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

GOPALAGIRI COLONY-1 (4B3E2F2b) MICRO WATERSHED

Gundlupet Taluk, Chamarajanagara District, Karnataka

Karnataka Watershed Development Project – II

SUJALA – III

World Bank funded Project

The World Bank

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 Gopalagiri Colony-1 Microwatershed, Gundlupet Taluk, Chamarajanagar 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.

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PART-A

LAND RESOURCE INVENTORY

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EXECUTIVE SUMMARY

The land resource inventory of Gopalagiri Colony-1 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, characterstics, classification and use potentials of the soils in the microwartershed.

The present study covers an area of 550 ha in Gopalagiri Colony-1 microwatershed in Gundlupet taluk of Chamarajanagar district, Karnataka. The climate is semiarid and categorized as drought prone with an average annual rainfall of 734 mm. Maximum of 254 mm precipitation takes place during south–west monsoon period from June to September, the north-east monsoon contributes about 268 mm and prevails from October to early December and the remaining 212 mm takes place during the rest of the year. An area of about 95 per cent is covered by soils and 5 per cent by waterbodies, settlements, forest and others. The salient findings from the land resource inventory are summarized briefly below.

- *The soils belong to 10 soil series and 35 soil phases (management units) and 7 land management units.*
- *The length of crop growing period is about 150 days starting from the 3rd week of June to 3rd 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 major agricultural and horticultural crops were assessed and maps showing the degree of suitability along with constraints were generated.*
- *About 95 per cent area is suitable for agriculture and 5 per cent is not suitable for agriculture but well suited for forestry, pasture, agroforestry, silvi-pasture, recreation, installation of wind mills and as habitat for wildlife.*
- *About 41 per cent of the soils are very deep (>150 cm), 22 per cent deep to moderately deep (75 - 150 cm), 33 per cent are moderately shallow to shallow (25-75 cm).*
- *About 65 per cent of the area has clayey soils, 26 per cent loamy soils and 3 per cent sandy soils at the surface.*
- *About 47 per cent of the area has non-gravelly (<15% gravel) soils, 38 per cent gravelly soils (15-35 % gravel) and 9 per cent very gravelly to extremely gravelly soils (35- 80% gravel).*
- *About 41 per cent of the area has soils that are very high (>200mm/m) in available water capacity and about 54 per cent low (50-100 mm/m) and very low (<50mm/m) in available water capacity.*
- *About 94 per cent of the area has gently sloping (3-5%) to very gently sloping (1-3% slope) lands, 6 per cent has nearly level (0-1%).*

- *An area of about 44 per cent has soils that are slightly eroded (e1) and 50 per cent moderately eroded (e2).*
- *An area of about 17 per cent has soils that are neutral in reaction (pH 6.5 to 7.3), 28 per cent slightly alkaline (pH 7.3-7.8), 25 per cent moderately alkaline (pH 7.8 to 8.4), 24 per cent slightly acid (pH 6.0-6.5) to moderately acid (pH 5.5-6.0) in reaction.*
- *The Electrical Conductivity (EC) of the soils are dominantly <2 dsm^{-1} indicating that the soils are non-saline.*
- *About 66 per cent medium (0.5-0.75%), 23 per cent low (<0.5%) and 7 per cent high (>0.75%) in organic carbon.*
- *An area of 34 per cent has soils that are low (<23 kg/ha), an area of 43 per cent medium (23-57 kg/ha) and 17 per cent high (>57 kg/ha) in available phosphorus.*
- *About 9 per cent medium (145-337 kg/ha) and 85 per cent high (>337kg/ha) in available potassium.*
- *Available sulphur is low (<10 ppm) in about 84 per cent area and medium (10-20 ppm) 11 per cent in available sulphur.*
- *Available boron is low (<0.5 ppm) in about 45 per cent area and 50 per cent medium (0.5-1.0 ppm).*
- *About 33 per cent area has soils that are deficient (<4.5 ppm) in available iron and 62 per cent sufficient (>4.5 ppm).*
- *Available manganese and copper are sufficient in all the soils.*
- *About 70 per cent area has soils that are deficient (<0.6 ppm) in available zinc and 25 per cent sufficient (>0.6 ppm).*
- *The land suitability for 27 major crops (agricultural and horticultural) grown in the microwatershed were assessed and the areas that are highly suitable (S1) and moderately suitable (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, price and finally the demand and supply position.*

Land suitability for various crops in the Gopalagiri Colony-1 Microwatershed

Crop	Suitability Area in ha (%)			Crop	Suitability Area in ha (%)	
	Highly suitable(S1)	Moderately suitable(S2)			Highly suitable(S1)	Moderately suitable(S2)
Sorghum	*246 (1745)*	*150 (27)*		*Guava*	*140 (25)*	*118 (21)*
Maize	*205 (37)*	*109 (20)*		*Mango*	*140 (25)*	*94 (17)*
Red gram	*203(37)*	*210 (38)*		*Sapota*	*140 (25)*	*118 (21)*
Groundnut	*32 (6)*	*305(51)*		*Jackfruit*	*140 (25)*	*94 (17)*
Sunflower	*101 (18)*	*187 (34)*		*Jamun*	*140 (25)*	*176 (32)*
Cotton	*183 (33)*	*172 (31)*		*Musambi*	*140 (25)*	*176 (32)*
Onion	*140 (25)*	*256 (46)*		*Lime*	*140 (25)*	*176 (32)*
Beans	*140 (25)*	*256 (46)*		*Cashew*	*140 (25)*	*118 (21)*
Potato	*140 (25)*	*174(32)*		*Custard apple*	*205 (37)*	*203 (37)*
Beetroot	*140 (25)*	*174 (32)*		*Amla*	*203 (37)*	*257(37)*
Turmeric	*140 (25)*	*168 (31)*		*Tamarind*	*140 (25)*	*176(32)*
Horse gram	*203 (37)*	*257 (47)*		*Marigold*	*203 (37)*	*216(39)*
Field bean	*140 (25)*	*256 (46)*		*Chrysanthemum*	*140 (25)*	*256(46)*
Banana	*140 (25)*	*176 (32)*				

Apart from the individual crop suitability, a proposed crop plan has been prepared for the 7 identified LMUs by considering only the highly and moderately suitable lands for different crops and cropping systems with food, fibre and horticulture crops that helps in maintaining the ecological balance in the microwatershed.

- *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 and also in the hillocks, mounds and ridges.*

Chapter 1

INTRODUCTION

Soil is a finite natural resource that is central to sustainable agriculture and food security. Over the years, this precious resource is faced with problems of erosion, salinity, alkalinity, degradation, depletion of nutrients and even decline in the availability of land for agriculture. It is a known fact, that it takes thousands of years to form a few centimetres of soil; thus, soil is a precious gift of nature. 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. However, the capacity of a soil to produce is limited and the limits to the production are set by its intrinsic characteristics, agro-climatic setting, and use and management. There is, therefore, tremendous pressure on land and water resources, which is causing decline in soil-health and stagnation in productivity. The soils have been degrading at an estimated rate of one million hectares per year and ground water levels have been receding at an alarming rate resulting in decline in the ground water resource. 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 areas are facing various degrees of degradation, particularly soil erosion; salinity and alkalinity has emerged as a major problem (>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 situation 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. Added to this, every year there is a significant diversion of farm lands and water resources for non-agricultural purposes. Thus, developing strategies to slow down the degradation process or reclaim the soils to normal condition and ensure sustainability of production system are the major issues today. This demands a systematic appraisal of our soil and land resources with respect to their extent, geographic distribution, characteristics, behaviour and uses potential, which is very important for developing an effective land use and cropping systems for augmenting agricultural production on a sustainable basis.

The soil and land resource inventories made so far in Karnataka had limited utility because the surveys were of different types, scales and intensities carried out at different times with specific objectives. Hence, there is an urgent need to generate 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 all the parameters which are critical for productivity *viz.*, soils, site characteristics like slope, erosion, gravelliness and stoniness, climate, water, topography, geology, hydrology, vegetation, crops, land use pattern, animal population, socio-economic conditions, infrastructure, marketing facilities and various schemes and developmental works of the government etc. From the data collected at farm level, the specific problems and potentials of the area can be identified and highlighted, conservation measures required for the area can be planned on a scientific footing, suitability of the area for various uses can be worked out and finally viable and sustainable land use options suitable for each and every land holding can be prescribed.

The Land Resource Inventory is basically done for identifying 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 resolutions 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 landuse. An attempt has already made to upscale the soil resource information from 1:250000 and 1:50000 scale to the LEU map in Goa and other states. Here, an attempt is being 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 Gopalagiri Colony-1 microwatershed in Gundlupet Taluk, Chamarajanagara 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. Later, an attempt will be made to uplike this LRI data generated at 1:7920 scale under Sujala-III Project to the proposed Landscape Ecological units (LEUs) map.

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

The Gopalagiri Colony-1 microwatershed (Basavapur subwatershed) is located in the Southern part of south Karnataka in Gundlupet Taluk, Chamarajanagar District, Karnataka State (Fig.2.1). It comprises parts of Kannagal, Honnegaudanahalli and Hangala Hosalhalli villages. It lies between 11^0 43' to 11^0 44' North latitudes and 76^0 35' to 76^0 37' East longitudes and covers an area of 550 ha. It is surrounded by Honnegaudanahalli village in the north, Kannagal village in the West, Birainbadi state forest in the south and Hangala Hosalhalli village in the east.

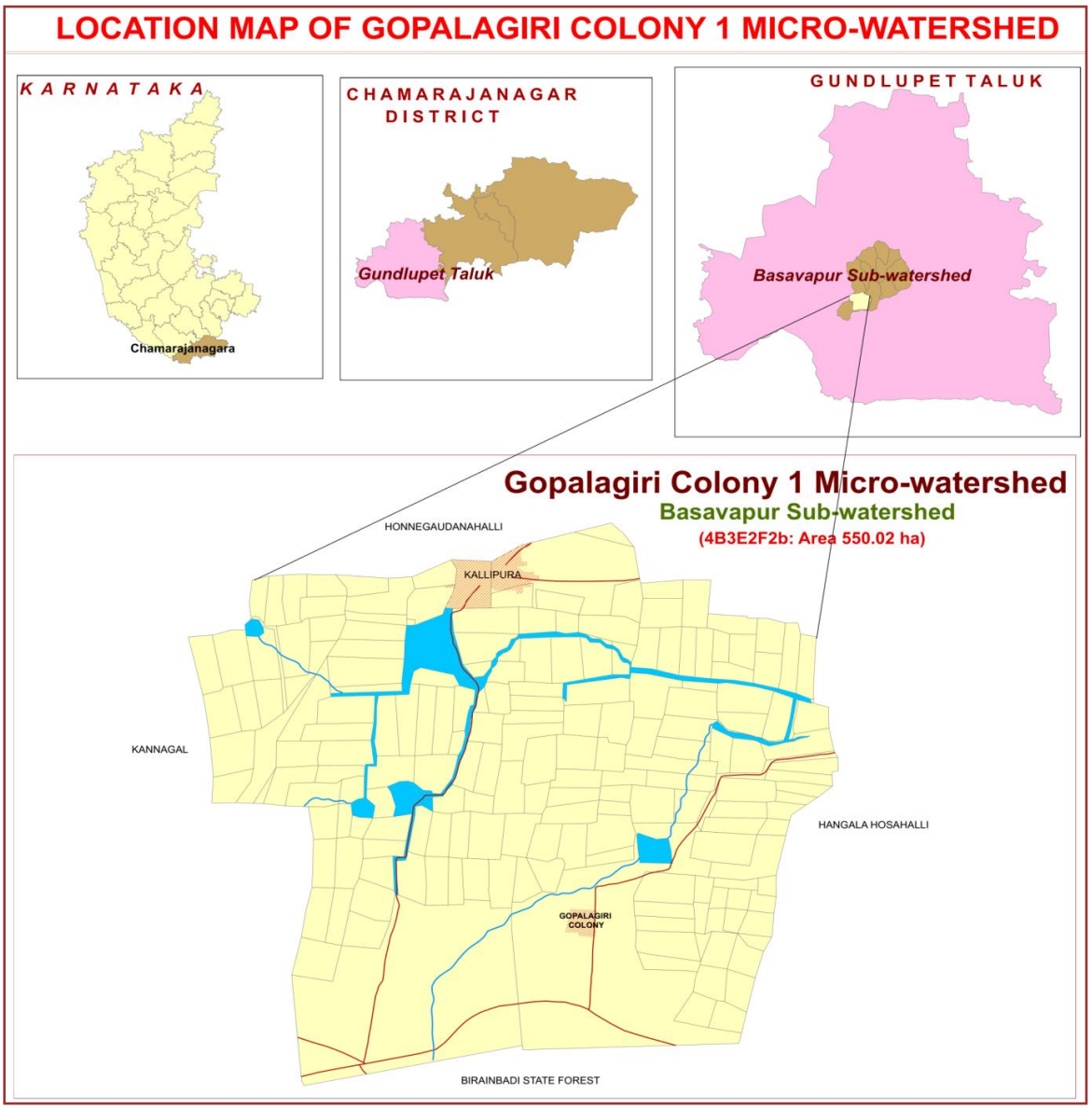


Fig.2.1 Location map of Gopalagiri Colony-1 Microwatershed

2.2 Geology

Major rock formations observed in the microwatershed are of Archaean age and comprise of (Figs.2.2a and b) granite and 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 weatherd, fractured and fissured upto a depth of about 10 m. Dolerite dykes and quartz veins are common with variable width and found to occur in Gopalagiri Colony-1 village.

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 823 to 948 m. The mounds and ridges are mostly covered by rock outcrops.

2.4 Drainage

There are no perennial rivers flowing in Gundlupet taluk. However, the area is drained by several small seasonal streams like Gundluhole along its course. Though, they are not perennial, during rainy season, it carries large quantities of rain water.The microwatershed area has only a 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 entire 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 734 mm (Table 2.1). Of the total rainfall, a maximum of 254 mm is received during south–west monsoon period from June to September, north-east monsoon from October to early December contributes maximum of about 268 mm and the remaining 212 mm is recived during the rest of the year. The winter season is from December to February. During April and May, the temperatures reach up to 42°C and in December and January, the temperatures will go down to 16°C. Rainfall distribution is shown in Figure 2.3. The average Potential Evapo Transpiration (PET) is 128 mm and varies from a low of 106 mm in November to 165 mm in the month of March. The PET is always higher than precipitation in all the months except in the last week of September to first week of November. 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 Gundlupet Taluk, Chamarajanagara District

Sl. no.	Months	Rainfall	PET	1/2 PET
1	JAN	0.80	129.10	64.55
2	FEB	6.80	133.80	66.90
3	MAR	26.90	164.90	82.45
4	APR	73.60	153.80	76.90
5	MAY	103.90	147.20	73.60
6	JUN	56.00	124.60	62.30
7	JUL	50.40	116.40	58.20
8	AUG	55.80	117.10	58.55
9	SEP	92.00	116.80	58.40
10	OCT	164.10	111.10	55.55
11	NOV	80.50	106.20	53.10
12	DEC	23.50	109.90	54.95
Total		**734.30**	**127.57**	

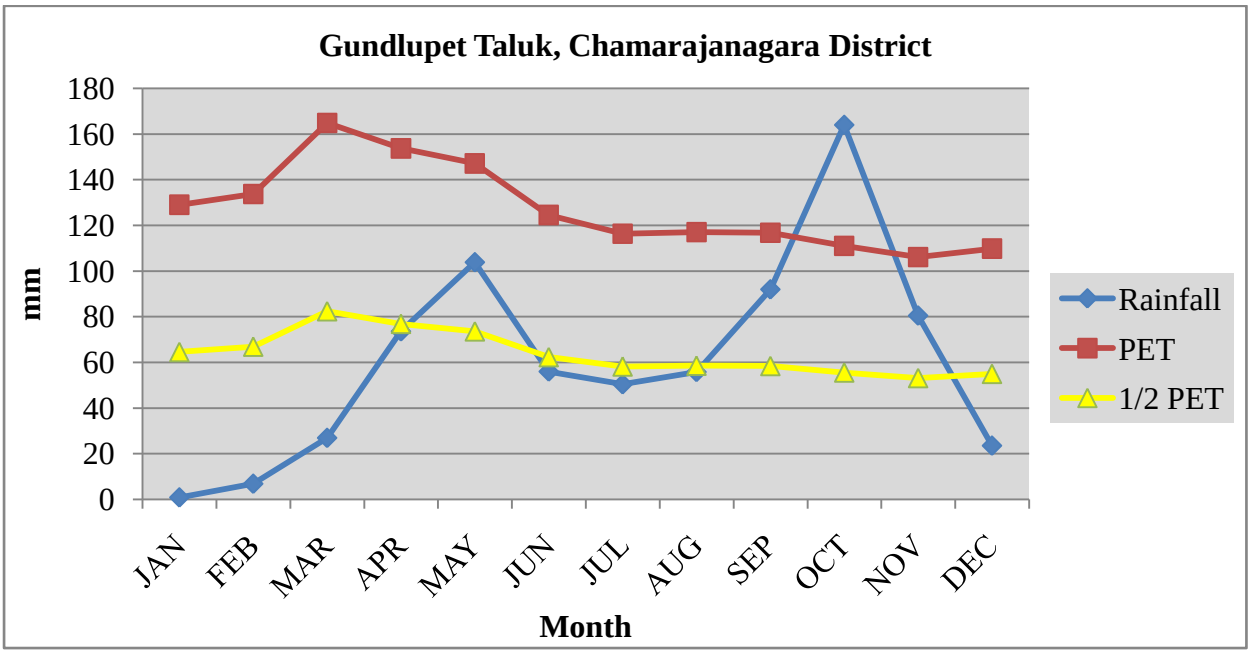


Fig 2.3 Rainfall distribution in Gundlupet Taluk, Chamarajanagara District

2.6 Natural Vegetation

Forests occupy about 32 per cent area in Gundlupet taluk. The major area of these forests is found in Bandipur National Park and Himavad Gopalaswamy Betta. The rest of the area in the taluk has sparse natural vegetation 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.

Fig. 2.4 Natural Vegetation of Gopalagiri Colony-1 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 is 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 slope, resulting in the formation of deep gullies in the foot slopes and eventually resulting in the heavy siltation of few tanks and reservoirs in the microwatershed.

2.7 Land Utilization

About 48 per cent area (Table 2.2) in Gundlupet taluk is cultivated at present. An area of about 6 per cent is currently barren. Forests occupy an area of about 32 per cent and the tree cover is in a very poor state except in Bandipura National Park and Gopalaswamy Betta. Most of the mounds, ridges and bouldery areas have very poor vegetative cover. Major crops grown in the area are sorghum, maize, cotton, mulberry, onion, sugarcane, safflower, groundnut, red gram, horsegram and sapota. 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 microwatershed is prepared. The current land use map prepared shows the arable and non-arable lands, other land uses and different types of crops grown in the area. The current land use map of microwatershed is presented in Fig.2.5. The different crops and cropping systems adopted in the microwatershed is presented in Fig.2.6. Simultaneously, enumeration of wells (bore wells and open wells) and exixting 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, soil conservation structures and other water bodies in Gopapagiri Colony-1 microwatershed is given Fig.2.7.

Table 2.2 Land Utilization in Gundlupet Taluk

Sl. No.	Agricultural land use	Area (ha)	Per cent
1.	Total geographical area	140607	
2.	Total cultivated area	67339	47.84
3.	Area sown more than once	13532	
4.	Trees and grooves	3485	2.47
5.	Forest	44859	31.98
6.	Cultivable wasteland	3265	2.32
7.	Permanent Pasture land	10287	7.31
8.	Barren land	7988	5.68
9.	Non- Agriculture land	3384	2.40

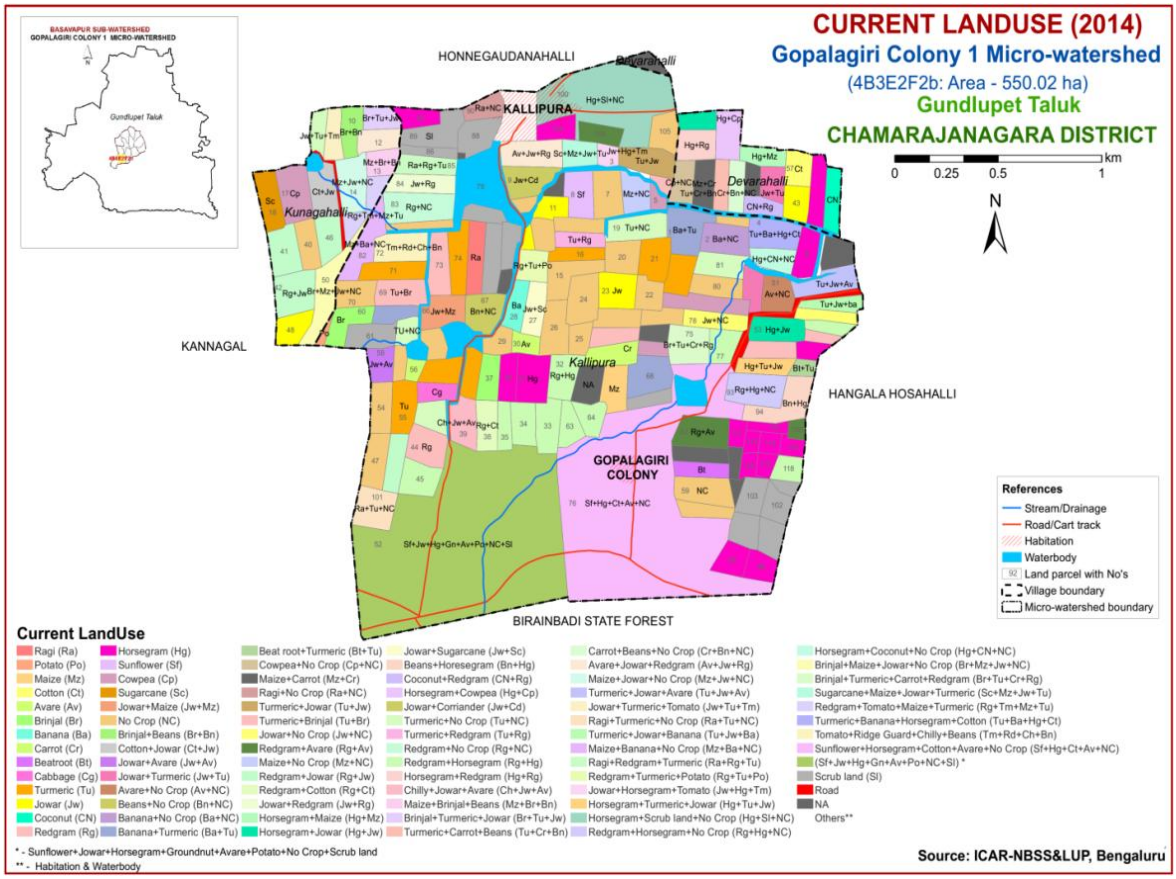


Fig. 2.5 Current Land Use map of Gopalagiri Colony-1 Microwatershed

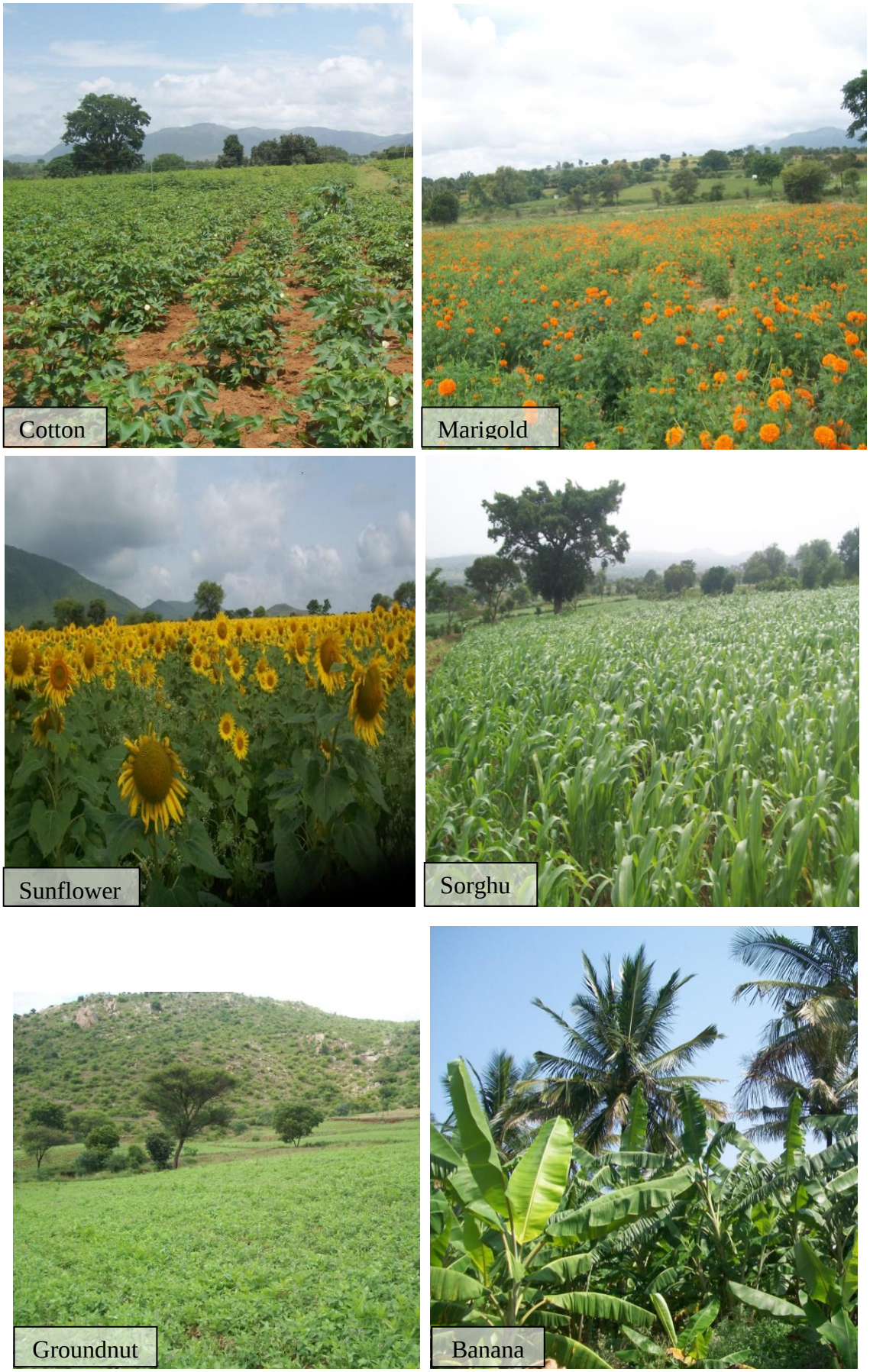


Fig.2.6. Different Crops and Cropping Systems in Gopalagiri Colony-1 Microwatershed

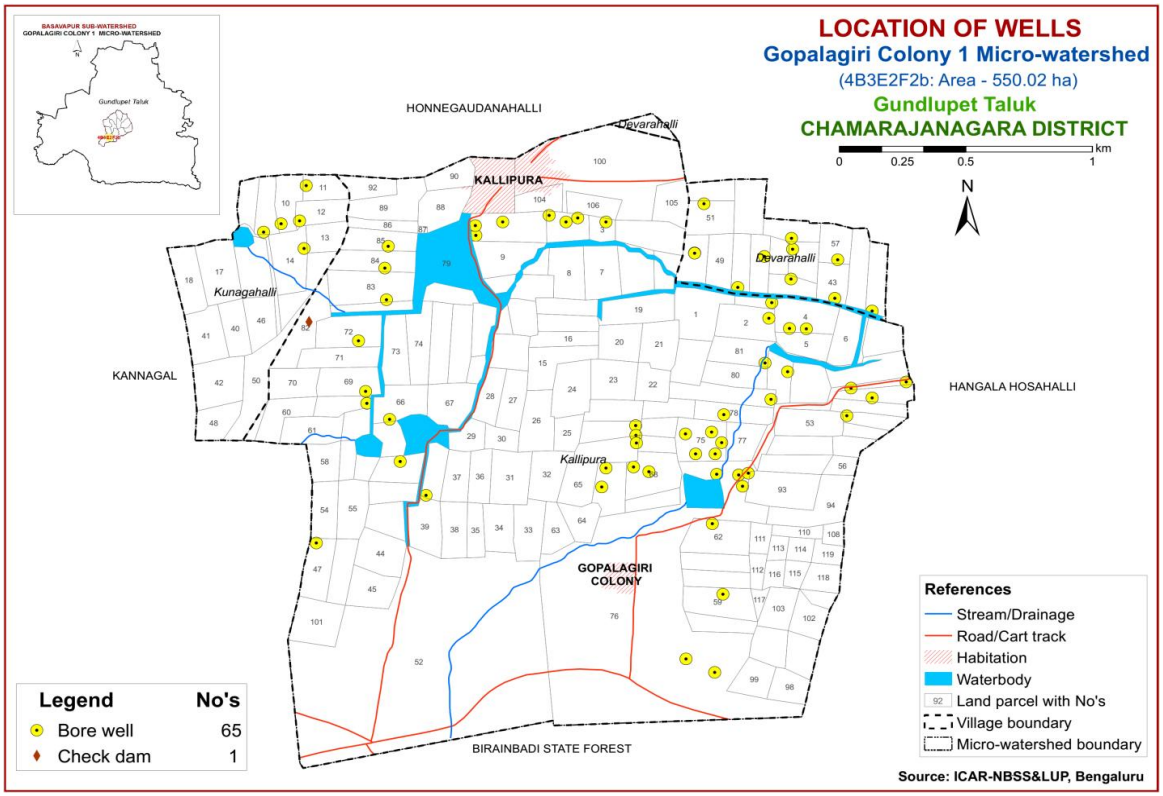


Fig. 2.7 Location of Wells and Conservation Structures map of Gopalagiri Colony-1 Microwatershed

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 Gopalagiri Colony-1 microwatershed by the detailed study of all the soil characteristics (depth, texture, colour, structure, consistence, coarse fragments, soil horizons, porosity, soil reaction etc.) and site characteristics (slope of the land, erosion, drainage, occurrence of rock fragments etc.) followed by grouping of similar areas based on soil-site characteristics into homogeneous units (management units) and showing their extent and geographic distribution on the microwatershed/ subwatershed cadastral map. The detailed survey at 1:7920 scale was carried out in 550 ha area. 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 Survey of India topographical map and cadastral map to identify the landscapes, landforms and other surface features. The cadastral map was overlaid on the satellite imagery (Fig.3.2) that helps to identify the parcel boundaries and other permanent 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.3.3). Apart from cadastral maps and images, toposheets of the area (1:50,000 scale) were used for initial traversing, identification of geology and 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 microwatershed area was visually interpreted using image interpretation elements 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. It was divided into three landforms, *viz;* ridges and mounds, uplands and lowlands based on slope and image characteristics. 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 Landform

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

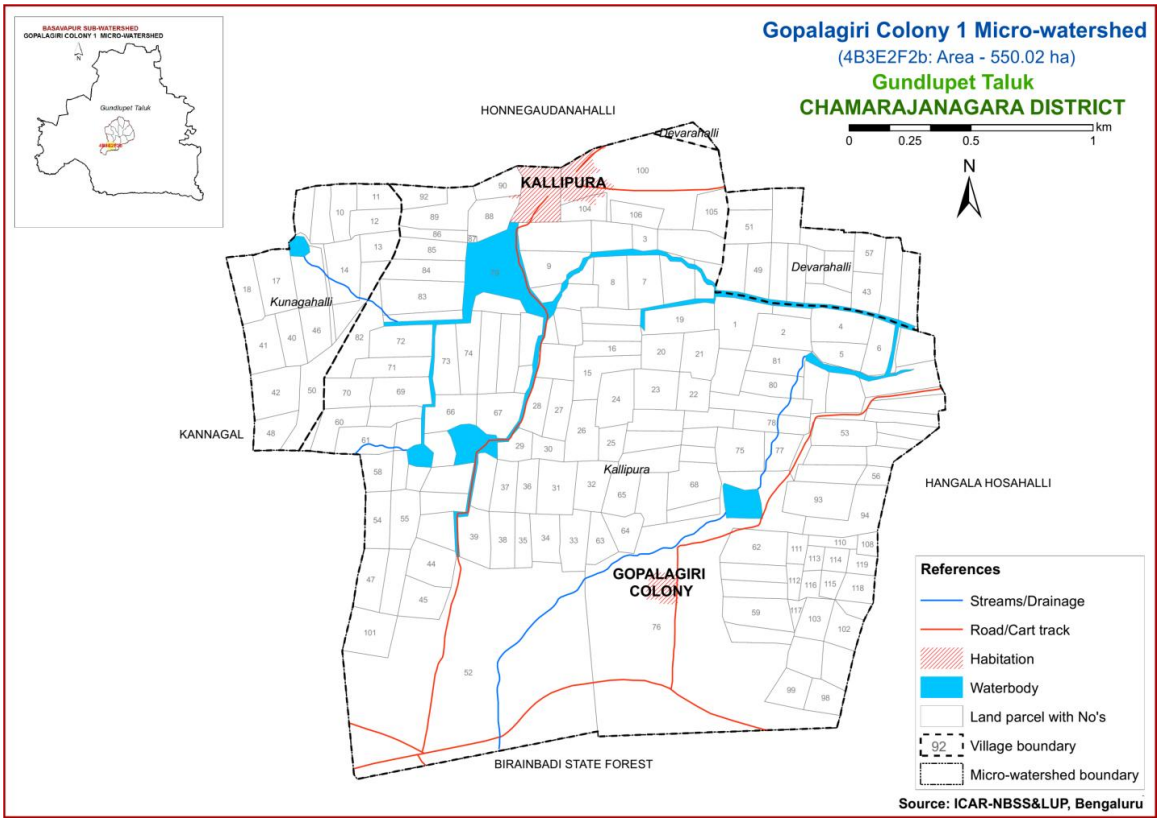


Fig. 3.1 Scanned and Digitized Cadastral map of Gopalagiri Colony -1 Microwatershed

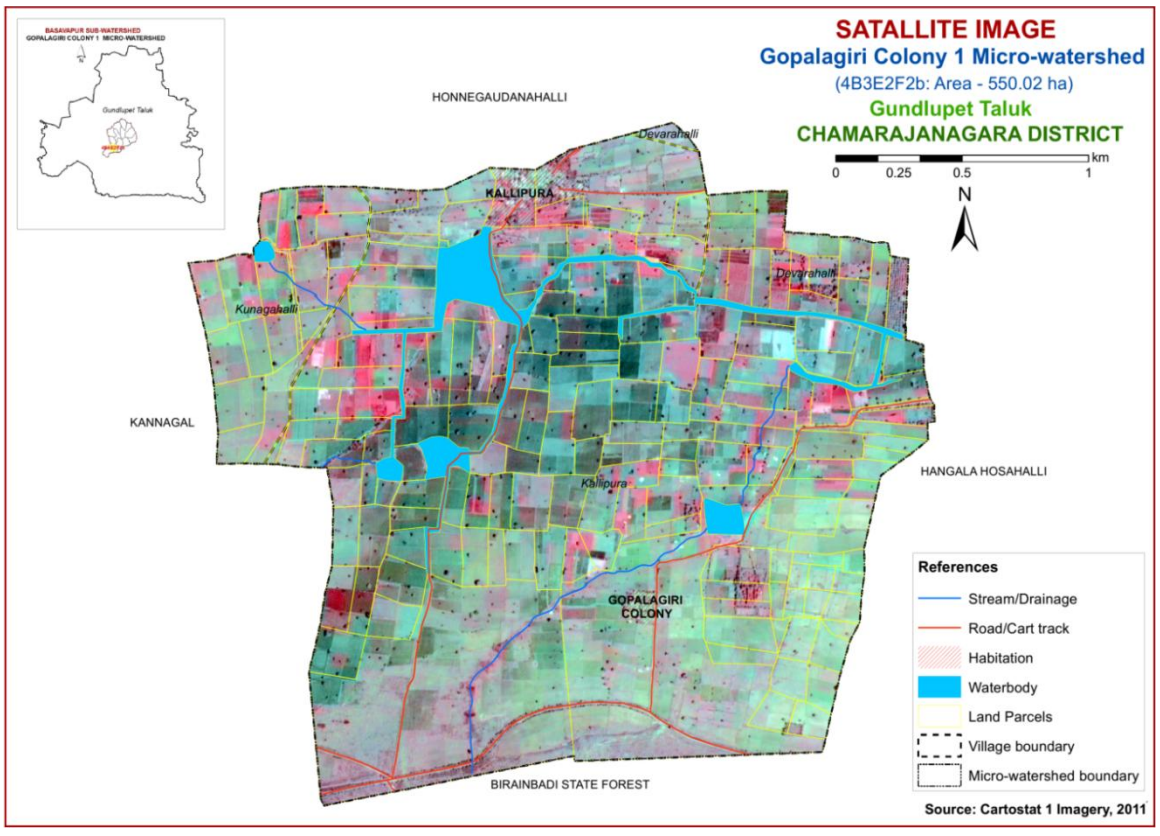


Fig. 3.2 Satellite image of Gopalagiri Colony -1 Microwatershed

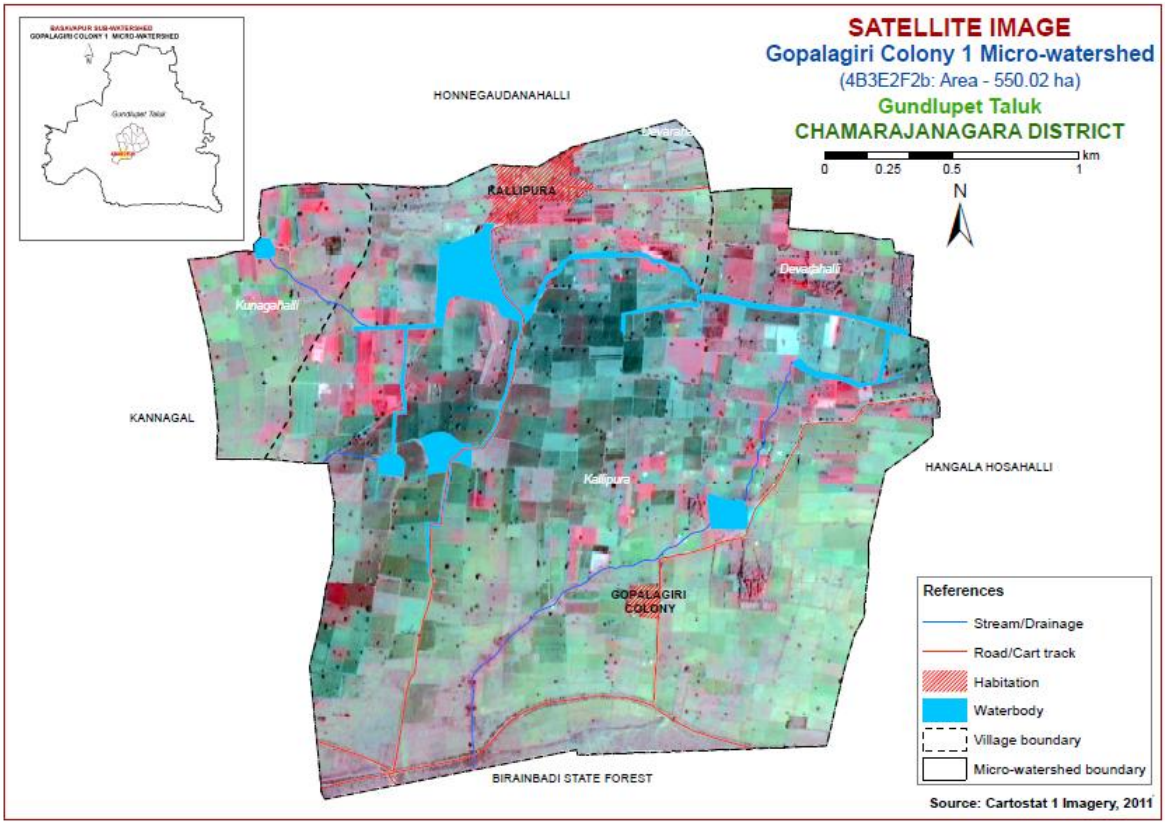


Fig. 3.3 Cadastral map overlaid on IRS PAN+LISS IV merged imagery of Gopalagiri Colony -1 Microwatershed

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 and uplands was carried out. Based on the variability observed on the surface, transects were selected across the slope covering all the landform units in the microwatershed (Natarajan and Dipak Sarkar, 2010). In the selected transect, soil profiles 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 the 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 the soil-site 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 in the microwatershed are given in Table 3.1. Based on the above characteristics, 10 soil series were identified in Gopalagiri Colony- 1 microwatershed.

Table 3.1 Differentiating Characteristics used for Identifying Soil Series (Characteristics are of series control section)

Sl. No	Soil Series	Depth (cm)	Colour	Texture	Gravel (%)	Horizon sequence
1	ARK (Annurkeri)	>150	2.5YR 2.5/2,3/2, 2.5/3,3/3,2.5/4,3/4	sc-c	<15	Ap-Bt
2	BMB (Beemanabeedu)	>150	10YR 2/1,2/2,3/1,3/2,4/1	c	-	Ap-Bw
3	DRH (Devarahalli)	50-75	2.5YR 2.5/4, 3/2,3/6	scl-sc	15-35	Ap-Bt-Cr
4	HDR (Hundipura)	25-50	2.5YR 2.5/4, 5YR3/2	scl-sc	<15	Ap-Bt-Cr
5	HGH (Honnegaudanahalli)	>150	7.5YR 2.5/2, 2.5/3,3/3,2.5/4,3/4	scl	<15	Ap-Bw
6	HPR (Hullipura)	50-75	7.5YR 2.5YR2.5/2,3/2	scl-sc	15-35	Ap-Bt-Cr
7	(KLP) (Hullipura)	100-150	2.5YR 2.5/3,2.5/4,3/4	scl-sc	15-35	Ap-Bt-Cr
8	(KNG) (Kannigala)	75-100	2.5YR 2.5/4,3/4,3/6	scl-sc	>35	Ap-Bt-Cr
9	(MDH) (Maddinahundi)	100-150	2.5YR 2.5/4,3/4	sc	>35	Ap-Bt-Cr
10	(MGH) (Magoonahalli)	50-75	2.5YR 2.5/4,3/4	scl	>35	Ap-Bt-Cr

3.4 Laboratory Characterization

Soil samples were collected from representative master profiles for laboratory characterization by following the methods outlined in The Laboratory Manual (Sarma *et al*, 1987). Surface soil samples (83) collected from farmer's fields 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 krigging method for the microwatershed.

3.5 Finalization of Soil Maps

The area under each soil series was further separated into 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.3.4) in the form of symbols. During the survey about 22 profile pits and few minipits 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 studied to validate the soil boundaries on the soil map. The soil map shows the geographic distribution of mapping units representing 10 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 35 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 they have to be treated accordingly.

The 35 soil phases identified and mapped in the microwatershed were regrouped into 7 Land Management Units (LMU's) for the purpose of preparing a proposed land use plan for sustained development of the microwatershed. The database (soil phases) generated under LRI was utilized for identifying Land Management Units (LMUs) based on the management needs. One or more than one soil site characteristic having influence on the management have been choosen for identification and delineation of LMUs. For Gopalagiri Colony-1 microwatershed, five soil and site characteristics, namely soil depth, soil texture, slope, erosion and gravel content have been considered for defining LMUs. The land management units are expected to behave similarly for a given level of management.

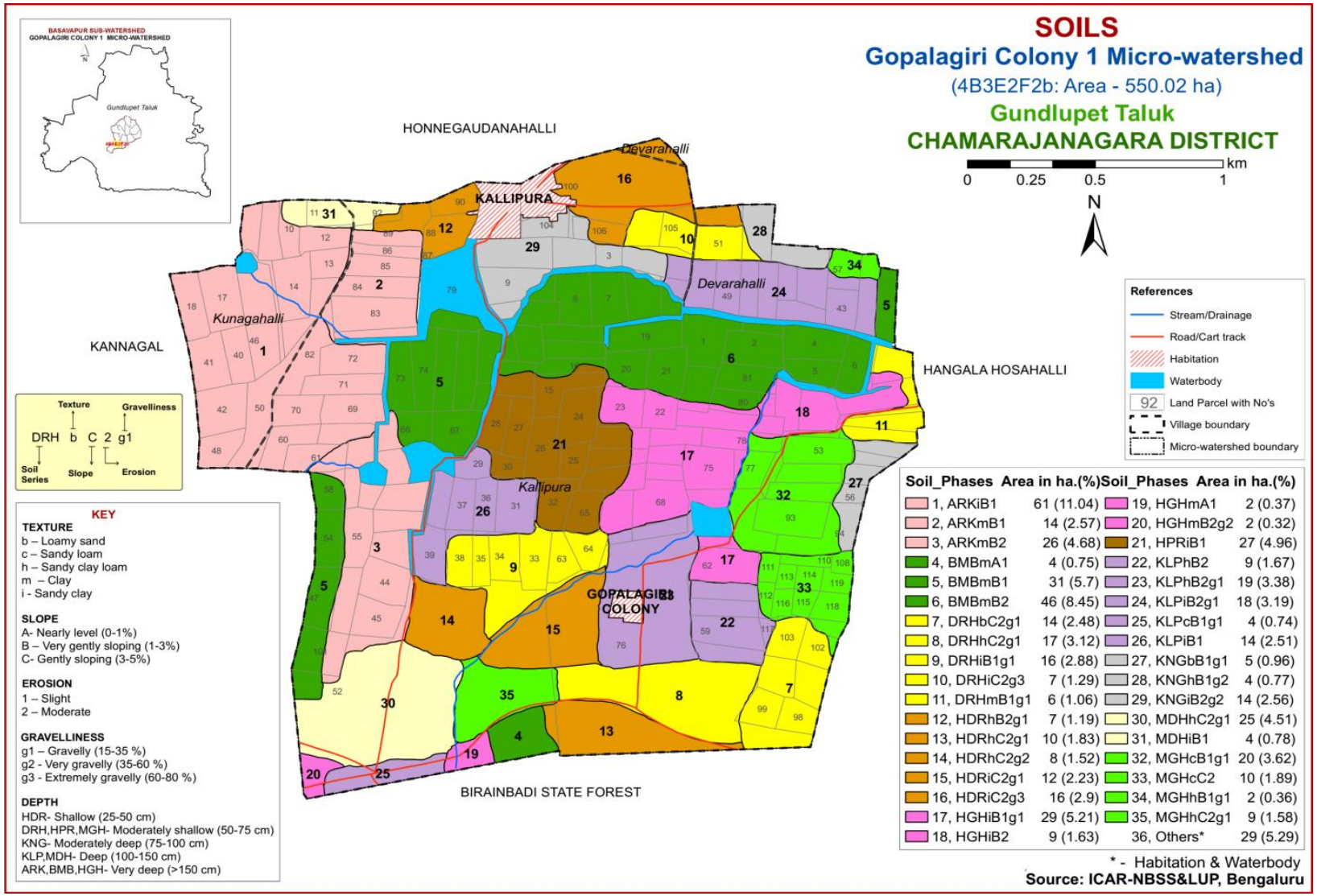


Fig. 3.4 Soil Phase or Management Units- Gopalagiri Colony-1 Microwatershed

Table:3.2 Soil Map Unit Description of Gopalagiri Colony-1

Series	Map symbol	Soil map unit	Description	Area in ha
SOILS OF GRANITE GNEISS LANDSCAPE				
ARK	Annurkeri soils are very deep (>150 cm), well drained, have dark reddish brown to very dusky red sandy clay to clay soils occurring on very gently sloping uplands under cultivation.			**100.59 (18.25)**
	1.	ARKiB1	Sandy clay surface, slope 1-3%, slight erosion	60.73 (11.04)
	2.	ARKmB1	Clay surface, slope 1-3%, slight erosion	14.12 (2.57)
	3.	ARKmB2	Clay surface, slope 1-3%, moderate erosion	25.74 (4.68)
BMB	Beemanabeedu soils are very deep (>150 cm), moderately well drained, have very dark greyish brown to dark grey and very dark brown clayey soils occurring on nearly level to very gently sloping lowlands under cultivation			**81.92 (14.90)**
	4.	BMBmA1	Clay surface, slope 0-1%, slight erosion	4.13 (0.75)
	5.	BMBmB1	Clay surface, slope 1-3%, slight erosion	31.33 (5.70)
	6.	BMBmB2	Clay surface, slope 1-3%, moderate erosion	46.46 (8.45)
DRH	Devarahalli soils are moderately shallow (50-75 cm), well drained, have dark red to reddish brown and dusky red gravelly sandy clay loam to sandy clay soils occurring on very gently to gently sloping uplands under cultivation			**59.61 (10.83)**
	7.	DRHbC2g1	Loamy sand surface, slope 3-5%, moderate erosion, gravelly (15-35%)	13.66 (2.48)
	8.	DRHhC2g1	Sandy clay loam surface, slope 3-5%, moderate erosion, gravelly (15-35%)	17.14 (3.12)
	9.	DRHiB1g1	Sandy clay surface, slope 1-3%, slight erosion, gravelly (15-35%)	15.84 (2.88)
	10.	DRHiC2g3	Sandy clay surface, slope 3-5%, moderate erosion, extremely gravelly (60-80%)	7.12 (1.29)
	11.	DRHmB1g1	Clay surface, slope 1-3%, slight erosion, gravelly (15-35%)	5.85 (1.06)
HDR	Hundipura soils are shallow (25-50 cm), well drained, have dark reddish brown to dusky red sandy clay loam to sandy clay soils occurring on very gently sloping uplands and moderately sloping mounds and ridges			**53.20 (9.67)**
	12.	HDRhB2g1	Sandy clay loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	6.53 (1.19)
	13.	HDRhC2g1	Sandy clay loam surface, slope 3-5%, moderate erosion, gravelly (15-35%)	10.09 (1.83)
	14.	HDRhC2g2	Sandy clay loam surface, slope 3-5%, moderate erosion, very gravelly (35-60%)	8.34 (1.52)
	15.	HDRiC2g1	Sandy clay surface, slope 3-5%, moderate erosion, gravelly (15-35%)	12.28 (2.23)
	16.	HDRiC2g3	Sandy clay surface, slope 3-5%, moderate	15.96

			erosion, extremely gravelly (60-80%)	(2.90)
HGH	Honnegaudanahalli soils are very deep (>150 cm), well drained, have very dark brown to brown and dark reddish brown sandy clay loam soils occurring on very gently sloping uplands under cultivation.			**41.42 (7.53)**
	17.	HGHiB1g1	Sandy clay surface, slope 1-3%, slight erosion, gravelly (15-35%)	28.68 (5.21)
	18.	HGHiB2	Sandy clay surface, slope 1-3%, moderate erosion	8.96 (1.63)
	19.	HGHmA1	Clay surface, slope 0-1%, slight erosion	2.04 (0.37)
	20.	HGHmB2g2	Clay surface, slope 1-3%, moderate erosion, very gravelly (35-60%)	1.74 (0.32)
HPR	Hullipura soils are moderately shallow (50-75 cm), well drained, have dark brown to very dark brown gravelly sandy clay loam to sandy clay soils occurring on very gently to gently sloping uplands under cultivation			**27.28 (4.96)**
	21.	HPRiB1	Sandy clay surface, slope 1-3%, slight erosion	27.28 (4.96)
KLP	Kallipura soils are deep (100-150 cm), well drained, have dark reddish brown to dark red gravelly sandy clay loam to sandy clay soils occurring on very gently sloping uplands under cultivation.			**63.18 (11.49)**
	22.	KLPhB2	Sandy clay loam surface, slope 1-3%, moderate erosion	9.21 (1.67)
	23.	KLPhB2g1	Sandy clay loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	18.57 (3.38)
	24.	KLPiB2g1	Sandy clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	17.52 (3.19)
	25.	KLPcB1g1	Sandy loam surface, slope 1-3%, slight erosion, gravelly (15-35%)	4.09 (0.74)
	26.	KLPiB1	Sandy clay surface, slope 1-3%, slight erosion	13.79 (2.51)
KNG	Kannigal soils are moderately deep (75-100 cm), well drained, have dark reddish brown to dark red gravelly sandy clay loam to sandy clay soils occurring on very gently sloping uplands and strongly sloping mounds and ridges.			**23.64 (4.29)**
	27.	KNGbB1g1	Loamy sand surface, slope 1-3%, slight erosion, gravelly (15-35%)	5.28 (0.96)
	28.	KNGhB1g2	Sandy clay loam surface, slope 1-3%, slight erosion, very gravely (35-60%)	4.25 (0.77)
	29.	KNGiB2g2	Sandy clay surface, slope 1-3%, moderate erosion, very gravelly (35-60%)	14.11 (2.56)
MDH	Maddinahundi soils are deep (100-150 cm), well drained, have very dark brown to dark brown gravelly sandy clay loam soils occurring on very gently sloping uplands and moderatly sloping mounds and ridges.			**26.77 (5.62)**
	30.	MDHhC2g1	Sandy clay loam surface, slope 3-5%, moderate erosion, gravelly (15-35%)	24.79 (4.51)
	31.	MDHiB1	Sandy clay surface, slope 1-3%, slight erosion	4.31 (0.78)

MGH	Magoonahalli soils are moderately shallow (50-75 cm), well drained, have very dark brown to dark brown gravelly sandy clay loam soils occurring on very gently sloping uplands and moderatly sloping mounds and ridges			**40.97 (7.45)**
	32.	MGHcB1g1	Sandy loam surface, slope 1-3%, slight erosion, gravelly (15-35%)	19.94 (3.62)
	33.	MGHcC2	Sandy loam surface, slope 3-5%, moderate erosion	10.41 (1.89)
	34.	MGHhB1g1	Sandy clay loam surface, slope 1-3%, slight erosion, gravelly (15-35%)	1.95 (0.36)
	35.	MGHhC2g1	Sandy clay loam surface, slope 3-5%, moderate erosion, gravelly (15-35%)	8.67 (1.58)
MISCELLANEOUS LANDS				
	36.	Others		16.05 (3.37)

Chapter 4

THE SOILS

Detailed information pertaining to the nature, extent and distribution of different kinds of soils occurring in Gopalagiri Colony-1 microwatershed is provided in this chapter. The microwatershed area has been identified as Granite gneisslandscape based on geology. In all, 10 soil series were identified in different landforms. Soil formation is the result of the combined effect of environmental and terrain factors that are reflected in soil morphology. In the Granite gneiss landform, it is by parent material, relief and climate.

