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

HONGAHALLI-4 (4B3E2A2d) MICRO WATERSHED

Gundlupet Taluk, Chamarajanagara District, Karnataka

Karnataka Watershed Development Project – II

SUJALA – III

World Bank funded Project

ICAR – NATIONAL BUREAU OF SOIL SURVEY AND LAND USE PLANNING

ICAR - NBSS & LUP

WATERSHED DEVELOPMENT DEPARTMENT
GOVT. OF KARNATAKA, BANGALORE

About ICAR - NBSS&LUP

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

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

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PREFACE

In Karnataka, as in other Indian States, the livelihoods of rural people are intertwined with farming pursuits. The challenges 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 Hongahalli-4 Microwatershed, Gundlupet Taluk and Chamarajanagara District, Karnataka" for integrated development was taken up in collaboration with the State Agricutural Universities, IISC, KSRSAC, KSNDMC as Consortia partners. The project provides detailed land resource information at cadastral level (1:7920 scale) for all the plots and socio-economic status of farm households covering thirty per cent farmers randomely selected representing landed and landless class of farmers in the micowatershed. The project report with the accompanying maps for the Microwatershed will provide required detailed database for evolving effective land use plan, alternative land use options and conservation plans for the planners, administrators, agricutural extention personnel, KVK officials, developmental departments and other land users to manage the land resources in a sustainable manner.

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

Nagpur
Date: 06.07.2018

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PART-A

LAND RESOURCE INVENTORY

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EXECUTIVE SUMMARY

The land resource inventory of Hongahalli-4 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 boundaries. The soil map shows the geographic distribution and extent, characteristics, classification, behavior and use potentials of the soils in the microwatershed.

The present study covers an area of 624 ha in Gundlupet taluk of Chamarajanagara district, Karnataka. The climate is semiarid and categorized as drought-prone with an average annual rainfall of 734 mm, of which about 254 mm is received during south-west monsoon, 268 mm during north-east and the remaining 212 mm during the rest of the year. An area of 611 ha in the microwatershed is covered by soils, 6 ha area under reserve forest and about 14 ha by others (habitation and water bodies). The salient findings from the land resource inventory are summarized briefly below.

- *The soils belong to 11 soil series and 33 soil phases (management units) and 8 land use class.*
- *The length of crop growing period is about 150 days starting from 3rd week of June to 3rd week of October.*
- *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 27 major agricultural and horticultural crops was assessed and maps showing the degree of suitability along with constraints were generated.*
- *Entire area in the microwatershed is suitable for agriculture.*
- *About 55 per cent area of the microwatershed has soils that are moderately deep to very deep (75 - >150 cm) and 41 per cent soils are shallow to moderately shallow (25-75 cm).*
- *About 7 per cent area in the microwatershed has sandy soils, 46 per cent of loamy soils and 44 per cent clayey soils at the surface.*
- *About 17 per cent area is non gravelly (<15%), 48 per cent is gravelly (15-35%) and 32 per cent is very gravelly (35-60%).*
- *About 41 per cent area of the microwatershed is very high (>200 mm/m) in available water capacity, 22 per cent area low (51-100 mm/m) and 34 per cent area very low (<50 mm/m) in available water capacity.*

- *About 70 per cent area of the microwatershed has very gently sloping (1-3% slope) lands and 26 per cent area is gently (3-5% slope) to moderately sloping (5-10% slope) lands.*
- *An area of about 31 per cent has soils that are slightly eroded (e1), 63 per cent area is moderately (e2) eroded and 3 per cent area is severely (e3) eroded.*
- *An area of about 31 per cent soils are moderately to slightly acid (pH 5.5-6.5), 34 per cent soils are neutral (pH 6.5-7.3) in soil reaction and 31 per cent soil are slightly to moderately alkaline (pH 7.3-8.4).*
- *The Electrical Conductivity (EC) of the soils in the entire area of the microwatershed is dominantly <2 dsm^{-1}indicating that the soils are non-saline.*
- *About 15 per cent of the soils are low (<0.5%) in organic carbon, 62 per cent medium (0.5-0.75%) and 20 per cent high (>0.75).*
- *About 73 per cent of the area is medium (23-57 kg/ha) in available phosphorus and 24 per cent is high (>57 kg/ha).*
- *About 7 per cent is low (145 kg/ha) is low in available potassium, 72 per cent medium (145-337 kg/ha) and 18 per cent is high (>337 kcg/ha).*
- *Available sulphur is low (<10 ppm) in an area of about 78 per cent and medium (10 - 20 ppm) in 18 per cent area of the microwatershed.*
- *Available boron is low (0.5 ppm) in an area of about 10 per cent and medium (0.5-1.0 ppm) in 87 per cent.*
- *Available iron is sufficient (>4.5 ppm) in 90 per cent area and deficient (<4.5 ppm) in 7 per cent area of the microwatershed.*
- *Available manganese and copper are sufficient in all the soils of the microwatershed.*
- *Available zinc is deficient (<0.6 ppm) in 82 per cent and sufficient (>0.6 ppm) in 15 per cent of the soils in the microwatershed.*
- *The land suitability for 27 major crops 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, market price and finally the demand and supply position.*

Land suitability for various crops in the Microwatershed

Crop	Suitability Area in ha (%)			Crop	Suitability Area in ha (%)	
	Highly suitable (S1)	Moderately suitable (S2)			Highly suitable (S1)	Moderately suitable (S2)
Sorghum	*85(14)*	*287(46)*		*Guava*	*97(16)*	*18(3)*
Maize	*116 (19)*	*218(35)*		*Mango*	*97(16)*	*27(4)*
Redgram	*97(16)*	*320(51)*		*Sapota*	*97(16)*	*27(4)*
Horsegram	*97(16)*	*341(55)*		*Jackfruit*	*86(14)*	*38(6)*
Sunflower	*47(8)*	*209(33)*		*Jamun*	*76(12)*	*131(21)*
Cotton	*85(14)*	*218(35)*		*Musambi*	*97(16)*	*158(25)*
Beans	*97 (16)*	*227(36)*		*Lime*	*97(16)*	*158(25)*
Field beans	*97(16)*	*273(44)*		*Cashew*	*97(16)*	*68(11)*
Onion	*97(16)*	*295(47)*		*Custard apple*	*97(16)*	*386(62)*
Beetroot	*97(16)*	*258(41)*		*Amla*	*97(16)*	*364(59)*
Groundnut	*-*	*401(64)*		*Tamarind*	*97(16)*	*158(25)*
Banana	*97(16)*	*248(40)*		*Marigold*	*97(16)*	*341(55)*
Potato	*97(16)*	*258(41)*		*Chrysanthemum*	*97(16)*	*273(44)*
Turmeric	*97(16)*	*258(41)*				

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

- *Maintaining soil-health is vital to crop production and conserve soil and land resource base for maintaining ecological balance and to mitigate climate change. For this, several ameliorative measures have been suggested to these problematic soils like saline/alkali, highly eroded, sandy soils etc.,*
- *Soil and water conservation treatment plan has been prepared that would help in identifying the sites to be treated and also the type of structures required.*
- *As part of the greening programme, several tree species have been suggested to be planted in marginal and submarginal lands, field bunds and also in the hillocks, mounds and ridges. This would help in not only supplementing the farm income but also provide fodder and fuel and generate lot of biomass which would help in maintaining an ecological balance and also contribute to mitigating the climate change.*

Chapter 1

INTRODUCTION

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

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

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

Therefore, the land resource inventory required for farm level planning is the one which investigates not only the surface but also consider the other parameters which are critical for productivity *viz.*, soils, climate, water, minerals and rocks, topography, geology, hydrology, vegetation, crops, land use pattern, animal population, socio-

economic conditions, infrastructure, marketing facilities and various schemes and developmental works of the government etc. From the data collected at farm level, the specific problems and potentials of the area can be identified and highlighted, conservation measures required for the area can be planned on a scientific footing, suitability of the area for various uses can be worked out and finally viable and sustainable land use options suitable for each and every land holding can be prescribed.

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

The land resource inventory aims to provide site specific database for Hongahalli-4 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 uplink 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 Hongahalli-4 microwatershed (Hongahalli subwatershed) is located in the southern part of Karnataka in Gundlupet Taluk, Chamarajanagara District, Karnataka State (Fig.2.1). It comprises parts of Baragi, Masahalli, Mookahalli Kannigala and Bheemanabeedu villages. It lies between 11^0 47' and 11^0 49' North latitudes and 76^0 34' and 76^0 37' East longitudes covering an area of 624 ha. It is about 14 km west of Gundlupet town and is surrounded by Baragi on the north, Hongahalli on the west, Kannagal on the south, Bhimanabid on the southeast and Mukahalli village on the eastern side.

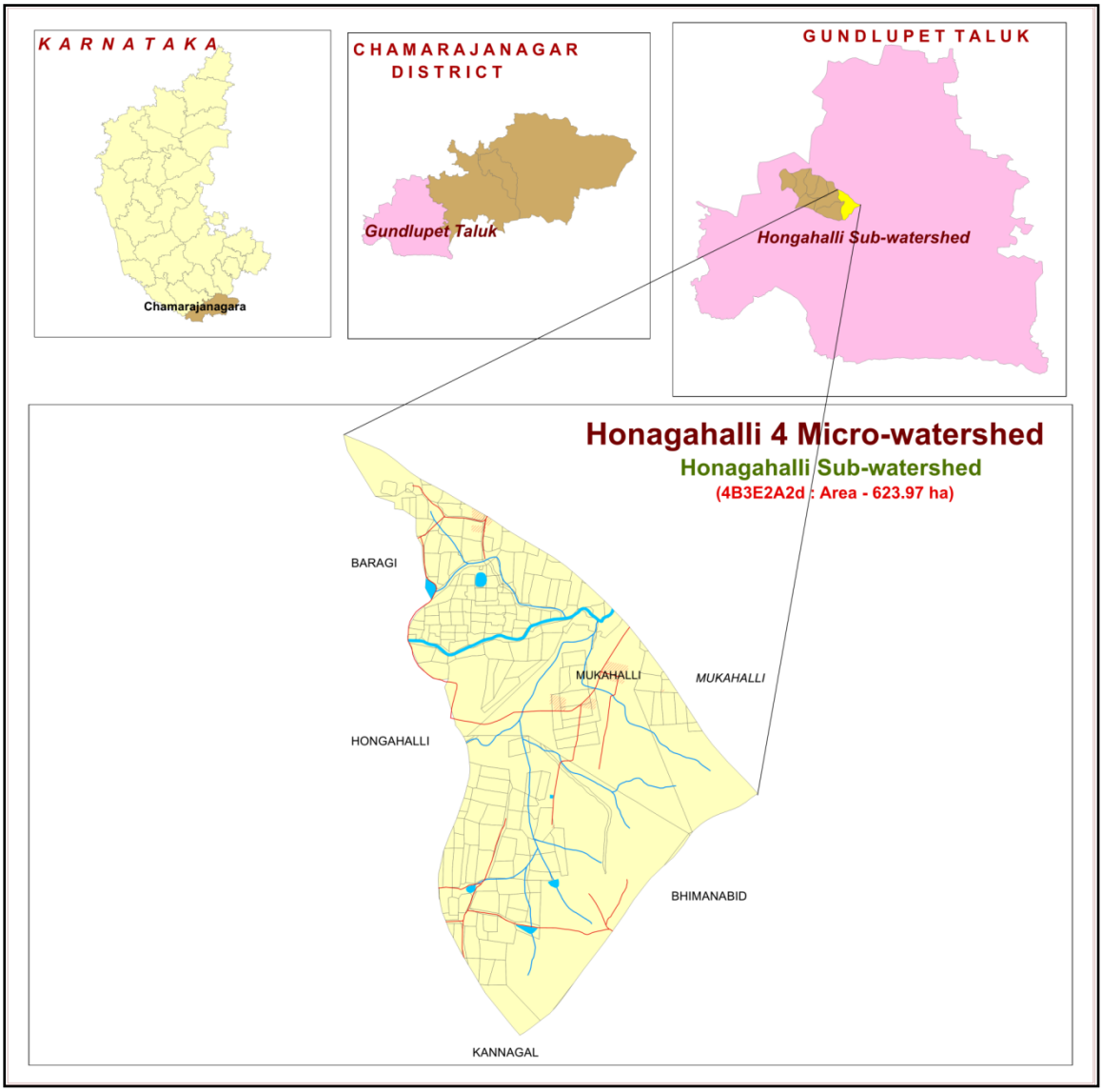


Fig.2.1 Location map of Hongahalli-4 Microwatershed

2.2 Geology

Major rock formations observed in the microwatershed are of Archaean age and comprise of (Figs.2.2 and 2.3) 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 weathered, fractured and fissured upto a depth of about 10 m.

Fig.2.2 Granite and granite gneiss rocks

Fig. 2.3 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 863-926 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, it is not a perennial one, during rainy season, it carries large quantities of rain water. The microwatershed 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 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 about 268 mm and the remaining 212 mm is received during the rest of the year. The winter season is from December to February. During April and May, the temperatures reach up to 42°C and in December and January, the temperatures will go down to 16°C. Rainfall distribution is shown in Figure 2.4. 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 October. Generally, the length of crop growing period (LGP) is 150 days and starts from 3rd week of June to third week of November.

