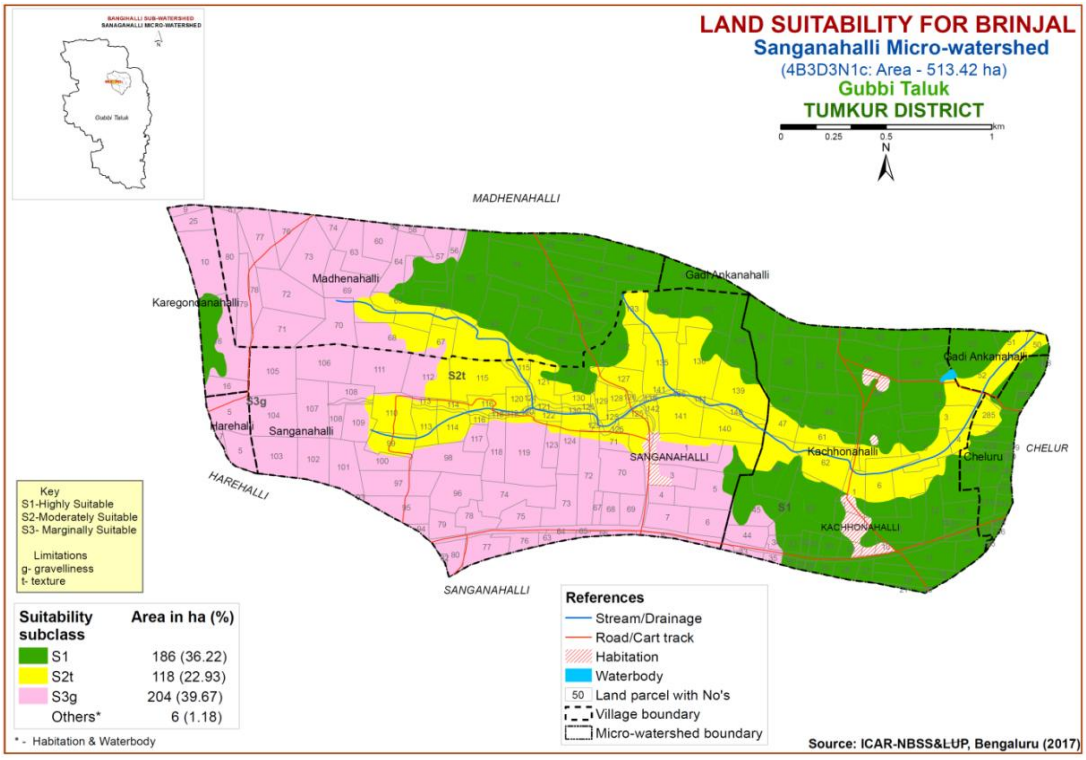


Fig. 7.15 Land Suitability map of Brinjal

7.15 Land Suitability for Tomato (*Lycopersicon esculentum*)

Tomato is one of the most important vegetable crop grown in an area of 0.65 lakh ha in almost all the districts of the State. The crop requirements for growing Tomato (Table 7.15) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing Tomato was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.15.

Table 7.15 Land suitability criteria for Tomato

Crop requirement			**Rating**			
Soil–site characteristics		**unit**	**Highly suitable(S1)**	**Moderately Suitable(S2)**	**Marginally suitable(S3)**	**Not suitable(N)**
climate	Temperature in growing season	^{0}c	25-28	29-32 20-24	15-19 33-36	<15 >36
Soil moisture	Growing period	Days	>150	120-150	90-120	
Soil aeration	Soil drainage	class	Well drained	Moderately well drained	Poorly drained	V. poorly drained
Nutrient availability	Texture	Class	l, sl, cl, scl	sic, sicl, sc, c(m/k)	c (ss), ls	s
	pH	1:2.5	6.0-7.3	5.5-6.0,7.3-8.4	8.4-9.0	>9.0
	$CaCO_3$ in root zone	%	Non calcareous	Slightly calcareous	Strongly calcareous	
Rooting conditions	Soil depth	cm	>75	50-75	25-50	<25
	Gravel content	%vol.	<15	15-35	>35	
Soil toxicity	Salinity	ds/m	Non saline	slight	strongly	
	Sodicity(ESP)	%	<10	10-15	>15	-
Erosion	Slope	%	1-3	3-5	5-10	>10

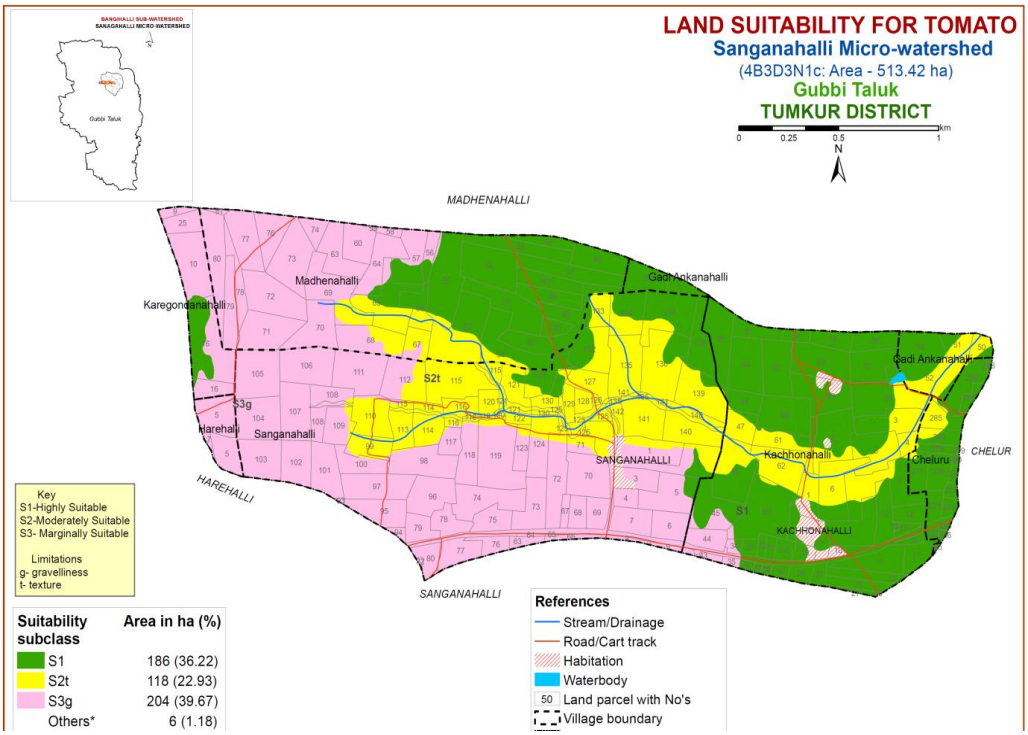


Fig. 7.15 Land Suitability map of Tomato

An area of about 186 ha (36%) is highly suitable (Class S1) for growing Tomato and are distributed in the northern, northeastern and eastern part the microwatershed. An area of about 118 ha (23%) is moderately suitable (Class S2) for growing Tomato and are distributed in the central and northeastern part the microwatershed. They have minor limitation of texture. Marginally suitable lands (Class S3) for growing Tomato occupy major area of about 204 ha (40%) and occur in the western, northwestern and southern part of the microwatershed. They have moderate limitation of gravelliness.

7.16 Land Suitability for Mango (*Mangifera indica*)

Mango is one of the most important fruit crop grown in about 1.73 lakh ha area in almost all the districts of the State. The crop requirements (Table 7.16) for growing mango were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing mango was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed is given in Figure 7.16.

An area of about 186 ha (36%) is highly suitable (Class S1) for growing mango and are distributed in the northern, northeastern and eastern part the microwatershed. Major area of about 321 ha (63%) is marginally suitable (Class S3) for growing mango and are distributed in the major part of the microwatershed. They have moderate limitations of gravelliness, rooting depth and texture.

Table 7.16 Crop suitability criteria for Mango

Crop requirement		Rating			
Soil-site characteristics	**Unit**	**Highly suitable(S1)**	**Moderately Suitable(S2)**	**Marginally suitable(S3)**	**Not suitable(N)**

Climate	Temp. in growing season	^{0}C	28-32	24-27 33-35	36-40	20-24
	Min. temp. before flowering	^{0}C	10-15	15-22	>22	
Soil moisture	Growing period	Days	>180	150-180	120-150	<120
Soil aeration	Soil drainage	Class	Well drained	Mod. To imperfectly drained	Poor drained	Very poorly drained
	Water table	M	>3	2.50-3.0	2.5-1.5	<1.5
Nutrient availability	Texture	Class	sc, l, sil, cl	sl, sc, sic, l, c	c (<60%)	c (>60%),
	pH	1:2.5	5.5-7.5	7.6-8.5,5.0-5.4	8.6-9.0,4.0-4.9	>9.0<4.0
	OC	%	High	medium	low	
	$CaCO_3$ in root zone	%	Non calcareous	<5	5-10	>10
Rooting conditions	Soil depth	cm	>200	125-200	75-125	<75
	Gravel content	%vol	Non-gravelly	<15	15-35	>35
Soil toxicity	Salinity	dS/m	Non saline	<2.0	2.0-3.0	>3.0
	Sodicity	%	Non sodic	<10	10-15	>15
Erosion	Slope	%	<3	3-5	5-10	

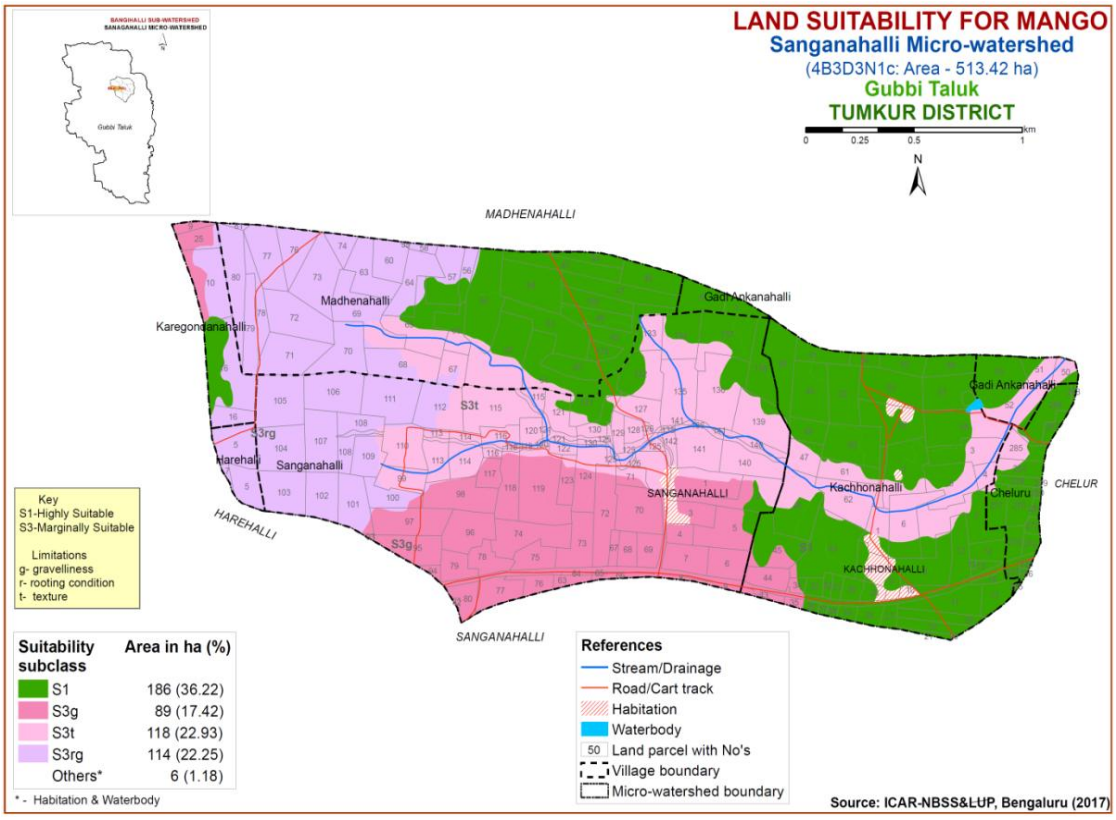


Fig. 7.16 Land Suitability map of Mango

7.17 Land Suitability for Sapota (*Manilkara zapota*)

Sapota is one of the most important fruit crop grown in an area of 29373 ha in almost all the districts of the State. The crop requirements (Table 7.17) for growing sapota were matched with the soil-site characteristics (Table 7.1) and a land suitability

map for growing sapota was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.17.

An area of about 186 ha (36%) is highly suitable (Class S1) for growing sapota and are distributed in the northern, northeastern and eastern part the microwatershed. Major area of about 321 ha (63%) is marginally suitable (Class S3) for growing sapota and are distributed in the major part of the microwatershed. They have minor limitations of gravelliness, rooting depth and texture.

Table 7.17 Crop suitability criteria for Sapota

Crop requirement			**Rating**			
Soil –site characteristics		**Unit**	**Highly suitable(S1)**	**Moderately suitable(S2)**	**Marginally suitable(S3)**	**Not suitable(N)**
Climate	Temperature in growing season	^{0} C	28-32	33-36 24-27	37-42 20-23	>42 <18
Soil moisture	Growing period	Days	>150	120-150	90-120	<120
Soil aeration	Soil drainage	Class	Well drained	Moderately well drained	Imperfectly drained	Poorly drained
Nutrient availability	Texture	Class	scl, l, cl, sil	sl, sicl, sc	c (<60%)	ls, s, c (>60%)
	pH	1:2.5	6.0-7.5	7.6-8.0 5.0-5.9	8.1-9.0 4.5-4.9	>9.0 <4.5
	$CaCO_3$ in root zone	%	Non calcareous	<10	10-15	>15
Rooting conditions	Soil depth	Cm	>150	75-150	50-75	<50
	Gravel content	%vol.	Non gravelly	<15	15-35	<35
Soil toxicity	Salinity	dS/m	Non saline	Up to 1.0	1.0-2.0	2.0-4.0
	Sodicity	%	Non sodic	10-15	15-25	>25
Erosion	Slope	%	<3	3-5	5-10	>10

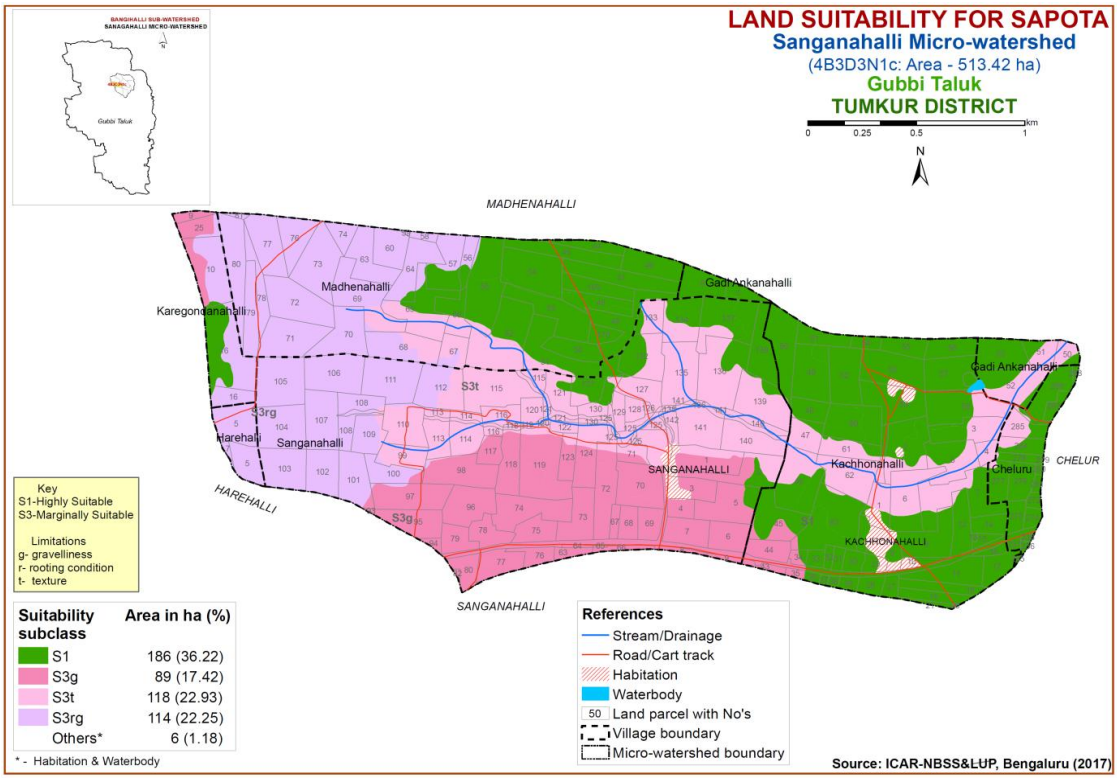


Fig. 7.18 Land Suitability map of Sapota

7.18 Land Suitability for Guava (*Psidium guajava*)

Guava is one of the most important fruit crop grown in an area of 6558 ha in almost all the districts of the State. The crop requirements (Table 7.18) for growing guava were matched with the soil-site characteristics (7.1) and a land suitability map for growing guava was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.18.

Table 7.18 Crop suitability criteria for Guava

Crop requirement			Rating			
Soil –site characteristics		Unit	Highly suitable(S1)	Moderately Suitable (S2)	Marginally suitable(S3)	Not suitable(N)
Climate	Temperature in growing season	^{0}C	28-32	33-36 24-27	37-42 20-23	
Soil moisture	Growing period	Days	>150	120-150	90-120	<90
Soil aeration	Soil drainage	Class	Well drained	Mod. to imperfectly	poor	Very poor
Nutrient availability	Texture	Class	scl,l,cl,sil	sl,sicl,sic.,sc,c	c (<60%)	c (>60%)
	pH	1:2.5	6.0-7.5	7.6-8.0:5.0-5.9	8.1-8.5:4.5-4.9	>8.5:<4.5
	$CaCO_3$ in root zone	%	Non calcareous	<10	10-15	>15
Rooting conditions	Soil depth	cm	>100	75-100	50-75	<50
	Gravel content	%vol.	<15	15-35	>35	
Soil toxicity	Salinity	dS/m	<2.0	2.0-4.0	4.0-6.0	
	Sodicity	%	Non sodic	10-15	15-25	>25

Erosion	Slope	%	<3	3-5	5-10	>10

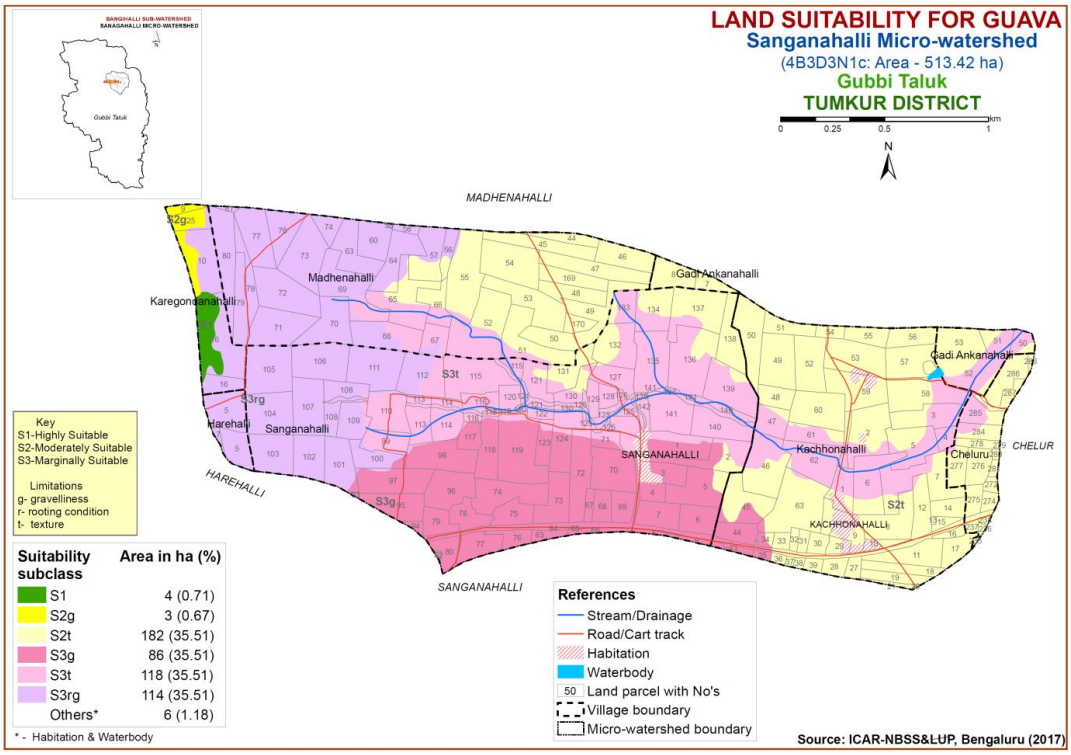


Fig. 7.18 Land Suitability map of Guava

A very small area of about 4 ha (1%) is highly suitable (Class S1) for growing guava and is distributed in the eastern part of the microwatershed. An area of about 185 ha (36%) is moderately suitable (Class S2) and are distributed in the northern, northeastern and eastern part the microwatershed. They have minor limitation texture. Marginally suitable lands (Class S3) for growing guava occupy major area of about 318 ha (63%) and occur in the major part of the microwatershed and have moderate limitations of rooting depth, texture and gravelliness.

7.19 Land Suitability for Pomegranate (*Punica granatum*)

Pomegranate is one of the commercially grown fruit crop in Karnataka in an area of 0.18 lakh ha mainly in Bijapur, Bagalkot, Koppal, Gadag and Chitradurga districts. The crop requirements for growing pomegranate (Table 7.19) were matched with the soil-site characteristics (Table 7.1) of the soils of the microwatershed and a land suitability map for growing pomegranate was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.19.

An area of about 186 ha (36%) is highly suitable (Class S1) for growing pomegranate and are distributed in the northern, northeastern and eastern part of the microwatershed. An area of about 118 ha (23%) is moderately suitable (Class S2) for growing pomegranate and are distributed in the central and northeastern part of the microwatershed. They have minor limitation of texture. Marginally suitable lands (Class

S3) for growing pomegranate occupy major area of about 203 ha (40%) and occur in the western, northwestern and southern part of the microwatershed. They have moderate limitations of gravelliness and rooting depth.

Table 7.19 Crop suitability criteria for Pomegranate

Crop requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable(S1)**	**Moderately Suitable(S2)**	**Marginally suitable(S3)**	**Not suitable(N)**
Climate	Temperature in growing season	^{0}C	30-34	35-38 25-29	39-40 15-24	
Soil moisture	Growing period	Days	>150	120-150	90-120	<90
Soil aeration	Soil drainage	class	Well drained	imperfectly drained		
Nutrient availability	Texture	Class	sl, scl, l, cl	c, sic, sicl	cl, s, ls	s, fragmental
Rooting conditions	pH	1:2.5	5.5-7.5	7.6-8.5	8.6-9.0	
	Soil depth	cm	>100	75-100	50-75	<50
	Gravel content	%vol.	nil	15-35	35-60	>60
Soil toxicity	Salinity	dS/m	Nil	<9	>9	<50
	Sodicity	%	nil			
Erosion	Slope	%	<3	3-5	5-10	

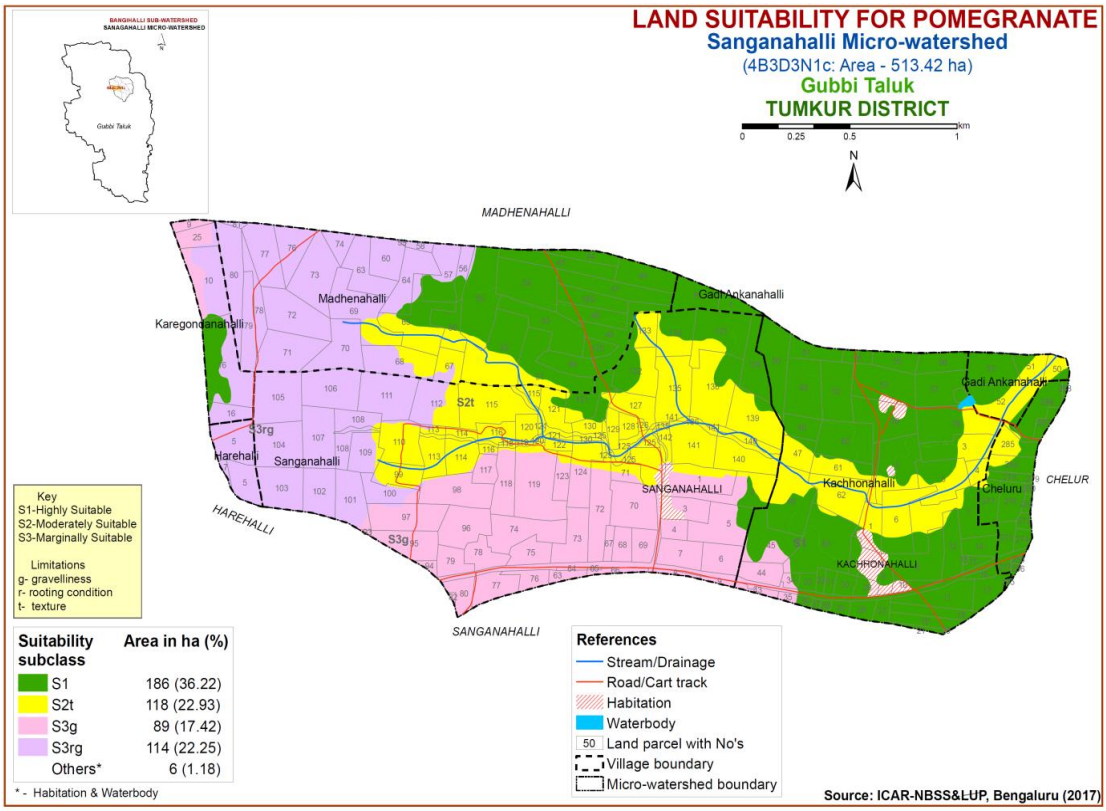


Fig. 7.19 Land Suitability map of Pomegranate

7.20 Land Suitability for Banana (*Musa paradisiaca*)

Banana is one of the major fruit crop grown in an area of 1.02 lakh ha in Karnataka State. The crop requirements for growing banana (Table 7.20) were matched with the soil-site characteristics (Table 7.1) of the soils of the microwatershed and a land suitability map for growing banana was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.20.

Table 7.20 Crop suitability criteria for Banana

Crop requirement			Rating			
Soil –site characteristics		Unit	Highly suitable(S1)	Moderately suitable(S2)	Marginally suitable(S3)	Not suitable(N)
Climate	Temperature in growing season	^{0}C	26-33	34-36 24-25	37-38	>38
Soil aeration	Soil drainage	Class	Well drained	Moderately to imperfectly drained	Poorly drained	Very poorly drained
Nutrient availability	Texture	Class	l,cl, scl,sil	sicl,sc,c(<45%)	c(>45%),sic,sl	ls, s
	pH	1:2.5	6.5-7.0	7.1-8.5,5.5-6.4	>8.5,<5.5	
Rooting conditions	Soil depth	cm	>125	76-125	50-75	<50
	Stoniness	%	<10	10-15	15-35	>35
Soil toxicity	Salinity	dS/m	<1.0	1-2	>2	
	Sodicity	%	<5	5-10	10-15	>15
Erosion	Slope	%	<3	3-5	5-15	>15

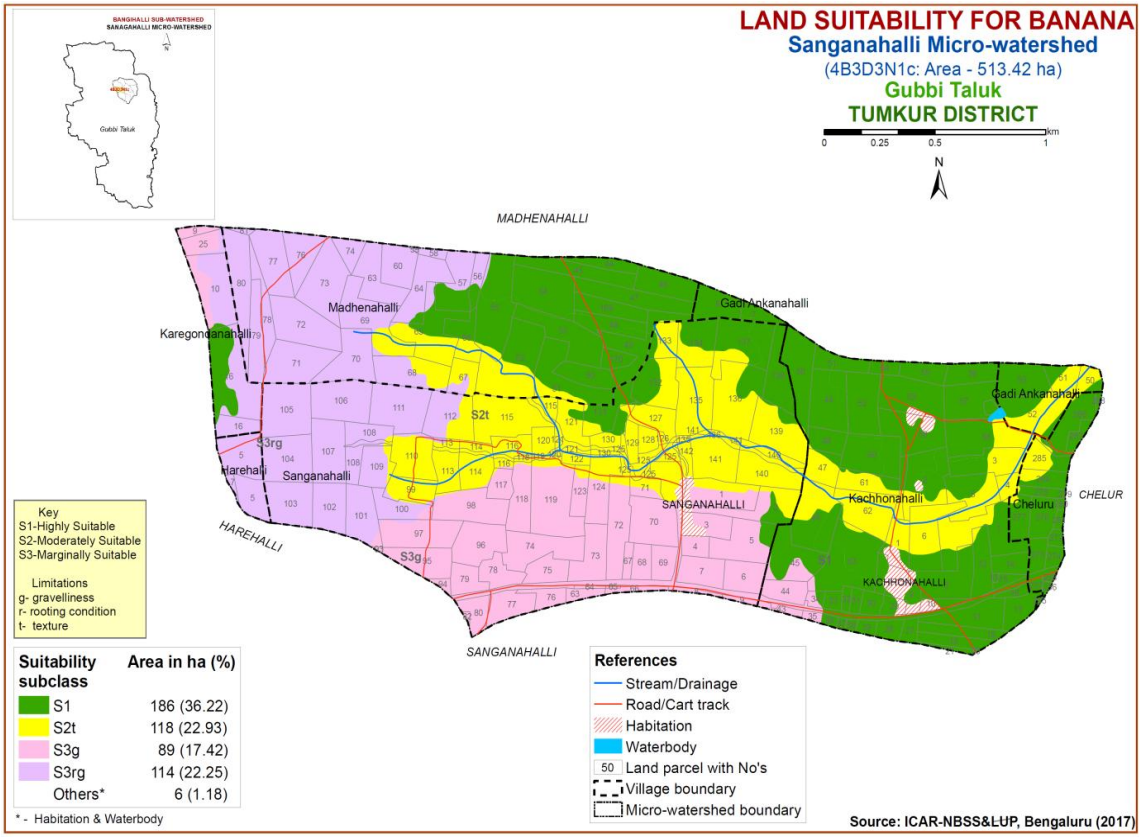


Fig. 7.20 Land Suitability map of Banana

An area of about 186 ha (36%) is highly suitable (Class S1) for growing banana and are distributed in the northern, northeastern and eastern part the microwatershed. An area of about 118 ha (23%) is moderately suitable (Class S2) for growing banana and are distributed in the central and northeastern part the microwatershed. They have minor limitation of texture. Marginally suitable lands (Class S3) for growing banana occupy major area of about 203 ha (40%) and occur in the western, northwestern and southern part of the microwatershed. They have moderate limitation of gravelliness.

7.21 Land Suitability for Jackfruit (*Artocarpus heterophyllus*)

Jackfruit is one of the most important fruit crop grown in 5368 ha in all the districts of the state. The crop requirements for growing jackfruit were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing jackfruit (Table 7.21) was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.21.

An area of about 186 ha (36%) is highly suitable (Class S1) for growing jackfruit and are distributed in the northern, northeastern and eastern part of the microwatershed. Major area of about 321 ha (63%) is marginally suitable lands (Class S3) for growing jackfruit and are distributed in the major part of the microwatershed. They have minor limitations of gravelliness, rooting depth and texture.