A brief description of each of the 10 soil series identified followed by the soil phases (management units) mapped under each series 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 characteristics 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, ersion, 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

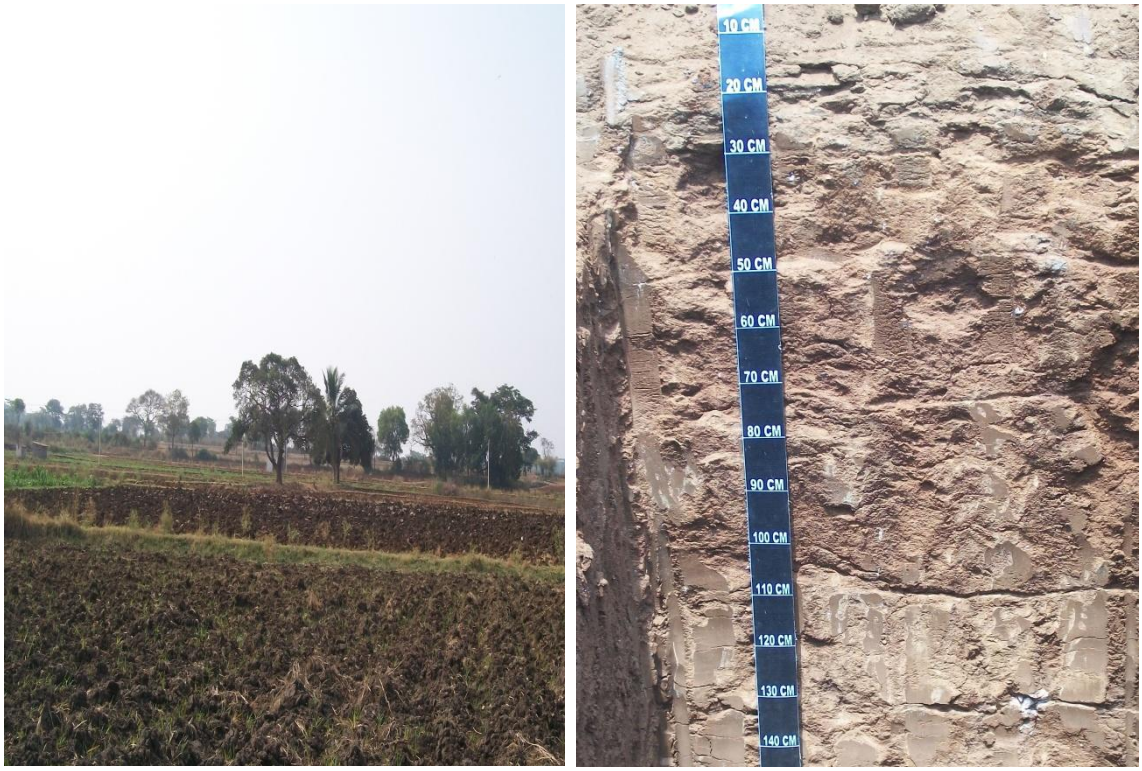
In this landscape, 10 soil series are identified and mapped. Of these, Annurkeri (ARK) soil series occupies maximum area of about 101 ha (18%) followed by Beemanabeedu (BMB) 82 ha (15%) area. Brief description of each series identified in the microwatershed area is given below.

4.1.1 Annurkeri (ARK) Series: Annurkeri soils are very deep (>150 cm), well drained, have dark reddish brown to very dusky red sandy clay to clay soils. They are developed from weathered granite gneiss and occur on very gently sloping uplands.

The thickness of the solum ranges from 150 to 200 cm. The thickness of A horizon ranges from 11 to 18 cm. Its colour is in 5YR and 2.5 YR hue with value 3 and chroma 3 to 4. The texture varies from sandy clay to clay with 10 to 15 per cent gravel. 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 2 to 4. Texture is dominantly sandy clay to clay with less than 15 per cent gravel. The available water capacity is very high (>200 mm/m).

Three phases were identified:

ARKiB1	Sandy clay surface, slope 1-3%, slight erosion
ARKmB1	Clay surface, slope 1-3%, slight erosion
ARKmB2	Clay surface, slope 1-3%, moderate erosion



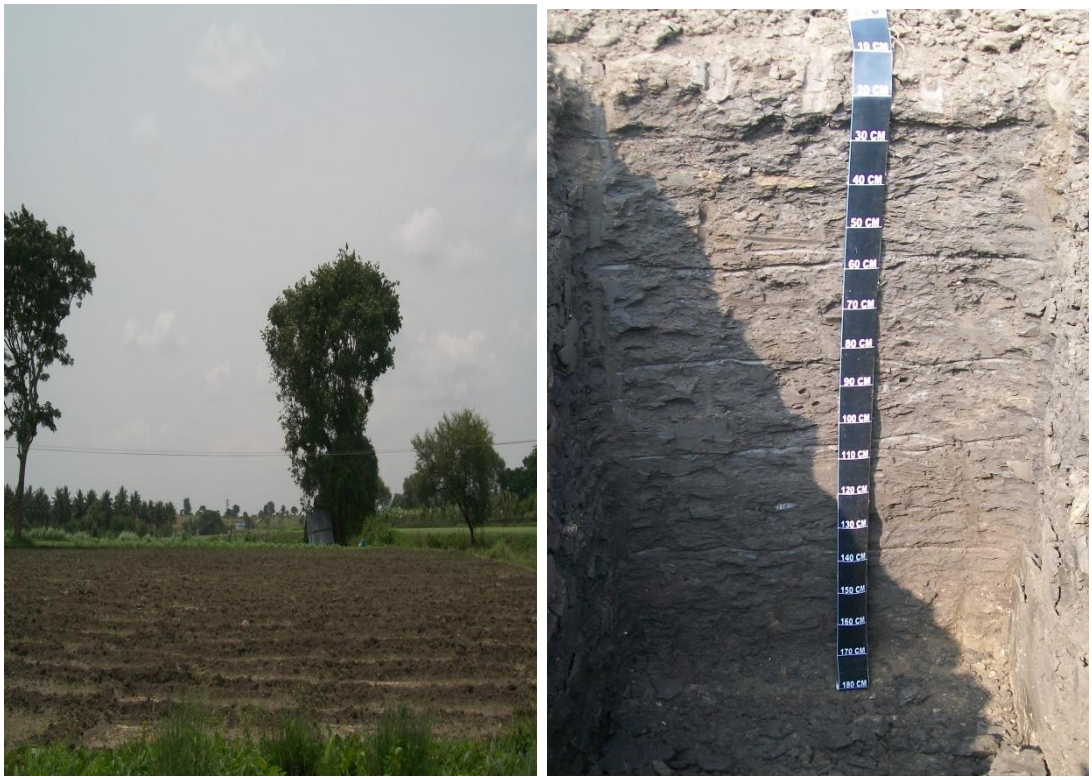
Landscape and Soil Profile characteristics of Annurkeri (ARK) Series

4.1.2 Beemanabeedu (BMB) Series: Beemanabeedu soils are very deep (>150 cm), moderately well drained, have very dark greyish brown to dark grey and very dark brown clayey soils. They are developed from weathered granite gneiss and occur on very gently sloping lowlands.

The thickness of the solum ranges from 150 to 200 cm. The thickness of A horizon ranges from 12 to 17 cm. Its colour is in 10 YR and 7.5 YR hue with value 2.5 to 4 and chroma 2 to 4. The texture varies from sandy clay to clay with 10 to 12 per cent gravel. The thickness of B horizon is more than 150 cm. Its colour is in 10 YR hue with value 2 to 4 and chroma 1to 2. Texture is clay with less than 15 per cent gravel. The available water capacity is very high (>200 mm/m).

Three phases were identified:

BMBmA1	Clay surface, slope 0-1%, slight erosion
BMBmB1	Clay surface, slope 1-3%, slight erosion
BMBmB2	Clay surface, slope 1-3%, moderate erosion



Landscape and Soil Profile characteristics of Beemanabeedu (BMB) Series

4.1.3 Devarahalli (DRH) Series: Devarahalli soils are moderately shallow (50-75 cm), well drained, have dark red to reddish brown and dusky red sandy clay loam to sandy clay soils. They have developed from granite gneiss and occur on very gently to gently sloping uplands.

The thickness of the solum ranges from 52 to 73 cm. The thickness of A horizon ranges from 7 to 15 cm. Its colour is in 7.5 YR and 5YR hue with value 3 to 4 and chroma 2 to 6. The texture varies from loamy sand to clay with 10 to 25 per cent gravel. The thickness of B horizon ranges from 45 to 58 cm. Its colour is in 2.5 YR hue with value 2.5 to 3 and chroma 4 to 6. Its texture is gravells sandy clay loam to gravelly sandy clay with gravel content of 15 to 35 per cent. The available water capacity is low (51-100 mm/m).

Five phases were identified:

DRHbC2g1	Loamy sand surface, slope 3-5%, moderate erosion, gravelly (15-35%)
DRHhC2g1	Sandy clay loam surface, slope 3-5%, moderate erosion, gravelly (15-35%)
DRHiB1g1	Sandy clay surface, slope 1-3%, slight erosion, gravelly (15-35%)
DRHiC2g3	Sandy clay surface, slope 3-5%, moderate erosion, extremely gravelly (60-80%)
DRHmB1g1	Clay surface, slope 1-3%, slight erosion, gravelly (15-35%)

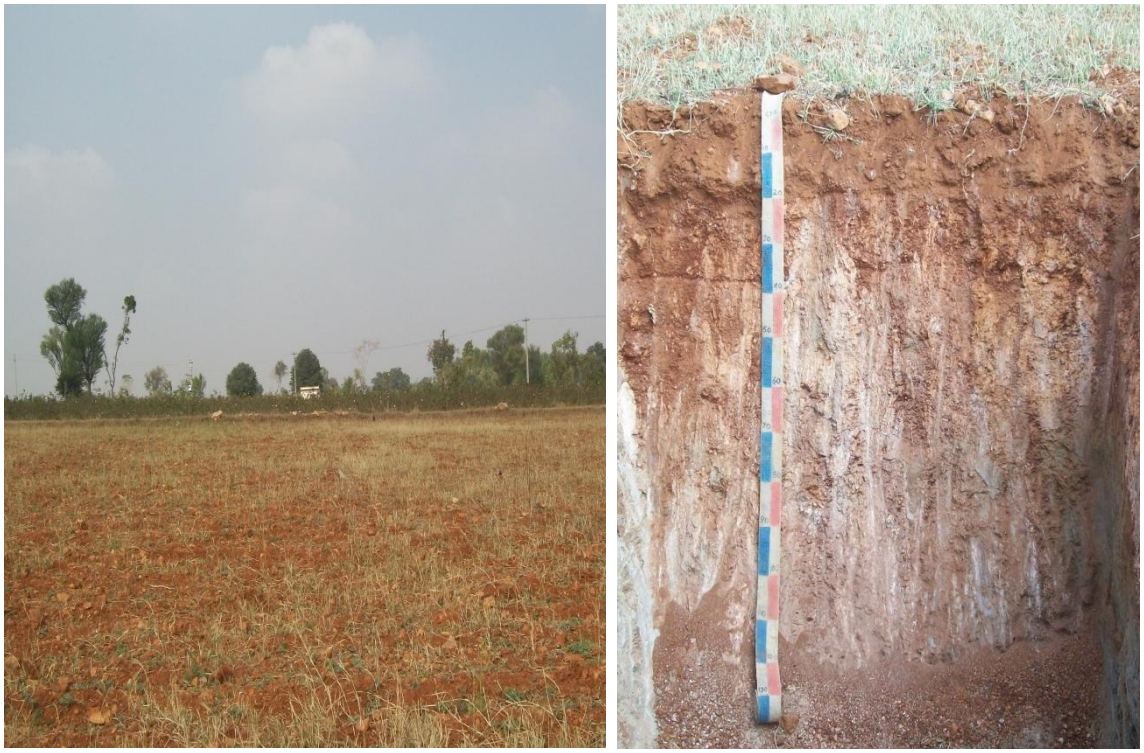
Landscape and Soil Profile characteristics of Devarahalli (DRH) Series

4.1.4 Hundipura (HDR) Series: Hundipura soils are shallow (25-50 cm), well drained, have dark reddish brown to dusky red sandy clay loam to sandy clay soils. They have developed from granite gneiss and occur on very gently to moderately sloping uplands.

The thickness of the solum ranges from 35 to 46 cm. The thickness of A horizon ranges from 7 to 18 cm. Its colour is in 7.5 YR and 5 YR hue with value 3 and chroma 3 to 4. The texture varies from loamy sand to clay with 10 to 20 per cent gravel. The thickness of B horizon ranges from 19 to 31 cm. Its colour is in 2.5 YR and 5 YR hue with value 2.5 to 3 and chroma 2 to 4. Its texture is sandy clay loam to sandy clay with gravel content of < 15 per cent. The available water capacity is very low (<50 mm/m).

Five phases were identified:

HDRhB2g1	Sandy clay loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)
HDRhC2g1	Sandy clay loam surface, slope 3-5%, moderate erosion, gravelly (15-35%)
HDRhC2g2	Sandy clay loam surface, slope 3-5%, moderate erosion, very gravelly (35-60%)
HDRiC2g1	Sandy clay surface, slope 3-5%, moderate erosion, gravelly (15-35%)
HDRiC2g3	Sandy clay surface, slope 3-5%, moderate erosion, extremely gravelly (60-80%)



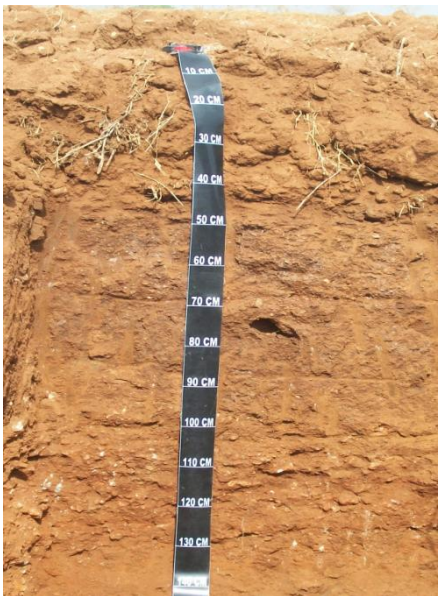
Landscape and Soil Profile characteristics of Hundipura (HDR) Series

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

The thickness of the solum ranges from 150-200 cm. The thickness of A horizon ranges from 14 to 19 cm. Its colour is in 7.5 YR hue with value 2.5 to 4 and chroma 2 to 6. The texture varies from sandy loam to clay with 10 to 15 per cent gravel. The thickness of B horizon is more than 150 cm. Its colour is in 7.5 YR hue with value 2.5 to 3 and chroma 2 to 4. Texture is sandy clay loam with <15 per cent gravel. The available water capacity is very high (>200mm/m).

Four phases were identified:

HGHiB1g1	Sandy clay surface, slope 1-3%, slight erosion, gravelly (15-35%)
HGHiB2	Sandy clay surface, slope 1-3%, moderate erosion
HGHmA1	Clay surface, slope 0-1%, slight erosion
HGHmB2g2	Clay surface, slope 1-3%, moderate erosion, very gravelly (35-60%)



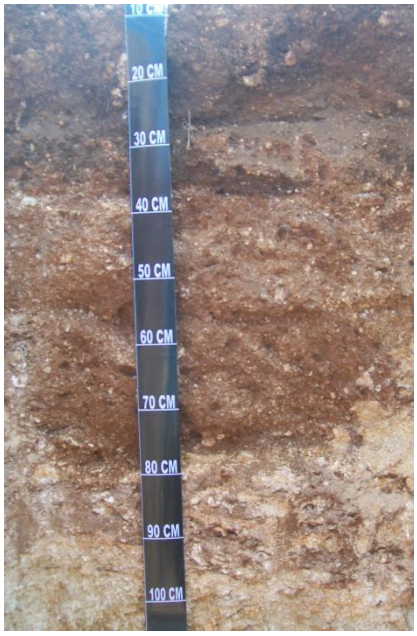
Landscape and Soil Profile characteristics of Honnegaudanahalli (HGH) Series

4.1.6 Hullipura (HPR) Series: Hullipura soils are moderately shallow (50-75 cm), well drained, have dark brown to very dark brown sandy clay loam to sandy clay soils. They have developed from granite gneiss and occur on very gently to gently sloping uplands.

The thickness of the solum ranges from 51 to 71 cm. The thickness of A horizon ranges from 13 to 18 cm. Its colour is in 7.5YR and 10 YR hue with value 2.5 to 3 and chroma 2 to 4. The texture varies from gravelly sandy loam to gravelly clay with 15 to 25 per cent gravel. The thickness of B horizon ranges from 38 to 52 cm. Its colour is in 2.5 YR and 7.5 YR hue with value 2.5 to 3 and chroma 2. Its texture is gravelly sandy clay loam to gravelly sandy clay with gravel content of 15 to 35 per cent. The available water capacity is low (51-100 mm/m).

Only one phase was identified:

HPRiB1	Sandy clay surface, slope 1-3%, slight erosion

Landscape and Soil Profile characteristics of Hullipura (HPR) Series

4.1.7 Kallipura (KLP) Series: Kallipura soils are moderately shallow (50 to 75cm), well drained, have brown to very dark brown and dark reddish brown sandy loam to clay loam soils. They have developed from granite gneiss and occur on nearly level to gently sloping uplands.

The thickness of the solum ranges from 54 to 75 cm. The thickness of A horizon ranges from 11 to 19 cm. Its colour is in 7.5 YR, 5YR and 2.5 YR hue with value 2.5 to 4 and chroma 2 to 6. The texture varies from gravelly sandy loam to gravelly clay loam with 10 to 20 per cent gravel. The thickness of B horizon ranges from 43 to 60 cm. Its colour is in 2.5 YR hue with value 3 and chroma 4 to 6. Its texture is gravelly sandy clay loam to gravelly sandy clay with gravel content of 15 to 35 per cent. The available water capacity is low (51-100 mm/m).

Five phases were identified:

KLPhB2	Sandy clay loam surface, slope 1-3%, moderate erosion
KLPhB2g1	Sandy clay loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)
KLPiB2g1	Sandy clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)
KLPcB1g1	Sandy loam surface, slope 1-3%, slight erosion, gravelly (15-35%)
KLPiB1	Sandy clay surface, slope 1-3%, slight erosion

Landscape and Soil Profile characteristics of Kallipura (KLP) Series

4.1.8 Kannigala (KNG) Series: Kannigala soils are moderately deep (75-100 cm), well drained, have dark reddish brown to dark red sandy clay loam to sandy clay soils. They have developed from granite gneiss and occur on very gently to strongly sloping uplands.

The thickness of the solum ranges from 78 to 94 cm. The thickness of A horizon ranges from 12 to 15 cm. Its colour is in 5YR, 2.5 YR and 7.5 YR hue with value 3 and

chroma 3 to 4. The texture varies from gravelly loamy sand to clay with 15 to 25 per cent gravel. The thickness of B horizon ranges from 69 to 80 cm. Its colour is in 2.5 YR hue with value 2.5 to 3 and chroma 4 to 6. Texture varies from gravelly sandy clay loam to gravelly sandy clay with 40 to 60 per cent gravel. The available water capacity is very low (<50 mm/m).

Three phases were identified:

KNGbB1g1	Loamy sand surface, slope 1-3%, slight erosion, gravelly (15-35%)
KNGhB1g2	Sandy clay loam surface, slope 1-3%, slight erosion, very gravely (35-60%)
KNGiB2g2	Sandy clay surface, slope 1-3%, moderate erosion, very gravelly (35-60%)

4.1.9 Maddinahundi (MDH) Series: Maddinahundi soils are deep (100-150 cm), well drained, have dark reddish brown sandy clay soils. They have developed from granite gneiss and occur on very gently to gently sloping uplands.

The thickness of the solum ranges from 102 to 150 cm. The thickness of A horizon ranges from 12 to 25 cm. Its colour is in 7.5 YR, 5 YR and 2.5 YR hue with value 3 and chroma 2 to 6. The texture varies from gravelly sandy loam to gravelly sandy clay with 15 to 30 per cent gravel. The thickness of B horizon ranges from 90 to 138 cm. Its colour is in 2.5 YR hue with value 2.5 to 3 and chroma 4. Its texture is gravelly sandy clay with gravel content of >35 per cent. The available water capacity is low (51-100 mm/m).

Two phases were identified:

MDHhC2g1	Sandy clay loam surface, slope 3-5%, moderate erosion, gravelly (15-35%)
MDHiB1	Sandy clay surface, slope 1-3%, slight erosion

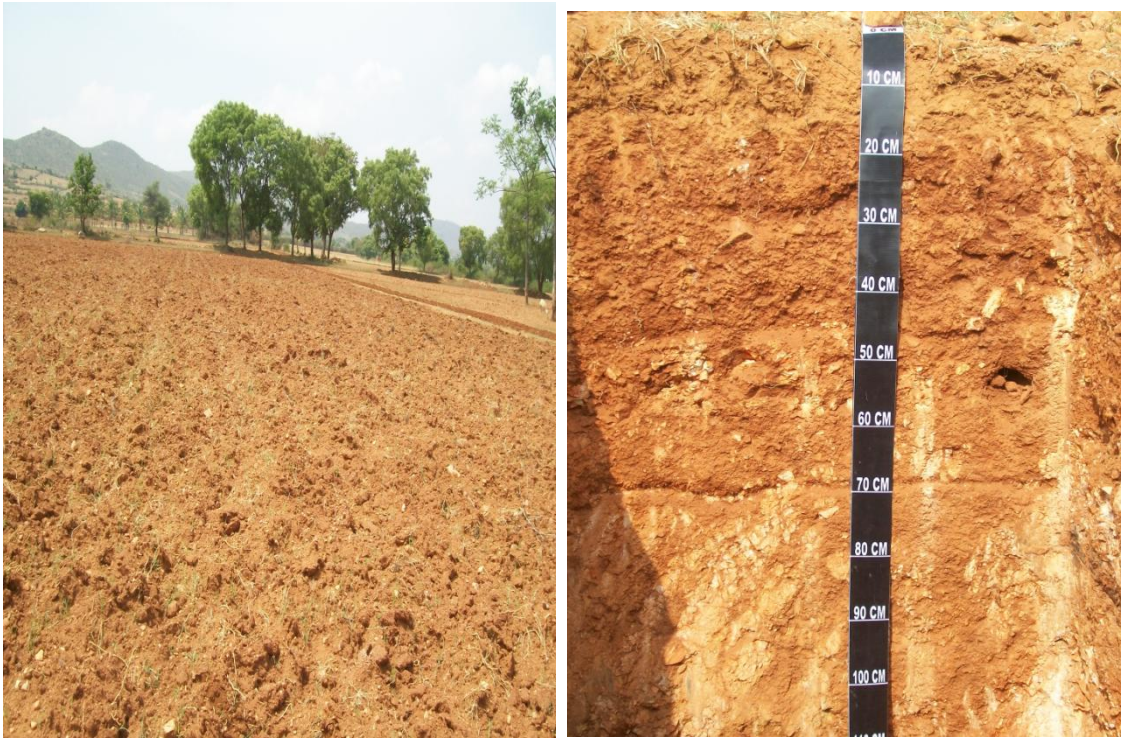
Landscape and Soil Profile characteristics of Maddinahundi (MDH) Series

4.1.10 Magoonahalli (MGH) Series: Magoonahalli soils are moderately shallow (50-75 cm), well drained, have very dark brown to dark brown sandy clay loam soils. They have developed from granite gneiss and occur on very gently to moderately sloping uplands.

The thickness of the solum ranges from 53 to 74 cm. The thickness of A horizon ranges from 15 to 18 cm. Its colour is in 7.5 YR and 5 YR hue with value 3 to 4 and chroma 2 to 6. The texture varies from gravelly sandy loam to gravelly clay with 15 to 25 per cent gravel. The thickness of B horizon ranges from 44 to 52 cm. Its colour is in 2.5 YR hue with value 2.5 to 3 and chroma 4. Its texture is gravelly sandy clay loam with gravel content of >35 per cent. The available water capacity is very low (<50 mm/m).

Four phases were identified:

MGHcB1g1	Sandy loam surface, slope 1-3%, slight erosion, gravelly (15-35%)
MGHcC2	Sandy loam surface, slope 3-5%, moderate erosion
MGHhB1g1	Sandy clay loam surface, slope 1-3%, slight erosion, gravelly (15-35%)
MGHhC2g1	Sandy clay loam surface, slope 3-5%, moderate erosion, gravelly (15-35%)



Landscape and Soil Profile characteristics of Magoonahalli (MGH) 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 gathered through land resource inventory and several thematic maps are generated. These would help in identifying the areas suitable for growing crops and conservation structures needed thus helping to maintain good soil health for sustained crop production. The various 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: Soil depth, soil texture, coarse fragments, soil reaction, available water capacity, calcareousness, salinity/alkali *etc*.
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: The soil map units have few or very few limitations that restrict their use.
Class II: The soil map units have moderate limitations that reduce the choice of crops or that require moderate conservation practices.
Class III: The soil map units have severe limitations that reduce the choice of crops or that require special conservation practices.
Class IV: The soil map units have very severe limitations that reduce the choice of crops or that require very careful management.
Class V: Soils in the mapping units are not likely to erode, but have other limitations that are impractical to remove and as such not suitable for agriculture.
Class VI: The lands have severe limitations that make them generally unsuitable for cultivation.

Class VII: The lands have very severe limitations that make them unsuitable for cultivation.
Class VIII: Soil and other miscellaneous areas that have very severe limitations that nearly preclude their use for any crop production.

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 or slopes, “w” indicates drainage or wetness as a limitation for plant growth, “s” indicates shallow soil depth, coarse or heavy textures, calcareousness, salinity/alkali 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 35 soil map units identified in Gopalagiri Colony-1 microwatershed in Gundlupet taluk have been grouped under two land capability classes and 5 land capability subclasses (Fig 5.1). About 95 per cent area is suitable for agriculture and remaining 5 per cent is not suitable for agriculture.

Good cultivable lands (Class II) cover a maximum area of about 76 per cent and are distributed in all the part of the micowatershed with minor problems of soil, wetness and erosion. Moderately good cultivable lands (Class III) cover an area of about 18 per cent and are distributed in the southern, eastern, central and northern part of the microwatershed with moderate problems of erosion and soil.

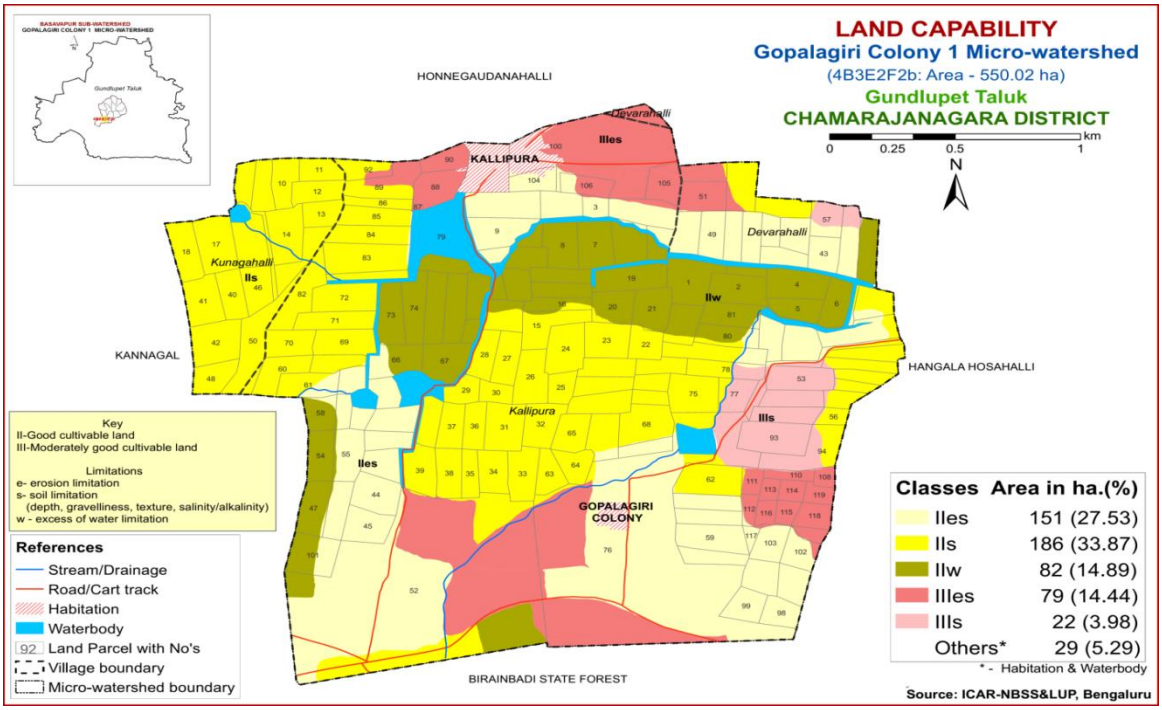


Fig. 5.1 Land Capability map of Gopalagiri Colony-1 Microwatershed

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 shown in Figure 5.2.

Very deep soils (>150 cm) cover maximum area of about 224 ha (41%) and are distributed in all the parts of the microwatershed. Deep (100-150 cm) soils occupy an area of about 92 ha (17%) and are distributed in the southern, central and northeastern part of the microwatershed. Moderately deep (75-100 cm) soils occupy small area of about 24 ha (4%) and are distributed in the northern part of the microwatershed. Moderately shallow (50-75 cm) soils occupy an area about 128 ha (23%) and are distributed in the southern, central, southeastern, northern and northeastern part of the microwatershed. Shallow soils (25-50 cm) occupy an area of about 53 ha (10%) in the northern and southern part of the microwatershed.

The most productive lands 316 ha (57%) with respect to soil rooting depth where all climatically adapted annual and perennial crops can be grown are deep (100-150 cm) and very deep (>150 cm depth) occurring in all the parts of the microwatershed.

The most problem lands with an area of about 53 ha (10%) having shallow (25-50 cm) rooting depth occur in the southern, central and northern part of the microwatershed. They are not suitable for growing agricultural crops but well suited for pasture, forestry or other recreational purposes. Occasionally, short duration crops may be grown if rainfall is normal.

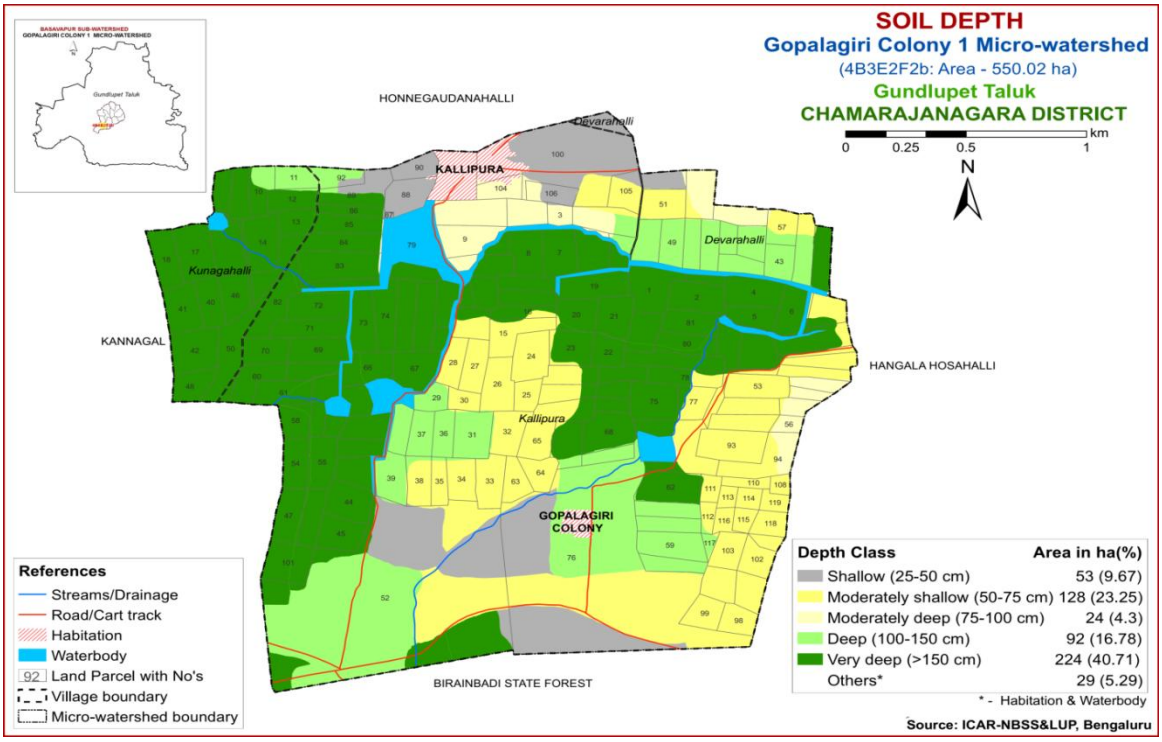


Fig. 5.2 Soil Depth map of Gopalagiri Colony-1 Microwatershed

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.

Maximum area of 358 ha (65%) has soils that are clayey at the surface and are distributed in all the parts of the microwatershed. Loamy soil covers an area of about 144 ha (26%) and is distributed in southern, southwestern, eastern and northern part of the microwatershed. A small area of about 19 ha (3%) has soils that are sandy loam at the surface and are distributed in the eastern, southeastern and northern part of the microwatershed.

The most productive lands (65%) 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 problems of drainage, infiltration, workability and other physical problems. The other most productive lands (26%) loamy soils which are have high potential for AWC, nutrient availability but have no drainage or other physical problem. The most problem soils (3%) with respect to surface soil texture are the sandy soils that have poor soil water retention and availability and nutrient retention and availability, but have better rain water infiltration, less runoff and soil moisture conservation, less capillary rise and less evaporation losses.

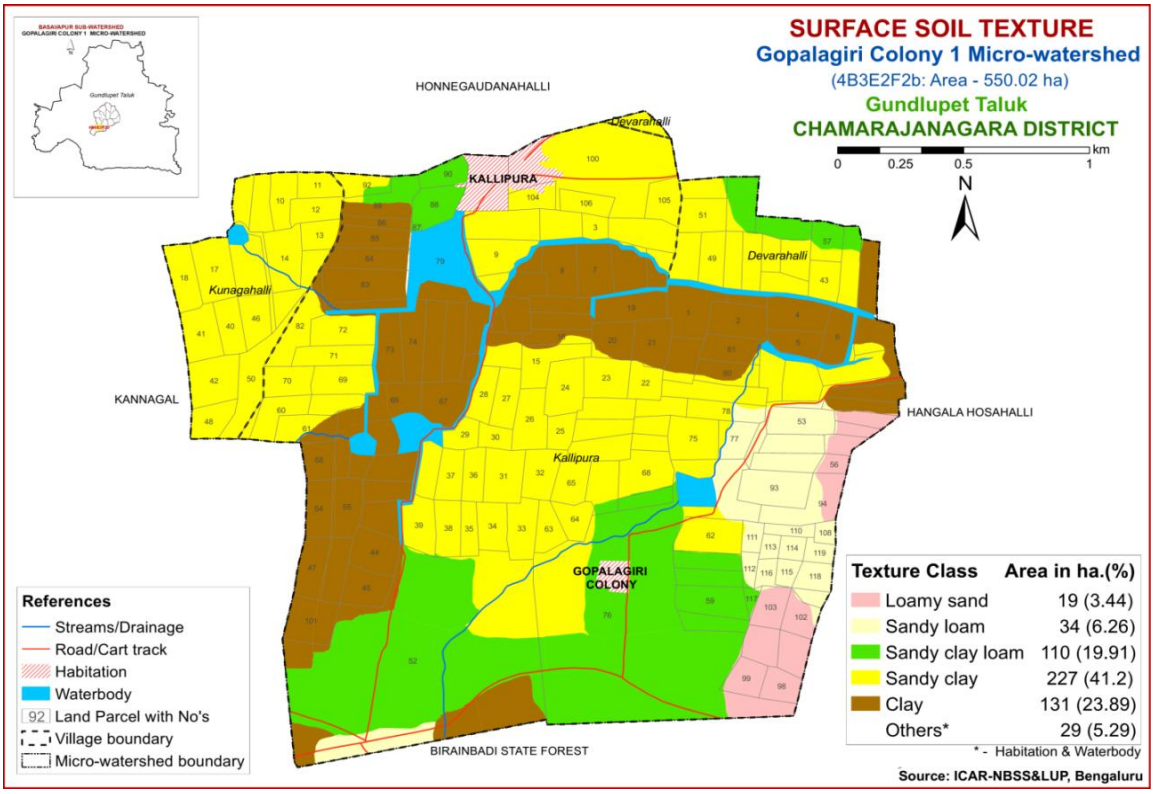


Fig. 5.3 Surface Soil Texture map of Gopalagiri Colony-1 Microwatershed

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 the 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 geographical distribution in the microwatershed is shown in Figure 5.4.

Maximum area in the microwatershed has soils that are non gravelly (<15%) covering about 259 ha (47%) and are distributed in all parts of the microwatershed (Fig.

5.4) followed by soils that are gravelly (15-35%) covering about 211 ha (38%) and are distributed in the northeastern, southern, northern, eastern and central part of the microwatershed. The soils that are very gravelly (35-60%) covering a small area of about 28 ha (5%) are distributed in the northern and southern part of the microwatershed. The extremely gravelly soils (60-80%) covering a minor area of about 23 ha (4%) are distributed in the northern part of the microwatershed.

The most productive lands with respect to gravelliness are found to be 47 %. They are non-gravelly with less than 15 per cent gravel and have potential for growing both annual and perennial crops. The problem soils (9%) that are very gravelly (35-60%) and extremely gravelly (60-80%) where only short duration crops can be grown.

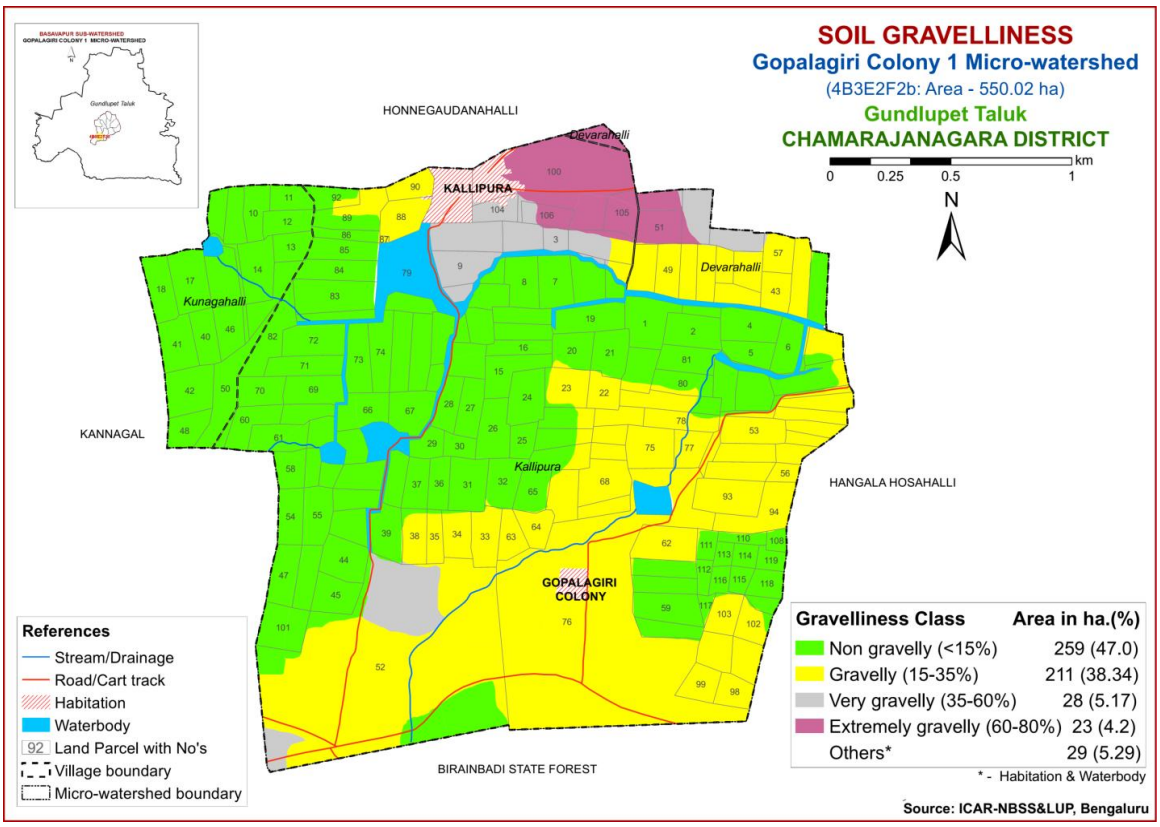


Fig. 5.4 Soil Gravelliness map of Gopalagiri Colony-1 Microwatershed

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) were estimated by considering the soil texture, mineralogy, soil depth and gravel content (Sehghal *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 those classes an AWC map was

generated. The area extent and their geographical distribution in the microwatershed is shown in Figure 5.5.

An area of about 118 ha (21%) in the microwatershed has soils that are very low (<50 mm/m) in available water capacity and are distributed in the northern, southern and eastern part of the microwatershed. An area of about 179 ha (33%) has soils that are low (51-100 mm/m) in available water capacity and are distributed in the central, southern, northeastern and southeastern part of the microwatershed. Maximum area of 224 ha (41%) has soils that have very high (>200 mm/m) available water capacity and are distributed in all parts of the microwatershed.

An area of about 224 ha (41%) has soils that have high potential (>200 mm/m) with regard to available water capacity where all climatically adapted long duration crops can be grown successfully. About 297 ha (54%) 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.

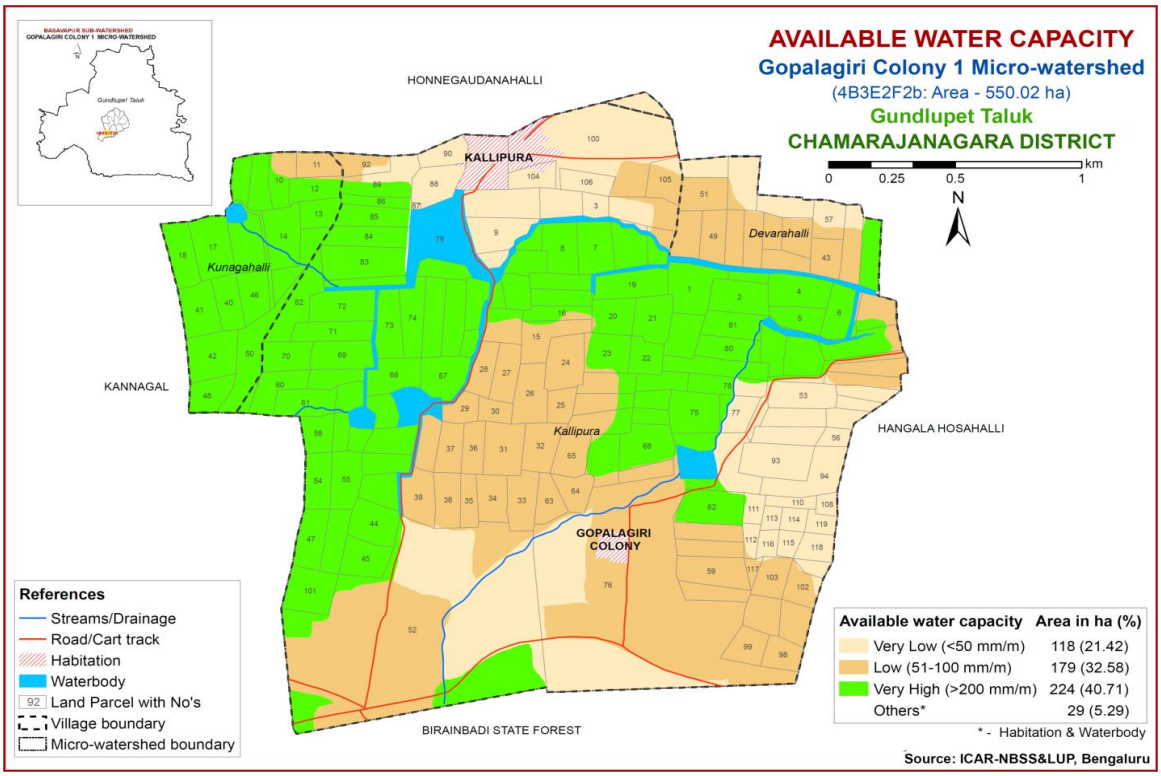


Fig. 5.5 Available Water Capacity map of Gopalagiri Colony-1 Microwatershed

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. The area extent and their geographical distribution in the microwatershed is shown in Figure 5.6.

Major area of about 386 ha (70%) falls under very gently sloping (1-3% slope) lands and are distributed in all parts of the microwatershed followed by a gently sloping (3-5% slope) lands. It covers an area of about 128 ha (23%) and is distributed in the southern, southeastern and northern part of the microwatershed. A minor area of about 6 ha (1%) falls under nearly level (0-1% slope) lands and are distributed in the southern part of the microwatershed.

An area of about 392 ha (71%) 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.

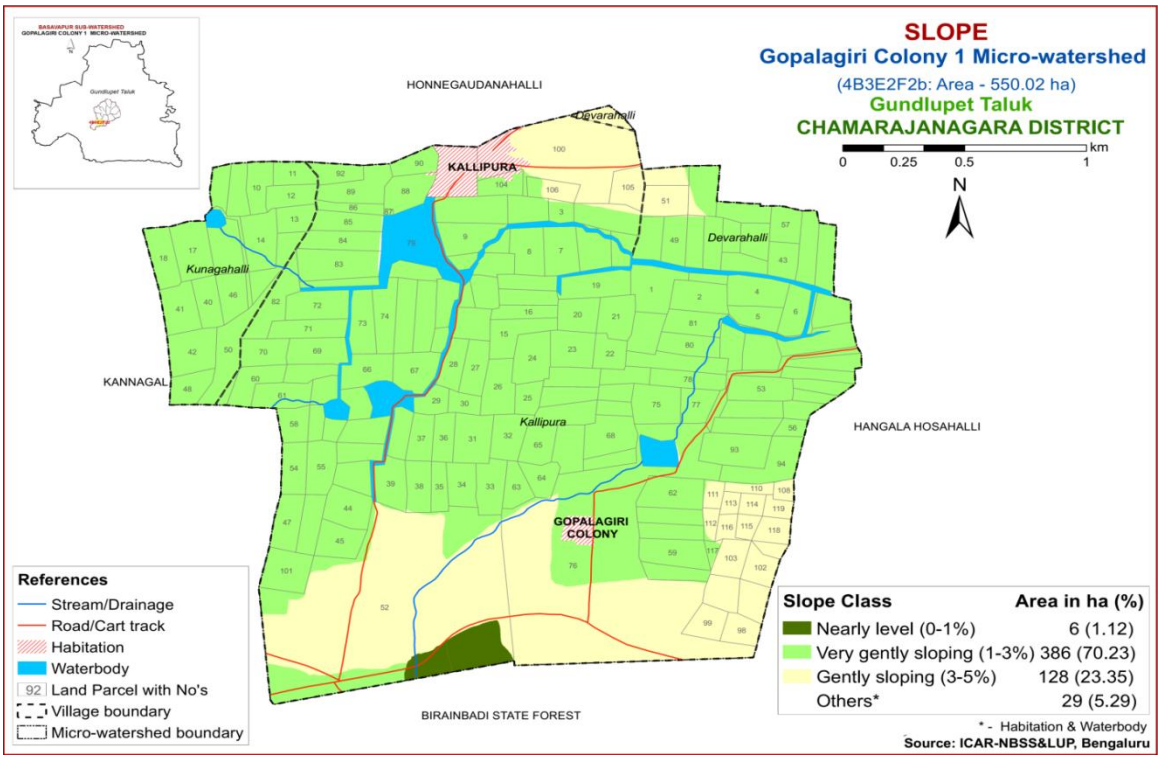


Fig. 5.6 Soil Slope map of Gopalagiri Colony-1 Microwatershed

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 different microwatersheds is given in Figure 5.7.

Soils that are slightly eroded (e1 class) cover an area of about 244 ha (44%) in the microwatershed. They are distributed in the central, western, eastern and southern part of the microwatershed. Moderately eroded (e2 class) soils cover maximum area of about 277 ha (50%) and are distributed in the central, southwestern, southern, northern and southeastern part of the microwatershed.

The problem soils with respect to erosion are moderately eroded soils covering an area of 277 ha (50%) that need soil and water conservation and other land husbandry measures.

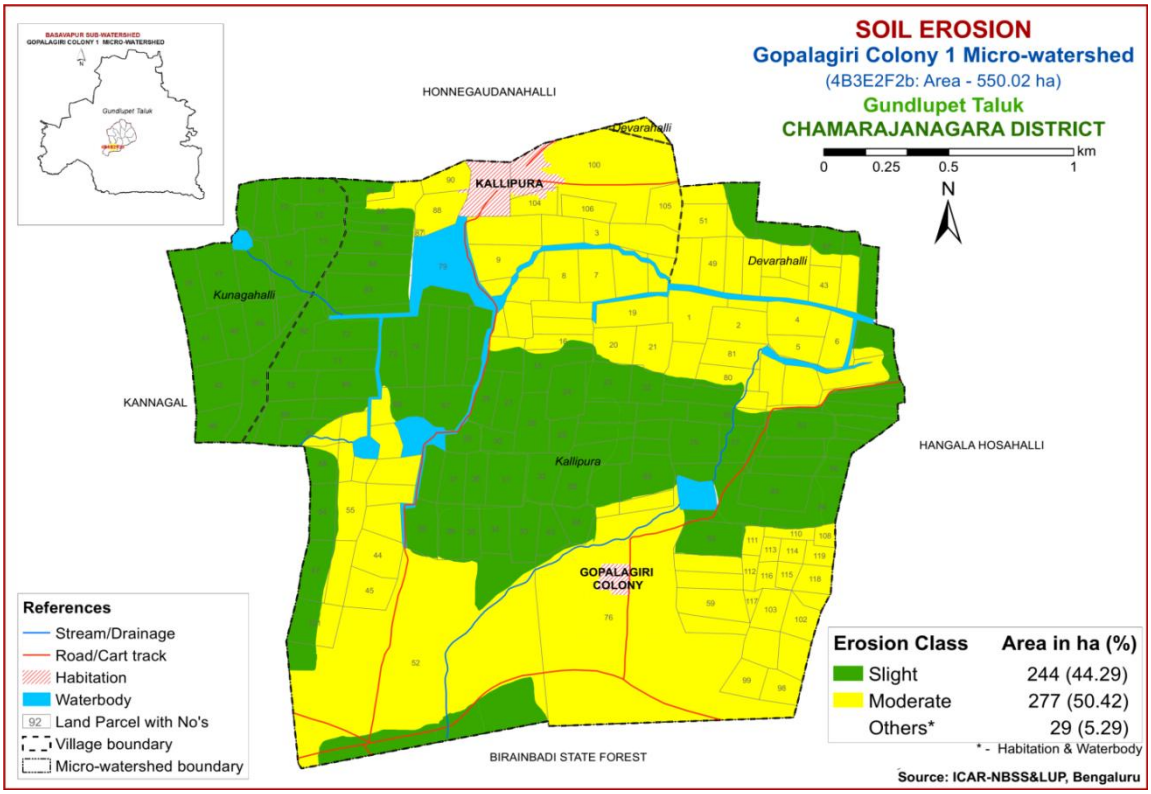


Fig. 5.7 Soil Erosion map of parts of Gopalagiri Colony-1 Microwatershed

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. 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 (83 samples) from the grid points (one soil sample at every 250 m interval) all over the watersheds through land resource inventory in the year 2014 were analysed for pH, EC, organic carbon, available phosphorus and potassium and for micronutrients like zinc, 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 Gopalagiri Colony-1 microwatershed for soil reaction (pH) showed that an area of about 139 ha (25%) is moderately alkaline (pH 7.8-8.4) and is distributed in the central and northeastern part of the microwatershed. Maximum area of about 155 ha (28%) is slightly alkaline (pH 7.3-7.8) and is distributed in the western, northern and central part of the microwatershed. An area of about 65 ha (12%) is moderately acid (pH 5.5-6.0) and is distributed in the southern part of the microwatershed. About 66 ha (12%) is slightly acid (pH 6.0-6.5) and is distributed in the southern and southeastern part of the microwatershed. An area of about 95 ha (17%) is under neutral (pH 6.5-7.3) and is distributed in the southwestern, central, eastern and northwestern part of the microwatershed (Fig.6.1).

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 content in the soils of the microwatershed is low (<0.5%) covering an area of about 124 ha (23%) and is distributed in the southern and eastern part of microwatershed. Major area of about 361 ha (66%) is medium (0.5-0.75%) in organic carbon and is distributed in all parts of the microwatershed. A very small area of about 36 ha (7%) is high (>0.75%) in organic carbon and is distributed in the southwestern part of the microwatershed (Fig.6.3).