Table 2.1 Mean Monthly Rainfall, PET, 1/2 PET in Gundlupet Taluk, Chamarajanagara District

Sl. No.	Months	Rainfall (mm)	PET	1/2 PET
1	January	0.80	129.10	64.55
2	February	6.80	133.80	66.90
3	March	26.90	164.90	82.45
4	April	73.60	153.80	76.90
5	May	103.90	147.20	73.60
6	June	56.00	124.60	62.30
7	July	50.40	116.40	58.20
8	August	55.80	117.10	58.55
9	September	92.00	116.80	58.40
10	October	164.10	111.10	55.55
11	November	80.50	106.20	53.10
12	December	23.50	109.90	54.95
Total		**734.30**		

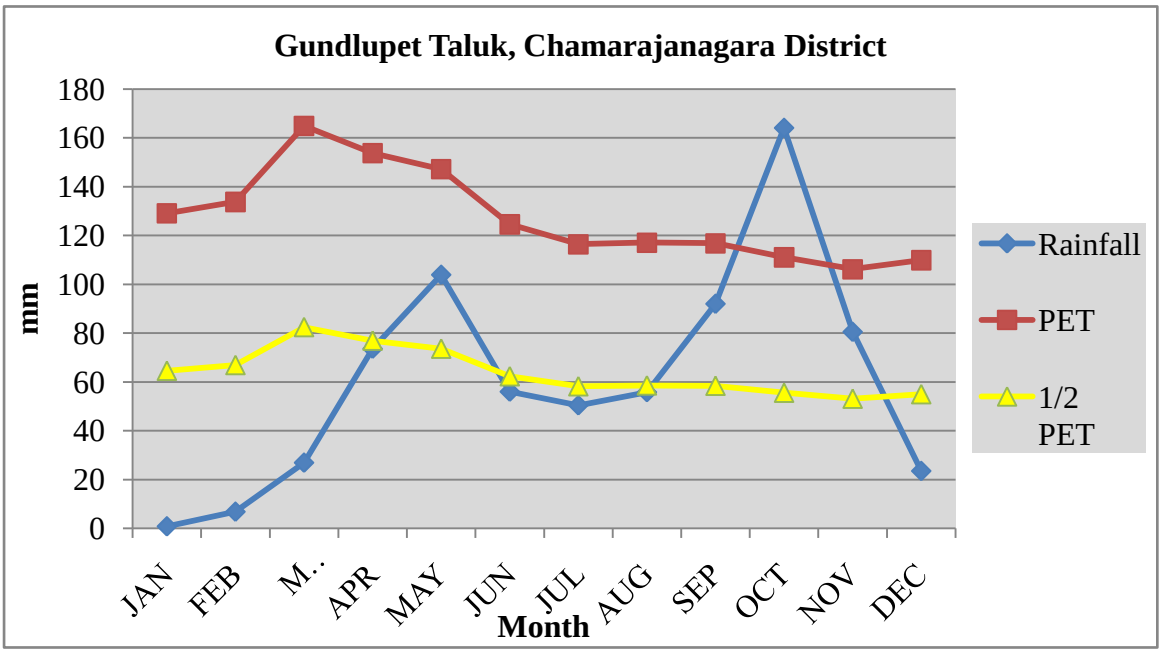


Fig 2.4 Rainfall distribution in Gundlupet Taluk, Chamarajanagara District

2.6 Natural Vegetation

Forests occupy about 32 per cent area in Gundlupet taluk. The major area of these forests are 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 (Fig. 2.5). The mounds, ridges and boulders occupy very sizeable area which is 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. 2.5 Natural vegetation of Hongahalli-4 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 slopes, 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, sunflower, safflower, groundnut, tobacco, red gram, horsegram, banana, marigold and sapota (Fig 2.6 a, b & c). The cropping intensity is about 120 per cent. 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 generated. The current land use map generated shows the arable and non-arable lands, other land uses and different types of crops grown in the area (Fig.2.7). Simultaneously, enumeration of wells (bore wells and open wells) and existing conservation structures in the microwatershed are made and their location in different survey numbers is located on the cadastral map. Map showing the location of wells and other water bodies in Hongahalli-4 microwatershed is given in Figure 2.8.

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.	Cropping intensity	-	120.09
5.	Trees and grooves	3485	2.47
6.	Forest	44859	31.98
7.	Cultivable wasteland	3265	2.32
8.	Permanent Pasture land	10287	7.31
9.	Barren land	7988	5.68
10.	Non- Agriculture land	3384	2.40

Fig.2.6.a. Major crops and cropping systems in Hongahalli-4 Microwatershed

Fig.2.6.b. Major crops and cropping systems in Hongahalli-4 Microwatershed

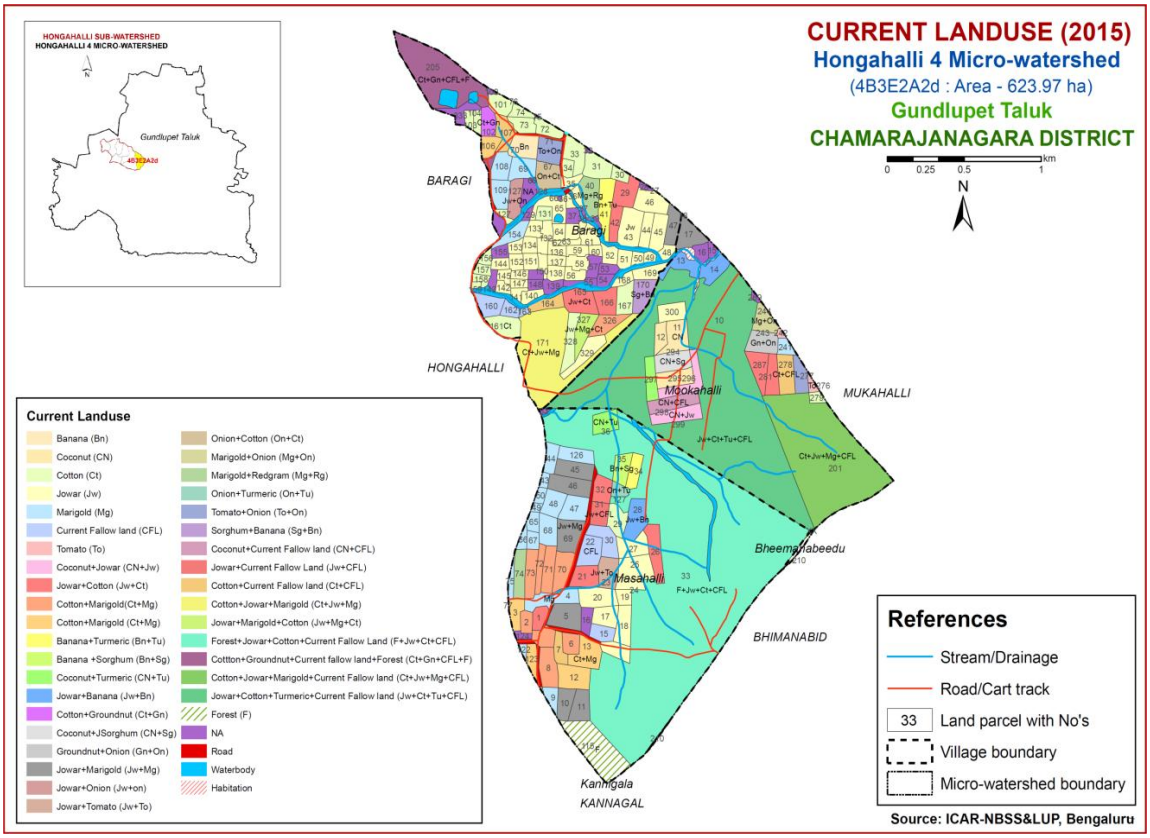


Fig. 2.7 Current Land Use map of Hongahalli-4 Microwatershed

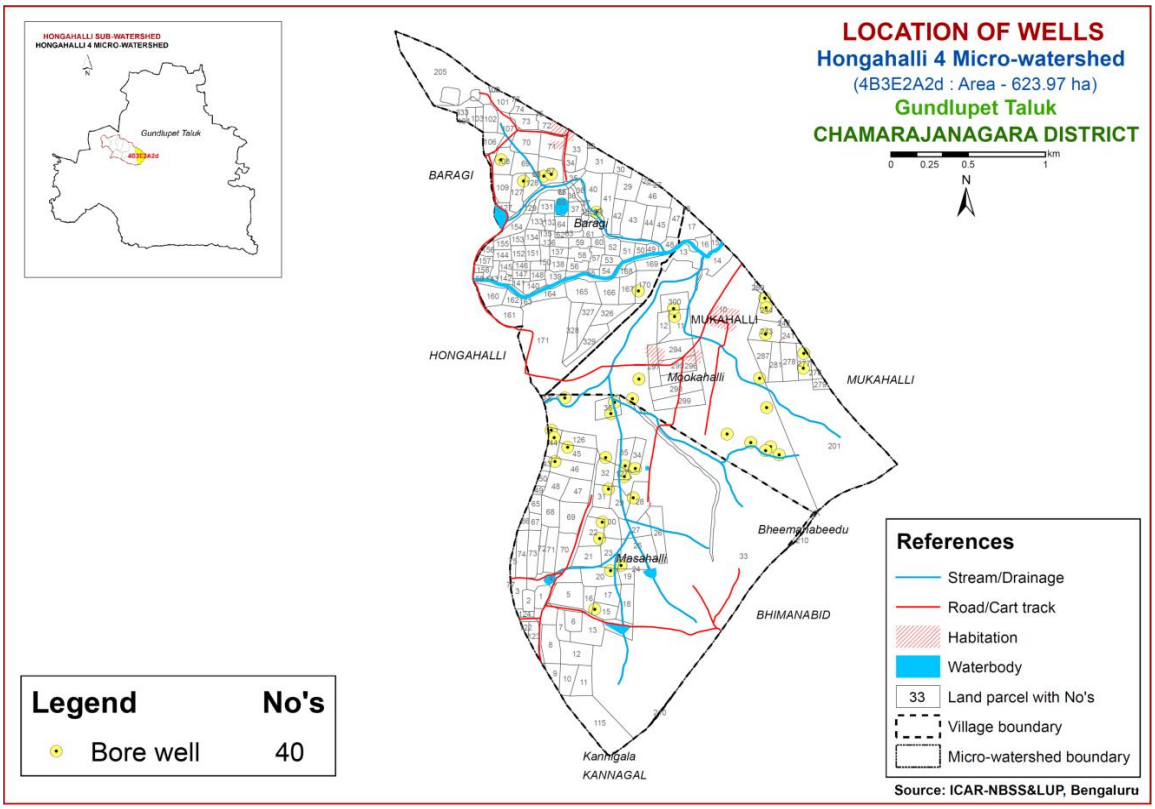


Fig. 2.8 Location of Wells map of Hongahalli-4 Microwatershed

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 Hongahalli-4 microwatershed by the detailed study of all the soil characteristics (depth, texture, colour, structure, consistence, coarse fragments, porosity, soil reaction, soil horizons etc.) and site characteristics (slope of the land, erosion, drainage, occurrence of rock fragments etc.) and followed by grouping of similar areas based on soil-site characteristics into homogeneous (management units) units, and showing their area extent and geographic distribution on the microwatershed cadastral map. The detailed survey at 1:7920 scale was carried out in an area of 624 ha. The methodology followed for carrying out land resource inventory was as per the guidelines given in Soil Survey Manual (IARI, 1971; Soil Survey Staff, 2006; Natarajan *et al.,* 2015) which is briefly described below.

3.1 Base Maps

The detailed survey of the land resources occurring in the microwatershed was carried out by using digitized cadastral map as a base supplied by KSRSAC. 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 supplied by KSRSAC were used in conjunction with the cadastral map to identify the landscapes, landforms and other surface features. The imagery helped in the identification and delineation of boundaries between hills, uplands and lowlands, water bodies, forest and vegetated areas, roads, habitations and other cultural features of the area (Fig. 3.2). The cadastral map was overlaid on the satellite imagery (Fig. 3.3) that helps to identify the parcel boundaries and other permanent features. Apart from cadastral maps and images, toposheets of the area (1:50,000 scale) were also 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 the microwatershed area was visually interpreted using image interpretation elements along with the geology map and all the available collateral data with local knowledge. The delineated physiographic boundaries were transferred on to a cadastral map overlaid on satellite imagery. Physiographically, the area has been identified as granite gneiss landscape and is divided into landforms such as ridges, mounds, uplands and valleys based on slope and other relief features. They were further subdivided into physiographic/ image interpretation units based on image characteristics. The image interpretation legend for physiography is given below.