Table 7.21 Land suitability criteria for Jackfruit

Crop requirement			**Rating**			
Soil–site characteristics		**Unit**	**Highly suitable(S1)**	**Moderately Suitable(S2)**	**Marginally suitable(S3)**	**Not suitable(N)**
Soil aeration	Soil drainage	class	well	Mod. well	Poorly	V. Poorly
Nutrient availability	Texture	Class	scl, cl, sc, c (red)	-	sl, ls, c (black)	-
	pH	1:2.5	5.5-7.3	5.0-5.5,7.3-7.8	7.8-8.4	>8.4
Rooting conditions	Soil depth	cm	>100	75-100	50-75	<50
	Gravel content	% vol.	<15	15-35	35-60	>60
Erosion	Slope	%	0-3	3-5	>5	-

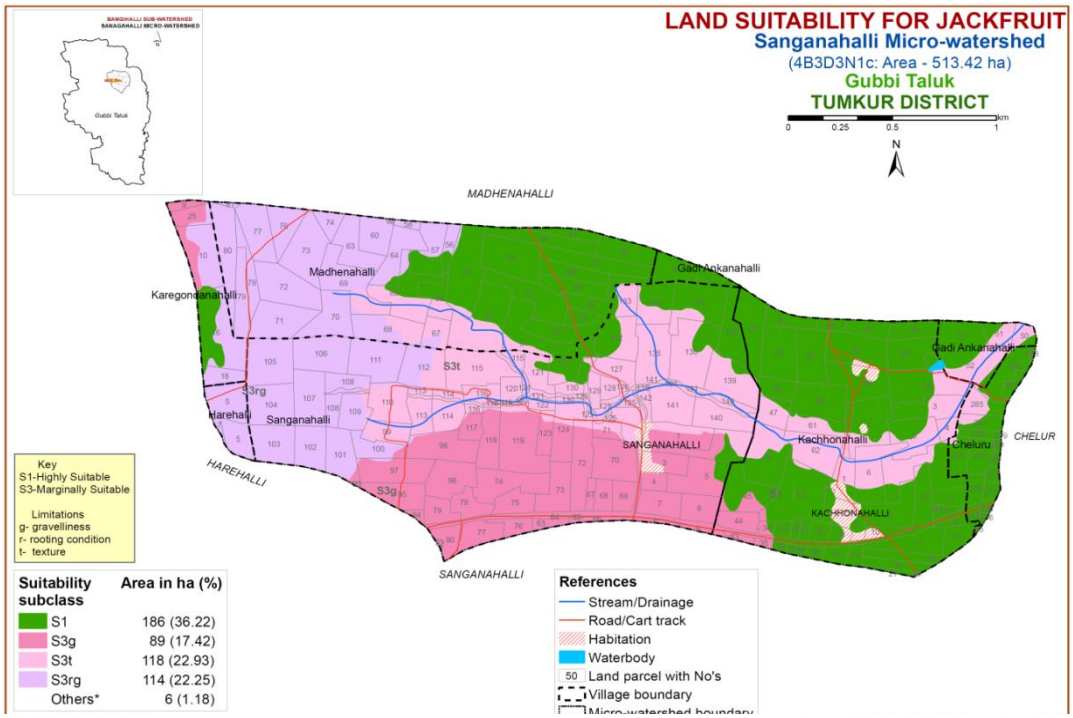


Fig. 7.21 Land Suitability map of Jackfruit

7.22 Land Suitability for Jamun (*Syzygium cumini*)

Jamun is one of an important fruit crop grown in almost all the districts of the State. The crop requirements for growing jamun were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing jamun (Table .22) was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.22.

Highly suitable (Class S1) lands for growing jamun occupy an area of about 186 ha (36%) and are distributed in the northern, northeastern and eastern part the microwatershed. An area of about 118 ha (23%) is moderately suitable (Class S2) for growing jamun and are distributed in the central and northeastern part of the microwatershed. They have minor limitation of texture. Marginally suitable lands (Class S3) for growing jamun occupy major area of about 203 ha (40%) and occur in the western, northwestern and southern part of the microwatershed. They have moderate limitations of gravelliness and rooting depth.

Table 7.22 Land suitability criteria for jamun

Crop requirement			Rating			
Soil–site characteristics		unit	Highly suitable(S1)	Moderately Suitable(S2)	Marginally suitable(S3)	Not suitable(N)
Soil aeration	Soil drainage	Class	Well	Mod. well	Poorly	V.Poorly
Nutrient availability	Texture	Class	scl, cl, sc, c (red)	sl, c (black)	ls	-
	pH	1:2.5	6.0-7.8	5.0-6.0	7.8-8.4	>8.4
Rooting	Soil	cm	>150	100-150	50-100	<50

conditions	depth					
	Gravel content	% vol.	<15	15-35	35-60	>60
Erosion	Slope	%	0-3	3-5	5-10	>10

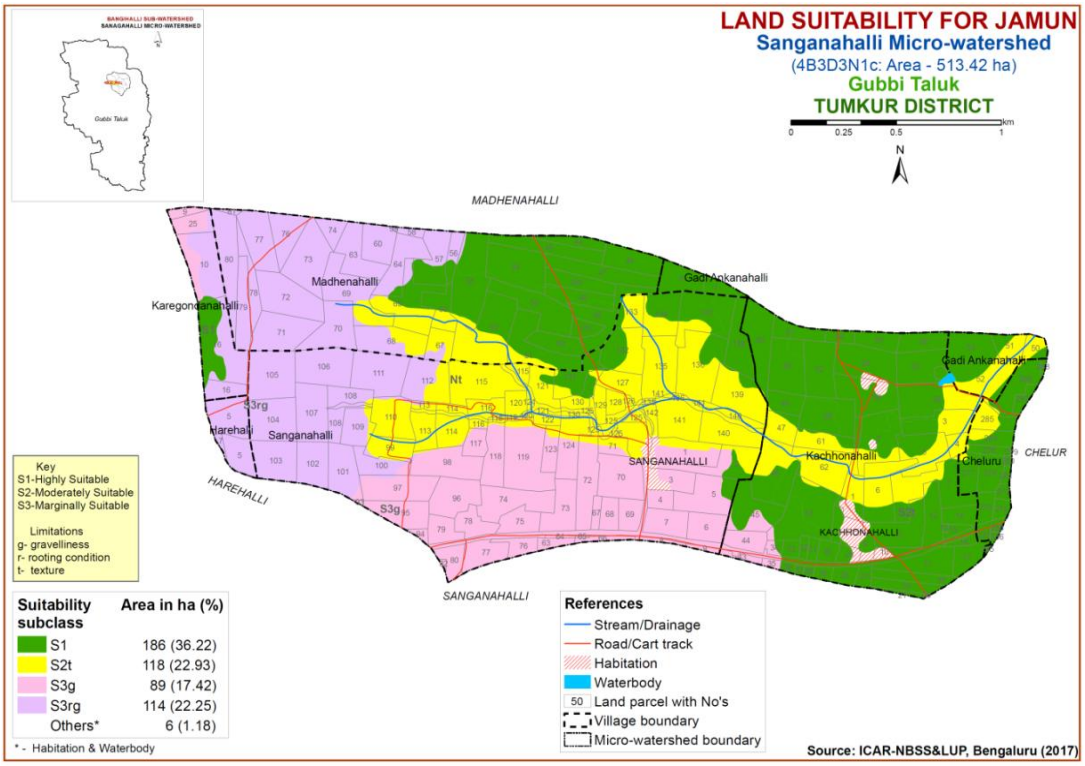


Fig. 7.22 Land Suitability map of Jamun

7.23 Land Suitability for Musambi (*Citrus limetta*)

Musambi is one of the most important fruit crop grown in an area of 5446 ha in almost all the districts of the state. The crop requirements for growing musambi were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing musambi (Table 7.23) was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.23.

An area of about 186 ha (36%) is highly suitable (Class S1) for growing musambi and are distributed in the northern, northeastern and eastern part the microwatershed. An area of about 118 ha (23%) is moderately suitable (Class S2) for growing musambi and are distributed in the central and northeastern part of the microwatershed. They have minor limitation of texture. Marginally suitable lands (Class S3) for growing musambi occupy major area of about 203 ha (40%) and occur in the western, northwestern and southern part of the microwatershed. They have moderate limitations of gravelliness and rooting depth.

Table 7.23 Crop suitability criteria for Musambi

Crop requirement	Rating

Soil –site characteristics		Unit	Highly suitable(S1)	Moderately suitable(S2)	Marginally suitable(S3)	Not suitable(N)
Soil aeration	Soil drainage	Class	Well drained	Mod. to imper.drained	poorly	Very poorly
Nutrient availability	Texture	Class	scl,l,sicl,cl,s	sc, sc, c	c (>70%)	S, ls
	pH	1:2.5	6.0-7.5	5.5-6.4,7.6-8.0	4.0-5.4,8.1-8.5	<4.0,>8.5
Rooting conditions	Soil depth	cm	>150	100-150	50-100	<50
	Gravel content	% vol.	Non gravelly	15-35	35-55	>55
Erosion	Slope	%	<3	3-5	5-10	

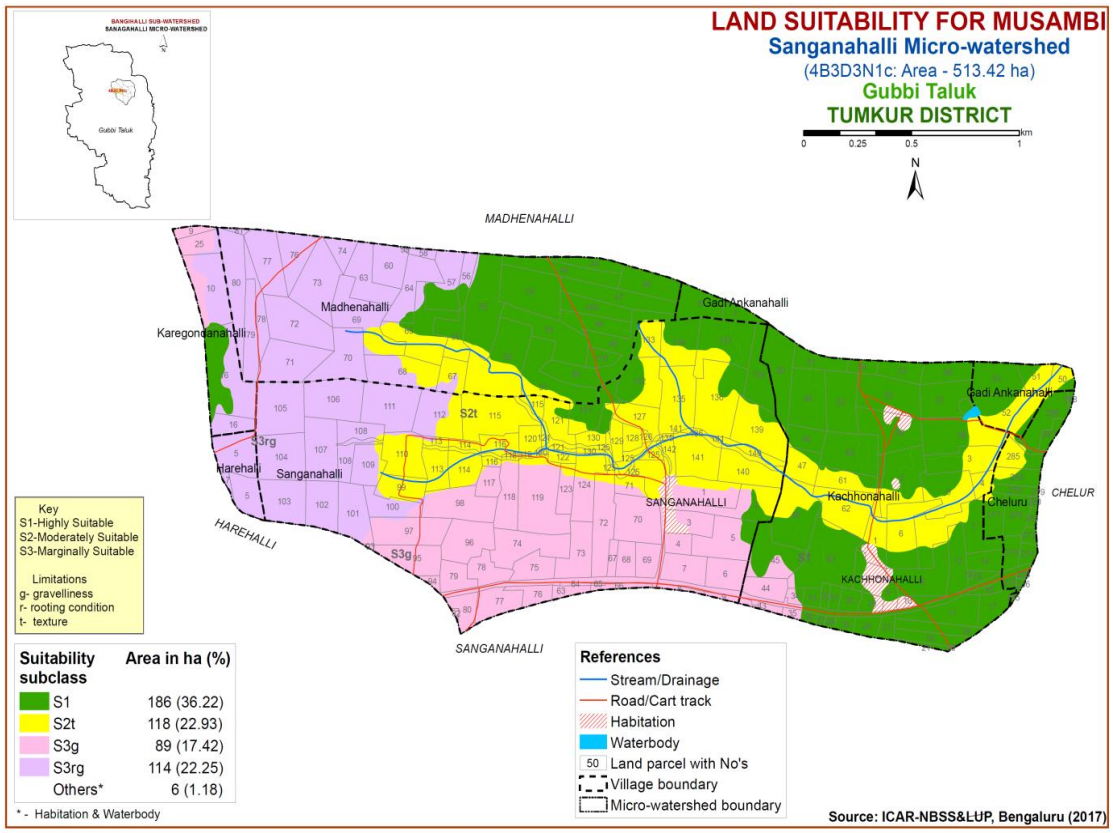


Fig. 7.23 Land Suitability map of Musambi

7.24 Land Suitability for Lime (*Citrus sp*)

Lime is one of the most important fruit crop grown in an area of 11752 ha in almost all the districts of the State. The crop requirements for growing lime (Table 7.24) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing lime was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7. 24.

Highly suitable (Class S1) lands for growing lime occupy an area of about 186 ha (36%) and are distributed in the northern, northeastern and eastern part the microwatershed. An area of about 118 ha (23%) is moderately suitable (Class S2) for growing lime and are distributed in the central and northeastern part the microwatershed. They have minor limitation of texture. Marginally suitable lands (Class S3) for growing

lime occupy major area of about 203 ha (40%) and occur in the western, northwestern and southern part of the microwatershed. They have moderate limitations of gravelliness and rooting depth.

Table 7.24 Crop suitability criteria for Lime

Crop requirement			Rating			
Soil –site characteristics		Unit	Highly suitable(S1)	Moderately Suitable(S2)	Marginally suitable(S3)	Not suitable(N)
Climate	Temperature in growing season	^{0}C	28-30	31-35 24-27	36-40 20-23	>40 <20
Soil moisture	Growing period	Days	240-265	180-240	150-180	<150
Soil aeration	Soil drainage	Class	Well drained	Mod. to imperfectly drained	poorly	Very poorly
Nutrient availability	Texture	Class	scl,l,sicl,cl,s	sc, sc, c	c(>70%)	s, ls
	pH	1:2.5	6.0-7.5	5.5-6.4,7.6-8.0	4.0-5.4,8.1-8.5	<4.0,>8.5
	$CaCO_3$ in root zone	%	Non 34 calcareous	Upto 5	5-10	>10
Rooting conditions	Soil depth	cm	>150	100-150	50-100	<50
	Gravel content	%vol.	Nongravelly	15-35	35-55	>55
Soil toxicity	Salinity	dS/m	Non saline	Upto 1.0	1.0-2.5	>2.5
	Sodicity	%	Non sodic	5-10	10-15	>15
Erosion	Slope	%	<3	3-5	5-10	

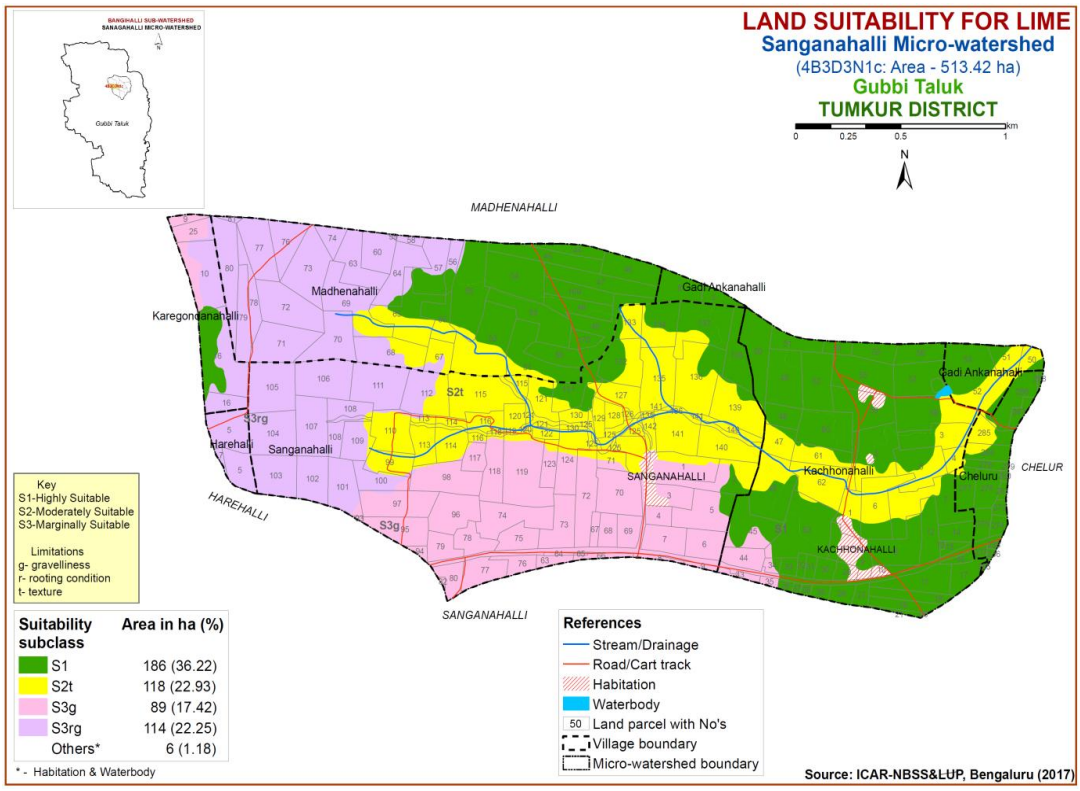


Fig. 7.24 Land Suitability map of Lime

7.25 Land Suitability for Cashew (*Anacardium occidentale)*

Cashew is one of the most important fruit crop grown in an area of 7052 ha in almost all the districts of the State. The crop requirements for growing cashew were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing cashew (Table 7.25) was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.25.

Table 7.25 Land suitability criteria for Cashew

Crop requirement			Rating			
Soil–site characteristics		Unit	Highly suitable(S1)	Moderately Suitable(S2)	Marginally suitable(S3)	Not suitable(N)
Soil aeration	Soil drainage	Class	Well drained	Mod. well drained	Poorly drained	V.Poorly drainage
Nutrient availability	Texture	Class				
	pH	1:2.5	5.5-6.5	5.0-5.5,6.5-7.3	7.3-7.8	>7.8
Rooting conditions	Soil depth	cm	>100	75-100	50-75	<50
	Gravel content	% vol.	<15	15-35	35-60	>60
Erosion	Slope	%	0-3	3-10	>10	

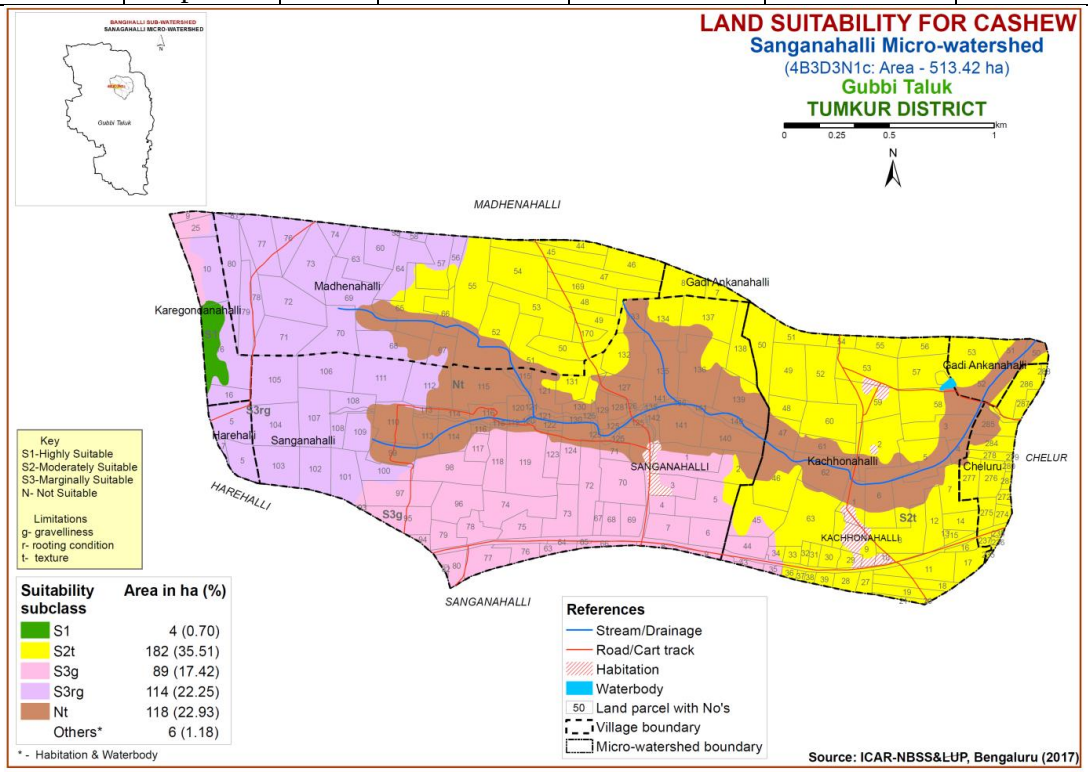


Fig. 7.25 Land Suitability map of Cashew

A very small area of about 4 ha (1%) is highly suitable (Class S1) for growing cashew and is distributed in the eastern part of the microwatershed. An area of about 182 ha (35%) is moderately suitable (Class S2) and are distributed in the northern, northeastern and eastern part of the microwatershed. They have minor limitation texture. Marginally suitable lands (Class S3) for growing cashew occupy major area of about 203

ha (40%) and occur in the major part of the microwatershed and have moderate limitations of rooting depth and gravelliness. An area of about 118 ha (23%) is not suitable (Class N) and occur in the northeastern and central part of the microwatershed and have severe limitation of texture.

7.26 Land Suitability for Custard Apple (*Annona reticulata*)

Custard apple is one of the most important fruit crop grown in almost all the districts of the State. The crop requirements for growing custard apple were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing custard apple (Table 26) was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.26.

An area of about 186 ha (36%) is highly suitable (Class S1) for growing custard apple and are distributed in the northern, northeastern and eastern part the microwatershed. Major area of about 322 ha (63%) is moderately suitable (Class S2) for growing custard apple and are distributed in the major part of the microwatershed. They have minor limitations of gravelliness and texture.

Table 7.26 Land suitability criteria for Custard apple

Crop requirement			**Rating**			
Soil–site characteristics		**Unit**	**Highly suitable(S1)**	**Moderately Suitable(S2)**	**Marginally suitable(S3)**	**Not suitable(N)**
Soil aeration	Soil drainage	Class	Well drained	Mod. well drained	Poorly drained	V. Poorly drained
Nutrient availability	Texture	Class	scl,cl,sc,c(red) c(black)	-	sl, ls	-
	pH	1:2.5	6.0-7.3	7.3-8.4	5.0-5.5,8.4-9.0	>9.0
Rooting conditions	Soil depth	cm	>75	50-75	25-50	<25
	Gravel content	% vol.	<15-35	35-60	60-80	-
Erosion	Slope	%	0-3	3-5	>5	

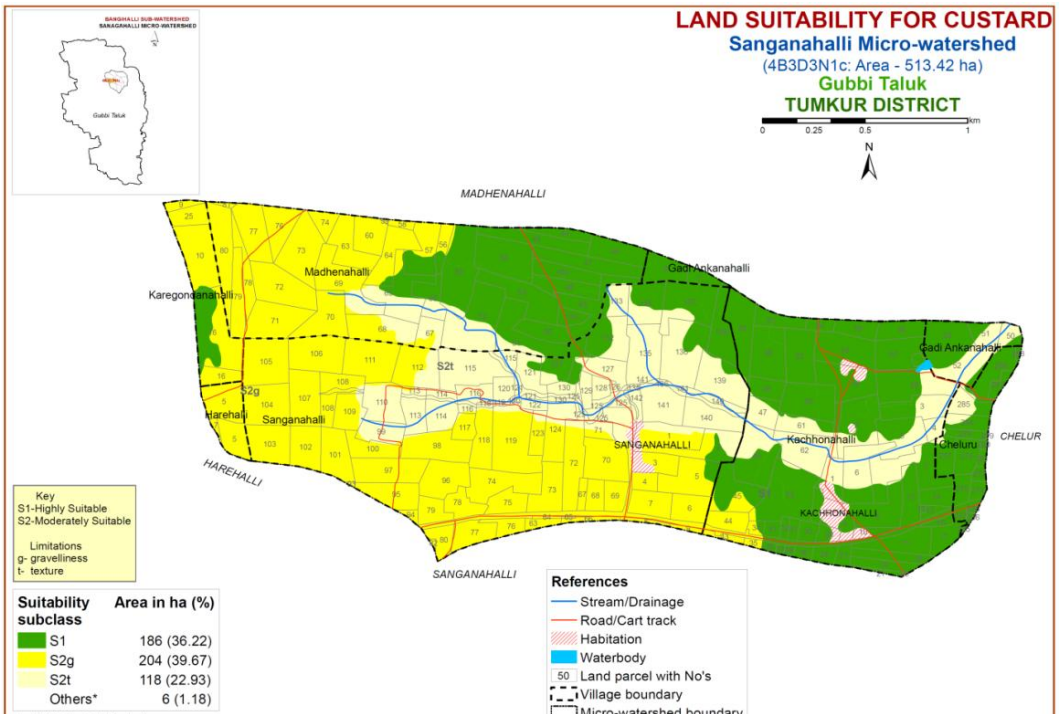


Fig. 7.26 Land Suitability map of Custard Apple

7.27 Land Suitability for Amla (*Phyllanthus emblica*)

Amla is one of the fruit and medicinal crop grown in almost all the districts of the State. The crop requirements for growing amla were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing amla (Table 7.27) was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.27.

An area of about 186 ha (36%) is highly suitable (Class S1) for growing amla and are distributed in the northern, northeastern and eastern part the microwatershed. Major area of about 322 ha (63%) is moderately suitable (Class S2) for growing amla and are distributed in the major part of the microwatershed. They have minor limitations of gravelliness and texture.

Table 7. 27 Land suitability criteria for Amla

Crop requirement			Rating			
Soil–site characteristics		Unit	Highly suitable(S1)	Moderately Suitable(S2)	Marginally suitable(S3)	Not suitable(N)
Soil aeration	Soil drainage	Class	Well drained	Mod.well drained	Poorly drained	V. Poorly drained
Nutrient availability	Texture	Class	scl,cl,sc,c (red)	c (black)	ls, sl	-
	pH	1:2.5	5.5-7.3	5.0-5.5	7.8-8.4	>8.4
Rooting conditions	Soil depth	cm	>75	50-75	25-50	<25
	Gravel content	% vol.	<15-35	35-60	60-80	
Erosion	Slope	%	0-3	3-5	5-10	>10

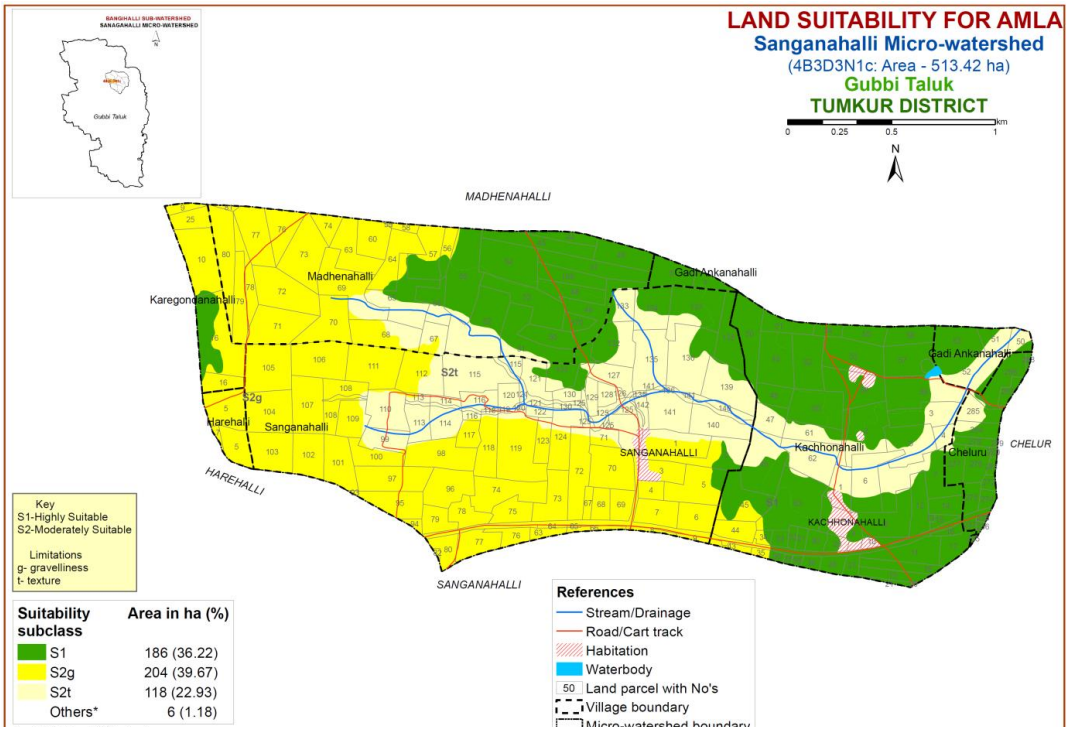


Fig. 7.27 Land Suitability map of Amla

7.28 Land Suitability for Tamarind (*Tamarindus indica*)

Tamarind is one of the most important spice crop grown in 14897 ha in all the districts of the state. The crop requirements for growing tamarind were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing tamarind (Table 7.28) was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.28.

An area of about 186 ha (36%) is highly suitable (Class S1) for growing tamarind and are distributed in the northern, northeastern and eastern part the microwatershed. An area of about 118 ha (23%) is moderately suitable (Class S2) for growing tamarind and are distributed in the central and northeastern part the microwatershed. They have minor limitation of texture. Marginally suitable lands (Class S3) for growing tamarind occupy major area of about 203 ha (40%) and occur in the western, northwestern and southern part of the microwatershed. They have moderate limitations of gravelliness and rooting depth.

Table 7.28 Land suitability criteria for Tamarind

Crop requirement			Rating			
Soil–site characteristics		Unit	Highly suitable(S1)	Moderately Suitable(S2)	Marginally suitable(S3)	Not suitable(N)
Soil aeration	Soil drainage	Class	Well drained	Mod.well drained	Poorly drained	V.Poorly drained
Nutrient availability	Texture	Class	Scl,cl,sc,c(red)	Sl, c (black)	ls	-
	pH	1:2.5	6.0-7.3	5.0-6.0,7.3-7.8	7.8-8.4	>8.4
Rooting conditions	Soil depth	Cm	>150	100-150	75-100	<50
	Gravel content	%vol.	<15	15-35	35-60	60-80

Erosion	Slope	%	0-3	3-5	5-10	>10

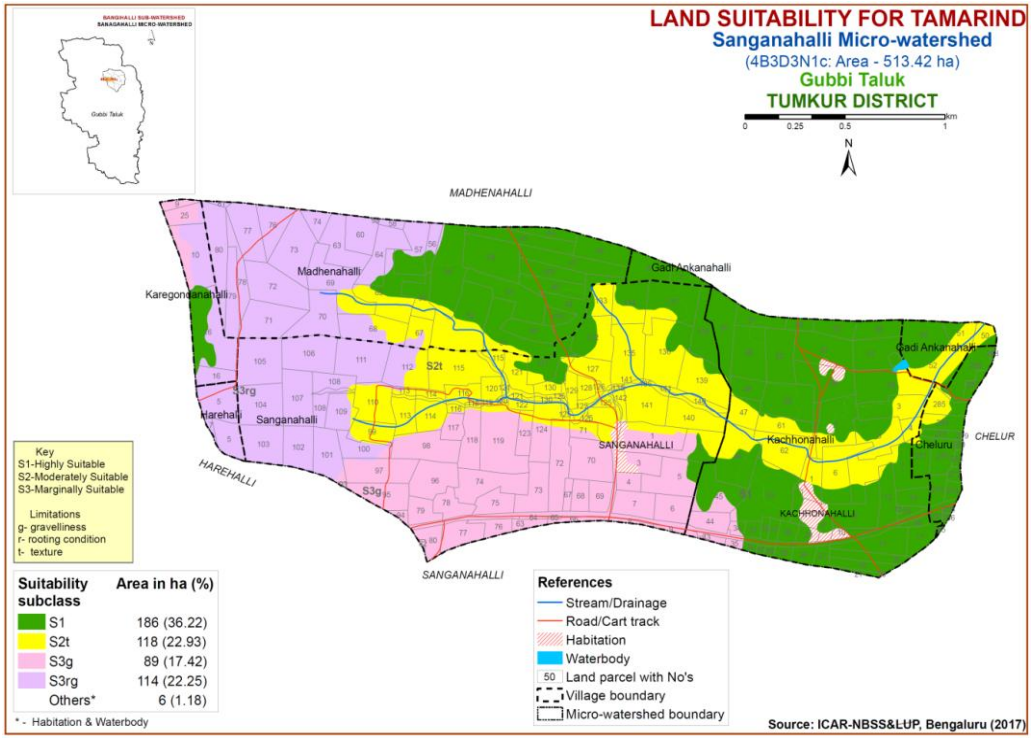


Fig. 7.28 Land Suitability map of Tamarind

7.29 Land Suitability for Marigold (*Tagetes sps*.)

Marigold is one of the most important flower crop grown in an area of 9108 ha in almost all the districts of the state. The crop requirements (Table 7.29) for growing marigold were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing marigold was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.29.