6.4 Available Phosphorus

The soil analysis revealed that available phosphorus (Fig.6.4) is medium (23-57kg/ha) in maximum area of about 237 ha (43%) and is distributed in all parts of the microwatershed. An area of about 188 ha (34%) is is low (<23 kg/ha) and is distributed in the southern, central, southeastern, western and northeastern part of the microwatershed. About 95 ha (17%) is high (>57 kg/ha) and is distributed in the northwestern, southwestern and central part of the microwatershed. There is an urgent need to increase the dose of phosphorous for all the crops by 25 per cent over the recommended dose to realize better crop performance.

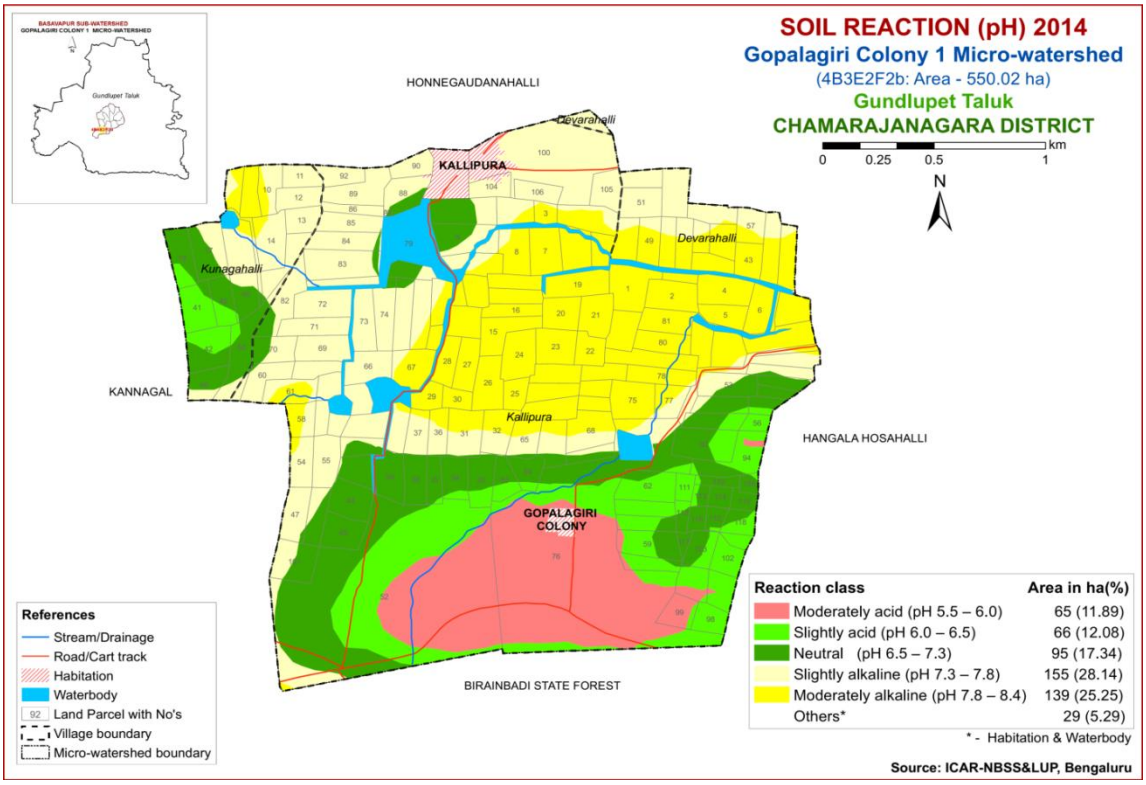


Fig. 6.1 Soil Reaction (pH) map of Gopalagiri Colony-1 Microwatershed

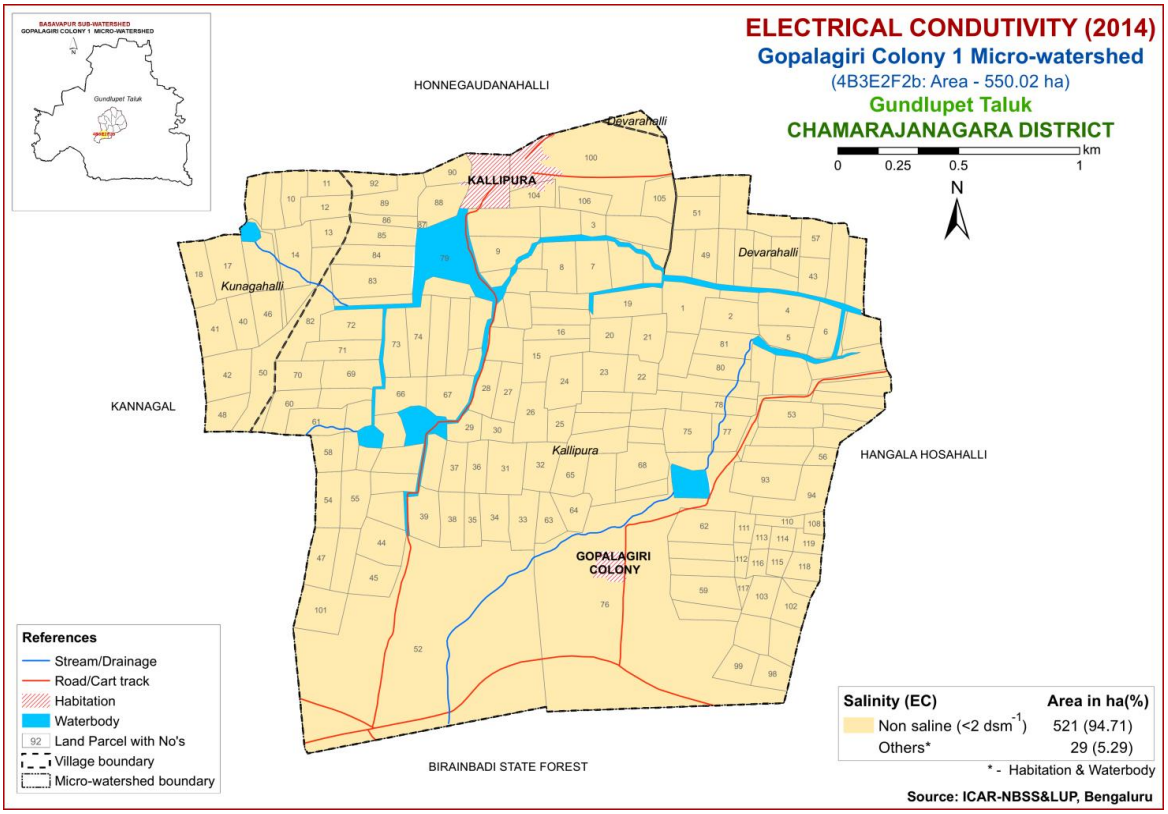


Fig. 6.2 Electrical Conductivity (EC) map of Gopalagiri Colony-1 Microwatershed

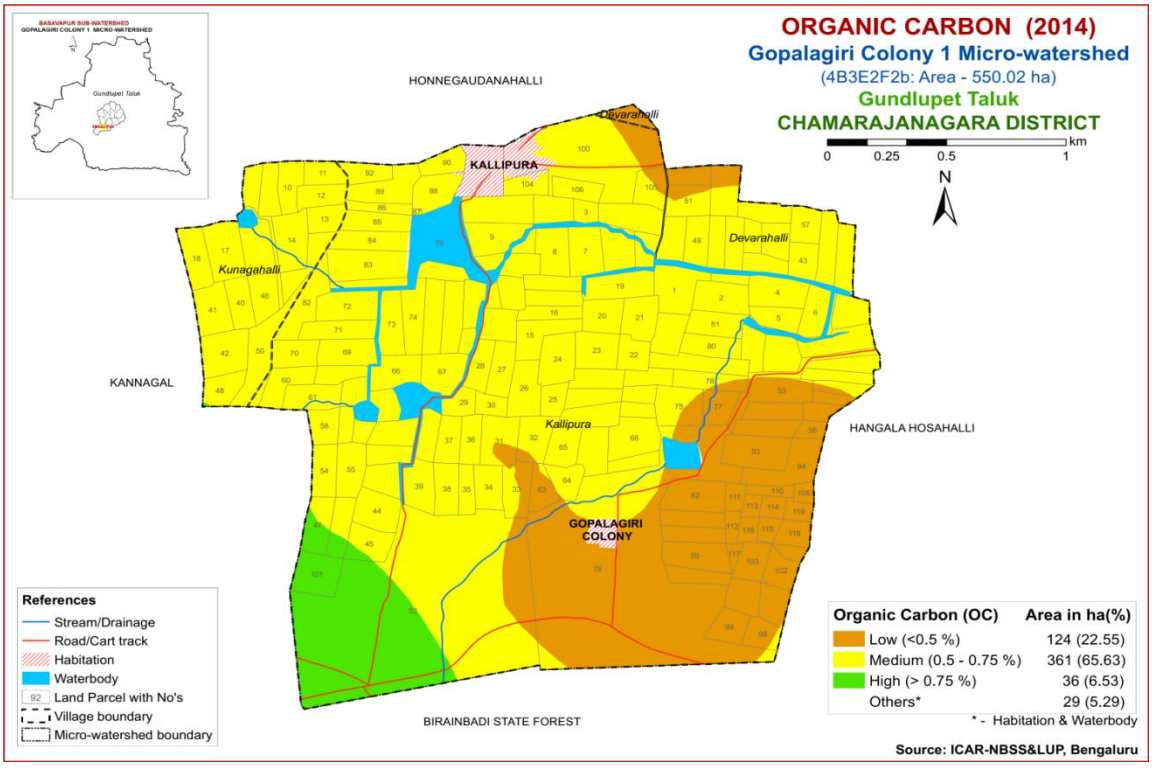


Fig.6.3 Soil Organic Carbon map of Gopalagiri Colony-1 Microwatershed

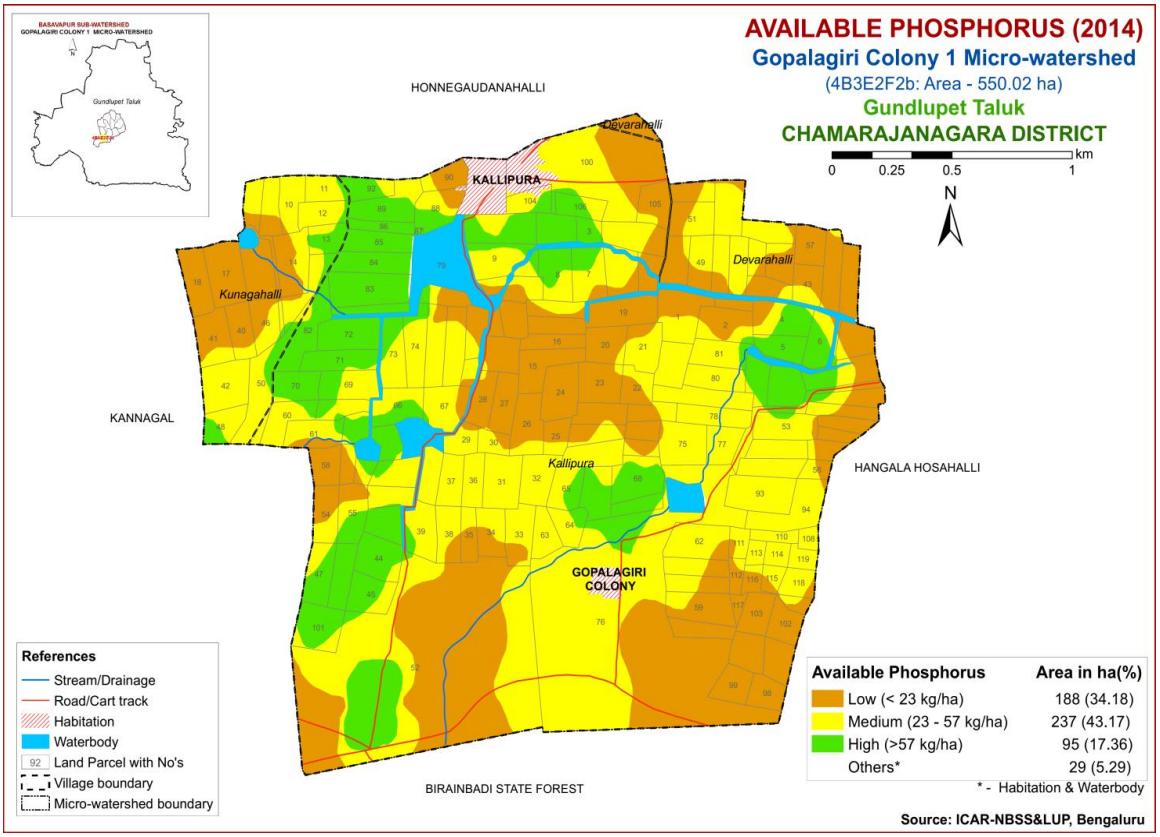


Fig.6.4 Soil available Phosphorus map of Gopalagiri Colony-1 Microwatershed

6.5 Available Potassium

Available potassium is high (>337 kg/ha) in maximum area of about 469 ha (85%) and is distributed in all parts of the microwatershed (Fig.6.5). The available potassium content is medium (145-337 kg/ha) in an area of 52 ha (9%) and is distributed in the southeastern part of the microwatershed.

6.6 Available Sulphur

Available sulphur content is low (<10 ppm) in maximum area of about 461 ha (84%) in the microwatershed and is distributed in all parts of the microwatershed. An area of about 60 ha (11%) is medium (10-20 ppm) in available sulphur and is distributed in the southern and central part of the microwatershed (Fig.6.6).

6.7 Available Boron

Available boron content (Fig 6.7) is low (<0.5 ppm) in an area of about 246 ha (45%) and are distributed in the southwestern, central, eastern, northwestern and northern part of the microwatershed. Available boron content is medium (0.5-1.0 ppm) in maximum area of about 275 ha (50%) and is distributed in the central, southern, western, northern, southwestren and eastern part of the microwatershed.

6.8 Available Iron

Available iron is deficient (<4.5 ppm) in an area of 179 ha (32%) and is distributed in northeastern and central part of the microwatershed. Major area of about 342 ha (62%) is sufficient in available iron and is distributed in all parts of the microwatershed (Fig 6.8).

6.9 Available Manganese

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

6.10 Available Copper

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

6.11 Available Zinc

Available zinc is deficient (<0.6 ppm) in maximum area of 385 ha (70%) and is distributed in all parts of the microwatershed. An area of about 135 ha (25%) is sufficient in available zinc and is distributed in the northern, northwestern, northeastern and southwestern part of the microwatershed (Fig 6.11).

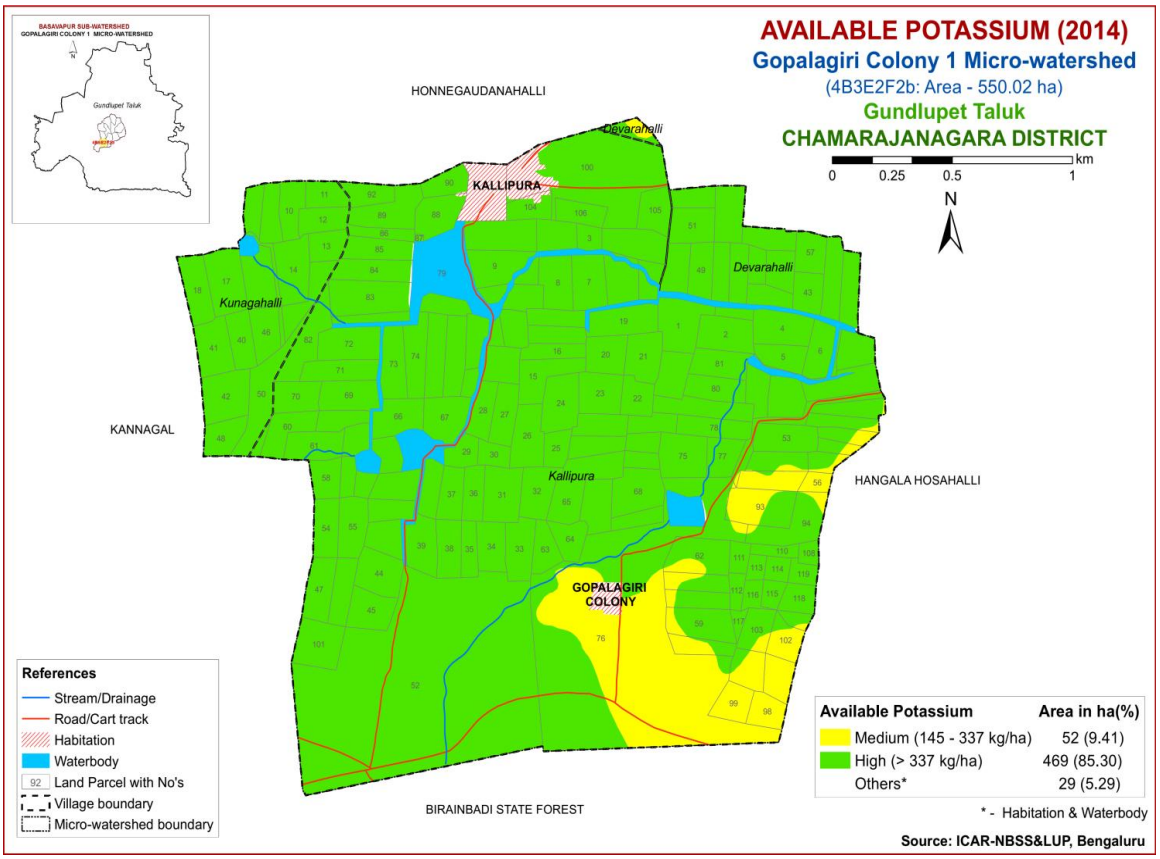


Fig.6.5 Soil available Potassium map of Gopalagiri Colony-1 Microwatershed

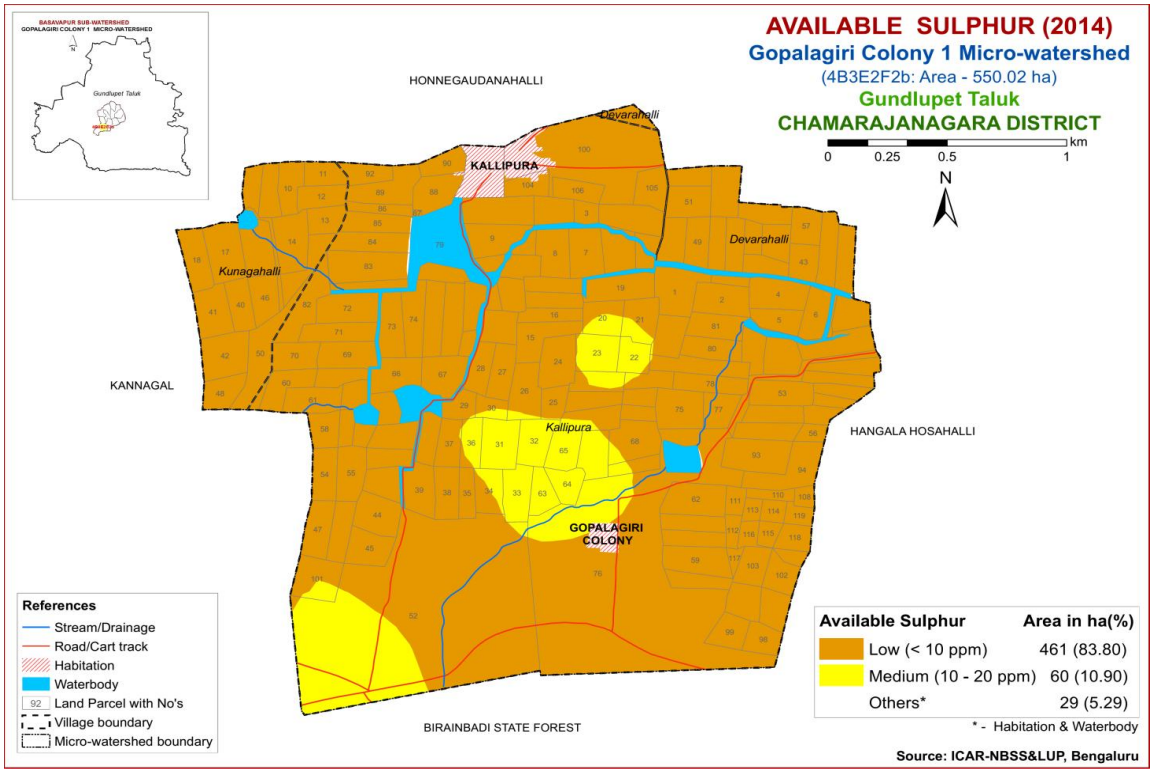


Fig.6.6 Soil available Sulphur map of Gopalagiri Colony-1 Microwatershed

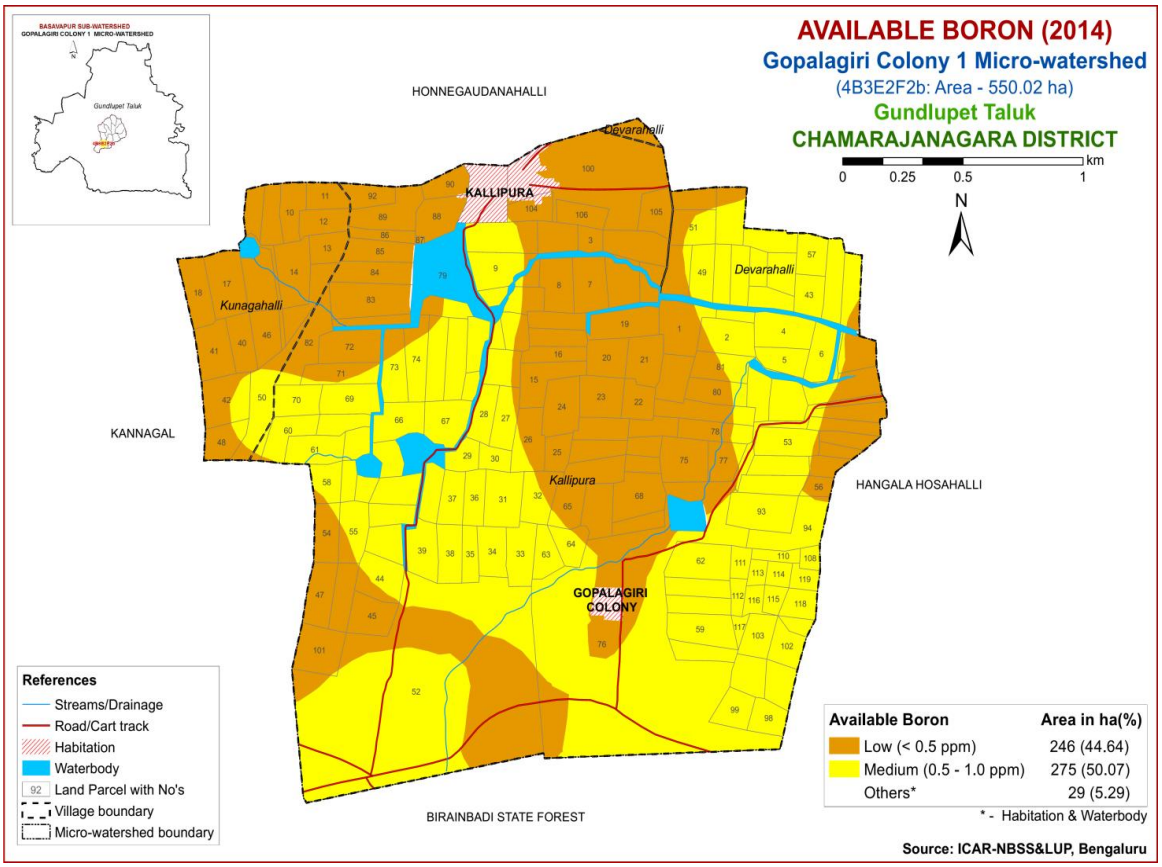


Fig.6.7 Soil available Boron map of Gopalagiri Colony-1 Microwatershed

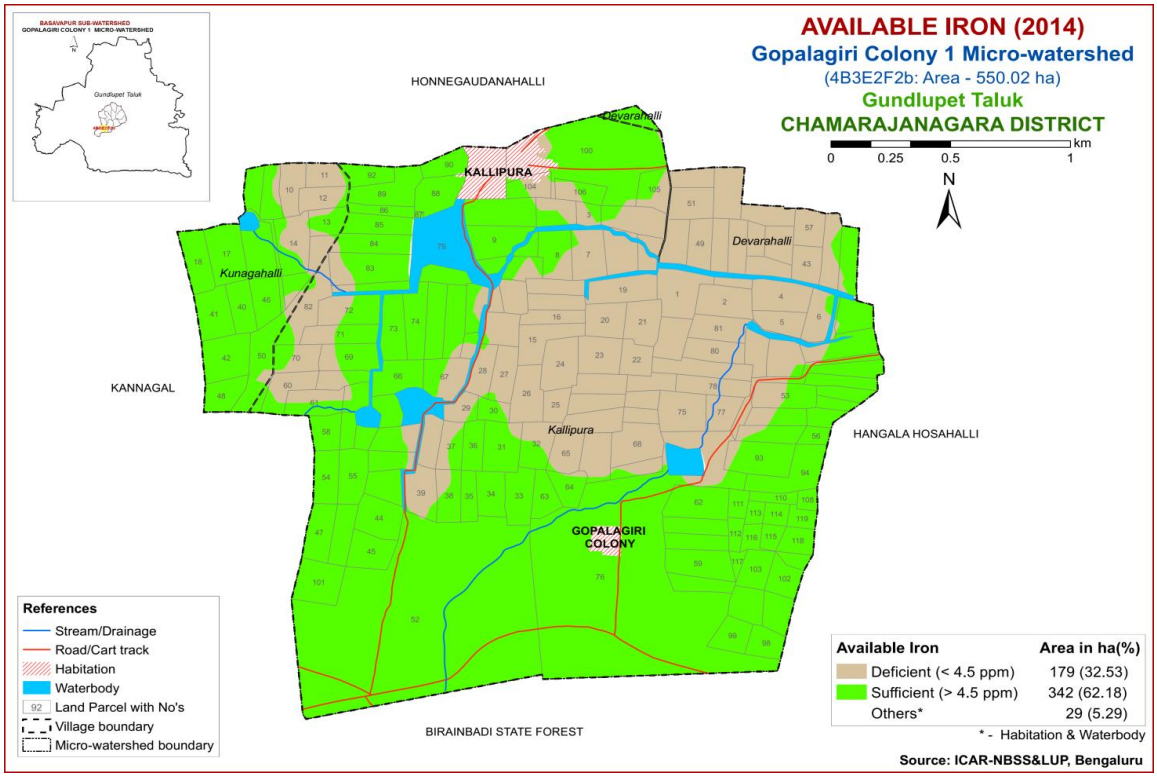


Fig.6.8 Soil available Iron map of Gopalagiri Colony-1 Microwatershed

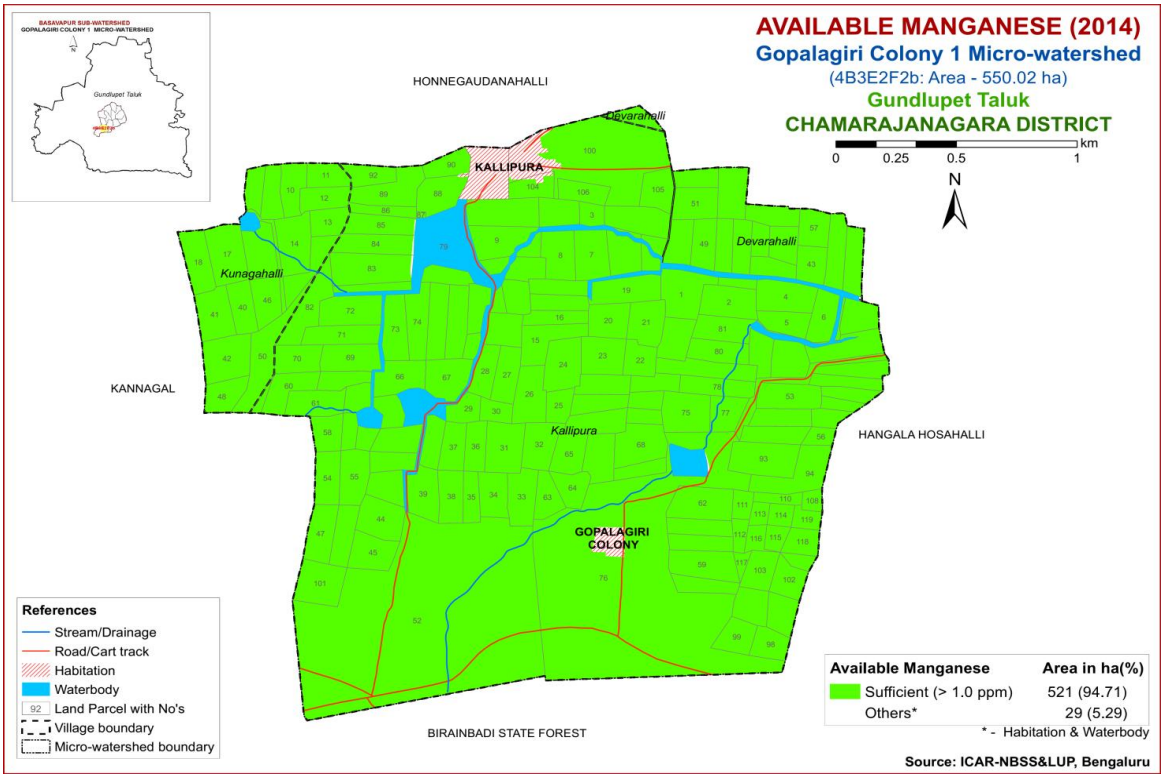


Fig.6.9 Soil available Manganese map of Gopalagiri Colony-1 Microwatershed

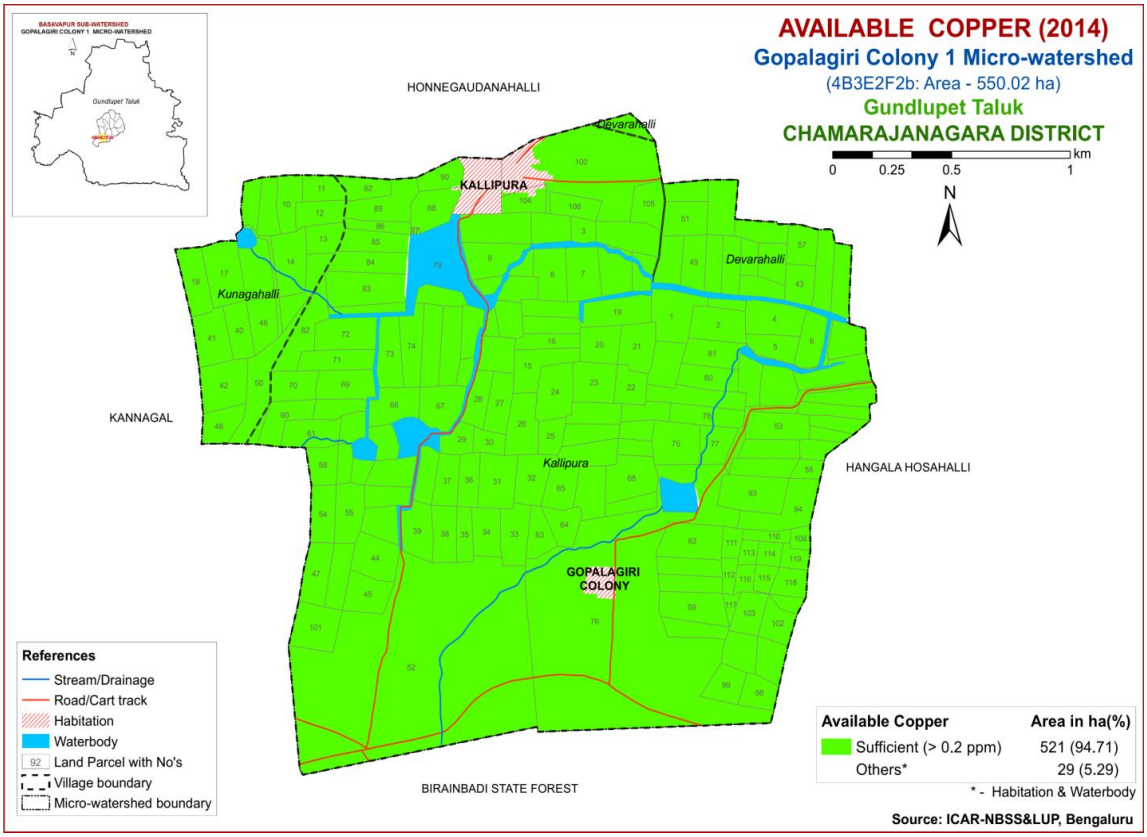


Fig.6.10 Soil available Copper map of Gopalagiri Colony-1 Microwatershed

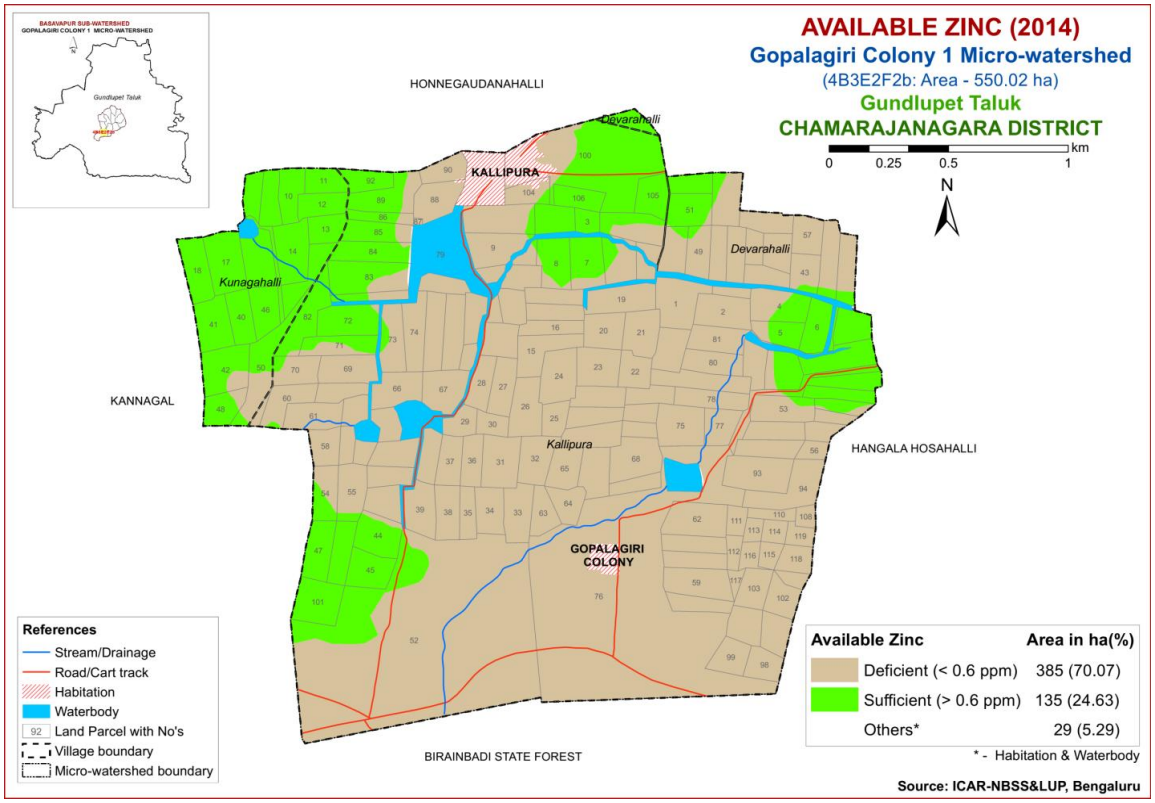


Fig.6.11 Soil available Zinc map of Gopalagiri Colony-1 Microwatershed

Chapter 7

LAND SUITABILITY FOR MAJOR CROPS

The soil and land resource units (soil phases) of Gopalagiri Colony-1 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 excess salt/calcareousness and 'w' for drainage. These limitations are indicated as lower case letters to the class symbol. For example, moderately suitable land 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 27 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 bicolar*)

Sorghum is one of the major crops grown in Karnataka in an area of 11.02 lakh ha in Bijapur, Gulbarga, Raichur, Bidar, Belgaum, Dharwad, Bellary, Chitradurga, Mysore and Chamarajnagar 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 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.

Maximum area of about 246 ha (45%) in the microwatershed has soils that are highly suitable (Class S1) for growing sorghum crop. They have minor or no limitations for growing sorghum and are distributed in the western, northwestern, central and

northeastern part of the microwatershed. An area of about 150 ha (29%) is moderately suitable (Class S2) for growing sorghum and are distributed in the central, southeastern, southwestern and eastern part of the microwatershed.

Table 7.1 Soil-Site Characteristics of Gopalagiri Colony-1 Microwatershed

Soil Map Units	Climate (P) (mm)	Growing period (Days)	Drainage class	Soil depth (cm)	Soil texture		Gravelliness		AWC (mm/m)	Slope (%)	Erosion	pH	EC	ESP	CEC Cmol (p^+)kg^{-1}	BS (%)
					Surface	Subsurface	Surface (%)	Subsurface (%)								
ARKiB1	734	150	wd	>150	sc	sc-c	-	<15	>200	1-3	Slight					
ARKmB1	734	150	wd	>150	c	sc-c	-	<15	>200	1-3	Slight					
ARKmB2	734	150	wd	>150	c	sc-c	-	<15	>200	1-3	Moderate					
BMBmA1	734	150	mwd	>150	c	c	-	-	>200	0-1	Slight					
BMBmB1	734	150	mwd	>150	c	c	-	-	>200	1-3	Slight					
BMBmB2	734	150	mwd	>150	c	c	-	-	>200	1-3	Moderate					
DRHbC2g1	734	150	wd	50-75	ls	scl-sc	15-35	15-35	51-100	3-5	Moderate					
DRHhC2g1	734	150	wd	50-75	sc	scl-sc	15-35	15-35	51-100	3-5	Moderate					
DRHiB1g1	734	150	wd	50-75	sc	scl-sc	15-35	15-35	51-100	1-3	Slight					
DRHiC2g3	734	150	wd	50-75	sc	scl-sc	60-80	15-35	51-100	3-5	Moderate					
DRHmB1g1	734	150	wd	50-75	c	scl-sc	15-35	15-35	51-100	1-3	Slight					
HDRhB2g1	734	150	wd	25-50	sc	scl-sc	15-35	<15	<50	1-3	Moderate					
HDRhC2g1	734	150	wd	25-50	sc	scl-sc	15-35	<15	<50	3-5	Moderate					
HDRhC2g2	734	150	wd	25-50	sc	scl-sc	35-60	<15	<50	3-5	Moderate					
HDRiC2g1	734	150	wd	25-50	sc	scl-sc	15-35	<15	<50	3-5	Moderate					
HDRiC2g3	734	150	wd	25-50	sc	scl-sc	60-80	<15	<50	3-5	Moderate					
HGHiB1g1	734	150	wd	>150	sc	scl	15-35	<15	>200	1-3	Slight					
HGHiB2	734	150	wd	>150	sc	scl	-	<15	>200	1-3	Moderate					
HGHmA1	734	150	wd	>150	c	scl	-	<15	>200	0-1	Slight					
HGHmB2g2	734	150	wd	>150	c	scl	35-60	<15	>200	1-3	Moderate					
HPRiB1	734	150	wd	50-75	sc	scl-sc	-	15-35	51-100	1-3	Slight					
KLPhB2	734	150	wd	100-150	sc	scl-sc	-	15-35	51-100	1-3	Moderate					
KLPhB2g1	734	150	wd	100-150	sc	scl-sc	15-35	15-35	51-100	1-3	Moderate					
KLPiB2g1	734	150	wd	100-150	sc	scl-sc	15-35	15-35	51-100	1-3	Moderate					
KLPcB1g1	734	150	wd	100-150	sl	scl-sc	15-35	15-35	51-100	1-3	Slight					
KLPiB1	734	150	wd	100-150	sc	scl-sc	-	15-35	51-100	1-3	Slight					
KNGbB1g1	734	150	wd	75-100	ls	scl-sc	15-35	>35	<50	1-3	Slight					

KNGhB1g2	734	150	wd	75-100	sc	scl-sc	35-60	>35	<50	1-3	Slight					
KNGiB2g2	734	150	wd	75-100	sc	scl-sc	35-60	>35	<50	1-3	Moderate					
MDHhC2g1	734	150	wd	100-150	sc	sc	15-35	>35	51-100	3-5	Moderate					
MDHiB1	734	150	wd	100-150	sc	sc	-	>35	51-100	1-3	Slight					
MGHcB1g1	734	150	wd	50-75	sl	scl	15-35	>35	<50	1-3	Slight					
MGHcC2	734	150	wd	50-75	sl	scl	-	>35	<50	3-5	Moderate					
MGHhB1g1	734	150	wd	50-75	sc	scl	15-35	>35	<50	1-3	Slight					
MGHhC2g1	734	150	wd	50-75	sc	scl	15-35	>35	<50	3-5	Moderate					

They have minor limitations of gravelliness, texture and rooting depth. Marginally suitable lands (Class S3) for growing sorghum occupy an area of about 102 ha (18%) and mainly occur in the southern, eastern and northern part of the microwatershed. They have moderate limitations of rooting depth and gravelliness. A small area of about 23 ha (4%) is not suitable (Class N) for growing sorghum and occur in the northern part of the microwatershed. They have severe limitations of gravelliness.

Table 7.2 Land suitability criteria for Sorghum

Crop requirement		Rating			
Soil site characteristics	**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N)**
Slope	%	<3	3-8	8-15	>15
LGP	Days	120-150	120-90	<90	
Soil drainage	class	Well to mod.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
Sub Surface soil texture	Class	C, cl, sicl,sc	l, sil, sic	l, ls	S, fragmental skeletal
Soil depth	Cm	100-75	50-75	30-50	<30
Gravel content	% vol.	<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

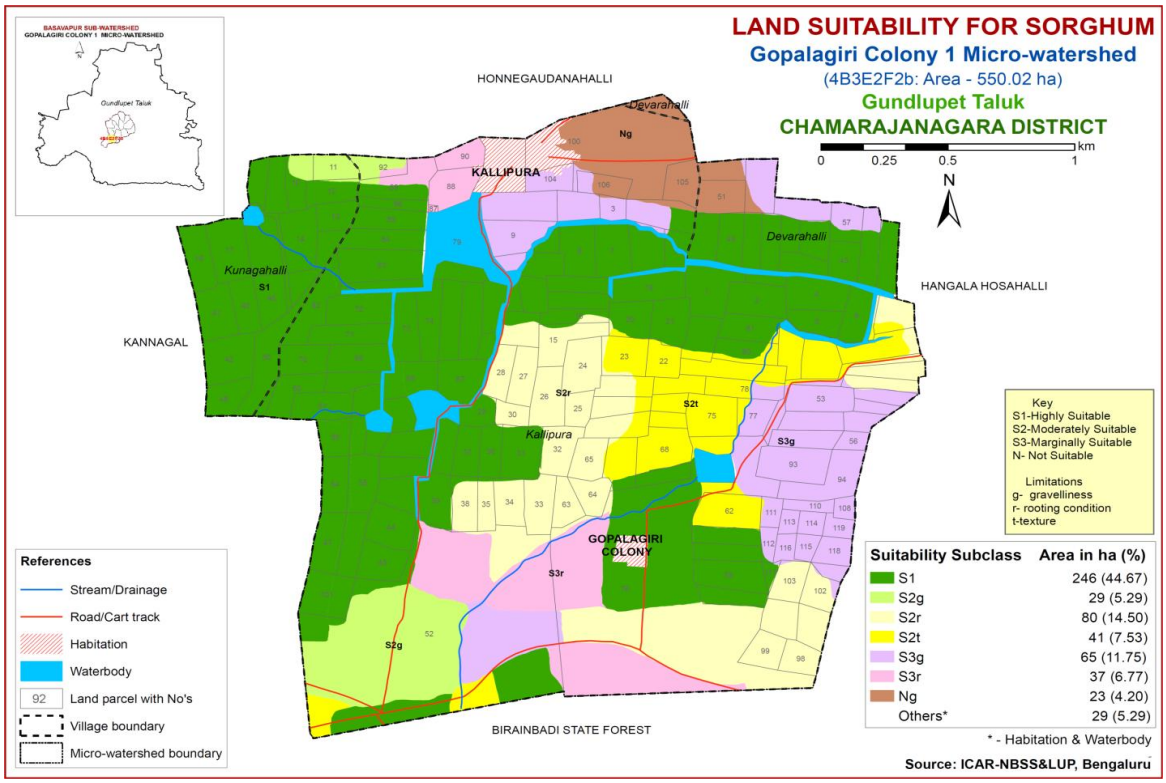


Fig. 7.1 Land Suitability map of Sorghum

7.2 Land Suitability for Maize (*Zea maize*)

Maize is the most important food crop grown in an area of 13.73 lakh ha in almost all the districts of the State. The crop requirements for growing maize (Table 7.3) were matched with the soil-site characteristics (Table 7.1) of soils of the microwatershed and a land suitability map for growing maize was generated. The area extent and geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.2.

Maximum area of about 205 ha (37%) in the microwatershed has soils that are highly suitable (Class S1) for growing maize crop. They have minor or no limitations for growing maize and are distributed in the western, central, northeastern and southwestern part of the microwatershed. An area of about 109 ha (20%) is moderately suitable (Class S2) for growing maize and are distributed in the southwestern, central, eastern and southeastern part the microwatershed. They have minor limitations of gravelliness and rooting depth. Marginally suitable (Class S3) lands cover an area of about 184 ha (33%) and occur in the southern, eastern and northern part of the microwatershed. They have moderate limitations of gravelliness, topography, wetness and rooting depth. A small area of about 23 ha (4%) is not suitable (Class N) for growing maize and occur in the northern part of the microwatershed. They have severe limitations of gravelliness.

Table 7.3 Land 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	
Sub Surface soil texture	Class	l, cl, scl, sil	sicl, sic,c	C(s-s), ls, sl	
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	

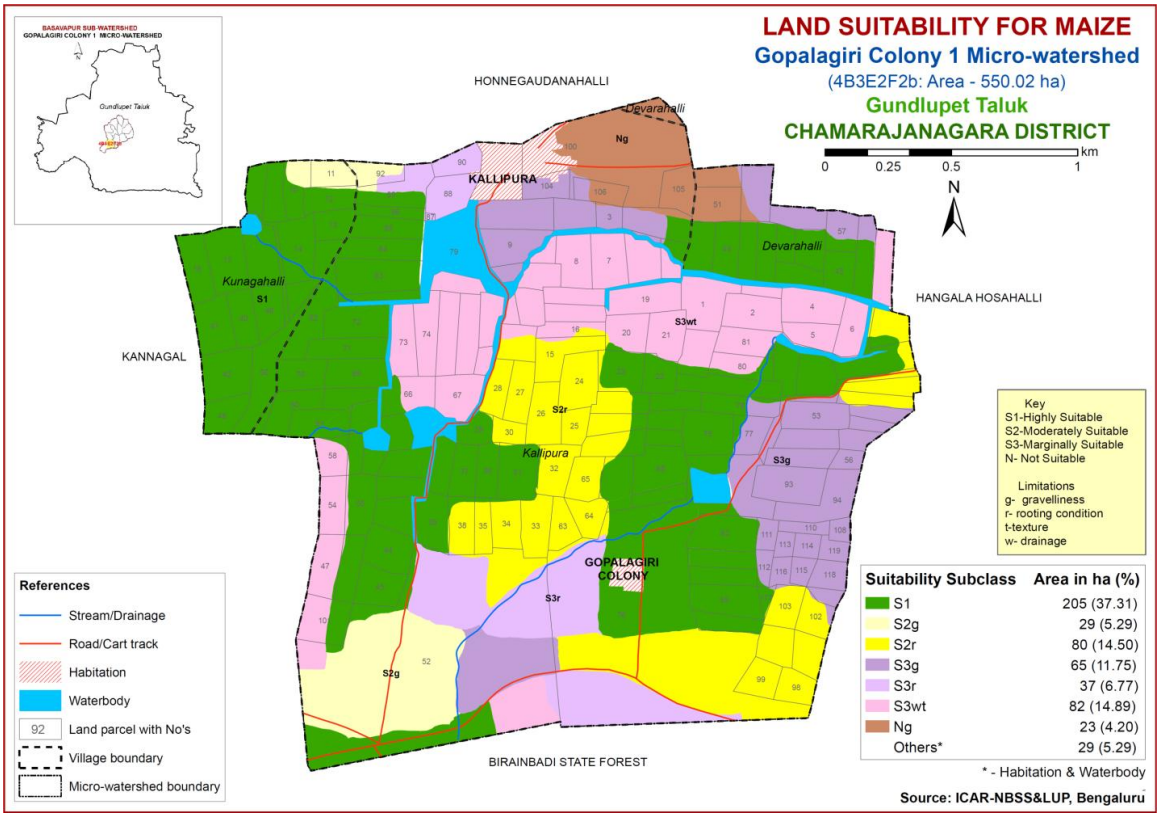


Fig. 7.2 Land Suitability map of Maize

7.3 Land Suitability for Redgram (*Cajanus cajan*)

Redgram is the most important pulse crop grown in an area of 8.23 lakh ha in almost all the districts of the State. The crop requirements for growing redgram (Table 7.4) were matched with the soil-site characteristics (Table 7.1) of soils of microwatershed and a land suitability map for growing redgram was generated. The area extent and geographical distribution of different suitability subclasses in different microwatersheds is given in Figure 7.3.

An area of about 203 ha (37%) in the microwatershed has soils that are highly suitable (Class S1) for growing redgram crop. They have minor or no limitations for growing redgram and are distributed mainly in the western, northwestern, central and northeastern part of the microwatershed. Major area of about 210 ha (38%) is moderately suitable (Class S2) for redgram. They are distributed in the southwestern, eastern, central, and northeastern part of the microwatershed. They have minor limitations of gravelliness, wetness and rooting depth. Marginally suitable (Class S3) lands cover an area of about 47 ha (8%) and occur in the central, eastern and southeastern part of the microwatershed. They have moderate limitations of rooting depth. An area of about 60 ha (11%) is not suitable (Class N) for growing redgram and occur in the northern part of the microwatershed. They have severe limitations of gravelliness and rooting depth.

Table 7.4 Land suitability criteria for Redgram

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)	dsm^{-1}	<1.0	1.0-2.0	>2.0	
Sodicity (ESP)	%	<10	10-15	>15	

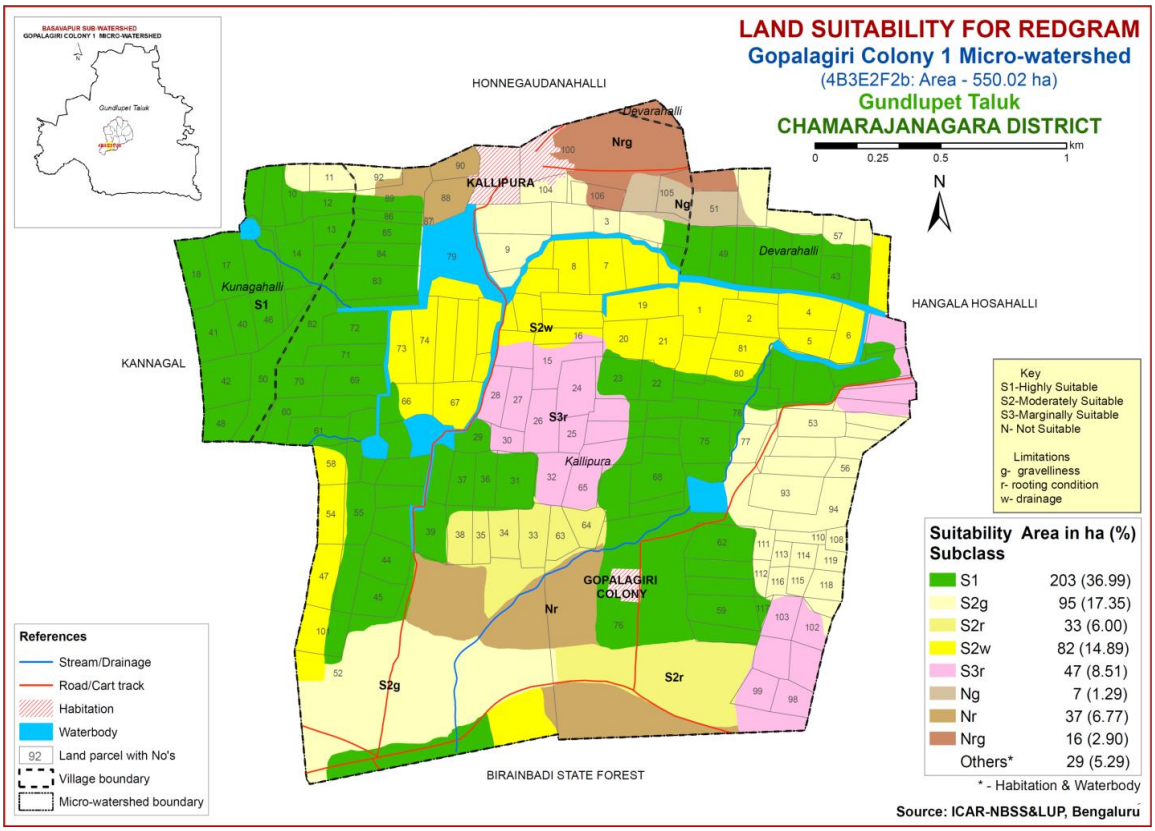


Fig. 7.3 Land Suitability map of Redgram

7.4 Land suitability for Horsegram (*Marcotyloma uniflorum*)

Horsegram is 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 (Table 7.5) for growing horsegram were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing horsegram was generated. The area and geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.4.