Image Interpretation Legend for Physiography

G- Granite gneiss landscape

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

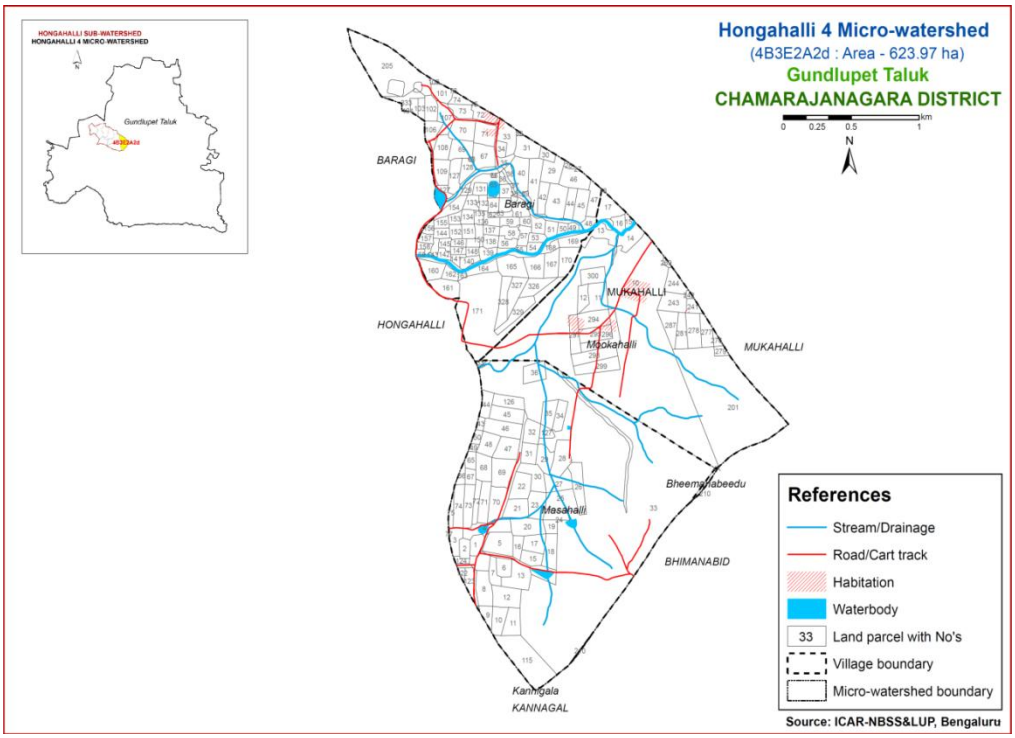


Fig 3.1 Scanned and Digitized Cadastral map of Hongahalli-4 Microwatershed

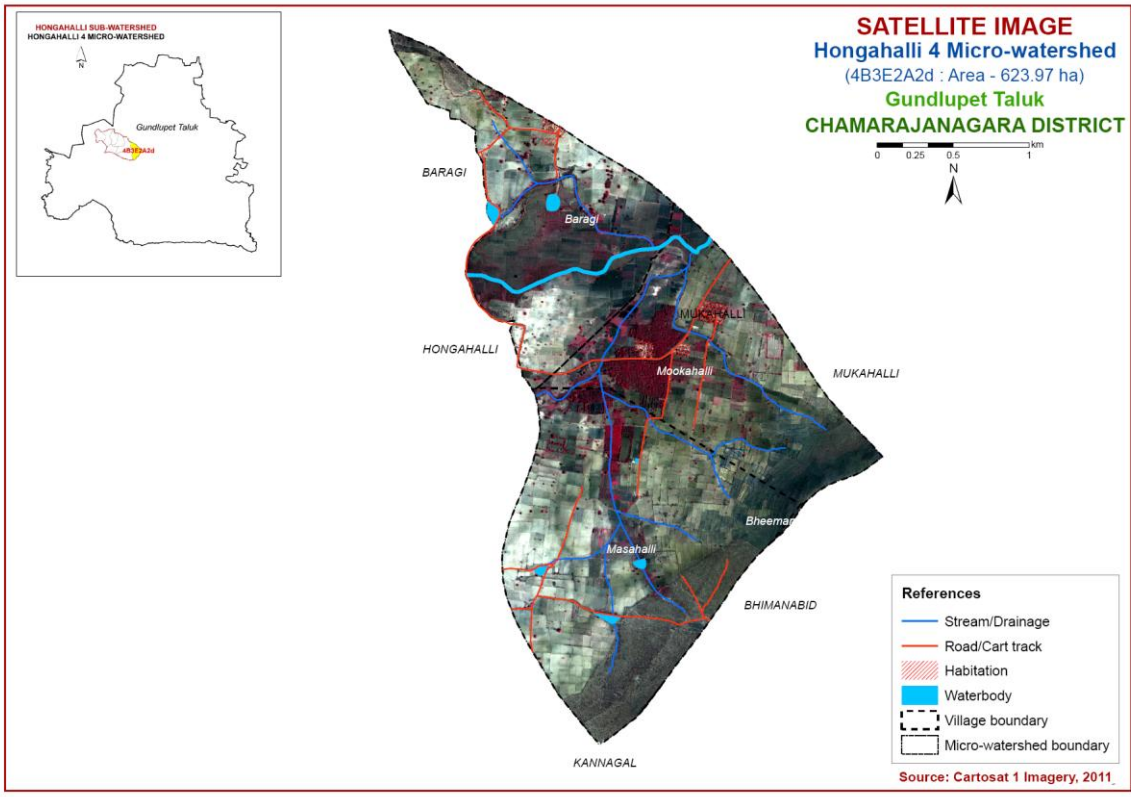


Fig.3.2 Satellite Image of Hongahalli-4 Microwatershed

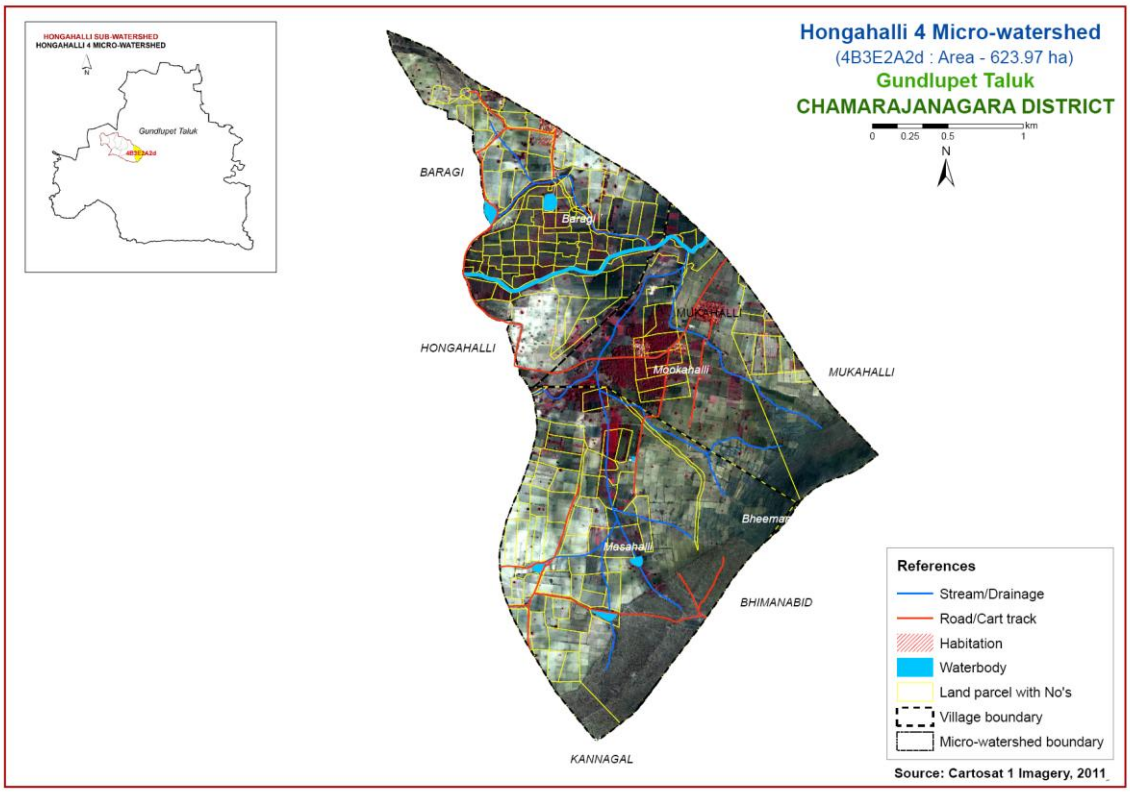


Fig.3.3 Cadastral map overlaid on IRS PAN+LISS IV merged imagery of Hongahalli-4 Microwatershed

3.3 Field Investigation

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

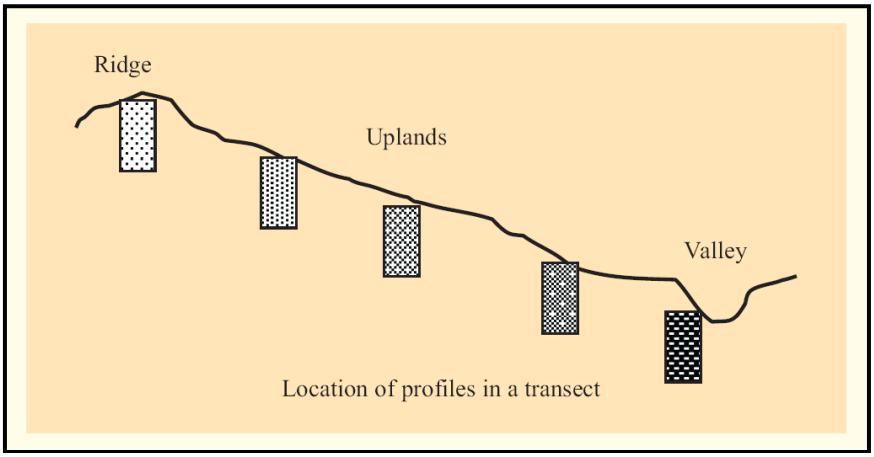


Fig: 3.4. Location of profiles in a transect

In the selected transect, soil profiles were located (Fig. 3.4) 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 upto 200 cm or to the depth limited by rock or hard substratum and studied in detail for all their morphological and physical characteristics. The soil and site characteristics were recorded for all profile sites on a standard proforma as per the guidelines given in USDA Soil Survey Manual (Soil Survey Staff, 2012). Apart from the transect study, profiles were also studied at random, almost like in a grid pattern, outside the transect areas.

Based on the soil characteristics, the soils were grouped into different soil series. Soil series is the most homogeneous unit having similar horizons and properties and behaves similarly for a given level of management. Soil depth, texture, colour, kind of horizon and horizon sequence, calcareousness, amount and nature of gravel present, nature of substratum etc, were used as the major differentiating characteristics for identifying soil series occurring in the area. The differentiating characteristics used for identifying the soil series are given in Table 3.1. Based on the above characteristics, 11 soil series were identified in the Hongahalli-4 microwatershed.

Table 3.1 Differentiating Characteristics used for identifying Soil Series

(Characteristics are of Series Control Section)

Soils of Granite gneiss Landscape							
Sl. no	**Soil Series**	**Depth (cm)**	**Colour (moist)**	**Texture**	**Gravel (%)**	**Horizon sequence**	**Calcare-ousness**
1	SPR (Shivapura)	25-50	2.5 YR 2.5/4, 3/4	gscl	>35	Ap-Bt-Cr	-
2	BMD (Berambadi)	25-50	10YR3/3,4/2, 7.5YR3/2,3/3	scl	<15	Ap-Bw-Cr	-
3	MGH (Magoonahalli)	50-75	2.5YR2.5/4,3/4	gscl	>35	Ap-Bt-Cr	-
4	DRH (Devarahalli)	50-75	2.5YR2.5/4,3/2,3/6	gscl	15-35	Ap-Bt-Cr	-
5	HPR (Hullipura)	50-75	7.5YR 2.5YR2.5/2,3/2	gsl-sc	15-35	Ap-Bw-Ck	-
6	(KNG) (Kannigala)	75-100	2.5YR2.5/4,3/4,3/6	gscl	>35	AP-Bt-Cr	-
7	MDH (Maddinahundi)	100-150	2.5YR2.5/4,3/4	gsc-c	>35	Ap-Bt-Cr	-
8	(KDH) (Kalligaudanahalli)	>150	5YR2.5/2,3/2,3/3 2.5YR3/2	scl-sc	<15	Ap-Bt	-
9	(HGH) (Honnegaudanahalli)	>150	7.5YR 2.5/2,2.5/3, 3/3,2.5/4,3/4	scl-c	<15	Ap-Bw	-
10	BRG (Bargi)	>150	10YR3/2,3/3	c	<15	Ap-Bw	e-ev
11	(BMB) (Beemanabeedu)	>150	10YR 2/1,2/2,3/1, 3/2,4/1	sc-c	-	Ap-Bw	-

3.4 Soil Mapping

The area under each soil series was further separated into 33 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 soil map (Fig.3.5) in the form of symbols. During the survey about 24 profile pits, few minipits and a few auger bores representing different landforms occurring in the microwatershed were studied. In addition to the profile study, spot observations in the form of minipits, road cuts, terrace cuts etc., were studied to validate the soil boundaries on the soil map.

The soil map shows the area extent and their geographic distribution of 33 mapping units representing 11 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 33 soil phases mapped in the microwatershed. Each mapping unit (soil phase) delineated on the map has similar soil and site characteristics. In other words, all the farms or survey numbers included in one phase will have similar management needs and have to be treated accordingly.

3.5 Laboratory Characterization

Soil samples from each series 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 collected from farmer's fields (46 samples) for fertility status (major and micronutrients) at 250 m grid interval in the year 2015 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 by using Kriging method for the microwatershed.