An area of about 186 ha (36%) is highly suitable (Class S1) for growing Marigold and are distributed in the central, southern and southeastern part of the microwatershed. An area of about 204 ha (40%) is moderately suitable (Class S2) for growing Marigold and are distributed in the eastern part of the microwatershed and have minor limitations of wetness and texture. Marginally suitable (Class S3) lands for growing Marigold occupy an area of about 118 ha (23%) and are distributed in the major part of the microwatershed. They have minor limitation of gravelliness.

Table 7.29 Land suitability criteria for Marigold

Crop requirement			Rating			
Soil–site characteristics		**Unit**	**Highly suitable(S1)**	**Moderately Suitable(S2)**	**Marginally suitable(S3)**	**Not suitable(N)**
Climate	Temperature in growing season		18-23	17-15 24-35	35-40 10-14	>40 <10
Soil aeration	Soil drainage	Class	Well drained	Moderately well drained	Imperfectly drained	Poorly drained

Nutrient availability	Texture	Class	l ,sl, scl, cl, sil	sicl, sc, sic, c	c	ls, s
	pH	1:2.5	7.0-7.5	5.5-5.9 7.6-8.5	<5 >8.5	-
	$CaCO_3$ in root zone	%	Non calcareous	Slightly calcareous	Strongly calcareous	-
Rooting conditions	Soil depth	cm	>75	50-75	25-50	<25
	Gravel content	%vol.	<15	15-35	>35	-
Soil toxicity	Salinity	ds/m	Non saline	Slightly	Strongly	-
	Sodicity (ESP)	%	<10	10-15	>15	-
Erosion	Slope	%	1-3	3-5	5-10	-

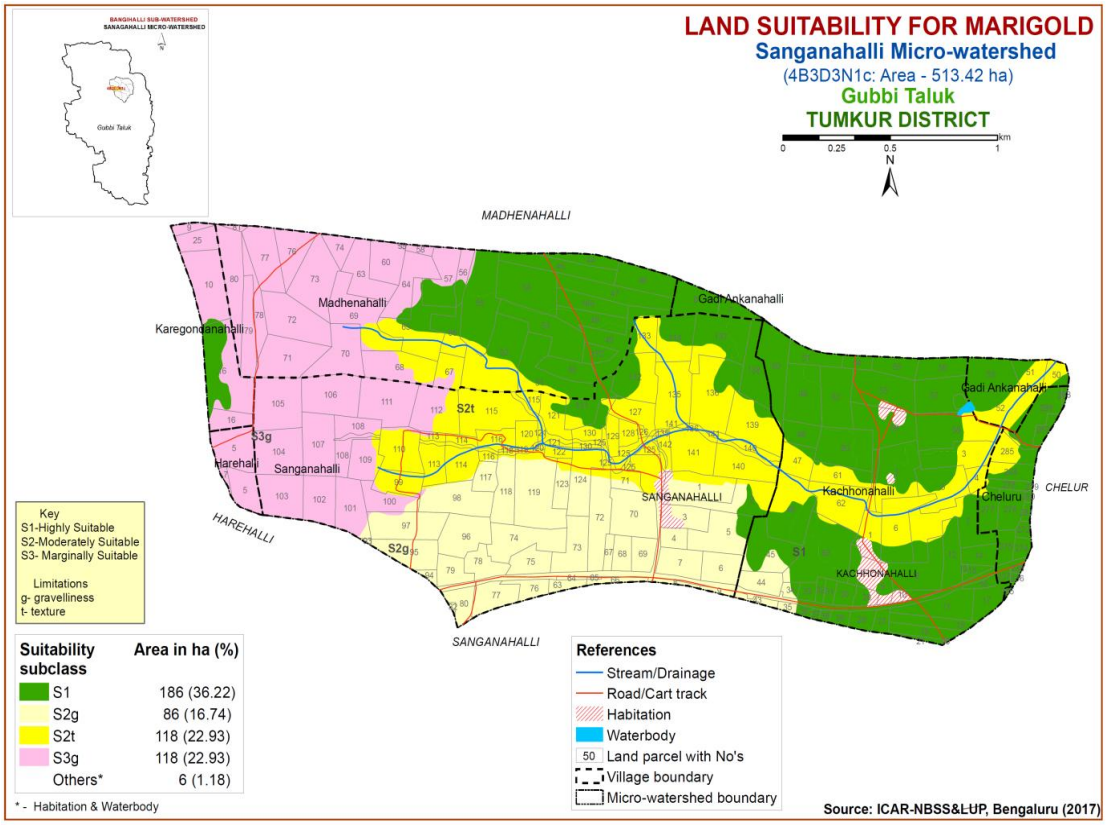


Fig. 7.29 Land Suitability map of Marigold

7.30 Land Suitability for Chrysanthemum (*Dendranthema grandiflora*)

Chrysanthemum is one of the most important flower crop grown in an area of 803 ha in almost all the districts of the State. The crop requirements (7.30) for growing chrysanthemum were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing chrysanthemum was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.30.

Table 7.30 Land suitability criteria for Chrysanthemum

Crop requirement			Rating			
Soil–site characteristics		**Unit**	**Highly suitable(S1)**	**Moderately Suitable(S2)**	**Marginally suitable(S3)**	**Not suitable(N)**
Climate	Temperature in growing season		18-23	17-15 24-35	35-40 10-14	>40 <10
Soil aeration	Soil drainage	Class	Well drained	Moderately well drained	Imperfectly drained	Poorly drained
Nutrient availability	Texture	Class	l ,sl, scl, cl, sil	sicl, sc, sic, c	c	ls, s
	pH	1:2.5	7.0-7.5	5.5-5.9,7.6-8.5	<5, >8.5	
	$CaCO_3$ in root zone	%	Non calcareous	Slightly calcareous	Strongly calcareous	
Rooting conditions	Soil depth	cm	>75	50-75	25-50	<25
	Gravel content	%vol.	<15	15-35	>35	
Soil toxicity	Salinity	ds/m	Non saline	slightly	strongly	
	Sodicity (ESP)	%	<10	10-15	>15	-
Erosion	Slope	%	1-3	3-5	5-10	

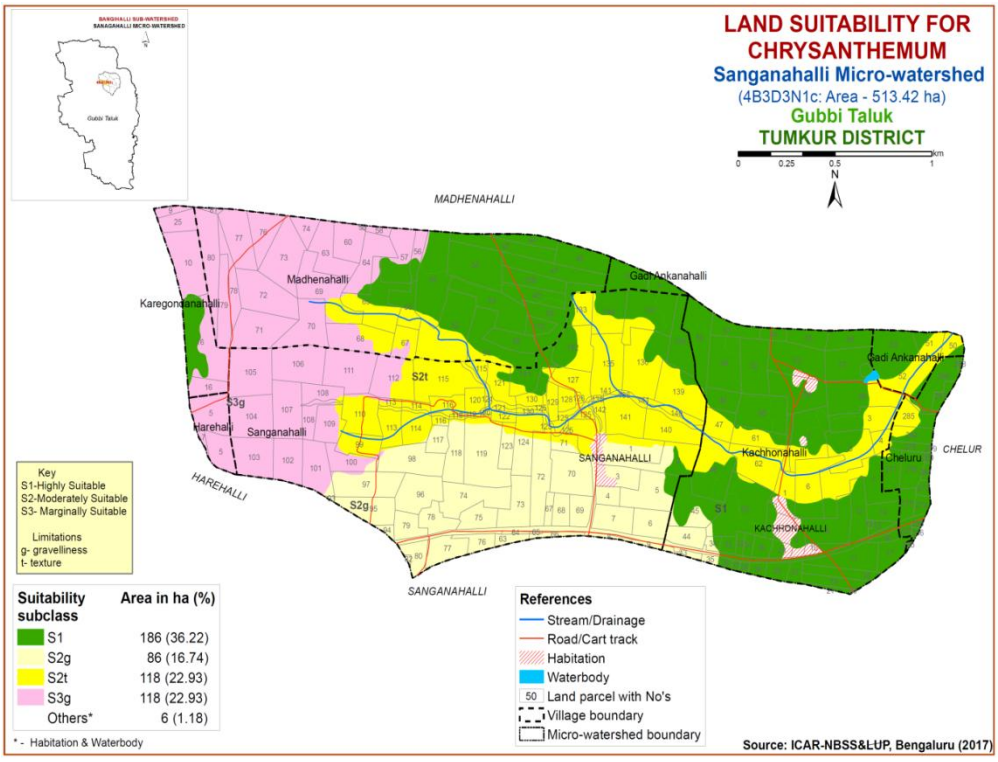


Fig. 7.30 Land Suitability map of Chrysanthemum

An area of about 186 ha (36%) is highly suitable (Class S1) for growing chrysanthemum and are distributed in the northern, northeastern and eastern part of the microwatershed. Major area of about 204 ha (40%) is moderately suitable (Class S2) for growing chrysanthemum and are distributed in the central and northeastern part the microwatershed. They have minor limitations of gravelliness and texture. Marginally suitable lands (Class S3) for growing chrysanthemum occupy an area of about 118 ha (23%) and occur in the western, northwestern and southern part of the microwatershed. They have moderate limitation of gravelliness.

7. 31 Land Suitability for Jasmine *(Jasminum sp.)*

Jasmine is one of the most important flower crop grown in an area of 803 ha in almost all the districts of the State. The crop requirements (Table 7.31) for growing Jasmine were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing Jasmine was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.31.

An area of about 186 ha (36%) is highly suitable (Class S1) for growing Jasmine and are distributed in the northern, northeastern and eastern part the microwatershed. Major area of about 204 ha (40%) is moderately suitable (Class S2) for growing Jasmine and are distributed in the central and northeastern part of the microwatershed. They have minor limitations of gravelliness and texture. Marginally suitable lands (Class S3) for growing Jasmine occupy an area of about 118 ha (23%) and occur in the western, northwestern and southern part of the microwatershed. They have moderate limitation of gravelliness.

Table 7.31 Land suitability criteria for jasmine (irrigated)

Crop requirement			**Rating**			
Soil–site characteristics		**Unit**	**Highly suitable(S1)**	**Moderately Suitable(S2)**	**Marginally suitable(S3)**	**Not suitable(N)**
Climate	Temperature in growing season		18-23	17-15 24-35	35-40 10-14	
Soil aeration	Soil drainage	Class	Well drained	Moderately drained	Imperfectly drained	Poorly drained
Nutrient availability	Texture	Class	scl, l, scl, cl, sil	sicl, sc, sic, c (m/k)	c(ss),	ls, s
	pH	1:2.5	6.0-7.5	5.5-5.9,7.6-8.5	<5,>8.5	
	$CaCO_3$ in root zone	%	Non calcareous	Slightly calcareous	Strong calcareous	
Rooting conditions	Soil depth	cm	>75	50-75	25-50	<25
	Gravel content	%vol.	<15	15-35	>35	
Soil toxicity	Salinity	ds/m	Non saline	Slight	Strongly	
	Sodicity	%	Non sodic	Slight	Strongly	

Erosion	Slope	%	1-3	3-5	5-10	

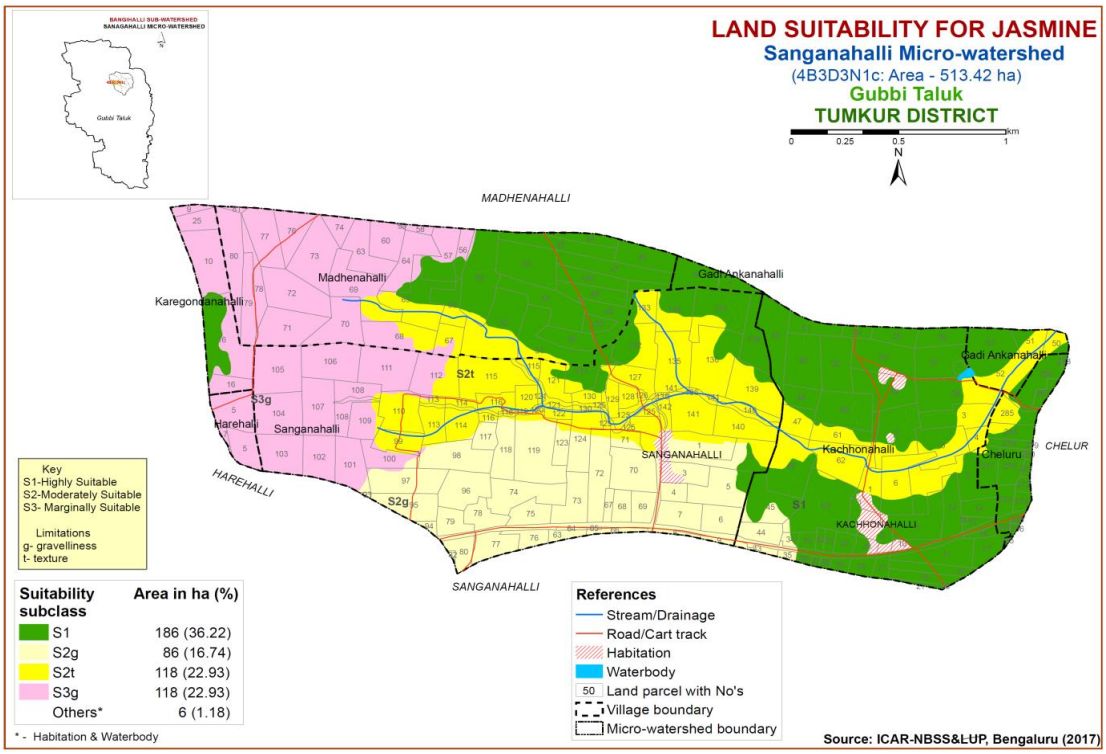


Fig. 7.31 Land Suitability map of Jasmine

7.32 Land Suitability for Coconut (*Cocos nucifera*)

Coconut is the most important nut crop grown in almost all the districts of the State. The crop requirements (7.32) for growing Coconut were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing Coconut was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.32.

A very small area of about 4 ha (1%) is highly suitable (Class S1) for growing Coconut and is distributed in the eastern part of the microwatershed. An area of about 182 ha (35%) is moderately suitable (Class S2) and are distributed in the northern, northeastern and eastern part of the microwatershed. They have minor limitation texture. Marginally suitable lands (Class S3) for growing Coconut occupy major area of about 322 ha (63%) and occur in the major part of the microwatershed and have moderate limitations of texture and gravelliness.

Table 7. 32 Land suitability criteria for Coconut

Crop requirement		Rating			
Soil–site characteristics	**Unit**	**Highly suitable(S1)**	**Moderately Suitable(S2)**	**Marginally suitable(S3)**	**Not suitable (N)**
Slope	%	0-3	3-5	5-10	>10
Soil drainage	class	Well drained	Mod. drained	Poorly	Very poorly
Soil reaction	pH	5.1-6.5	6.6-7.5	7.6-8.5	-
Surface soil texture	Class	sc, cl, scl	c (red), sl	c(black), ls	-
Soil depth	cm	>100	75-100	50-75	<50

Gravel content	%vol.	<15	15-35	35-60	>60

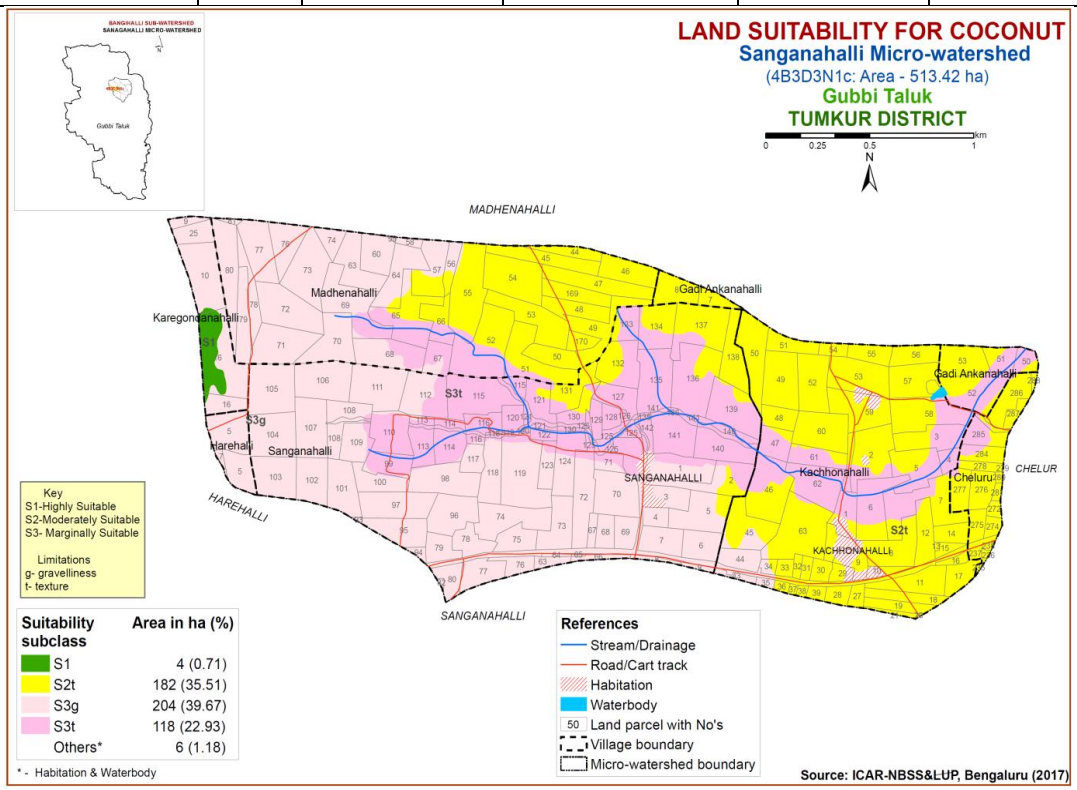


Fig. 7.32 Land Suitability map of Coconut

7.33 Land Suitability for Areca nut (*Areca catechu*)

Areca nut is the most important nut crop grown in few districts of the State. The crop requirements (7.33) for growing Areca nut were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing Areca nut was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.33.

Table 7.33 Land suitability criteria for Areca nut

Crop requirement		**Rating**			
Soil–site characteristics	**Unit**	**Highly suitable (S1)**	**Moderately Suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N)**
Slope	%	0-3	3-5	5-10	>10
Soil drainage	class	Well drained	Mod. to poorly drained	-	Very poorly
Soil reaction	pH	5.0-6.5	6.6-7.5	7.6-8.5	
Surface soil texture	Class	sc, cl, scl	c (red), sl	c (black), ls	-
Soil depth	cm	>100	75-100	50-75	<50
Gravel content	% vol.	<15	15-35	35-60	>60

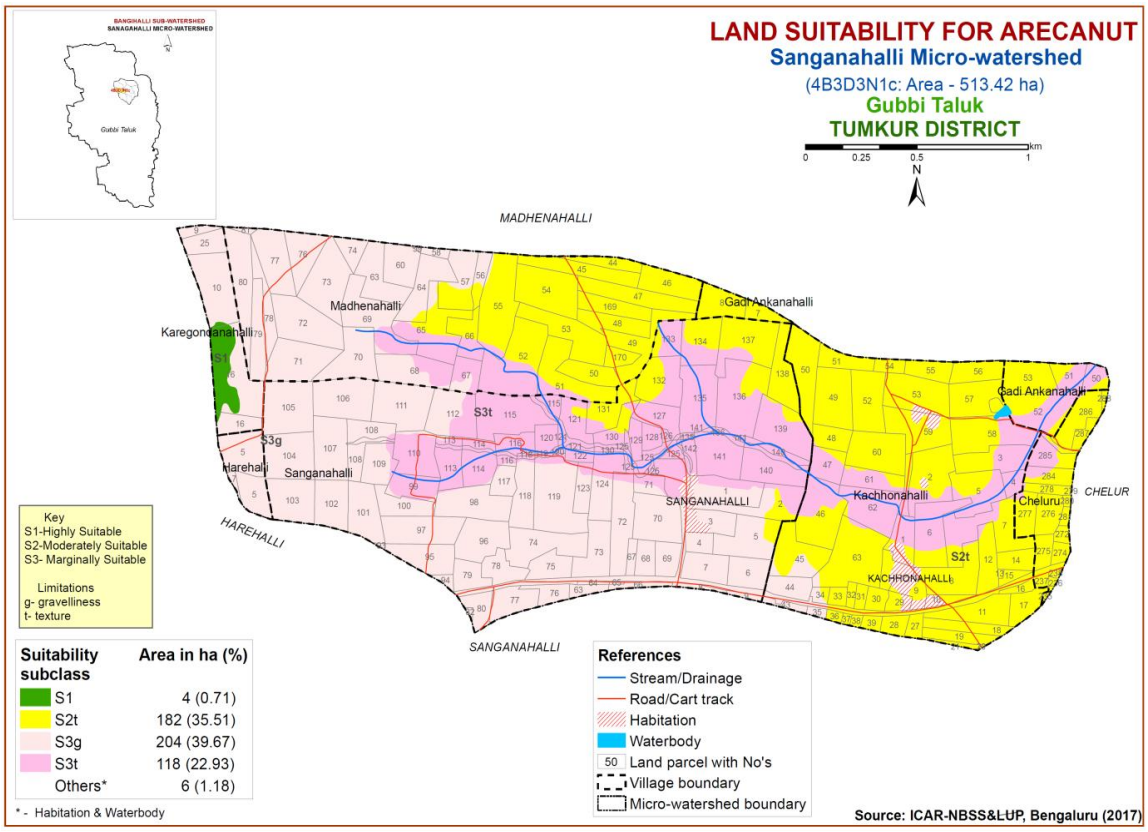


Fig. 7.33 Land Suitability map of Arecanut

A very small area of about 4 ha (1%) is highly suitable (Class S1) for growing Areca nut and is distributed in the eastern part of the microwatershed. An area of about 182 ha (35%) is moderately suitable (Class S2) and are distributed in the northern, northeastern and eastern part of the microwatershed. They have minor limitation texture. Marginally suitable lands (Class S3) for growing Areca nut occupy major area of about 322 ha (63%) and occur in the major part of the microwatershed and have moderate limitations of texture and gravelliness.

7.34 Land Suitability for Mulberry (*Morus nigra*)

Mulberry is the most important leaf crop grown in about 1.66 lakh ha in all the districts of the state for feeding silk worms. The crop requirements for growing mulberry (Table 7.34) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing mulberry was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.11.

Moderately suitable (Class S2) lands occupy maximum area of about 390 ha (76%) and occur in all parts of the microwatershed. They have minor limitations of gravelliness, rooting depth and texture. Marginally suitable lands cover an area of about 118 ha (23%) and occur in the northeastern and central part of the microwatershed. They have moderate limitation of texture.

Table 34 Land suitability criteria for Mulberry

Crop requirement			Rating			
Soil–site characteristics		Unit	Highly suitable(S1)	Moderately Suitable(S2)	Marginally suitable(S3)	Not suitable(N)
Soil aeration	Soil drainage	Class	Well drained	Moderately well drained	Poorly drained	V. Poorly drained
Nutrient availability	Texture	Class	Sc, cl, scl	C (red)	C(black),sl,ls	-
	pH	1:2.5				
Rooting conditions	Soil depth	Cm	>100	75-100	50-75	<50
	Gravel content	% vol.	0-35	35-60	60-80	>80
Erosion	Slope	%	0-3	3-5	5-10	>10

Note: Suitability evaluation only for Mulberry leaf not for Silk worm rearing

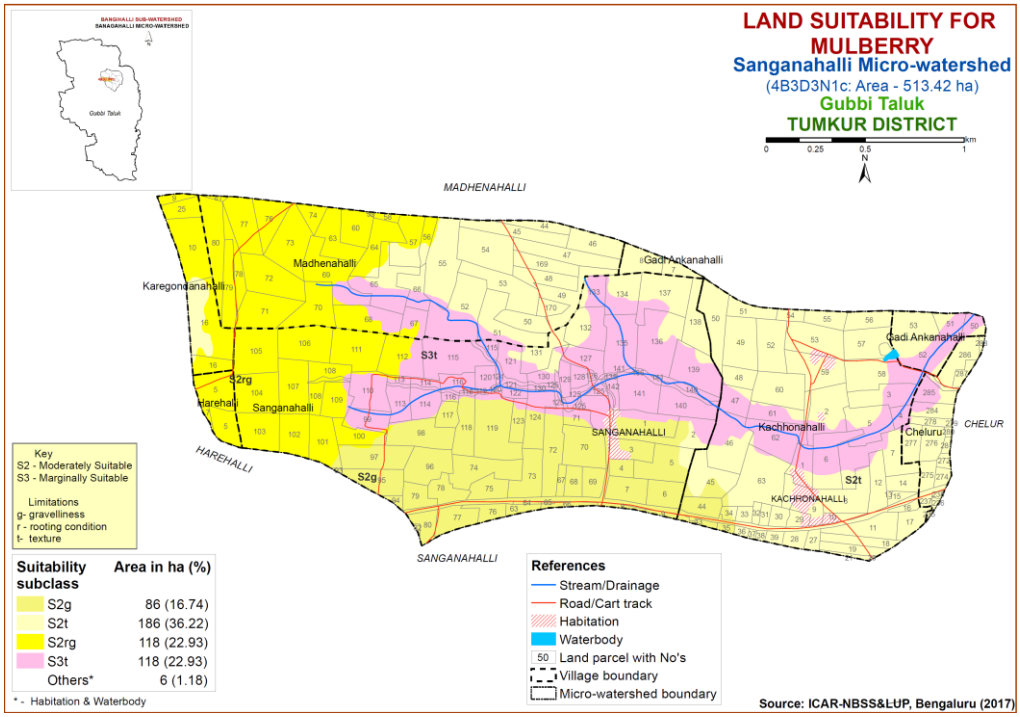


Fig. 7.34 Land Suitability map of Mulberry

7.35 Land Use Classes (LUCs)

The 12 soil map units identified in Sanganahalli microwatershed have been regrouped into 4 Land Use Classes (LUC's) for the purpose of preparing a Proposed Crop Plan. Land Use Classes are grouped based on the similarities in respect of the type of soil, the depth of the soil, the surface soil texture, gravel content, AWC, slope, erosion etc. and a Land Use Classes map (Fig. 7.35) has been generated. These land use classes are expected to behave similarly for a given level of management.

The map units that have been grouped into 4 land use classes along with brief description of soil and site characteristics are given below.

LUC NO.	Soil map unit number	Soil map units	Soil and site characteristics
1	5,6,7,8	HLKhB1 RTRcA1 RTRcB1 RTRhB1	Very deep, red sandy loam to sandy clay loam soils with slopes of 0-3% and slight erosion
2	9,10	NDLcB1 NDLhB1	Very deep, sandy loam to sandy clay loam soils with slopes of 1-3% and slight erosion
3	1,2,3,4	BDGcB1 BDGcB1g1 BDGhB1 BPRcB1g1	Moderately deep to deep sandy loam to sandy clay loam with slopes of 1-3%, gravelly (15-35%) and slight erosion
4	11,12	TDGhA1 TDGiA1	Deep, red gravelly sandy clay loam to sandy clay soils with slopes of 0-1% and slight erosion

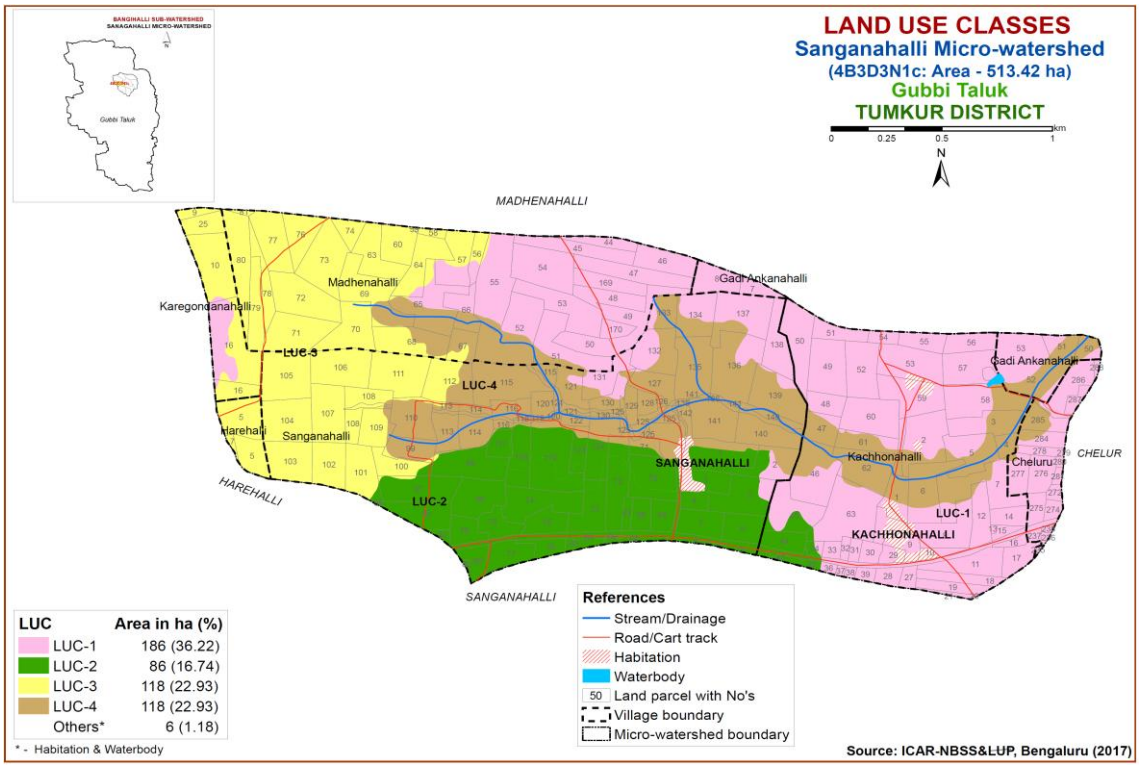


Fig. 7.35 Land Use Classes Map-Sanganahalli Microwatershed

7.36 Proposed Crop Plan for Sanganahalli Microwatershed

After assessing the land suitability for the 34 crops, a proposed crop plan has been prepared for the 4 identified LUCs by considering only the highly (Class S1) and moderately (Class S2) suitable lands for each of the 34 crops. The resultant proposed crop plan is presented below in Table 7.35.