An area of about 203 ha (37%) in the microwatershed has soils that are highly suitable (Class S1) for growing horsegram. They have minor or no limitations for

growing horsegram and are distributed in the western, southwestern, central and northeastern part of the microwatershed. Maximum area of about 257 ha (47%) is moderately suitable (Class S2) for growing horsegram and are distributed in the southern, central, southwestern, southeastern and northeastern part the microwatershed. They have minor limitations of gravelliness, wetness and rooting depth. Marginally suitable (Class S3) lands cover an area of about 60 ha (11%) and occur in the southern and northern part of the microwatershed. They have moderate limitations of rooting depth and gravelliness.

Table 7.5 Land suitability criteria for Horsegram

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	Well drained/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
Sub Surface soil texture	Class	l, sl, scl, cl, sc	ls,sic, sicl, c, ls	Heavy clays (>60%), ls	
Soil depth	Cm	50-75	25-50	<25	
$CaCO_3$ in root zone	% vol.	<15	15-35	25-30	>30
Salinity (EC)	dsm^{-1}	<1.0	1.0-2.0	>2.0	
Sodicity (ESP)	%	<10	10-15	>15	

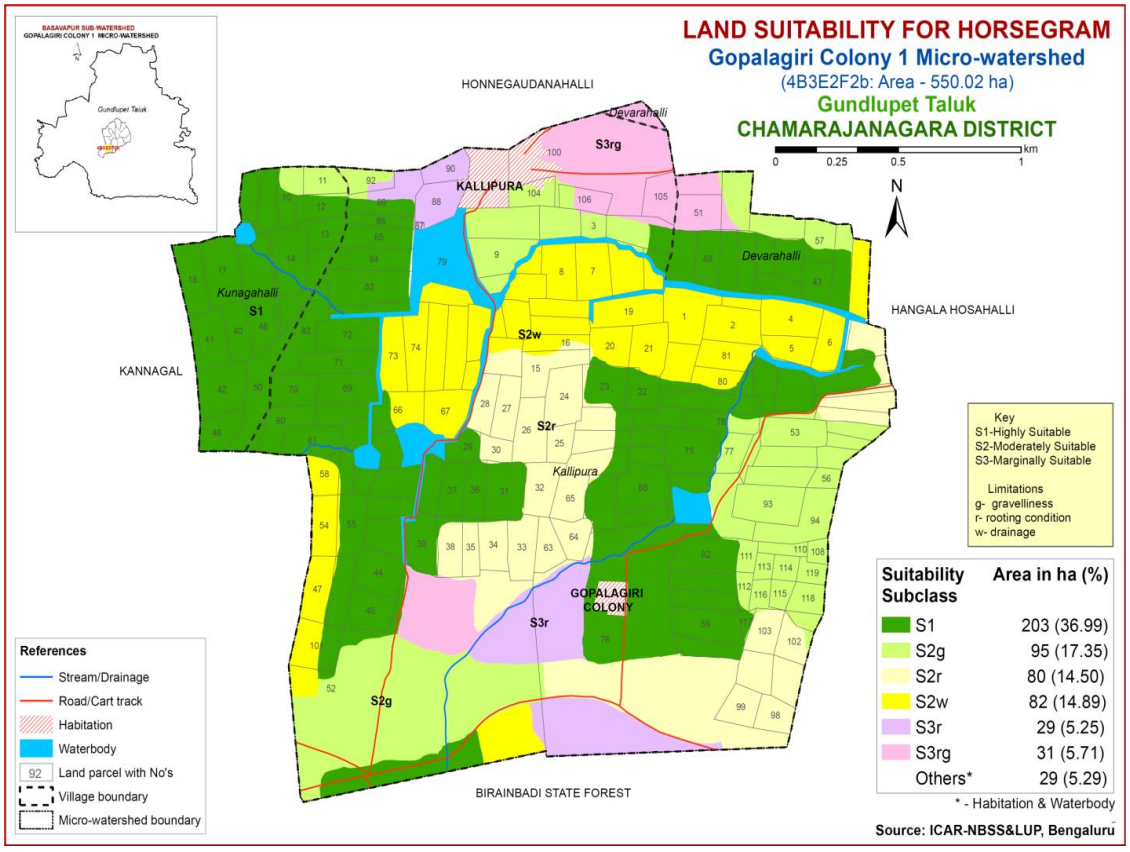


Fig. 7.4 Land Suitability map of Horsegram

7.5 Land suitability for Field bean (*Dolichos lablab*)

Field bean is the most important pulse crop grown in an area of 0.68 lakh ha in almost all the districts of the State. The crop requirements (Table 7.6) 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 and geographical distribution of different suitability subclasses the in microwatershed is given in Figure 7.5.

An area of about 140 ha (25%) in the microwatershed has soils that are highly suitable (Class S1) for growing field bean crop. They have minor or no limitations for growing field bean and are distributed in the western, central, southwestern and eastern part of the microwatershed. A maximum area of about 256 ha (46%) is moderately suitable (Class S2) for growing field bean and are distributed in all parts except western part of the microwatershed. They have minor limitations of gravelliness, wetness and rooting depth. Marginally suitable (Class S3) lands cover an area of about 102 ha (18%) and occur in the southern and northern part of the microwatershed. They have moderate limitations of rooting depth and gravelliness. An area of about 23 ha (4%) is not suitable (Class N) for growing field beans and occur in the northern part of the microwatershed. They have severe limitations of gravelliness.

Table 7.6 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. 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
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

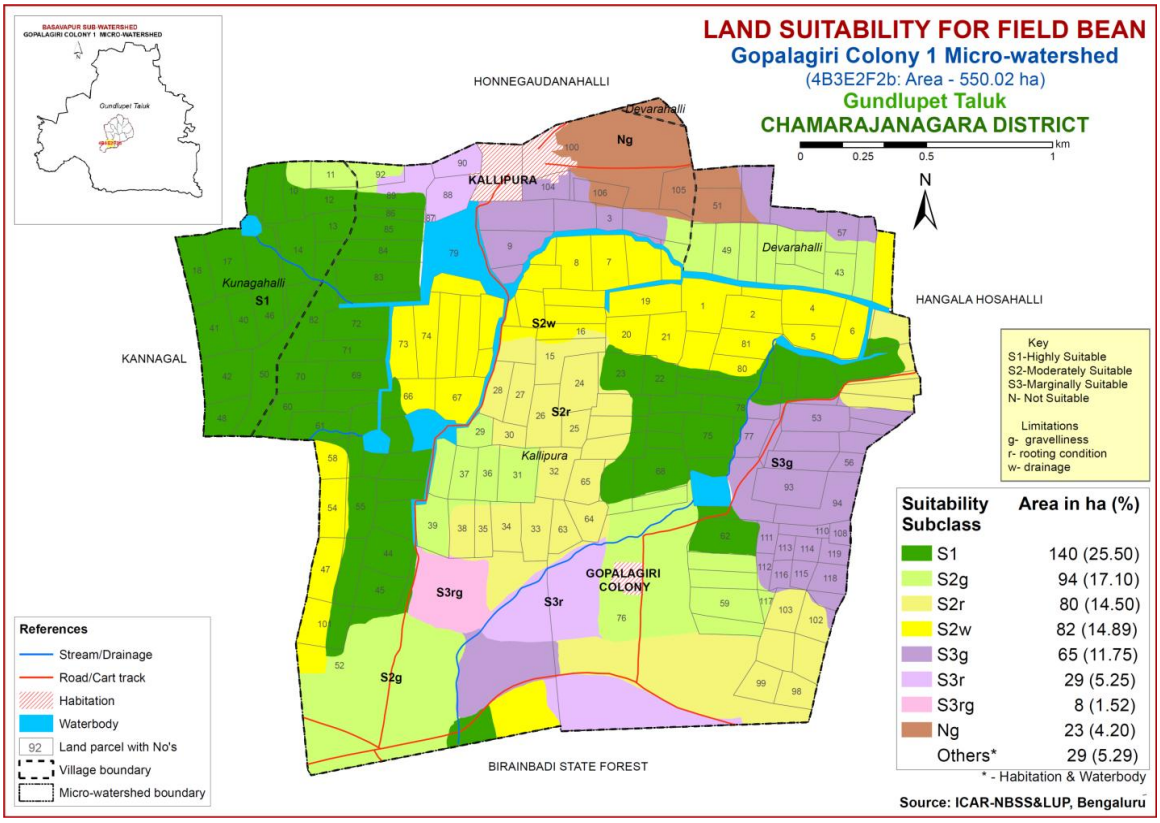


Fig. 7.5 Land Suitability map of Field bean

7.6 Land suitability for Groundnut (*Arachis hypogaea*)

Groundnut is the most important oilseed crop grown in an area of 6.5 lakh ha in almost all the districts of the State. The crop requirements for growing groundnut (Table 7.7) were matched with the soil-site characteristics (Table 7.1) of soils of the microwatershed and a land suitability map for growing groundnut was generated. The area extent and geographical distribution of different suitability subclasses of the microwatershed is given in Figure 7.6.

A small area of about 32 ha (6%) in the microwatershed has soils that are highly suitable (Class S1) for growing groundnut crop. They have minor or no limitations for growing groundnut and are distributed in the northeastern part of the microwatershed. A maximum area of about 305 ha (51%) is moderately suitable (Class S2) for growing groundnut and are distributed in all the parts of the microwatershed. They have minor limitations of gravelliness, texture and rooting depth. Marginally suitable (Class S3) lands cover an area of about 183 ha (33%) and occur in the southern, eastern, northern and central part of the microwatershed. They have moderate limitations of gravelliness, wetness, texture and rooting depth.

Table 7.7 Land 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 rained	imperfectly drained	Poorly drained
Soil reaction	pH	6.0-8.0	8.1-8.5 5.5-5.9	>8.5 <5.5	
Sub Surface soil texture	Class	l, cl, sil, scl, sicl	Sc, sic, c,sl	S, ls, c (>60%)	
Soil depth	Cm	>75	50-75	25-50	<25
Gravel content	% vol.	<35	35-50	>50	
$CaCO_3$ in root zone	%	low	Medium	high	
Salinity (EC)	dsm^{-1}	<2.0	2.0-4.0	4.0-8.0	
Sodicity (ESP)	%	<5	5-10	>10	

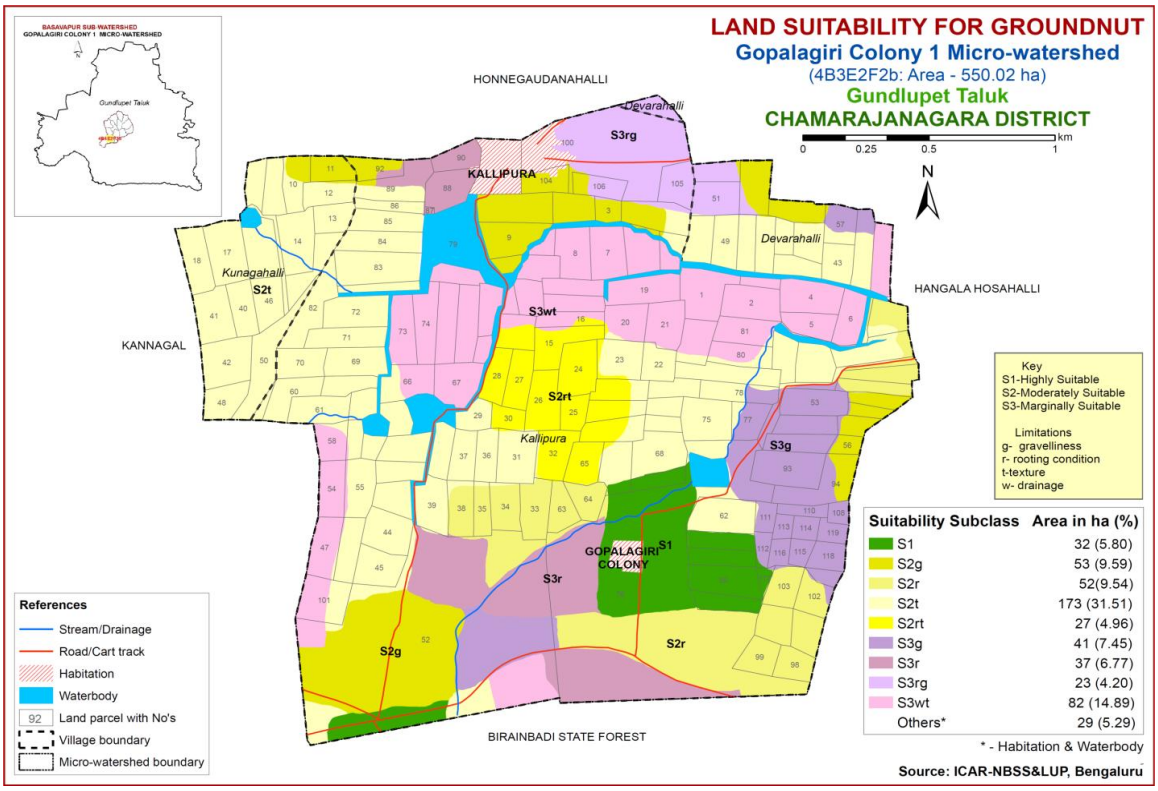


Fig. 7.6 Land Suitability map of Groundnut

7.7 Land suitability for Sunflower (*Helianthus annus*)

Sunflower is the most important oil seed crop grown in an area of 4.1 lakh ha in almost all the districts of the State. The crop requirements (Table 7.8) for growing sunflower were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing sunflower was generated. The area extent and geographical distribution of different suitability subclasses in microwatersheds is given in Figure 7.7.

An area of about 101 ha (18%) in the microwatershed has soils that are highly suitable (Class S1) for growing sunflower crop. They have minor or no limitations for growing sunflower and are distributed in the western, northwestern and southwestern part of the microwatershed. Major area of about 187 ha (34%) is moderately suitable (Class S2) for growing sunflower and are distributed in the central, northeastern and southwestern part of the microwatershed. They have minor limitations of gravelliness, wetness and texture. Marginally suitable (Class S3) lands cover an area of about 174 ha (32%) and occur in the southern, southeastern, central, southwestern and northern part of the microwatershed. They have moderate limitations of gravelliness and rooting depth. An area of about 50 ha (11%) is not suitable (Class N) for growing sunflower and occur in the northern part of the microwatershed. They have very severe limitations of gravelliness and rooting depth.

Table 7.8 Land 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	8.1-8.5 5.5-6.4	8.6-9.0; 4.5-5.4	>9.0 <4.5
Sub Surface soil texture	Class	l, cl, sil, sc	cl, 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	

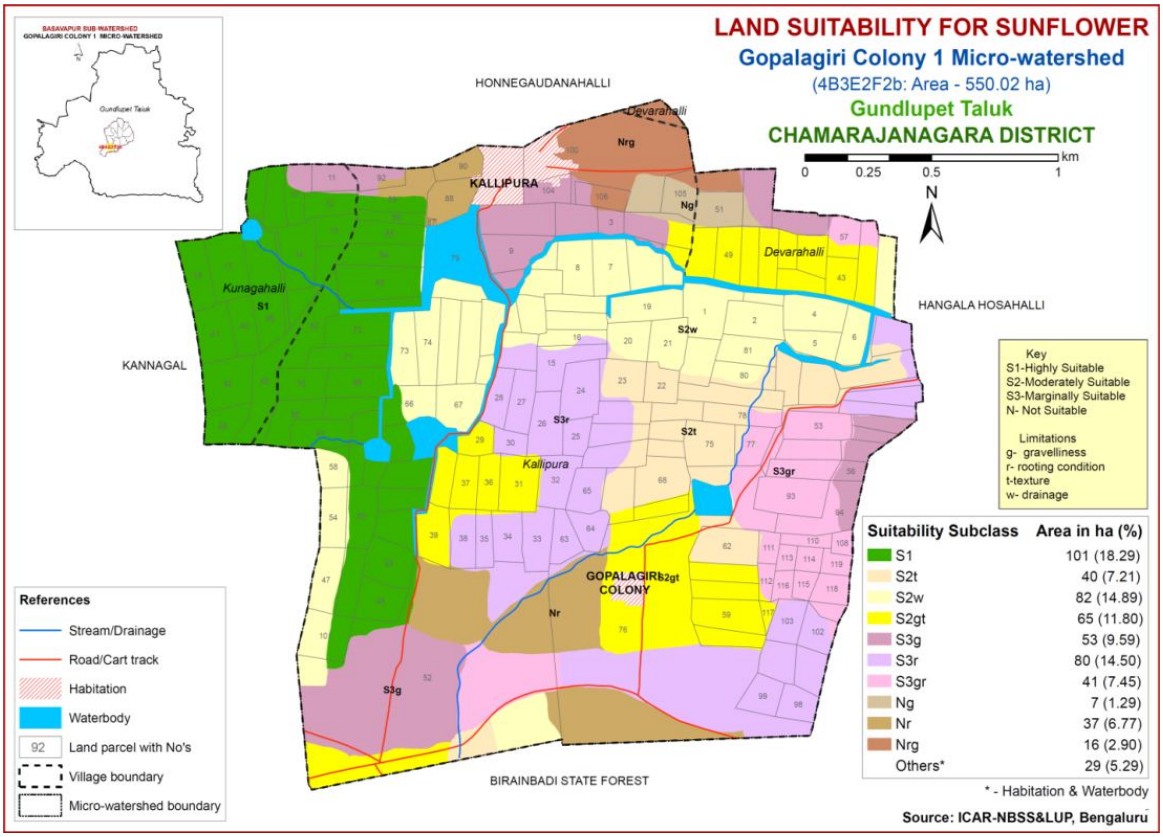


Fig. 7.7 Land Suitability map of Sunflower

7.8 Land suitability for Cotton (*Gossypium hirsutum*)

Cotton is the most important fibre crop grown in the State in about 6.6 lakh ha in Raichur, Dharwad, Belgaum, Gulbarga, Bijapur, Bidar, Bellary, Chitradurga and Chamarajnagar districts. The crop requirements (Table 7.9) for growing cotton were matched with the soil-site (Table 7.1) characteristics and a land suitability map for growing cotton was generated. The area extent and geographical distribution of different suitability subclasses of the microwatershed is given in Figure 7.8 .

Maximum area of about 183 ha (33%) in the microwatershed has soils that are highly suitable (Class S1) for growing cotton crop. They have minor or no limitations for growing cotton and are distributed in the western, northwestern, southwestern part of the microwatershed. An area of about 172 ha (31%) is moderately suitable (Class S2) for growing cotton and are distributed in the central, southeastern, southwestern and northeastern part the microwatershed. They have minor limitations of gravelliness, rooting depth and texture. Marginally suitable (Class S3) lands cover an area of about 143 ha (26%) and occur in the southern, eastern, central and northern part of the microwatershed. They have moderate limitations of gravelliness, texture and rooting depth. An area of about 23 ha (4%) is not suitable (Class N) for growing cotton and occur in the northern part of the microwatershed. They have very severe limitations of gravelliness.

Table 7.9 Land suitability criteria for Cotton

Crop requirement		Rating			
Soil-site characteristics	**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N)**
Slope	%	1-2	2-3	3-5	>5
LGP	Days	180-240	120-180	<120	
Soil drainage	class	Well to moderately well	imperfectly drained	Poor somewhat excessive	Stagnant/excessive
Soil reaction	pH	6.5-7.5	7.6-8.0	8.1-9.0	>9.0>6.5
Sub Surface soil texture	Class	Sic, c	Sicl, cl	Si, sil, sc, scl, l	Sl, s,ls
Soil depth	Cm	100-150	75-100	50-75	<50
Gravel content	% vol.	<5	5-10	10-15	15-35
$CaCO_3$ in root zone	%	<3	3-5	5-10	10-20
Salinity (EC)	dsm^{-1}	2-4	4.0-8.0	8.0-12	>12
Sodicity (ESP)	%	5-10	10-20	20-30	>30

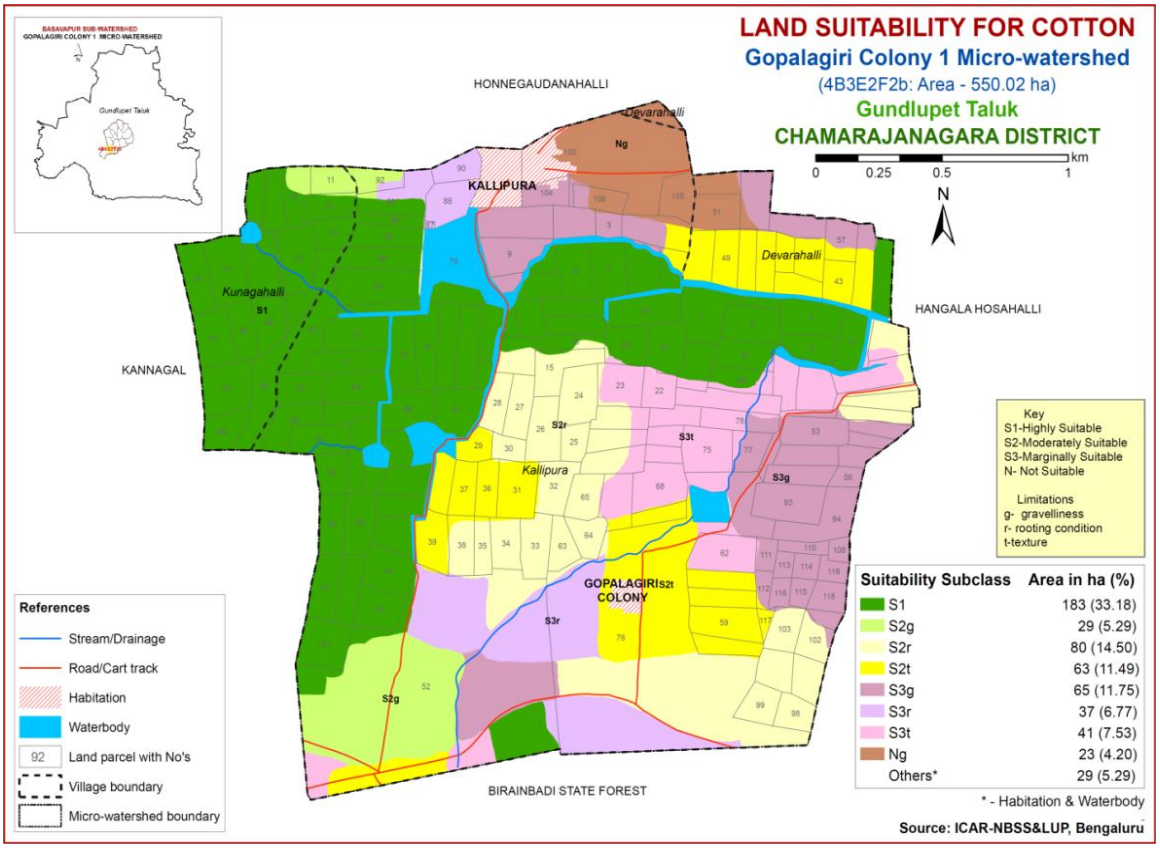


Fig. 7.8 Land Suitability map of Cotton

7.9 Land suitability for Onion (*Allium cepa*)

Onion is the most important vegetable crop grown in Raichur, Dharwad, Belgaum, Gulbarga, Bijapur, Bidar, Bellary, Chitradurga and Chamarajanagar districts. The crop requirements (Table 7.10) for growing onion were matched with the soil-site (Table 7.1) characteristics and a land suitability map for growing onion was generated. The area extent and geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.9.

An area of about 140 ha (25%) in the microwatershed has soils that are highly suitable (Class S1) for growing onion crop. They have minor or no limitations for growing onion and are distributed in the western, northwestern and central part of the microwatershed. A maximum area of about 256 ha (46%) is moderately suitable (Class S2) for growing onion and are distributed in the central, southwestern, southeastern and northeastern part of the microwatershed. They have minor limitations of gravelliness, wetness, texture and rooting depth. Marginally suitable (Class S3) lands cover an area of about 102 ha (19%) and occur in the southern, eastern and northern part of the microwatershed. They have moderate limitations of gravelliness and rooting depth. An area of about 23 ha (4%) is not suitable (Class N) for growing onoin and occur in the northern part of the microwatershed. They have very severe limitations of gravelliness.

Table 7.10 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 drainage	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	<4
Salinity (EC)	dsm^{-1}	<1.0	1.0-2.0	2.0-4.0	<4
Sodicity (ESP)	%	<5	5-10	10-15	>15

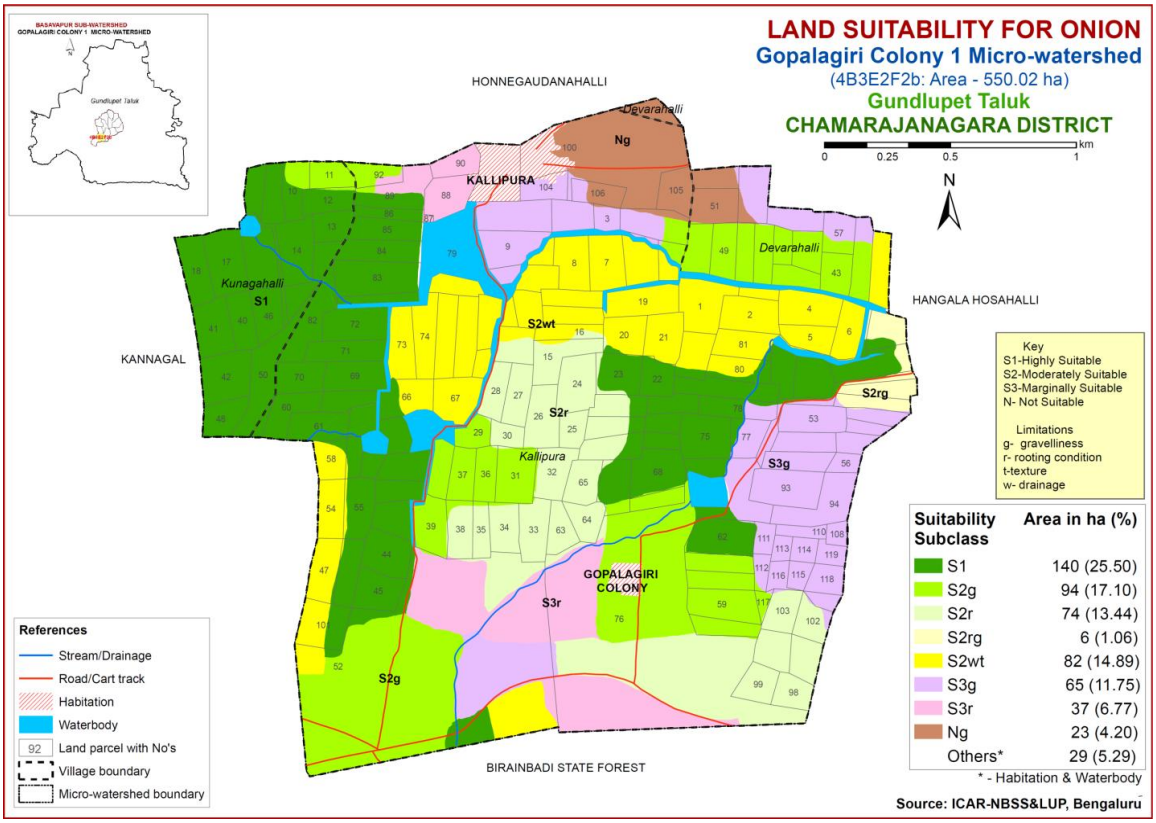


Fig. 7.9 Land Suitability map of Onion

7.10 Land suitability for Potato (*Solanum tuberosum*)

Potato is one of the major vegetable crop grown in Raichur, Dharwad, Belgaum, Gulbarga, Bijapur, Bidar, Bellary, Chitradurga, Chikkaballapur, Kolar Chikkamangalore and Chamarajanagar districts. The crop requirements for growing potato (Table 7.11) were matched with the soil-site characteristics of the soils of the microwatershed and land suitability map for growing potato was prepared. The area extent and their geographic distribution of different suitability subclasses of the microwatershed is given in Figure 7.10.

An area of about 140 ha (25%) in the microwatershed has soils that are highly suitable (Class S1) for growing potato crop. They have minor or no limitations for growing potato and are distributed in the western, southwestern and eastern part of the microwatershed. An area of about 174 ha (32%) is moderately suitable (Class S2) for growing potato and are distributed in the southwestern, central, southeastern and northeastern part the microwatershed. They have minor limitations of gravelliness and rooting depth. Marginally suitable (Class S3) lands cover maximum area of about 184 ha (33%) and occur in the southern, central, eastern and northeastern part of the microwatershed. They have moderate limitations of rooting depth, gravelliness, wetness and texture. An area of about 23 ha (4%) is not suitable (Class N) for growing potato and occur in the northern part of the microwatershed. They have severe limitations of gravelliness.

Table 7.11 Land suitability criteria for Potato

Crop requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately Suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N)**
Slope	Hills	%	<5	5-10	10-15	>15
	Plains	%	<3	3-5	5-8	>8
Mean temperature in growing season		^{0}c	16-25	26-30 13-15	31-32 10-12	>32 <10
Soil drainage		class	Well drained	Moderately /imperfectly	Poor drained	Very poorly drained
Soil reaction		pH	5.5-6.5	6.6-8.2 5.0-5.4	>8.2 <5.0	-
Surface soil texture		Class	Scl, sil	S, sil	s	
Soil depth		Cm	75-100	50-75	25-50	<25
Stoniness		%	0-10	10-15	15-35	>35
Salinity (ECe)		dsm^{-1}	<1.0	1.0-2.0	2.0-4.0	>4.0
Sodicity (ESP)		%	<10	10-15	>15	-

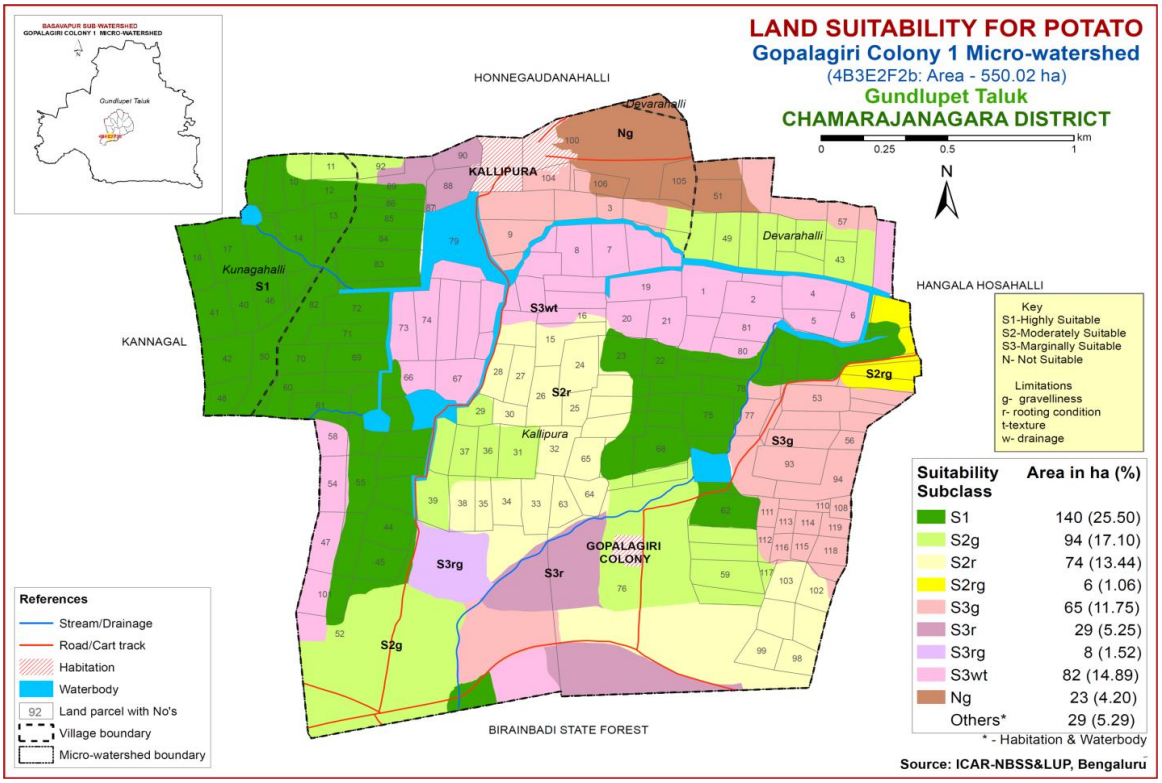


Fig. 7.10 Land Suitability map of Potato

7.11 Land suitability for Beans (*Phaseolus vulgaris*)

Beans is the most important pulse and vegetable crop grown in almost all the districts of the State. The crop requirements for growing beans were matched with the soil-site characteristics of the soils of the microwatershed and land suitability map for growing beans was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed is given in. Figure 7.11.

An area of about 140 ha (25%) in the microwatershed has soils that are highly suitable (Class S1) for growing beans crop. They have minor or no limitations for growing beans and are distributed in the western, central, southwestern and northeastern part of the microwatershed. A maximum area of about 256 ha (46%) is moderately suitable (Class S2) for growing beans and are distributed in all parts except western part of the microwatershed. They have minor limitations of gravelliness, wetness, texture and rooting depth. Marginally suitable (Class S3) lands cover an area of about 102 ha (19%) and occur in the southern and northern part of the microwatershed. They have moderate limitations of rooting depth and gravelliness. An area of about 23 ha (4%) is not suitable (Class N) for growing beans and occur in the northern part of the microwatershed. They have severe limitations of gravelliness.

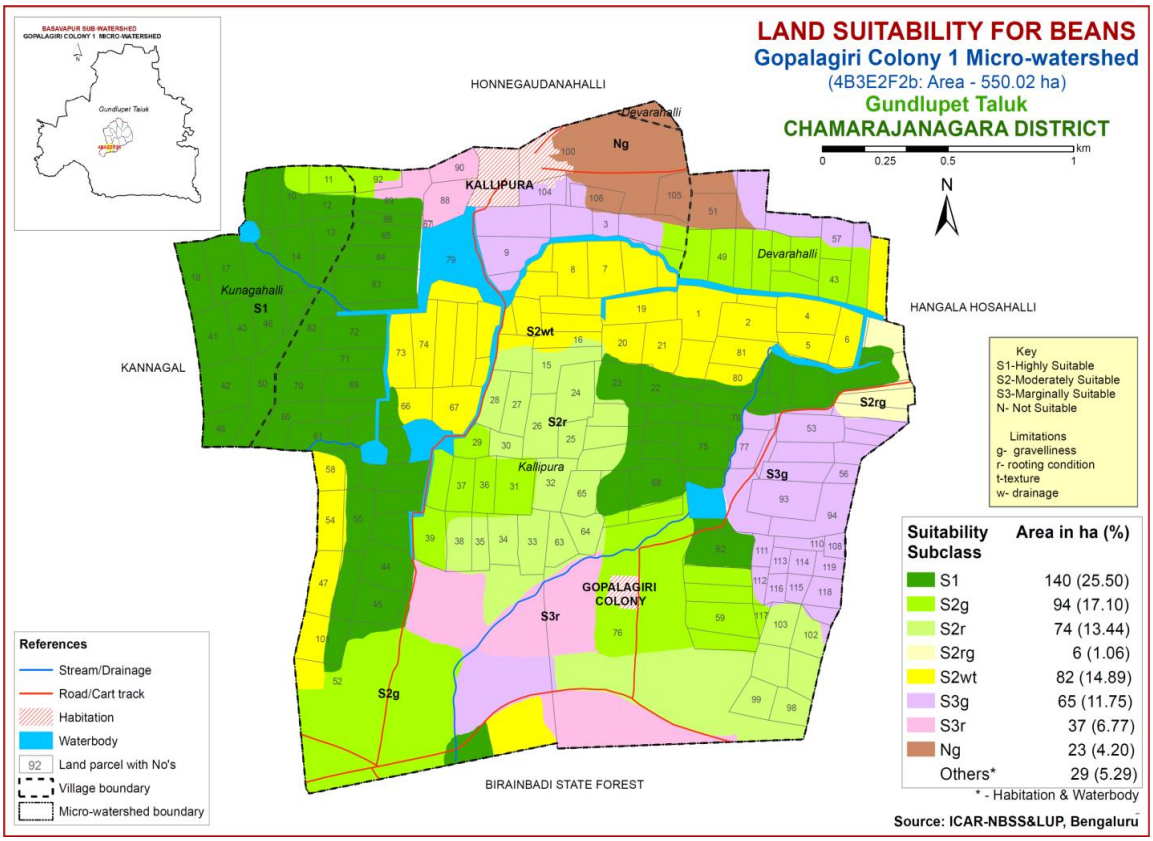


Fig. 7.11 Land Suitability map of Bean

7.12 Land suitability for Beetroot (*Beta vulgaris*)

Beetroot is one of the major vegetable crop grown in almost all the district of Karnataka State. The crop requirements for growing beetroot were matched with the soil-site characteristics of the soils of the microwatershed and land suitability map for growing beetroot was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed is given in Figure 7.12.

An area of about 140 ha (25%) in the microwatershed has soils that are highly suitable (Class S1) for growing beetroot crop. They have minor or no limitations for growing beetroot and are distributed in the western, southwestern and eastern part of the microwatershed. An area of about 174 ha (32%) is moderately suitable (Class S2) for growing beetroot and are distributed in the southwestern, central, southeastern and northeastern part the microwatershed. They have minor limitations of gravelliness and rooting depth. Marginally suitable (Class S3) lands cover maximum area of about 184 ha (33%) and occur in the southern, central, eastern and northeastern part of the microwatershed. They have moderate limitations of rooting depth, gravelliness, wetness and texture. An area of about 23 ha (4%) is not suitable (Class N) for growing beetroot and occur in the northern part of the microwatershed. They have severe limitations of gravelliness.

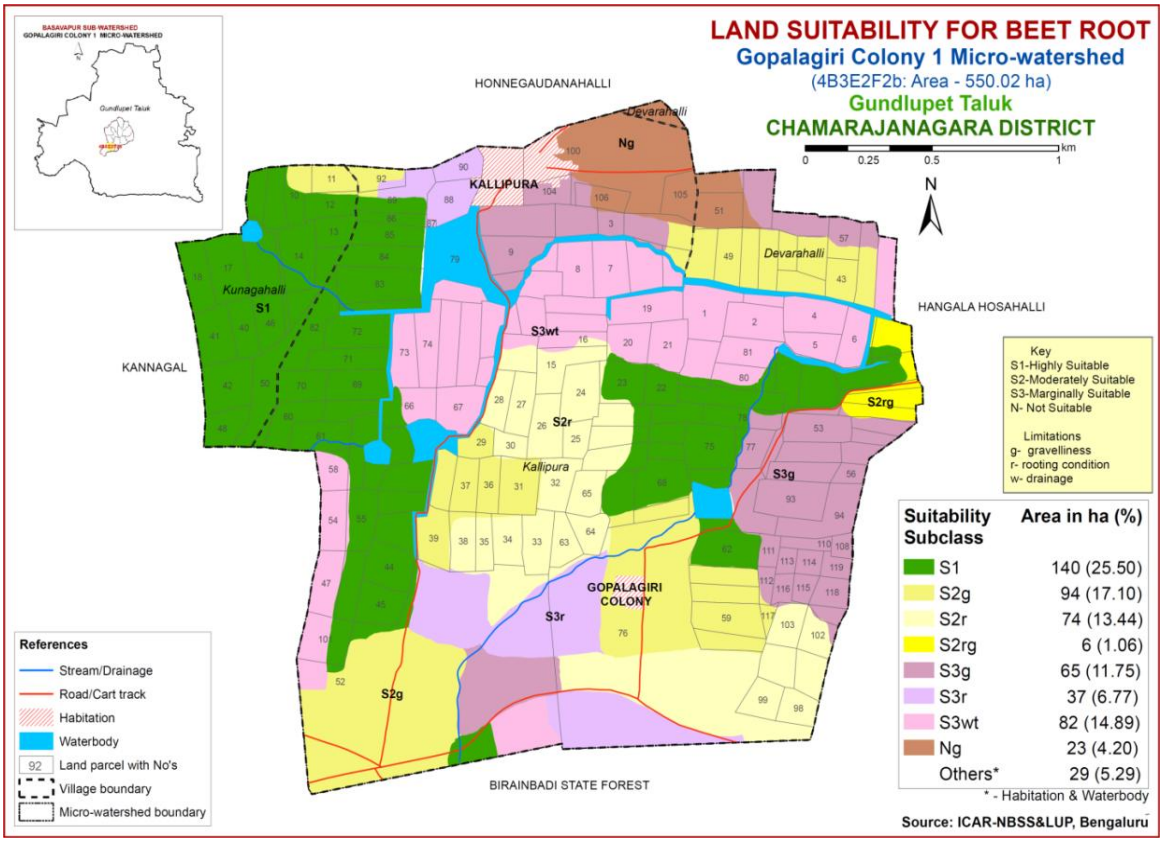


Fig. 7.12 Land Suitability map of Beetroot

7.13 Land suitability for Mango (*Mangifera indica*)

Mango is the most important fruit crop grown in an area of 18.53 lakh ha in almost all the districts of the State. The crop requirements (Table 7.12) for growing mango were matched with the soil-site (Table 7.1) characteristics and a land suitability map for growing mango was generated. The area extent and geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.13.

An area of about 140 ha (25%) in the microwatershed has soils that are highly suitable (Class S1) for growing mango crop. They have minor or no limitations for growing mango and are distributed in the western, northeastern, southwestern, eastern and central part of the microwatershed. An area of about 94 ha (17%) is moderately suitable (Class S2) for growing mango and are distributed in the southwestern, central and northern part of the microwatershed. They have minor limitations of gravelliness and rooting depth. Marginally suitable (Class S3) lands cover an area of about 106 ha (19%) and occur in the southwestern, central, northeastern and northern part of the microwatershed. They have moderate limitations of rooting depth, gravelliness, texture and wetness. A major area of about 181 ha (33%) is not suitable (Class N) for growing mango and occur in the southern, southeastern, eastern and northern part of the microwatershed. They have severe limitations of gravelliness and rooting depth.

Table 7.12 Land suitability criteria for Mango

Crop requirement			**Rating**			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Mod.suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N)**
climate	Tempin 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	7.6-8.55.0-5.4	8.6-9.04.0-4.9	>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	Nongravelly	<15	15-35	>35
	Hard pans	cm	>250	150-250	100-150	<100
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	

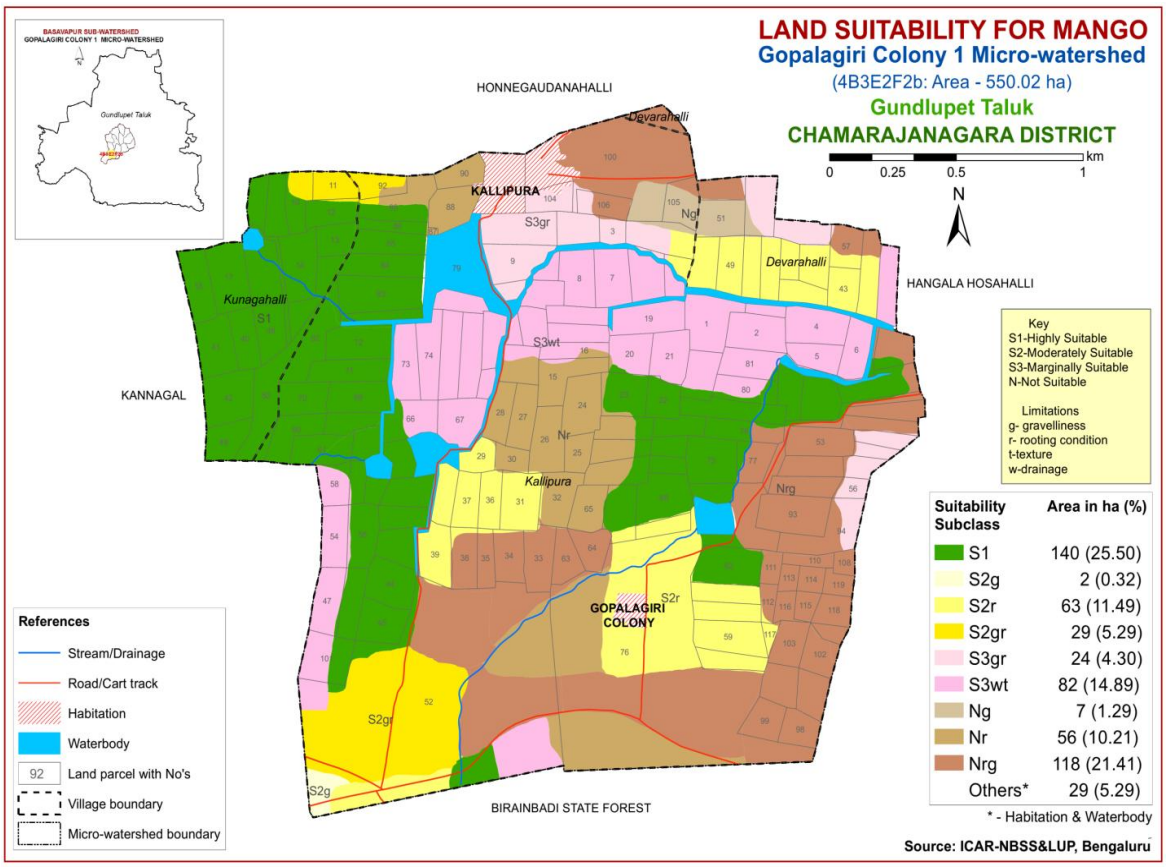


Fig. 7.13 Land Suitability map of Mango

7.14 Land suitability for Sapota (*Manilkara zapota*)

Sapota is the most important fruit crop grown in an area of 3.11 lakh ha in almost all the districts of the State. The crop requirements (Table 7.13) for growing sapota were matched with the soil-site (Table 7.1) characteristics and a land suitability map for growing sapota was generated and the area and geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.14.

An area of about 140 ha (25%) in the microwatershed has soils that are highly suitable (Class S1) for growing sapota crop. They have minor or no limitations for growing sapota and are distributed in the western, northwestern, central and eastern part of the microwatershed. An area of about 118 ha (21%) is moderately suitable (Class S2) for growing sapota and are distributed in the southwestern, central and northern part the microwatershed. They have minor limitations of gravelliness and rooting depth. Marginally suitable (Class S3) lands cover major area of about 202 ha (37%) and occur in all parts of the microwatershed. They have moderate limitations of rooting depth, wetness, texture and gravelliness. An area of about 60 ha (11%) is not suitable (Class N) for growing sapota and occur in the northern and southern part of the microwatershed. They have severe limitations of gravelliness and rooting depth.

Table 7.13 Land 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 availabiliy	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

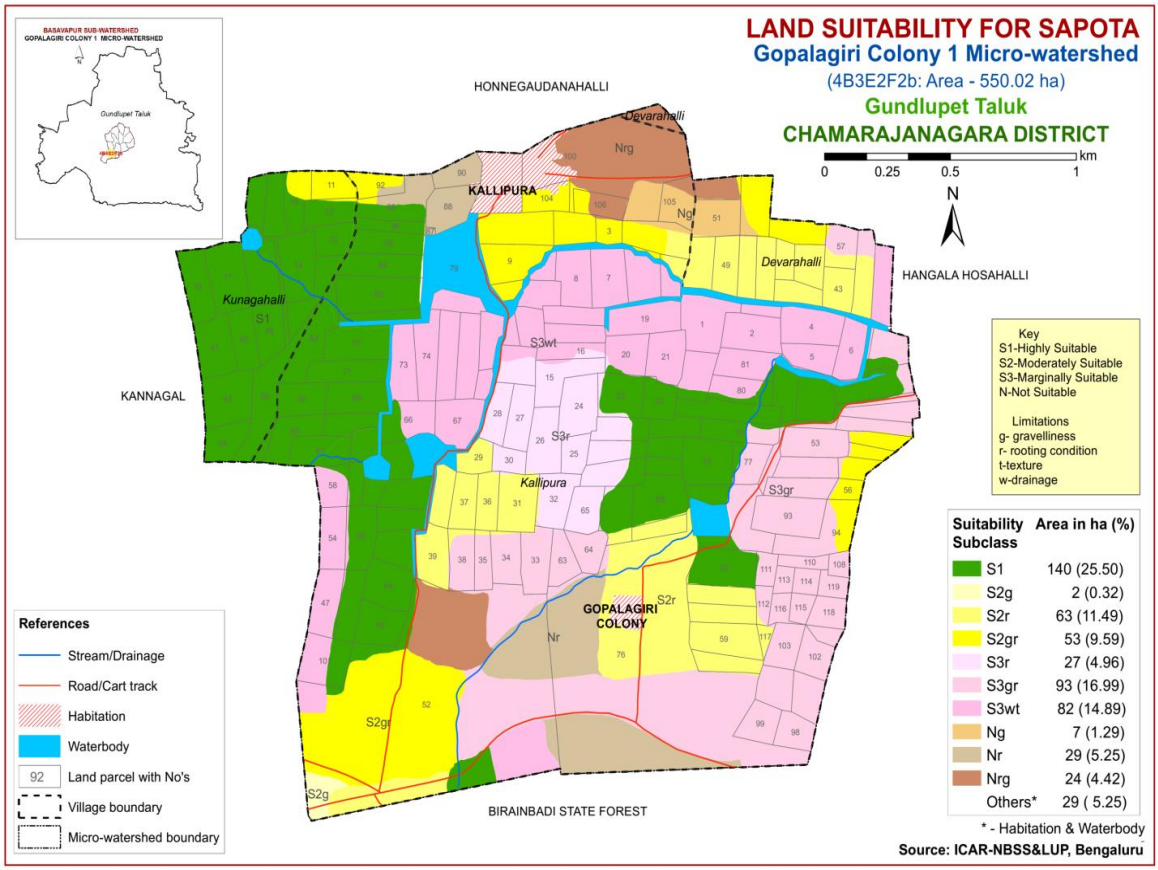


Fig. 7.14 Land Suitability map of Sapota

7.15 Land suitability for Guava (*Psidium guajava*)

Guava is the most important fruit crop grown in an area of 0.64 lakh ha in almost all the districts of the State. The crop requirements (Table 7.14) for growing guava were matched with the soil-site (Table 7.1) characteristics and a land suitability map for growing guava was generated and the area and geographical distribution of different suitability subclasses in the microwatershed is given in Figure. 7.15.

An area of about 140 ha (25%) in the microwatershed has soils that are highly suitable (Class S1) for growing guava crop. They have minor or no limitations for growing guava and are distributed in the western, northwestern, central and eastern part of the microwatershed. An area of about 118 ha
(21%) is moderately suitable (Class S2) for growing guava and are distributed in the southwestern, central and northern part the microwatershed. They have minor limitations of gravelliness and rooting depth. Marginally suitable (Class S3) lands cover major area of about 202 ha (37%) and occur in all parts of the microwatershed. They have moderate limitations of rooting depth, wetness, texture and gravelliness. An area of about 60 ha (11%) is not suitable (Class N) for growing guava and occur in the northern and southern part of the microwatershed. They have severe limitations of gravelliness and rooting depth.

Table 7.14 Land 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 drained	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

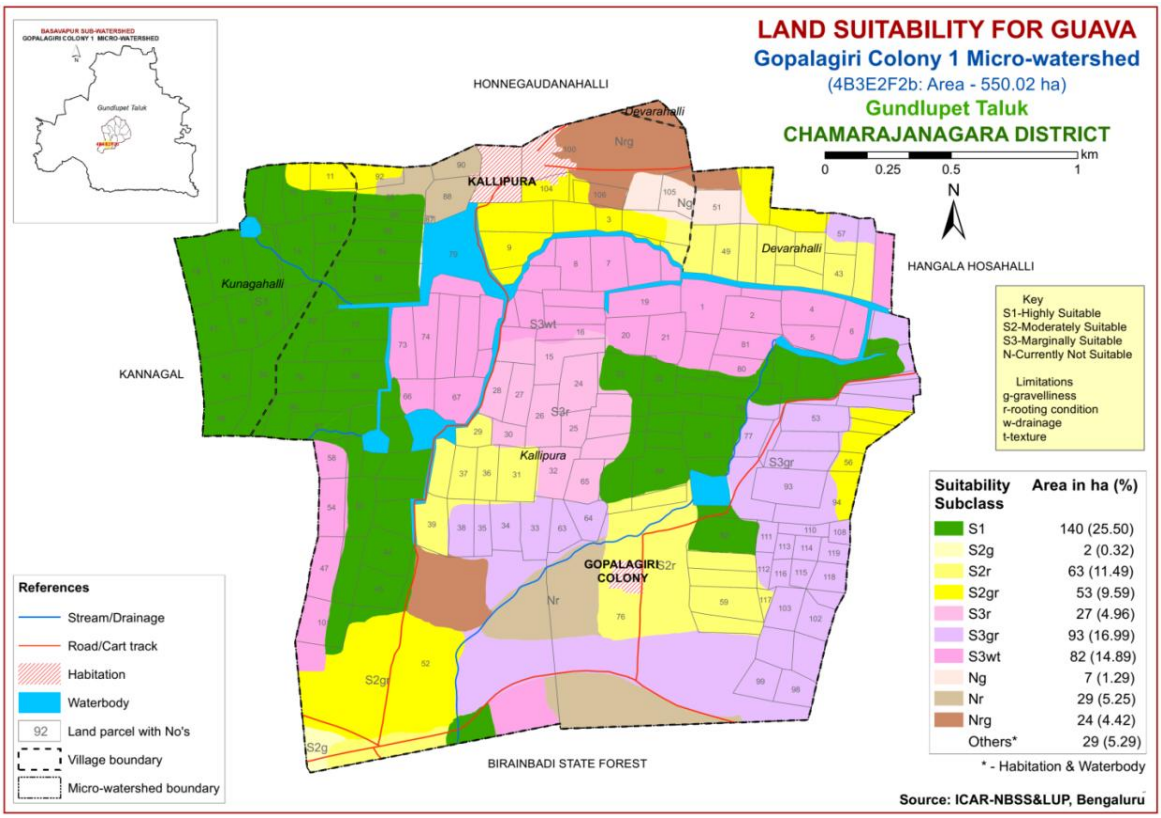


Fig. 7.15 Land Suitability map of Guava

7.16 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 (Table 7.15) for growing banana were matched with the soil-site (Table 7.1) characteristics 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 is given in Figure 7.16.