3.6 Land Use Classes

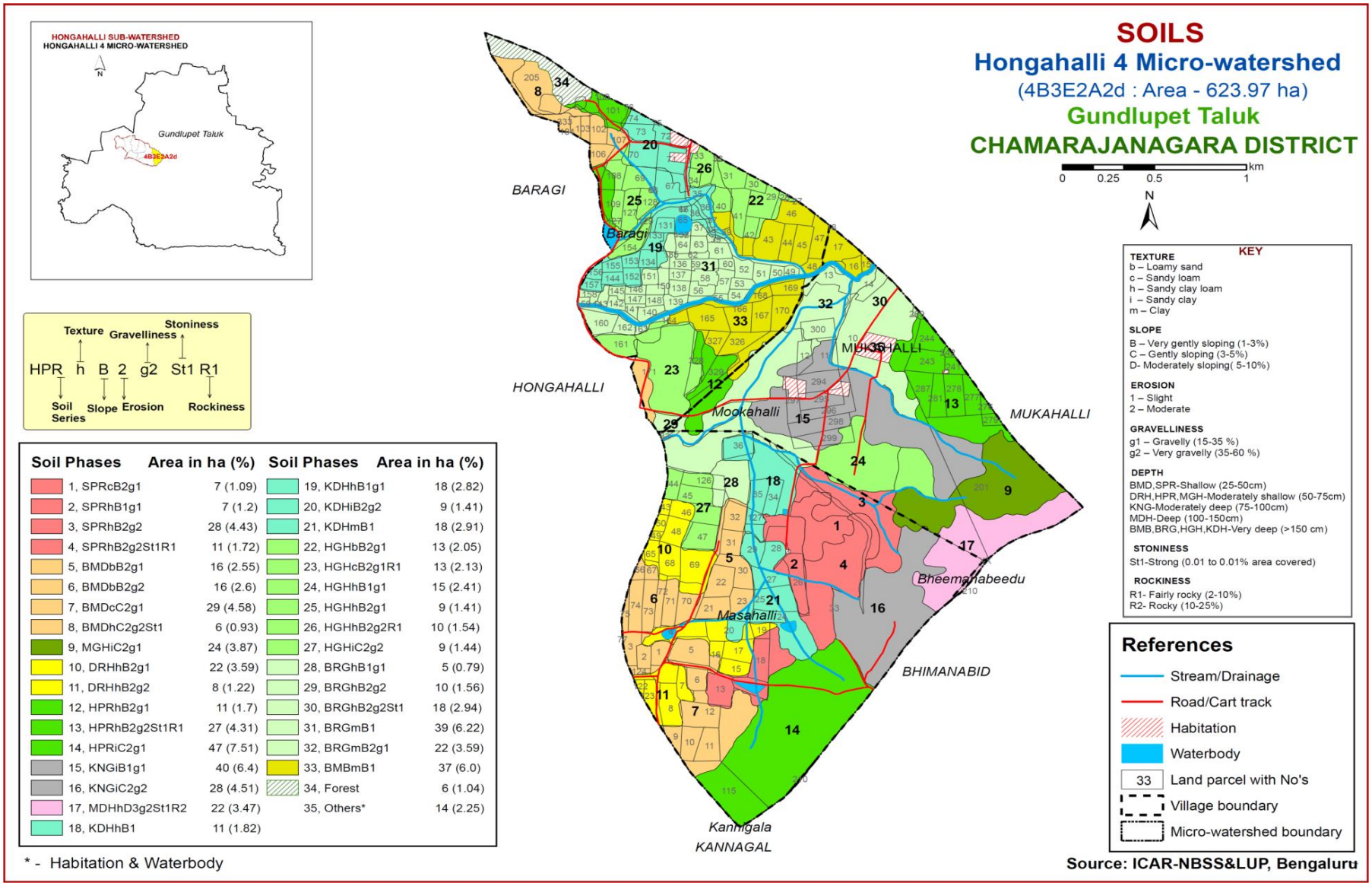
The 33 soil phases identified and mapped in the microwatershed were grouped into 8 Land Use Classes (LUC's) for the purpose of preparing a Proposed Crop Plan for sustained development of the microwatershed. The database (soil phases) generated under LRI was utilized for identifying Land Use Classes (LUC's) 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 LUCs. For Hongahalli-4 microwatershed, five soil and site characteristics, namely soil depth, soil texture, slope, erosion and gravel content have been considered for defining LUCs. The land use classes are expected to behave similarly for a given level of management.

Table 3.2 Soil map unit description of Hongahalli-4 Microwatershed

Soil Map unit No	Soil Series	Soil Phase	Mapping Unit Description	Area in ha (%)
SOILS OF GRANITE GNEISS LANDSCAPE				
	SPR	Shivapura soils are shallow (25-50 cm), well drained, have dark reddish brown gravelly sandy clay loam soils occurring on very gently sloping uplands and very strongly sloping hills, mounds and ridges.		**53 (8.44)**
1		SPRcB2g1	Sandy loam surface, slopes 1-3 %, moderate erosion, gravelly (15-35 %)	7 (1.09)
2		SPRhB1g1	Sandy clay loam surface, slopes 1-3 %, slight erosion, gravelly (15-35 %)	7 (1.20)
3		SPRhB2g2	Sandy clay loam surface, slopes 1-3 %, moderate erosion, very gravelly (35-60 %)	28 (4.43)
4		SPRhB2g2St1R1	Sandy clay loam surface, slopes 1-3 %, moderate erosion, very gravelly (35-60 %), strong stoniness (<2-10%), few to fairly rocky (0.01-0.1%)	11 (1.72)
	BMD	Berambadi soils are shallow (25-50 cm), well drained, have very dark gray to dark brown sandy clay loam soils occurring on very gently to moderately sloping uplands under cultivation		**67 (10.66)**
5		BMDbB2g1	Loamy sand surface, slopes 1-3%, moderate erosion, gravelly (15-35 %)	16 (2.55)
6		BMDbB2g2	Loamy sand surface, slopes 1-3 %, moderate erosion,very gravelly (35-60 %)	16 (2.60)
7		BMDcC2g1	Sandy loam surface, slopes 3-5 %, moderate erosion, gravelly (15-35 %)	29 (4.58)
8		BMDhC2g2St1	Sandy clay loam surface, slopes 3-5 %, moderate erosion, very gravelly (35-60 %), strong stoniness (0.01-0.1%)	6 (0.93)
	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 to moderately sloping uplands		**24 (3.87)**
9		MGHiC2g1	Sandy clay surface, slopes 3-5 %, moderate erosion, gravelly (15-35 %)	24 (3.87)
	DRH	Devarahalli soils are moderately shallow (50-75 cm), well drained, have dark red to reddish brown and dusky red gravelly sandy clay loam soils occurring on very gently to gently sloping uplands under cultivation		**30 (4.81)**
10		DRHhB2g1	Sandy clay loam surface, slopes 1-3 %, moderate erosion, gravelly (15-35 %)	22 (3.59)
11		DRHhB2g2	Sandy clay loam surface, slopes 1-3 %, moderate erosion, very gravelly (35-60 %)	8 (1.22)
	HPR	Hullipura soils are moderately shallow (50-75 cm), well drained, have dark brown to very dark brown gravelly sandy loam to sandy clay soils occurring on very gently to gently sloping uplands		**85 (13.52)**

		under cultivation		
12		HPRhB2g1	Sandy clay loam surface, slopes 1-3 %, moderate erosion, gravelly (15-35 %)	11 (1.70)
13		HPRhB2g2St1R1	Sandy clay loam surface, slopes 1-3 %, moderate erosion, very gravelly (35-60 %), strong stoniness (0.01-0.1%), few to fairly rocky (0.01-0.1%)	27 (4.31)
14		HPRiC2g1	Sandy clay surface, slopes 3-5 %, moderate erosion, gravelly (15-35 %)	47 (7.51)
	KNG	Kannigala soils are moderately deep (75-100 cm), well drained, have dark reddish brown to dark red gravelly sandy clay loam soils occurring on very gently to gently sloping uplands		**68 (10.91)**
15		KNGiB1g1	Sandy clay surface, slopes 1-3 %, slight erosion, gravelly (15-35 %)	40 (6.40)
16		KNGiC2g2	Sandy clay surface, slopes 3-5 %, moderate erosion, very gravelly (35-60 %)	28 (4.51)
	MDH	Maddinahundi soils are deep (100-150 cm), well drained, have dark reddish brown gravelly sandy clay to clay soils occurring on moderately sloping uplands under cultivation.		**22 (3.47)**
17		MDHhD3g2St1R2	Sandy clay loam surface, slopes 5-10 %, severe erosion, very gravelly (35-60%), strong stoniness (0.01-0.1%), rocky (10-25%)	22 (3.47)
	KDH	Kalligaudanahalli soils are very deep (>150 cm), well drained, have dark red to dark reddish brown and dark brown sandy clay loam to sandy clay soils occurring on very gently to gently sloping uplands under cultivation.		**56 (8.96)**
18		KDHhB1	Sandy clay loam surface, slopes 1-3 %, slight erosion	11 (1.82)
19		KDHhB1g1	Sandy clay loam surface, slopes 1-3 %, slight erosion	18 (2.82)
20		KDHiB2g2	Sandy clay surface, slopes 1-3 %, moderate erosion, very gravelly (35-60 %)	9 (1.41)
21		KDHmB1	Clay surface, slopes 1-3 %, slight erosion	18 (2.91)
	HGH	Honnegaudanahalli soils are very deep (>150 cm), well drained, have very dark brown to brown and dark reddish brown sandy clay loam to clay soils occurring on very gently sloping uplands under cultivation.		**69 (10.98)**
22		HGHbB2g1	Loamy sand surface, slopes 1-3 %, moderate erosion, gravelly (15-35%)	13 (2.05)
23		HGHcB2g1R1	Sandy loam surface, slopes 1-3 %, moderate erosion, gravelly (15-35%), few to fairly rocky (<2-10%)	13 (2.13)
24		HGHhB1g1	Sandy clay loam surface, slopes 1-3 %, slight erosion, gravelly (15-35 %)	15 (2.41)
25		HGHhB2g1	Sandy clay loam surface, slopes 1-3 %, moderate erosion, gravelly (15-35 %)	9 (1.41)

26		HGHhB2g2R1	Sandy clay loam surface, slopes 1-3 %, moderate erosion, very gravelly (35-60 %), few to fairly rocky (0.01-0.1%)	10 (1.54)
27		HGHiC2g2	Sandy clay surface, slopes 3-5 %, moderate erosion, very gravelly (35-60 %)	9 (1.44)
	BRG	Bargi soils are very deep (>150 cm), moderately well drained, have very dark brown to very dark grayish brown calcareous cracking clay soils occurring on very gently sloping uplands under cultivation.		**94 (15.1)**
28		BRGhB1g1	Sandy clay loam surface, slopes 1-3 %, slight erosion, gravelly (15-35 %)	5 (0.79)
29		BRGhB2g2	Sandy clay loam surface, slopes 1-3 %, moderate erosion, very gravelly (35-60 %)	10 (1.56)
30		BRGhB2g2St1	Sandy clay loam surface, slopes 1-3 %, moderate erosion, very gravelly (35-60 %), strong stoniness (0.0.1-0.1%)	18 (2.94)
31		BRGmB1	Clay surface, slopes1-3 %, slight erosion	39 (6.22)
32		BRGmB2g1	Clay surface, slopes 1-3 %, moderate erosion, gravelly (15-35%)	22 (3.59)
	BMB	Beemanabeedu soils are very deep (>150 cm), moderately well drained, have very dark greyish brown to dark grey and very dark brown sandy clay to clay soils occurring on very gently sloping lowlands under cultivation		**37 (6.00)**
33		BMBmB1	Clay surface, slopes 1-3 %, slight erosion	37 (6.00)
34	Forest			6 (1.04)
35	Others		Habitation and water body	14 (2.25)



Soil Phases	Area in ha (%)	Soil Phases	Area in ha (%)
1, SPRcB2g1	7 (1.09)	19, KDHhB1g1	18 (2.82)
2, SPRhB1g1	7 (1.2)	20, KDHiB2g2	9 (1.41)
3, SPRhB2g2	28 (4.43)	21, KDHmB1	18 (2.91)
4, SPRhB2g2St1R1	11 (1.72)	22, HGHbB2g1	13 (2.05)
5, BMDbB2g1	16 (2.55)	23, HGHcB2g1R1	13 (2.13)
6, BMDbB2g2	16 (2.6)	24, HGHhB1g1	15 (2.41)
7, BMDcC2g1	29 (4.58)	25, HGHhB2g1	9 (1.41)
8, BMDhC2g2St1	6 (0.93)	26, HGHhB2g2R1	10 (1.54)
9, MGHiC2g1	24 (3.87)	27, HGHiC2g2	9 (1.44)
10, DRHhB2g1	22 (3.59)	28, BRGhB1g1	5 (0.79)
11, DRHhB2g2	8 (1.22)	29, BRGhB2g2	10 (1.56)
12, HPRhB2g1	11 (1.7)	30, BRGhB2g2St1	18 (2.94)
13, HPRhB2g2St1R1	27 (4.31)	31, BRGmB1	39 (6.22)
14, HPRiC2g1	47 (7.51)	32, BRGmB2g1	22 (3.59)
15, KNGiB1g1	40 (6.4)	33, BMBmB1	37 (6.0)
16, KNGiC2g2	28 (4.51)	34, Forest	6 (1.04)
17, MDHhD3g2St1R2	22 (3.47)	35, Others*	14 (2.25)
18, KDHhB1	11 (1.82)		

* - Habitation & Waterbody

Fig 3.5 Soil Phase or Management Units - Hongahalli-4 Microwatershed

Chapter 4

THE SOILS

Detailed information pertaining to the nature, extent and their distribution of different kinds of soils occurring in Hongahalli-4 microwatershed is provided in this chapter. The microwatershed area has been identified as granite gneiss landscape based on geology. In all, 11 soil series are identified. Soil formation is the result of the combined effect of environmental and terrain factors that are reflected in soil morphology. In the granite gneiss landscape, it is by parent material, relief and climate.

A brief description of each of the 11 soil series identified followed by 33 soil phases (management units) mapped are furnished below. The physical and chemical characteristics of soil series identified in Hongahalli-4 microwatershed are given in Table 4.1. The soils in any one map unit differ from place to place in their depth, texture, slope, gravelliness, erosion or any other site characteristic that affect management. The soil phase map can be used for identifying the suitability of areas for growing specific crops or for other alternative uses and also for deciding the type of conservation structures needed. The detailed information on soil and site-characteristics like soil depth, surface soil texture, slope, erosion, gravelliness, AWC, LCC etc, with respect to each of the soil phase identified is given village/survey number wise for the microwatershed in Appendix-I.

4.1 Soils of granite gneiss landscape

In this landscape, 11 soil series are identified and mapped. Brief description of each series identified is given below. Of these, BRG series occupies a maximum area of 94 ha (15%) followed by HPR 85 ha (14%), HGH 69 ha (11%) and KNG 68 ha (11%). The other series occupy minor area in the microwatershed. Brief description of each series identified and number of soil phases mapped is given below.