Table 7.35 Proposed Crop Plan for Sanganahalli Microwatershed

LUC No	Mapping Units	Survey Number	Soil and site characteristics	Field Crops	Forestry/ Grasses	Horticulture Crops with suitable interventions	Suitable Interventions
LMU1 (186 ha.)	5,6,7,8 Very deep (>150 cm), red clayey soils	**Cheluru:**235,236,237,238, 272, 274,275,276,277,278, 279,280,281,284,286,287,288 **Gadi Ankanahalli:** 7,8,53 **Kachhonahalli:**2,7,8,10,11, 12,13,14,15,16,17,18,19,20, 21,27,28,29,30,31,32,33,36, 37,38,39,45,48,49,50,51,52, 53,54,55,56, 57,58,59,60,63 **Madhenahalli:**44,45,46,47, 48,49,50, 51,53,54,55,66, 169, 170 **Sanganahalli:**131,134,137, 138	Very deep, red sandy loam to sandy clay loam soils with slopes of 0-3% and slight erosion	**Sole Crop:** Ragi, Upland paddy, Maize, Sorghum, Fodder sorghum, Sunflower, Groundnut, Redgram, Field bean, Cowpea **Intercropping:** Redgram + Fodder sorghum Ragi + Cowpea Ragi + Redgram Ragi + Field bean	Neem, Silver Oak **Grasses** *Styloxanthes hamata*, *Styloxanthes Scabra*, Hybrid Napier, Sesbania,	**Vegetables**: Onion, Tomato, Brinjal Chillies, Coriander, Drumstick **Flower crops:** Chrysanthemum, Jasmine, China aster, Marigold, Crossandra **Fruit crops/ Plantation crops:** Mango, Sapota, Guava, Cashew, Pomegranate, Jackfruit, Musambi, Arecanut, Coconut	Summer ploughing, cultivation on raised beds with mulches, Drip irrigation and suitable conservation practices (Crescent Bunding with Catch Pit etc)
LMU 2 (86 ha.)	9,10 Very deep (>150 cm), gravelly red clayey soils	**Kachhonahalli:**34,35,43,44 **Sanganahalli:**1,2,3,4,5,6,7,8, 9,63,64,65,66,67,68,69,70,72, 73,74,75,76,77,78,79,80,82,93 ,94,95,96,97,98,117,118,119,1 23, 124	Very deep, sandy loam to sandy clay loam soils with slopes of 0-1% and slight erosion	**Sole Crop:** Ragi, Upland paddy, Maize, Sorghum, Fodder sorghum, Groundnut, Redgram, Field bean, Cowpea	Neem, Silver Oak **Grasses** *Styloxanthes hamata*, *Styloxanthes Scabra*,	**Vegetables**: Onion, Tomato, Brinjal Chillies, Coriander, Drumstick **Flower crops:** Chrysanthemum, Jasmine, China aster,	Summer ploughing, cultivation on raised beds with mulches, Drip irrigation and suitable

				Intercropping: Redgram + Fodder sorghum Ragi + Cowpea Ragi + Redgram Ragi + Field bean	Hybrid Napier, Sesbania,	Marigold **Fruit crops/ Plantation crops:** Mango, Sapota, Guava, Cashew, Custard apple, Amla, Pomegranate, Jackfruit, Musambi, Arecanut, Coconut	conservation practices
LMU 3 (118 ha.)	1,2,3,4 Moderately deep to very deep (75- >150 cm), gravelly red clayey soils	**Harehalli:** 5,7 **Karegondanahalli:**9,10,16,25 **Madhenahalli:**56,57,58,59,60 ,63,64,68,69,70,71,72,73,74, 76,77,78,79,80,81 **Sanganahalli:**100,101,102,10 3,104,105,106,107,108,109, 111,112	Moderately deep to deep sandy loam to sandy clay loam soils with slopes of 1-3%, gravelly (15-35%) and slight erosion	**Sole crop**: Upland paddy, Ragi, Maize, Sorghum, Groundnut, Fieldbean, Cowpea, Fodder sorghum, Horsegram	Glyricidia, **Grasses:** *Styloxanthes hamata*, *Styloxanthes scabra*, Hybrid Napier	**Vegetables:** Tomato, Brinjal, Drumstick, Chillies, Curry leaf **Flower crops:** Chrysanthemum, Marigold,Crossandra, **Fruit crops:** Tamarind, Custard Apple, Amla, Lime, Musambi	Drip irrigation, Mulching, suitable conservation practices (Crescent Bunding with Catch Pit etc)
LMU 4 (118 ha.)	11,12 deep (100-150 cm), sandy loam to sandy clay lowland soils	**Cheluru:**285 **Gadi Ankanahalli:** 50,51,52 **Kachhonahalli:**1,3,4,5,6,46, 47,61,62 **Madhenahalli:**52,65,67 **Sanganahalli:**71,99,110_TANK,113,114,115,116,120,121, 122,125,126,127,128,129,130, 132,133,135,136,139,140,141, 142	Deep, red gravelly sandy clay loam to sandy clay soils with slopes of 0-1% and slight erosion	**Sole crop**: Paddy	Hebbevu, Silveroak **Grasses:** *Styloxanthes hamata*, *Styloxanthes scabra*, Hybrid napier	**Fruit crops/ plantation crops:** Tamarind, Custard Apple, Amla, Arecanut, Coconut	Providing proper drainage, addition of organic manures, green leaf manuring, suitable conservation practises

Chapter 8

SOIL HEALTH MANAGEMENT

8.1 Soil Health

Soil is fundamental to crop production. Without soil, no food could be produced nor would livestock be fed on a large scale. Because it is finite and fragile, soil is a precious resource that requires special care from its users.

Soil health or the capacity of the soil to function is critical to human survival. Soil health has been defined as: "the capacity of the soil to function as a living system without adverse effect on the ecosystem". Healthy soils maintain a diverse community of soil organisms that help to form beneficial symbiotic associations with plant roots, recycle essential plant nutrients, improve soil structure with positive repercussions for soil, water and nutrient holding capacity and ultimately improve crop production and also contribute to mitigating climate change by maintaining or increasing its carbon content.

Functional interactions of soil biota with organic and inorganic components, air and water determine a soil's potential to store and release nutrients and water to plants and to promote and sustain plant growth. Thus, maintaining soil health is vital to crop production and conserve soil resource base for sustaining agriculture.

The most important characterististics of a healthy soil are

- Good soil tilth
- Sufficient soil depth
- Good water storage and good drainage
- Adequate supply, but not excess of nutrients
- Large population of beneficial organisms
- Small proportion of plant pathogens and insect pests
- Low weed pressure
- Free of chemicals and toxins that may harm the crop
- Resistance to degradation
- Resilience when unfavourable conditions occur

Characteristics of Sanganahalli Microwatershed

- The soil phases identified in the microwatershed belonged to the soil series of RTR 182 ha (35%), TDG 117 ha (23%), BDG 114 ha (9%), BPR 3 ha (1%), NDL 86 ha (17%) and HLK 4 ha (1%).
- As per land capability classification, entire area in the microwatershed falls under arable land category (Class II & III). The major limitations identified in the arable lands were soil.
- On the basis of soil reaction, maximum area of about 483 ha (94%) is slightly acid to strongly acid (pH 5.0 -6.5) and about 26 ha (5%) is neutral (pH 6.5-7.3).

❖ **Soil Health Management**

The following actions are required to improve the current land husbandry practices that provide a sound basis for the successful adoption of sustainable crop production system.

Acid soils

1. Growing crops suitable for particular soil pH.
2. Ameliorating the soils through the application of amendments (liming materials).

Liming materials:

1. $CaCO_3$ (Calcium Carbonate). More than 90% use in India.
2. Dolomite [Ca Mg $(Co_3)_2$]
3. Quick lime (Cao)
4. Slaked lime [Ca $(OH)_2$]

For normal pH and pH-4.8 (35 t/ha) and pH -6 .0-7.0 (4 t/ha) lime is required.

Alkaline soils

(Slightly alkaline to moderately alkaline soils)

1. Regular addition of organic manure, green manuring, green leaf manuring, crop residue incorporation and mulching needs to be taken up to improve the soil organic matter status.
2. Application of biofertilizers (Azospirullum, Azatobacter, Rhizobium).
3. Application of 25% extra N and P (125 % RDN&P).
4. Application of $ZnSO_4$ – 12.5 kg/ha (once in three years).
5. Application of Boron – 5kg/ha (once in three years).

Neutral soils

1. Regular addition of organic manure, green manuring, green leaf manuring, crop residue incorporation and mulching needs to be taken up to improve the soil organic matter status.
2. Application of biofertilizers, (Azospirullum, Azotobacter, Rhizobium).
3. Application of 100 per cent RDF.
4. Need based micronutrient applications.

Besides the above recommendations, the best transfer of technology options are also to be adopted.

Soil Degradation

Soil erosion is not a major factor affecting the soil health in the microwatershed. Entire area in the microwatershed is slightly eroded.

Dissemination of Information and Communication of Benefits

Any large scale implementation of soil health management requires that supporting information is made available widely, particularly through channels familiar to farmers and extension workers. Given the very high priority attached to soil health especially by the Central Government on issuing Soil-Health Cards to all the farmers, media outlets like Regional, State and National Newspapers, Radio and Dooradarshan programs in local languages but also modern information and communication technologies such as Cellular phones and the Internet, which can be much more effective in reaching the younger farmers.

Inputs for Net Planning (Saturation Plan) and Interventions needed

Net planning in IWMP is focusing on preparation of

1. Soil and Water Conservation Plans for each plot or farm.
2. Productivity enhancement measures/ interventions for existing crops/livestock/other farm enterprises.
3. Diversification of farming mainly with perennial horticultural crops and livestock.
4. Improving livelihood opportunities and income generating activities.

In this connection, how various outputs of Sujala-III are of use in addressing these objectives of Net Planning (Saturation Plan) are briefly presented below.

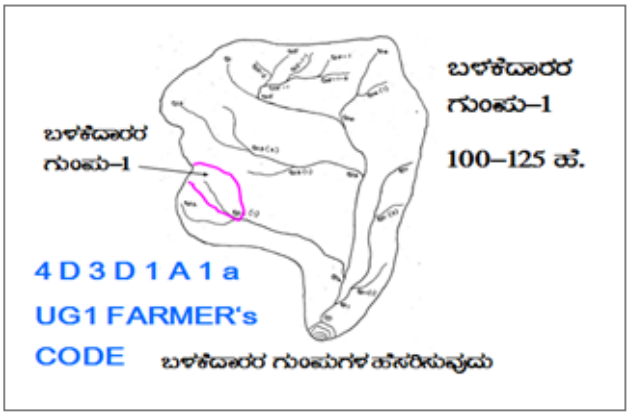
- **Soil Depth:** The depth of a soil decides the amount of moisture and nutrients it can hold, what crops can be taken up or not, depending on the rooting depth and the length of growing period available for raising any crop. Deeper the soil, better for a wide variety of crops. If sufficient depth is not available for growing deep rooted crops, either choose medium or short duration crops or deeper planting pits need to be opened and additional good quality soil brought from outside has to be filled into the planting pits.
- **Surface soil texture:** Lighter soil texture in the top soil means, better rain water infiltration, less run-off and soil moisture conservation, less capillary rise and less evaporation losses. Lighter surface textured soils are amenable to good soil tilth and are highly suitable for crops like groundnut and root vegetables (carrot, raddish, potato etc) but not ideal for crops that need stagnant water like lowland paddy. Heavy textured soils are poor in water infiltration and percolation. They are prone for sheet erosion; such soils can be improved by sand mulching. The technology that is developed by the AICRP-Dryland Agriculture, Vijayapura, Karnataka can be adopted.
- **Gravelliness:** More gravel content is favorable for run-off harvesting but poor in soil moisture storage and nutrient availability. It is a significant parameter that decides the kind of crop to be raised.
- **Land Capability Classification:** The land capability map shows the areas suitable and not suitable for agriculture and the major constraints in each of the plot/survey number. Hence, one can decide what kind of enterprise is possible in each of these units. In general, erosion and soil are the major constraints in Sanganahalli microwatershed.

- **Organic Carbon:** The OC content is medium (0.5-0.75%) in about 340 ha (66%) area and low (<0.5%) in about 168 ha (33%). The areas that are low and medium in OC needs to be further improved by applying farmyard manure and rotating crops with cereals and legumes or mixed cropping.
- **Promoting green manuring:** Growing of green manuring crops costs Rs. 1250/ha (green manuring seeds) and about Rs. 2000/ha towards cultivation that totals to Rs. 3250/- per ha. On the other hand, application of organic manure @ 10 tons/ha costs Rs. 5000/ha. The practice needs to be continued for 2-3 years or more. Nitrogen fertilizer needs to be supplemented by 25% in addition to the recommended level in 508 ha area where OC is medium (0.5-0.75%) and low (<0.5%). For example, for rainfed maize, recommended level is 50 kg N per ha and an additional 12 kg /ha needs to be applied for all the crops grown in these plots.
- **Available Phosphorus**: The available phosphorus is high (>57 kg/ha) in the entire area.
- **Available Potassium:** Available potassium is medium in maximum area of 382 ha (74%) in the microwatershed, about 65 ha (19%) area is low (<145 kg/ha) in available potassium and an area of about 60 ha (12%) is high (>337 kg/ha) in available potassium. Hence, in all these plots, where available potassium is low and medium, for all the crops, additional 25 % potassium may be applied.
- **Available Sulphur:** Available sulphur is a very critical nutrient for oilseed crops. It is medium in the entire microwatershed area. These areas need to be applied with magnesium sulphate or gypsum or Factamphos (p) fertitilizer (13% sulphur) for 2-3 years for the deficiency to be corrected.
- **Available Boron:** Available boron is low in an area of 478 ha (93%) and medium in 29 ha (6%) in the microwatershed. These areas need to be applied with sodium borate @ 10 kg/ha as soil application or 0.2% borax as foliar application to correct the boron deficiency.
- **Available Iron:** Entire area is sufficient in available iron in the microwatershed.
- **Available Manganese and Available Copper:** Entire area in the microwatershed is sufficient for both available manganese and copper.
- **Available Zinc:** It is deficient (<0.6 ppm) in 111 ha (22%) area of the microwatershed. Application of zinc sulphate @25kg/ha is to be recommended and about 396 ha (77%) area is sufficient (>0.6 ppm) in available Zinc.
- **Soil acidity:** The microwatershed has 483 ha (94%) area with soils that are slightly to strongly acid. These areas need application of lime (Calcium Carbonate).
- **Land Suitability for various crops:** Areas that are highly, moderately and marginally suitable for growing various crops are indicated. Along with the suitability, various constraints that are limiting the productivity are also indicated. For example, in case of cotton, gravel content, rooting depth and salinity/alkalinity are the major constraints in various plots. With suitable management interventions, the productivity can be enhanced. In order to increase water holding capacity of light textured soils, growing of green manure crops and application of organic manure is recommended.

Chapter 9

SOIL AND WATER CONSERVATION TREATMENT PLAN

For preparing soil and water conservation treatment plan for Sanganahalli microwatershed, the land resource inventory database generated under Sujala-III project has been transformed as information through series of interpretative (thematic) maps using soil phase map as a base. The various thematic maps (1:7920 scale) generated were



- Soil depth
- Surface soil texture
- Soil gravelliness
- Available water capacity
- Soil slope
- Soil erosion
- Land capability
- Present land use and land cover
- Crop suitability
- Rainfall
- Hydrology
- Water Resources
- Socio-economic data
- Contour plan with existing features- network of waterways, pothissa boundaries, cut up/ minor terraces etc.
- Cadastral map (1:7920 scale)
- Satellite imagery (1:7920 scale)

Apart from these, Hand Level/ Hydro Marker/ Dumpy Level/ Total Station and Kathedars' List is collected.

Steps for Survey and Preparation of Treatment Plan

The boundaries of Land User Groups' and Survey No. boundaries are traced in the field.

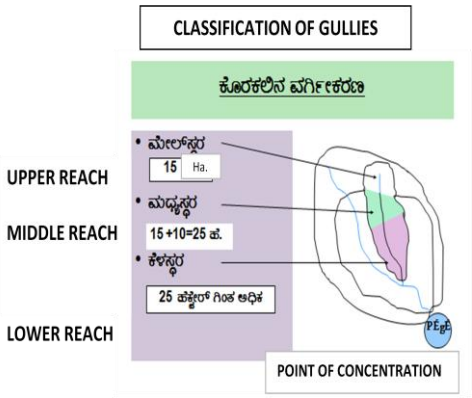
- Naming of user groups and farmers
- Identification of arable and non arable lands
- Identification of drainage lines and gullies
- Identification of non treatable areas
- Identification of priority areas in the arable lands
- Treatment plan for arable lands
- Location of water harvesting and recharge structures

9.1 Treatment Plan

The treatment plan recommended for arable lands is briefly described below.

9.1.1 Arable Land Treatment

A. BUNDING

Steps for Survey and Preparation of Treatment Plan		USER GROUP-1
Cadastral map (1:7920 scale) is enlarged to a scale of 1:2500 scale Existing network of waterways, pothissa boundaries, grass belts, natural drainage lines/ watercourse, cut ups/ terraces are marked on the cadastral map to the scale Drainage lines are demarcated into		
Small gullies	(up to 5 ha catchment)	
Medium gullies	(5-15 ha catchment)	
Ravines	(15-25 ha catchment) and	
Halla/Nala	(more than 25ha catchment)	

Measurement of Land Slope

Land slope is estimated or determined by the study and interpretation of contours or by measurement in the field using simple instruments like Hand Level or Hydromarker.

Vertical and Horizontal intervals between bunds as recommended by the Watershed Development Department.

Slope percentage	Vertical interval (m)	Corresponding Horizontal Distance (m)
2 - 3%	0.6	24
3 - 4%	0.9	21
4 - 5%	0.9	21
5 - 6%	1.2	21
6 - 7%	1.2	21

Note: (i) The above intervals are maximum.

(ii) Considering the slope class and erosion status (A1… A= 0-1% slope, 1= slight erosion) the intervals have to be decided.

Bund length recording: Considering the contour plan and the existing grass belts/partitions, the bunds are aligned and lengths are measured.

Section of the Bund

Bund section is decided considering the soil texture class and gravelliness class ($bg_{0....}$ b= loamy sand, g_o=<15% gravel). The recommended Sections for different soils are given below.

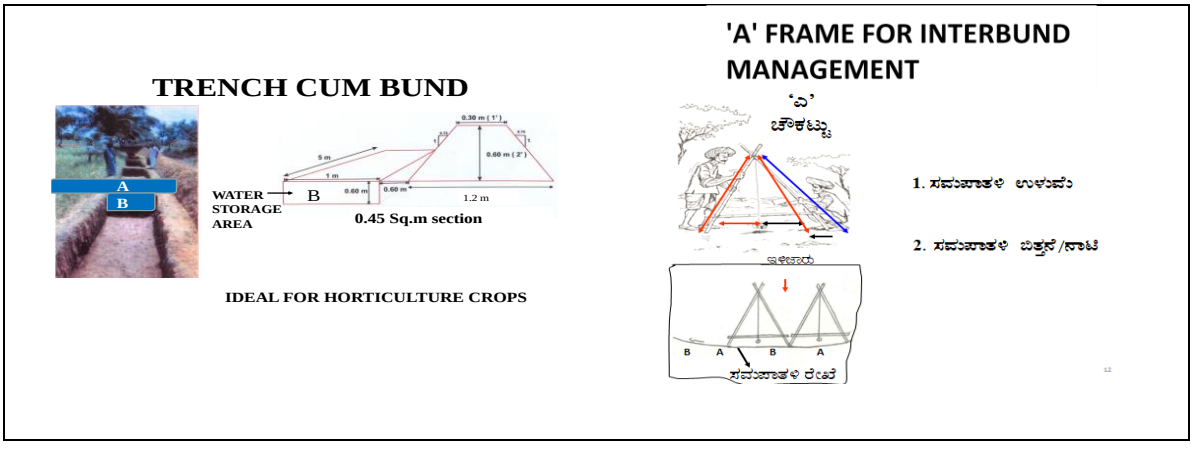
Recommended Bund Section

Top width (m)	Base width (m)	Height (m)	Side slope (Z:1;H:V)	Cross section (sq m)	Soil Texture	Remarks
0.3	0.9	0.3	01:01	0.18	Sandy loam	Vegetative bund
0.3	1.2	0.3	1.5:1	0.225	Sandy clay	
0.3	1.2	0.5	0.9:1	0.375	Red gravelly soils	
0.3	1.2	0.6	0.75:1	0.45		
0.3	1.5	0.6	01:01	0.54	Red sandy loam	
0.3	2.1	0.6	1.5:1	0.72	Very shallow black soils	
0.45	2	0.75	01:01	0.92		
0.45	2.4	0.75	1.3:1	1.07	Shallow black soils	
0.6	3.1	0.7	1.78:1	1.29	Medium black soils	
0.5	3	0.85	1.47:1	1.49		

Formation of Trench cum Bund

Dimensions of the Borrow Pits/ Trenches to be excavated (machinery are decided considering the Bund Section).

Details of Borrow Pit dimensions are given below



Size of Borrow Pit/ Trench recommended for Trench cum Bund (by machinery)

Bund section	Bund length	Earth quantity	Pit				Berm (pit topit)	Soil depth Class
m^2	m	m^3	L(m)	W(m)	D(m)	QUANTITY (m^3)	m	
0.375	6	2.25	5.85	0.85	0.45	2.24	0.15	Shallow
0.45	6	2.7	5.4	1.2	0.43	2.79	0.6	Shallow
0.45	6	2.7	5	0.85	0.65	2.76	1	Moderately Shallow
0.54	5.6	3.02	5.5	0.85	0.7	3.27	0.1	Moderately shallow
0.54	5.5	2.97	5	1.2	0.5	3	0.5	Shallow
0.72	6.2	4.46	6	1.2	0.7	5.04	0.2	Moderately shallow
0.72	5.2	3.74	5.1	0.85	0.9	3.9	0.1	Moderately deep

B. Waterways

1. Existing waterways are marked on the cadastral map (1:7920 scale) and their dimensions are recorded.
2. Considering the contour plan of the MWS, additional waterways/ modernization of the existing ones can be thought of.
3. The design details are given in the Manual.

C. Farm Ponds

Waterways and the catchment area will give an indication on the size of the Farm Pond. Location of the pond can be decided based on the contour plan/ field condition and farmers' need/desire.

D. Diversion channel

Existing EPT/ CPT are marked on the cadastral map. Looking to the need, these can be modernized or fresh diversion channel can be proposed and runoff from this can be stored in *Gokatte*/ Recharge ponds.

9.1.2 Non-Arable Land Treatment

Depending on the gravelliness and crops preferred by the farmers, the concerned authorities can decide appropriate treatment plan. The recommended treatments may be Contour Trench, Staggered Trench, Crescent Bund, Boulder Bund or Pebble Bund are formed in the field.

9.1.3 Treatment of Natural Water Course/ Drainage Lines

a) The cadastral map has to be updated as regards the network of drainge lines (gullies/ *nalas/ hallas*) and existing structures are marked to the scale and storage capacity of the existing water bodies are documented.
b) The drainage line will be demarcated into Upper Reach, Middle Reach and Lower Reach.
c) Considering the Catchment, *Nala* bed and bank conditions, suitable structures are decided.
d) Number of storage structures (Check dam/ *Nala* bund/ Percolation tank) will be decided considering the commitments and available runoff from water budgeting and quality of water in the wells and site suitability.
e) Detailed Levelling Survey using Dumpy Level / Total Station has to be carried out to arrive at the site-specific designs as shown in the Manual.
f) The location of ground water recharge structures are decided by examining the lineaments and fracture zones from geological maps.
g) Rainfall intensity data of the nearest Rain Gauge station is considered for Hydrologic Designs.
h) Silt load to the Storage/Recharge structures is reduced by providing vegetative, boulder and earthen checks in the natural water course. Location and design details are given in the Manual.

9.2 Recommended Soil and Water Conservation Measures

The appropriate conservation structures best suited for each of the land parcel/ survey number (Appendix-I) are selected based on the slope per cent, severity of erosion, amount of rainfall, land use and soil type. The different kinds of conservation structures recommended are

1. Graded / Strengthening of Bunds
2. Trench cum Bunds (TCB)
3. Trench cum Bunds / Strengthening
4. Crescent Bunds

A map (Fig. 9.1) showing soil and water conservation plan with different kinds of structures recommended has been generated which shows the spatial distribution and extent of area. A maximum area of about 359 ha (70%) requires trench cum Bunding and an area about 148 ha (29%) area requires Bunding/ Strengthening of existing bunds. The conservation plan generated may be presented to all the stakeholders including farmers and after including their suggestions, the conservation plan for the microwatershed may be finalised in a participatory approach.

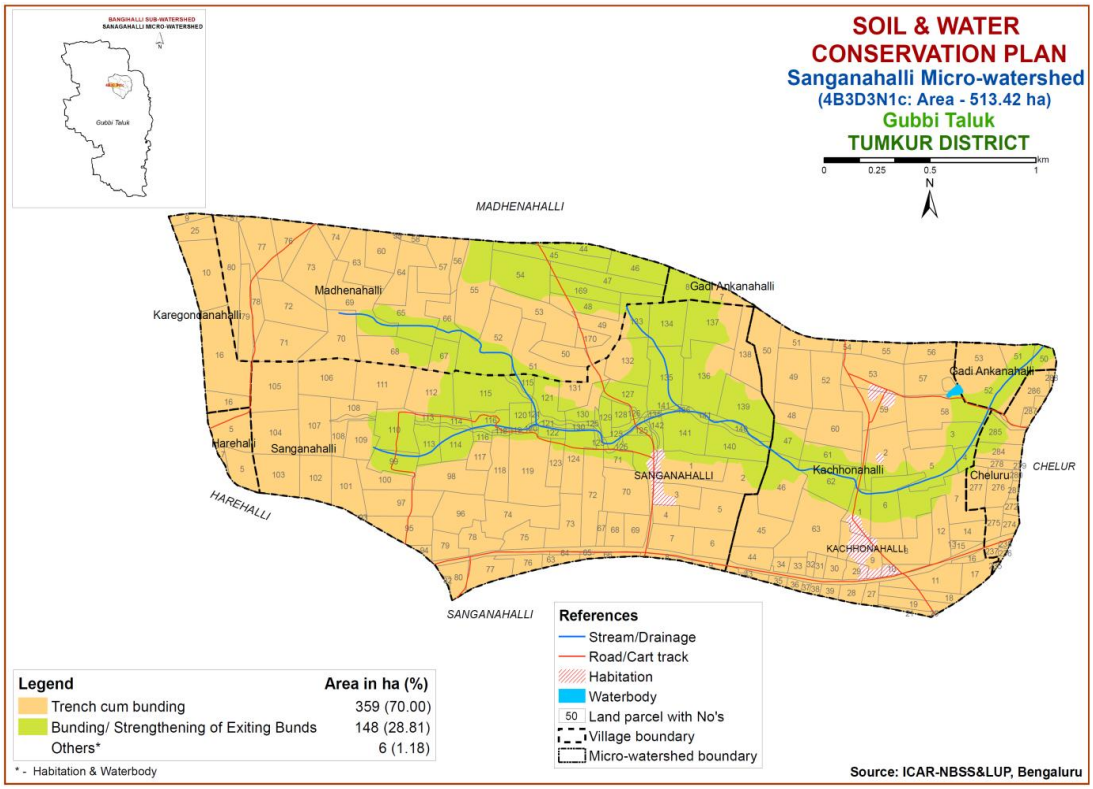


Fig. 9.1 Soil and Water Conservation Plan map of Sanganahalli Microwatershed

9.3 Greening of Microwatershed

As part of the greening programme in the watersheds, it is envisaged to plant a variety of horticultural and other tree plants that are edible, economical and produce lot of biomass which helps to restore the ecological balance in the watersheds. The lands that are suitable for greening programme are non-arable lands (land capability Classes V, VI, VII and VIII) and also the lands that are not suitable or marginally suitable for growing annual and perennial crops. The method of planting these trees is given below.

It is recommended to open pits during the 1st week of March along the contour and heap the dug out soil on the lower side of the slope in order to harness the flowing water and facilitate weathering of soil in the pit. Exposure of soil in the pit also prevents spread of pests and diseases due to scorching sun rays. The pits should be filled with mixture of soil and organic manure during the second week of April and keep ready with sufficiently tall seedlings produced either in poly bags or in root trainer nurseries so that planting can be done during the 2nd or 3rd week of April depending on the rainfall.

The tree species suitable for the area considering rainfall, temperature and adaptability is listed below; waterlogged areas are recommended to be planted with species like Neral (*Sizyzium cumini*) and Bamboo. Dry areas are to be planted with species like Honge, Bevu, Seetaphal *etc*.