An area of about 140 ha (33%) in the microwatershed has soils that are highly suitable (Class S1) for growing banana crop. They have minor or no limitations for growing banana and are distributed in the western, northwestern and central part of the microwatershed. Major area of about 176 ha (32%) is moderately suitable (Class S2) for growing banana and are distributed in the southwestern, central and northeastern part of the microwatershed. They have minor limitations of gravelliness, wetness and texture. Marginally suitable (Class S3) lands cover an area of about 152 ha (27%) and occur in the southeastern, eastern and central part of the microwatershed. They have moderate limitations of gravelliness and rooting depth. An area of about 53 ha (10%) is not suitable (Class N) for growing banana and occur in the northern part of the microwatershed. They have severe limitations of gravelliness and rooting depth.

Table 7.15 Land 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
	Gravelliness	%	<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	%	<1	1-3	3-8	>8

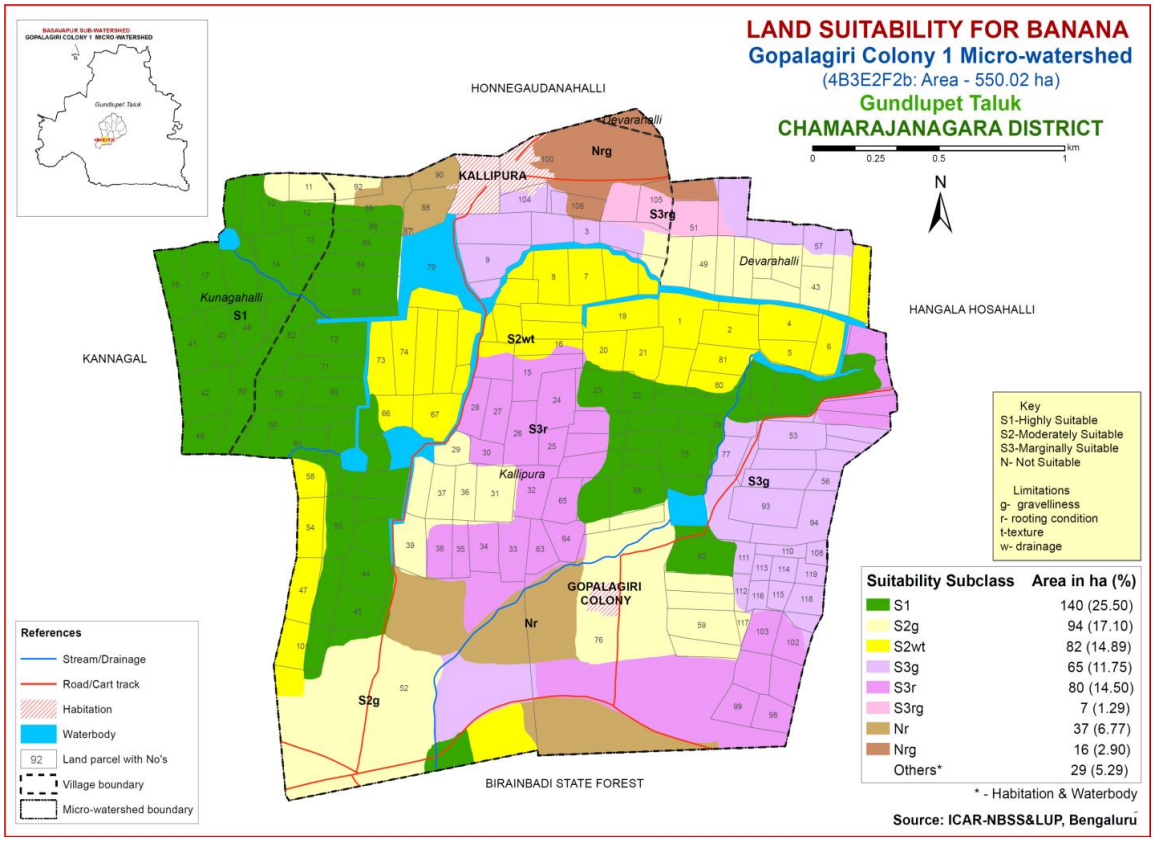


Fig. 7.16 Land Suitability map of Banana

7.17 Land suitability for Jackfruit (*Artocarpus heterophyllus*)

Jackfruit is the most important fruit crop grown in almost all the districts of the State. The crop requirements for growing jackfruit were matched with the soil-site characteristics and a land suitability map for growing jackfruit was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.17.

An area of about 140 ha (25%) in the microwatershed has soils that are highly suitable (Class S1) for growing jackfruit crop. They have minor or no limitations for growing jackfruit and are distributed in the western, northwestern, southwestern and central part of the microwatershed. An area of about 94 ha (17%) is moderately suitable (Class S2) for growing jackfruit and are distributed in the southwestern, central and northern part of the microwatershed. They have minor limitations of gravelliness and rooting depth. Marginally suitable (Class S3) lands cover maximum area of about 226 ha (41%) and occur in the southwestern, southern, central, southeastern and northeastern part of the microwatershed. They have moderate limitations of rooting depth, texture, wetness and gravelliness. An area of about 60 ha (11%) is not suitable (Class N) for growing jackfruit and occur in the southern and northern part of the microwatershed. They have severe limitations of gravelliness and rooting depth.

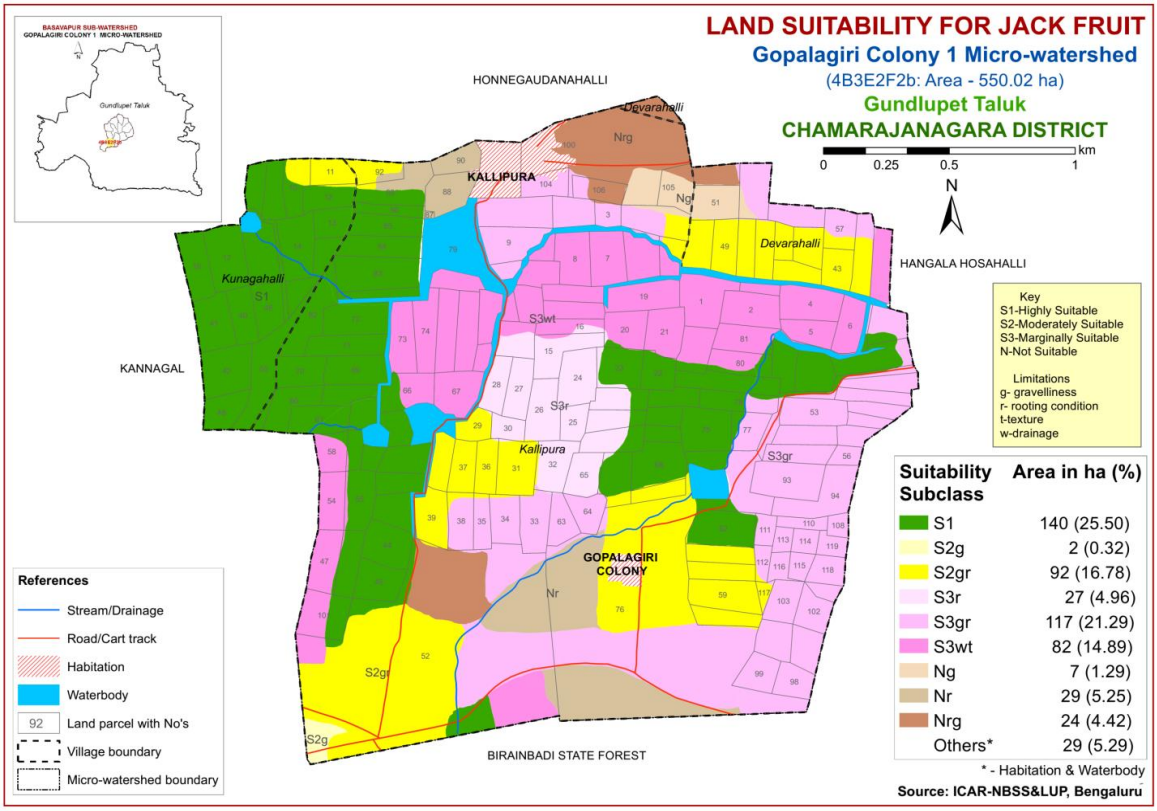


Fig. 7.17 Land Suitability map of Jackfruit

7.18 Land suitability for Jamun (*Syzygium cumini*)

Jamun is 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 and a land suitability map for growing jamun was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.18.

An area of about 140 ha (25%) in the microwatershed has soils that are highly suitable (Class S1) for growing jamun crop. They have minor or no limitations for growing jamun and are distributed in the western, northwestern and central part of the microwatershed. Maximum area of about 176 ha (32%) is moderately suitable (Class S2) for growing jamun and are distributed in the southwestern, central and northeastern part of the microwatershed. They have minor limitations of gravelliness, texture, rooting depth and wetness. Marginally suitable (Class S3) lands cover an area of about 144 ha (26%) and occur in the eastern, southern, southeastern, central and northeastern part of the microwatershed. They have moderate limitations of rooting depth and gravelliness. An area of about 60 ha (11%) is not suitable (Class N) for growing jamun and occur in the southern and northern part of the microwatershed. They have severe limitations of gravelliness, rooting depth and topography.

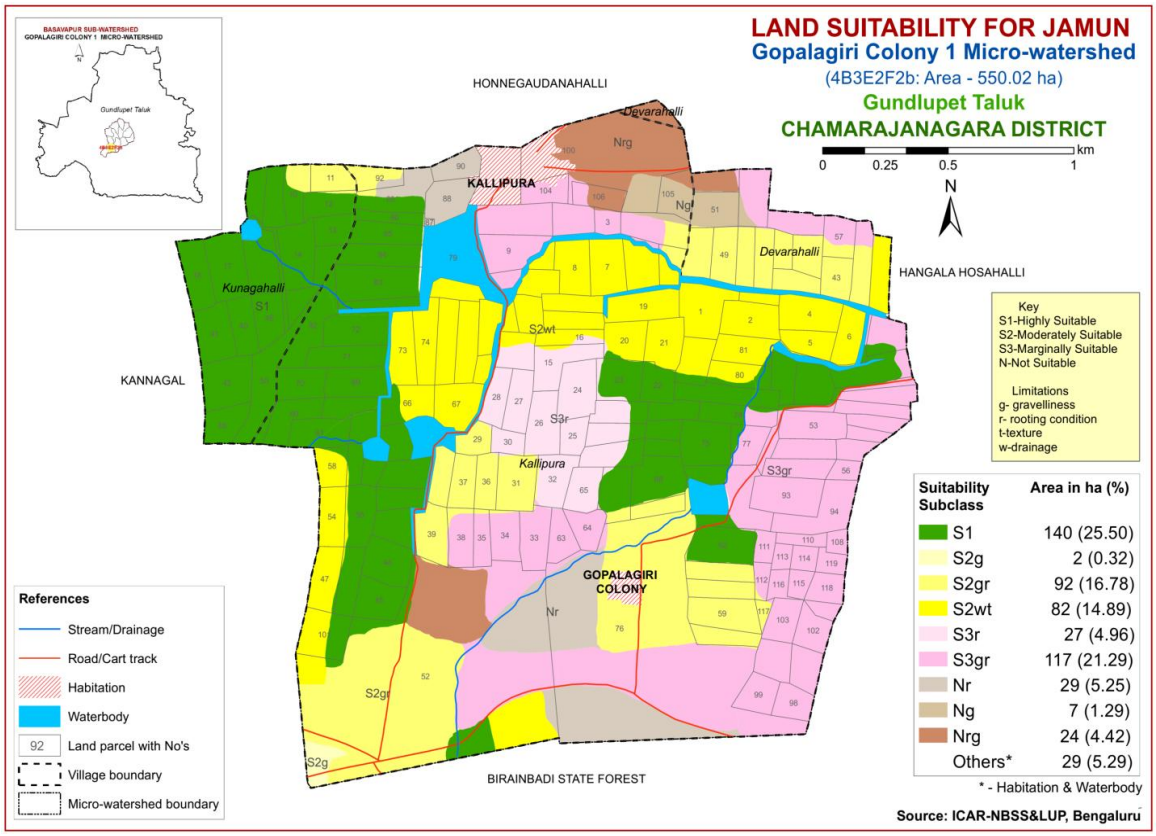


Fig. 7.18 Land Suitability map of Jamun

7.19 Land Suitability for Musambi (*Citrus limetta*)

Musambi is one of the important fruit crop grown in almost all the districts of the State. The crop requirements for growing musambi were matched with the soil-site characteristics and a land suitability map for growing musambi 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 140 ha (25%) in the microwatershed has soils that are highly suitable (Class S1) for growing musambi crop. They have minor or no limitations for growing musambi and are distributed in the western, northwestern and central part of the microwatershed. Maximum area of about 176 ha (32%) is moderately suitable (Class S2) for growing musambi and are distributed in the southwestern, central and northeastern part of the microwatershed. They have minor limitations of gravelliness, texture, rooting depth and wetness. Marginally suitable (Class S3) lands cover an area of about 144 ha (26%) and occur in the eastern, southern, southeastern, central and northeastern part of the microwatershed. They have moderate limitations of rooting depth and gravelliness. An area of about 60 ha (11%) is not suitable (Class N) for growing musambi and occur in the southern and northern part of the microwatershed. They have severe limitations of gravelliness, rooting depth and topography.

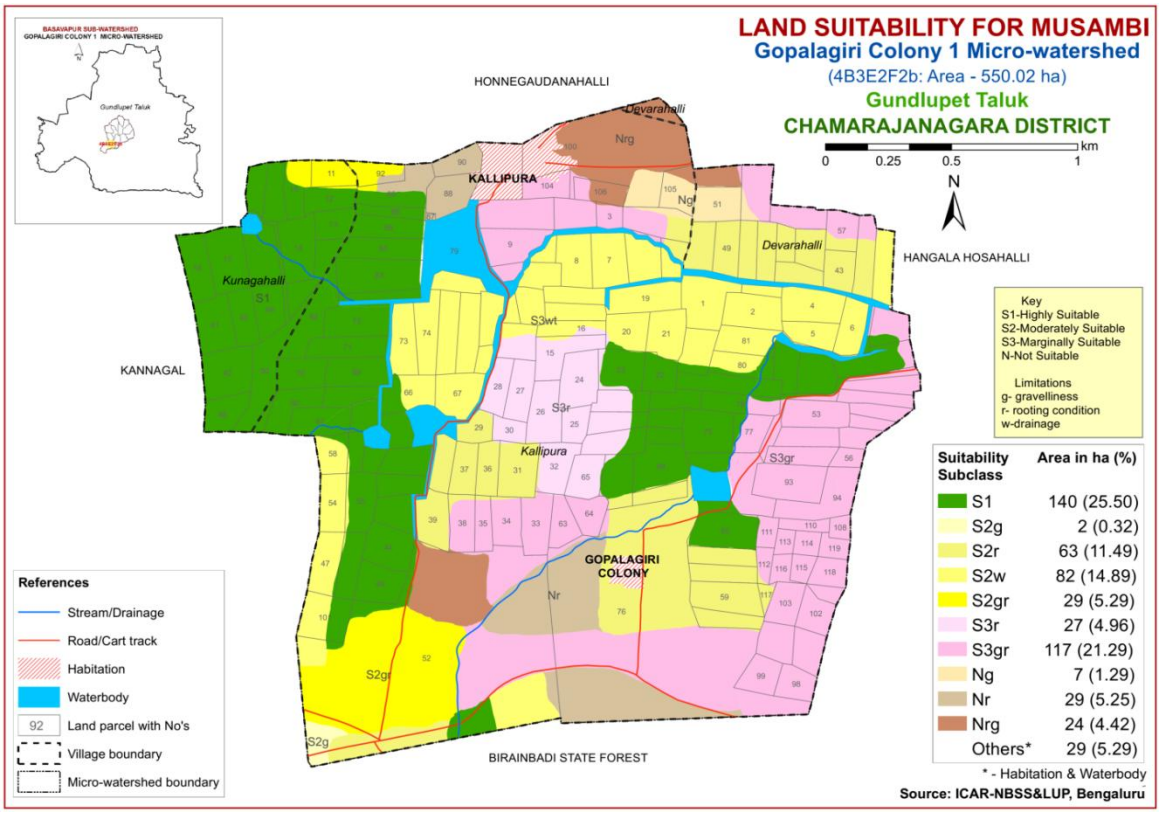


Fig. 7.19 Land Suitability map of Musambi

7.20 Land Suitability for Lime (*Citrus sp*)

Lime is one of the most important fruit crop grown in an area of 0.11 ha in almost all the districts of the State. The crop requirements for growing lime (Table 7.16) were matched with the soil-site characteristics and a land suitability map for growing lime was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.20.

An area of about 140 ha (25%) in the microwatershed has soils that are highly suitable (Class S1) for growing lime crop. They have minor or no limitations for growing lime and are distributed in the western, northwestern and central part of the microwatershed. Maximum area of about 176 ha (32%) is moderately suitable (Class S2) for growing lime and are distributed in the southwestern, central and northeastern part of the microwatershed. They have minor limitations of gravelliness, texture, rooting depth and wetness. Marginally suitable (Class S3) lands cover an area of about 144 ha (26%) and occur in the eastern, southern, southeastern, central and northeastern part of the microwatershed. They have moderate limitations of rooting depth and gravelliness. An area of about 60 ha (11%) is not suitable (Class N) for growing lime and occur in the southern and northern part of the microwatershed. They severe have limitations of gravelliness, rooting depth and topography.

Table 7.16 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	5.5-6.47.6-8.0	4.0-5.4 8.1-8.5	<4.0 >8.5
	$CaCO_3$ in root zone	%	Non 34calcareous	Upto 5	5-10	>10
Rooting conditions	Soil depth	Cm	>150	100-150	50-100	<50
	Gravel content	% vol.	Non gravelly	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	

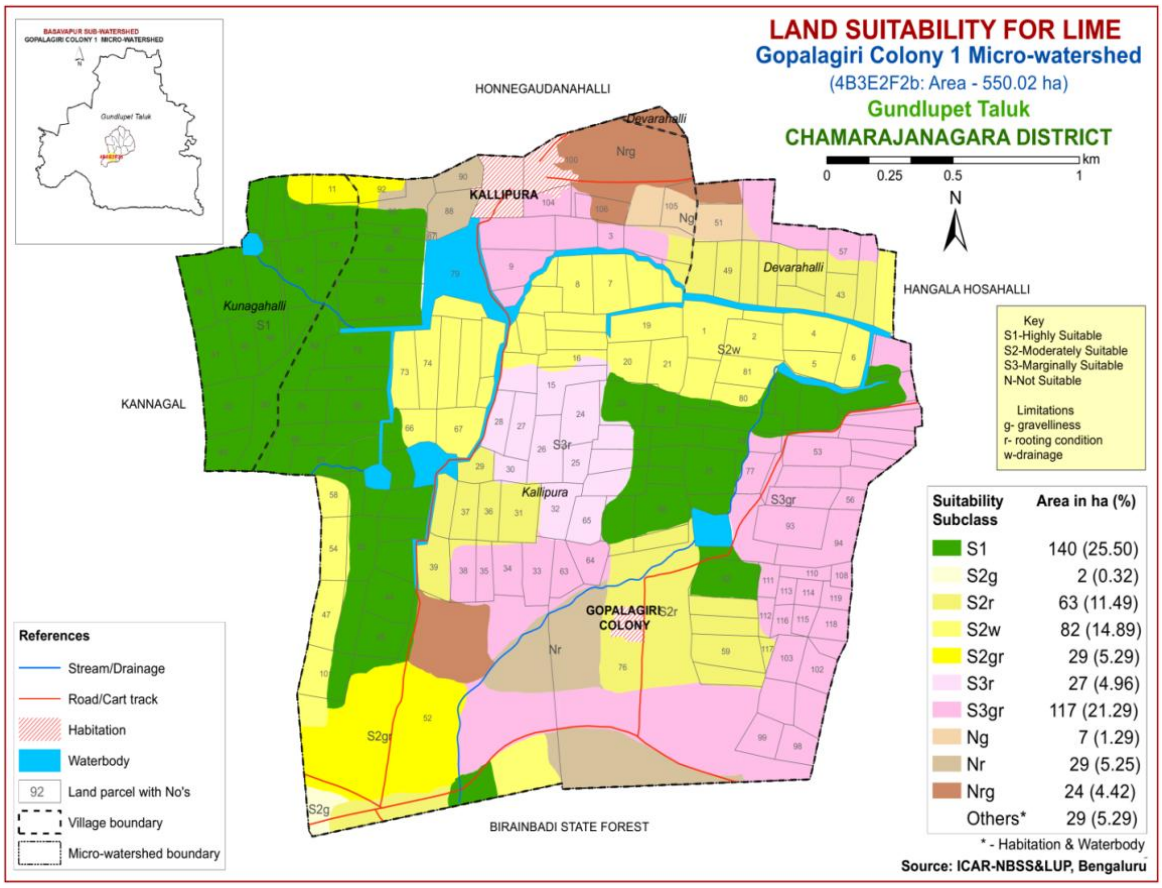


Fig. 7.20 Land Suitability map of Lime

7.21 Land Suitability for Cashew (*Anacardium occidentale)*

Cashew is one of the most important fruit crop grown in an area of 1.24 lakh ha in almost all the districts of the State. The crop requirements for growing cashew were matched with the soil-site characteristics and a land suitability map for growing cashew was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.21.

An area of about 140 ha (25%) in the microwatershed has soils that are highly suitable (Class S1) for growing cashew crop. They have minor or no limitations for growing cashew and are distributed in the western, northwestern, southwestern and cental part of the microwatershed. An area of about 118 ha (21%) is moderately suitable (Class S2) for growing cashew and are distributed in the southwestern, northeastern, northwestern and central part of the microwatershed. They have minor limitations of gravelliness and rooting depth. Marginally suitable (Class S3) lands cover an area of about 120 ha (22%) and occur in the southern, southeastern, central and eastern part of the microwatershed. They have moderate limitations of rooting depth and gravelliness. An area of about 142 ha (26%) is not suitable (Class N) for growing cashew and occur in the southern and northern part of the microwatershed. They have severe limitations of gravelliness, rooting depth, drainage and texture.

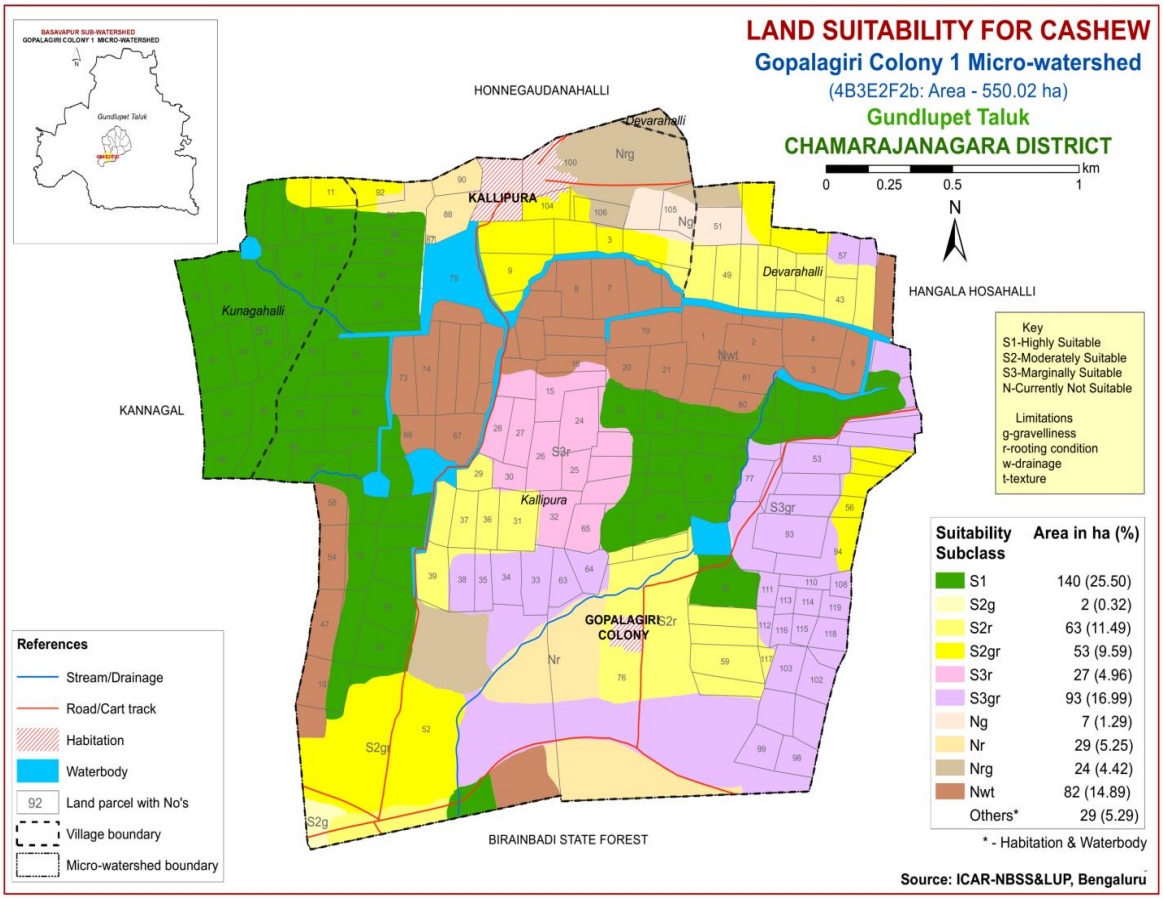


Fig. 7.21 Land Suitability map of Cashew

7.22 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 and a land suitability map for growing custard apple was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.22.

Maximum area of about 205 ha (37%) in the microwatershed has soils that are highly suitable (Class S1) for growing custard apple. They have minor or no limitations for growing custard apple and are distributed in the western, northwestern, southwestern, central and northeastern part of the microwatershed. An area of about 203 ha (37%) is moderately suitable (Class S2) for growing custard apple and are distributed in the southwestern, central, northern, eastern and northeastern part of the microwatershed. They have minor limitations of gravelliness, wetness and rooting depth. Marginally suitable (Class S3) lands cover an area of about 97 ha (18%) and occur in the southern, central and northern part of the microwatershed. They have moderate limitations of rooting depth and gravelliness. A small area of about 16 ha (3%) is not suitable (Class N) for growing custard apple and occur in the northern part of the microwatershed. They have severe limitations of gravelliness and topography.

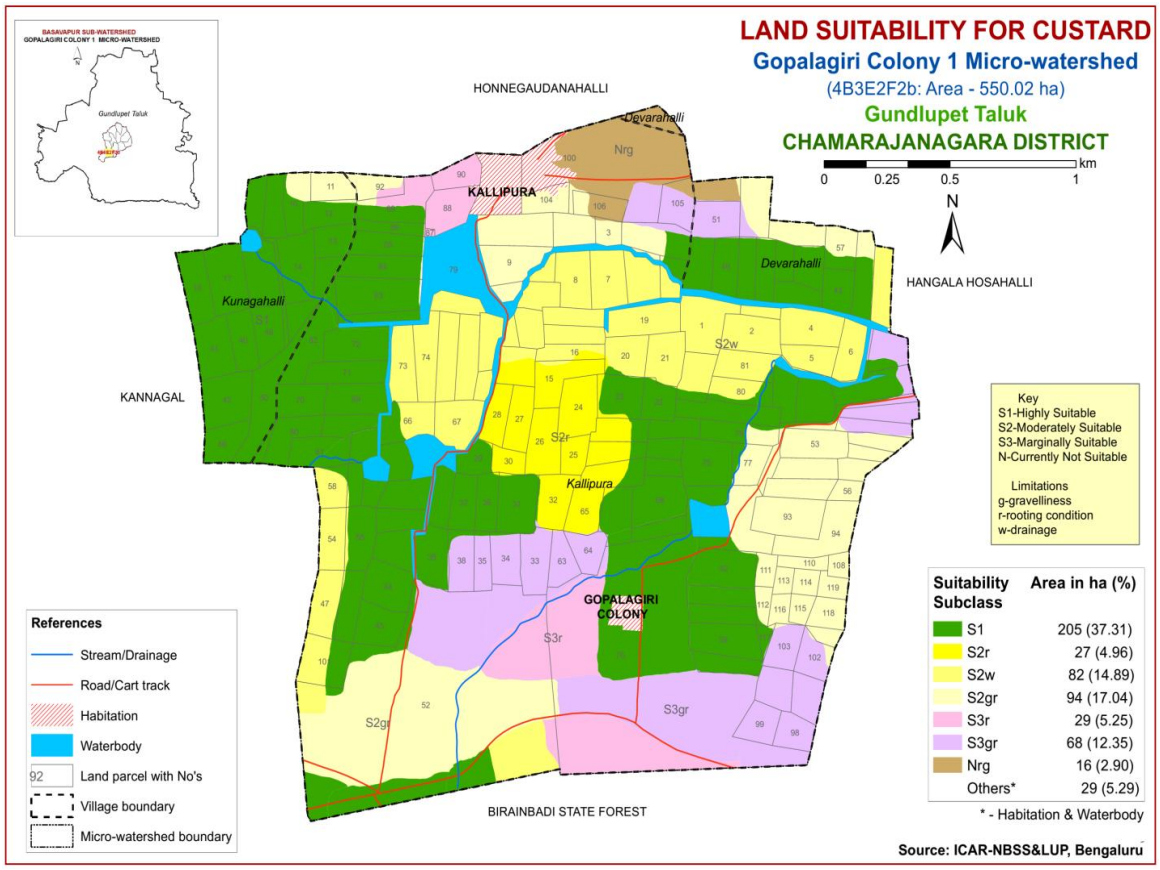


Fig. 7.22 Land Suitability map of Custard Apple

7.23 Land Suitability for Amla (*Phyllanthus emblica*)

Amla is one of the fruit crop grown in almost all the districts of the State. The crop requirements for growing amla were matched with the soil-site characteristics and a land suitability map for growing amla was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.23.

An area of about 203 ha (37%) in the microwatershed has soils that are highly suitable (Class S1) for growing amla crop. They have minor or no limitations for growing amla and are distributed in the western, northeastern, central and northewestern part of the microwatershed. A major area of about 257 ha (47%) is moderately suitable (Class S2) for growing amla and are distributed in all parts of the microwatershed. They have minor limitations of gravelliness, wetness and rooting depth. Marginally suitable (Class S3) lands cover an area of about 44 ha (8%) and occur in the southern and northern part of the microwatershed. They have moderate limitations of rooting depth and gravelliness. A small area of about 16 ha (3%) is not suitable (Class N) for growing amla and occur in the northern part of the microwatershed. They have severe limitations of gravelliness and rooting depth.

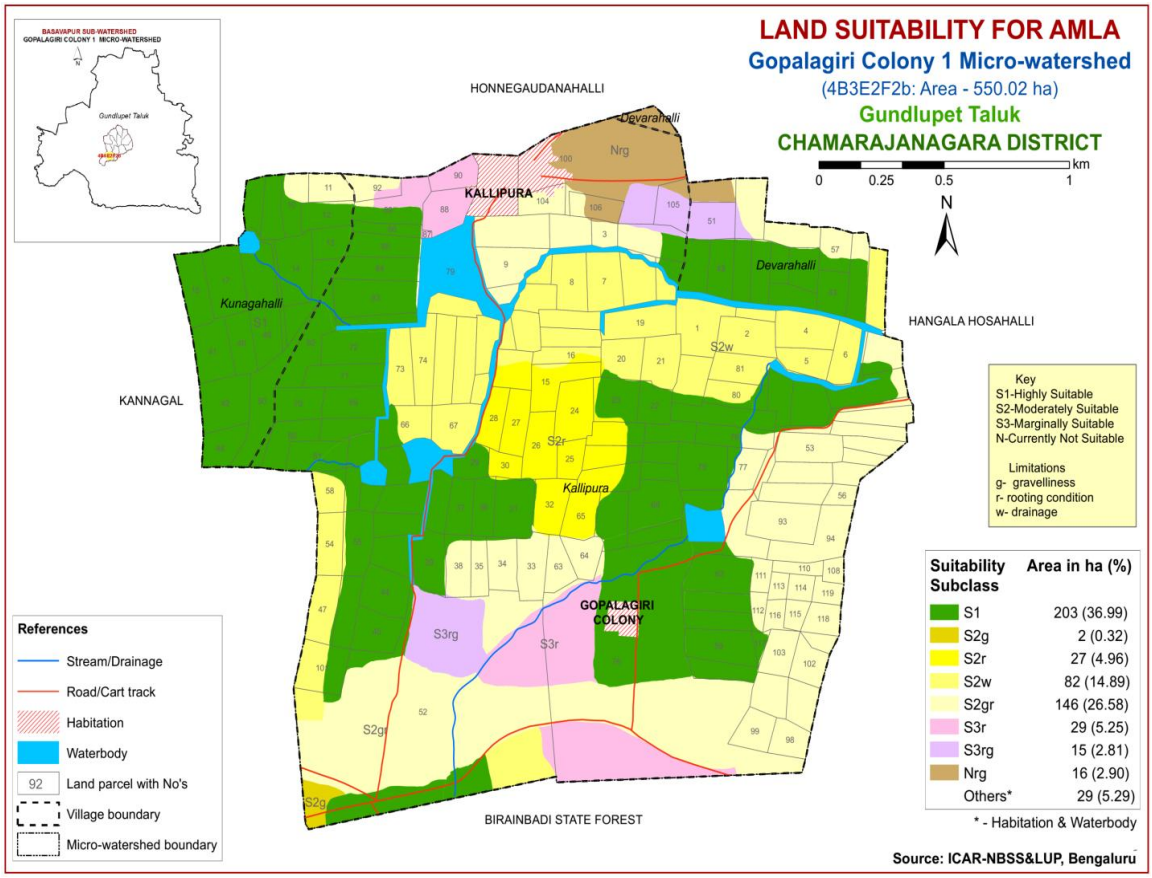


Fig. 7.23 Land Suitability map of Amla

7.24 Land Suitability for Tamarind (*Tamarindus indica*)

Tamarind is one of the fruit crop grown in almost all the districts of the State. The crop requirements for growing tamarind were matched with the soil-site characteristics and a land suitability map for growing tamarind was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.24.

An area of about 140 ha (25%) in the microwatershed has soils that are highly suitable (Class S1) for growing tamarind. They have minor or no limitations for growing tamarind and are distributed in the western, northeastern, central and southwestern part of the microwatershed. An area of about 176 ha (32%) is moderately suitable (Class S2) for growing tamarind and are distributed in the southwestern, central and northeastern part of the microwatershed. They have minor limitations of gravelliness, wetness, rooting depth and texture. Marginally suitable (Class S3) lands cover an area of about 117 ha (22%) and occur in the southeastern, eastern, central and northeastern part of the microwatershed. They have moderate limitations of rooting depth and gravelliness. An area of about 87 ha (16%) is not suitable (Class N) for growing tamarind and occur in the central and northern part of the microwatershed. They have severe limitations of gravelliness and rooting depth.

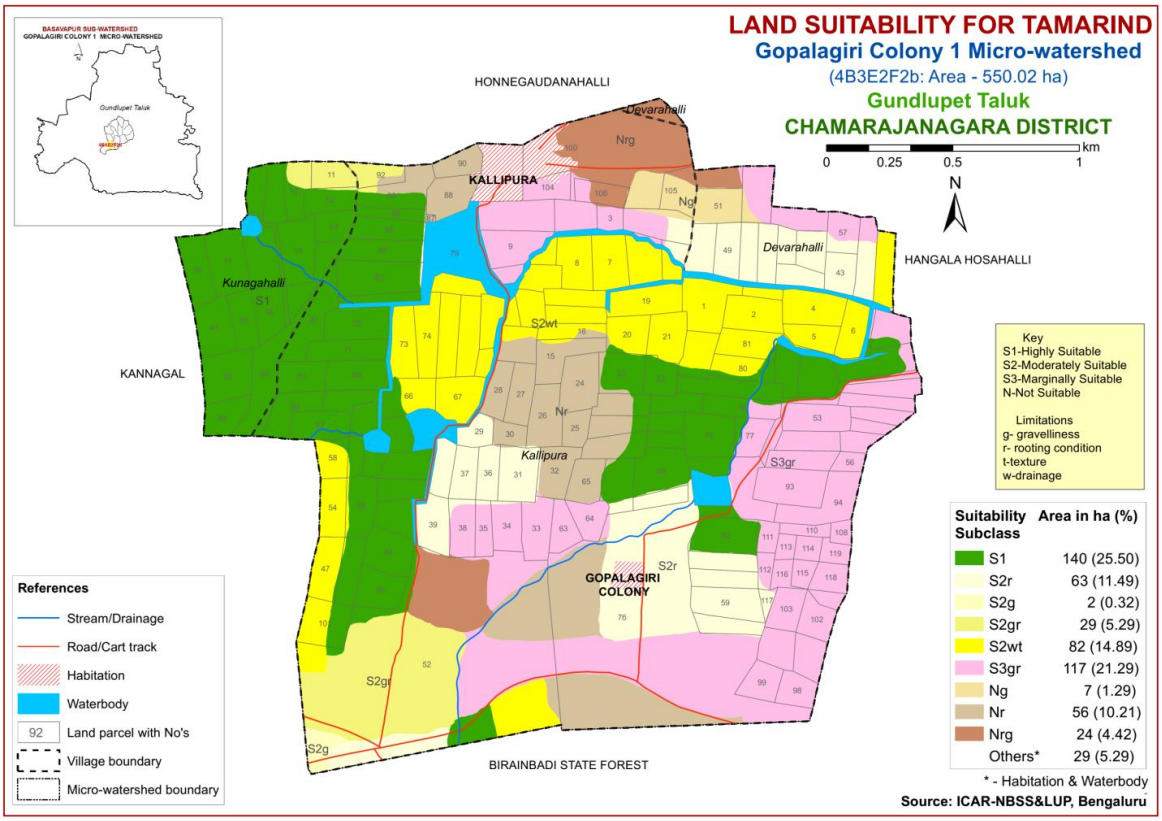


Fig. 7.24 Land Suitability map of Tamarind

7.25 Land suitability for Marigold (*Tagetes sps.)*

Marigold is the most important flower crop grown in an area of 1858 ha in almost all the districts of the State. The crop requirements for growing marigold (Table 7.17) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing marigold was generated. The area extent and geographical distribution of different suitability subclasses inthe microwatershed is given in Figure 7.25.

An area of about 203 ha (37%) in the microwatershed has soils that are highly suitable (Class S1) for growing marigold. They have minor or no limitations for growing marigold and are distributed in the western, northwestern, central, northeastern and southwestern part of the microwatershed. A major area of about 216 ha (39%) is moderately suitable (Class S2) for growing marigold and are distributed in the southern, southwestern, southeastern, central and northeastern part the microwatershed. They have minor limitations of gravelliness, wetness, texture and rooting depth. Marginally suitable (Class S3) lands cover an area of about 85 ha (15%) and occur in the southern, eastern and northern part of the microwatershed. They have moderate limitations of rooting depth and gravelliness. A small area of about 16 ha (3%) is not suitable (Class N) for growing marigold and occur in the northern part of the microwatershed. They severe have limitations of gravelliness.

Table 7.17 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	-

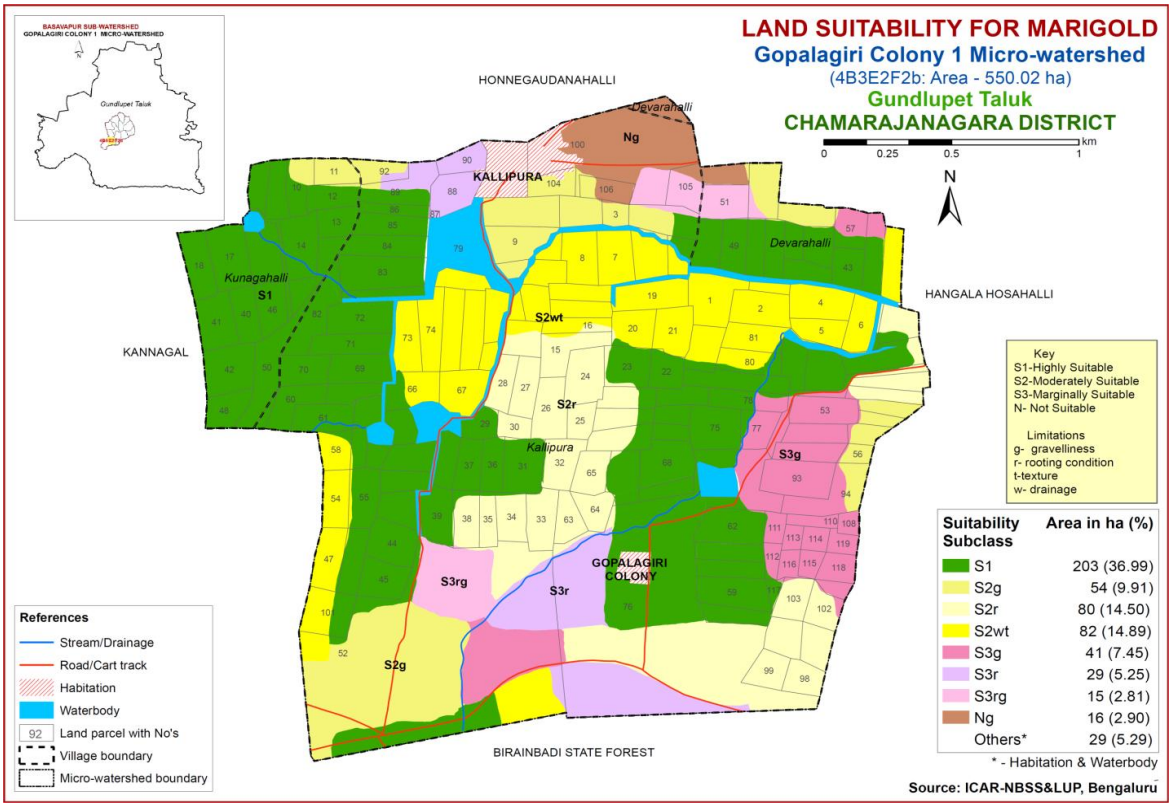


Fig. 7.25 Land Suitability map of Marigold

7.26 Land suitability for Chrysanthemum (*Dendranthema grandiflora*)

Chrysanthemum is the most important flower crop grown in an area of 803 ha in almost all the districts of the State. The crop requirements for growing chrysanthemum (Table 7.18) were matched with the soil-site characteristics and a land suitability map for growing chrysanthemum was generated. The area extent and geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.26.

An area of about 140 ha (25%) in the microwatershed has soils that are highly suitable (Class S1) for growing chrysanthemum. They have minor or no limitations for growing chrysanthemum and are distributed in the western, northwestern and central part of the microwatershed. A major area of about 256 ha (46%) is moderately suitable (Class S2) for growing chrysanthamum and are distributed in all parts of the microwatershed. They have minor limitations of gravelliness, wetness, texture and rooting depth. Marginally suitable (Class S3) lands cover an area of about 102 ha (18%) and occur in the southern and northern part of the microwatershed. They have moderate limitations of rooting depth and gravelliness. A small area of about 23 ha (4%) is not suitable (Class N) for growing chrysanthamum and occur in the northern part of the microwatershed. They have severe limitations of gravelliness.

Table 7.18 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	

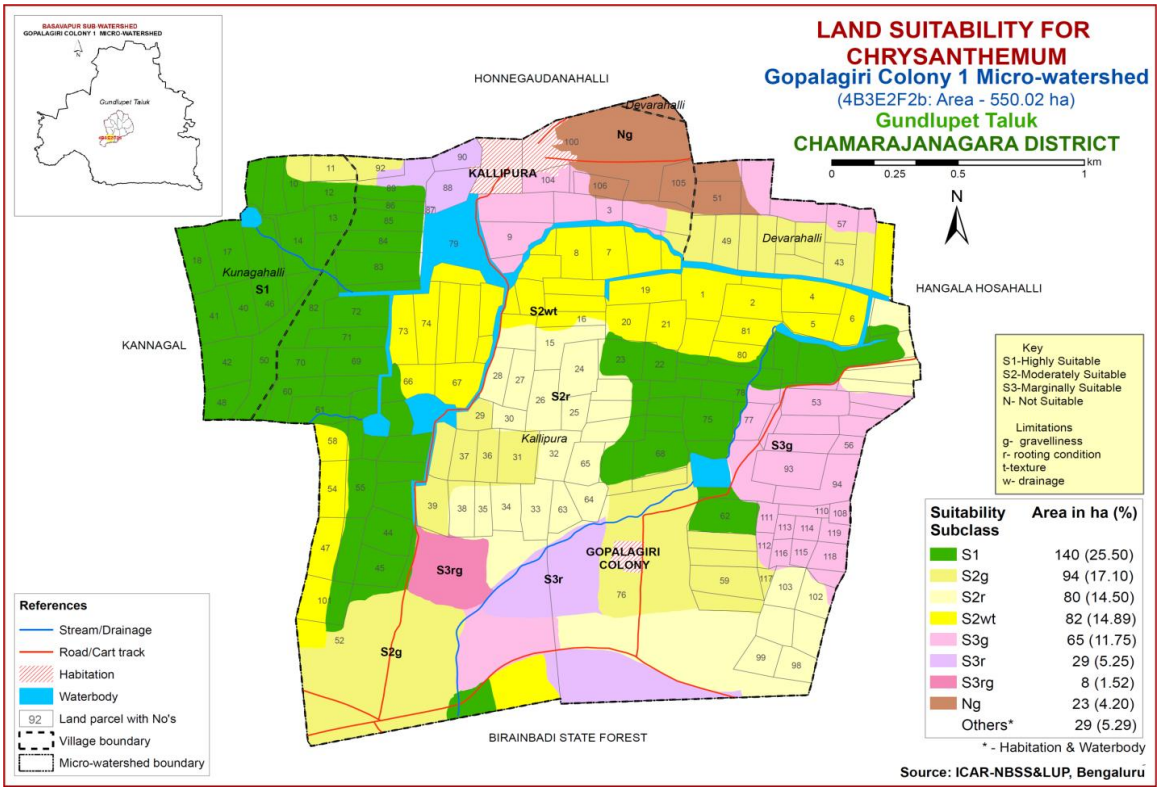


Fig. 7.26 Land Suitability map of Chrysanthemum

7.27 Land Suitability for Turmeric (*Curcuma longa*)

Turmeric is the most important spice crop grown in an area of 1.39 lakh ha in almost all the districts of the State. The crop requirements (Table 7.19) for growing turmeric were matched with the soil-site (Table 7.1) characteristics and a land suitability map for growing turmeric was generated. The area extent and geographical distribution of different suitability subclasses in the microwatersheds is given in Figure 7.27.

An area of about 140 ha (25%) in the microwatershed has soils that are highly suitable (Class S1) for growing turmeric crop. They have minor or no limitations for growing turmeric and are distributed in the western, southwestern and eastern part of the microwatershed. An area of about 168 ha (31%) is moderately suitable (Class S2) for growing turmeric and are distributed in the southwestern, central, southeastern and northeastern part of the microwatershed. They have minor limitations of gravelliness and rooting depth. Marginally suitable (Class S3) lands cover maximum area of about 190 ha (34%) and occur in the southern, central, eastern and northeastern part of the microwatershed. They have moderate limitations of rooting depth, gravelliness, wetness and texture. An area of about 23 ha (4%) is not suitable (Class N) for growing turmeric and occur in the northern part of the microwatershed. They have severe limitations of gravelliness.

Table 7.19 Land suitability criteria for Turmeric

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	20-27 33-37	10-19 38-40	<10 >40
Soil aeration	Soil drainage	class	Well drained	Mod. well drained	Imperfectly drained	Poorly drained
Nutrient availability	Texture	Class	l, cl, scl, sl	Sc, sic, sicl	C(40-60%), ls	Stony heavy clay>60%
	pH	1:2.5				
	Available nutrient status (NPK)	Fertility rating class	high	medium	low	
Rooting conditions	Soil depth	Cm	>75	50-75	25-50	<25
Erosion	Slope	%	<3	3-8	8-15	>15mm

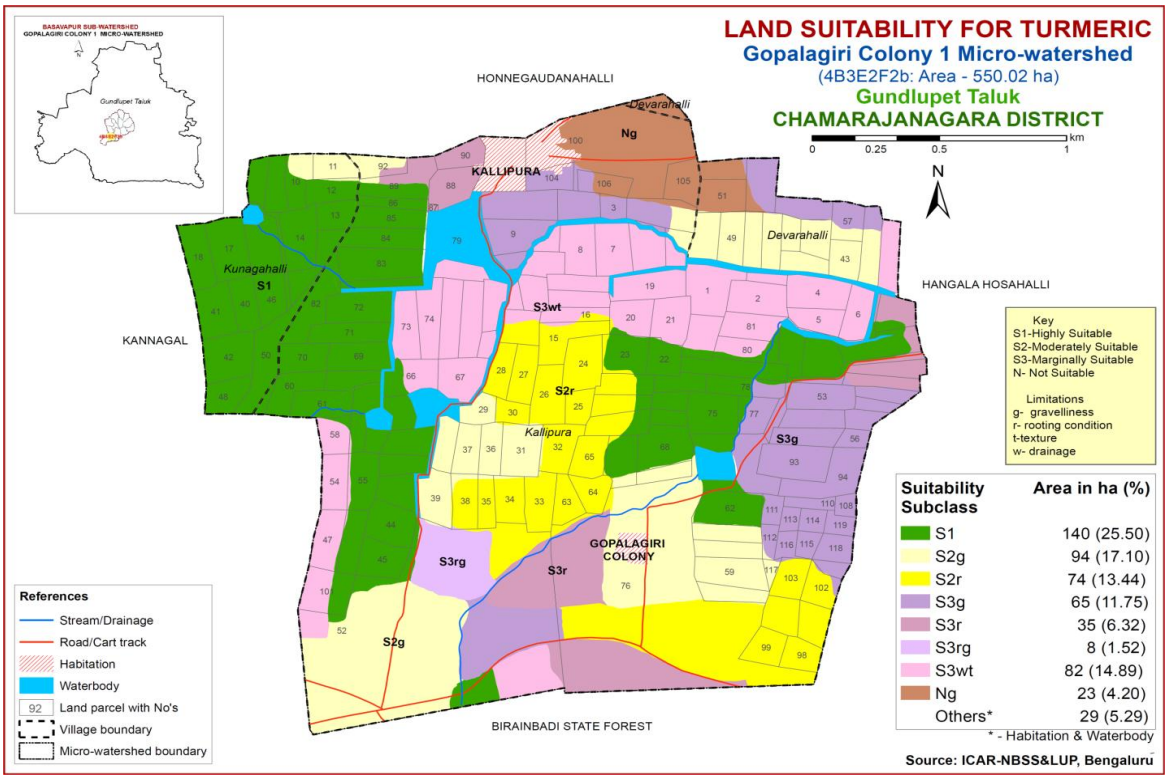


Fig. 7.27 Land Suitability map of Turmeric

7.28 Land Management Units (LMUs)

The 35 soil map units identified in the microwatershed have been regrouped into 7 Land Management Units (LMU's) for the purpose of preparing Proposed Crop Plan. Land Management Units 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 Management Units map (Fig.7.28) has been generatedd. These Land Management Units are expected to behave similarly for a given level of management.

The map units that have been grouped into 7 land management units along with brief description of soil and site characteristics are given below.