4.1.1 Shivapura (SPR) Series: Shivapura soils are shallow (25-50 cm), well drained, have dark reddish brown sandy clay loam soils. They have developed from granite gneiss and occur on very gently sloping uplands. The Shivapura series has been classified as a member of the loamy-skeletal, mixed, isohyperthermic family of (paralithic) Rhodustalfs.

The thickness of the solum ranges from 26 to 46 cm. The thickness of A horizon ranges from 9 to 17 cm. Its colour is in 7.5 YR and 2.5 YR hue with value 3 to 4 and chroma 3 to 6. The texture varies from sandy loam to sandy clay with 15 to 25 per cent gravel. The thickness of B horizon ranges from 18 to 30 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 and mapped.

Landscape and Soil Profile characteristics of Shivapura (SPR) Series

4.1.2 Berambadi (BMD) Series: Berambadi soils are shallow (25-50 cm), well drained, have very dark gray to dark brown sandy clay loam soils. They have developed from granite gneiss and occur on very gently to moderately sloping uplands under cultivation. The Berambadi series has been classified as a member of the fine-loamy, mixed, isohyperthermic family of Typic Haplustepts. Four phases were identified and mapped.

The thickness of the solum ranges from 30 to 50 cm. The thickness of A-horizon ranges from 10 to 17 cm. Its colour is in 10 YR hue with value 3 to 4 and chroma 3. The texture varies from sandy loam to sandy clay with 15 to 25 per cent gravel. The thickness of B horizon ranges from 30 to 40 cm. Its colour is in 10YR and 7.5YR hue with value 3 to 4 and chroma 2 to 4. Its texture is sandy clay loam with gravel content of 10 to 15 per cent. The available water capacity is low (50-100 mm/m).

4.1.3 Magoonahalli (MGH) Series: Magoonahalli soils are moderately shallow (50-75 cm), well drained, have very dark brown to dark brown gravelly sandy clay loam soils. They have developed from granite gneiss and occur on very gently to moderately sloping uplands. The Magoonahalli series has been classified as a member of the loamy-skeletal, mixed, isohyperthermic family of Typic Rhodustalfs.

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). Only one phase was identified and mapped.

Landscape and Soil Profile characteristics of Magoonahalli (MGH) Series

4.1.4 Devarahalli (DRH) Series: Devarahalli soils are moderately shallow (50-75 cm), well drained, have dark red to reddish brown and dusky red gravelly sandy clay loam soils. They have developed from granite gneiss and occur on very gently to gently sloping uplands under cultivation. The Devarahalli series has been classified as a member of the fine-loamy, mixed, isohyperthermic family of Typic Rhodustalfs.

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 gravelly sandy clay loam with gravel content of 15 to 35 per cent. The available water capacity is low (50-100 mm/m). Two phases were identified and mapped.

Landscape and Soil Profile characteristics of Devarahalli (DRH) Series

4.1.5 Hullipura (HPR) Series: Hullipura soils are moderately shallow (50-75 cm), well drained, have dark brown to very dark brown gravelly sandy loam to sandy clay soils. They have developed from granite gneiss and occur on very gently to gently sloping uplands under cultivation. The Hullipura series has been classified as a member of the fine-loamy, mixed, isohyperthermic family of Typic Haplustepts.

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 sandy clay with gravel content of 15 to 35 per cent. The available water capacity is low (50-100 mm/m). Three phases were identified and mapped.

Landscape and Soil Profile characteristics of Hullipura (HPR) Series

4.1.6 Kannigala (KNG) Series: Kannigala soils are moderately deep (75-100 cm), well drained, have dark reddish brown to dark red sandy clay loam soils. They have developed from granite gneiss and occur on very gently to strongly sloping uplands. The Kannigala series has been classified as a member of the loamy-skeletal, mixed, isohyperthermic family of Typic Haplustalfs.

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 is gravelly sandy clay loam with 40 to 60 per cent gravel. The available water capacity is very low (<50 mm/m). Two phases were identified and mapped.

Landscape and soil profile characteristics of Kannigala (KNG) Series

4.1.7 Maddinahundi (MDH) Series: Maddinahundi soils are deep (100-150 cm), well drained, have dark reddish brown sandy clay to clay soils. They have developed from granite gneiss and occur on very gently to gently sloping uplands. The Maddinahundi series has been classified as a member of the clayey-skeletal, mixed, isohyperthermic family of Typic Rhodustalfs.

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 to clay with gravel content of >35 per cent. The available water capacity is medium (100-150 mm/m). Only one phase was identified and mapped.

Landscape and Soil Profile characteristics of Maddinahundi (MDH) Series

4.1.8 Kalligaudanahalli (KDH) Series: Kalligaudanahalli soils are very deep (>150 cm), well drained, have dark red to dark reddish brown and dark brown sandy clay to clay soils. They are developed from weathered granite gneiss and occur on very gently to gently sloping uplands under cultivation. The Kalligaudanahalli series has been classified as member of the fine-loamy, mixed, isohyperthermic family of Typic Paleustalfs.

The thickness of the solum ranges from 150-200 cm. The thickness of A horizon ranges from 13 to 19 cm. Its colour is in 7.5 YR, 5 YR and 2.5 YR hue with value 3 and chroma 2 to 6. Texture varies from sandy clay loam to clay with 10 to 15 per cent gravel. The thickness of B horizon is >150 cm. Its colour is in 2.5 YR and 5 YR hue with value 2.5 to 3 and chroma 2 to 3. Texture is sandy clay loam to sandy clay with less than 15 per cent gravel. The available water capacity is very high (>200 mm/m). Four phases were identified and mapped.

Landscape and Soil Profile characteristics of Kalligaudanahalli (KDH) Series

4.1.9 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 to clay soils. They are developed from weathered granite gneiss and occur on very gently sloping upland under cultivation. The Honnegaudanahalli series has been classified as a member of the fine-loamy over clayey, mixed, isohyperthermic family of Typic Haplustepts.

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 to clay with less than 15 per cent gravel. The available water capacity is very high (>200mm/m). Six phases were identified and mapped.

Landscape and Soil Profile characteristics of Honnegaudanahalli (HGH) Series

4.1.10 Bargi (BRG) Series: Bargi soils are very deep (>150 cm), moderately well drained, have very dark grayish brown to dark brown calcareous cracking clay soils. They have developed from granite gneiss and occur on very gently sloping uplands under cultivation.

The thickness of the solum is > 150 cm. The thickness of A horizon ranges from 16 to 20 cm. Its colour is in 10YR hue with value 3 and chroma 2 to 4. The texture is dominantly clay. The thickness of B horizon ranges from 89 to 126 cm. Its colour is in 10YR hue with value 3 to 4 and chroma 2 to 4. Texture is dominantly clay. The available water capacity is very high (>200 mm/m). Five phases were identified and mapped.

4.1.11 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 sandy clay to clay soils. They are developed from weathered granite gneiss and occur on very gently sloping lowlands. The Beemanabeedu series has been classified as a member of the fine, mixed, isohyperthermic family of Typic Haplustepts.

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 less than 15 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 1 to 2. Texture is sandy clay to clay with less than 15 per cent gravel. The available water capacity is very high (>200 mm/m). Only one phase was identified and mapped.

Landscape and Soil Profile characteristics of Beemanabeedu (BMB) Series

Table: 4.1 Physical and Chemical Characteristics of Soil Series identified in Hongahalli-4 microwatershed

Soil Series: Shivapura (SPR), **Pedon:** TR-17/P3

Location: $11^0$43'33"N, $76^0$40'58.6"E, (4B3E2J2a) Shivapura village, Gundlupet taluk, Chamarajanagara district

Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Loamy-skeletal, mixed, isohyperthermic, (paralithic) Rhodustalfs

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-18	Ap	68.60	12.70	18.70	2.44	11.38	20.43	24.90	9.45	-	sl	-	-
18-30	Bt1	52.69	12.78	34.52	8.28	10.46	11.70	14.60	7.66	-	scl	-	-

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-18	7.83	-	-	0.33	0.36	0.41	-	-	0.39	0.08	-	9.80	0.52	100	0.82
18-30	8.00	-	-	0.26	0.28	0.41	-	-	0.31	0.22	-	19.38	0.56	100	1.14

Contd…

Soil Series: Berambadi (BMD), **Pedon:** RM-125

Location: $11^0$43'17"N, $76^0$41' 41.4"E, (4B3E2J2a) Hundipur village, Gundlupet taluk, Chamarajanagara district

Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Fine-loamy, mixed, isohyperthermic Typic Haplustepts

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-12	Ap	64.81	10.27	24.92	5.78	13.11	18.99	17.54	9.39	-	scl	-	-
12-30	A1	63.68	11.19	25.13	5.52	12.59	16.86	19.98	8.74	-	scl	-	-
30-43	Bw	55.49	10.87	33.65	17.55	10.76	11.29	10.14	5.75	-	scl	-	-

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-12	8.28	-	-	0.23	0.74	1.02	-	-	0.73	0.15	-	18.13	0.73	100	0.83
12-30	8.61	-	-	0.18	0.70	1.14	-	-	0.98	0.54	-	19.61	0.78	100	2.75
30-43	8.68	-	-	0.20	0.51	2.28	-	-	0.48	0.58	-	19.15	0.57	1003	3.03

Contd…

Soil Series: Magoonahalli (MGH), **Pedon:** RM-80

Location: $11^0$42’59”N, $76^0$38’36.5”E, (4B3E2H1b) Magoonahalli village, Gundlupet taluk, Chamarajanagara district

Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Loamy-skeletal, mixed, isohyperthermic Typic Rhodustalfs

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-12	Ap	74.82	11.17	14.01	7.31	9.95	14.92	24.97	17.66	-	sl	-	-
12-32	Bt1	63.65	11.76	25.59	14.77	12.02	12.83	14.66	9.37	-	scl	-	-
32-50	Bt2	59.88	14.94	25.18	13.44	12.83	12.42	14.15	7.03	-	scl	-	-
50-60	Bc	67.38	11.65	20.97	10.94	17.22	14.49	16.01	8.92	-	scl	-	-

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-12	6.42	-	-	0.13	0.74	0.00	-	-	0.35	0.12	-	14.02	1.00	100	0.86
12-32	6.44	-	-	0.07	0.70	0.00	-	-	0.14	0.08	-	9.35	0.37	100	0.86
32-50	6.83	-	-	0.05	0.62	0.00	-	-	0.12	0.12	-	7.87	0.31	100	1.52
50-60	6.92	-	-	0.04	0.51	0.00	-	-	0.11	0.14	-	7.75	0.37	100	1.81

Contd…

Soil Series: Devarahalli (DRH) (Pedon: TR17/P1)

Location: $11^0$42'57.4"N, $76^0$40'41.4"E, (4B3E2J2a) Shivapura village, Gundlupet taluk, Chamarajanagara district

Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Fine-loamy, mixed, isohyperthermic Typic Rhodustalfs

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-14	Ap	77.94	12.17	9.89	5.47	9.31	16.50	25.11	20.55	30	sl	-	-
14-29	Bt1	58.64	15.33	26.03	7.41	11.01	12.45	16.67	11.11	15	scl	-	-
29-55	Bt2	58.99	14.28	26.73	11.36	12.40	11.88	13.95	9.40	40	scl	-	-

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-14	5.43	-	-	0.13	0.46	0.00	3.05	1.04	0.21	0.01	4.31	11.40	1.15	38	0.09
14-29	6.64	-	-	0.08	0.43	0.00	9.33	2.90	0.21	0.08	12.52	13.45	0.52	93	0.59
29-55	6.81	-	-	0.06	0.39	0.00	10.13	2.76	0.17	0.12	13.18	13.22	0.49	100	0.91

Contd…

Soil Series: Hullipura (HPR), **Pedon:** RM-126

Location: $11^0$43'21.8"N, $76^0$41' 28.1"E, (4B3E2J2a) Hundipur village, Gundlupet taluk, Chamarajanagara district

Analysis at: NBSS&LUP, Regional Centre, Bangalore **Classification:** Fine-loamy, mixed, isohyperthermic Typic Haplustepts

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-15	Ap	47.38	17.57	35.05	7.38	9.95	8.98	10.80	10.27	-	sc	-	-
15-28	Bw1	49.95	18.96	31.10	7.21	10.29	9.97	12.51	9.97	-	scl	-	-
28-55	Bc	70.38	11.41	18.21	6.23	13.18	14.20	21.45	15.32	-	sl	-	-

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-15	8.36	-	-	0.36	0.60	2.34	-	-	0.93	0.43	-	24.17	0.69	100	1.78
15-28	8.36	-	-	0.37	0.72	3.30	-	-	1.10	0.61	-	6.16	0.20	100	9.90
28-55	8.73	-	-	0.23	0.24	0.84	-	-	0.41	0.85	-	16.30	0.90	100	5.21

Contd…

Soil Series: Kannigala (KNG), **Pedon:** TR-26/1

Location: $11^0$47'25.9"N, $76^0$34'11"E, (4B3E2E2f) Hongahalli-4 village, Gundlupet taluk, Chamarajanagaraja district

Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Loamy-skeletal, mixed, isohyperthermic, Typic haplustalfs

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-15	Ap	65.41	16.99	17.60	4.18	6.02	15.71	25.61	13.88	-	sl	-	-
15-38	BA	63.15	10.36	26.48	11.98	15.56	11.26	14.43	9.93	-	scl	-	-
38-72	Bt1	61.51	9.22	29.28	22.20	11.00	10.79	10.49	7.03	-	scl	-	-
72-100	Bt2	50.82	16.19	32.99	10.25	8.20	12.50	9.32	10.55	-	scl	-	-