Dry Deciduous Species			Temp (°C)	Rainfall (mm)
1.	Bevu	*Azadiracta indica*	21–32	400 –1,200
2.	Tapasi	*Holoptelia integrifolia*	20-30	500 - 1000
3.	Seetaphal	*Anona Squamosa*	20-40	400 - 1000
4.	Honge	*Pongamia pinnata*	20 -50	500–2,500
5.	Kamara	*Hardwikia binata*	25 -35	400 - 1000
6.	Bage	*Albezzia lebbek*	20 - 45	500 - 1000
7.	Ficus	*Ficus bengalensis*	20 - 50	500–2,500
8.	Sisso	*Dalbargia Sissoo*	20 - 50	500 -2000
9.	Ailanthus	*Ailanthus excelsa*	20 - 50	500 - 1000
10.	Hale	*Wrightia tinctoria*	25 - 45	500 - 1000
11.	Uded	*Steriospermum chelanoides*	25 - 45	500 -2000
12.	Dhupa	*Boswella Serrata*	20 - 40	500 - 2000
13.	Nelli	*Emblica Officinalis*	20 - 50	500 -1500
14.	Honne	*Pterocarpus marsupium*	20 - 40	500 - 2000
Moist Deciduous Species			**Temp (°C)**	**Rainfall (mm)**
15.	Teak	*Tectona grandis*	20 - 50	500-5000
16.	Nandi	*Legarstroemia lanceolata*	20 - 40	500 - 4000
17.	Honne	*Pterocarpus marsupium*	20 - 40	500 - 3000
18.	Mathi	*Terminalia alata*	20 -50	500 - 2000
19.	Shivane	*Gmelina arboria*	20 -50	500 -2000
20.	Kindal	*T.Paniculata*	20 - 40	500 - 1500
21.	Beete	*Dalbargia latifolia*	20 - 40	500 - 1500
22.	Tare	*T. belerica*	20 - 40	500 - 2000
23.	Bamboo	*Bambusa arundinasia*	20 - 40	500 - 2500
24.	Bamboo	*Dendrocalamus strictus*	20 – 40	500 – 2500
25.	Muthuga	*Butea monosperma*	20 - 40	400 - 1500
26.	Hippe	*Madhuca latifolia*	20 - 40	500 - 2000
27.	Sandal	*Santalum album*	20 - 50	400 - 1000
28.	Nelli	*Emblica officinalis*	20 - 40	500 - 2000
29.	Nerale	*Sizyzium cumini*	20 - 40	500 - 2000
30.	Dhaman	*Grevia tilifolia*	20 - 40	500 - 2000
31.	Kaval	*Careya arborea*	20 - 40	500 - 2000
32.	Harada	*Terminalia chebula*	20 - 40	500 - 2000

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Appendix I

Sanganahalli Colony-1 Microwatershed

Soil Phase Information

Village	Survey No	Total Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	AWC	Slope	Soil Erosion	CLU Code	WELLS	LCC	Conservation Plan
Cheluru	235	0.1	RTRcB1	LMU-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	NA	Not Available	IIs	TCB
Cheluru	236	0.19	RTRcB1	LMU-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	NA	Not Available	IIs	TCB
Cheluru	237	0.36	RTRcB1	LMU-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	NA	Not Available	IIs	TCB
Cheluru	238	0.17	RTRcB1	LMU-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	NA	Not Available	IIs	TCB
Cheluru	272	0.48	RTRcB1	LMU-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIs	TCB
Cheluru	274	0.68	RTRcB1	LMU-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Coconut (CN)	Not Available	IIs	TCB
Cheluru	275	1.16	RTRcB1	LMU-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Coconut (CN)	Not Available	IIs	TCB
Cheluru	276	1.96	RTRcB1	LMU-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Coconut (CN)	1 Bore Well	IIs	TCB
Cheluru	277	1.85	RTRcB1	LMU-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Coconut (CN)	1 Bore Well	IIs	TCB
Cheluru	278	0.86	RTRcB1	LMU-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Coconut (CN)	Not Available	IIs	TCB
Cheluru	279	0.02	RTRcB1	LMU-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	NA	Not Available	IIs	TCB
Cheluru	280	0.18	RTRcB1	LMU-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Coconut (CN)	Not Available	IIs	TCB
Cheluru	281	0.31	RTRcB1	LMU-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Coconut (CN)	Not Available	IIs	TCB
Cheluru	284	1.63	RTRcB1	LMU-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Coconut (CN)	Not Available	IIs	TCB
Cheluru	285	1.88	TDGiA1	LMU-4	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Coconut (CN)	1 Bore Well	IIs	Field bunds
Cheluru	286	2.72	RTRcB1	LMU-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Coconut (CN)	Not Available	IIs	TCB
Cheluru	287	0.75	RTRcB1	LMU-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIs	TCB
Cheluru	288	0.19	RTRcB1	LMU-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	NA	Not Available	IIs	TCB
Gadi Ankanahalli	7	1.11	RTRhB1	LMU-1	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	NA	Not Available	IIs	TCB
Gadi Ankanahalli	8	2.56	RTRcA1	LMU-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	NA	Not Available	IIs	Field bunds
Gadi Ankanahalli	50	1.17	TDGiA1	LMU-4	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Coconut (CN)	Not Available	IIs	Field bunds
Gadi Ankanahalli	51	1.61	TDGiA1	LMU-4	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Coconut (CN)	Not Available	IIs	Field bunds

Village	Survey No	Total Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	AWC	Slope	Soil Erosion	CLU Code	WELLS	LCC	Conservation Plan
Gadi Ankanahalli	52	4.58	TDGiA1	LMU-4	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Ragi (Ra)	Not Available	IIs	Field bunds
Gadi Ankanahalli	53	3.11	RTRcB1	LMU-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Coconut (CN)	Not Available	IIs	TCB
Harehalli	5	5.69	BDGcB1	LUC-3	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIIs	TCB
Harehalli	7	0.27	BDGcB1	LUC-3	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	NA	Not Available	IIIs	TCB
Kachhonahalli	1	2.16	TDGiA1	LUC-4	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Mango (Mn)	Not Available	IIs	Field bunds
Kachhonahalli	2	4.61	RTRcB1	LUC-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Coconut (CN)	1 Bore Well	IIs	TCB
Kachhonahalli	3	3.32	TDGiA1	LUC-4	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Coconut (CN)	2 Bore Well	IIs	Field bunds
Kachhonahalli	4	0.93	TDGiA1	LUC-4	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Mango (Mn)	Not Available	IIs	Field bunds
Kachhonahalli	5	3.81	TDGiA1	LUC-4	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Coconut (CN)	2 Bore Well	IIs	Field bunds
Kachhonahalli	6	4.37	TDGiA1	LUC-4	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Coconut (CN)	Not Available	IIs	Field bunds
Kachhonahalli	7	5.5	RTRcB1	LUC-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Coconut (CN)	Not Available	IIs	TCB
Kachhonahalli	8	3.88	RTRcB1	LUC-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIs	TCB
Kachhonahalli	9	1.5	Habitation	Others	Others	Others	Others	Others	Others	Others	Mango (Mn)	Not Available	Others	Others
Kachhonahalli	10	0.84	RTRcB1	LUC-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIs	TCB
Kachhonahalli	11	3.08	RTRcB1	LUC-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Coconut (CN)	Not Available	IIs	TCB
Kachhonahalli	12	2.45	RTRcB1	LUC-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	1 Bore Well	IIs	TCB
Kachhonahalli	13	0.1	RTRcB1	LUC-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	NA	Not Available	IIs	TCB
Kachhonahalli	14	1.45	RTRcB1	LUC-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	1 Bore Well	IIs	TCB
Kachhonahalli	15	0.55	RTRcB1	LUC-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIs	TCB
Kachhonahalli	16	0.53	RTRcB1	LUC-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	NA	Not Available	IIs	TCB
Kachhonahalli	17	1.78	RTRcB1	LUC-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Coconut (CN)	Not Available	IIs	TCB
Kachhonahalli	18	1.75	RTRcB1	LUC-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIs	TCB
Kachhonahalli	19	1.51	RTRcB1	LUC-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Coconut+Mango (CN+Mn)	Not Available	IIs	TCB
Kachhonahalli	20	0.04	RTRcB1	LUC-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	NA	Not Available	IIs	TCB
Kachhonahalli	21	0.4	RTRcB1	LUC-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	NA	Not Available	IIs	TCB

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Kachhonahalli	27	0.73	RTRcB1	LUC-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIs	TCB
Kachhonahalli	28	0.97	RTRcB1	LUC-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Arecanut(Ar)	Not Available	IIs	TCB
Kachhonahalli	29	0.82	RTRcB1	LUC-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Coconut (CN)	Not Available	IIs	TCB
Kachhonahalli	30	0.92	RTRcB1	LUC-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	NA	Not Available	IIs	TCB
Kachhonahalli	31	0.54	RTRcB1	LUC-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIs	TCB
Kachhonahalli	32	0.43	RTRcB1	LUC-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIs	TCB
Kachhonahalli	33	0.65	RTRcB1	LUC-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIs	TCB
Kachhonahalli	34	0.53	NDLcB1	LUC-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIIs	TCB
Kachhonahalli	35	0.35	NDLcB1	LUC-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Coconut (CN)	Not Available	IIIs	TCB
Kachhonahalli	36	0.34	RTRcB1	LUC-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Coconut (CN)	Not Available	IIs	TCB
Kachhonahalli	37	0.19	RTRcB1	LUC-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIs	TCB
Kachhonahalli	38	0.26	RTRcB1	LUC-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIs	TCB
Kachhonahalli	39	0.55	RTRcB1	LUC-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Coconut (CN)	Not Available	IIs	TCB
Kachhonahalli	43	0.55	NDLcB1	LUC-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Coconut (CN)	Not Available	IIIs	TCB
Kachhonahalli	44	1.81	NDLcB1	LUC-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIIs	TCB
Kachhonahalli	45	4.16	RTRcB1	LUC-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Coconut+Mango (CN+Mn)	Not Available	IIs	TCB
Kachhonahalli	46	5.26	TDGhA1	LUC-4	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Arecanut+Coconut (Ar+CN)	Not Available	IIs	Field bunds
Kachhonahalli	47	2.1	TDGhA1	LUC-4	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Coconut (CN)	2 Bore Well	IIs	Field bunds
Kachhonahalli	48	1.65	RTRhB1	LUC-1	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIs	TCB
Kachhonahalli	49	4.28	RTRhB1	LUC-1	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIs	TCB
Kachhonahalli	50	4.16	RTRhB1	LUC-1	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIs	TCB
Kachhonahalli	51	1.76	RTRcB1	LUC-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIs	TCB
Kachhonahalli	52	3.83	RTRcB1	LUC-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIs	TCB
Kachhonahalli	53	4.4	RTRcB1	LUC-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Mango+Ragi (Mn+Ra)	Not Available	IIs	TCB

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Kachhonahalli	54	0.81	RTRcB1	LUC-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIs	TCB
Kachhonahalli	55	1.68	RTRcB1	LUC-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIs	TCB
Kachhonahalli	56	2.05	RTRcB1	LUC-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Coconut (CN)	Not Available	IIs	TCB
Kachhonahalli	57	3.43	RTRcB1	LUC-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Coconut+Mango (CN+Mn)	1 Bore Well	IIs	TCB
Kachhonahalli	58	4.95	RTRcB1	LUC-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Coconut (CN)	1OpenWell, 3BoreWell	IIs	TCB
Kachhonahalli	59	4.26	RTRcB1	LUC-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIs	TCB
Kachhonahalli	60	4.29	RTRhB1	LUC-1	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIs	TCB
Kachhonahalli	61	2.29	TDGiA1	LUC-4	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Coconut (CN)	Not Available	IIs	Field bunds
Kachhonahalli	62	4.19	TDGiA1	LUC-4	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Arecanut+Coconut (Ar+CN)	2 Bore Well	IIs	Field bunds
Kachhonahalli	63	6.64	RTRhB1	LUC-1	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Arecanut+Coconut (Ar+CN)	3 Bore Well	IIs	TCB
Karegondanahalli	9	0.67	BPRcB1g1	LUC-3	Moderately deep (75-100 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Ragi (Ra)	Not Available	IIIs	TCB
Karegondanahalli	10	4.97	BDGcB1	LUC-3	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIIs	TCB
Karegondanahalli	16	8.52	BDGcB1	LUC-3	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Coconut+Mango (CN+Mn)	Not Available	IIIs	TCB
Karegondanahalli	25	1.69	BPRcB1g1	LUC-3	Moderately deep (75-100 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Ragi (Ra)	Not Available	IIIs	TCB
Madhenahalli	44	1.4	RTRcA1	LUC-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Mango (Mn)	Not Available	IIs	Field bunds
Madhenahalli	45	3.16	RTRcA1	LUC-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Ragi (Ra)	Not Available	IIs	Field bunds
Madhenahalli	46	2.87	RTRcA1	LUC-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Mango (Mn)	Not Available	IIs	Field bunds
Madhenahalli	47	3.68	RTRcA1	LUC-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Coconut+Mango (CN+Mn)	Not Available	IIs	Field bunds
Madhenahalli	48	2.36	RTRcA1	LUC-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Coconut (CN)	Not Available	IIs	Field bunds
Madhenahalli	49	3.56	RTRhB1	LUC-1	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIs	TCB
Madhenahalli	50	2.11	RTRhB1	LUC-1	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Coconut (CN)	Not Available	IIs	TCB
Madhenahalli	51	4.75	RTRhB1	LUC-1	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Arecanut+Coconut (Ar+CN)	Not Available	IIs	TCB
Madhenahalli	52	6.95	TDGhA1	LUC-4	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Coconut+Mango (CN+Mn)	Not Available	IIs	Field bunds
Madhenahalli	53	4.39	RTRhB1	LUC-1	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIs	TCB

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Madhenahalli	54	5.03	RTRcA1	LUC-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Mango (Mn)	Not Available	IIs	Field bunds
Madhenahalli	55	6.26	RTRhB1	LUC-1	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIs	TCB
Madhenahalli	56	1.25	BDGcB1g1	LUC-3	Moderately deep (75-100 cm)	Sandy loam	Gravelly (15-35%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIIs	TCB
Madhenahalli	57	3.34	BDGcB1g1	LUC-3	Moderately deep (75-100 cm)	Sandy loam	Gravelly (15-35%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Coconut (CN)	Not Available	IIIs	TCB
Madhenahalli	58	0.46	BDGcB1g1	LUC-3	Moderately deep (75-100 cm)	Sandy loam	Gravelly (15-35%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIIs	TCB
Madhenahalli	59	0.07	BDGcB1g1	LUC-3	Moderately deep (75-100 cm)	Sandy loam	Gravelly (15-35%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	NA	Not Available	IIIs	TCB
Madhenahalli	60	2.65	BDGcB1g1	LUC-3	Moderately deep (75-100 cm)	Sandy loam	Gravelly (15-35%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Ragi (Ra)	Not Available	IIIs	TCB
Madhenahalli	63	3.42	BDGcB1	LUC-3	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIIs	TCB
Madhenahalli	64	3.48	BDGcB1g1	LUC-3	Moderately deep (75-100 cm)	Sandy loam	Gravelly (15-35%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	2 Bore Well	IIIs	TCB
Madhenahalli	65	5.14	TDGhA1	LUC-4	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Mango (Mn)	Not Available	IIs	Field bunds
Madhenahalli	66	2.17	RTRhB1	LUC-1	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Coconut (CN)	Not Available	IIs	TCB
Madhenahalli	67	1.85	TDGhA1	LUC-4	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Coconut (CN)	Not Available	IIs	Field bunds
Madhenahalli	68	4.16	BDGcB1	LUC-3	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIIs	TCB
Madhenahalli	69	5.46	BDGcB1	LUC-3	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIIs	TCB
Madhenahalli	70	4.15	BDGcB1	LUC-3	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIIs	TCB
Madhenahalli	71	4.51	BDGhB1	LUC-3	Moderately deep (75-100 cm)	Sandy clay loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Coconut (CN)	Not Available	IIIs	TCB
Madhenahalli	72	5	BDGcB1	LUC-3	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Arecanut+Coconut +Mango(Ar+CN+Mn)	Not Available	IIIs	TCB
Madhenahalli	73	5.04	BDGcB1	LUC-3	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Coconut+Mango (CN+Mn)	Not Available	IIIs	TCB
Madhenahalli	74	1.26	BDGcB1g1	LUC-3	Moderately deep (75-100 cm)	Sandy loam	Gravelly (15-35%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIIs	TCB
Madhenahalli	76	2.84	BDGcB1g1	LUC-3	Moderately deep (75-100 cm)	Sandy loam	Gravelly (15-35%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIIs	TCB
Madhenahalli	77	3.83	BDGcB1g1	LUC-3	Moderately deep (75-100 cm)	Sandy loam	Gravelly (15-35%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIIs	TCB
Madhenahalli	78	1.95	BDGcB1	LUC-3	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIIs	TCB
Madhenahalli	79	2.66	BDGcB1	LUC-3	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Ragi (Ra)	Not Available	IIIs	TCB
Madhenahalli	80	4.31	BDGcB1g1	LUC-3	Moderately deep (75-100 cm)	Sandy loam	Gravelly (15-35%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Mango+Ragi (Mn+Ra)	Not Available	IIIs	TCB

Village	Survey No	Total Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	AWC	Slope	Soil Erosion	CLU Code	WELLS	LCC	Conservation Plan
Madhenahalli	81	0.21	BDGcB1g1	LUC-3	Moderately deep (75-100 cm)	Sandy loam	Gravelly (15-35%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	NA	Not Available	IIIs	TCB
Madhenahalli	169	2.28	RTRcA1	LUC-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Mango (Mn)	Not Available	IIs	Field bunds
Madhenahalli	170	1.05	RTRhB1	LUC-1	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIs	TCB
Sanganahalli	1	3.79	NDLcB1	LUC-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Coconut (CN)	Not Available	IIIs	TCB
Sanganahalli	2	3.89	NDLcB1	LUC-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Arecanut+Coconut (Ar+CN)	1 Bore Well	IIIs	TCB
Sanganahalli	3	2.27	NDLcB1	LUC-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Ragi (Ra)	Not Available	IIIs	TCB
Sanganahalli	4	1.11	NDLcB1	LUC-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Coconut (CN)	Not Available	IIIs	TCB
Sanganahalli	5	4.26	NDLcB1	LUC-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Arecanut+Coconut (Ar+CN)	Not Available	IIIs	TCB
Sanganahalli	6	2.37	NDLcB1	LUC-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIIs	TCB
Sanganahalli	7	2.47	NDLcB1	LUC-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Mango+Ragi (Mn+Ra)	Not Available	IIIs	TCB
Sanganahalli	8	0.36	NDLcB1	LUC-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	NA	Not Available	IIIs	TCB
Sanganahalli	9	0.35	NDLcB1	LUC-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	NA	Not Available	IIIs	TCB
Sanganahalli	63	0.77	NDLcB1	LUC-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIIs	TCB
Sanganahalli	64	0.2	NDLcB1	LUC-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	NA	Not Available	IIIs	TCB
Sanganahalli	65	0.09	NDLcB1	LUC-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	NA	Not Available	IIIs	TCB
Sanganahalli	66	0.66	NDLcB1	LUC-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	NA	Not Available	IIIs	TCB
Sanganahalli	67	0.63	NDLcB1	LUC-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIIs	TCB
Sanganahalli	68	1.34	NDLcB1	LUC-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIIs	TCB
Sanganahalli	69	1.63	NDLcB1	LUC-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIIs	TCB
Sanganahalli	70	4.26	NDLhB1	LUC-2	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Arecanut+Coconut +Mango(Ar+CN+Mn)	1 Bore Well	IIIs	TCB
Sanganahalli	71	1.16	TDGhA1	LUC-4	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Coconut (CN)	Not Available	IIs	Field bunds
Sanganahalli	72	4.07	NDLcB1	LUC-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIIs	TCB
Sanganahalli	73	3.11	NDLcB1	LUC-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Coconut+Mango (CN+Mn)	1 Bore Well	IIIs	TCB
Sanganahalli	74	4.26	NDLcB1	LUC-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Coconut+Mango (CN+Mn)	1 Bore Well	IIIs	TCB

Village	Survey No	Total Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	AWC	Slope	Soil Erosion	CLU Code	WELLS	LCC	Conservation Plan
Sanganahalli	75	2.02	NDLcB1	LUC-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	1 Bore Well	IIIs	TCB
Sanganahalli	76	1.24	NDLcB1	LUC-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIIs	TCB
Sanganahalli	77	2.39	NDLcB1	LUC-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIIs	TCB
Sanganahalli	78	1.95	NDLcB1	LUC-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIIs	TCB
Sanganahalli	79	1.76	NDLcB1	LUC-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Coconut (CN)	Not Available	IIIs	TCB
Sanganahalli	80	1.55	NDLcB1	LUC-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIIs	TCB
Sanganahalli	82	0.11	NDLcB1	LUC-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	NA	Not Available	IIIs	TCB
Sanganahalli	93	0.08	NDLcB1	LUC-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	NA	Not Available	IIIs	TCB
Sanganahalli	94	0.39	NDLcB1	LUC-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Coconut (CN)	Not Available	IIIs	TCB
Sanganahalli	95	3.13	NDLcB1	LUC-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Coconut (CN)	1 Bore Well	IIIs	TCB
Sanganahalli	96	3.69	NDLcB1	LUC-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Coconut (CN)	1 Bore Well	IIIs	TCB
Sanganahalli	97	4.23	NDLcB1	LUC-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIIs	TCB
Sanganahalli	98	4.25	NDLcB1	LUC-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Coconut+Mango (CN+Mn)	1 Bore Well	IIIs	TCB
Sanganahalli	99	2.28	TDGhA1	LUC-4	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Coconut (CN)	1 Bore Well	IIs	Field bunds
Sanganahalli	100	2.27	BDGhB1	LUC-3	Moderately deep (75-100 cm)	Sandy clay loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Coconut (CN)	2 Bore Well	IIIs	TCB
Sanganahalli	101	3.46	BDGcB1	LUC-3	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIIs	TCB
Sanganahalli	102	3.13	BDGcB1	LUC-3	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIIs	TCB
Sanganahalli	103	3.8	BDGcB1	LUC-3	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Coconut (CN)	Not Available	IIIs	TCB
Sanganahalli	104	4.48	BDGcB1	LUC-3	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Coconut+Mango (CN+Mn)	Not Available	IIIs	TCB
Sanganahalli	105	5.06	BDGcB1	LUC-3	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Coconut (CN)	Not Available	IIIs	TCB
Sanganahalli	106	4.62	BDGcB1	LUC-3	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Coconut+Mango (CN+Mn)	Not Available	IIIs	TCB
Sanganahalli	107	4.14	BDGcB1	LUC-3	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Mango+Ragi (Mn+Ra)	Not Available	IIIs	TCB
Sanganahalli	108	2.89	BDGhB1	LUC-3	Moderately deep (75-100 cm)	Sandy clay loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Coconut (CN)	Not Available	IIIs	TCB
Sanganahalli	109	2.46	BDGhB1	LUC-3	Moderately deep (75-100 cm)	Sandy clay loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Coconut (CN)	2 Bore Well	IIIs	TCB

Village	Survey No	Total Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	AWC	Slope	Soil Erosion	CLU Code	WELLS	LCC	Conservation Plan
Sanganahalli	110	3.56	TDGhA1	LUC-4	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Arecanut+Coconut (Ar+CN)	2BoreWell, 1OpenWell	IIs	Field bunds
Sanganahalli	111	4.91	BDGhB1	LUC-3	Moderately deep (75-100 cm)	Sandy clay loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Coconut (CN)	Not Available	IIIs	TCB
Sanganahalli	112	4.18	BDGcB1	LUC-3	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	1OpenWell, 1BoreWell	IIIs	TCB
Sanganahalli	113	2.41	TDGhA1	LUC-4	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Arecanut+Coconut (Ar+CN)	1 Bore Well	IIs	Field bunds
Sanganahalli	114	2.76	TDGhA1	LUC-4	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Mango (Mn)	Not Available	IIs	Field bunds
Sanganahalli	115	5.92	TDGhA1	LUC-4	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Arecanut+Coconut (Ar+CN)	4 Bore Well	IIs	Field bunds
Sanganahalli	116	1.88	TDGhA1	LUC-4	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Coconut (CN)	2 Bore Well	IIs	Field bunds
Sanganahalli	117	1.36	NDLcB1	LUC-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIIs	TCB
Sanganahalli	118	2.93	NDLhB1	LUC-2	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Coconut (CN)	Not Available	IIIs	TCB
Sanganahalli	119	6.63	NDLhB1	LUC-2	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Arecanut+Coconut (Ar+CN)	3 Bore Well	IIIs	TCB
Sanganahalli	120	1.2	TDGhA1	LUC-4	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Coconut (CN)	1 Bore Well	IIs	Field bunds
Sanganahalli	121	2.54	TDGhA1	LUC-4	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Coconut (CN)	1 Open Well	IIs	Field bunds
Sanganahalli	122	0.67	TDGhA1	LUC-4	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Mango (Mn)	Not Available	IIs	Field bunds
Sanganahalli	123	1.54	NDLhB1	LUC-2	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Coconut (CN)	Not Available	IIIs	TCB
Sanganahalli	124	3.32	NDLhB1	LUC-2	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Coconut (CN)	Not Available	IIIs	TCB
Sanganahalli	125	1.66	TDGhA1	LUC-4	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	NA	Not Available	IIs	Field bunds
Sanganahalli	126	0.19	TDGhA1	LUC-4	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	NA	Not Available	IIs	Field bunds
Sanganahalli	127	2.14	TDGhA1	LUC-4	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Coconut (CN)	Not Available	IIs	Field bunds
Sanganahalli	128	0.92	TDGhA1	LUC-4	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Coconut (CN)	1 Bore Well	IIs	Field bunds
Sanganahalli	129	0.96	TDGhA1	LUC-4	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Coconut (CN)	Not Available	IIs	Field bunds
Sanganahalli	130	1.8	TDGhA1	LUC-4	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Coconut (CN)	2 Bore Well	IIs	Field bunds
Sanganahalli	131	2.62	RTRhB1	LUC-1	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Arecanut+Coconut (Ar+CN)	Not Available	IIs	TCB
Sanganahalli	132	3.82	TDGhA1	LUC-4	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Arecanut+Mango (Ar+Mn)	Not Available	IIs	Field bunds
Sanganahalli	133	1.89	TDGhA1	LUC-4	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Arecanut+Coconut (Ar+CN)	Not Available	IIs	Field bunds

Village	Survey No	Total Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	AWC	Slope	Soil Erosion	CLU Code	WELLS	LCC	Conservation Plan
Sanganahalli	134	3.49	RTRcA1	LUC-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Coconut (CN)	Not Available	IIs	Field bunds
Sanganahalli	135	4.72	TDGhA1	LUC-4	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Arecanut+Coconut (Ar+CN)	2 Bore Well	IIs	Field bunds
Sanganahalli	136	6.22	TDGhA1	LUC-4	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Arecanut+Coconut (Ar+CN)	1OpenWell, 1BoreWell	IIs	Field bunds
Sanganahalli	137	5.08	RTRcA1	LUC-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Coconut+Mango (CN+Mn)	Not Available	IIs	Field bunds
Sanganahalli	138	3.12	RTRhB1	LUC-1	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Coconut (CN)	Not Available	IIs	TCB
Sanganahalli	139	4.63	TDGhA1	LUC-4	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Arecanut+Coconut (Ar+CN)	1BoreWell, 1OpenWell	IIs	Field bunds
Sanganahalli	140	4.12	TDGhA1	LUC-4	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Arecanut+Coconut (Ar+CN)	5 Bore Well	IIs	Field bunds
Sanganahalli	141	3.73	TDGhA1	LUC-4	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Arecanut+Coconut (Ar+CN)	3 Bore Well	IIs	Field bunds
Sanganahalli	142	0.74	TDGhA1	LUC-4	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	NA	Not Available	IIs	Field bunds

Appendix II

Sanganahalli Microwatershed

Soil Fertility Information

Village	Survey No.	Soil Reaction	Salinity (dsm^{-1})	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Cheluru	235	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Cheluru	236	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Cheluru	237	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Cheluru	238	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Cheluru	272	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Cheluru	274	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Cheluru	275	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Cheluru	276	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Cheluru	277	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Cheluru	278	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Cheluru	279	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Cheluru	280	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Cheluru	281	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Cheluru	284	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Cheluru	285	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Cheluru	286	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Cheluru	287	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Cheluru	288	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Gadi Ankanahalli	7	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Gadi Ankanahalli	8	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Gadi Ankanahalli	50	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Gadi Ankanahalli	51	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)

Village	Survey No.	Soil Reaction	Salinity (dsm^{-1})	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Gadi Ankanahalli	52	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Gadi Ankanahalli	53	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Harehalli	5	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harehalli	7	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	1	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	2	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	3	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	4	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	5	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	6	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	7	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	8	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	9	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Kachhonahalli	10	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	11	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	12	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	13	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	14	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	15	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	16	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	17	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	18	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	19	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	20	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Kachhonahalli	21	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)

Village	Survey No.	Soil Reaction	Salinity (dsm^{-1})	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Kachhonahalli	27	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	28	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	29	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	30	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	31	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	32	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	33	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	34	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	35	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	36	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	37	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	38	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	39	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	43	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	44	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	45	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	46	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	47	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	48	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	49	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	50	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	51	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	52	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	53	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)

Village	Survey No.	Soil Reaction	Salinity (dsm^{-1})	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Kachhonahalli	54	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Kachhonahalli	55	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Kachhonahalli	56	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Kachhonahalli	57	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Kachhonahalli	58	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	59	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	60	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	61	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	62	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kachhonahalli	63	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Karegondanahalli	9	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Karegondanahalli	10	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Karegondanahalli	16	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Karegondanahalli	25	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Madhenahalli	44	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Madhenahalli	45	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Madhenahalli	46	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Madhenahalli	47	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Madhenahalli	48	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Madhenahalli	49	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Madhenahalli	50	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Madhenahalli	51	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Madhenahalli	52	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Madhenahalli	53	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)

Village	Survey No.	Soil Reaction	Salinity (dsm^{-1})	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Madhenahalli	54	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Madhenahalli	55	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Madhenahalli	56	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Madhenahalli	57	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Madhenahalli	58	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Madhenahalli	59	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Madhenahalli	60	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Madhenahalli	63	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Madhenahalli	64	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Madhenahalli	65	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Madhenahalli	66	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Madhenahalli	67	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Madhenahalli	68	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Madhenahalli	69	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Madhenahalli	70	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Madhenahalli	71	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Madhenahalli	72	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Madhenahalli	73	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Madhenahalli	74	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Madhenahalli	76	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Madhenahalli	77	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Madhenahalli	78	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Madhenahalli	79	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Madhenahalli	80	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)

Village	Survey No.	Soil Reaction	Salinity (dsm^{-1})	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Madhenahalli	81	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Madhenahalli	169	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Madhenahalli	170	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	1	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	2	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	3	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	4	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	5	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	6	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	7	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	8	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	9	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	63	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Sanganahalli	64	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	65	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	66	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	67	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	68	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	69	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	70	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	71	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	72	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	73	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	74	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)

Village	Survey No.	Soil Reaction	Salinity (dsm^{-1})	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Sanganahalli	75	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	76	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Sanganahalli	77	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Sanganahalli	78	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	79	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	80	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Sanganahalli	82	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Sanganahalli	93	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	94	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	95	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	96	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	97	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	98	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	99	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	100	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	101	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	102	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	103	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	104	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	105	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Sanganahalli	106	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	107	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	108	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	109	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)

Village	Survey No.	Soil Reaction	Salinity (dsm^{-1})	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Sanganahalli	110	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	111	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	112	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	113	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	114	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	115	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	116	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	117	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	118	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	119	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	120	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	121	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	122	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	123	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	124	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	125	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	126	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	127	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	128	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	129	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	130	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	131	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	132	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	133	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)

Village	Survey No.	Soil Reaction	Salinity (dsm^{-1})	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Sanganahalli	134	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	135	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	136	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	137	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	138	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	139	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	140	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	141	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Sanganahalli	142	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient(>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)

Appendix III

Sanganahalli Microwatershed

Soil Suitability Information

Village	Survey No	Sorgham	Fodder Sorghum	Maize	UplandPaddy	Finger Millet	Redgram	Horsegram	Field-bean	Cowpea	Groundnut	Sunflower	Onion	Chilly	Brinjal	Tomato	Mango	Sapota	Guava	Pomegranate	Banana	Jackfruit	Jamun	Musambi	Lime	Cashew	Custard-apple	Amla	Tamarind	Marigold	Chrysanthemum	Jasmine	Coconut	Arecanut	Mulberry
Cheluru	235	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Cheluru	236	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Cheluru	237	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Cheluru	238	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Cheluru	272	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Cheluru	274	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Cheluru	275	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Cheluru	276	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Cheluru	277	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Cheluru	278	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Cheluru	279	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Cheluru	280	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Cheluru	281	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Cheluru	284	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Cheluru	285	S2t	S2t	S3t	S2t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t	S2t	S2t	S3t	S2t	S2t	S2t	Nt	S2t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t
Cheluru	286	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Cheluru	287	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Cheluru	288	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Gadi Ankanahalli	7	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Gadi Ankanahalli	8	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
GadiAnkanahalli	50	S2t	S2t	S3t	S2t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t	S2t	S2t	S3t	S2t	S2t	S2t	Nt	S2t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t
GadiAnkanahalli	51	S2t	S2t	S3t	S2t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t	S2t	S2t	S3t	S2t	S2t	S2t	Nt	S2t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t
GadiAnkanahalli	52	S2t	S2t	S3t	S2t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t	S2t	S2t	S3t	S2t	S2t	S2t	Nt	S2t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t
GadiAnkanahalli	53	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Harehalli	5	S3rg	S3rg	S3rg	S2g	S2g	S3g	S2g	S3g	S3g	S2rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2g	S2g	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg
Harehalli	7	S3rg	S3rg	S3rg	S2g	S2g	S3g	S2g	S3g	S3g	S2rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2g	S2g	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg
Kachhonahalli	1	S2t	S2t	S3t	S2t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t	S2t	S2t	S3t	S2t	S2t	S2t	Nt	S2t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t
Kachhonahalli	2	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t