LMUs	Soil map units	Soil and site characteristics
1	ARKiB1, ARKmB1, ARKmB2, HGHiB1g1, HGHiB2, HGHmA1, HGHmB2g2	Very deep, sandy clay to clay soils with slopes of <1-3%, gravelly (15-60%) and slight to moderate erosion
2	BMBmA1, BMBmB1, BMBmB2	Very deep, black clay soils with slopes of <1-3% and slight to moderate erosion
3	KLPhB2, KLPhB2g1, KLPiB2g1, KLPcB1g1, KLPiB1, MDHhC2g1, MDHiB1	Deep, red sandy clay to clay soils with slopes of 1-5%, gravelly (15-35%) and slight to moderate erosion
4	KNGbB1g1, KNGhB1g2, KNGiB2g2	Moderately deep, red gravelly sandy clay loam to sandy clay soils with slopes of 1-3%, gravelly to very gravelly (15-60%) and slight to moderate erosion
5	DRHbC2g1, DRHhC2g1, DRHiB1g1, DRHiC2g3, DRHmB1g1	Moderately shallow, red sandy clay loam to sandy clay soils with slopes of 1-5%, very gravelly to extremely gravelly (15-80%) and slight to moderate erosion
6	MGHcB1g1, MGHcC2, MGHhB1g1, MGHhC2g1	Moderately shallow, gravelly red sandy clay loam soils with slopes of 1-5%, gravelly (15-35%) and slight to moderate erosion
7	HDRhB2g1, HDRhC2g1, HDRhC2g2, HDRiC2g1, HDRiC2g3	Shallow, red sandy clay loam to sandy clay soils with slopes of 1-5%, gravelly to extremely gravelly (15-80%) and moderate erosion

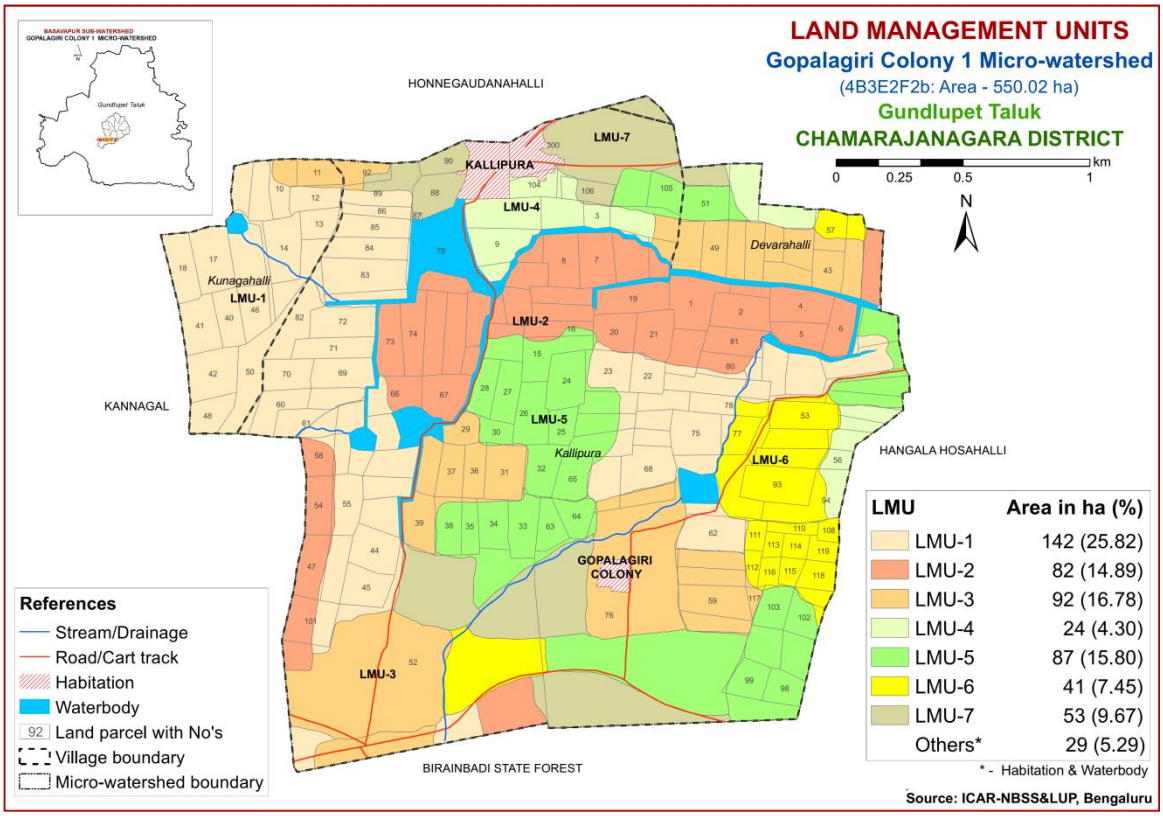


Fig. 7.28 Land Management Units Map- Gopalagiri Colony-1 Microwatershed

7.29 Proposed Crop Plan for Gopalagiri Colony-1 Microwatershed

After assessing the land suitability for the 27 crops, the proposed crop plan has been prepared for the 7 identified LMUs by considering only the highly (Class S1) and moderately (Class S2) suitable lands for each of the 27 crops. The resultant proposed crop plan is presented below in Table 7.20

Table 7.20 Proposed Crop Plan for Gopalagiri Colony-1 Microwatershed

LMU No	Mapping Units	Survey Number	Field Crops/Forestry	Suitable Horticulture Crops under Irrigation	Horticulture Crops with suitable Interventions	Suitable Interventions
LMU1	1, 2, 3, 17, 18, 19, 20 (142ha) (>150 cm) (Very deep, red clay soils)	Hungala Hosahalli: 50,51,52,62,66,68,72,73,74, 75,78,79 Kallipura: 22,23,41,42,43,44,45,46,55,56, 57,60,61,63,64,68,69,70,71,72,81,82,83,84,85,86,89 Kunagahalli:8,9,10,12,13,14,15,17, 18,40,41,42,45,46,48,50	Maize, Sorghum, Cotton, Sunflower, Redgram, Sugarcane **Multiple crop rotation:** Redgram+Maize Redgram+Groundnut Pulses+Ragi Pulses+Sorghum	Turmeric, Banana, Lime, Tomato, Beans, Bhendi	**Perennial components:** Mango, Sapota, Lime **Flower crops:** Marigold, Chrysanthemum **Annual vegetables:** Chillies, Bhendi	Drip irrigation, Mulching, crop suitable conservation practices
LMU 2	4, 5, 6 (82ha) (>150 cm) (Very deep, lowland clay soils)	Devarahalli: 41 Hungala Hosahalli: 1,2,3,4,5,6,80,81 ,82 Kallipura: 5,6,7,8,11,12,13,16,17,18, 19, 20,21,47,54,58,66,67,73,74, 75, 76,77,78,80,101	Cotton, Sorghum, Sunflower, Redgram, Sugarcane **Multiple crop rotation:** Reg gram+Fodder Sorghum Pulses+ Sorghum	Beetroot, Banana, Lime, Tomato, Beans, Bhendi	**Flower crops:** Marigold, Chrysanthemum **Perennial components:** Custard apple, Amla, Lime **Annual vegetables:** Chillies, Bhendi	Drip Irrigation, Mulching, crop suitable conservation practices
LMU 3	22, 23, 24, 25, 26, 30, 31 (92 ha) (100-150 cm)	Devarahalli:42,43,44,45,46,47 ,48,49,50 Hungala Hosahalli: 58,59,60,61,67,117	Maize, Sorghum, Cotton, Sunflower, Redgram **Multiple crop rotation:** Redgram+Maize	Tomato, Beetroot, Potato, Mango, Banana, Beans, Bhendi, Turmeric	**Perennial components:** Mango, Sapota, Lime **Flower crops:**	Drip irrigation, Mulching, crop suitable conservation

	(Deep, gravelly clay soils)	Kallipura: 29,31,36,37,39,40,52,92 Kunagahalli: 11	Redgram+Groundnut Pulses+Sorghum		Marigold, Chrysanthemum **Annual vegetables:** Chillies, Bhendi	practices
LMU 4	27, 28, 29 (23 ha) (75-100 cm) Moderately deep, gravelly red clay soils	Devarahalli: 53,54 Hungala Hosahalli: 44,45,46,56 Kallipura: 1,2,3,4,9,10,104	Maize, Sorghum, Cotton, Ragi, Sunflower Pulses+Sorghum	Fieldbean, Tomato, Beetroot, Onion, Banana, Turmeric	**Perennial components:** Sapota, Guava **Flower crops:** Marigold, Chrysanthemum **Annual vegetables:** Chillies, Bhendi	Drip irrigation, Mulching, Crop suitable conservation practices
LMU 5	7, 8, 9, 10, 11, 21 (87 ha) (50-75 cm) Moderately shallow, gravelly red clay soils	Devarahalli: 51 Hungala Hosahalli: 7,47,49,63,64,65,69, 70,71,76,98,99,100, 101,102,103 Kallipura: 14,15,24,25,26,27,28, 30,32,33,34,35,38,105	Ragi, Groundnut, Maize, Sorghum, Cotton Pulses+Sorghum	Fieldbean, Tomato, Beetroot, Onion, Banana, Turmeric	Custard apple, Ber, Aonla **Vegetables:** Clusterbean, Bhendi **Flower crops:** Marigold, Chrysanthemum, Gillardia	Drip irrigation, Mulching, Crop suitable conservation practices
LMU 6	32, 33, 34, 35 (41 ha) (50-75 cm) Moderately shallow, gravelly red loam soils	Devarahalli: 57 Hungala Hosahalli: 53,54,55,57,77,93,94, 108,110,111,112,113, 114,115,116,118,119	Groundnut, Ragi, Horsegram	Custard apple, Amla	Custard apple, Amla, Drumstick, Fig	Drip irrigation, Mulching, Crop suitable conservation practices
LMU 7	12, 13, 14, 15, 16 (53 ha) (25-50 cm) Shallow red clay soils	Devarahalli: 52,76 Kallipura: 87,88,90,100,106	Groundnut, Horsegram, Fieldbean, Ragi	Custard apple, Amla	Custard apple, Ber	Drip irrigation, Mulching, Crop suitable conservation practices

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 Gopalagiri Colony-1 Microwatershed

- The soil phases with sizeable area identified in the microwatershed belonged to the soil series of ARK (101 ha), BMB (82 ha), KLP (63 ha), DRH (61 ha), HDR (53 ha), HGH (41 ha), MGH (41 ha), MDH (27 ha), HPR (27 ha) and KNG (24 ha).
- As per land capability classification, nearly 95 per cent area falls under arable land category (Class II and III). The major limitations identified in the arable lands were soil and erosion.
- On the basis of soil reaction, maximum area of about 155 ha (28%) is slightly alkaline (pH 7.3-7.8), about 139 ha (25%) is moderately alkaline (pH 7.8-8.4). An area of

about 95 ha (17%) under neutral (pH 6.5-7.3), an area of about 66 ha (12%) slightly acid (pH 6-6.5) followed by moderately acid (pH 5.5-6.0) reaction covering an area of about 65 ha (12%).

- **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.

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 one of the major factor affecting the soil health in the microwatershed. Out of total 550 ha area in the microwatershed, major area of 277 ha is suffering from moderate erosion. These areas need immediate soil and water conservation and, other land development and land husbandry practices for restoring soil health. An area of 244 ha is relatively a stable terrain with slight erosion.

Dissemination information and communicate 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 younger farmers.

Inputs for Net Planning and Interventions needed

Net planning in IWMP is focusing on preparation of Soil and Water Conservation Plans for each plot or farm.

1. Productivity enhancement measures/ interventions for existing crops/livestock/other farm enterprises.
2. Diversification of farming mainly with perennial horticultural crops and livestock.
3. 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 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, 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 the microwatershed.

❖ **Organic Carbon:** The OC content is medium (0.5-0.75%) in about 361 ha (66%) area, low (<0.5%) in 124 ha (23%) and high (>0.75%) in 36 ha (6%) area. 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 485 ha area where OC is low to medium. 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**: In 188 ha (34%) area the available phosphorus is low (<23 kg/ha) and 237 ha (43%) area medium (23-57 kg/ha) in available phosphorus. Hence for all the crops, 25% additional P-needs to be applied. It is high (>57 kg/ha) in 95 ha (17%).

❖ **Available Potassium:** Available potassium is medium in 52 ha (9%) area of the microwatershed and high in 469 ha (85%). Hence, in all these plots, when available potassium is medium, an additional 25 % potassium may be applied for all crops.

❖ **Available Sulphur:** Available sulphur is a very critical nutrient for oilseed crops. It is low in major area of about 461 ha (84%) of the microwatershed and medium in an area of about 60 ha (11%). 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 iron:** It is deficient in an area of 179 ha (33%) in the microwatershed. To manage iron deficiency, iron sulphate @ 25kg /ha needs to be applied for 2-3 years. It is sufficient in the rest of 342 ha (62 %) area in the microwatershed.

❖ **Available Zinc:** It is deficient in an area of 385 ha (70%) in the microwatershed and it is sufficient in the rest of 135 ha (25 %) area in the microwatershed. Application of zinc sulphate @25kg/ha is to be applied in those area where available zinc is deficient.

❖ **Soil alkalinity:** The microwatershed has 294 ha area where the soils are slightly to moderatly alkaline. These areas need application of gypsum and wherever calcium is in excess, iron pyrites and element sulphur can be recommended. Management practices like treating repeatedly with good quality water to drain out the excess salts and provision of

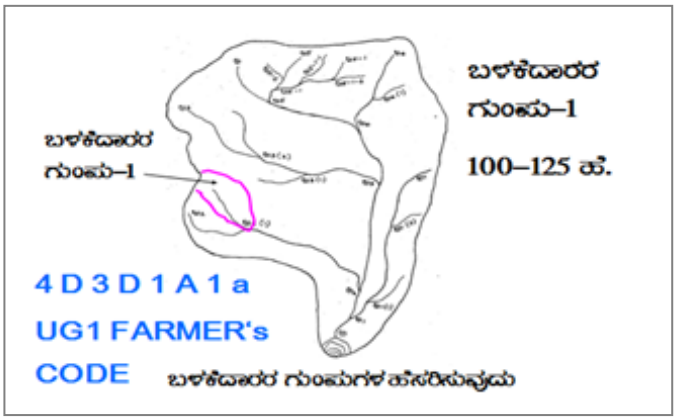
subsurface drainage and growing of salt tolerant crops like Casuarina, Acasia, Neem, Ber etc, are recommended.

❖ **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.

SOIL AND WATER CONSERVATION TREATMENT PLAN

For preparing soil and water conservation treatment plan for Gopalagiri Colony-1 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 maps
- Rainfall map
- 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 has to be collected.

Steps for Survey and Preparation of Treatment Plan

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

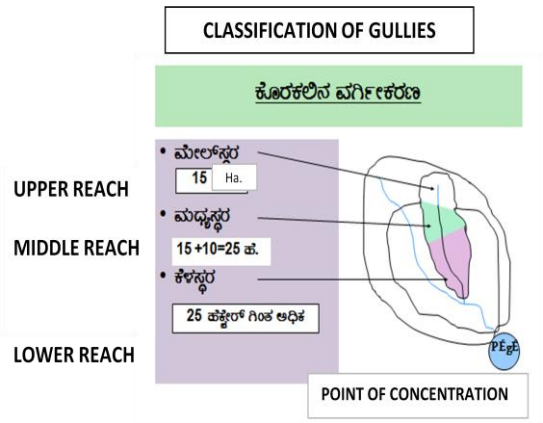
- Naming of user groups and farmers
- Identification of arable and non arable lands
- Identification of drainage lines and gullies
- Identification of non treatable areas
- Identification of priority areas in the arable lands
- Treatment plan for arable lands
- Location of water harvesting and recharge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

9.1 Treatment Plan

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

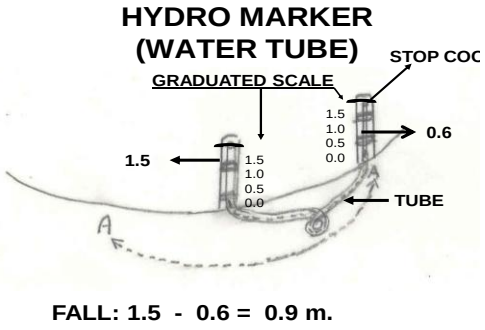
9.1.1 Arable Land Treatment

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 Hydrometer.



FALL: 1.5 - 0.6 = 0.9 m.

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

Slope per centage	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_0 = <15% gravel). The recommended Sections for different soils are given below.

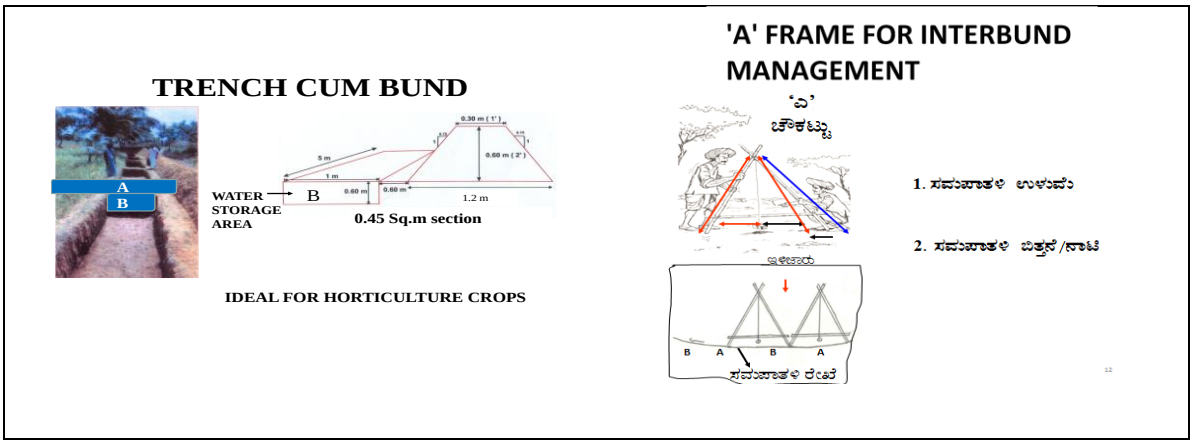
Recommended bund section

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 soil	
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/ Ttrenches to be excavated (Machinery are decided considering the Bund section).

Details of Borrow Pit dimensions are given below.



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

Bund section	Bund length	Earth quantity	Pit				Berm (pit to pit)	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. Water ways

1. Existing water ways are marked on the cadastral map (1:10000 scale). Their dimensions have to be recorded.
2. Considering the Contour plan of the MWS, additional water ways/ modernization of the existing ones can be thought of.
3. The design details are given in the Manual.

C. Farm ponds

Water ways and catchment will give an indication on the size of the 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 into 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/ concerned authorities, Contour Trench, Staggered Trench, Crescent Bund, Boulder Bund or Pebble Bunds 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 in 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 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 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 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 / Strngthening
4. Crescent Bunds

A map (Fig. 9.1) showing soil and water conservation plan with different kinds of structures recommended has been prepared which shows the spatial distribution and extent of area. Major area of about 515 ha (94%) requires trench cum bunding and small area of about 6 ha (1%) requires bunding/strengthening of existing bunds.

The conservation plan prepared 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.

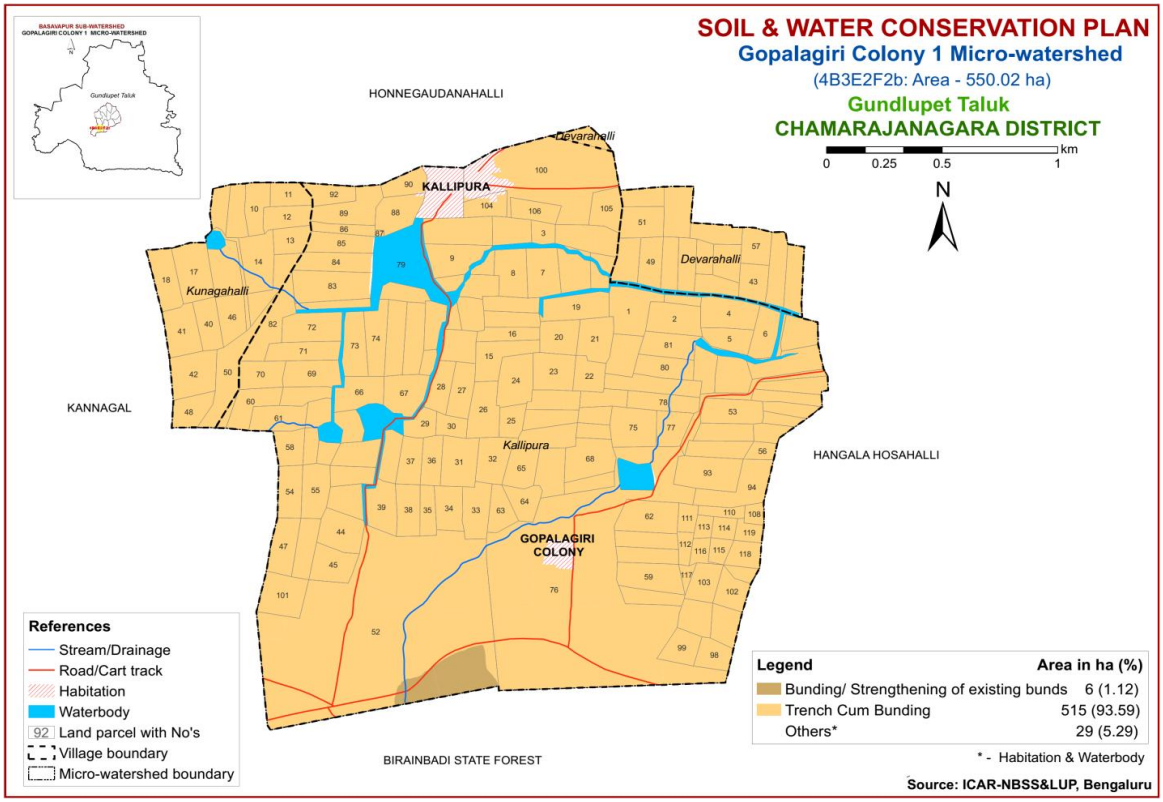


Fig. 9.1 Soil and Water Conservation Plan map of Gopalagiri Colony-1 Microwatershed

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 and VII) and also the lands that are not suitable or marginally suitable for growing annual and perennial crops. The methods of planting these trees are given below.

It is recommended to open pits during the 1st week of March along the contour and heap the dugout 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 be 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 and temperature is listed below; water logged areas are recommended to be planted with species like Neral (*Sizyziumcumini*) and Bamboos. 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

Gopalagiri Colony-1 Microwatershed

Soil Phase Information

Village	Survey Number	Total Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	AWC	Slope	Soil Erosion	CLU Code	WELLS	LCC	Conservation Plan
Devarahalli	41	2.16	BMBmB1	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	Coconut (CN)	1 Bore well	IIw	Trench Cum Bunding
Devarahalli	42	2.38	KLPiB2g1	LMU-3	Deep (100-150 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Horsegram (Hg)	Not Available	IIes	Trench Cum Bunding
Devarahalli	43	1.92	KLPiB2g1	LMU-3	Deep (100-150 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar (Jw)	1 Bore well	IIes	Trench Cum Bunding
Devarahalli	44	1.43	KLPiB2g1	LMU-3	Deep (100-150 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Coconut+Redgram (CN+Rg)	1 Bore well	IIes	Trench Cum Bunding
Devarahalli	45	1.8	KLPiB2g1	LMU-3	Deep (100-150 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar+Turmeric (Jw+Tu)	1 Bore well	IIes	Trench Cum Bunding
Devarahalli	46	1.07	KLPiB2g1	LMU-3	Deep (100-150 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	NA	Not Available	IIes	Trench Cum Bunding
Devarahalli	47	1.8	KLPiB2g1	LMU-3	Deep (100-150 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Carrot+Beans+No Crop (Cr+Bn+NC)	1 Bore well	IIes	Trench Cum Bunding
Devarahalli	48	1.64	KLPiB2g1	LMU-3	Deep (100-150 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Turmeric+Carrot+Beans (Tu+Cr+Bn)	1 Bore well	IIes	Trench Cum Bunding
Devarahalli	49	2.13	KLPiB2g1	LMU-3	Deep (100-150 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Carrot (Mz+Cr)	Not Available	IIes	Trench Cum Bunding
Devarahalli	50	2.01	KLPiB2g1	LMU-3	Deep (100-150 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Cowpea+No Crop (Cp+NC)	2 Bore well	IIes	Trench Cum Bunding
Devarahalli	51	2.55	DRHiC2g3	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Extremely gravelly (60-80%)	Low (51-100 mm/m)	Gently sloping (3-5%)	Moderate	Horsegram+Redgram (Hg+Rg)	1 Bore well	IIIes	Trench Cum Bunding
Devarahalli	52	1.49	HDRiC2g3	LMU-7	Shallow (25-50 cm)	Sandy clay	Extremely gravelly (60-80%)	Very Low (<50 mm/m)	Gently sloping (3-5%)	Moderate	Horsegram+Jowar (Hg+Jw)	Not Available	IIIes	Trench Cum Bunding
Devarahalli	53	2.68	KNGhB1g2	LMU-4	Moderately deep (75-100 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Horsegram+Cowpea (Hg+Cp)	Not Available	IIs	Trench Cum Bunding
Devarahalli	54	1.8	KNGhB1g2	LMU-4	Moderately deep (75-100 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Horsegram+Maize (Hg+Mz)	1 Bore well	IIs	Trench Cum Bunding
Devarahalli	57	1.97	MGHhB1g1	LMU-6	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Cotton (Ct)	1 Bore well	IIIs	Trench Cum Bunding
Devarahalli	76	1.23	HDRiC2g3	LMU-7	Shallow (25-50 cm)	Sandy clay	Extremely gravelly (60-80%)	Very Low (<50 mm/m)	Gently sloping (3-5%)	Moderate	NA	Not Available	IIIes	Trench Cum Bunding
Hungaladha Hosahalli	1	3.58	BMBmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Banana+Turmeric (Ba+Tu)	Not Available	IIw	Trench Cum Bunding
Hungaladha Hosahalli	2	3.06	BMBmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Banana+No Crop (Ba+NC)	1 Bore well	IIw	Trench Cum Bunding
Hungaladha Hosahalli	3	0.62	BMBmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Moderate	No Crop (NC)	1 Bore well	IIw	Trench Cum Bunding

Village	Survey Number	Total Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	AWC	Slope	Soil Erosion	CLU Code	WELLS	LCC	Conservation Plan
Hungaladha Hosahalli	4	3.16	BMBmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Turmeric+Banana+Horsegram+Cotton (Tu+Ba+Hg+Ct)	2 Bore well	IIw	Trench Cum Bunding
Hungaladha Hosahalli	5	1.96	BMBmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Horsegram+Coconut+No Crop (Hg+CN+NC)	Not Available	IIw	Trench Cum Bunding
Hungaladha Hosahalli	6	2.42	BMBmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Horsegram (Hg)	Not Available	IIw	Trench Cum Bunding
Hungaladha Hosahalli	7	1.99	DRHmB1g1	LMU-5	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	NA	Not Available	IIs	Trench Cum Bunding
Hungaladha Hosahalli	44	1.09	KNGbB1g1	LMU-4	Moderately deep (75-100 cm)	Loamy sand	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Horsegram (Hg)	Not Available	IIs	Trench Cum Bunding
Hungaladha Hosahalli	45	0.8	KNGbB1g1	LMU-4	Moderately deep (75-100 cm)	Loamy sand	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Turmeric+Brinjal (Tu+Br)	Not Available	IIs	Trench Cum Bunding
Hungaladha Hosahalli	46	1.22	KNGbB1g1	LMU-4	Moderately deep (75-100 cm)	Loamy sand	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Horsegram (Rg+Hg)	1 Bore well	IIs	Trench Cum Bunding
Hungaladha Hosahalli	47	1.51	DRHmB1g1	LMU-5	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Jowar+No Crop (Jw+NC)	Not Available	IIs	Trench Cum Bunding
Hungaladha Hosahalli	49	1.75	DRHmB1g1	LMU-5	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Turmeric+Jowar+Banana (Tu+Jw+Ba)	1 Bore well	IIs	Trench Cum Bunding
Hungaladha Hosahalli	50	2.89	HGHiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Turmeric+Jowar+Avare (Tu+Jw+Av)	Not Available	IIes	Trench Cum Bunding
Hungaladha Hosahalli	51	2.32	HGHiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Avare+No Crop (Av+NC)	Not Available	IIes	Trench Cum Bunding
Hungaladha Hosahalli	52	1.65	HGHiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar+Turmeric (Jw+Tu)	1 Bore well	IIes	Trench Cum Bunding
Hungaladha Hosahalli	53	2.82	MGHcB1g1	LMU-6	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Horsegram+Jowar (Hg+Jw)	Not Available	IIIs	Trench Cum Bunding
Hungaladha Hosahalli	54	1.89	MGHcB1g1	LMU-6	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Turmeric+Brinjal (Tu+Br)	Not Available	IIIs	Trench Cum Bunding
Hungaladha Hosahalli	55	1.97	MGHcB1g1	LMU-6	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Horsegram+Turmeric+Jowar (Hg+Tu+Jw)	Not Available	IIIs	Trench Cum Bunding
Hungaladha Hosahalli	56	0.9	KNGbB1g1	LMU-4	Moderately deep (75-100 cm)	Loamy sand	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Beat root+Turmeric (Bt+Tu)	Not Available	IIs	Trench Cum Bunding
Hungaladha Hosahalli	57	0.7	MGHcC2	LMU-6	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Gently sloping (3-5%)	Moderate	Scrub land (Sl)	Not Available	IIIes	Trench Cum Bunding
Hungaladha Hosahalli	58	1.66	KLPhB2	LMU-3	Deep (100-150 cm)	Sandy clay loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	No Crop (NC)	Not Available	IIes	Trench Cum Bunding
Hungaladha Hosahalli	59	3.31	KLPhB2	LMU-3	Deep (100-150 cm)	Sandy clay loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	No Crop (NC)	1 Bore well	IIes	Trench Cum Bunding

Village	Survey Number	Total Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	AWC	Slope	Soil Erosion	CLU Code	WELLS	LCC	Conservation Plan
Hungaladha Hosahalli	60	1.81	KLPhB2	LMU-3	Deep (100-150 cm)	Sandy clay loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Beatroot (Bt)	Not Available	IIes	Trench Cum Bunding
Hungaladha Hosahalli	61	1.89	KLPhB2	LMU-3	Deep (100-150 cm)	Sandy clay loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	NA	Not Available	IIes	Trench Cum Bunding
Hungaladha Hosahalli	62	3.52	HGHiB1g1	LMU-1	Very deep (>150 cm)	Sandy clay	Gravelly (15-35%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Avare (Rg+Av)	1 Bore well	IIs	Trench Cum Bunding
Hungaladha Hosahalli	63	1.83	DRHiB1g1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Horsegram (Rg+Hg)	Not Available	IIs	Trench Cum Bunding
Hungaladha Hosahalli	64	1.84	DRHiB1g1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Horsegram (Rg+Hg)	Not Available	IIs	Trench Cum Bunding
Hungaladha Hosahalli	65	2.23	HPRiB1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	NA	Not Available	IIs	Trench Cum Bunding
Hungaladha Hosahalli	66	2.48	HGHiB1g1	LMU-1	Very deep (>150 cm)	Sandy clay	Gravelly (15-35%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	2 Bore well	IIs	Trench Cum Bunding
Hungaladha Hosahalli	67	1.28	KLPhB2g1	LMU-3	Deep (100-150 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Scrub land (Sl)	Not Available	IIes	Trench Cum Bunding
Hungaladha Hosahalli	68	3.44	HGHiB1g1	LMU-1	Very deep (>150 cm)	Sandy clay	Gravelly (15-35%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	Banana+Turmeric (Ba+Tu)	2 Bore well	IIs	Trench Cum Bunding
Hungaladha Hosahalli	69	2.32	HPRiB1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Carrot (Cr)	1 Bore well	IIs	Trench Cum Bunding
Hungaladha Hosahalli	70	1.73	HPRiB1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Turmeric+Brinjal (Tu+Br)	2 Bore well	IIs	Trench Cum Bunding
Hungaladha Hosahalli	71	1.89	HPRiB1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	No Crop (NC)	Not Available	IIs	Trench Cum Bunding
Hungaladha Hosahalli	72	1.47	HGHiB1g1	LMU-1	Very deep (>150 cm)	Sandy clay	Gravelly (15-35%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	No Crop (NC)	Not Available	IIs	Trench Cum Bunding
Hungaladha Hosahalli	73	1.07	HGHiB1g1	LMU-1	Very deep (>150 cm)	Sandy clay	Gravelly (15-35%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	NA	Not Available	IIs	Trench Cum Bunding
Hungaladha Hosahalli	74	0.95	HGHiB1g1	LMU-1	Very deep (>150 cm)	Sandy clay	Gravelly (15-35%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	Cowpea (Cp)	Not Available	IIs	Trench Cum Bunding
Hungaladha Hosahalli	75	3.36	HGHiB1g1	LMU-1	Very deep (>150 cm)	Sandy clay	Gravelly (15-35%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	Brinjal+Turmeric+Carrot+Redgram (Br+Tu+Cr+Rg)	5 Bore well	IIs	Trench Cum Bunding
Hungaladha Hosahalli	76	59.84	DRHhC2g1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Gently sloping (3-5%)	Moderate	Sunflower+Horsegram+Cotton+Avare+No Crop (Sf+Hg+Ct+Av+NC)	6 Bore well	IIes	Trench Cum Bunding

Village	Survey Number	Total Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	AWC	Slope	Soil Erosion	CLU Code	WELLS	LCC	Conservation Plan
Hungaladha Hosahalli	77	2.03	MGHcB1g1	LMU-6	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Horsegram (Rg+Hg)	Not Available	IIIs	Trench Cum Bunding
Hungaladha Hosahalli	78	2.33	HGHiB1g1	LMU-1	Very deep (>150 cm)	Sandy clay	Gravelly (15-35%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar+No Crop (Jw+NC)	1 Bore well	IIs	Trench Cum Bunding
Hungaladha Hosahalli	79	2.89	HGHiB1g1	LMU-1	Very deep (>150 cm)	Sandy clay	Gravelly (15-35%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	Cowpea (Cp)	1 Bore well	IIs	Trench Cum Bunding
Hungaladha Hosahalli	80	2.31	BMBmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Moderate	No Crop (NC)	Not Available	IIw	Trench Cum Bunding
Hungaladha Hosahalli	81	2.48	BMBmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Turmeric+No Crop (Tu+NC)	1 Bore well	IIw	Trench Cum Bunding
Hungaladha Hosahalli	82	2.24	BMBmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Turmeric (Tu)	Not Available	IIw	Trench Cum Bunding
Hungaladha Hosahalli	93	3.9	MGHcB1g1	LMU-6	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Horsegram +No Crop (Rg+Hg+NC)	Not Available	IIIs	Trench Cum Bunding
Hungaladha Hosahalli	94	3.88	MGHcB1g1	LMU-6	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Beans+Horesegram (Bn+Hg)	Not Available	IIIs	Trench Cum Bunding
Hungaladha Hosahalli	98	1.81	DRHbC2g1	LMU-5	Moderately shallow (50-75 cm)	Loamy sand	Gravelly (15-35%)	Low (51-100 mm/m)	Gently sloping (3-5%)	Moderate	Horsegram (Hg)	Not Available	IIes	Trench Cum Bunding
Hungaladha Hosahalli	99	2	DRHbC2g1	LMU-5	Moderately shallow (50-75 cm)	Loamy sand	Gravelly (15-35%)	Low (51-100 mm/m)	Gently sloping (3-5%)	Moderate	Horsegram (Hg)	Not Available	IIes	Trench Cum Bunding
Hungaladha Hosahalli	100	2.04	DRHbC2g1	LMU-5	Moderately shallow (50-75 cm)	Loamy sand	Gravelly (15-35%)	Low (51-100 mm/m)	Gently sloping (3-5%)	Moderate	Scrub land (Sl)	Not Available	IIes	Trench Cum Bunding
Hungaladha Hosahalli	101	1.91	DRHbC2g1	LMU-5	Moderately shallow (50-75 cm)	Loamy sand	Gravelly (15-35%)	Low (51-100 mm/m)	Gently sloping (3-5%)	Moderate	Scrub land (Sl)	Not Available	IIes	Trench Cum Bunding
Hungaladha Hosahalli	102	1.93	DRHbC2g1	LMU-5	Moderately shallow (50-75 cm)	Loamy sand	Gravelly (15-35%)	Low (51-100 mm/m)	Gently sloping (3-5%)	Moderate	Scrub land (Sl)	Not Available	IIes	Trench Cum Bunding
Hungaladha Hosahalli	103	2.04	DRHbC2g1	LMU-5	Moderately shallow (50-75 cm)	Loamy sand	Gravelly (15-35%)	Low (51-100 mm/m)	Gently sloping (3-5%)	Moderate	Scrub land (Sl)	Not Available	IIes	Trench Cum Bunding
Hungaladha Hosahalli	108	0.75	MGHcC2	LMU-6	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Gently sloping (3-5%)	Moderate	Redgram+Avare (Rg+Av)	Not Available	IIIes	Trench Cum Bunding
Hungaladha Hosahalli	110	0.93	MGHcC2	LMU-6	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Gently sloping (3-5%)	Moderate	Horsegram (Hg)	Not Available	IIIes	Trench Cum Bunding
Hungaladha Hosahalli	111	1	MGHcC2	LMU-6	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Gently sloping (3-5%)	Moderate	Horsegram (Hg)	Not Available	IIIes	Trench Cum Bunding
Hungaladha Hosahalli	112	0.85	MGHcC2	LMU-6	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Gently sloping (3-5%)	Moderate	NA	Not Available	IIIes	Trench Cum Bunding

Village	Survey Number	Total Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	AWC	Slope	Soil Erosion	CLU Code	WELLS	LCC	Conservation Plan
Hungaladha Hosahalli	113	0.73	MGHcC2	LMU-6	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Gently sloping (3-5%)	Moderate	Horsegram (Hg)	Not Available	IIIes	Trench Cum Bunding
Hungaladha Hosahalli	114	0.97	MGHcC2	LMU-6	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Gently sloping (3-5%)	Moderate	Horsegram (Hg)	Not Available	IIIes	Trench Cum Bunding
Hungaladha Hosahalli	115	0.92	MGHcC2	LMU-6	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Gently sloping (3-5%)	Moderate	Horsegram (Hg)	Not Available	IIIes	Trench Cum Bunding
Hungaladha Hosahalli	116	0.91	MGHcC2	LMU-6	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Gently sloping (3-5%)	Moderate	Horsegram (Hg)	Not Available	IIIes	Trench Cum Bunding
Hungaladha Hosahalli	117	0.5	KLPhB2	LMU-3	Deep (100-150 cm)	Sandy clay loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	NA	Not Available	IIes	Trench Cum Bunding
Hungaladha Hosahalli	118	1.57	MGHcC2	LMU-6	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Gently sloping (3-5%)	Moderate	Redgram+Horsegram (Rg+Hg)	Not Available	IIIes	Trench Cum Bunding
Hungaladha Hosahalli	119	1	MGHcC2	LMU-6	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Gently sloping (3-5%)	Moderate	Horsegram (Hg)	Not Available	IIIes	Trench Cum Bunding
Kallipura	1	3.56	KNGiB2g2	LMU-4	Moderately deep (75-100 cm)	Sandy clay	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Avare+Jowar+Redgram (Av+Jw+Rg)	3 Bore well	IIes	Trench Cum Bunding
Kallipura	2	1.94	KNGiB2g2	LMU-4	Moderately deep (75-100 cm)	Sandy clay	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Sugarcane+Maize+Jowar+Turmeric (Sc+Mz+Jw+Tu)	3 Bore well	IIes	Trench Cum Bunding
Kallipura	3	0.99	KNGiB2g2	LMU-4	Moderately deep (75-100 cm)	Sandy clay	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar+Horsegram+Tomato (Jw+Hg+Tm)	1 Bore well	IIes	Trench Cum Bunding
Kallipura	4	3.01	KNGiB2g2	LMU-4	Moderately deep (75-100 cm)	Sandy clay	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Turmeric+Jowar (Tu+Jw)	Not Available	IIes	Trench Cum Bunding
Kallipura	5	1.21	BMBmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cowpea (Cp)	Not Available	IIw	Trench Cum Bunding
Kallipura	6	2.33	BMBmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+No Crop (Mz+NC)	Not Available	IIw	Trench Cum Bunding
Kallipura	7	2.98	BMBmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Moderate	No Crop (NC)	Not Available	IIw	Trench Cum Bunding
Kallipura	8	2.79	BMBmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Sunflower (Sf)	Not Available	IIw	Trench Cum Bunding
Kallipura	9	3.59	KNGiB2g2	LMU-4	Moderately deep (75-100 cm)	Sandy clay	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar+Corriander (Jw+Cd)	Not Available	IIes	Trench Cum Bunding
Kallipura	10	0.64	KNGiB2g2	LMU-4	Moderately deep (75-100 cm)	Sandy clay	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	No Crop (NC)	Not Available	IIes	Trench Cum Bunding

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Kallipura	11	1.48	BMBmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar (Jw)	Not Available	IIw	Trench Cum Bunding
Kallipura	12	1.56	BMBmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Moderate	No Crop (NC)	Not Available	IIw	Trench Cum Bunding
Kallipura	13	0.5	BMBmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar (Jw)	Not Available	IIw	Trench Cum Bunding
Kallipura	14	2.08	HPRiB1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Turmeric+Potato (Rg+Tu+Po)	Not Available	IIs	Trench Cum Bunding
Kallipura	15	2.95	HPRiB1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	No Crop (NC)	Not Available	IIs	Trench Cum Bunding
Kallipura	16	1.59	BMBmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Turmeric (Tu)	Not Available	IIw	Trench Cum Bunding
Kallipura	17	1.64	BMBmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Turmeric+Redgram (Tu+Rg)	Not Available	IIw	Trench Cum Bunding
Kallipura	18	1.6	BMBmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Moderate	No Crop (NC)	Not Available	IIw	Trench Cum Bunding
Kallipura	19	3.13	BMBmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Turmeric+No Crop (Tu+NC)	Not Available	IIw	Trench Cum Bunding
Kallipura	20	2.45	BMBmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Moderate	No Crop (NC)	Not Available	IIw	Trench Cum Bunding
Kallipura	21	2.72	BMBmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Turmeric (Tu)	Not Available	IIw	Trench Cum Bunding
Kallipura	22	1.87	HGHiB1g1	LMU-1	Very deep (>150 cm)	Sandy clay	Gravelly (15-35%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	No Crop (NC)	Not Available	IIs	Trench Cum Bunding
Kallipura	23	2.88	HGHiB1g1	LMU-1	Very deep (>150 cm)	Sandy clay	Gravelly (15-35%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	IIs	Trench Cum Bunding
Kallipura	24	3.22	HPRiB1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	No Crop (NC)	Not Available	IIs	Trench Cum Bunding
Kallipura	25	1.47	HPRiB1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	No Crop (NC)	Not Available	IIs	Trench Cum Bunding
Kallipura	26	3.08	HPRiB1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	No Crop (NC)	Not Available	IIs	Trench Cum Bunding
Kallipura	27	2.31	HPRiB1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Jowar+Sugarcane (Jw+Sc)	Not Available	IIs	Trench Cum Bunding
Kallipura	28	1.95	HPRiB1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Banana (Ba)	Not Available	IIs	Trench Cum Bunding
Kallipura	29	1.47	KLPiB1	LMU-3	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	No Crop (NC)	Not Available	IIs	Trench Cum Bunding
Kallipura	30	1.22	HPRiB1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Avare (Av)	Not Available	IIs	Trench Cum Bunding

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Kallipura	31	3.35	KLPiB1	LMU-3	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Horsegram (Hg)	Not Available	IIs	Trench Cum Bunding
Kallipura	32	2.79	HPRiB1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Horsegram (Rg+Hg)	Not Available	IIs	Trench Cum Bunding
Kallipura	33	2.75	DRHiB1g1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Horsegram (Rg+Hg)	Not Available	IIs	Trench Cum Bunding
Kallipura	34	2.31	DRHiB1g1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Horsegram (Rg+Hg)	Not Available	IIs	Trench Cum Bunding
Kallipura	35	1.48	DRHiB1g1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Horsegram (Rg+Hg)	Not Available	IIs	Trench Cum Bunding
Kallipura	36	1.87	KLPiB1	LMU-3	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Horsegram (Hg)	Not Available	IIs	Trench Cum Bunding
Kallipura	37	2.04	KLPiB1	LMU-3	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Brinjal (Br)	Not Available	IIs	Trench Cum Bunding
Kallipura	38	2.34	DRHiB1g1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Cotton (Rg+Ct)	Not Available	IIs	Trench Cum Bunding
Kallipura	39	2.72	KLPiB1	LMU-3	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Chilly+Jowar+Avare (Ch+Jw+Av)	Not Available	IIs	Trench Cum Bunding
Kallipura	40	1.74	KLPiB1	LMU-3	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Turmeric (Tu)	1 Bore well	IIs	Trench Cum Bunding
Kallipura	41	2.06	ARKmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Turmeric (Tu)	1 Bore well	IIes	Trench Cum Bunding
Kallipura	42	1.57	ARKmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cabbage (Cg)	Not Available	IIes	Trench Cum Bunding
Kallipura	43	1.9	ARKmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Turmeric+No Crop (Tu+NC)	Not Available	IIes	Trench Cum Bunding
Kallipura	44	3	ARKmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Trench Cum Bunding
Kallipura	45	2.65	ARKmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Horsegram (Rg+Hg)	Not Available	IIes	Trench Cum Bunding
Kallipura	46	2.2	ARKmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Jowar (Rg+Jw)	Not Available	IIes	Trench Cum Bunding
Kallipura	47	2.7	BMBmB1	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	No Crop (NC)	1 Bore well	IIw	Trench Cum Bunding
Kallipura	52	66	MDHhC2g1	LMU-3	Deep (100-150 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Gently sloping (3-5%)	Moderate	Sunflower+Jowar+Horsegram+Groundnut+Avare+Potato+No Crop+Scrub land (Sf+Jw+Hg+Gn+Av+Po+NC+Sl)	Not Available	IIes	Trench Cum Bunding
Kallipura	54	2.39	BMBmB1	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	No Crop (NC)	Not Available	IIw	Trench Cum Bunding

Village	Survey Number	Total Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	AWC	Slope	Soil Erosion	CLU Code	WELLS	LCC	Conservation Plan
Kallipura	55	2.75	ARKmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Turmeric (Tu)	Not Available	IIes	Trench Cum Bunding
Kallipura	56	0.78	ARKmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Avare (Av)	Not Available	IIes	Trench Cum Bunding
Kallipura	57	0.98	ARKmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Moderate	No Crop (NC)	Not Available	IIes	Trench Cum Bunding
Kallipura	58	1.88	BMBmB1	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar+Avare (Jw+Av)	Not Available	IIw	Trench Cum Bunding
Kallipura	60	2.48	ARKiB1	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	Brinjal (Br)	Not Available	IIs	Trench Cum Bunding
Kallipura	61	2.63	ARKiB1	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	Scrub land (Sl)	Not Available	IIs	Trench Cum Bunding
Kallipura	62	0.82	Waterbody	Others	Others	Others	Others	Others	Others	Others	Others	Not Available	Others	Others
Kallipura	63	1.22	ARKmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Turmeric+No Crop (Tu+NC)	Not Available	IIes	Trench Cum Bunding
Kallipura	64	1.43	ARKmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Moderate	No Crop (NC)	Not Available	IIes	Trench Cum Bunding
Kallipura	65	2.23	Waterbody	Others	Others	Others	Others	Others	Others	Others	Others	Not Available	Others	Others
Kallipura	66	2.74	BMBmB1	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar+Maize (Jw+Mz)	1 Bore well	IIw	Trench Cum Bunding
Kallipura	67	2.94	BMBmB1	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	Beans+No Crop (Bn+NC)	Not Available	IIw	Trench Cum Bunding
Kallipura	68	1.53	ARKiB1	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	Banana+Turmeric (Ba+Tu)	1 Bore well	IIs	Trench Cum Bunding
Kallipura	69	2.84	ARKiB1	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	Turmeric+Brinjal (Tu+Br)	1 Bore well	IIs	Trench Cum Bunding
Kallipura	70	2.33	ARKiB1	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	No Crop (NC)	Not Available	IIs	Trench Cum Bunding
Kallipura	71	2.58	ARKiB1	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	Turmeric (Tu)	Not Available	IIs	Trench Cum Bunding
Kallipura	72	3.24	ARKiB1	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	Tomato+Ridge Guard+Chilly+Beans (Tm+Rd+Ch+Bn)	1 Bore well	IIs	Trench Cum Bunding
Kallipura	73	2.78	BMBmB1	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	Redgram (Rg)	Not Available	IIw	Trench Cum Bunding
Kallipura	74	2.72	BMBmB1	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	Turmeric (Tu)	Not Available	IIw	Trench Cum Bunding
Kallipura	75	2.62	BMBmB1	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	Ragi (Ra)	Not Available	IIw	Trench Cum Bunding
Kallipura	76	2.61	BMBmB1	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	Scrub land (Sl)	Not Available	IIw	Trench Cum Bunding
Kallipura	77	0.65	BMBmB1	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	NA	Not Available	IIw	Trench Cum Bunding
Kallipura	78	1.58	BMBmB1	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	Scrub land (Sl)	Not Available	IIw	Trench Cum Bunding

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Kallipura	79	7.14	Waterbody	Others	Others	Others	Others	Others	Others	Others	Others	Not Available	Others	Others
Kallipura	80	1.4	BMBmB1	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	Scrub land (Sl)	Not Available	IIw	Trench Cum Bunding
Kallipura	81	1.09	ARKmB1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	No Crop (NC)	Not Available	IIs	Trench Cum Bunding
Kallipura	82	3.38	ARKiB1	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	Maize+Banana+No Crop (Mz+Ba+NC)	1 Checkdom	IIs	Trench Cum Bunding
Kallipura	83	4.4	ARKmB1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+No Crop (Rg+NC)	1 Bore well	IIs	Trench Cum Bunding
Kallipura	84	2.75	ARKmB1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar+Redgram (Jw+Rg)	1 Bore well	IIs	Trench Cum Bunding
Kallipura	85	2.4	ARKmB1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	Ragi+Redgram+Turmeric (Ra+Rg+Tu)	1 Bore well	IIs	Trench Cum Bunding
Kallipura	86	1.21	ARKmB1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	Scrub land (Sl)	Not Available	IIs	Trench Cum Bunding
Kallipura	87	0.11	HDRhB2g1	LMU-7	Shallow (25-50 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	NA	Not Available	IIIes	Trench Cum Bunding
Kallipura	88	2.75	HDRhB2g1	LMU-7	Shallow (25-50 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Scrub land (Sl)	Not Available	IIIes	Trench Cum Bunding
Kallipura	89	3.41	ARKmB1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	Scrub land (Sl)	Not Available	IIs	Trench Cum Bunding
Kallipura	90	1.76	HDRhB2g1	LMU-7	Shallow (25-50 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Ragi+No Crop (Ra+NC)	Not Available	IIIes	Trench Cum Bunding
Kallipura	92	1.71	MDHiB1	LMU-3	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Horsegram (Hg)	Not Available	IIs	Trench Cum Bunding
Kallipura	100	16.47	HDRiC2g3	LMU-7	Shallow (25-50 cm)	Sandy clay	Extremely gravelly (60-80%)	Very Low (<50 mm/m)	Gently sloping (3-5%)	Moderate	Horsegram+Scrub land+No Crop (Hg+Sl+NC)	Not Available	IIIes	Trench Cum Bunding
Kallipura	101	3.35	BMBmB1	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	Ragi+Turmeric+No Crop (Ra+Tu+NC)	Not Available	IIw	Trench Cum Bunding
Kallipura	104	1.75	KNGiB2g2	LMU-4	Moderately deep (75-100 cm)	Sandy clay	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Horsegram (Hg)	Not Available	IIes	Trench Cum Bunding
Kallipura	105	2.21	DRHiC2g3	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Extremely gravelly (60-80%)	Low (51-100 mm/m)	Gently sloping (3-5%)	Moderate	No Crop (NC)	Not Available	IIIes	Trench Cum Bunding
Kallipura	106	1.77	HDRiC2g3	LMU-7	Shallow (25-50 cm)	Sandy clay	Extremely gravelly (60-80%)	Very Low (<50 mm/m)	Gently sloping (3-5%)	Moderate	Redgram+Avare (Rg+Av)	Not Available	IIIes	Trench Cum Bunding
Kunagahalli	8	1.4	ARKiB1	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	Turmeric+No Crop (Tu+NC)	Not Available	IIs	Trench Cum Bunding
Kunagahalli	9	1.82	ARKiB1	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar+Turmeric+Tomato (Jw+Tu+Tm)	1 Bore well	IIs	Trench Cum Bunding

Village	Survey Number	Total Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	AWC	Slope	Soil Erosion	CLU Code	WELLS	LCC	Conservation Plan
Kunagahalli	10	2.1	ARKiB1	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	Brinjal+Beans (Br+Bn)	1 Bore well	IIs	Trench Cum Bunding
Kunagahalli	11	1.71	MDHiB1	LMU-3	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Brinjal+Turmeric+Jowar (Br+Tu+Jw)	1 Bore well	IIs	Trench Cum Bunding
Kunagahalli	12	1.99	ARKiB1	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	Avare+Jowar+Redgram (Av+Jw+Rg)	1 Bore well	IIs	Trench Cum Bunding
Kunagahalli	13	1.76	ARKiB1	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	Maize+Brinjal+Beans (Mz+Br+Bn)	Not Available	IIs	Trench Cum Bunding
Kunagahalli	14	3.39	ARKiB1	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	Maize+Jowar+No Crop (Mz+Jw+NC)	1 Bore well	IIs	Trench Cum Bunding
Kunagahalli	15	2.83	ARKiB1	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	Cotton+Jowar (Ct+Jw)	Not Available	IIs	Trench Cum Bunding
Kunagahalli	16	0.57	Waterbody	Others	Others	Others	Others	Others	Others	Others	Others	Not Available	Others	Others
Kunagahalli	17	3.71	ARKiB1	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	Cowpea (Cp)	Not Available	IIs	Trench Cum Bunding
Kunagahalli	18	2.8	ARKiB1	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	Sugarcane (Sc)	Not Available	IIs	Trench Cum Bunding
Kunagahalli	40	2.17	ARKiB1	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	No Crop (NC)	Not Available	IIs	Trench Cum Bunding
Kunagahalli	41	3.03	ARKiB1	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Jowar (Rg+Jw)	Not Available	IIs	Trench Cum Bunding
Kunagahalli	42	3.63	ARKiB1	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Jowar (Rg+Jw)	Not Available	IIs	Trench Cum Bunding
Kunagahalli	45	2.27	ARKiB1	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Tomato+Maize+Turmeric (Rg+Tm+Mz+Tu)	Not Available	IIs	Trench Cum Bunding
Kunagahalli	46	2.27	ARKiB1	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Jowar (Rg+Jw)	Not Available	IIs	Trench Cum Bunding
Kunagahalli	48	2.12	ARKiB1	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	IIs	Trench Cum Bunding
Kunagahalli	50	4.23	ARKiB1	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very High (>200 mm/m)	Very gently sloping (1-3%)	Slight	Brinjal+Maize+Jowar+No Crop (Br+Mz+Jw+NC)	Not Available	IIs	Trench Cum Bunding