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-15	5.41	-	-	0.23	0.76	0.06	4.23	1.11	0.32	0.04	5.70	6.82	0.39	84	0.59
15-38	6.61	-	-	0.09	0.60	0.09	6.69	1.40	0.15	0.11	8.34	8.74	0.33	95	1.26
38-72	7.01	-	-	0.05	0.32	0.12	-	-	0.20	0.27	-	6.82	0.23	100	3.96
72-100	6.66	-	-	0.05	0.28	0.24	-	-	0.12	0.38	-	1.15	0.03	100	33.04

Contd…

Soil Series: Maddinahundi (MDH) (Pedon: RM205)

Location: (4B3E2E2g) Kannigala village, Gundlupet taluk and Chamarajanagara district

Analysis at: NBSS&LUP, Regional Centre, Bangalore **Classification:** Clayey-skeletal, mixed, isohyperthermic Typic Rhodustalfs

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-20	Ap	81.73	9.04	9.24	5.92	15.36	21.08	24.90	14.46	20	ls	-	-
20-40	Bt1	58.51	9.25	32.24	10.19	11.11	13.25	15.19	8.77	20	scl	-	-
40-64	Bt2	41.16	9.23	49.61	9.25	7.48	9.77	9.25	5.41	40	c	-	-
64-92	Bt3	42.49	8.06	49.46	6.74	7.67	11.19	10.05	6.84	45	c	-	-
92-112	Bt4	42.53	12.73	44.74	5.92	15.36	21.08	24.90	14.46	45	c	-	-
112-134	Bc	50.77	11.92	37.31	10.19	11.11	13.25	15.19	8.77	25	sc	-	-

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-20	4.49	-	-	0.18	0.43	0.00	0.91	0.44	0.21	0.28	1.83	1.82	0.20	100	15.38
20-40	5.28	-	-	0.05	0.51	0.00	5.55	2.00	0.23	0.17	7.95	11.17	0.35	71	1.52
40-64	5.95	-	-	0.04	0.47	0.47	-	-	0.25	0.27	-	13.00	0.26	100	2.08
64-92	6.69	-	-	0.05	0.39	0.45	-	-	0.24	0.32	-	14.48	0.29	100	2.21
92-112	7.41	-	-	0.06	0.15	0.76	-	-	0.26	0.41	-	13.00	0.29	100	3.15
112-134	7.64	-	-	0.06	0.19	0.45	-	-	0.24	0.42	-	14.36	0.38	100	2.92

Contd…

Soil Series: Kalligaudanahalli (KDH), **Pedon:** RM-73

Location: $11^0$42'58.1"N, $76^0$39'44"E, (4B3E2H1b) Kalligaudanahalli village, Gundlupet taluk and Chamarajanagara district

Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Fine-loamy, mixed, isohyperthermic Typic Paleustalfs

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-27	Ap	58.04	14.10	27.86	2.58	4.23	17.73	16.19	17.32	-	scl	-	-
27-45	Bt1	61.41	12.10	26.48	4.71	10.13	13.61	19.55	13.41	-	scl	-	-
45-66	Bt2	68.99	7.47	23.54	6.55	14.23	18.63	19.86	9.72	-	scl	-	-
66-92	Bt3	61.78	10.30	27.92	6.40	11.57	14.88	16.84	12.09	-	scl	-	-
92-115	Bt4	49.16	14.82	36.01	4.49	9.39	11.48	13.88	9.92	-	sc	-	-
115-134	Bt5	55.60	12.77	31.58	6.63	10.57	13.06	15.85	9.53	-	scl	-	-
134-160	Bt6	47.35	14.43	38.21	3.32	9.66	11.94	12.36	12.36	-	sc	-	-
160-180	Bt7	51.29	13.11	35.60	4.75	11.56	14.24	13.00	13.00	-	sc	-	-

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-27	8.03	-	-	0.13	0.62	0.30	-	-	0.53	0.10	-	13.91	0.50	100	0.72
27-45	7.96	-	-	0.12	0.50	0.10	-	-	0.42	0.04	-	13.57	0.51	100	0.29
45-66	7.95	-	-	0.08	0.39	0.00	-	-	0.29	0.07	-	11.40	0.48	100	0.61
66-92	7.96	-	-	0.07	0.35	0.00	-	-	0.34	0.15	-	13.45	0.48	100	1.12
92-115	7.98	-	-	0.11	0.54	0.48	-	-	0.37	0.08	-	16.64	0.46	100	0.48
115-134	8.04	-	-	0.06	0.35	0.24	-	-	0.34	0.15	-	15.85	0.50	100	0.95
134-160	8.07	-	-	0.07	0.35	0.06	-	-	0.37	0.15	-	17.56	0.46	100	0.85
160-180	8.11	-	-	0.07	0.31	0.48	-	-	0.43	0.18	-	18.24	0.51	100	0.99

Contd…

Soil Series: Honnegaudanahalli (HGH), **Pedon**: RM-33

Location: $11^0$45'42.5"N, $76^0$36'46.2"E, (4B3E2F1c) Honnegaudanahalli village, Gundlupet taluk and Chamarajanagara district

Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Fine-loamy over clayey, mixed, isohyperthermic Typic Haplustepts

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
Ap	0-18	66.23	11.55	22.23	2.95	10.89	18.41	21.36	12.61	-	scl	-	-
Bw1	18-30	62.83	16.68	20.49	3.77	10.90	15.99	21.59	10.59	-	scl	-	-
Bw2	30-52	59.33	16.64	24.03	2.14	10.91	13.56	18.76	13.97	-	scl	-	-
Bw3	52-78	65.74	11.85	22.41	3.69	13.13	16.00	19.49	13.44	-	scl	-	-
Bw4	78-100	68.91	10.58	20.51	3.16	6.73	25.08	21.61	12.33	-	scl	-	-
Bw5	100-148	30.06	14.12	55.82	1.57	9.81	6.78	6.58	5.32	-	c	-	-
Bw6	148-160	22.82	29.70	47.48	1.49	4.13	6.54	5.39	5.28	-	c	-	-
Bw7	160-190	24.83	28.46	46.71	0.80	2.86	8.47	6.18	6.52	-	c	-	-

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-18	7.37	-	-	0.18	0.5	0.00	-	-	0.74	0.13	-	8.66	0.39	100	1.50
18-30	7.55	-	-	0.11	0.46	0.00	-	-	0.37	0.06	-	8.66	0.42	100	0.69
30-52	7.78	-	-	0.08	0.39	0.00	-	-	0.27	0.07	-	10.03	0.42	100	0.70
52-78	7.98	-	-	0.08	0.39	0.00	-	-	0.21	0.09	-	8.55	0.38	100	1.05
78-100	8.01	-	-	0.05	0.31	0.00	-	-	0.23	0.22	-	8.32	0.41	100	2.64
100-148	7.86	-	-	0.09	0.43	7.20	-	-	0.56	0.51	-	25.65	0.46	100	1.99
148-160	8.47	-	-	0.18	0.35	5.88	-	-	0.42	0.51	-	23.37	0.49	100	2.18
160-190	8.55	-	-	0.17	0.27	6.48	-	-	0.45	0.56	-	23.57	0.50	100	2.38

Contd…

Soil Series: Bheemanabeedu (BMB), **Pedon:** RM-34

Location: $11^0$43'45.9"N, $76^0$37'18.6"E, (4B3E2F1c) Honnegaudanahalli village, Gundlupet taluk**,** Chamarajanagara district

Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Fine, mixed, isohyperthermic Typic Haplustepts

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-13	Ap	63.25	17.32	19.42	3.89	9.31	13.61	19.14	17.30	-	sc	-	-
13-32	Bw1	61.95	18.00	20.05	3.18	12.21	13.54	18.56	14.46	-	sc	-	-
32-53	Bw2	54.42	20.16	25.42	3.89	9.79	12.63	14.95	13.16	-	sc	-	-
53-76	Bw3	40.54	20.40	39.05	2.40	8.25	9.82	11.91	8.15	-	c	-	-
76-114	Bw4	35.54	17.90	46.56	2.00	7.36	8.94	9.88	7.36	-	c	-	-
114-146	Bw5	28.31	19.25	52.44	2.55	5.73	6.68	6.89	6.47	-	c	-	-
146-180	Bw6	19.43	27.91	52.66	1.61	2.35	3.84	6.06	5.57	-	c	-	-

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-13	7.59	-	-	0.48	0.78	0.59	-	-	1.04	0.17	-	10.83	0.56	100	1.57
13-32	7.94	-	-	0.18	0.66	0.35	-	-	0.62	0.26	-	11.74	0.59	100	2.21
32-53	8.11	-	-	0.13	0.58	0.76	-	-	0.41	0.59	-	14.71	0.58	100	4.01
53-76	8.34	-	-	0.12	0.54	0.71	-	-	0.49	0.92	-	25.31	0.65	100	3.63
76-114	8.21	-	-	0.20	0.50	1.59	-	-	0.64	0.82	-	28.39	0.61	100	2.89
114-146	8.37	-	-	0.27	0.46	2.47	-	-	0.51	0.65	-	30.55	0.58	100	2.13
146-180	8.46	-	-	0.27	0.35	5.28	-	-	0.57	0.94	-	35.34	0.67	100	2.66

Chapter 5

INTERPRETATION FOR LAND RESOURCE MANAGEMENT

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

5.1 Land Capability Classification

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

Soil Characteristics: Depth, texture, gravelliness, calcareousness.

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

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

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

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

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

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

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

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

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

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

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

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

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

The 33 soil map units identified in the Hongahalli-4 microwatershed are grouped under 3 land capability classes and 6 subclasses. About 604 ha area (97%) in the microwatershed is suitable for agriculture (Fig. 5.1). An area of about 6 ha (1%) is covered by forest and 14 ha (2%) by others (habitation).

Good cultivable lands (Class II) cover an area of about 23 per cent and are distributed in the central, northwestern and northeastern part of the microwatershed with minor problems of soil and erosion. Moderately good cultivable lands (Class III) cover an area of about 59 per cent and are distributed in all parts of the microwatershed with moderate problems of soil and erosion. Fairly good lands (Class IV) cover an area of about 15 per cent and are distributed in the central, eastern, southern and northern part of the microwatershed with severe problems of soil and erosion.

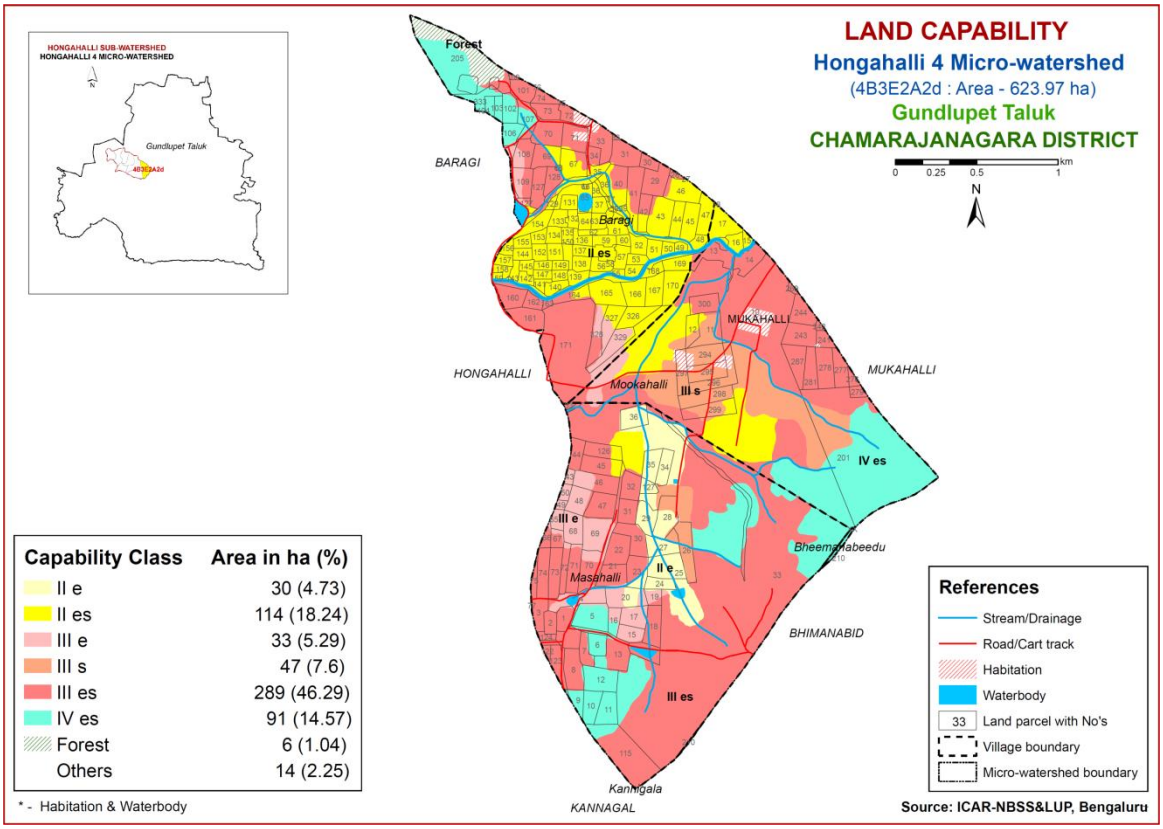


Fig. 5.1 Land Capability map of Hongahalli-4 Microwatershed

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 given in Fig. 5.2.

Shallow (25-50 cm) soils occur in an area of 119 ha (19%) and are distributed in the central, northern and southern part of the microwatershed. Moderately shallow (50-75 cm) soils occupy an area of about 138 ha (22%) and are distributed in all parts of the microwatershed. Moderately deep (75-100 cm) soils occupy an area of 68 ha (11%) and are distributed in the central and southeastern part of the microwatershed. Deep (100-150 cm) soils occupy 22 ha (3%) area and are distributed in the central and eastern part of the microwatershed. Very deep (>150 cm) soils cover a maximum area of 256 ha (41%) and are distributed all parts of the microwatershed.