Village	Survey No	Sorgham	Fodder Sorghum	Maize	UplandPaddy	Finger Millet	Redgram	Horsegram	Field-bean	Cowpea	Groundnut	Sunflower	Onion	Chilly	Brinjal	Tomato	Mango	Sapota	Guava	Pomegranate	Banana	Jackfruit	Jamun	Musambi	Lime	Cashew	Custard-apple	Amla	Tamarind	Marigold	Chrysanthemum	Jasmine	Coconut	Arecanut	Mulberry
Kachhonahalli	3	S2t	S2t	S3t	S2t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t	S2t	S2t	S3t	S2t	S2t	S2t	Nt	S2t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t
Kachhonahalli	4	S2t	S2t	S3t	S2t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t	S2t	S2t	S3t	S2t	S2t	S2t	Nt	S2t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t
Kachhonahalli	5	S2t	S2t	S3t	S2t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t	S2t	S2t	S3t	S2t	S2t	S2t	Nt	S2t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t
Kachhonahalli	6	S2t	S2t	S3t	S2t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t	S2t	S2t	S3t	S2t	S2t	S2t	Nt	S2t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t
Kachhonahalli	7	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Kachhonahalli	8	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Kachhonahalli	9	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Kachhonahalli	10	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Kachhonahalli	11	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Kachhonahalli	12	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Kachhonahalli	13	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Kachhonahalli	14	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Kachhonahalli	15	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Kachhonahalli	16	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Kachhonahalli	17	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Kachhonahalli	18	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Kachhonahalli	19	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Kachhonahalli	20	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Kachhonahalli	21	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Kachhonahalli	27	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Kachhonahalli	28	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Kachhonahalli	29	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Kachhonahalli	30	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Kachhonahalli	31	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Kachhonahalli	32	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Kachhonahalli	33	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Kachhonahalli	34	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g	S3g	S3g	S2g
Kachhonahalli	35	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g	S3g	S3g	S2g

Village	Survey No	Sorgham	Fodder Sorghum	Maize	UplandPaddy	Finger Millet	Redgram	Horsegram	Field-bean	Cowpea	Groundnut	Sunflower	Onion	Chilly	Brinjal	Tomato	Mango	Sapota	Guava	Pomegranate	Banana	Jackfruit	Jamun	Musambi	Lime	Cashew	Custard-apple	Amla	Tamarind	Marigold	Chrysanthemum	Jasmine	Coconut	Arecanut	Mulberry
Kachhonahalli	36	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Kachhonahalli	37	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Kachhonahalli	38	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Kachhonahalli	39	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Kachhonahalli	43	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g	S3g	S3g	S2g
Kachhonahalli	44	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g	S3g	S3g	S2g
Kachhonahalli	45	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Kachhonahalli	46	S2t	S2t	S3t	S2t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t	S2t	S2t	S3t	S2t	S2t	S2t	Nt	S2t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t
Kachhonahalli	47	S2t	S2t	S3t	S2t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t	S2t	S2t	S3t	S2t	S2t	S2t	Nt	S2t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t
Kachhonahalli	48	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Kachhonahalli	49	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Kachhonahalli	50	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Kachhonahalli	51	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Kachhonahalli	52	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Kachhonahalli	53	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Kachhonahalli	54	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Kachhonahalli	55	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Kachhonahalli	56	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Kachhonahalli	57	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Kachhonahalli	58	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Kachhonahalli	59	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Kachhonahalli	60	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Kachhonahalli	61	S2t	S2t	S3t	S2t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t	S2t	S2t	S3t	S2t	S2t	S2t	Nt	S2t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t
Kachhonahalli	62	S2t	S2t	S3t	S2t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t	S2t	S2t	S3t	S2t	S2t	S2t	Nt	S2t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t
Kachhonahalli	63	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Karegondanahalli	9	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3g	S2tg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S2rg
Karegondanahalli	10	S3rg	S3rg	S3rg	S2g	S2g	S3g	S2g	S3g	S3g	S2rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2g	S2g	S3rg	S3g	S3g	S3g	S3g	S3g	S3g	S2rg
Karegondanahalli	16	S3rg	S3rg	S3rg	S2g	S2g	S3g	S2g	S3g	S3g	S2rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2g	S2g	S3rg	S3g	S3g	S3g	S3g	S3g	S3g	S2rg
Karegondanahalli	25	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3g	S2tg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S2rg
Madhenahalli	44	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t

Village	Survey No	Sorgham	Fodder Sorghum	Maize	UplandPaddy	Finger Millet	Redgram	Horsegram	Field-bean	Cowpea	Groundnut	Sunflower	Onion	Chilly	Brinjal	Tomato	Mango	Sapota	Guava	Pomegranate	Banana	Jackfruit	Jamun	Musambi	Lime	Cashew	Custard-apple	Amla	Tamarind	Marigold	Chrysanthemum	Jasmine	Coconut	Arecanut	Mulberry
Madhenahalli	45	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Madhenahalli	46	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Madhenahalli	47	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Madhenahalli	48	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Madhenahalli	49	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Madhenahalli	50	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Madhenahalli	51	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Madhenahalli	52	S2t	S2t	S3t	S2t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t	S2t	S2t	S3t	S2t	S2t	S2t	Nt	S2t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t
Madhenahalli	53	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Madhenahalli	54	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Madhenahalli	55	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Madhenahalli	56	S3rg	S3rg	S3rg	S2g	S2g	S3g	S2g	S3g	S3g	S2rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2g	S2g	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg
Madhenahalli	57	S3rg	S3rg	S3rg	S2g	S2g	S3g	S2g	S3g	S3g	S2rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2g	S2g	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg
Madhenahalli	58	S3rg	S3rg	S3rg	S2g	S2g	S3g	S2g	S3g	S3g	S2rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2g	S2g	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg
Madhenahalli	59	S3rg	S3rg	S3rg	S2g	S2g	S3g	S2g	S3g	S3g	S2rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2g	S2g	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg
Madhenahalli	60	S3rg	S3rg	S3rg	S2g	S2g	S3g	S2g	S3g	S3g	S2rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2g	S2g	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg
Madhenahalli	63	S3rg	S3rg	S3rg	S2g	S2g	S3g	S2g	S3g	S3g	S2rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2g	S2g	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg
Madhenahalli	64	S3rg	S3rg	S3rg	S2g	S2g	S3g	S2g	S3g	S3g	S2rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2g	S2g	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg
Madhenahalli	65	S2t	S2t	S3t	S2t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t	S2t	S2t	S3t	S2t	S2t	S2t	Nt	S2t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t
Madhenahalli	66	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Madhenahalli	67	S2t	S2t	S3t	S2t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t	S2t	S2t	S3t	S2t	S2t	S2t	Nt	S2t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t
Madhenahalli	68	S3rg	S3rg	S3rg	S2g	S2g	S3g	S2g	S3g	S3g	S2rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2g	S2g	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg
Madhenahalli	69	S3rg	S3rg	S3rg	S2g	S2g	S3g	S2g	S3g	S3g	S2rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2g	S2g	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg
Madhenahalli	70	S3rg	S3rg	S3rg	S2g	S2g	S3g	S2g	S3g	S3g	S2rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2g	S2g	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg
Madhenahalli	71	S3rg	S3rg	S3rg	S2g	S2g	S3g	S2g	S3g	S3g	S2rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2g	S2g	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg
Madhenahalli	72	S3rg	S3rg	S3rg	S2g	S2g	S3g	S2g	S3g	S3g	S2rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2g	S2g	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg
Madhenahalli	73	S3rg	S3rg	S3rg	S2g	S2g	S3g	S2g	S3g	S3g	S2rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2g	S2g	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg
Madhenahalli	74	S3rg	S3rg	S3rg	S2g	S2g	S3g	S2g	S3g	S3g	S2rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2g	S2g	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg
Madhenahalli	76	S3rg	S3rg	S3rg	S2g	S2g	S3g	S2g	S3g	S3g	S2rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2g	S2g	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg
Madhenahalli	77	S3rg	S3rg	S3rg	S2g	S2g	S3g	S2g	S3g	S3g	S2rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2g	S2g	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg

Village	Survey No	Sorgham	Fodder Sorghum	Maize	UplandPaddy	Finger Millet	Redgram	Horsegram	Field-bean	Cowpea	Groundnut	Sunflower	Onion	Chilly	Brinjal	Tomato	Mango	Sapota	Guava	Pomegranate	Banana	Jackfruit	Jamun	Musambi	Lime	Cashew	Custard-apple	Amla	Tamarind	Marigold	Chrysanthemum	Jasmine	Coconut	Arecanut	Mulberry
Madhenahalli	78	S3rg	S3rg	S3rg	S2g	S2g	S3g	S2g	S3g	S3g	S2rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2g	S2g	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg
Madhenahalli	79	S3rg	S3rg	S3rg	S2g	S2g	S3g	S2g	S3g	S3g	S2rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2g	S2g	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg
Madhenahalli	80	S3rg	S3rg	S3rg	S2g	S2g	S3g	S2g	S3g	S3g	S2rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2g	S2g	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg
Madhenahalli	81	S3rg	S3rg	S3rg	S2g	S2g	S3g	S2g	S3g	S3g	S2rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2g	S2g	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg
Madhenahalli	169	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Madhenahalli	170	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Sanganahalli	1	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g	S3g	S3g	S2g
Sanganahalli	2	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g	S3g	S3g	S2g
Sanganahalli	3	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g	S3g	S3g	S2g
Sanganahalli	4	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g	S3g	S3g	S2g
Sanganahalli	5	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g	S3g	S3g	S2g
Sanganahalli	6	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g	S3g	S3g	S2g
Sanganahalli	7	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g	S3g	S3g	S2g
Sanganahalli	8	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g	S3g	S3g	S2g
Sanganahalli	9	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g	S3g	S3g	S2g
Sanganahalli	63	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g	S3g	S3g	S2g
Sanganahalli	64	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g	S3g	S3g	S2g
Sanganahalli	65	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g	S3g	S3g	S2g
Sanganahalli	66	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g	S3g	S3g	S2g
Sanganahalli	67	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g	S3g	S3g	S2g
Sanganahalli	68	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g	S3g	S3g	S2g
Sanganahalli	69	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g	S3g	S3g	S2g
Sanganahalli	70	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g	S3g	S3g	S2g
Sanganahalli	71	S2t	S2t	S3t	S2t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t	S2t	S2t	S3t	S2t	S2t	S2t	Nt	S2t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t
Sanganahalli	72	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g	S3g	S3g	S2g
Sanganahalli	73	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g	S3g	S3g	S2g
Sanganahalli	74	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g	S3g	S3g	S2g
Sanganahalli	75	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g	S3g	S3g	S2g
Sanganahalli	76	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g	S3g	S3g	S2g
Sanganahalli	77	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g	S3g	S3g	S2g

Village	Survey No	Sorgham	Fodder Sorghum	Maize	UplandPaddy	Finger Millet	Redgram	Horsegram	Field-bean	Cowpea	Groundnut	Sunflower	Onion	Chilly	Brinjal	Tomato	Mango	Sapota	Guava	Pomegranate	Banana	Jackfruit	Jamun	Musambi	Lime	Cashew	Custard-apple	Amla	Tamarind	Marigold	Chrysanthemum	Jasmine	Coconut	Arecanut	Mulberry
Sanganahalli	78	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g	S3g	S3g	S2g
Sanganahalli	79	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g	S3g	S3g	S2g
Sanganahalli	80	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g	S3g	S3g	S2g
Sanganahalli	82	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g	S3g	S3g	S2g
Sanganahalli	93	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g	S3g	S3g	S2g
Sanganahalli	94	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g	S3g	S3g	S2g
Sanganahalli	95	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g	S3g	S3g	S2g
Sanganahalli	96	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g	S3g	S3g	S2g
Sanganahalli	97	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g	S3g	S3g	S2g
Sanganahalli	98	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g	S3g	S3g	S2g
Sanganahalli	99	S2t	S2t	S3t	S2t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	Nt	S2t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t
Sanganahalli	100	S3rg	S3rg	S3rg	S2g	S2g	S3g	S2g	S3g	S3g	S2rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2g	S2g	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg
Sanganahalli	101	S3rg	S3rg	S3rg	S2g	S2g	S3g	S2g	S3g	S3g	S2rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2g	S2g	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg
Sanganahalli	102	S3rg	S3rg	S3rg	S2g	S2g	S3g	S2g	S3g	S3g	S2rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2g	S2g	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg
Sanganahalli	103	S3rg	S3rg	S3rg	S2g	S2g	S3g	S2g	S3g	S3g	S2rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2g	S2g	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg
Sanganahalli	104	S3rg	S3rg	S3rg	S2g	S2g	S3g	S2g	S3g	S3g	S2rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2g	S2g	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg
Sanganahalli	105	S3rg	S3rg	S3rg	S2g	S2g	S3g	S2g	S3g	S3g	S2rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2g	S2g	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg
Sanganahalli	106	S3rg	S3rg	S3rg	S2g	S2g	S3g	S2g	S3g	S3g	S2rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2g	S2g	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg
Sanganahalli	107	S3rg	S3rg	S3rg	S2g	S2g	S3g	S2g	S3g	S3g	S2rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2g	S2g	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg
Sanganahalli	108	S3rg	S3rg	S3rg	S2g	S2g	S3g	S2g	S3g	S3g	S2rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2g	S2g	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg
Sanganahalli	109	S3rg	S3rg	S3rg	S2g	S2g	S3g	S2g	S3g	S3g	S2rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2g	S2g	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg
Sanganahalli	110	S2t	S2t	S3t	S2t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	Nt	S2t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t
Sanganahalli	111	S3rg	S3rg	S3rg	S2g	S2g	S3g	S2g	S3g	S3g	S2rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2g	S2g	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg
Sanganahalli	112	S3rg	S3rg	S3rg	S2g	S2g	S3g	S2g	S3g	S3g	S2rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2g	S2g	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg
Sanganahalli	113	S2t	S2t	S3t	S2t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	Nt	S2t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t
Sanganahalli	114	S2t	S2t	S3t	S2t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t	S2t	S2t	S3t	S2t	S2t	S2t	Nt	S2t	S2t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t
Sanganahalli	115	S2t	S2t	S3t	S2t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t	S2t	S2t	S3t	S2t	S2t	S2t	Nt	S2t	S2t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t
Sanganahalli	116	S2t	S2t	S3t	S2t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t	S2t	S2t	S3t	S2t	S2t	S2t	Nt	S2t	S2t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t
Sanganahalli	117	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g	S3g	S3g	S2g
Sanganahalli	118	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g	S3g	S3g	S2g

Village	Survey No	Sorgham	Fodder Sorghum	Maize	UplandPaddy	Finger Millet	Redgram	Horsegram	Field-bean	Cowpea	Groundnut	Sunflower	Onion	Chilly	Brinjal	Tomato	Mango	Sapota	Guava	Pomegranate	Banana	Jackfruit	Jamun	Musambi	Lime	Cashew	Custard-apple	Amla	Tamarind	Marigold	Chrysanthemum	Jasmine	Coconut	Arecanut	Mulberry
Sanganahalli	119	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g	S3g	S3g	S2g
Sanganahalli	120	S2t	S2t	S3t	S2t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t	S2t	S2t	S3t	S2t	S2t	S2t	Nt	S2t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t
Sanganahalli	121	S2t	S2t	S3t	S2t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t	S2t	S2t	S3t	S2t	S2t	S2t	Nt	S2t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t
Sanganahalli	122	S2t	S2t	S3t	S2t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t	S2t	S2t	S3t	S2t	S2t	S2t	Nt	S2t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t
Sanganahalli	123	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g	S3g	S3g	S2g
Sanganahalli	124	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g	S3g	S3g	S2g
Sanganahalli	125	S2t	S2t	S3t	S2t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t	S2t	S2t	S3t	S2t	S2t	S2t	Nt	S2t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t
Sanganahalli	126	S2t	S2t	S3t	S2t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t	S2t	S2t	S3t	S2t	S2t	S2t	Nt	S2t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t
Sanganahalli	127	S2t	S2t	S3t	S2t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t	S2t	S2t	S3t	S2t	S2t	S2t	Nt	S2t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t
Sanganahalli	128	S2t	S2t	S3t	S2t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t	S2t	S2t	S3t	S2t	S2t	S2t	Nt	S2t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t
Sanganahalli	129	S2t	S2t	S3t	S2t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t	S2t	S2t	S3t	S2t	S2t	S2t	Nt	S2t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t
Sanganahalli	130	S2t	S2t	S3t	S2t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t	S2t	S2t	S3t	S2t	S2t	S2t	Nt	S2t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t
Sanganahalli	131	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Sanganahalli	132	S2t	S2t	S3t	S2t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t	S2t	S2t	S3t	S2t	S2t	S2t	Nt	S2t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t
Sanganahalli	133	S2t	S2t	S3t	S2t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t	S2t	S2t	S3t	S2t	S2t	S2t	Nt	S2t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t
Sanganahalli	134	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Sanganahalli	135	S2t	S2t	S3t	S2t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t	S2t	S2t	S3t	S2t	S2t	S2t	Nt	S2t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t
Sanganahalli	136	S2t	S2t	S3t	S2t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t	S2t	S2t	S3t	S2t	S2t	S2t	Nt	S2t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t
Sanganahalli	137	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Sanganahalli	138	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S2t	S2t
Sanganahalli	139	S2t	S2t	S3t	S2t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t	S2t	S2t	S3t	S2t	S2t	S2t	Nt	S2t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t
Sanganahalli	140	S2t	S2t	S3t	S2t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t	S2t	S2t	S3t	S2t	S2t	S2t	Nt	S2t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t
Sanganahalli	141	S2t	S2t	S3t	S2t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t	S2t	S2t	S3t	S2t	S2t	S2t	Nt	S2t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t
Sanganahalli	142	S2t	S2t	S3t	S2t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t	S2t	S2t	S3t	S2t	S2t	S2t	Nt	S2t	S2t	S2t	S2t	S2t	S2t	S3t	S3t	S3t

PART-B

SOCIO-ECONOMIC STATUS OF FARM HOUSEHOLDS

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Chapter 1

EXECUTIVE SUMMARY

Baseline socioeconomic characterisation is prerequisite to prepare action plan for program implementation and to assess the project performance before making any changes in the watershed development program. The baseline provides appropriate policy direction for enhancing productivity and sustainability in agriculture.

Methodology: *Sanganahalli micro-watershed (Bangihalli sub-watershed, Gubbi taluk, Tumkur district) is located in between $13^0$26' – $13^0$27' North latitudes and $76^0$51'–$76^0$53' East longitudes, covering an area of about 513.42 ha, bounded by Madhenahalli, Chelur, Harehalli and Sanganahalli villages. With an length of growing period (LGP) 120-150 days. We used soil resource map as basis for sampling farm households to test the hypothesis that soil quality influence crop selection, and conservation investment of farm households. The level of technology adoption and productivity gaps and livelihood patterns were analyses. The cost of soil degradation and ecosystem services were quantified.*

Results: *The socio-economic outputs for the Sanganahalli Microwatershed (Bangihalli sub-watershed, Gubbi taluk and Tumkur district) presented here.*

Social Indicators;

- *Male and female ratio is 46.6 to 53.3 per cent to the total sample population.*
- *Younger age 18 to 50 years group of population is around 55.5 per cent to the total population.*
- *Literacy population is around 79.4 per cent.*
- *Social groups belong to other backward caste (OBC) is around 55.0 per cent.*
- *Light petroleum gas (LPG) is the source of energy for a cooking among 70.0 per cent.*
- *About 27.2 per cent of households have a yashaswini health card.*
- *Majority of farm households (50.0 %) are having MGNREGA card for rural employment.*
- *Dependence on ration cards for food grains through public distribution system is around 90.0 per cent.*
- *Swach bharath program providing closed toilet facilities around 90.0 per cent of sample households.*
- *Institutional participation is only 2.2 per cent of sample households.*
- *Rural migration to unban centre for employment is prevalent among 10.5 per cent of farm households.*
- *Women participation in decisions making for agriculture production among all households.*

Economic Indicators;

- *The average land holding is 0.8 ha indicates that majority of farm households are belong to marginal and small farmers. The dry land of 61.9 % and irrigated land 38.1 % of total cultivated land area among the sample farmers.*
- *Agriculture is the main occupation among 64.5 per cent and agriculture is the main agriculture labour is subsidiary occupation for 33.3 per cent of sample households.*
- *The average value of domestic assets is around Rs. 11595 per household. Mobile and television are popular media mass communication.*
- *The average value of farm assets is around Rs. 8398 per household, about 60.0 per cent of sample farmers having weeder and sprayer (30.0 %).*
- *The average value of livestock is around Rs. 23339 per household; about 52.8 per cent of household are having livestock.*
- *The average per capita food consumption is around 683.8 grams (1482.2 kilo calories) against national institute of nutrition (NIN) recommendation at 827 gram. Around 90.0 per cent of sample households are consuming less than the NIN recommendation.*
- *The annual average income is around Rs. 41297 per household. About 70.0 per cent of farm households are above poverty line.*
- *The per capita average monthly expenditure is around Rs. 1012.*

Environmental Indicators-Ecosystem Services;

- *The value of ecosystem service helps to support investment to decision on soil and water conservation and in promoting sustainable land use.*
- *The onsite cost of different soil nutrients lost due to soil erosion is around Rs. 350 per ha/year. The total cost of annual soil nutrients is around Rs. 177305 per year for the total area of 513.1 ha.*
- *The average value of ecosystem service for food grain production is around Rs. 57854/ ha/year. Per hectare food grain production services is maximum in coconut (Rs. 58886) followed by the mango (Rs. 56822), ragi (Rs. 8191), horse gram (Rs. 4381) and red gram (Rs. 1564).*
- *The average value of ecosystem service for fodder production is around Rs. 1893/ ha/year. Per hectare fodder production services is maximum in ragi (Rs. 2305) and horse gram (Rs. 1482).*
- *The data on water requirement for producing one quintal of grain is considered for estimating the total value of water required for crop production. The per hectare value of water used and value of water was maximum in coconut (Rs. 343185) followed by red gram (Rs. 67233), mango (Rs. 23323) and horse gram (Rs. 20907).*

Economic Land Evaluation;

- *The major cropping pattern is ragi (33.2 %) followed by mango (28.2 %), coconut (19.2 %), horse gram (13.3%) and red gram (6.1 %).*
- *In Sanganahalli Microwatershed, major soils are Bidanagere (BDG) series is having moderately deep soil depth cover around 22.2 % of area. On this soil farmers are presently growing coconut (20.1 %) and mango (79.9 %). Niduvalalu (NDL) is also having very deep soil depth cover 16.8 % of area, the crops are coconut (69.1 %) and horse gram (30.9 %). Ranatur (RTR) soil series having very deep soil depth cover around 35.5 % of areas, crops are coconut (50.0 %) and mango (50.0 %) and Thondigere (TDG) soil series having very deep soil depth cover around 22.9 % of area, crops are coconut (25.2 %), horse gram (18.7 %), ragi (46.7 %) and red gram (9.3 %).*
- *The total cost of cultivation and benefit cost ratio (BCR) in study area for coconut ranges between Rs.90395/ha in NDL soil (with BCR of 1.95) and Rs.19835 /ha in RTR soil (with BCR of 4.48).*
- *In mango the cost of cultivation range between Rs 17724/ha in BDG soil (with of 5.79) and Rs17166/ha in RTR soil (with BCR of 4.32).*
- *In horse gram the cost of cultivation cost of cultivation ranges between Rs. 27090/ha in NDL soil (with BCR of 1.01) and Rs. 11695/ha in TDG soil (with BCR of 1.95).*
- *In ragi cost of cultivation in TDG soil is Rs. 20625/ha (with BCR of 1.61) and in red gram the cost of cultivation in TDG soil is Rs. 47836/ha (with BCR of 1.0.3).*
- *The land management practices reported by the farmers are crop rotation, tillage practices, fertilizer application and use of farm yard manure (FYM). Due to higher wages farmer are following labour saving strategies is not prating soil and water conservation measures. Less ownership of livestock limiting application of FYM.*
- *It was observed soil quality influences on the type and intensity of land use. More fertilizer applications in deeper soil to maximize returns.*

Suggestions;

- *Involving farmers is watershed planning helps in strengthing institutional participation.*
- *The per capita food consumption and monthly income is very low. Diversifying income generation activities from crop and livestock production in order to reduce risk related to drought and market prices.*
- *Majority of farmers reported that they are not getting timely support/extension services from the concerned development departments.*

- *By strengthing agricultural extension for providing timely advice improved technology there is scope to increase in net income of farm households.*
- *By adopting recommended package of practices by following the soil test fertiliser recommendation, there is scope to increase yield in coconut (36.6 to 59.3 %), horse gram (24.1 to 36.7 %), mango (86.1 to 87.3 %) and ragi (60.9 %).*

Chapter 2

INTRODUCTION

Watershed Development program aim to restore degraded watersheds in rainfed regions to increase their capacity to capture and store rain water, reduce soil erosion, and improved soil nutrients and carbon contents so they can produce greater agricultural yields and other benefits. As majority of rural poor live in these regions and dependent on natural resources for their livelihood and sustenance, improvements in agricultural yields improve human welfare and simultaneously improve national food security.

Sujala–III watershed development project conceptualised and implemented by the Watershed Development Department of Government of Karnataka with tripartite cost-sharing arrangements. The World Bank through International Development Association provided major portion of plan outlay as a loan to Government of India and in turn loan to Government of Karnataka.

The objectives of Sujala-III is to demonstrate more effective watershed management through greater integration of programs related to rain fed agriculture, innovative and science based approaches and strengthened institutions and capacities. The project is implemented in 11 districts of Bidar, Vijayapura, Gulbarga, Yadgir, Koppal, Gadag, Raichur, Davanagere, Tumkur, Chikkamangalur and Chamarajanagar which have been identified by the Watershed Development Department based on rainfall and socio-economic conditions. The project will be implemented over six years and linked with the centrally financed integrated watershed management programme.

Economic evaluations can better guide in watershed planning and implementation, as well as raise awareness of benefits of ecosystem restoration for food security and poverty alleviation program. The present study aims to characterize socio-economic status of farm households, assess the land and water use status, evaluate the economic viability of land use, prioritize farming constraints and suggest the measures for soil and water conservation for sustainable agriculture.

Objectives of the study

1. To characterize socio-economic status of farm households
2. To evaluate the economic viability of land use and land related constraints
3. To estimate the ecosystem service provided by the watershed and
4. To suggest alternatives for sustainable agriculture production.

Chapter 3

METHODOLOGY

Study area

Sanganahalli micro-watershed is located in Eastern Dry Zone of Karnataka (Figure 1): The zone covers entire Bangalore and Kolar districts and 2 taluks of Tumkur. It has an area of 1.80 M ha with 0.85 M ha under cultivation. About 0.23 M ha are irrigated mainly from tanks and wells. Elevation ranges from 800 to 1500m MSL with major area falling between 800 and 900 m. The major soil type is non-gravelly red loam with a narrow belt of lateritic soil. Average annual rainfall ranges between 680 and 890mm. The principal crops of the zone are ragi, rice, pulses, maize, oil seeds and mulberry. A sizeable area is also under vegetables and flowering plants. It's represented Agro Ecological Region (AER) – 3 having LGP 120-150 days.

Sanganahalli micro-watershed (Bangihalli sub-watershed, Gubbi taluk, Tumkur district) is located in between $13^0$26' – $13^0$27' North latitudes and $76^0$51'– $76^0$53' East longitudes, covering an area of about 513.42 ha, bounded by Madhenahalli, Chelur, Harehalli and Sanganahalli villages.

Sampling Procedure:

In this study we have followed soil variability as criterion for sampling the farm households. In each micro-watershed the survey numbers and associated soil series are listed. Minimum three farm households for each soil series were taken and summed up to arrive at total sample for analysis. Sources of data and analysis:

Sources of data and analysis:

For evaluating the specific objectives of the study, primary data was collected from the sample respondents by personal interview method with the help of pre-tested questionnaire. The data on socio-economic characteristics of respondents such as family size and composition, land holdings, asset position, occupational pattern and education level was collected. The present cropping pattern and the level of input use and yields collected during survey. The data collected from the representative farm households were analysed using Automated Land Potential Evaluation System (Figure 2).

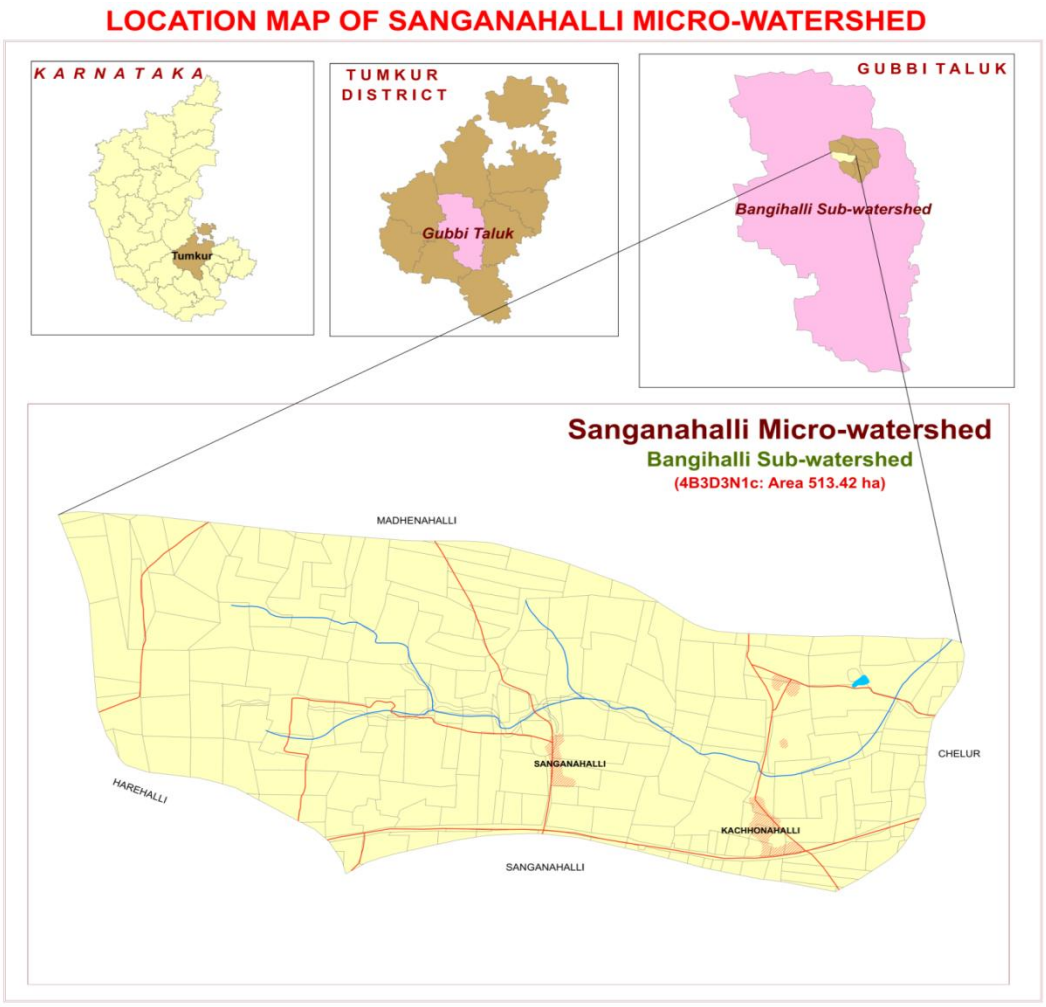


Figure 1: Location of study area

Steps followed in socio-economic assessment

1. •After the completion of soil profile study link the cadastral number to the soil profile in the micro watershed.
2. • Download the names of the farmers who are owning the land for each cadastral number in the Karnataka BHOOMI Website.
3. • Compiling the names of the farmers representing for all the soil profiles studied in the micro watershed for socio-economic Survey.
4. • Conducting the socioeconomic survey of selected farm households in the micro watershed .
5. • Farm households database created using the Automated Land Potential Evaluation System (ALPES) for analysis of socio economic status for each micro watershed .
6. • Synthesis of tables and preparation of report for each micro watershed .