Appendix II

Gopalagiri Colony-1 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
Devarahalli	41	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Devarahalli	42	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Devarahalli	43	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Devarahalli	44	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Devarahalli	45	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Devarahalli	46	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Devarahalli	47	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Devarahalli	48	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Devarahalli	49	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Devarahalli	50	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Devarahalli	51	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Devarahalli	52	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (<0.5 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Devarahalli	53	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Devarahalli	54	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Devarahalli	57	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Devarahalli	76	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (<0.5 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Hungaladha Hosahalli	1	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	2	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	3	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	4	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (>57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	5	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (>57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Hungaladha Hosahalli	6	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (>57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 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
Hungaladha Hosahalli	7	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Hungaladha Hosahalli	44	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (<0.5 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	45	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (<0.5 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	46	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Hungaladha Hosahalli	47	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Hungaladha Hosahalli	49	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Hungaladha Hosahalli	50	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (>57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Hungaladha Hosahalli	51	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (>57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Hungaladha Hosahalli	52	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (>57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	53	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (<0.5 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	54	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (<0.5 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	55	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (<0.5 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	56	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Low (<0.5 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	57	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Low (<0.5 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	58	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Low (<0.5 %)	Low (< 23 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	59	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Low (<0.5 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	60	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Low (<0.5 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	61	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Low (<0.5 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	62	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Low (<0.5 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	63	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (<0.5 %)	Medium (23 - 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)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	64	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 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)	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
Hungaladha Hosahalli	65	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	66	Slightly alkaline (pH 7.3 – 7.8)	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)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	67	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (>57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	68	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (>57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	69	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	70	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	71	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	72	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	73	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	74	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	75	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	76	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	77	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (<0.5 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	78	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	79	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	80	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	81	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	82	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	93	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (<0.5 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	94	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Low (<0.5 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	98	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Low (<0.5 %)	Low (< 23 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	99	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (<0.5 %)	Low (< 23 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 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
Hungaladha Hosahalli	100	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Low (<0.5 %)	Low (< 23 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	101	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Low (<0.5 %)	Low (< 23 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	102	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Low (<0.5 %)	Low (< 23 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	103	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (<0.5 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	108	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (<0.5 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	110	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (<0.5 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	111	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Low (<0.5 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	112	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (<0.5 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	113	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (<0.5 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	114	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (<0.5 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	115	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (<0.5 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	116	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (<0.5 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	117	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (<0.5 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	118	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Low (<0.5 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hungaladha Hosahalli	119	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (<0.5 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	1	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (>57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	2	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (>57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kallipura	3	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (>57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kallipura	4	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	5	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	6	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	7	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kallipura	8	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (>57 kg/ha)	High (> 337 kg/ha)	Low (< 10 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
Kallipura	9	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	10	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	11	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	12	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	13	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	14	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	15	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	16	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	17	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	18	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	19	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	20	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	21	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	22	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	23	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	24	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	25	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	26	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	27	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	28	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	29	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	30	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	31	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 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)	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
Kallipura	32	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	33	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (<0.5 %)	Medium (23 - 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)	Deficient (< 0.6 ppm)
Kallipura	34	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	35	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	36	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 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)	Deficient (< 0.6 ppm)
Kallipura	37	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	38	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	39	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	40	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	41	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	42	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	43	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (>57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	44	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (>57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kallipura	45	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (>57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kallipura	46	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (>57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kallipura	47	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	High (>57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kallipura	52	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	54	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	55	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (>57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	56	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (>57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	57	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	58	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	60	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 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
Kallipura	61	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	62	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Kallipura	63	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (>57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	64	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (>57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	65	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Kallipura	66	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	67	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	68	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	69	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	70	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (>57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	71	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (>57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kallipura	72	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (>57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kallipura	73	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	74	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	75	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	76	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	77	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	78	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	79	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Kallipura	80	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	81	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (>57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	82	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (>57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kallipura	83	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (>57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kallipura	84	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (>57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kallipura	85	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (>57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kallipura	86	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (>57 kg/ha)	High (> 337 kg/ha)	Low (< 10 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
Kallipura	87	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (>57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	88	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (>57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	89	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (>57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kallipura	90	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	92	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (>57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kallipura	100	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kallipura	101	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (>57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kallipura	104	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallipura	105	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kallipura	106	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (>57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kunagahalli	8	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kunagahalli	9	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kunagahalli	10	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kunagahalli	11	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kunagahalli	12	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kunagahalli	13	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (>57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kunagahalli	14	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kunagahalli	15	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kunagahalli	16	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Kunagahalli	17	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kunagahalli	18	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kunagahalli	40	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kunagahalli	41	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kunagahalli	42	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kunagahalli	45	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Deficient (< 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
Kunagahalli	46	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kunagahalli	48	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kunagahalli	50	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)

Appendix III

Gopalagiri Colony-1 Microwatershed

Soil Suitability Information

Village	Survey No.	Sorgham	Maize	Redgram	Groundnut	Sunflower	Cotton	Onion	Turmeric	Beetroot	Potato	Beans	Horsegram	Field-bean	Guava	Mango	Sapota	Jackfruit	Jamun	Musambi	Lime	Cashew	Custard-apple	Amla	Tamarind	Banana	Marigold	Chrysanthemum
Devarahalli	41	S1	S3 wt	S2w	S3wt	S2w	S1	S2wt	S3wt	S3 wt	S3 wt	S2 wt	S2w	S2w	S3 wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	Nwt	S2w	S2w	S2wt	S2wt	S2 wt	S2wt
Devarahalli	42	S1	S1	S1	S2t	S2gt	S2t	S2g	S2g	S2 g	S2 g	S2 g	S1	S2g	S2 r	S2r	S2r	S2g r	S2g r	S2r	S2r	S2r	S1	S1	S2r	S2g	S1	S2g
Devarahalli	43	S1	S1	S1	S2t	S2gt	S2t	S2g	S2g	S2 g	S2 g	S2 g	S1	S2g	S2 r	S2r	S2r	S2g r	S2g r	S2r	S2r	S2r	S1	S1	S2r	S2g	S1	S2g
Devarahalli	44	S1	S1	S1	S2t	S2gt	S2t	S2g	S2g	S2 g	S2 g	S2 g	S1	S2g	S2 r	S2r	S2r	S2g r	S2g r	S2r	S2r	S2r	S1	S1	S2r	S2g	S1	S2g
Devarahalli	45	S1	S1	S1	S2t	S2gt	S2t	S2g	S2g	S2 g	S2 g	S2 g	S1	S2g	S2 r	S2r	S2r	S2g r	S2g r	S2r	S2r	S2r	S1	S1	S2r	S2g	S1	S2g
Devarahalli	46	S1	S1	S1	S2t	S2gt	S2t	S2g	S2g	S2 g	S2 g	S2 g	S1	S2g	S2 r	S2r	S2r	S2g r	S2g r	S2r	S2r	S2r	S1	S1	S2r	S2g	S1	S2g
Devarahalli	47	S1	S1	S1	S2t	S2gt	S2t	S2g	S2g	S2 g	S2 g	S2 g	S1	S2g	S2 r	S2r	S2r	S2g r	S2g r	S2r	S2r	S2r	S1	S1	S2r	S2g	S1	S2g
Devarahalli	48	S1	S1	S1	S2t	S2gt	S2t	S2g	S2g	S2 g	S2 g	S2 g	S1	S2g	S2 r	S2r	S2r	S2g r	S2g r	S2r	S2r	S2r	S1	S1	S2r	S2g	S1	S2g
Devarahalli	49	S1	S1	S1	S2t	S2gt	S2t	S2g	S2g	S2 g	S2 g	S2 g	S1	S2g	S2 r	S2r	S2r	S2g r	S2g r	S2r	S2r	S2r	S1	S1	S2r	S2g	S1	S2g
Devarahalli	50	S1	S1	S1	S2t	S2gt	S2t	S2g	S2g	S2 g	S2 g	S2 g	S1	S2g	S2 r	S2r	S2r	S2g r	S2g r	S2r	S2r	S2r	S1	S1	S2r	S2g	S1	S2g
Devarahalli	51	Ng	Ng	Ng	S3rg	Ng	Ng	Ng	Ng	Ng	Ng	Ng	S3rg	Ng	Ng	Ng	Ng	Ng	Ng	Ng	Ng	Ng	S3gr	S3rg	Ng	S3rg	S3 rg	Ng
Devarahalli	52	Ng	Ng	Nrg	S3rg	Nrg	Ng	Ng	Ng	Ng	Ng	Ng	S3rg	Ng	Nrg	Nrg	Nrg	Nrg	Nrg	Nrg	Nrg	Nrg	Nrg	Nrg	Nrg	Nrg	Ng	Ng
Devarahalli	53	S3g	S3 g	S2g	S2g	S3g	S3g	S3g	S3g	S3 g	S3 g	S3 g	S2g	S3g	S2 gr	S3gr	S2gr	S3gr	S3gr	S3gr	S3gr	S2gr	S2gr	S2gr	S3gr	S3g	S2 g	S3g
Devarahalli	54	S3g	S3 g	S2g	S2g	S3g	S3g	S3g	S3g	S3 g	S3 g	S3 g	S2g	S3g	S2 gr	S3gr	S2gr	S3gr	S3gr	S3gr	S3gr	S2gr	S2gr	S2gr	S3gr	S3g	S2 g	S3g
Devarahalli	57	S3g	S3 g	S2g	S3g	S3gr	S3g	S3g	S3g	S3 g	S3 g	S3 g	S2g	S3g	S3 gr	Nrg	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S2gr	S2gr	S3gr	S3g	S3 g	S3g
Devarahalli	76	Ng	Ng	Nrg	S3rg	Nrg	Ng	Ng	Ng	Ng	Ng	Ng	S3rg	Ng	Nrg	Nrg	Nrg	Nrg	Nrg	Nrg	Nrg	Nrg	Nrg	Nrg	Nrg	Nrg	Ng	Ng
Hungaladha Hosahalli	1	S1	S3 wt	S2w	S3wt	S2w	S1	S2wt	S3wt	S3 wt	S3 wt	S2 wt	S2w	S2w	S3 wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	Nwt	S2w	S2w	S2wt	S2wt	S2 wt	S2wt
Hungaladha Hosahalli	2	S1	S3 wt	S2w	S3wt	S2w	S1	S2wt	S3wt	S3 wt	S3 wt	S2 wt	S2w	S2w	S3 wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	Nwt	S2w	S2w	S2wt	S2wt	S2 wt	S2wt
Hungaladha Hosahalli	3	S1	S3 wt	S2w	S3wt	S2w	S1	S2wt	S3wt	S3 wt	S3 wt	S2 wt	S2w	S2w	S3 wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	Nwt	S2w	S2w	S2wt	S2wt	S2 wt	S2wt
Hungaladha Hosahalli	4	S1	S3 wt	S2w	S3wt	S2w	S1	S2wt	S3wt	S3 wt	S3 wt	S2 wt	S2w	S2w	S3 wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	Nwt	S2w	S2w	S2wt	S2wt	S2 wt	S2wt
Hungaladha Hosahalli	5	S1	S3 wt	S2w	S3wt	S2w	S1	S2wt	S3wt	S3 wt	S3 wt	S2 wt	S2w	S2w	S3 wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	Nwt	S2w	S2w	S2wt	S2wt	S2 wt	S2wt
Hungaladha Hosahalli	6	S1	S3 wt	S2w	S3wt	S2w	S1	S2wt	S3wt	S3 wt	S3 wt	S2 wt	S2w	S2w	S3 wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	Nwt	S2w	S2w	S2wt	S2wt	S2 wt	S2wt

Village	Survey No.	Sorgham	Maize	Redgram	Groundnut	Sunflower	Cotton	Onion	Turmeric	Beetroot	Potato	Beans	Horsegram	Field-bean	Guava	Mango	Sapota	Jackfruit	Jamun	Musambi	Lime	Cashew	Custard-apple	Amla	Tamarind	Banana	Marigold	Chrysanthemum
Hungaladha Hosahalli	7	S2r	S2r	S3r	S2r	S3r	S2r	S2rg	S3r	S2rg	S2rg	S2rg	S2r	S2r	S3gr	Nrg	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S2gr	S3gr	S3r	S2r	S2r
Hungaladha Hosahalli	44	S3g	S3g	S2g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2gr	S3gr	S2gr	S3gr	S3gr	S3gr	S3gr	S2gr	S2gr	S2gr	S3gr	S3g	S2g	S3g
Hungaladha Hosahalli	45	S3g	S3g	S2g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2gr	S3gr	S2gr	S3gr	S3gr	S3gr	S3gr	S2gr	S2gr	S2gr	S3gr	S3g	S2g	S3g
Hungaladha Hosahalli	46	S3g	S3g	S2g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2gr	S3gr	S2gr	S3gr	S3gr	S3gr	S3gr	S2gr	S2gr	S2gr	S3gr	S3g	S2g	S3g
Hungaladha Hosahalli	47	S2r	S2r	S3r	S2r	S3r	S2r	S2rg	S3r	S2rg	S2rg	S2rg	S2r	S2r	S3gr	Nrg	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S2gr	S3gr	S3r	S2r	S2r
Hungaladha Hosahalli	49	S2r	S2r	S3r	S2r	S3r	S2r	S2rg	S3r	S2rg	S2rg	S2rg	S2r	S2r	S3gr	Nrg	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S2gr	S3gr	S3r	S2r	S2r
Hungaladha Hosahalli	50	S2t	S1	S1	S2t	S2t	S3t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Hungaladha Hosahalli	51	S2t	S1	S1	S2t	S2t	S3t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Hungaladha Hosahalli	52	S2t	S1	S1	S2t	S2t	S3t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Hungaladha Hosahalli	53	S3g	S3g	S2g	S3g	S3gr	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3gr	Nrg	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S2gr	S2gr	S3gr	S3g	S3g	S3g
Hungaladha Hosahalli	54	S3g	S3g	S2g	S3g	S3gr	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3gr	Nrg	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S2gr	S2gr	S3gr	S3g	S3g	S3g
Hungaladha Hosahalli	55	S3g	S3g	S2g	S3g	S3gr	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3gr	Nrg	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S2gr	S2gr	S3gr	S3g	S3g	S3g
Hungaladha Hosahalli	56	S3g	S3g	S2g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2gr	S3gr	S2gr	S3gr	S3gr	S3gr	S3gr	S2gr	S2gr	S2gr	S3gr	S3g	S2g	S3g
Hungaladha Hosahalli	57	S3g	S3g	S2g	S3g	S3gr	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3gr	Nrg	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S2gr	S2gr	S3gr	S3g	S3g	S3g
Hungaladha Hosahalli	58	S1	S1	S1	S1	S2gt	S2t	S2g	S2g	S2g	S2g	S2g	S1	S2g	S2r	S2r	S2r	S2gr	S2gr	S2r	S2r	S2r	S1	S1	S2r	S2g	S1	S2g
Hungaladha Hosahalli	59	S1	S1	S1	S1	S2gt	S2t	S2g	S2g	S2g	S2g	S2g	S1	S2g	S2r	S2r	S2r	S2gr	S2gr	S2r	S2r	S2r	S1	S1	S2r	S2g	S1	S2g
Hungaladha Hosahalli	60	S1	S1	S1	S1	S2gt	S2t	S2g	S2g	S2g	S2g	S2g	S1	S2g	S2r	S2r	S2r	S2gr	S2gr	S2r	S2r	S2r	S1	S1	S2r	S2g	S1	S2g
Hungaladha Hosahalli	61	S1	S1	S1	S1	S2gt	S2t	S2g	S2g	S2g	S2g	S2g	S1	S2g	S2r	S2r	S2r	S2gr	S2gr	S2r	S2r	S2r	S1	S1	S2r	S2g	S1	S2g
Hungaladha Hosahalli	62	S2t	S1	S1	S2t	S2t	S3t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Hungaladha Hosahalli	63	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3gr	Nrg	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S2gr	S3gr	S3r	S2r	S2r
Hungaladha Hosahalli	64	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3gr	Nrg	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S2gr	S3gr	S3r	S2r	S2r
Hungaladha Hosahalli	65	S2r	S2r	S3r	S2rt	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	Nr	S3r	S3r	S3r	S3r	S3r	S3r	S2r	S2r	Nr	S3r	S2r	S2r
Hungaladha Hosahalli	66	S2t	S1	S1	S2t	S2t	S3t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1

Village	Survey No.	Sorgham	Maize	Redgram	Groundnut	Sunflower	Cotton	Onion	Turmeric	Beetroot	Potato	Beans	Horsegram	Field-bean	Guava	Mango	Sapota	Jackfruit	Jamun	Musambi	Lime	Cashew	Custard-apple	Amla	Tamarind	Banana	Marigold	Chrysanthemum
Hungaladha Hosahalli	67	S1	S1	S1	S1	S2gt	S2t	S2g	S2g	S2g	S2g	S2g	S1	S2g	S2r	S2r	S2r	S2gr	S2gr	S2r	S2r	S2r	S1	S1	S2r	S2g	S1	S2g
Hungaladha Hosahalli	68	S2t	S1	S1	S2t	S2t	S3t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Hungaladha Hosahalli	69	S2r	S2r	S3r	S2rt	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	Nr	S3r	S3r	S3r	S3r	S3r	S3r	S2r	S2r	Nr	S3r	S2r	S2r
Hungaladha Hosahalli	70	S2r	S2r	S3r	S2rt	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	Nr	S3r	S3r	S3r	S3r	S3r	S3r	S2r	S2r	Nr	S3r	S2r	S2r
Hungaladha Hosahalli	71	S2r	S2r	S3r	S2rt	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	Nr	S3r	S3r	S3r	S3r	S3r	S3r	S2r	S2r	Nr	S3r	S2r	S2r
Hungaladha Hosahalli	72	S2t	S1	S1	S2t	S2t	S3t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Hungaladha Hosahalli	73	S2t	S1	S1	S2t	S2t	S3t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Hungaladha Hosahalli	74	S2t	S1	S1	S2t	S2t	S3t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Hungaladha Hosahalli	75	S2t	S1	S1	S2t	S2t	S3t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Hungaladha Hosahalli	76	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3gr	Nrg	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S2gr	S3gr	S3r	S2r	S2r
Hungaladha Hosahalli	77	S3g	S3g	S2g	S3g	S3gr	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3gr	Nrg	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S2gr	S2gr	S3gr	S3g	S3g	S3g
Hungaladha Hosahalli	78	S2t	S1	S1	S2t	S2t	S3t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Hungaladha Hosahalli	79	S2t	S1	S1	S2t	S2t	S3t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Hungaladha Hosahalli	80	S1	S3wt	S2w	S3wt	S2w	S1	S2wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	S3wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	Nwt	S2w	S2w	S2wt	S2wt	S2wt	S2wt
Hungaladha Hosahalli	81	S1	S3wt	S2w	S3wt	S2w	S1	S2wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	S3wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	Nwt	S2w	S2w	S2wt	S2wt	S2wt	S2wt
Hungaladha Hosahalli	82	S1	S3wt	S2w	S3wt	S2w	S1	S2wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	S3wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	Nwt	S2w	S2w	S2wt	S2wt	S2wt	S2wt
Hungaladha Hosahalli	93	S3g	S3g	S2g	S3g	S3gr	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3gr	Nrg	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S2gr	S2gr	S3gr	S3g	S3g	S3g
Hungaladha Hosahalli	94	S3g	S3g	S2g	S3g	S3gr	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3gr	Nrg	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S2gr	S2gr	S3gr	S3g	S3g	S3g
Hungaladha Hosahalli	98	S2r	S2r	S3r	S2r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3gr	Nrg	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S2gr	S3gr	S3r	S2r	S2r
Hungaladha Hosahalli	99	S2r	S2r	S3r	S2r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3gr	Nrg	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S2gr	S3gr	S3r	S2r	S2r
Hungaladha Hosahalli	100	S2r	S2r	S3r	S2r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3gr	Nrg	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S2gr	S3gr	S3r	S2r	S2r
Hungaladha Hosahalli	101	S2r	S2r	S3r	S2r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3gr	Nrg	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S2gr	S3gr	S3r	S2r	S2r
Hungaladha Hosahalli	102	S2r	S2r	S3r	S2r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3gr	Nrg	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S2gr	S3gr	S3r	S2r	S2r

Village	Survey No.	Sorgham	Maize	Redgram	Groundnut	Sunflower	Cotton	Onion	Turmeric	Beetroot	Potato	Beans	Horsegram	Field-bean	Guava	Mango	Sapota	Jackfruit	Jamun	Musambi	Lime	Cashew	Custard-apple	Amla	Tamarind	Banana	Marigold	Chrysanthemum
Hungaladha Hosahalli	103	S2r	S2r	S3r	S2r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3gr	Nrg	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S2gr	S3gr	S3r	S2r	S2r
Hungaladha Hosahalli	108	S3g	S3g	S2g	S3g	S3gr	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3gr	Nrg	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S2gr	S2gr	S3gr	S3g	S3g	S3g
Hungaladha Hosahalli	110	S3g	S3g	S2g	S3g	S3gr	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3gr	Nrg	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S2gr	S2gr	S3gr	S3g	S3g	S3g
Hungaladha Hosahalli	111	S3g	S3g	S2g	S3g	S3gr	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3gr	Nrg	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S2gr	S2gr	S3gr	S3g	S3g	S3g
Hungaladha Hosahalli	112	S3g	S3g	S2g	S3g	S3gr	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3gr	Nrg	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S2gr	S2gr	S3gr	S3g	S3g	S3g
Hungaladha Hosahalli	113	S3g	S3g	S2g	S3g	S3gr	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3gr	Nrg	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S2gr	S2gr	S3gr	S3g	S3g	S3g
Hungaladha Hosahalli	114	S3g	S3g	S2g	S3g	S3gr	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3gr	Nrg	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S2gr	S2gr	S3gr	S3g	S3g	S3g
Hungaladha Hosahalli	115	S3g	S3g	S2g	S3g	S3gr	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3gr	Nrg	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S2gr	S2gr	S3gr	S3g	S3g	S3g
Hungaladha Hosahalli	116	S3g	S3g	S2g	S3g	S3gr	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3gr	Nrg	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S2gr	S2gr	S3gr	S3g	S3g	S3g
Hungaladha Hosahalli	117	S1	S1	S1	S1	S2gt	S2t	S2g	S2g	S2g	S2g	S2g	S1	S2g	S2r	S2r	S2r	S2gr	S2gr	S2r	S2r	S2r	S1	S1	S2r	S2g	S1	S2g
Hungaladha Hosahalli	118	S3g	S3g	S2g	S3g	S3gr	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3gr	Nrg	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S2gr	S2gr	S3gr	S3g	S3g	S3g
Hungaladha Hosahalli	119	S3g	S3g	S2g	S3g	S3gr	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S3gr	Nrg	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S2gr	S2gr	S3gr	S3g	S3g	S3g
Kallipura	1	S3g	S3g	S2g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2gr	S3gr	S2gr	S3gr	S3gr	S3gr	S3gr	S2gr	S2gr	S2gr	S3gr	S3g	S2g	S3g
Kallipura	2	S3g	S3g	S2g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2gr	S3gr	S2gr	S3gr	S3gr	S3gr	S3gr	S2gr	S2gr	S2gr	S3gr	S3g	S2g	S3g
Kallipura	3	S3g	S3g	S2g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2gr	S3gr	S2gr	S3gr	S3gr	S3gr	S3gr	S2gr	S2gr	S2gr	S3gr	S3g	S2g	S3g
Kallipura	4	S3g	S3g	S2g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2gr	S3gr	S2gr	S3gr	S3gr	S3gr	S3gr	S2gr	S2gr	S2gr	S3gr	S3g	S2g	S3g
Kallipura	5	S1	S3wt	S2w	S3wt	S2w	S1	S2wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	S3wt	S3wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	Nwt	S2w	S2w	S2wt	S2wt	S2wt	S2wt
Kallipura	6	S1	S3wt	S2w	S3wt	S2w	S1	S2wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	S3wt	S3wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	Nwt	S2w	S2w	S2wt	S2wt	S2wt	S2wt
Kallipura	7	S1	S3wt	S2w	S3wt	S2w	S1	S2wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	S3wt	S3wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	Nwt	S2w	S2w	S2wt	S2wt	S2wt	S2wt
Kallipura	8	S1	S3wt	S2w	S3wt	S2w	S1	S2wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	S3wt	S3wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	Nwt	S2w	S2w	S2wt	S2wt	S2wt	S2wt
Kallipura	9	S3g	S3g	S2g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2gr	S3gr	S2gr	S3gr	S3gr	S3gr	S3gr	S2gr	S2gr	S2gr	S3gr	S3g	S2g	S3g
Kallipura	10	S3g	S3g	S2g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2gr	S3gr	S2gr	S3gr	S3gr	S3gr	S3gr	S2gr	S2gr	S2gr	S3gr	S3g	S2g	S3g
Kallipura	11	S1	S3wt	S2w	S3wt	S2w	S1	S2wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	S3wt	S3wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	Nwt	S2w	S2w	S2wt	S2wt	S2wt	S2wt

Village	Survey No.	Sorgham	Maize	Redgram	Groundnut	Sunflower	Cotton	Onion	Turmeric	Beetroot	Potato	Beans	Horsegram	Field-bean	Guava	Mango	Sapota	Jackfruit	Jamun	Musambi	Lime	Cashew	Custard-apple	Amla	Tamarind	Banana	Marigold	Chrysanthemum
Kallipura	12	S1	S3wt	S2w	S3wt	S2w	S1	S2wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	S3wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	Nwt	S2w	S2w	S2wt	S2wt	S2wt	S2wt
Kallipura	13	S1	S3wt	S2w	S3wt	S2w	S1	S2wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	S3wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	Nwt	S2w	S2w	S2wt	S2wt	S2wt	S2wt
Kallipura	14	S2r	S2r	S3r	S2rt	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	Nr	S3r	S3r	S3r	S3r	S3r	S3r	S2r	S2r	Nr	S3r	S2r	S2r
Kallipura	15	S2r	S2r	S3r	S2rt	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	Nr	S3r	S3r	S3r	S3r	S3r	S3r	S2r	S2r	Nr	S3r	S2r	S2r
Kallipura	16	S1	S3wt	S2w	S3wt	S2w	S1	S2wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	S3wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	Nwt	S2w	S2w	S2wt	S2wt	S2wt	S2wt
Kallipura	17	S1	S3wt	S2w	S3wt	S2w	S1	S2wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	S3wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	Nwt	S2w	S2w	S2wt	S2wt	S2wt	S2wt
Kallipura	18	S1	S3wt	S2w	S3wt	S2w	S1	S2wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	S3wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	Nwt	S2w	S2w	S2wt	S2wt	S2wt	S2wt
Kallipura	19	S1	S3wt	S2w	S3wt	S2w	S1	S2wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	S3wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	Nwt	S2w	S2w	S2wt	S2wt	S2wt	S2wt
Kallipura	20	S1	S3wt	S2w	S3wt	S2w	S1	S2wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	S3wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	Nwt	S2w	S2w	S2wt	S2wt	S2wt	S2wt
Kallipura	21	S1	S3wt	S2w	S3wt	S2w	S1	S2wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	S3wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	Nwt	S2w	S2w	S2wt	S2wt	S2wt	S2wt
Kallipura	22	S2t	S1	S1	S2t	S2t	S3t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kallipura	23	S2t	S1	S1	S2t	S2t	S3t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kallipura	24	S2r	S2r	S3r	S2rt	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	Nr	S3r	S3r	S3r	S3r	S3r	S3r	S2r	S2r	Nr	S3r	S2r	S2r
Kallipura	25	S2r	S2r	S3r	S2rt	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	Nr	S3r	S3r	S3r	S3r	S3r	S3r	S2r	S2r	Nr	S3r	S2r	S2r
Kallipura	26	S2r	S2r	S3r	S2rt	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	Nr	S3r	S3r	S3r	S3r	S3r	S3r	S2r	S2r	Nr	S3r	S2r	S2r
Kallipura	27	S2r	S2r	S3r	S2rt	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	Nr	S3r	S3r	S3r	S3r	S3r	S3r	S2r	S2r	Nr	S3r	S2r	S2r
Kallipura	28	S2r	S2r	S3r	S2rt	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	Nr	S3r	S3r	S3r	S3r	S3r	S3r	S2r	S2r	Nr	S3r	S2r	S2r
Kallipura	29	S1	S1	S1	S2t	S2gt	S2t	S2g	S2g	S2g	S2g	S2g	S1	S2g	S2r	S2r	S2r	S2gr	S2gr	S2r	S2r	S2r	S1	S1	S2r	S2g	S1	S2g
Kallipura	30	S2r	S2r	S3r	S2rt	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	Nr	S3r	S3r	S3r	S3r	S3r	S3r	S2r	S2r	Nr	S3r	S2r	S2r
Kallipura	31	S1	S1	S1	S2t	S2gt	S2t	S2g	S2g	S2g	S2g	S2g	S1	S2g	S2r	S2r	S2r	S2gr	S2gr	S2r	S2r	S2r	S1	S1	S2r	S2g	S1	S2g
Kallipura	32	S2r	S2r	S3r	S2rt	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	Nr	S3r	S3r	S3r	S3r	S3r	S3r	S2r	S2r	Nr	S3r	S2r	S2r
Kallipura	33	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3gr	Nrg	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S2gr	S3gr	S3r	S2r	S2r
Kallipura	34	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3gr	Nrg	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S2gr	S3gr	S3r	S2r	S2r
Kallipura	35	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3gr	Nrg	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S2gr	S3gr	S3r	S2r	S2r

Village	Survey No.	Sorgham	Maize	Redgram	Groundnut	Sunflower	Cotton	Onion	Turmeric	Beetroot	Potato	Beans	Horsegram	Field-bean	Guava	Mango	Sapota	Jackfruit	Jamun	Musambi	Lime	Cashew	Custard-apple	Amla	Tamarind	Banana	Marigold	Chrysanthemum
Kallipura	36	S1	S1	S1	S2t	S2gt	S2t	S2g	S2g	S2g	S2g	S2g	S1	S2g	S2r	S2r	S2r	S2gr	S2gr	S2r	S2r	S2r	S1	S1	S2r	S2g	S1	S2g
Kallipura	37	S1	S1	S1	S2t	S2gt	S2t	S2g	S2g	S2g	S2g	S2g	S1	S2g	S2r	S2r	S2r	S2gr	S2gr	S2r	S2r	S2r	S1	S1	S2r	S2g	S1	S2g
Kallipura	38	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3gr	Nrg	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S3gr	S2gr	S3gr	S3r	S2r	S2r
Kallipura	39	S1	S1	S1	S2t	S2gt	S2t	S2g	S2g	S2g	S2g	S2g	S1	S2g	S2r	S2r	S2r	S2gr	S2gr	S2r	S2r	S2r	S1	S1	S2r	S2g	S1	S2g
Kallipura	40	S1	S1	S1	S2t	S2gt	S2t	S2g	S2g	S2g	S2g	S2g	S1	S2g	S2r	S2r	S2r	S2gr	S2gr	S2r	S2r	S2r	S1	S1	S2r	S2g	S1	S2g
Kallipura	41	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kallipura	42	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kallipura	43	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kallipura	44	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kallipura	45	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kallipura	46	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kallipura	47	S1	S3wt	S2w	S3wt	S2w	S1	S2wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	S3wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	Nwt	S2w	S2w	S2wt	S2wt	S2wt	S2wt
Kallipura	52	S2g	S2g	S2g	S2g	S3g	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2gr	S2gr	S2gr	S2gr	S2gr	S2gr	S2gr	S2gr	S2gr	S2gr	S2gr	S2g	S2g	S2g
Kallipura	54	S1	S3wt	S2w	S3wt	S2w	S1	S2wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	S3wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	Nwt	S2w	S2w	S2wt	S2wt	S2wt	S2wt
Kallipura	55	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kallipura	56	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kallipura	57	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kallipura	58	S1	S3wt	S2w	S3wt	S2w	S1	S2wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	S3wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	Nwt	S2w	S2w	S2wt	S2wt	S2wt	S2wt
Kallipura	60	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kallipura	61	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kallipura	62	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
Kallipura	63	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kallipura	64	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kallipura	65	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
Kallipura	66	S1	S3wt	S2w	S3wt	S2w	S1	S2wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	S3wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	Nwt	S2w	S2w	S2wt	S2wt	S2wt	S2wt
Kallipura	67	S1	S3wt	S2w	S3wt	S2w	S1	S2wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	S3wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	Nwt	S2w	S2w	S2wt	S2wt	S2wt	S2wt
Kallipura	68	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kallipura	69	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kallipura	70	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kallipura	71	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kallipura	72	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1

Village	Survey No.	Sorgham	Maize	Redgram	Groundnut	Sunflower	Cotton	Onion	Turmeric	Betroot	Potato	Beans	Horsegram	Field-bean	Guava	Mango	Sapota	Jackfruit	Jamun	Musambi	Lime	Cashew	Custard-apple	Amla	Tamarind	Banana	Marigold	Chrysanthemum
Kallipura	73	S1	S3wt	S2w	S3wt	S2w	S1	S2wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	S3wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	Nwt	S2w	S2w	S2wt	S2wt	S2wt	S2wt
Kallipura	74	S1	S3wt	S2w	S3wt	S2w	S1	S2wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	S3wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	Nwt	S2w	S2w	S2wt	S2wt	S2wt	S2wt
Kallipura	75	S1	S3wt	S2w	S3wt	S2w	S1	S2wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	S3wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	Nwt	S2w	S2w	S2wt	S2wt	S2wt	S2wt
Kallipura	76	S1	S3wt	S2w	S3wt	S2w	S1	S2wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	S3wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	Nwt	S2w	S2w	S2wt	S2wt	S2wt	S2wt
Kallipura	77	S1	S3wt	S2w	S3wt	S2w	S1	S2wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	S3wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	Nwt	S2w	S2w	S2wt	S2wt	S2wt	S2wt
Kallipura	78	S1	S3wt	S2w	S3wt	S2w	S1	S2wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	S3wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	Nwt	S2w	S2w	S2wt	S2wt	S2wt	S2wt
Kallipura	79	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
Kallipura	80	S1	S3wt	S2w	S3wt	S2w	S1	S2wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	S3wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	Nwt	S2w	S2w	S2wt	S2wt	S2wt	S2wt
Kallipura	81	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kallipura	82	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kallipura	83	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kallipura	84	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kallipura	85	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kallipura	86	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kallipura	87	S3r	S3r	Nr	S3r	Nr	S3r	S3r	S3r	S3r	S3r	S3r	S3r	S3r	Nr	Nr	Nr	Nr	Nr	Nr	Nr	Nr	S3r	S3r	Nr	Nr	S3r	S3r
Kallipura	88	S3r	S3r	Nr	S3r	Nr	S3r	S3r	S3r	S3r	S3r	S3r	S3r	S3r	Nr	Nr	Nr	Nr	Nr	Nr	Nr	Nr	S3r	S3r	Nr	Nr	S3r	S3r
Kallipura	89	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kallipura	90	S3r	S3r	Nr	S3r	Nr	S3r	S3r	S3r	S3r	S3r	S3r	S3r	S3r	Nr	Nr	Nr	Nr	Nr	Nr	Nr	Nr	S3r	S3r	Nr	Nr	S3r	S3r
Kallipura	92	S2g	S2g	S2g	S2g	S3g	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2gr	S2gr	S2gr	S2gr	S2gr	S2gr	S2gr	S2gr	S2gr	S2gr	S2gr	S2g	S2g	S2g
Kallipura	100	Ng	Ng	Nrg	S3rg	Nrg	Ng	Ng	Ng	Ng	Ng	Ng	S3rg	Ng	Nrg	Nrg	Nrg	Nrg	Nrg	Nrg	Nrg	Nrg	Nrg	Nrg	Nrg	Nrg	Ng	Ng
Kallipura	101	S1	S3wt	S2w	S3wt	S2w	S1	S2wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	S3wt	S3wt	S3wt	S3wt	S2wt	S2w	S2w	Nwt	S2w	S2w	S2wt	S2wt	S2wt	S2wt
Kallipura	104	S3g	S3g	S2g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2gr	S3gr	S2gr	S3gr	S3gr	S3gr	S3gr	S2gr	S2gr	S2gr	S3gr	S3g	S2g	S3g
Kallipura	105	Ng	Ng	Ng	S3rg	Ng	Ng	Ng	Ng	Ng	Ng	Ng	S3rg	Ng	Ng	Ng	Ng	Ng	Ng	Ng	Ng	Ng	S3gr	S3rg	Ng	S3rg	S3rg	Ng
Kallipura	106	Ng	Ng	Nrg	S3rg	Nrg	Ng	Ng	Ng	Ng	Ng	Ng	S3rg	Ng	Nrg	Nrg	Nrg	Nrg	Nrg	Nrg	Nrg	Nrg	Nrg	Nrg	Nrg	Nrg	Ng	Ng
Kunagahalli	8	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kunagahalli	9	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kunagahalli	10	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kunagahalli	11	S2g	S2g	S2g	S2g	S3g	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2gr	S2gr	S2gr	S2gr	S2gr	S2gr	S2gr	S2gr	S2gr	S2gr	S2gr	S2g	S2g	S2g

Village	Survey No.	Sorgham	Maize	Redgram	Groundnut	Sunflower	Cotton	Onion	Turmeric	Beetroot	Potato	Beans	Horsegram	Field-bean	Guava	Mango	Sapota	Jackfruit	Jamun	Musambi	Lime	Cashew	Custard-apple	Amla	Tamarind	Banana	Marigold	Chrysanthemum
Kunagahalli	12	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kunagahalli	13	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kunagahalli	14	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kunagahalli	15	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kunagahalli	16	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
Kunagahalli	17	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kunagahalli	18	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kunagahalli	40	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kunagahalli	41	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kunagahalli	42	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kunagahalli	45	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kunagahalli	46	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kunagahalli	48	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kunagahalli	50	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1

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: Gopalagiri Colony-1 micro-watershed (Basavapur sub-watershed, Gundlupet taluk, Chamarajanagar district) is located in between $11^0 43'$ – $11^0 44'$ North latitudes and $76^0 35'$ – $76^0 37'$ East longitudes, covering an area of about 550 ha, bounded by Kannagal, Honnegaudanahalli, Hangala and Hosalhalli villages with 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 Gopalagiri Colony-1 micro-watershed (Basavapur sub-watershed, Gundlupet taluk, Chamarajanagar district are presented here.*

Social Indicators

- *Male and female ratio is 59.5 to 40.5 per cent to the total sample population.*
- *Younger age groups 18 to 50 years group of population is around 54 per cent to the total population.*
- *Literacy population is around 78.4 per cent.*
- *Social groups belong to other backward caste (OBC) is around 77.8 per cent.*
- *Liquefied petroleum gas (LPG) is the source of energy for a cooking among 88.9 per cent.*
- *About 44.4 per cent of households have a yashaswini health card.*
- *About 11.1 per cent farm households are having MGNREGA card for rural employment.*
- *Dependence on ration cards for food grains through public distribution system is around 88.9 per cent.*
- *Swach bharath program providing closed toilet facilities is among all the sample households.*
- *Institutional participation is only 24.3 per cent of sample households.*
- *Rural migration to unban centre for employment is prevalent among 18.9 per cent of farm households.*
- *Women participation in decisions making are around 66.8 per cent of households were found.*

Economic Indicators

- *The average land holding is 0.66 ha indicates that majority of farm households are belong to marginal farmers. The dry land account for 65.1 % and irrigated land 34.9 % of total cultivated land area among the sample farmers.*
- *Agriculture is the main occupation among 90.6 per cent and agriculture is the main and non-agriculture labour is subsidiary occupation for 28.1 per cent of sample households.*
- *The average value of domestic assets is around Rs.8070 per household. Mobile and television are mass popular mass communication media.*
- *The average farm assets a value is around Rs.11850 per household, about 44.4 per cent of sample farmers own plough.*
- *The average livestock value is around Rs.26600 per livestock; about 100 per cent of household are having livestock.*
- *The average per capita food consumption is around 641.6 grams (1561 kilo calories) against national institute of nutrition (NIN) recommendation at 827 gram. Around 77.8 per cent of sample households are consuming less than the NIN recommendation.*
- *The annual average income is around Rs. 45088 per household. Among all farm sample households are below poverty line.*
- *The per capita monthly average expenditure is around Rs.1242.*

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.773 per ha/year. The total cost of annual soil nutrients is around Rs. 402711 per year for the total area of 550.02 ha.*
- *The average value of ecosystem service for food grain production is around Rs. 19780/ha/year. Per hectare food grain production services is maximum in banana (Rs. 96601), followed by turmeric (Rs. 45085), maize (Rs. 26807), red gram (Rs. 19672), horse gram (Rs. 6623), bajra (Rs. 4432), groundnut (Rs. 2961).*
- *The average value of ecosystem service for fodder production is around Rs. 2806/ ha/year. Per hectare fodder production services is maximum in horse gram (Rs. 5472) followed by ragi (Rs. 3800), sorghum (Rs. 3529), maize (Rs. 2609), groundnut (Rs. 1051) and bajra (Rs. 374).*
- *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 banana (Rs. 185838) followed by turmeric (Rs. 54978), sorghum (Rs. 53775), bajra (Rs. 52269), red*

gram (Rs. 51718), sunflower (Rs. 39261), maize (Rs. 37562), groundnut (Rs. 23392), horse gram (Rs. 22578) and ragi (Rs. 15479).

Economic Land Evaluation

- *The major cropping pattern is bajra (29.8 %) followed by horse gram (12.8 %), groundnut (10.9 %), red gram (10.8 %), maize (10.4 %), sunflower (10.4 %), turmeric (6.2 %), banana (5.4%), safflower (2.3 %) and sorghum (0.9 %).*
- *In Gopalgiri colony 1 micro-watershed, major soils are Annurkeri (ARK) soil series are having deep soil depth cover around 18.25 per cent of area. On this soil farmers are presently growing groundnut (46.8 %), turmeric (26.78 %) and bajra (26.5 %). Bheemanabeedu (BMB) soil series are having deep soil depth cover around 14.9 per cent of area; the major crops grown are sunflower (83.3 %) and sorghum (16.7 %), Devarahalli (DRH) having moderately shallow soil depth covers around 10.83 per cent of area and the major crops grown are bajra (39.4 %), red gram (39.4 %) and banana (21.2 %). Hullipura (HPR) soil series having moderately shallow soil depth cover 4.96 per cent of area. On this soil crops are horse gram and ragi. Kannigala (KNG) soil series having moderately deep soil depth cover around 4.29 per cent of area in this soil maize (50 %) and sunflower (50 %) are grown. Maddinahundi (MDH) soil series having deep soil cover 5.29 per cent of area. In this soil bajra and horse gram.*
- *The total cost of cultivation and benefit cost ratio (BCR) in study area sunflower range between Rs. 57430/ha in BMB soil (with of 0.98) and Rs. 34393/ha in KNG soil (with BCR of 1.26).*
- *In turmeric the cost of cultivation is Rs. 220347/ha in ARK soil (with BCR of 1.2).*
- *In banana the cost of cultivation is in DRH soil Rs. 115113/ha (with BCR of 1.8).*
- *In groundnut the cost of cultivation is Rs. 39081/ha in ARK soil (with BCR of 1.1).*
- *In sorghum the cost of cultivation is Rs 42790/ha in BMB soil (with BCR of 1.07).*
- *In horse gram the cost of cultivation range between MDH soil is Rs. 20809/ha (with BCR of 1.74) and Rs 32697/ha in HPR soil (with BCR value of 1.3).*
- *In red gram the cost of cultivation is in DRH soil is Rs 21177/ha (with BCR of 1.9) and ragi cost of cultivation Rs in HPR soil is 54721/ha (with BCR of 1.1).*
- *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 are deeper soils 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 strengthen 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 bajra (11.2 % to 28.8%), banana (39.8%), red gram (22.1 %), horse gram (14.6% to 35.1 %), ragi (55.8 %), maize (63.0 %), sunflower (24.1 % to 32.5 %), ground nut (50.8 %) and sorghum (37.1%).*

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.

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Chapter 3

METHODOLOGY

Study area

Gopalagiri Colony-1 micro-watershed is located in Southern Dry Zone of Karnrataka (Figure 1). It has a total geographical area of 1.56 M ha with 0.74 M ha under cultivation of which 0.22 M ha is irrigated. The mean elevation ranges from 450 to 900 m MSL; most part of the zone is situated at 800-900m. The major soils are red loams with pockets of black soils in Kollegal, Yalandur and T.N. Pura taluks of Mysore district. The average annual rainfall ranges from 670 to 890 mm, of which about 55 to 75 per cent is received during the kharif season. The major crops grown are rice, ragi, sugarcane, pulses and minor millets. It's represented Agro Ecological Sub Region (AESR) 8.2 having LGP 120-150 days.

Gopalagiri Colony-1 micro-watershed (Basavapur sub-watershed, Gundlupet taluk, Chamarajanagar district) is located in between $11^0$43' – $11^0$44' North latitudes and $76^0$35' – $76^0$37' East longitudes, covering an area of about 550 ha, bounded by Kannagal, Honnegaudanahalli and Hangala Hosalhalli 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

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 survry. The data collected from the representative farm households were analysed using Automated Land Potential Evalution System (Figure 2).

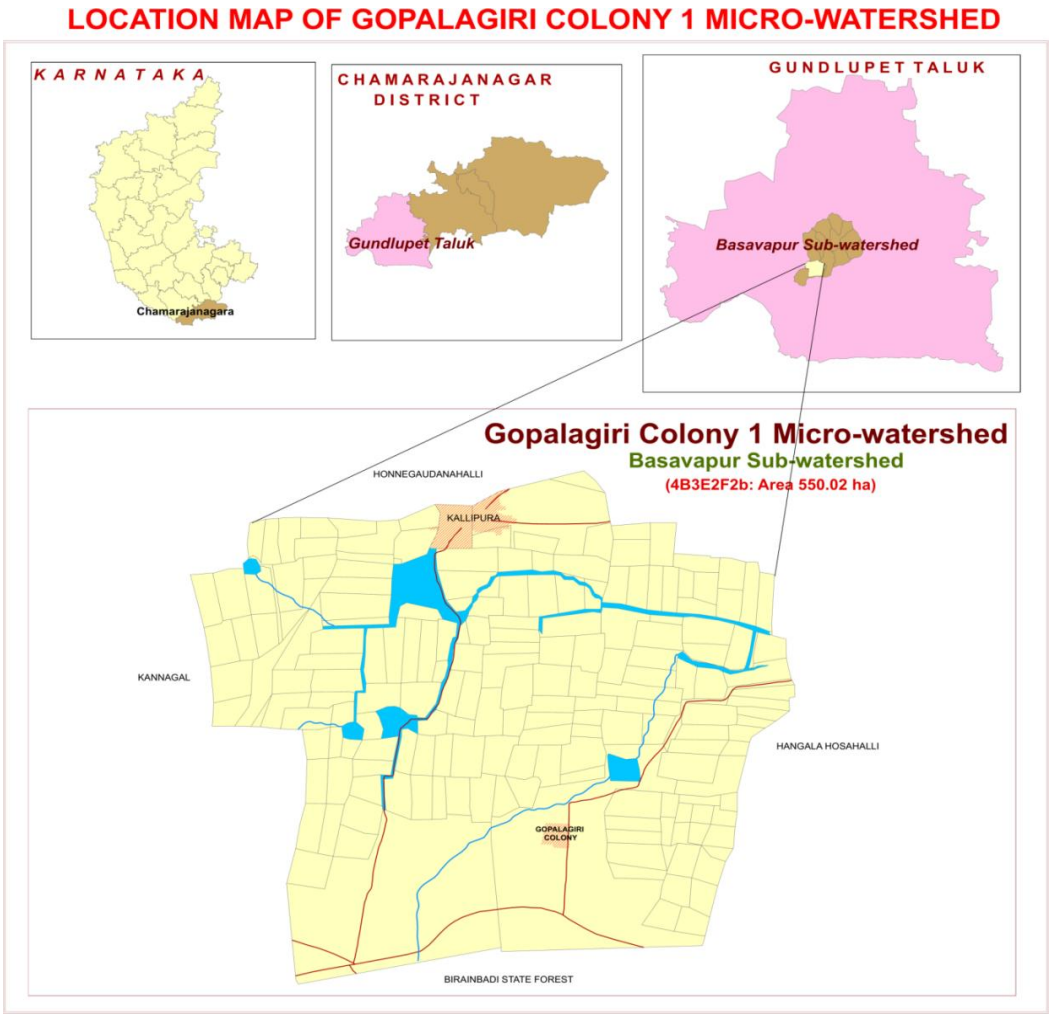


Figure 1: Location of study area

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 .

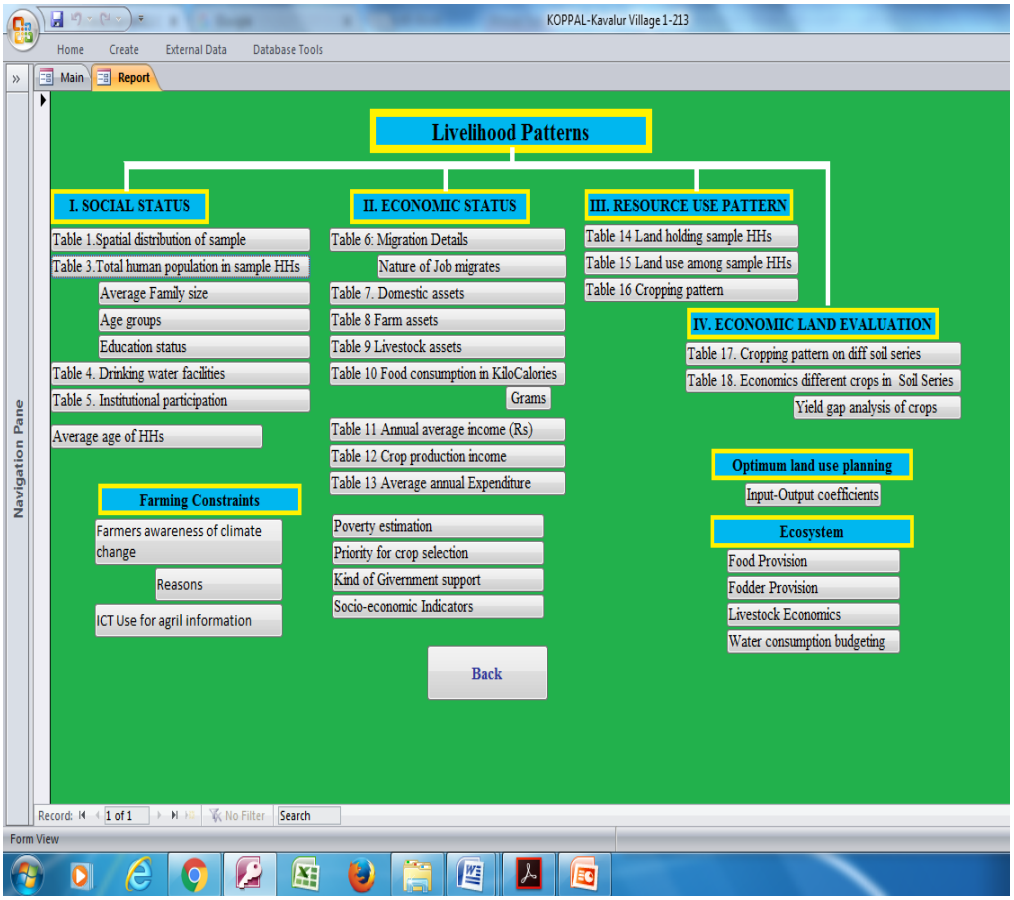


Figure 2: ALPES FRAMEWORK

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.

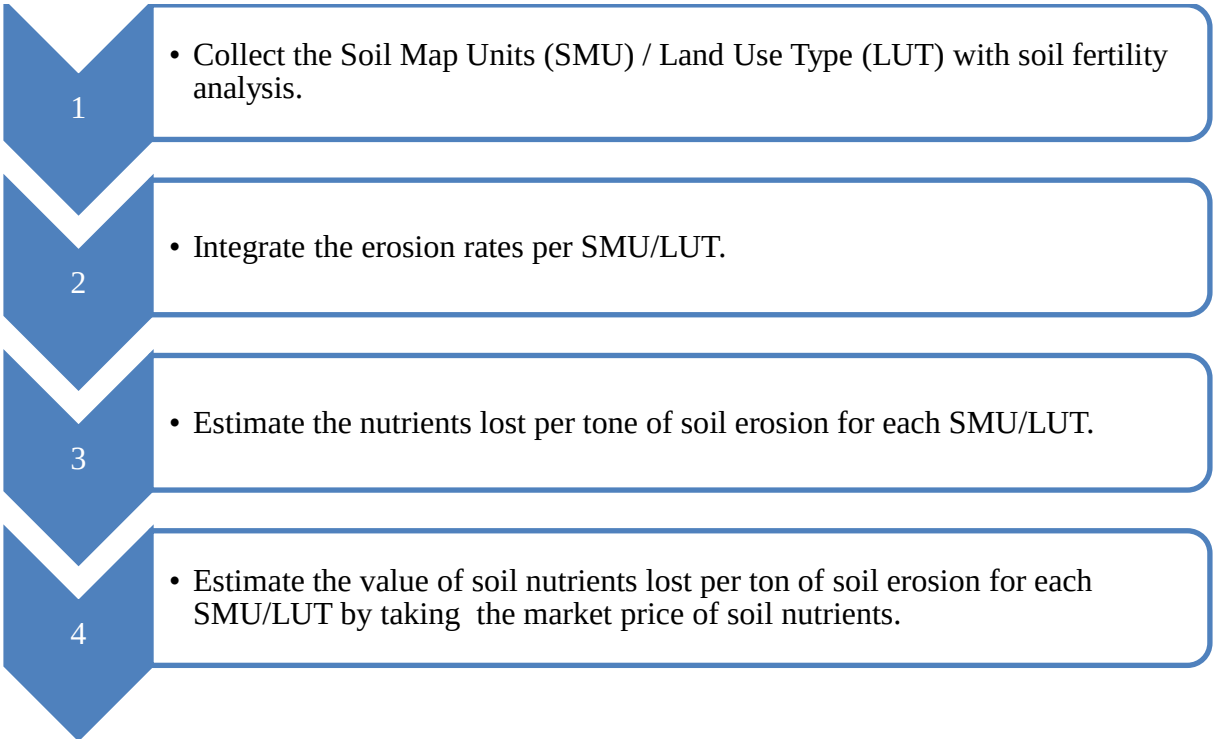
Operational Cost = cost of seeds, fertilizers, pesticides. Cost of human and bullock labour, cost of machinery, cost of irrigation water + interest on working capital.
Gross returns = Yield (Quintals/hectare)*Price (Rs/Quintal)
Net returns = Gross returns-Operational cost.
Benefit Cost Ratio = Net returns/Total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



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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 37, out of which 59.5 per cent were males and 40.5 per cent females. Average family size of the households is 4.1. 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 more than 50 years (35.1 %) followed by 30 to 50 years (32.4 %), 18 to 30 years (21.6%) and 0 to 18 years are (10.8 %). 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 78.4 per cent literate (Table 1).