The most productive lands 278 ha (45%) with respect to soil rooting depth where all climatically adapted annual and perennial crops can be grown are deep to very deep

(100 to >150 cm depth) soils occurring in the major part of the microwatershed. The problem soils cover about 119 ha (19%) where only short duration crops can be grown. The probability of crop failure is high.

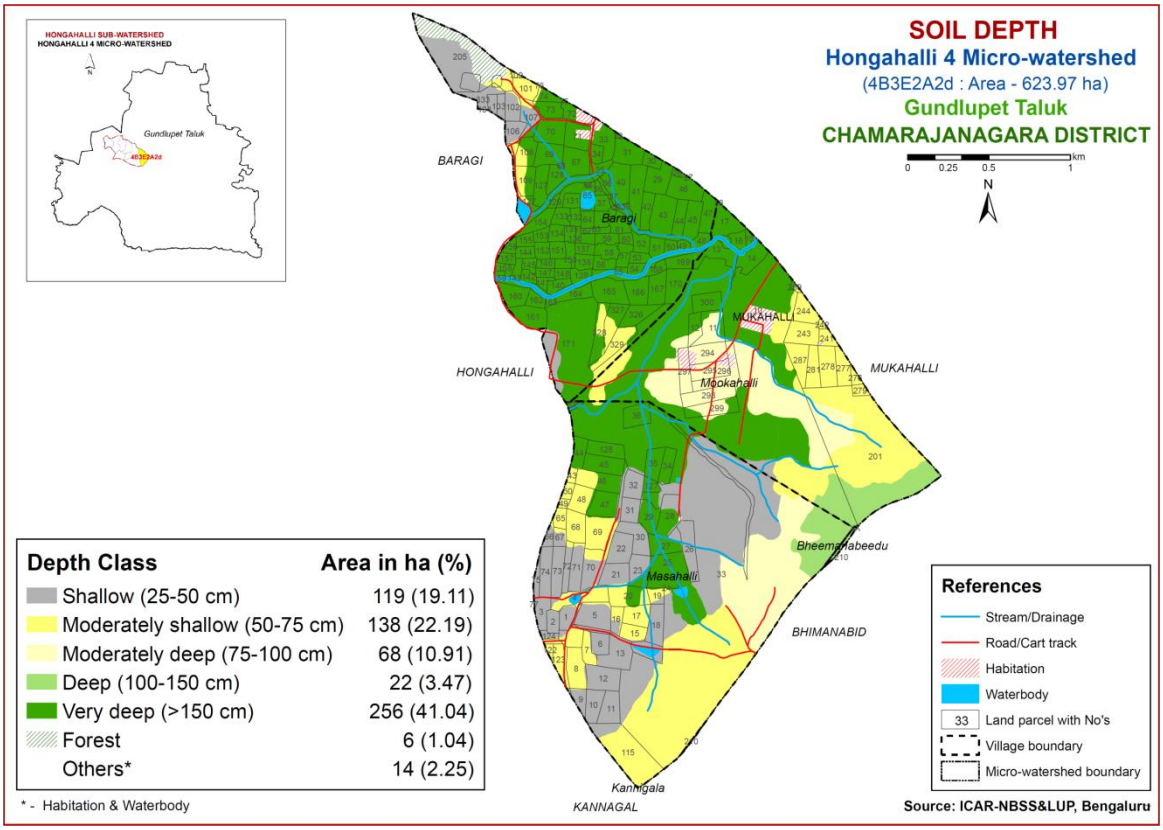


Fig. 5.2 Soil Depth map of Hongahalli-4 Microwatershed

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.

An area of about 45 ha (7%) has soils that are sandy at the surface and are distributed in the central, western and southwestern part of the microwatershed. Maximum area of about 285 ha (46%) soils are loamy and are distributed in the major part of the microwatershed. An area of 274 ha (44%) has soils that are clayey at the surface and occur in all parts of the microwatershed.

Entire area has most productive lands with respect to surface soil texture. The clayey soils (44%) have high potential for soil-water retention and availability, and

nutrient retention and availability, but have more problems of drainage, infiltration, workability and other physical problems. The other productive lands (46%) are loamy soils which also have high potential for soil-water retention and nutrient availability but have no drainage or other physical problems. The sandy soils are also productive for specific root and tuber crops, but these soils has the major limitation of moisture and nutrient retention, hence frequent and shallow irrigation is to be followed in order to get better crop yields.

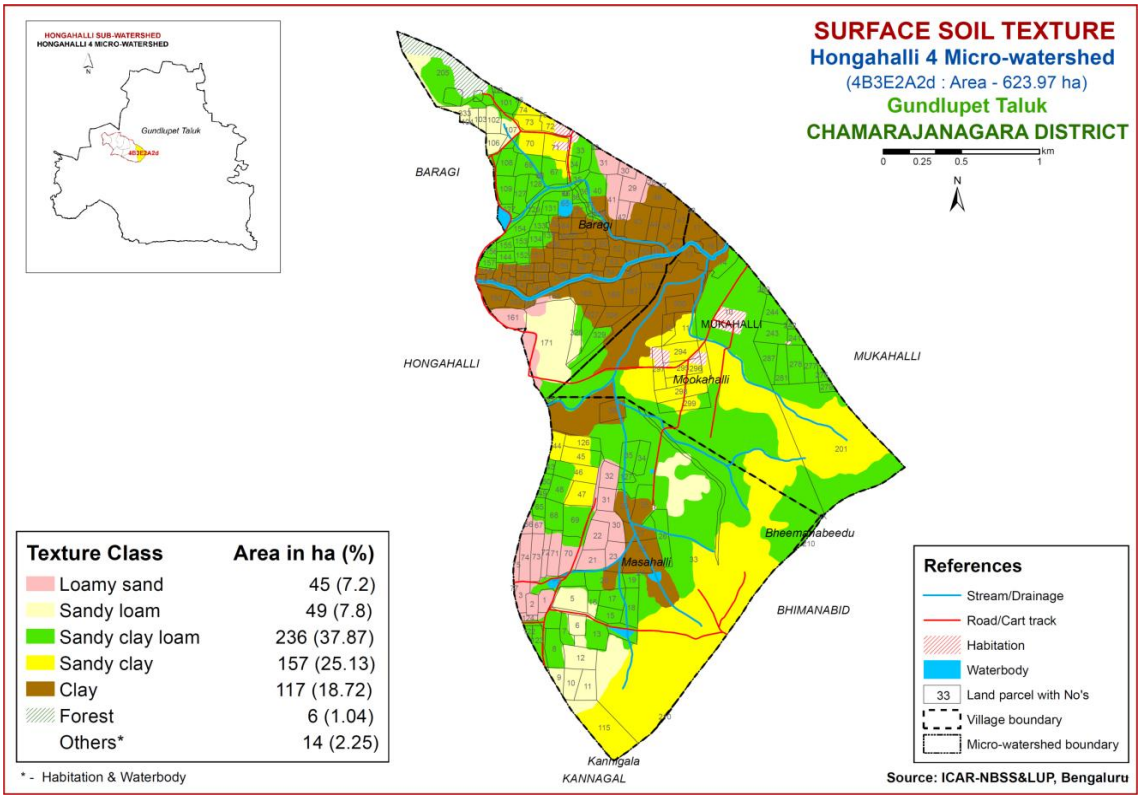


Fig. 5.3 Surface Soil Texture map of Hongahalli-4 Microwatershed

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 soil reduces the volume of soil responsible for moisture and nutrient storage, drainage, infiltration and runoff, and hinders plant growth by impeding root growth and seedling emergence, intercultural operations and farm mechanization. The gravelliness classes used in LRI were used to classify the soils and using these classes a gravelliness map was generated. The area extent and their geographic distribution in the microwatershed is shown in Figure 5.4.

Non gravelly (<15%) soils cover an area of about 106 ha (17%) and are distributed in the central and northeastern part of the microwatershed. Maximum area of about 298 ha (48%) is gravelly (15-35%) and are distributed in the major part of the microwatershed. Very gravelly (35-60%) soils cover an area of 200 ha (32%) and are distributed in all parts of the microwatershed.

The problem soils (80%) that are gravelly and very gravelly (15-60%), where only short or medium duration crops can be grown are distributed in the major part of the microwatershed. The most productive soils (17%) are non gravelly (<15%) and are distributed in the central and northeastern part of the microwatershed where all climatically adapted long duration crops can be grown.

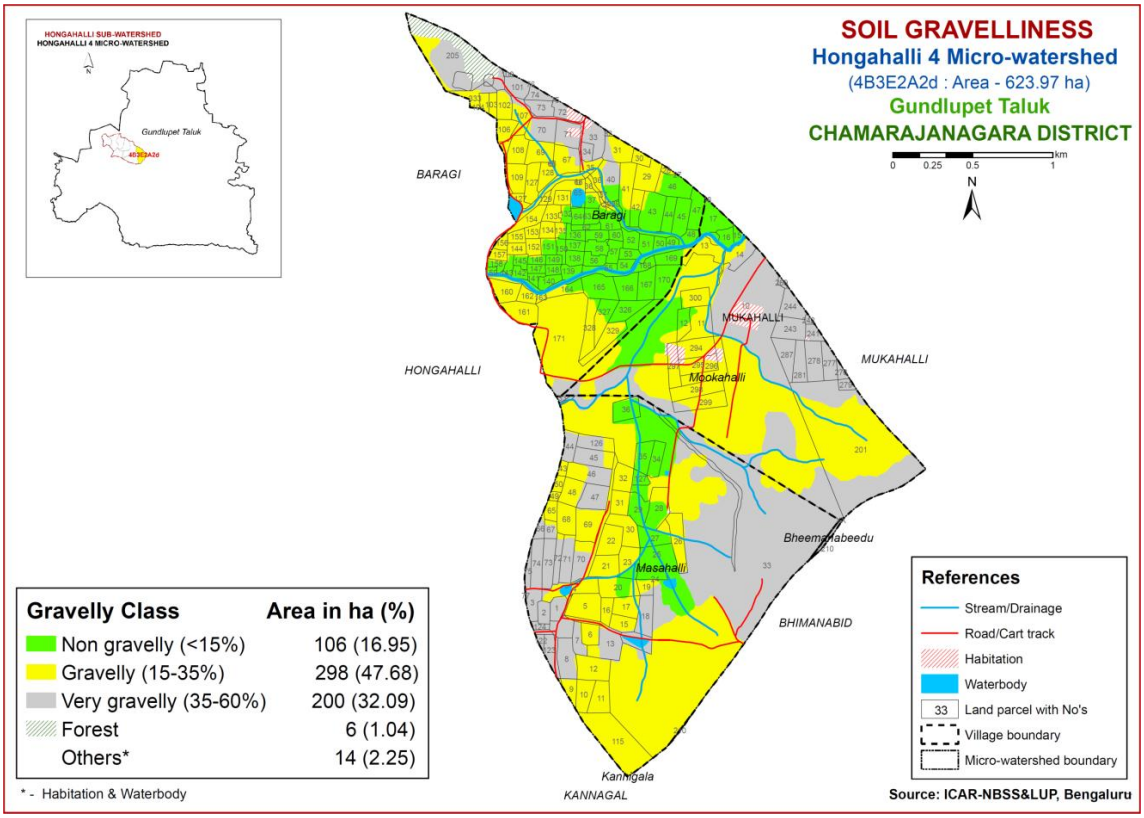


Fig. 5.4 Soil Gravelliness map of Hongahalli-4 Microwatershed

5.5 Available Water Capacity

The soil available water capacity (AWC) is estimated based on the ability of the soil column to retain water between the tensions of 0.33 and 15 bar in a depth of 100 cm or the entire solum if the soil is shallower. The AWC of the soils (soil series) as estimated by considering the soil texture, mineralogy, soil depth and gravel content (Sehgal *et al.*, 1990) and accordingly the soil map units were grouped into five AWC classes *viz*, very low (<50 mm/m), low (50-100 mm/m), medium (100-150 mm/m), high (150-200 mm/m) and very high (>200 mm/m) and using these values, an AWC map was generated. The area extent and their geographic distribution of different AWC classes in the microwatershed is given in Figure 5.5.

An area of about 211 ha (34%) and 136 ha (22%) in the microwatershed has soils that are very low (<50 mm/m) and low (51-100 mm/m) in available water capacity respectively and are distributed in all parts of the microwatershed, Maximum area of about 256 ha (41%) is very high (>200 mm/m) in available water capacity and are distributed in the major part of the microwatershed.

About 347 ha (56%) area in the microwatershed has soils that are problematic with regard to available water capacity. Here, only short duration crops can be grown and the probability of crop failure is very high. These areas are best put to other alternative uses. An area of 256 ha (41%) are potential areas with regard to AWC where all climatically adapted annual and perennial crops can be grown.