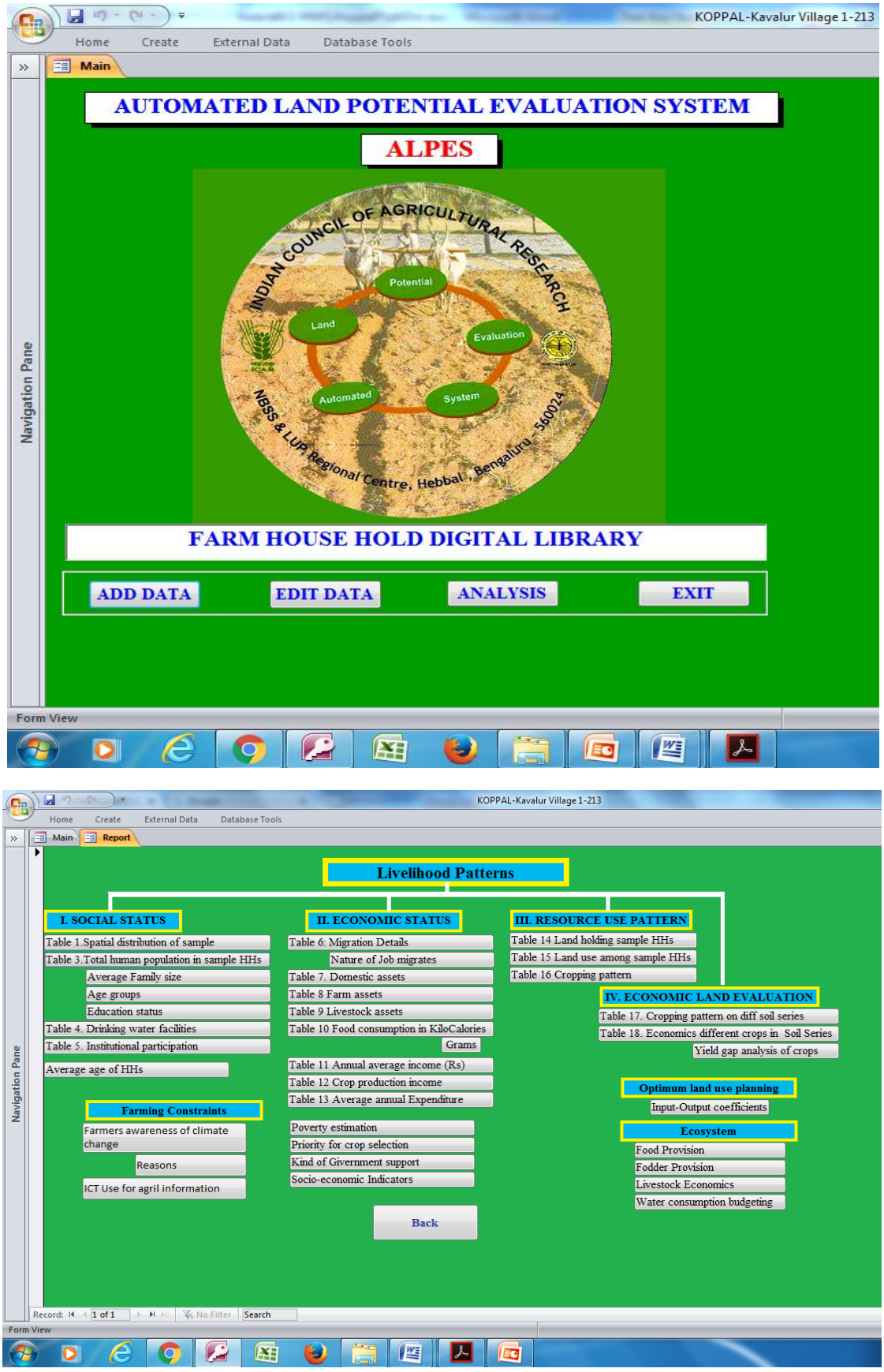


Figure 2: ALPES FRAMEWORK

The sample farmers were post classified in to marginal and small (0.0 to <=2 ha), medium and semi medium (>2 to <=10 ha) and large (>10 ha). The steps involved in estimation of soil potential involve estimation of total cost of cultivation, the yield/gross returns and net income per hectare. The cost of inputs such seed, manure and fertilizer, plant protection chemicals, payment towards human and bullock labour and interest on working capita are included under operational costs. In the case of perennial crops, the cost of establishment was estimated by using actual physical requirements and prevailing market prices. Estimation cost included maintenance cost up to bearing period. The value of main product and by product from the crop enterprise at the market rates were the gross returns of the crop. Net returns were worked out by deducting establishment and maintained cost from gross returns.

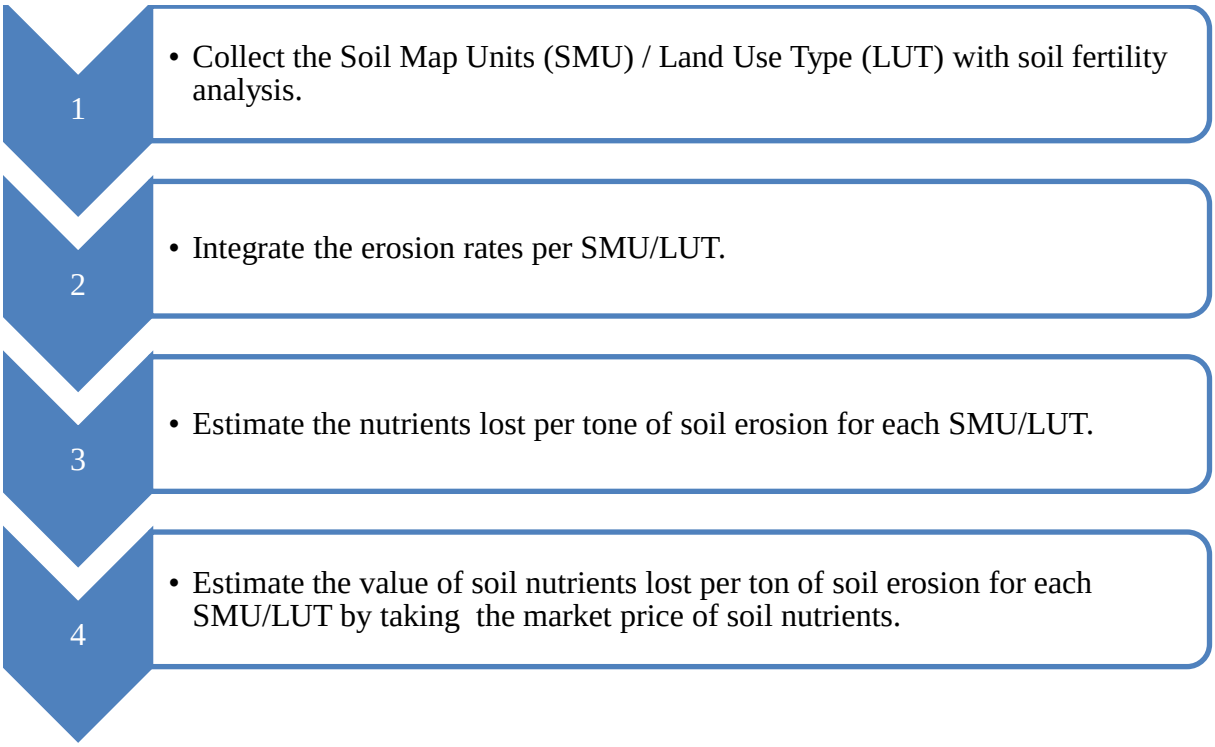
Operational Cost = cost of seeds, fertilizers, pesticides. Cost of human and bullock labour, cost of machinery, cost of irrigation water + interest on working capital.
Gross returns = Yield (Quintals/hectare)*Price (Rs/Quintal)
Net returns = Gross returns-Operational cost.
Benefit Cost Ratio = Net returns/Total cost.

Economic suitability classes: once each land use –land area combination has been assigned an economic value by the land evaluation, the question arises as to its 'suitability', that is, the degree to which it satisfies the land user. The FAO framework defines two suitability orders: 'S'(suitable if benefit cost ratio (BCR)>1) and 'N'(not suitable if (BCR<1), which are dived into five economic suitability classes:'S1'(highly suitable if BCR>3), 'S2'(suitable if BCR>2 and <3),'S3'(Marginally suitable if BCR >1 and <2), 'N1'(Not suitable for economic reasons but physically suitable) and 'N2'(not suitable for physical reasons). The limit between 'S3' and 'N1'must be at least at the point of financial feasibility (i.e. net returns, NPV, or IRR>0 and BCR>1). The other limits depend on social factors such as farm size, family size, alternative employment or investment possibilities and wealth expectations; these need to be specified for the Soil series.

Economic Valuation of Soil ecosystem services:

The replacement cost approach was followed for estimating the onsite cost of soil erosion, Market price method was followed for estimating the value of food and fodder production. Value transfer menthods was followed for estimating the value of water demand by different crops in the micro watershed.

Steps followed in Replacement cost methods for estimation of onsite cost of soil erosion



Chapter 4

RESULTS AND DISCUSSIONS

The demographic information shows that the household population dynamics encompasses the socioeconomic status of the farmer. For a rural family, the household size should be optimal to earn a comfortable livelihood through farm and non-farm wage earning. The total number of population in watershed area was 45, out of which 46.6 per cent were males and 53.3 per cent females. Average family size of the households is 4.5. Age is an important factor, which affects the potential employment and mobility status of respondents. The data on age wise distribution of farmers in the sample households indicated that majority of the farmers are coming under the age group of followed by 0 to18 years (13.3) 18 to 30 years (24.4 %) 30 to 50 years (31.1 %) and more than 50 years (31.1 %). Hence, in the study area in general, the respondents were of young and middle age, indicating thereby that the households had almost settled with whatever livelihood options they were practicing and sample respondents were young by age who could venture into various options of livelihood sources. Data on literacy indicated that 21.6 per cent of respondents were illiterate and 79.4 per cent literate (Table 1).

Table 1: Human population among sample households in Sanganahalli Microwatershed

Particulars	**Units**	**Value**
Total human population in sample HHs	Number	45
Male	% to total Population	46.6
Female	% to total Population	53.3
Average family size	Number	4.5
Age group		
0 to 18 years	% to total Population	13.3
18 to 30 years	% to total Population	24.4
30 to 50 years	% to total Population	31.1
>50 years	% to total Population	31.1
Average age	Age in years	39.7
Education Status		
Illiterates	% to total Population	21.6
Literates	% to total Population	79.4
Primary School (<5 class)	% to total Population	23.0
Middle School (6- 8 class)	% to total Population	14.1
High School (9- 10 class)	% to total Population	18.8
Others	% to total Population	28.21

The ethnic groups among the sample farm households found to be 50.0 per cent belonging to other backward castes (OBC) followed by 50.0 per cent belonging to general

castes, scheduled caste (SC), 9.4 per cent and scheduled tribe (ST) 3.4 per cent (Table 2 and Figure 3). About 70.0 per cent of sample households are using fire LPG as source of fuel for cooking. All the sample farmers are having electricity connection. About 27.2 per cent are sample households having health cards. Majority (50 %) are having MNREGA job cards for employment generation. About 90.0 per cent of farm households are having ration cards for taking food grains from public distribution system. About 90.0 per cent of farm households are having toilet facilities.

Table 2: Basic needs of sample households in Sanganahalli Microwatershed

Particulars	**Units**	**Value**
Social groups		
SC	% of Households	9.4
ST	% of Households	3.4
OBC	% of Households	55.0
General	% of Households	32.1
Types of fuel use for cooking		
Gas	% of Households	70.0
Fire Wood	% of Households	30.0
Energy supply for home		
Electricity	% of Households	100
Number of households having Health card		
Yes	% of Households	27.2
No	% of Households	72.7
MGNREGA Card		
Yes	% of Households	50.0
No	% of Households	50.0
Ration Card		
Yes	% of Households	90.0
No	% of Households	10.0
Households with toilet		
Yes	% of Households	90.0
No	% of Households	10.0
Drinking water facilities		
Tube well	% of Households	60.0
Tank	% of Households	40.0

The data collected on the source of drinking water in the study area is presented in Table 2. Majority of the sample respondents are having tube well source for water supply for domestic purpose (60%) and 40 per cent of tank.

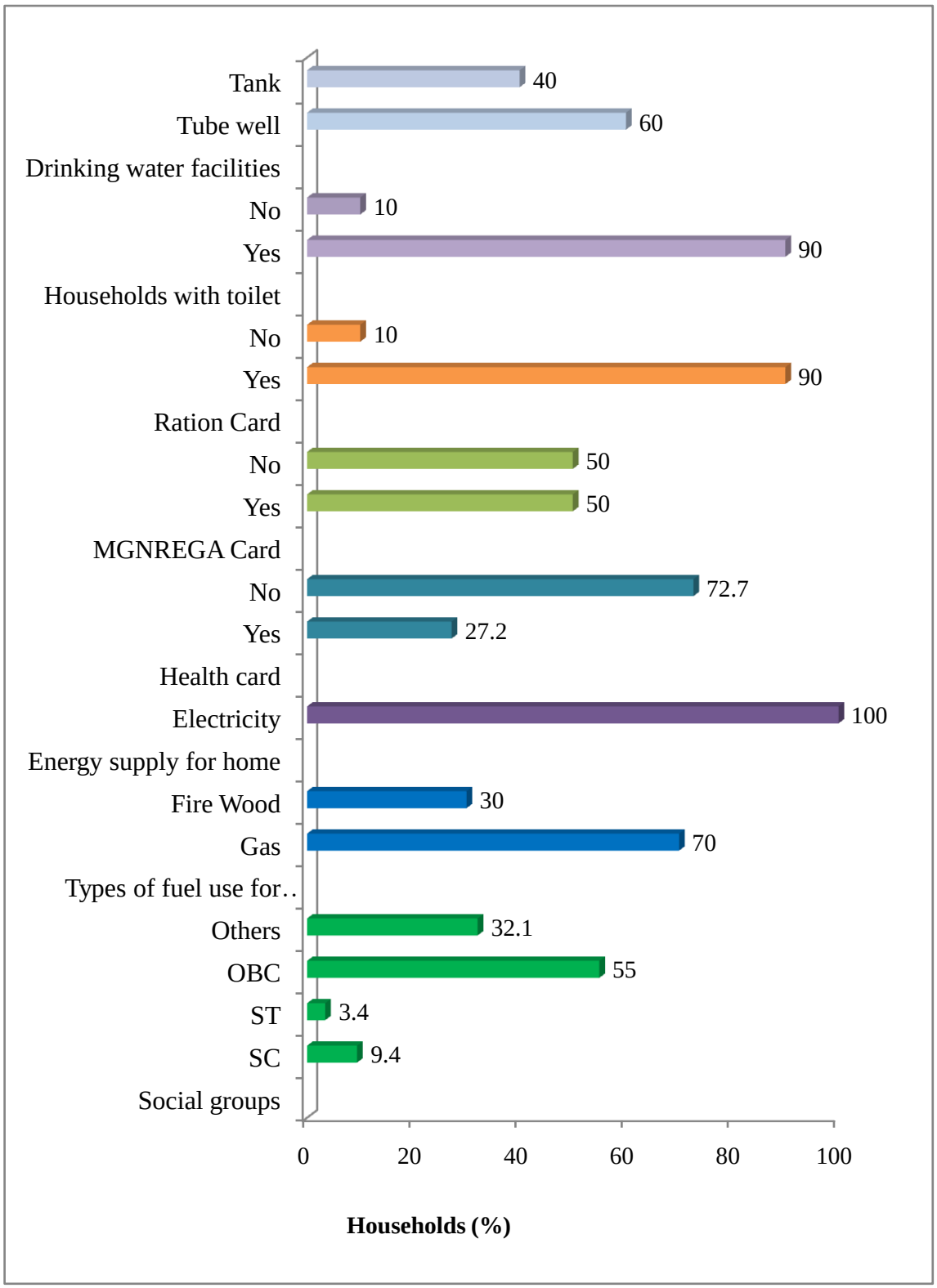


Figure 3: Basic needs of sample households in Sanganahalli Microwatershed

Only 2.2 percent of the farmers are participating in community based organizations is marketing co-operatives societies (Table 3).

Table 3: Institutional participation among the sample population in Sanganahalli Microwatershed

Particulars	Units	Value
No. Of people participating	% to total	2.2
Co-operative Societies-Marketing	% to total	2.2
No. Of people not participating	% to total	97.7

The data on migration in Sanganahalli Micro-watershed is given in Table 4. It indicated that around 10.5 percent of samples households were migrated. The average distance travelled for seeking employment is100 km.

Table 4: Migration details among the sample households in Sanganahalli Microwatershed

Particulars	Value
% of households showing migration	10.5
% of persons migrating	5.3
No. of months migrated in a year	12.0
Average Distance of migration(Km)	100
Nature of job (%)	
Job/wage/work	100

The occupational pattern (Table 5) among sample households shows that agriculture is the main occupation around 64.5 percent of farmers followed by subsidiary occupations like agricultural labour (33.3 %) and private services is 2.2 per cent.

Table 5: Occupational pattern in sample population in Sanganahalli Microwatershed

Occupation		% to total
Main	Subsidiary	
Agriculture	Agriculture	64.5
	Agriculture Labour	33.3
	Private service	2.2
Family labour availability		**Man days/month**
Male		37.5
Female		30.0
Total		67.5

The important assets especially with reference to domestic assets were analyzed and are given in Table 6 and Figure 4. The important domestic assets possessed by all categories of farmers are mobile phones (100 %) followed by television (90.0 %), motorcycle (50.0 %) and radio (10.0 %). The average value of domestic assets is around Rs 11594 per households.

Table 6: Domestic assets among the sample households in Sanganahalli Microwatershed

Particulars	% of households	Average value in Rs
Mixer/grinder	90.0	2944
Mobile Phone	100.0	3250
Motor cycle	50.0	43000
Radio	10.0	1000
Television	90.0	7778
Average value	11594	

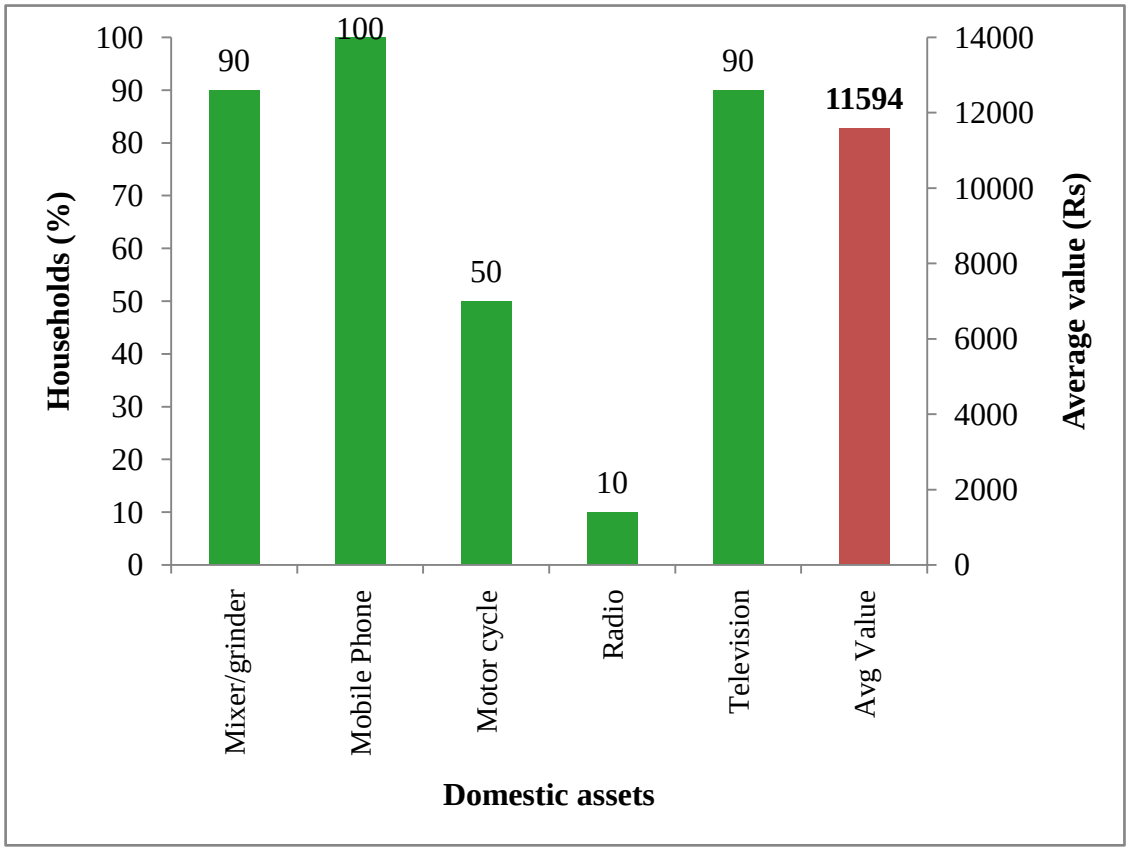


Figure 4: Domestic assets among the sample households in Sanganahalli Micro watershed

The most popularly owned farm equipments were sickles, plough, cattle shed; pump sets, chaff cutter, bullock cart, sprayer and thresher. Plough and sickle were commonly present in all the sampled farmers; these were primary implements in agriculture. The per cent of households owned weeder (60.0 %), sprayer (30 %), plough (20.0 %), bullock cart (20.0 %) and seeds cum fertiliser drill (20.0 %). The average value of farm asset is Rs. 8398 per household (Table 7 and Figure 5).

Table 7: Farm assets among samples households in Sanganahalli Microwatershed

Particulars	% of households	Average value in Rs
Weeder	60.0	190
Sprayer	30.0	5000
Seed Cum fertiliser drill	20.0	15000
Plough	20.0	1800
Bullock cart	20.0	20000
Average value	8398	

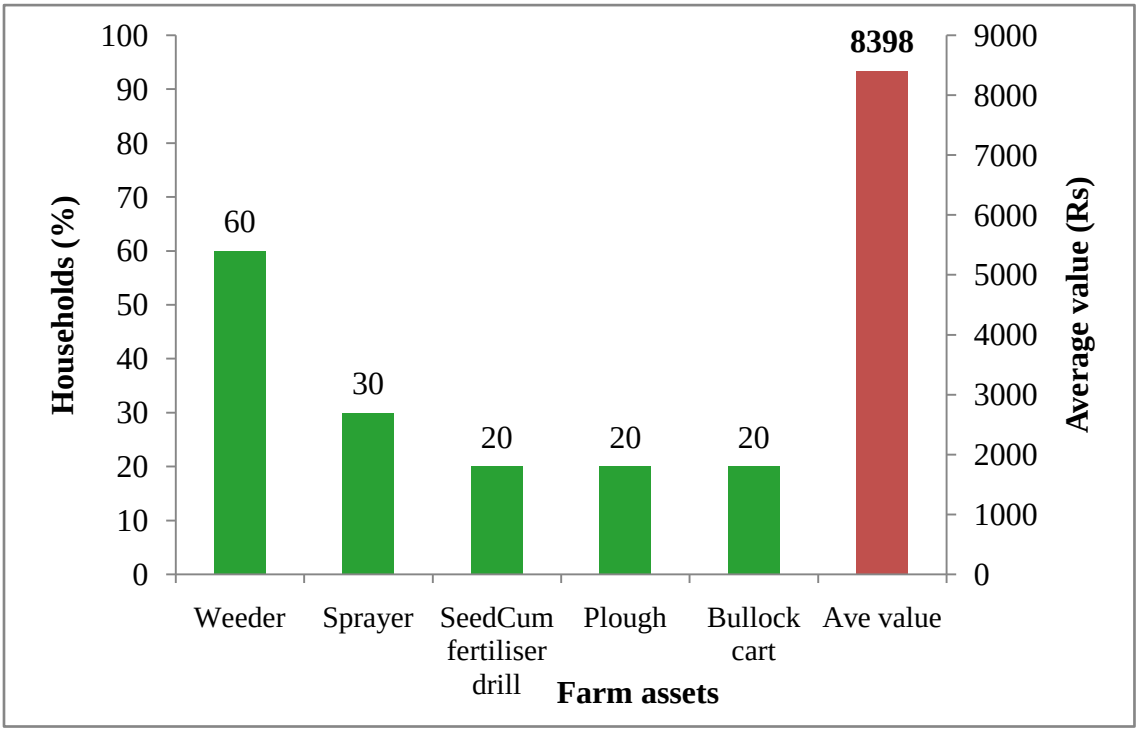


Figure5: Farm assets among samples households in Sanganahalli Microwatershed

Livestock is an integral component of the conventional farming systems (Table 8 and Figure 6). The highest livestock population crossbred milching cow is were around 58.3 per cent followed by local dry cow (16.7 %), crossbred dry cow (16.7 %) and local milching cow around 8.3 per cent. The average value of livestock was Rs.31750 per household.

Table 8: Livestock assets among sample households in Sanganahalli Microwatershed

Particulars	% of livestock population	Average value in Rs
Local Dry Cow	16.7	10500
Local Milching Cow	8.3	20000
Crossbred Dry Cow	16.7	20000
Crossbred Milching Cow	58.3	42857
Average value	23339	

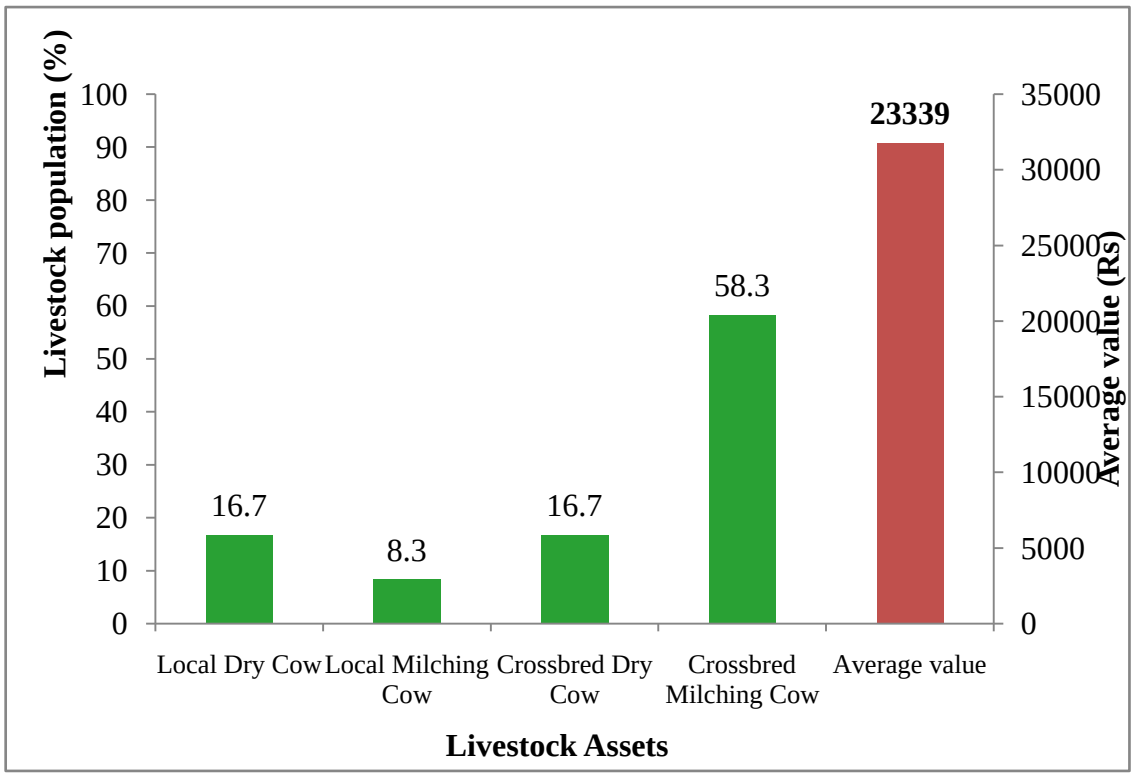


Figure 6: Livestock assets among sample households in Sanganahalli Microwatershed

Average milk produced in sample households is 640 litters/ annum. Among the farm households, sorghum, Horsegram and Ragi are the main crops for domestic food and fodder for animals. About 2673 kg /ha of average fodder is available per season for the livestock feeding (Table 9).

Table 9: Milk produced and fodder availability of sample households in Sanganahalli Microwatershed

Particulars	
Name of the Livestock	**Ltr./Lactation/animal**
Crossbred Milching Cow	831
Local Milching Cow	450
Average Milk produced	784
Fodder produces	**Fodder yield (kg/ha.)**
Horsegram	1333
Ragi	4013
Average fodder availability	2673
Livestock having households (%)	100
Livestock population (Numbers)	21

A woman participation in decision making is in this Microwatershed is presented in Table 10. Among all sample housedolds women taking decision in her family and

agriculture related activities, 90.0 per cent women earning for her family requirement and only 10.0 per cent of women participation in local organization activities.

Table 10: Women empowerment of sample households in Sanganahalli Microwatershed

% to Grand Total

Particulars	**Yes**	**No**
Women participation in local organization activities	10.0	90.0
Women elected as panchayat member	0.0	100.0
Women earning for her family requirement	90.0	10.0
Women taking decision in her family and agriculture related activities	100.0	0.0

The food intake in terms of kilo calorie (kcal) per person per day was calculated and presented in the Table 11 and Figure 7. More quantity of cereals are consumed by sample farmers which accounted for 933.8 kcal per person. The other important food items consumed was pulses 147.3 kcal followed by cooking oil 190.7 kcal, milk 104.2 kcal, vegetables 29.0 kcal, egg 68.7 kcal and meat 8.1 kcal. In the sampled households, farmers were consuming less (1482.2 kcal) than NIN- recommended food requirement (2250 kcal).