Table 1: Human population among sample households in Gopalgiri colony 1 Microwatershed

Particulars	**Units**	**Value**
Total human population in sample HHs	Number	37.0
Male	% to total Population	59.5
Female	% to total Population	40.5
Average family size	Number	4.1
Age group		
0 to 18 years	% to total Population	10.8
18 to 30 years	% to total Population	21.6
30 to 50 years	% to total Population	32.4
>50 years	% to total Population	35.1
Average age	Age in years	44.4
Education Status		
Illiterates	% to total Population	21.6
Literates	% to total Population	78.4
Primary School (<5 class)	% to total Population	16.2
Middle School (6- 8 class)	% to total Population	8.1
High School (9- 10 class)	% to total Population	32.4
Others	% to total Population	21.6

The ethnic groups among the sample farm households found to be 77.89 per cent belonging to other backward caste (OBC) and 22.2 per cent belonging to general castes (Table 2 and Figure 3). About 88.9 per cent of sample households are using gas as source of fuel for cooking. All the sample farmers are having electricity connection. About 44.4 per cent are sample households having health cards. Around 11.1 per cent are having MNREGA job cards for employment generation. About 55.5 per cent of farm households

are having ration cards for taking food grains from public distribution system. About 88.9 per cent of farm households are having toilet facilities

Table 2: Basic needs of sample households in Gopalgiri colony 1 Microwatershed

Particulars	Units	Value
Social groups		
OBC	% of Households	77.8
General	% of Households	22.2
Types of fuel use for cooking		
Fire wood	% of Households	11.1
Gas	% of Households	88.9
Energy supply for home		
Electricity	% of Households	100
Number of households having Health card		
Yes	% of Households	44.4
No	% of Households	55.6
MGNREGA Card		
Yes	% of Households	11.1
No	% of Households	88.9
Ration Card		
Yes	% of Households	88.9
No	% of Households	11.1
Households with toilet		
Yes	% of Households	100
No	% of Households	0.0
Drinking water facilities		
Yes	% of Households	55.6
No	% of Households	44.4

The data collected on the source of drinking water in the study area is presented in Table 2. Majority of the sample respondents are tube well good source for water supply for domestic purpose.

Only 24.3 per cent of the farmers are participating in community based organizations (Table 3). Among them majority were participating in followed by diary co-operatives societies (8.1 %), credit co-operative societies (2.7 %) and village panchayath (2.7%) and self help groups (10.8 %) like Sri Dharmasthala Swasahaya Sangha, Stri Shakhti Sangha.

Table 3: Institutional participation among the sample population in Gopalgiri colony 1 Microwatershed

Particulars	Units	Value
No. Of people participating	% to total	24.3
Co-operative Societies - Credit	% to total	2.7
Co-operative Societies-Dairy	% to total	8.1
Village Panchayath	% to total	2.7
Self help groups(SHG's)	% to total	10.8
No. Of people not participating	% to total	75.7

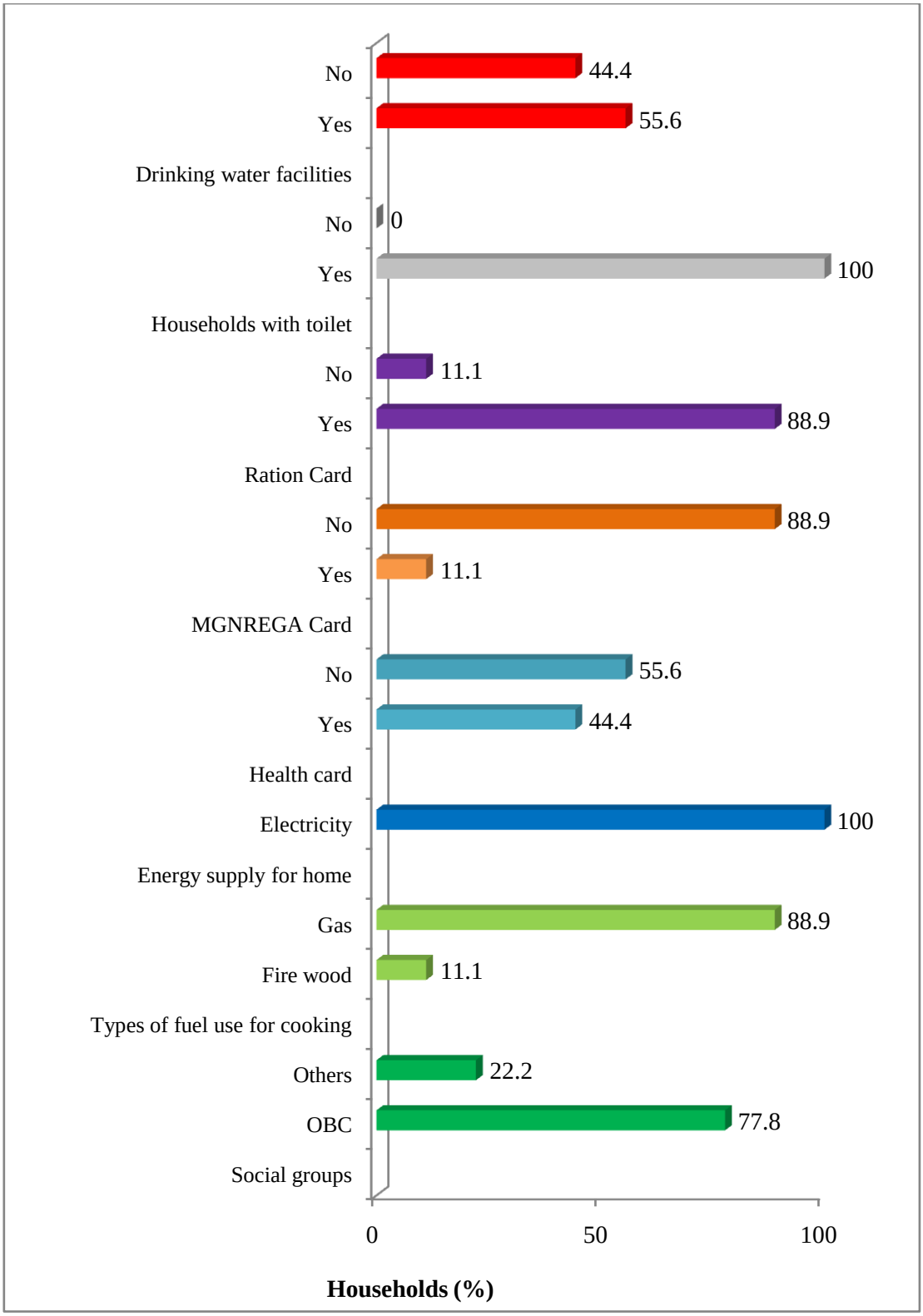

Figure 3: Basic needs of sample households in Gopalgiri colony 1 Microwatershed

The data on migration in Gopalgiri colony 1 Micro-watershed is given in Table 4. It indicated that around 18.9 per cent of samples households were migrated. The average distance travelled for seeking employment is 104 km.

Table 4: Migration details among the sample households in Gopalgiri colony 1 micro-watershed

Particulars	**Value**
% of households showing migration	18.9
% of persons migrating	22.2
No. of months migrated in a year	15.0
Average Distance of migration (Km)	104
Nature of job (%)	
Job/wage/work	100

The occupational pattern (Table 5) among sample households shows that agriculture is the main occupation followed by agriculture as subsidiary around 9.4 per cent of farmer's subsidiary occupations like agricultural labour (53.1%), non agricultural labour (28.1%) and private service (3.1). About 6.2 per cent of the households are non agriculture labour as main occupation and agriculture labour as subsidiary occupation.

Table 5: Occupational pattern in sample households in Gopalgiri colony 1 Microwatershed

Occupation		**% to total population**
Main	**Subsidiary**	
Agriculture	Agriculture	9.4
	Agriculture labour	53.1
	Non Agriculture Labour	28.1
	Private service	3.1
Non Agriculture Labour		6.2
Grand Total		100
Family labour Availability		**Man days/Month**
Male		47.2
Female		24.4
Total		71.7

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 (88.90 %) followed by television (88.90 %), mixer/grinder (66.7%), motor cycle (44.4 %), refrigerator (11.1 %), microwave (11.1 %) and bicycle (11.1%). The average value of domestic assets is around Rs 8070 per households (Table 6).

Table 6: Domestic assets among the sample households in Gopalgiri colony 1 Microwatershed

Particulars	% of households	Average value in Rs
Bicycle	11.1	600
Microwave	11.1	1000
Mixer/grinder	66.7	1233
MobilePhone	88.9	2838
Motorcycle	44.4	37250
Refrigerator	11.1	10000
Television	88.9	3575
Average Value	8070	

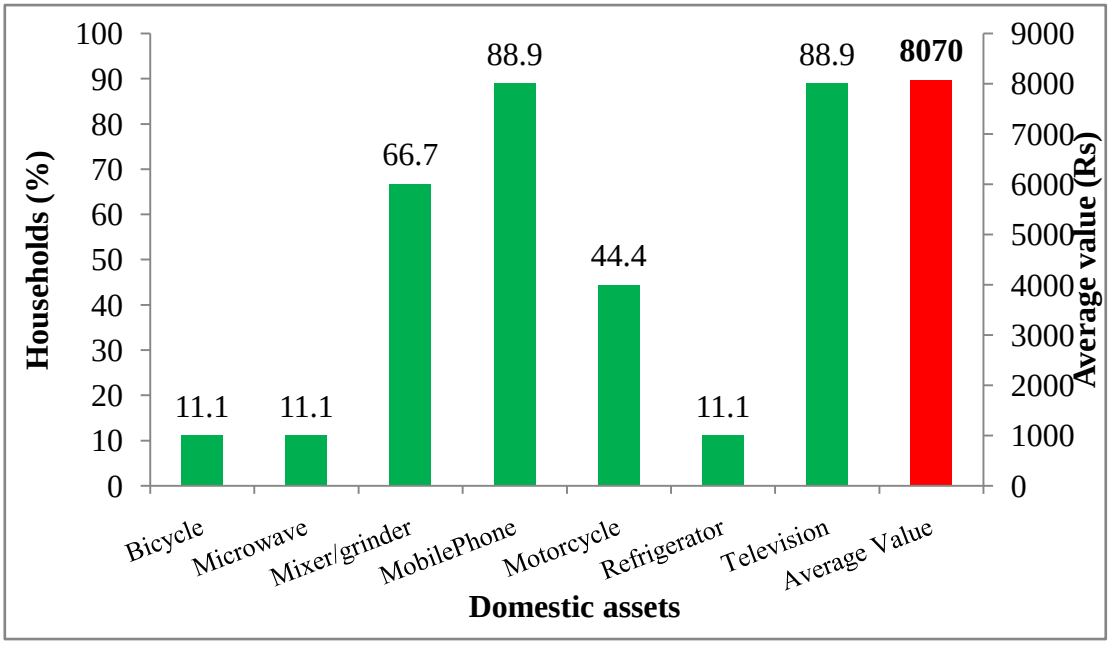

Figure 4: Domestic assets among the sample households in Gopalgiri colony 1 Microwatershed

The most popularly owned farm equipments were sickles, plough, cattle shed; pump sets, chaff cutter, bullock cart, sprayer and thresher. Plough and weeder were commonly present in all the sampled farmers; these were primary implements in agriculture. The per cent of households owned plough (44.4 %), weeder (22.2 %), bullock cart (22.2 %), tractor (22.2 %), earth remover (11.1 %), drip/sprinkler (11.1 %), seed cum fertilizer drill (11.1 %) and irrigation pump (11.1 %) was found highest among the sample farmers. The average value of farm assets is around Rs 25180 per households (Table 7 and Figure 5).

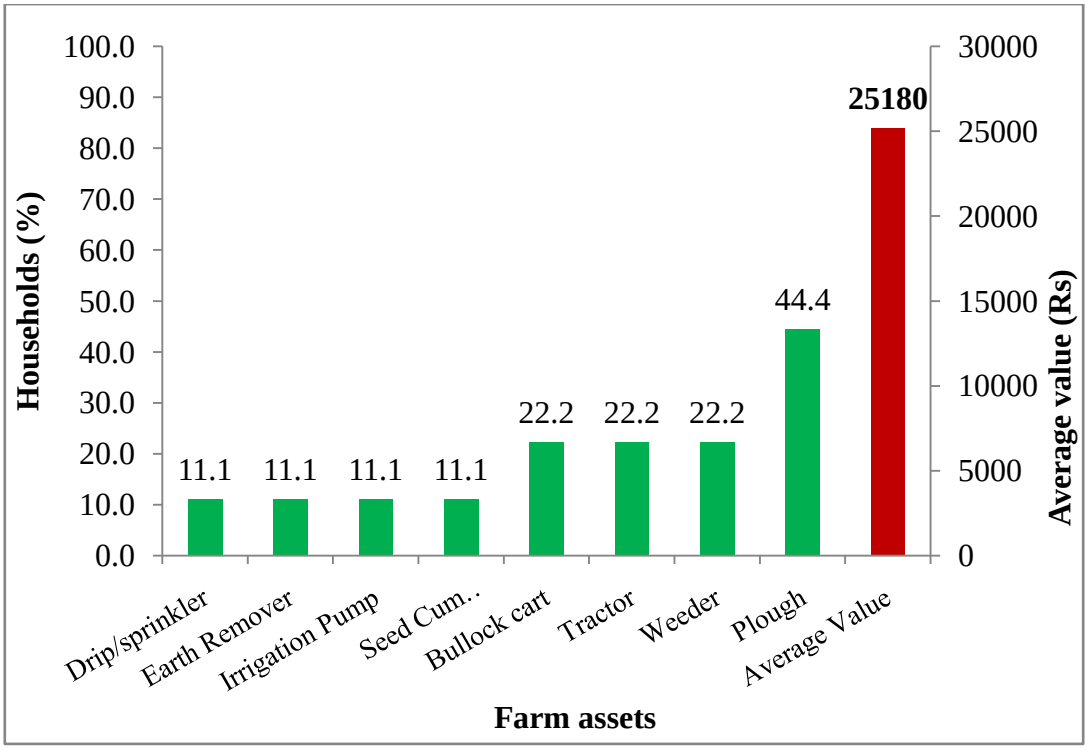

Figure 5: Farm assets among samples households in Channamallipura Microwatershed

Table 7: Farm assets among samples households in Gopalgiri colony 1 Microwatershed

Particulars	% of households	Average value in Rs
Drip/sprinkler	11.1	3000
Earth Remover	11.1	13000
Irrigation Pump	11.1	20000
Seed Cum Fertilizer Drill	11.1	25000
Bullock cart	22.2	13250
Tractor	22.2	125000
Weeder	22.2	58
Plough	44.4	2133
Average Value	25180	

Livestock is an integral component of the conventional farming systems (Table 8 and Figure 6). The highest livestock population is crossbred milching cow were around 60 per cent and local milching cow are 40 per cent the average livestock value is Rs 26600 per livestock.

Table 8: Livestock assets among sample households in Gopalgiri colony 1 micro-watershed

Particulars	% of livestock population	Average value in Rs
Local Milching Cow	40	19000
Crossbred Milching Cow	60	31666
Average value	26600	

Average milk produced in sample households is 810 litters/ annum. Among the farm households, maize, sorghum and bajra are the main crops for domestic food and fodder for animals. About 1603 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 Gopalgiri colony 1 Microwatershed

Particulars	
Name of the Livestock	**Ltr./Lactation/animal**
Local Milching Cow	630
Crossbred Milching	990
Average Milk produced	810
Fodder produces	**Fodder yield (kg/ha.)**
Maize	2222
Bajra	2332
Sorghum	1562
Groundnut	1063
Horse gram	833
Average fodder availability	1603
Livestock having households (%)	50.0
Livestock population (Numbers)	11

A woman participation in decision making is in this micro-watershed is presented in Table 10. About 89.9 per cent of women participation in local organisation activates and 68.8 per cent of women taking decision in her family and agriculture related activities.

Table 10: Women empowerment of sample households in Gopalgiri colony 1 Microwatershed % to Grand Total

Particulars	**Yes**	**No**
Women participation in local organization activities	88.9	11.1
Women elected as panchayat member	0.0	100
Women earning for her family requirement	0.0	100
Women taking decision in her family and agriculture related activities	66.8	33.2

Table 11: Per capita daily consumption of food among the sample households in Gopalgiri colony 1 Microwatershed

Particulars	**NIN recommendation (gram/ per day/ person)**	**Present level of consumption (gram/ per day/ person)**	**Kilo Calories /day/person**
Cereals	396.0	293.1	996.7
Pulses	43.0	28.7	98.5
Milk	200.0	118.4	76.9
Vegetables	143.0	38.5	9.2
Cooking Oil	31.0	32.2	183.8
Egg	0.5	106.4	159.6
Meat	14.2	24.2	36.3
Total	**827.7**	**641.6**	**1561.1**
Threshold of NIN recommendation		27 gram*	2250 Kcal*
% Below NIN		77.8	77.8
% Above NIN		22.2	22.2

Note: * day/person

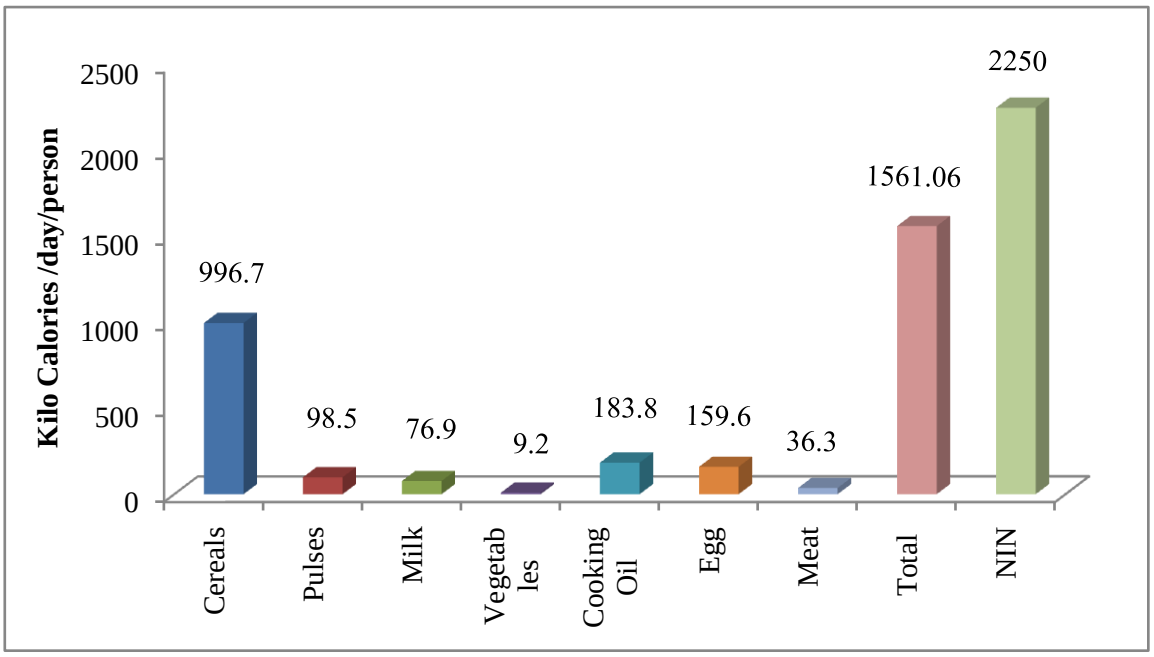

Figure 6: Per capita daily consumption of food among the sample households in Gopalgiri colony 1 Microwatershed

The food intake in terms of kilo calorie (kcal) per person per day was calculated and presented in the Table 11 and Figure 6. More quantity of cereals is consumed by sample farmers which accounted for 996.7 kcal per person. The other important food items consumed was pulses 98.51 kcal followed by cooking oil 183.77 kcal, milk 76.98kcal, vegetables 9.24 kcal, egg 159.59 kcal and meat 36.27 kcal. In the sampled households, farmers were consuming less (1561.1 kcal) than NIN- recommended food requirement (2250 kcal).

Table 12: Annual average income of HHs from various sources in Gopalgiri colony 1 Microwatershed

Particulars	**Income ***
Nonfarm income (Rs)	10620 (22.2)
Livestock income (Rs)	12275 (44.4)
Crop Production (Rs)	17903 (100)
Total Annual Income (Rs)	***40789***
Average monthly per capita income (Rs)	827
Threshold for Poverty level (Rs 975 per month/person)	
% of households below poverty line	77.8
% of households above poverty line	22.2

* Figure in the parenthesis indicates % of Households

Annual income of the sample HHs: The average annual household income is around Rs 40789. Major source of income to the farmers in the study area is from crop production (Rs 17903) followed by livestock (Rs. 12275). The income from non farm

income was very low at Rs 10620. The monthly per capita income is Rs. 827, 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).

Table 13: Average annual expenditure of sample HHs in Gopalgiri colony 1 Microwatershed

Particulars	Value in Rupees	Per cent
Food	32533	53.1
Education	6111	10.0
Clothing	5056	8.3
Social functions	5333	8.7
Health	12222	20.0
Total Expenditure (Rs/year)	61256	100.0
Monthly per capita expenditure (Rs)	1242	

The average annual expenditure of farm households indicated that farmers in the study area spend highest on food (Rs. 32533) followed by education, clothing, social function and health. Now a days 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 1242 and about 22.2 per cent of farm households are below poverty line (Table 13 and Figure 7).

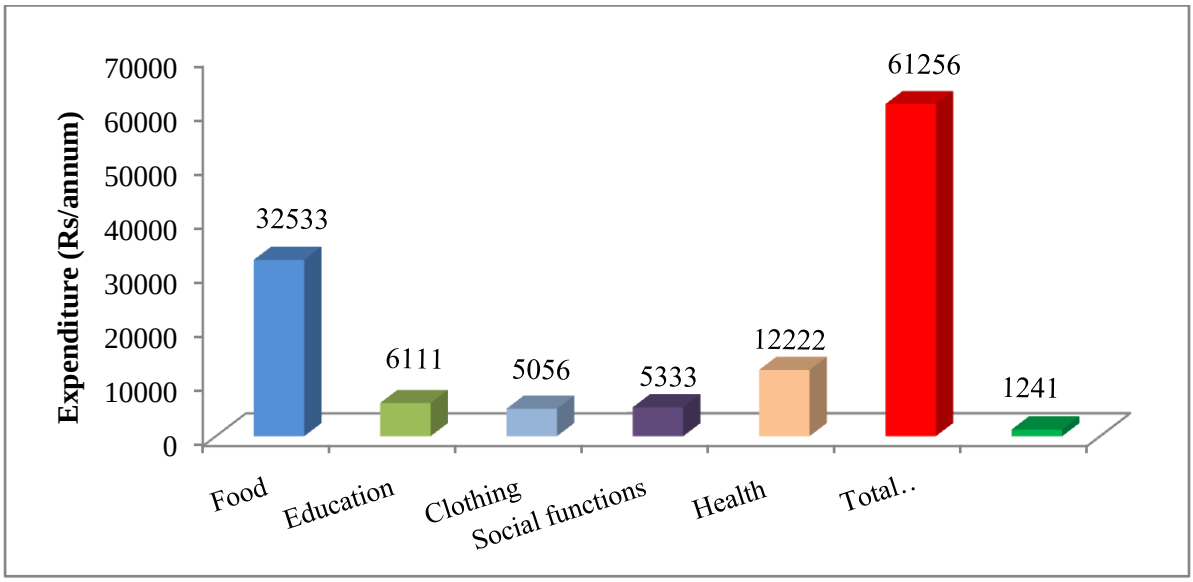

Figure 7: Average annual expenditure of sample HHs in Gopalgiri colony 1 Microwatershed

Land use: The total land holding in the Gopalgiri colony 1 micro-watershed is 5.9 ha (Table 14). Of which 3.8 ha is rain fed land and 2.08 ha is irrigated land. The average land holding per household is worked out to be 0.66 ha.

Table 14: Land use among samples households in Gopalgiri colony 1 Microwatershed

Particulars	Per cent	Area in ha
Irrigated land	34.9	2.1
Rainfed Land	65.1	3.8
fallow land	0.0	0.0
Total land holding	100	5.9
Average land holding	0.66	

In the micro-watershed, the prevalent present land uses under perennial plants are coconut (56.4 %) followed by neem tree (15.4%),banyan tree (alada) (10.2%), tamarind (5.1 %) teak (7.7), lime (2.5%) and mango (2.5%) (Table 15).

Table 15: Number of trees/plants covered in sample farm households in Gopalgiri colony 1 Microwatershed

Particulars	Number of Plants/trees	Per cent
Banyan tree(Alada)	4	10.2
Coconut	22	56.4
Lime	1	2.5
Mango	1	2.5
Neem trees	6	15.4
Tamarind	2	5.1
Teak	3	7.7
Grand Total	39	100

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 dry lands in the study area were by bajra (18.9 %) followed by groundnut (10.9 %), red gram (10.8 %), sunflower(10.4 %),turmeric (6.2 %),banana(5.4 %) and sorghum (0.9 %) which are taken during kharif and horse gram (12.8 %), bajra (10.8 %), safflower (2.3 %) and maize (10.4 %) during rabi season respectively. The cropping intensity was 113.6 per cent (Table 16 and Figure 8).

Table 16: Present cropping pattern and cropping intensity in Gopalgiri colony 1 Microwatershed **% to Grand Total**

Crops	Kharif	Rabi	Grand Total
Bajra	18.9	10.8	29.8
Horsegram	0.0	12.8	12.8
Groundnut	10.9	0.0	10.9
Redgram	10.8	0.0	10.8
Maize	0.0	10.4	10.4
Sunflower	10.4	0.0	10.4
Safflower	2.3	0.0	2.3
Turmeric	6.2	0.0	6.2
Banana	5.4	0.0	5.4
Sorghum	0.9	0.0	0.9
Grand Total	66	34	100
Cropping intensity (%)	151.5		

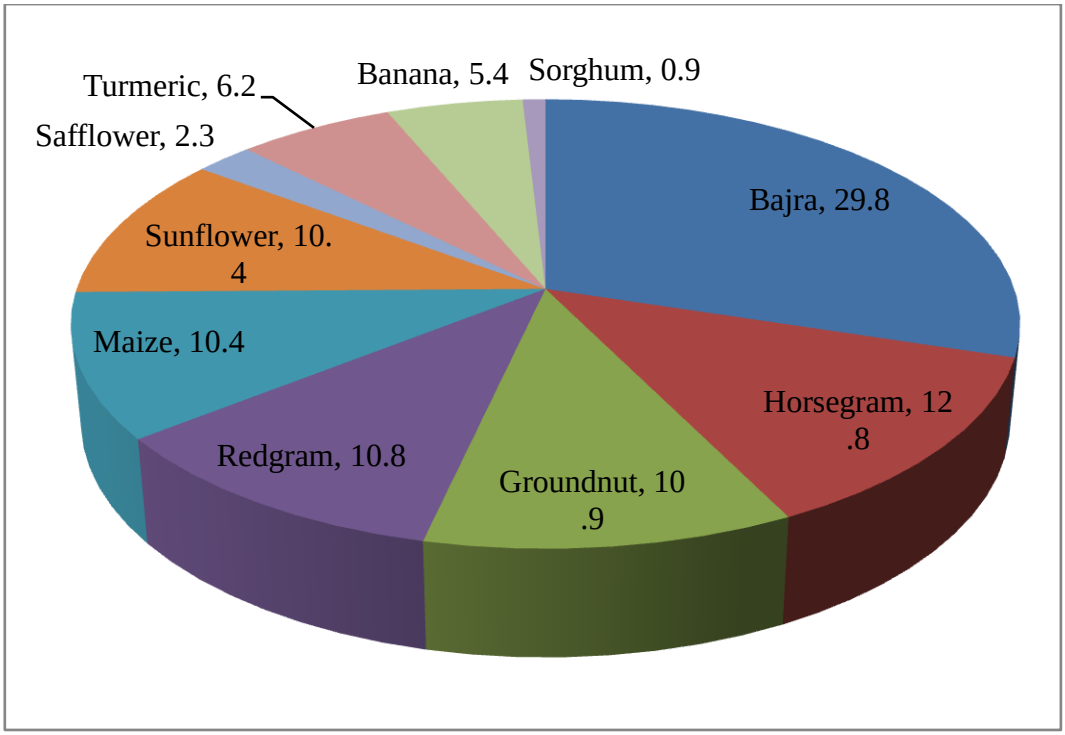

Figure 8: Present cropping pattern in Gopalgiri colony 1 Microwatershed

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 Gopalgiri colony 1 micro-watershed, 10 soil series are identified and mapped (Table 17). The distribution of major soil series are Annurkeri covering an area around 100.59 ha (18.25 %) followed by Beemanabeedu 81.92 ha (14.90%), Devarahalli 59.61 ha (1`0.83 %), Hindupur 53.20 ha (9.67 %), Honnegaudanahalli 41.42 ha (7.53 %), Hullipura 27.28 ha (4.96 %), Kallipura 63.18 ha (11.49 %), Kannigala 23.64 ha (4.29 %), Maddinahundi 29.10 ha (5.29 %) and Magoonahalli 40.97 ha (7.45 %).

Table 17: Distribution of soil series in Gopalgiri colony 1 Microwatershed

Soil No	Soil Series	Mapping Unit Description	Area in ha (%)
1	ARK	Annurkeri soils are very deep (>150 cm), well drained, have dark reddish brown to very dusky red sandy clay to clay soils occurring on very gently sloping uplands under cultivation.	100.59 18.25)
2	BMB	Beemanabeedu soils are very deep (>150 cm), moderately well drained, have very dark greyish brown to dark grey and very dark brown clayey soils occurring on nearly level to very gently sloping lowlands under cultivation	81.92 (14.90)
3	DRH	Devarahalli soils are moderately shallow (50-75 cm), well drained, have dark red to reddish brown and dusky red gravelly sandy clay loam to sandy clay soils occurring on very gently to gently sloping uplands under cultivation	59.61 (10.83)

4	HDR	Hindupur soils are shallow (25-50 cm), well drained, have dark reddish brown to dusky red sandy clay loam to sandy clay soils occurring on very gently sloping uplands and moderately sloping mounds and ridges	53.20 (9.67)
5	HGH	Honnegaudanahalli soils are very deep (>150 cm), well drained, have very dark brown to brown and dark reddish brown sandy clay loam soils occurring on very gently sloping uplands under cultivation.	41.42 (7.53)
6	HPR	Hullipura soils are moderately shallow (50-75 cm), well drained, have dark brown to very dark brown gravelly sandy clay loam to sandy clay soils occurring on very gently to gently sloping uplands under cultivation	27.28 (4.96)
7	KLP	Kallipura soils are deep (100-150 cm), well drained, have dark reddish brown to dark red gravelly sandy clay loam to sandy clay soils occurring on very gently sloping uplands under cultivation.	63.18 (11.49)
8	KNG	Kannigala soils are moderately deep (75-100 cm), well drained, have dark reddish brown to dark red gravelly sandy clay loam to sandy clay soils occurring on very gently sloping uplands and strongly sloping mounds and ridges.	23.64 (4.29)
9	MDH	Maddinahundi soils are deep (100-150 cm), well drained, have dark reddish brown gravelly sandy clay soils occurring on very gently to gently sloping uplands under cultivation.	29.10 (5.29)
10	MGH	Magoonahalli soils are moderately shallow (50-75 cm), well drained, have very dark brown to dark brown gravelly sandy clay loam soils occurring on very gently sloping uplands and moderatly sloping mounds and ridges	40.97 (7.45)

Present cropping pattern on different soil series are given in Table 18. Crops grown on Gopalgiri colony 1, Devarahalli soil bajra, banana and red gram; horse gram and ragi grown in hullipura soils; maize and sunflower are grown on kannigala soils; bajra and horse gram on maddinahundi soils are grow; bajra, groundnut and turmeric on annurkeri soils are grow. Sorghum and sunflower on Beemanabeedu soils can grow.

Table 18: Cropping pattern on major soil series in Gopalgiri colony 1 micro-watershed **(Area in per cent)**

Soil Series	Soil Depth	Crops	Dry		Irrigated		Grand Total
			Kharif	Rabi	Kharif	Rabi	
DRH	Moderately shallow (50-75 cm)	Bajra	0.0	39.4	0.0	0.0	39.4
		Banana	0.0	0.0	21.2	0.0	21.2
		Redgram	39.4	0.0	0.0	0.0	39.4
HPR	Moderately shallow (50-75 cm)	Horsegram	0.0	50.0	0.0	0.0	50.0
		Ragi	50.0	0.0	0.0	0.0	50.0
KNG	Moderately deep (75-100 cm)	Maize	0.0	0.0	0.0	50.0	50.0
		Sunflower	50.0	0.0	0.0	0.0	50.0
MDH	Deep (100-150 cm)	Bajra	50.0	0.0	0.0	0.0	50.0
		Horsegram	0.0	50.0	0.0	0.0	50.0
ARK	Very deep (>150 cm)	Bajra	26.5	0.0	0.0	0.0	26.5
		Groundnut	46.8	0.0	0.0	0.0	46.8
		Turmeric	0.0	0.0	26.7	0.0	26.7
BMB	Very deep (>150 cm)	Sorghum	0.0	0.0	16.7	0.0	16.7
		Sunflower	0.0	0.0	83.3	0.0	83.3

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 Gopalgiri colony 1 Microwatershed.

Soil Series	Small farmers
ARK	Bajra (1.00), Groundnut (1.19),Turmeric (1.17)
BMB	Sorghum (1.32),Sunflower (1.33)
DRH	Bajra (1.52), Banana (1.78), Redgram (1.93)
HPR	Horsegram (1.63), Ragi (1.11)
KNG	Maize (2.47), Sunflower(1.93)
MDH	Bajra (1.47), Horsegram (1.65)

The productivity of different crops grown in Gopalgiri colony 1 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 turmeric is Rs. 220347/ha in ARK soil (with BCR of 1.2), banana cultivation is in DRH soil Rs. 115113/ha (with BCR of 1.8), sunflower range between Rs 57430/ha in BMB soil (with of 0.98) and Rs. 34393/ha in KNG soil (with BCR of 1.26), groundnut cost of cultivation range is Rs. 39081/ha in ARK soil (with BCR of 1.1), sorghum range is Rs 42790/ha in BMB soil (with BCR of 1.07), horse gram cultivation range between MDH soil is Rs. 20809/ha (with BCR of 1.74) and Rs 32697/ha in HPR soil (with BCR value of 1.3), red gram in DRH soil is Rs 21177/ha(with BCR of 1.9), ragi cost of cultivation Rs in HPR soil is 54721/ha (with BCR of 1.1), ground nut cultivation in ARK soil is Rs 40768/ha (with BCR value of 1.2) and horse gram cultivation range between in HPR and MDH soil is Rs 46759/ha and Rs 20808/ha respectively (with BCR of 1.6 & 1.7).

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 92982 in banana and a minimum of Rs 3353 in bajra cultivation.

Table 20: Economic land evaluation and bridging yield gap for different crops in Gopalgiri colony 1 micro-watershed

Particulars	HPR (50-75 cm)		DRH (50-75 cm)			KNG (75-100 cm)		MDH (100-150 cm)		ARK (>150 cm)			BMB (>150 cm)	
	Horse gram	Ragi	Bajra	Banana	Red gram	Maize	Sun flower	Bajra	Horse gram	Bajra	Ground nut	Turmeric	Sor ghum	Sun flower
Total cost (Rs/ha)	32697	39474	19144	115113	21177	19299	34393	17731	20809	30403	39081	220347	42790	57430
Gross Return (Rs/ha)	41800	41800	27867	211714	42117	46107	43362	24189	36268	30457	43094	265433	45871	56193
Net returns (Rs/ha)	9103	2326	8723	96601	20940	26808	8969	6458	15460	54	4012	45086	3082	-1238
BCR	1.28	1.06	1.46	1.84	1.99	2.39	1.26	1.36	1.74	1.00	1.10	1.20	1.07	0.98
Farmers Practices (FP)														
FYM (t/ha)	0.0	0.0	0.0	7.9	0.0	0.0	2.2	0.0	0.0	1.9	1.1	3.7	3.0	5.0
Nitrogen (kg/ha)	36.1	36.1	41.1	127.0	41.1	35.6	35.6	28.5	28.5	0.0	19.1	153.0	11.3	11.3
Phosphorus (kg/ha)	92.1	92.1	73.7	91.3	73.7	25.6	25.6	72.8	72.8	0.0	48.9	171.6	28.8	28.8
Potash (kg/ha)	0.0	0.0	32.1	119.0	32.1	16.7	16.7	0.0	0.0	0.0	0.0	111.9	37.5	37.5
Grain (Qtl/ha)	6.4	12.8	11.8	238.1	9.6	31.1	11.1	10.5	8.4	13.2	8.5	33.6	17.9	12.5
Price of Yield (Rs/Qtl)	5000	3000	2400	900	4300	1500	3800	2300	4100	2200	5000	8000	2400	3650
Soil test based fertilizer Recommendation (STBR)														
FYM (t/ha)	0.0	8.6	6.2	39.5	7.4	8.6	6.6	6.2	0.0	6.2	8.6	24.7	7.4	6.6
Nitrogen (kg/ha)	24.7	74.1	39.5	432.3	24.7	123.5	55.2	39.5	24.7	39.5	24.7	148.2	81.5	55.2
Phosphorus (kg/ha)	46.3	54.0	39.5	259.4	49.4	46.3	44.5	29.6	27.8	29.6	46.3	92.6	42.6	44.5
Potash (kg/ha)	18.5	33.3	0.0	407.6	18.5	24.1	27.8	0.0	18.5	0.0	23.2	185.3	29.6	27.8
Grain (Qtl/ha)	9.9	30.9	14.8	395.2	12.4	84.0	16.5	14.8	9.9	14.8	17.3	24.7	28.4	16.5
% of Adoption/yield gap (STBR-FP) / (STBR)														
FYM (%)	0.0	100.0	100.0	79.9	100.0	100.0	66.3	100.0	0.0	69.6	87.7	84.9	59.8	24.1
Nitrogen (%)	-46.0	51.3	-4.1	70.6	-66.5	71.2	35.5	27.9	-15.3	100.0	22.5	-3.2	86.2	79.6
Phosphorus (%)	-99.0	-70.5	-86.5	64.8	-49.2	44.8	42.5	-145.6	-161.9	100.0	-5.7	-85.3	32.5	35.3
Potash (%)	100.0	100.0	0.0	70.8	-73.0	30.8	40.0	0.0	0.0	0.0	100.0	39.6	0.0	-35.0
Grain (%)	35.1	58.5	20.7	39.8	22.1	63.0	32.5	28.8	14.6	11.2	50.8	-36.0	37.1	24.1
Value of yield and Fertilizer (Rs)														
Additional Cost (Rs/ha)	-1783	8091	4010	48412	5872	10762	5654	4409	-1655	6074	7995	18901	5729	2611
Additional Benefits (Rs/ha)	17349	54163	7363	141394	11759	79303	20351	9824	5909	3657	43897	-71057	25315	14478
Net change Income (Rs/ha)	19131	46072	3353	92982	5887	68541	14697	5415	7564	-2417	35901	-89957	19585	11868

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 9. The average value of soil nutrient loss is around Rs 772.9 per ha/year. The total cost of annual soil nutrients is around Rs 402711 per year for the total area of 550.02 ha.

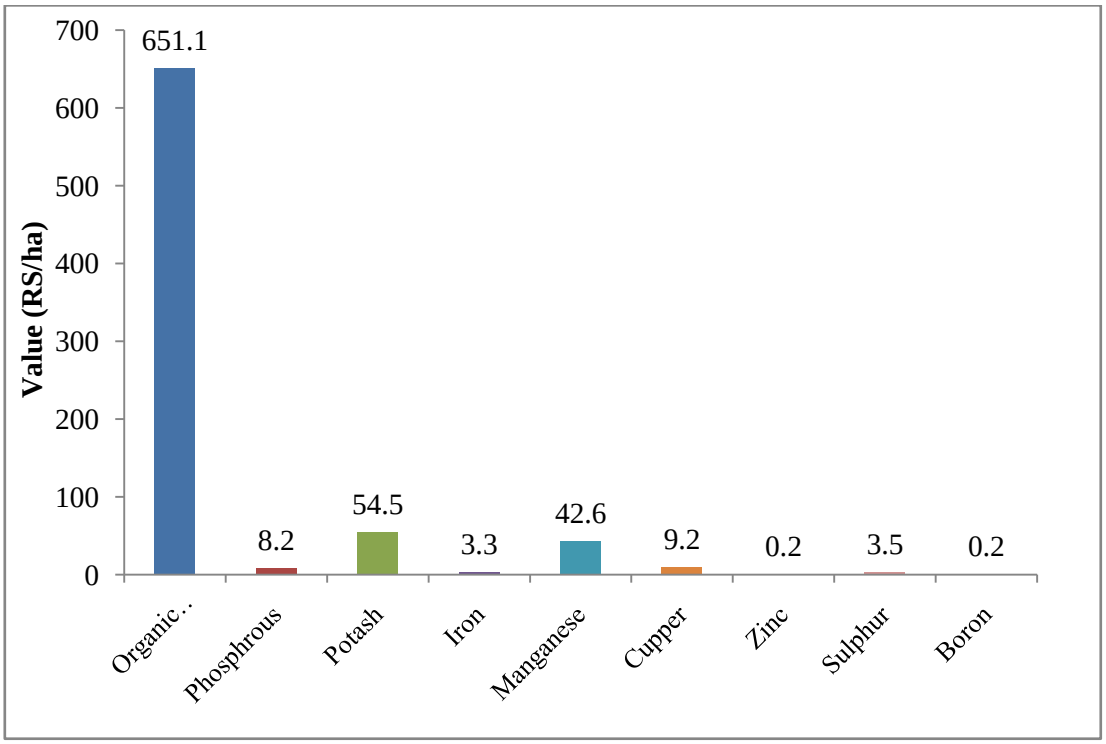

Figure 9: Estimation of onsite cost of soil erosion in Gopalgiri colony 1 micro-watershed

Table 21: Estimation of onsite cost of soil erosion in Gopalgiri colony 1 micro-watershed

Particulars	**Quantity(kg)**		**Value (Rs)**	
	Per ha	**Total**	**Per ha**	**Total**
Organic matter	103.35	53847	651.12	339234
Phosphorus	0.19	97	8.22	4283
Potash	2.73	1420	54.52	28403
Iron	0.07	36	3.33	1735
Manganese	0.15	81	42.62	22204
Cupper	0.02	9	9.24	4812
Zinc	0.00	2	0.18	95
Sulphur	0.09	46	3.51	1828
Boron	0.01	3	0.22	117
Total	120.74	55541	772.96	402711

The average value of ecosystem service for food grain production is around Rs 19780/ ha/year (Table 22 and Figure 10). Per hectare food grain production services is maximum in

banana (Rs 96601), followed by turmeric (Rs 45085), maize (Rs 26807), red gram (Rs 19672), horse gram (Rs 6623), bajra (Rs 4432), groundnut (Rs 2961).

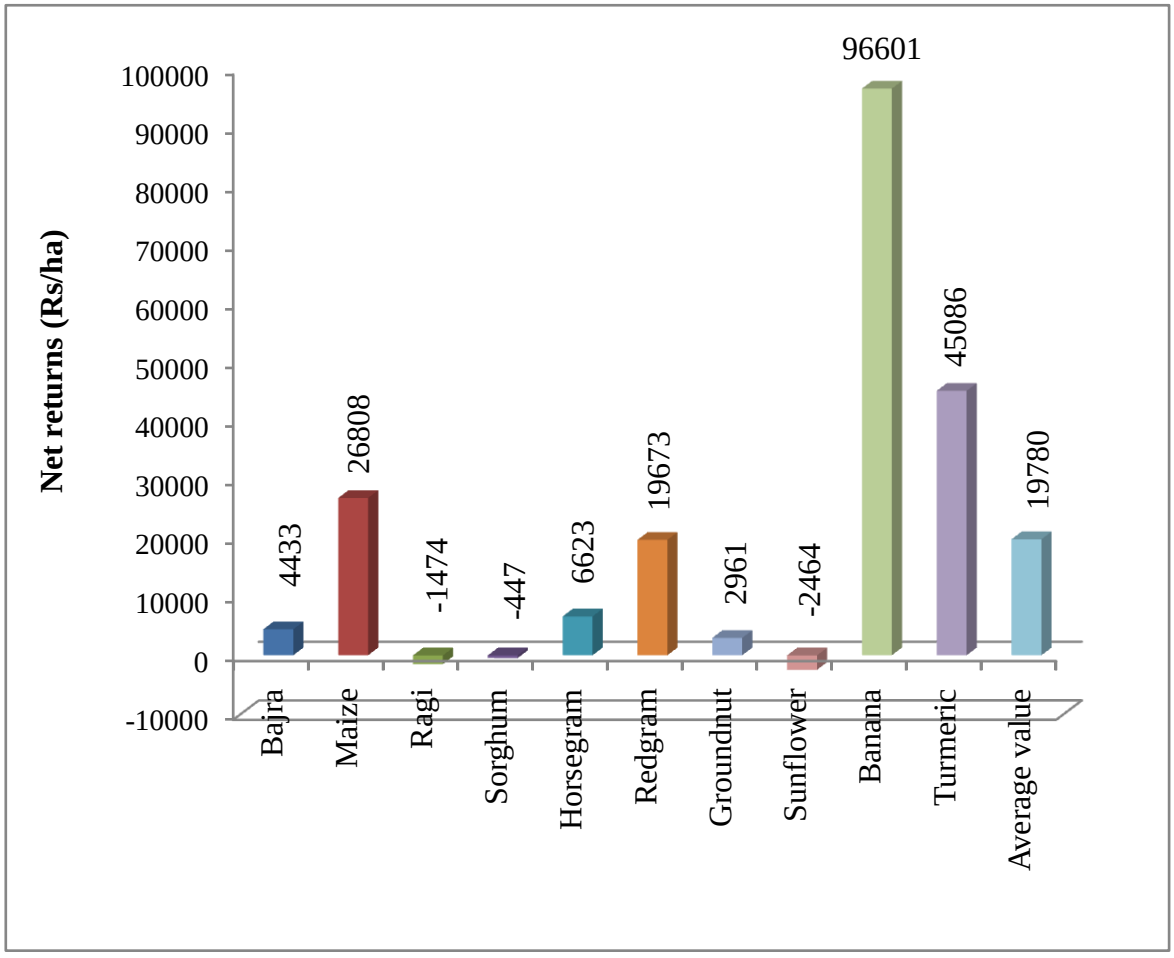

Figure 10: Ecosystem services of food grain production in Gopalgiri colony 1 Microwatershed

Table 22: Ecosystem services of food grain production in Gopalgiri colony 1 Microwatershed

Production items	Crops	Area in ha	Yield (Qtl/ha)	Price (Rs/Qtl)	Returns Gross (Rs/ha)	Cost of Cultivation (Rs/ha)	Net Returns (Rs/ha)
Cereals	Bajra	2.4	11.7	2300	26859	22426	4433
	Maize	0.9	30.7	1500	46107	19299	26808
	Ragi	0.2	12.7	3000	38000	39474	-1474
	Sorghum	0.2	17.6	2400	42343	42790	-447
Pulses	Horsegram	1.1	7.3	4550	33376	26753	6623
	Redgram	0.9	9.5	4300	40850	21177	19673
Oil seeds	Groundnut	1.0	8.4	5000	42043	39081	2961
	Sunflower	1.3	11.7	3725	43448	45912	-2464
Fruits	Banana	0.5	235.2	900	211714	115113	96601
Spice crops	Turmeric	0.5	33.2	8000	265433	220347	45086
Average value		9.1	37.8	3568	79017	59237	19780

The average value of ecosystem service for fodder production is around Rs 2806/ ha/year (Table 23). Per hectare fodder production services is maximum in horse gram (Rs 5472) followed by ragi (Rs 3800), sorghum (Rs 3529), maize (Rs 2609), groundnut (Rs 1051) and bajra (Rs 374).

Table 23: Ecosystem services of fodder production in Gopalgiri colony 1 Micro watershed

Production items	Crops	Area in ha	Yield (Qtl/ha)	Price (Rs/Qtl)	Net Returns (Rs/ha)
Cereals	Bajra	2.4	0.9	433	374
	Maize	0.9	2.9	915	2609
	Ragi	0.2	3.2	1200	3800
	Sorghum	0.2	2.9	1200	3529
Pulses	Horse gram	1.1	4.2	1300	5472
Oil seeds	Groundnut	1.0	1.1	1000	1051
Average value		5.8	2.5	1008	2806

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 in banana (Rs 185838) followed by turmeric (Rs 54978), sorghum (Rs 53775), bajra (Rs 52269), red gram (Rs 51718), sunflower (Rs 39261), maize (Rs 37562), groundnut (Rs 23392), horse gram (Rs 22578) and ragi (Rs 15479).

Table 24: Ecosystem services of water supply in Gopalgiri colony 1 Microwatershed

Crops	Yield (Qtl/ha)	Virtual water (cubic mete) per ha	Value of Water (Rs/ha)	Water consumption (Cubic meters/Qtl)
Banana	235.2	18584	185838	79
Turmeric	33.2	5498	54978	166
Sorghum	17.6	5378	53775	305
Bajra	11.7	5227	52269	448
Red gram	9.5	5172	51718	544
Sunflower	11.7	3926	39261	337
Maize	30.7	3756	37562	122
Groundnut	8.4	2339	23392	278
Horse gram	7.3	2258	22578	308
Ragi	12.7	1548	15479	122
Average value	37.8	5369	53685	271

The main farming constraints in Gopalgiri colony 1 micro-watershed to be found are less rainfall, lack of good quality seeds, non availability fertilizers, lack of transportation , damage of crops by wild animals and non availability of plant protection chemicals. Majority of farmers depend up on money lender 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 and television. Farmers reported that they are

not getting timely support/extension services from the concerned development department (Table 25).

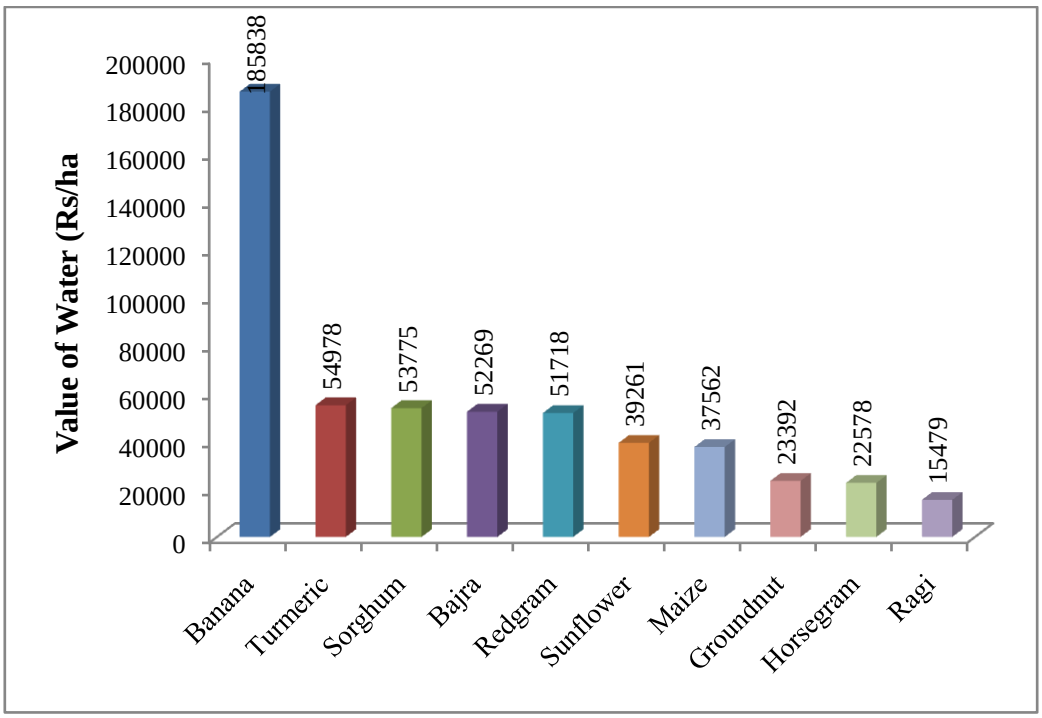

Figure 11: Ecosystem services of water supply in Gopalgiri colony 1 Microwatershed

Table 25: Farming constraints related land resources of sample households in Gopalgiri colony 1 Microwatershed

Sl. No	Particulars	Per cent
1	Less Rainfall	100.0
2	Lack of good quality seeds	33.3
3	Non availability Fertilizers	33.3
4	Animal Pests & Diseases	11.1
5	Lack of transportation	22.2
6	Damage of crops by Wild Animals	88.9
7	Non availability of Plant Protection Chemicals	44.4
8	**Source of loan**	
	Money Leander	100.0
9	**Market for selling**	
	Regulated	11.1
	Village market	88.9
10	**Sources of Agri -Technology information**	
	Newspaper	77.8
	Television	22.2

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