Table 11: Per capita daily consumption of food among the sample households in Sanganahalli Microwatershed

Particulars	**NIN recommendation (gram/ per day/ person)**	**Present level of consumption (gram/ per day/ person)**	**Kilo Calories /day/person**
Cereals	396.0	274.6	933.8
Pulses	43.0	42.9	147.3
Milk	200.0	160.4	104.2
Vegetables	143.0	121.1	29.0
Cooking Oil	31.0	33.4	190.7
Egg	0.5	45.8	68.7
Meat	14.2	5.4	8.1
Total	**827.7**	**683.8**	**1482.2**
Threshold of NIN recommendation		827 gram*	2250 Kcal*
% Below NIN		90.0	100.0
% Above NIN		10.0	0.0

Note: * day/person

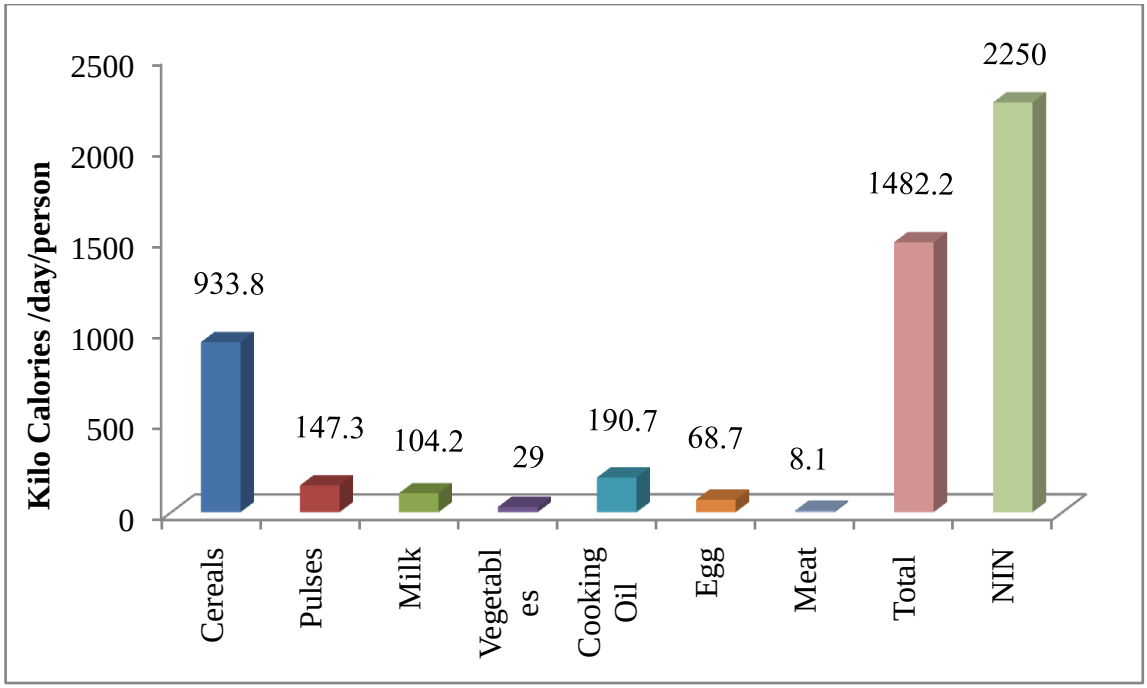


Figure 7: Per capita daily consumption of food among the sample households in Sanganahalli Microwatershed

Annual income of the sample HHs: The average annual household income is around Rs 41296. Major source of income to the farmers in the study area is from crop production (Rs 35138) followed by livestock (Rs.6157). The livestock income was very low at Rs 6157. The average monthly per capita income is Rs.764, which is less than the threshold monthly income of Rs 975 for considering above poverty line. Due to the fact that erratic rainfall and shortage of water, farmers are diverting from crop production activities to enable the household for a comfortable livelihood. The incomes from the other aforesaid sources are very meagre (Table 12).

Table12: Annual average income of HHs from various sources in Sanganahalli Microwatershed

Particulars	**Income ***
Nonfarm income (Rs)	0(0)
Livestock income (Rs)	6157(80)
Crop Production (Rs)	35138(100)
Total Annual Income (Rs)	41296
Average monthly per capita income (Rs)	764
Threshold for Poverty level (Rs 975 per month/person)	
% of households below poverty line	70.0
% of households above poverty line	30.0

* Figure in the parenthesis indicates % of Households

The average annual expenditure of farm households indicated that farmers in the study area spend highest on food (Rs.35268) followed by education, clothing, social function and health. Now a day's education is most important among all of us. In today's competitive world, education is a necessity for man after food, clothing, and shelter. It is the only fundamental way by which a desired change in the society can happen. The average per capita monthly expenditure is around Rs 1012 and about 70.0 per cent of farm households are below poverty line and 30.0 per of farm households are above poverty line (Table 13 and Figure 8).

Table 13: Average annual expenditure of sample HHs in Sanganahalli Microwatershed

Particulars	Value in Rupees	Per cent
Food	35268	64.5
Education	4500	8.2
Clothing	3950	7.2
Social functions	3550	6.5
Health	7400	13.5
Total Expenditure (Rs/year)	54668	100
Monthly per capita expenditure (Rs)	1012	

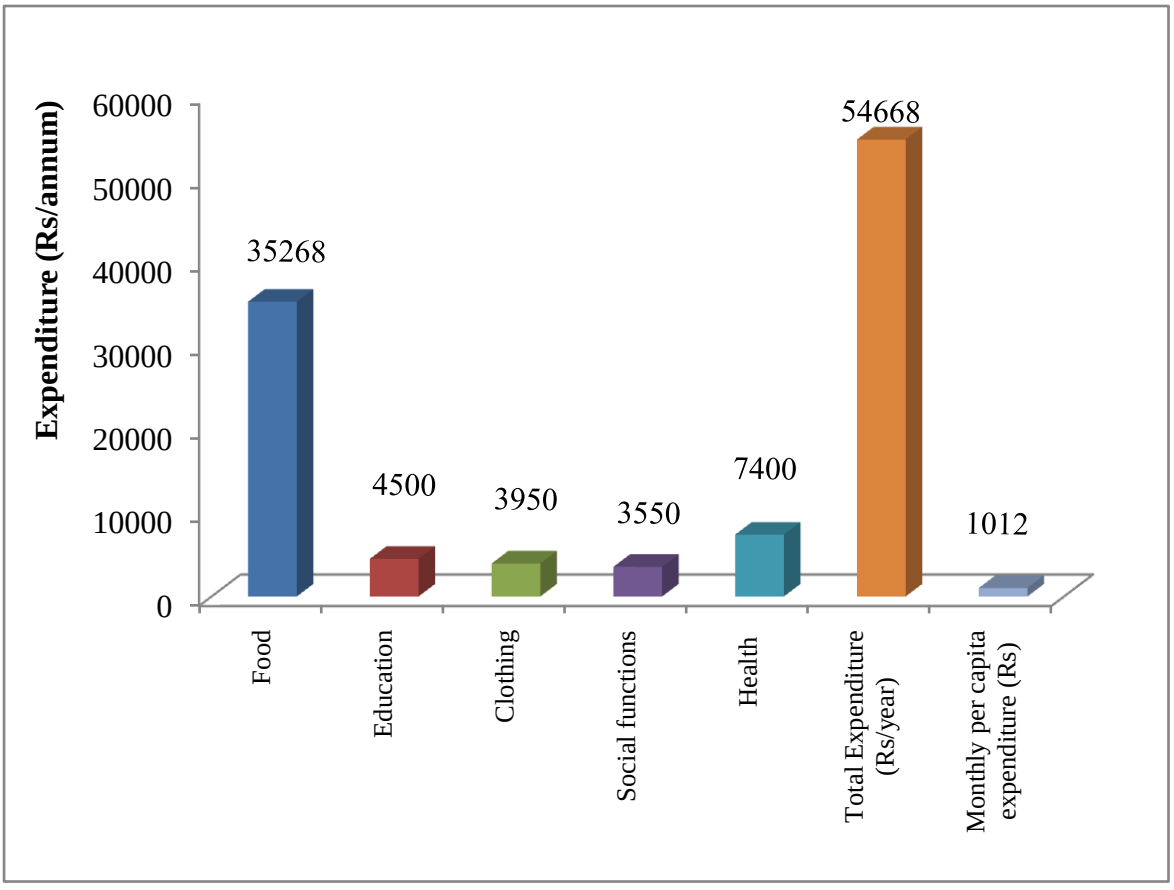


Figure 8: Average annual expenditure of sample HHs in Sanganahalli Microwatershed

Land use: The total land holding in the Sanganahalli Microwatershed is 7.8 ha (Table 14). Of which 4.8 ha is dry land and 3.0 ha is irrigated land. The average land holding per household is worked out to be 0.8 ha.

Table 14: Land use among samples households in Sanganahalli Microwatershed

Particulars	Per cent	Area in ha
Irrigated land	38.1	3.0
Dry land	61.9	4.8
Fallow Land	0.0	0.0
Total land holding	100.0	7.8
Average land holding	0.8	

In the Microwatershed, the prevalent present land uses under perennial plants are coconut (56.9 %) followed by neem (39.8%) and mango (3.2 %) (Table15).

Table 15: Number of trees/plants covered in sample farm households in Sanganahalli Microwatershed

Particulars	Number of Plants/trees	Per cent
Coconut	350	56.9
Neem trees	20	39.8
Mango	245	3.2

The land use decisions are usually based on experience of farmers, tradition, expected profit, personal preferences, resources and social requirements.

The present dominant crops grown in the study area were by mango (28.2 %) followed by coconut (19.2 %), ragi (8.8 %) and red gram (1.7 %) which are taken during Kharif and ragi (24.4 %), horse gram (13.3 %) and red gram (4.4 %) during rabi season respectively. The cropping intensity was 173 (Table 16 and Figure 9).

Table 16: Present cropping pattern and cropping intensity in Sanganahalli Microwatershed % to Grand Total

Crops	Kharif	Rabi	Grand Total
Coconut	19.2	0.0	19.2
Horse gram	0.0	13.3	13.3
Mango	28.2	0.0	28.2
Ragi	8.8	24.4	33.2
Redgram	1.7	4.4	6.1
Grand Total	57.9	42.1	100.0
Cropping intensity (%)	173		

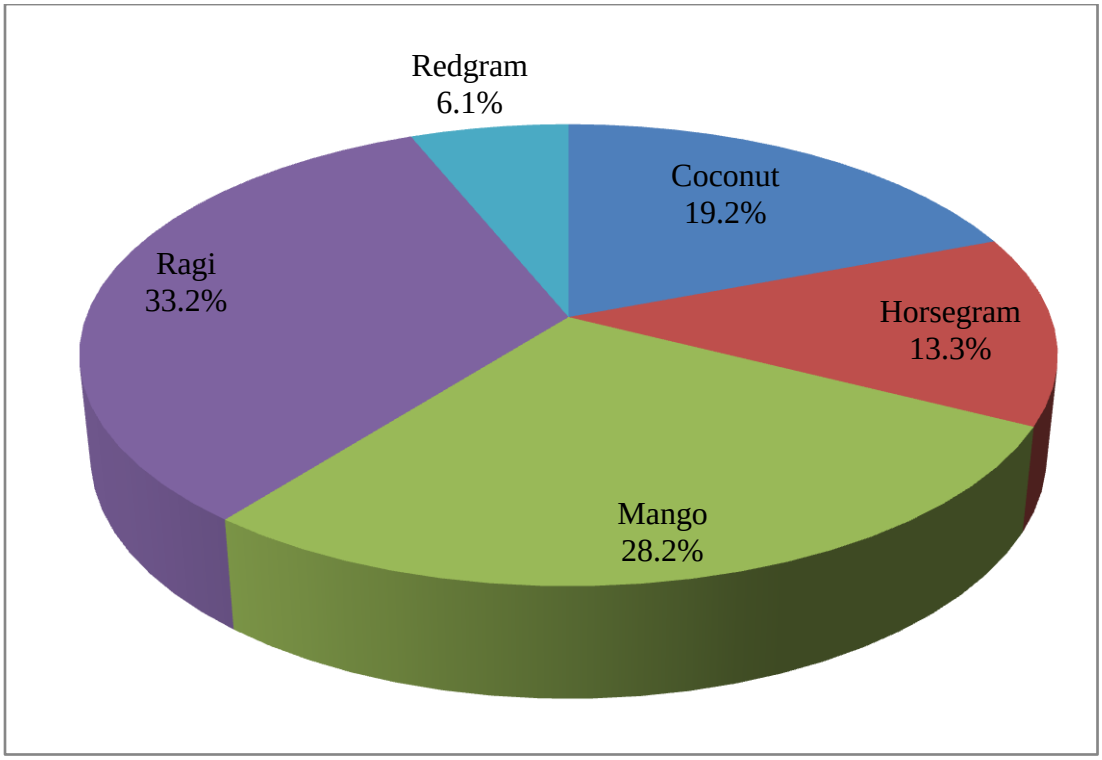


Figure 9: Present cropping pattern in Sanganahalli Microwatershed

Economic land evaluation

The main purpose of economic land evaluation in the watershed is to identify the existing production constraints and propose the potential/alternate options for agro-technology transfer and for bridging the adoption and yield gap.

In Sanganahalli Microwatershed, 6 soil series are identified and mapped (Table 17). The distribution of major soil series are Bidanagere covering an area around 114.ha (22.2%) followed by Balapura 3.0 ha (0.7 %), Hallikere 4 ha (0.7 %), Rantatur 182 ha (35.5 %), Naduvalau 86 ha (16.7 %) and Thondigere 117 ha (22.9 %).

Table 17: Distribution of soil series in Sanganahalli 1Microwatershed

Soil No	Soil Series	Mapping Unit Description	Area in ha (%)
SOILS OF GRANITE GNEISS LANDSCAPE			
1	BDG	Bidanagere soils are moderately deep (75-100 cm), well drained, have dark reddish brown gravelly sandy clay loam to sandy clay soils occurring on very gently sloping uplands under cultivation	114(22.2)
2	BPR	Balapur soils are deep (100-150 cm), well drained, have dark reddish brown to dark red gravelly sandy clay to clay soils occurring on very gently sloping uplands under cultivation	3 (0.7)

3	HLK	Hallikere soils are very deep (>150 cm), well drained, have dark brown to dark reddish brown clayey soils occurring on very gently sloping uplands under cultivation	4 (0.7)
4	RTR	Ranatur soils are very deep (>150 cm), well drained, have dark reddish brown to dark red clay soils occurring on very gently sloping uplands under cultivation	182(35.5)
5	NDL	Niduvalalu soils are very deep (>150 cm), well drained, have red to dark reddish brown gravelly sandy clay soils occurring on very gently sloping uplands under cultivation	86(16.7)
6	TDG	Thondigere soils are very deep (>150 cm), well drained, have dark brown to dark yellowish brown sandy loam to sandy clay soils occurring on very gently sloping lowlands under cultivation	117(22.9)
Other			6 (1.2)

Present cropping pattern on different soil series are given in Table 18. Crops grown on Bidenagere soils are coconut and mango. Coconut and horsegram on Niduvalalu soils is grown. Coconut and mango on Ranatur soils are grown. Coconut, horsegram, ragi and redgram on Tondigere soils are can grow.

Table 18: Cropping pattern on major soil series in Sanganahalli Micro-watershed

(Area in per cent)

Soil Series	**Soil Depth**	**Crops**	**Dry**		**Irrigated**		**Grand**
			Kharif	**Rabi**	**Kharif**	**Rabi**	**Total**
BDG	Moderately deep (75-100 cm)	Coconut	0.0	0.0	20.1	0.0	20.1
		Mango	79.9	0.0	0.0	0.0	79.9
NDL	Very deep (>150 cm)	Coconut	69.1	0.0	0.0	0.0	69.1
		Horsegram	0.0	30.9	0.0	0.0	30.9
RTR	Very deep (>150 cm)	Coconut	0.0	0.0	50.0	0.0	50.0
		Mango	0.0	0.0	50.0	0.0	50.0
TDG	Very deep (>150 cm)	Coconut	0.0	0.0	13.0	12.2	25.2
		Horsegram	0.0	18.7	0.0	0.0	18.7
		Ragi	18.7	9.3	0.0	18.7	46.7
		Redgram	0.0	9.3	0.0	0.0	9.3

Land is used for agricultural use for growing cereals, pulse, oilseeds and commercial crops. The soil/ land potential are measures in terms of physical yield and net income. The alternative land use options for each micro-watershed are given below (Table 19)

Table 19: Alternative land use options for different size group of farmers (Benefit Cost Ratio) in Sanganahalli Microwatershed

Soil Series	Small Farmers
BDG	Coconut (3.21) & Mango (5.79)
NDL	Coconut (1.95) & Horse gram (1.01)
RTR	Coconut (4.48) & Mango (4.32)
TDG	Coconut (1.61), Horse gram (1.95), Ragi (1.61) & Redgram (1.03)

The productivity of different crops grown in Sanganahalli micro-watershed under potential yield of the crops is given in Table 20.

The data on cost of cultivation and benefit cost ratio (BCR) of different crops is given in Table 20. The total cost of cultivation in study area for coconut ranges between Rs.90395 /ha in NDL soil (with BCR of 1.95) and Rs.19835/ha in RTR soil (with BCR of 4.48), mango range between Rs 17166/ha in BDG soil (with of 5.79) and Rs.17166/ha in RTR soil (with BCR of 4.32), horse gram range between Rs. 27090/ha in NDL soil (with BCR of 1.01) and Rs. 11695/ha in TDG soil (with BCR of 1.95), ragi cost of cultivation in TDG soil is Rs.20625/ha (with BCR of 1.61) and red gram in TDG soil is Rs 47836/ha (with BCR of 1.03).

The data on FYM, Nitrogen, Phosphorus and Potash application by the farmers to different crops and recommended FYM for different crops is given in Table 20. There is a huge gap between FYM application by farmers and recommended FYM in all the crops across the soils. There is a larger yield gap in crops grown across different soil series. Adequate knowledge about recommended package of practices is the pre-requisite for their use in cultivation of crops. It is a fact that, recommended practices are major contributing factors to yield. Inadequate knowledge about recommended practices leads to their improper adoption. Strengthening of extension services by concerned agency is required to increase adoption of recommended cultivation practices and ultimately reducing the gap. By adopting soil-test fertiliser recommendation, there is scope to increase yield and income to a maximum of Rs 453271in mango and a minimum of Rs 9733 in horse gram cultivation.

Table 20: Economic land evaluation and bridging yield gap for different crops in Sanganahalli Microwatershed

Particulars	BDG (75-100cm)		RTR (>150 cm)		TDG (>150 cm)				NDL (>150 cm)	
	Coconut	Mango	Coconut	Mango	Coconut	Horsegram	Ragi	Redgram	Coconut	Horsegram
Total cost (Rs/ha)	41999	11724	19835	17166	88253	11695	20625	47836	90395	27090
Gross Return (Rs/ha)	134727	67826	88920	74100	126830	22848	31369	49400	129675	27417
Net returns (Rs/ha)	92728	56102	69085	56934	38577	11153	10744	1564	39280	327
BCR	3.21	5.79	4.48	4.32	1.61	1.95	1.61	1.03	1.95	1.01
Farmers Practices (FP)										
FYM (t/ha)	2.3	1.7	2.5	1.3	9.1	1.3	2.1	2.5	6.0	0.0
Nitrogen (kg/ha)	39.8	5.1	27.5	27.5	157.7	45.6	64.6	85.4	143.6	80.0
Phosphorus (kg/ha)	71.6	13.2	53.8	53.8	134.0	43.1	67.2	95.8	177.2	57.5
Potash (kg/ha)	19.3	34.3	29.4	29.4	30.0	0.0	25.0	50.0	59.0	0.0
Grain (Qtl/ha)	113.6	13.7	75.0	12.5	117.0	6.3	12.1	12.5	102.1	7.5
Price of Yield(Rs/Qtl)	1200	5000	1200	6000	1000	3500	2500	4000	1067	3500
Soil test based fertilizer Recommendation (STBR)										
FYM (t/ha)	10.0	61.8	10.0	61.8	10.0	0.0	8.6	7.4	10.0	0.0
Nitrogen (kg/ha)	102.5	185.3	102.5	185.3	102.5	24.7	74.1	24.7	119.6	30.9
Phosphorus (kg/ha)	48.8	37.1	48.8	37.1	48.8	27.8	32.4	37.1	48.8	27.8
Potash (kg/ha)	245.0	172.9	245.0	172.9	183.8	24.7	37.1	18.5	245.0	24.7
Grain (Qtl/ha)	184.5	98.8	184.5	98.8	184.5	9.9	30.9	12.4	184.5	9.9
% of Adoption/yield gap (STBR-FP) / (STBR)										
FYM (%)	77.3	97.2	75.0	98.0	9.4	0.0	75.9	66.3	40.3	0.0
Nitrogen (%)	61.2	97.2	73.2	85.2	-53.9	-84.7	12.8	-245.8	-20.1	-159.1
Phosphorus (%)	-46.9	64.5	-10.3	-45.1	-174.9	-55.2	-107.2	-158.7	-263.5	-106.9
Potash (%)	92.1	80.1	88.0	83.0	83.7	100.0	32.5	-169.9	0.0	100.0
Grain (%)	38.4	86.1	59.3	87.3	36.6	36.7	60.9	-1.2	44.7	24.1
Value of yield and Fertilizer (Rs)										
Additional Cost (Rs/ha)	11989	66018	12493	64529	-395	-1682	5387	965	1806	-1403
Additional Benefits Rs/ha)	85036	425350	131400	517800	67497	12705	46979	-600	87911	8330
Net change Income(Rs/ha)	73048	359332	118908	453271	67892	14387	41592	-1565	86105	9733

Economic valuation of Ecosystem Services (ES) was aimed at combining use and non-use values to determine Total Economic Value (TEV) of ES. Ecosystem Services (ES) were valued based on their annual flow or utilization in common monetary units, Rs/year. The valuation of ES was based on market price in 2017 or market cost approaches whichever is applicable, and in other cases on value or benefit transfer from previous valuation studies.

The onsite cost of different soil nutrients lost due to soil erosion is given in Table 21 and Figure 10. The average value of soil nutrient loss is around Rs 349.71 per ha/year. The total cost of annual soil nutrients is around Rs 177305per year for the total area of 513.4 ha.

Table 21: Estimation of onsite cost of soil erosion in Sanganahalli micro-watershed

Particulars	Quantity(kg)		Value (Rs)	
	Per ha	Total	Per ha	Total
Organic matter	46.34	23495	291.95	148017
Phosphorous	0.28	140	12.17	6172
Potash	0.54	273	10.76	5454
Iron	0.07	37	3.53	1788
Manganese	0.09	46	24.91	12632
Cupper	0.01	3	3.16	1604
Zinc	0.00	2	0.16	81
Sulphur	0.07	38	2.98	1513
Boron	0.00	1	0.09	43
Total	47.41	24035	349.71	177305

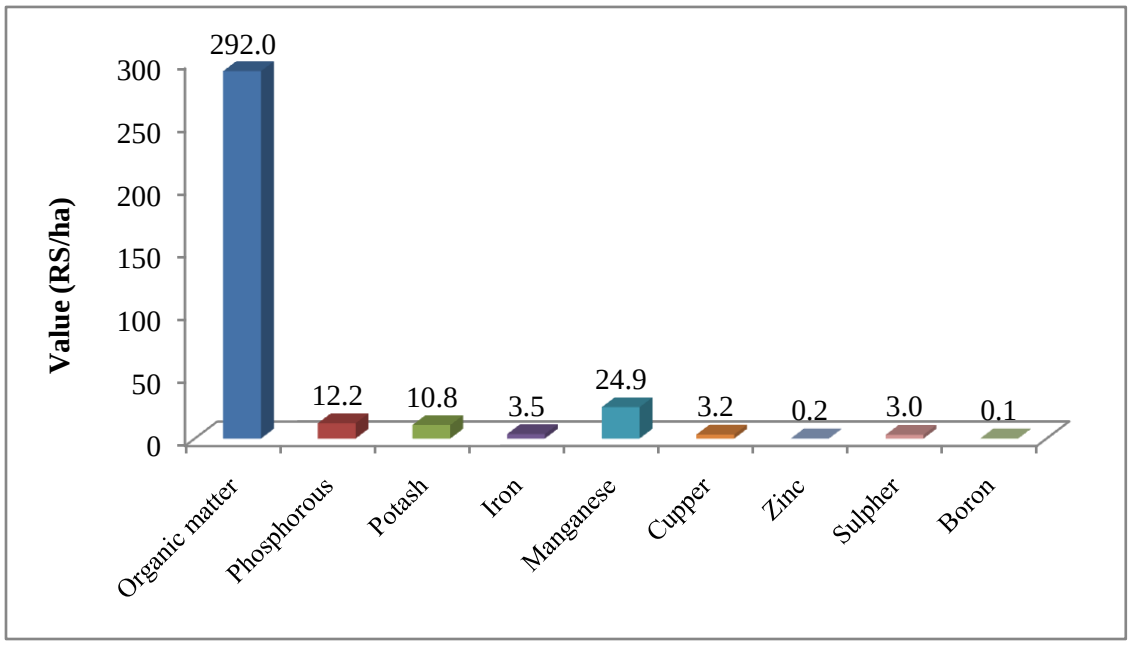


Figure 10: Estimation of onsite cost of soil erosion in Sanganahalli Microwatershed

The average value of ecosystem service for food grain production is around Rs 57854/ ha/year (Table 22 and Figure 11). Per hectare food grain production services is maximum in coconut (Rs. 58886) followed by the mango (Rs. 56822), ragi (Rs. 8191), horse gram (Rs. 4381) and red gram (Rs. 1564).

Table 22: Ecosystem services of food production in Sanganahalli Microwatershed

Production items	Crops	Area in ha	Yield (Qtl/ha)	Price (Rs/Qtl)	Gross Returns	Cost of Cultivation	Net Returns
Cereals	Ragi	2.0	11.5	2500	28817	20625	8191
Pulses	Horse gram	1.2	6.8	3500	23774	19392	4381
	Redgram	0.4	12.4	4000	49400	47836	1564
Oil seeds	Coconut	3.3	127.7	1029	131370	72484	58886
Fruits	Mango	2.6	13.0	5500	71267	14445	56822
Average value		9.5	34.3	3306	60925	34956	25969

The average value of ecosystem service for fodder production is around Rs 1893/ ha/year (Table 23). Per hectare fodder production services is maximum in ragi (Rs 2305) and horse gram (Rs 1482).

Table 23: Ecosystem services of fodder production in Sanganahalli Microwatershed

Production items	Crops	Area in ha	Yield (Qtl/ha)	Price (Rs/Qtl)	Total returns (Rs)	Returns (Rs/ha)
Cereals	Ragi	2	2.5	933	4667	2305
Pulses	Horse gram	1.2	1.9	800	1800	1482
Average value		3.2	2.2	866	3233	1893

The water demand for production of different crops was worked out in arriving at the ecosystem services of water support to crop growth. The data on water requirement for producing one quintal of grain is considered for estimating the total value of water required for crop production. The per hectare value of water used and value of water was maximum (Table 24 and Figure 12) in coconut (Rs.343185) followed by redgram (Rs 67233), mango (Rs 23323), horse gram (Rs 20907) and ragi (Rs 122.2).

Table 24: Ecosystem services of water supply in Sanganahalli Microwatershed

Crops	Yield (Qtl/ha)	Virtual water (cubic meter) per ha	Value of Water (Rs/ha)	Water consumption (Cubic meters/Qtl)
Coconut	127.7	34318.5	343185	268.7
Horse gram	6.7	2090.7	20907	307.8
Mango	12.9	2332.3	23323	180
Ragi	11.5	1408.5	14085	122.2
Redgram	12.3	6723.3	67233	544.4
Average value	171.1	9374.6	93746	284.6

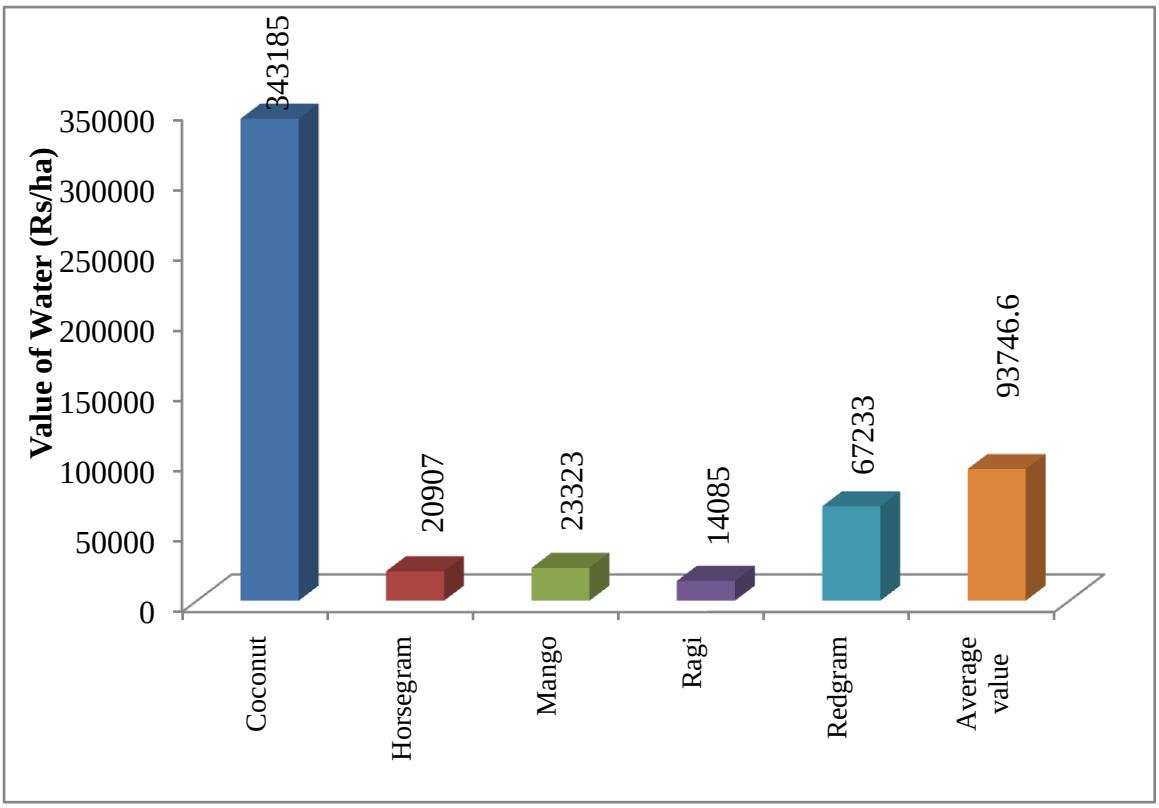


Figure 11: Ecosystem services of water supply in Sanganahalli Microwatershed

Table 25: Farming constraints related land resources of sample households in Sanganahalli Microwatershed

Sl.No	Particulars	Per cent
1	Less Rainfall	100
2	Non availability Fertilizers	10
3	High Crop Pests & Diseases	10
4	Lack of transportation	20
5	Damage of crops by Wild Animals	80
6	Non availability of Plant Protection Chemicals	100
7	**Source of loan**	
	Money Leander	50
	Village merchants	50
8	**Market for selling**	
	Village market	100
9	**Sources of Agri-Technology information**	
	Newspaper	100

The main farming constraints in Sanganahalli Microwatershed to be found are less rainfall, non availability fertilizers, high crop pests & diseases, animal pests & diseases, lack of transportation, damage of crops by wild animals and non availability of plant

protection chemicals. Majority of farmers depend up on money lender and village merchants of the sources of loan for purpose of crop production. Farmers to sell the agriculture produce through village market and the farmers getting the agriculture related information on newspaper. Farmers reported that they are not getting timely support/extension services from the concerned development department (Table 25).

The findings of the study would be very much useful to the planners and policy makers of the study area to identify the irrationality in the existing production pattern and to suggest appropriate production plans for efficient utilization of their scarce resources resulting in increased net farm incomes and employment. The study also throws light on future potentialities of increasing net farm income and employment under different situations viz., with existing and recommended technology.