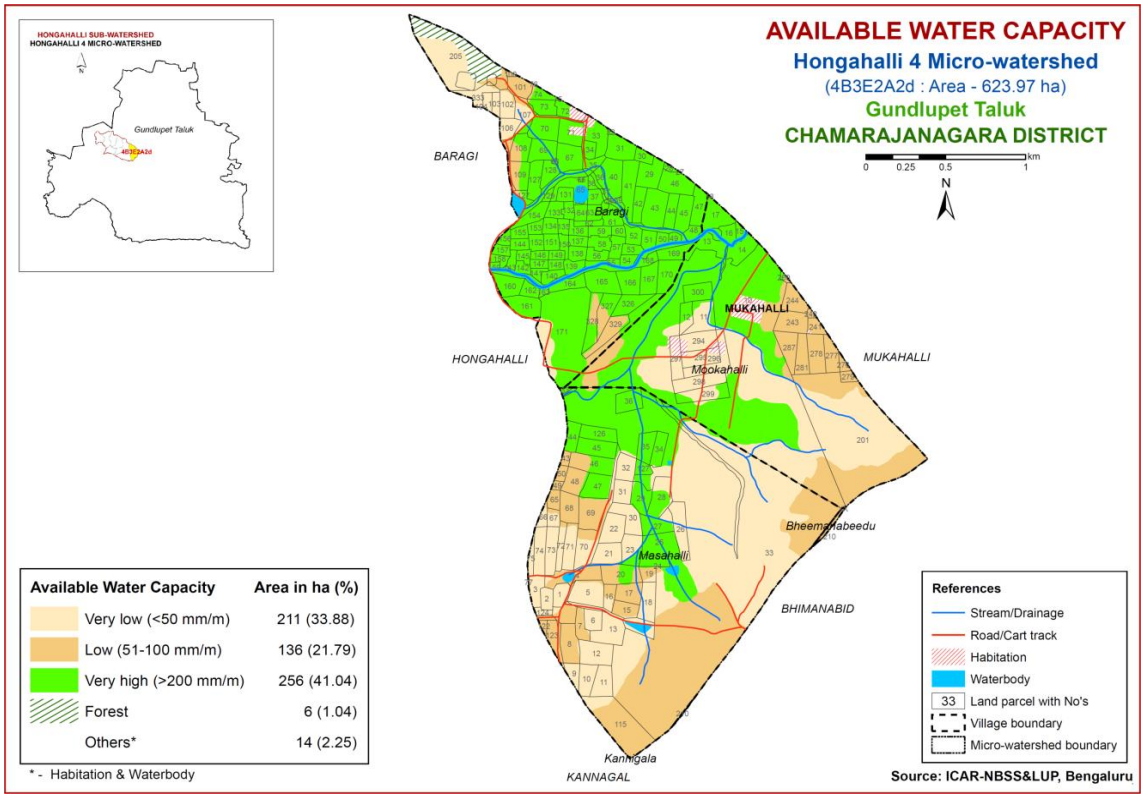


Fig. 5.5 Soil Available Water Capacity map of Hongahalli-4 Microwatershed

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 three slope classes and a slope map was generated showing the area extent and their geographic distribution in the microwatershed (Fig. 5.6).

Maximum area of about 439 ha (70%) falls under very gently sloping (1-3% slope) lands and is distributed in the major part of the microwatershed. An area of about 143 ha (23%) are gently sloping (3-5%) and are distributed in the northern, western, central, southern and eastern part of the microwatershed. Small area of about 22 ha (3%) is under moderately sloping (5-10%) and are distributed in the eastern part of the microwatershed.

An area of 439 ha (70%) 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. An area of 165 (26%) are problematic and require appropriate soil and water conservation measures.

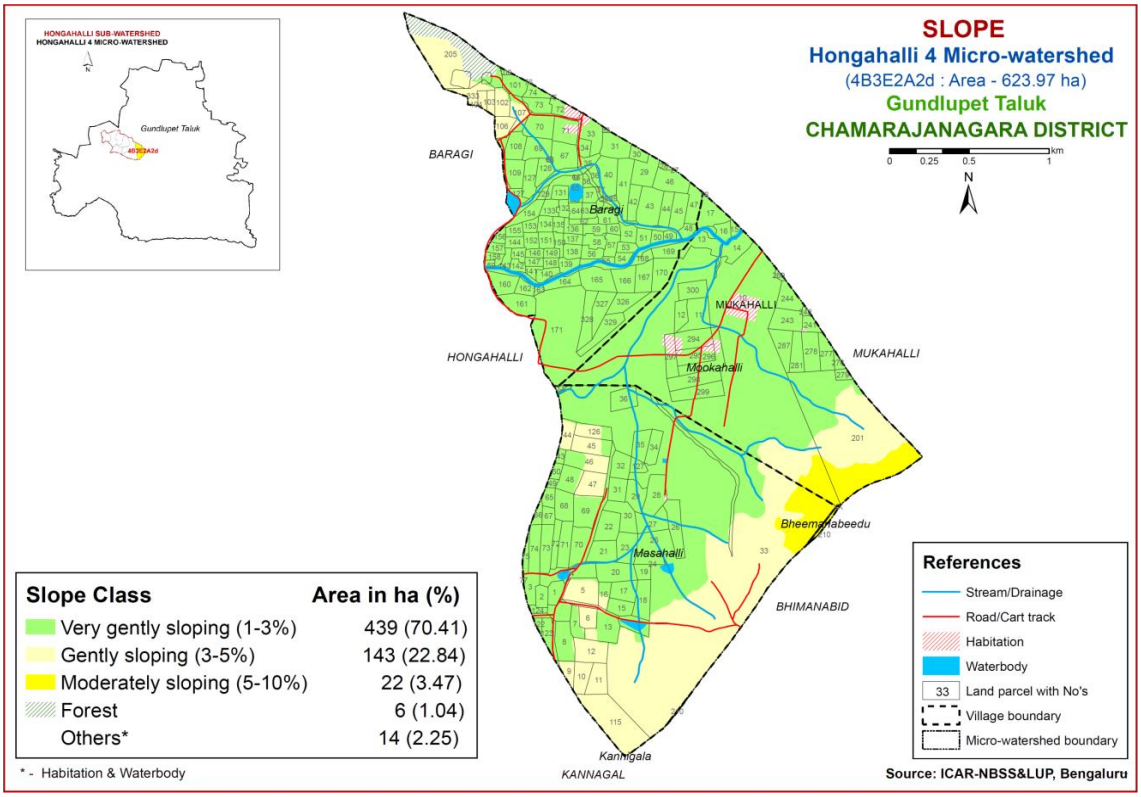


Fig. 5.6 Soil Slope map of Hongahalli-4 Microwatershed

5.7 Soil Erosion

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

Soils that are slightly eroded (e1 class) cover an area of 191 ha (31%) and are distributed in the central, northeastern and eastern part of the microwatershed. Moderately eroded (e2 class) soils cover a maximum area of about 391 ha (63%) in the microwatershed. They are distributed in all parts of the microwatershed. Severely eroded soils cover a small area of 22 ha (3%) and are distributed in the eastern part of the microwatershed.

Maximum area of about 413 ha (66%) in the microwatershed is problematic because of moderate and severe erosion. For these areas, taking up soil and water conservation and other land development measures are needed.

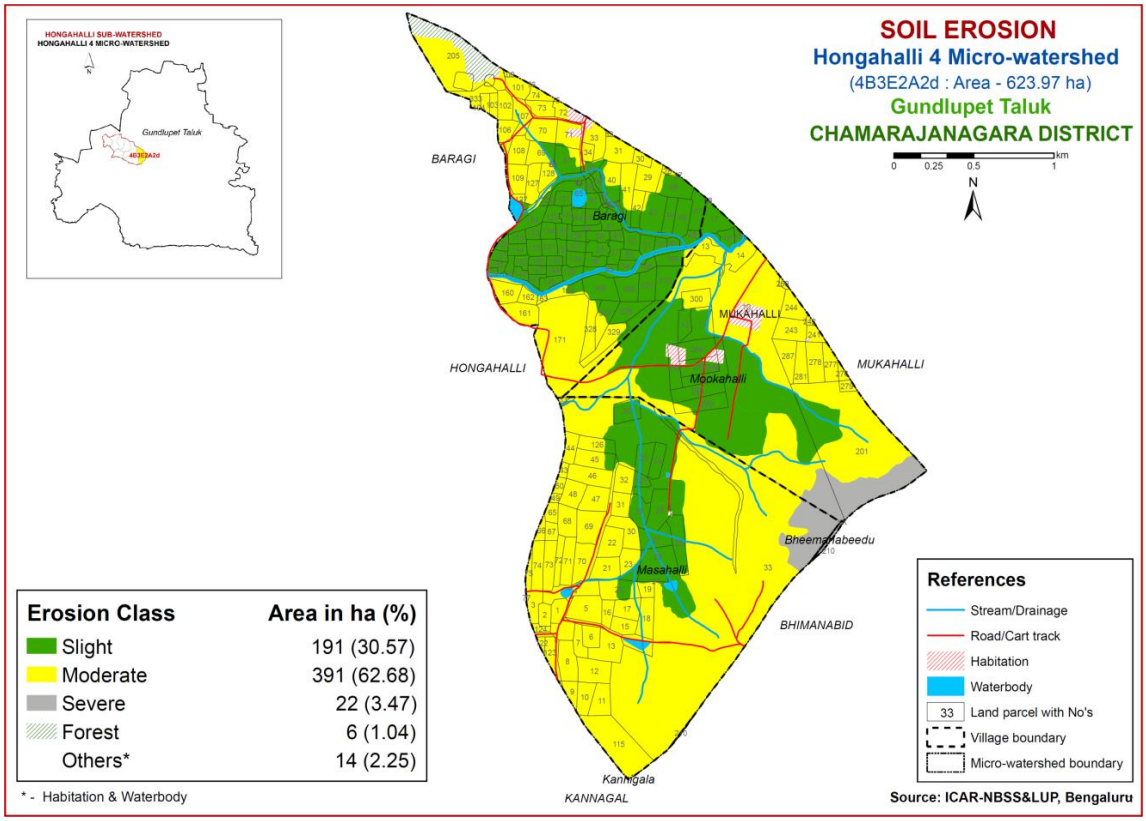


Fig. 5.7 Soil Erosion map of Hongahalli-4 Microwatershed

Chapter 6

FERTILITY STATUS

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

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

6.1 Soil Reaction (pH)

The soil analysis of the Hongahalli-4 microwatershed for soil reaction (pH) showed that a small area of about 40 ha (6%) is moderately acid (pH 5.5-6.0) and are distributed in the central, western and southwestern part of the microwatershed. An area of 153 ha (24%) is slightly acid (pH 6.0-6.5) and are distributed in the central, southern, southwestern and southeastern part of the microwatershed. Maximum area of 215 ha (34%) is neutral (pH 6.5-7.3) and are distributed in all parts of the microwatershed. An area of about 113 ha (18%) is slightly alkaline (pH 7.3-7.8) and are distributed in the central, eastern and northeastern part of the microwatershed. An area of about 83 ha (13%) are moderately alkaline (pH 7.8-8.4) and are distributed in the central and northeastern 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 dS m^{-1} (Fig 6.2) and as such the soils are non-saline.

6.3 Organic Carbon

The soil organic carbon content (an index of available Nitrogen) in the soils of the microwatershed is high (>0.75) in an area of about 124 ha (20%) and are distributed in the southern, central and southeastern part of the microwatershed, medium (0.5-0.75%) covering a maximum area of about 386 ha (62%) and are distributed in the major part of the microwatershed, whereas low (<0.5%) in about 92 ha (15%) area and are distributed in the central, northern and southwestern part of the microwatershed (Fig. 6.3).

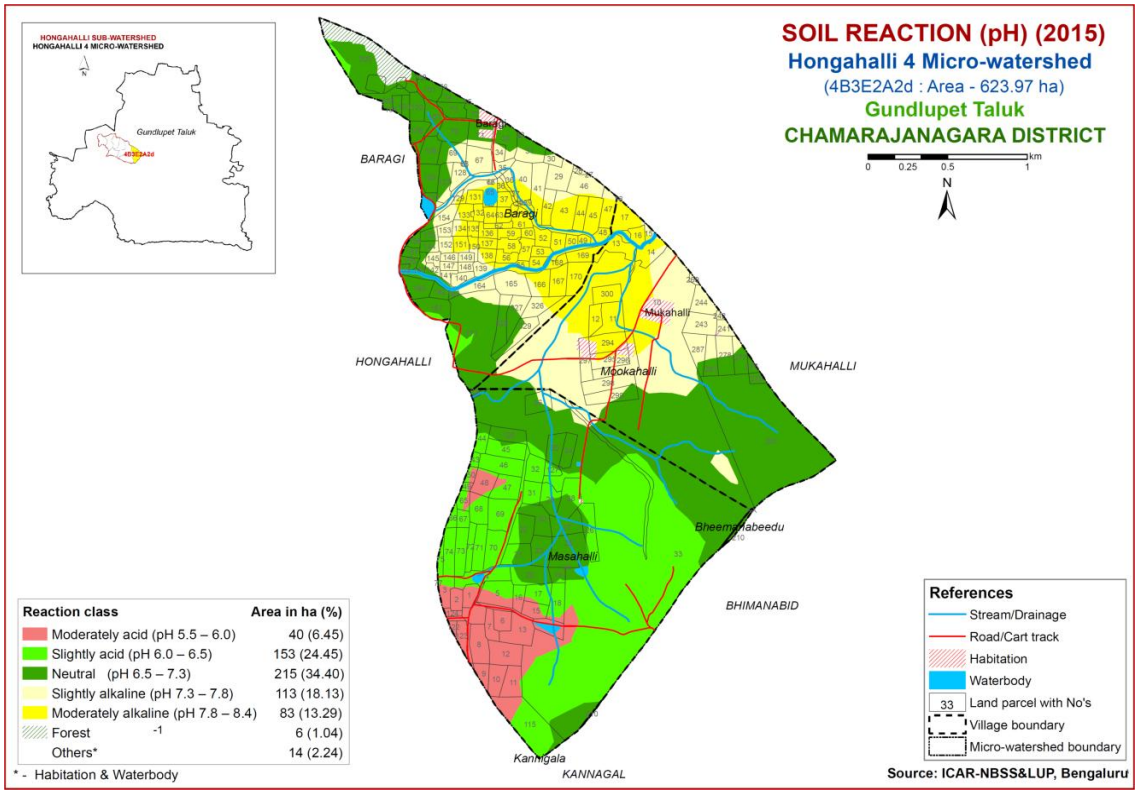


Fig.6.1 Soil Reaction (pH) map of Hongahalli-4 Microwatershed

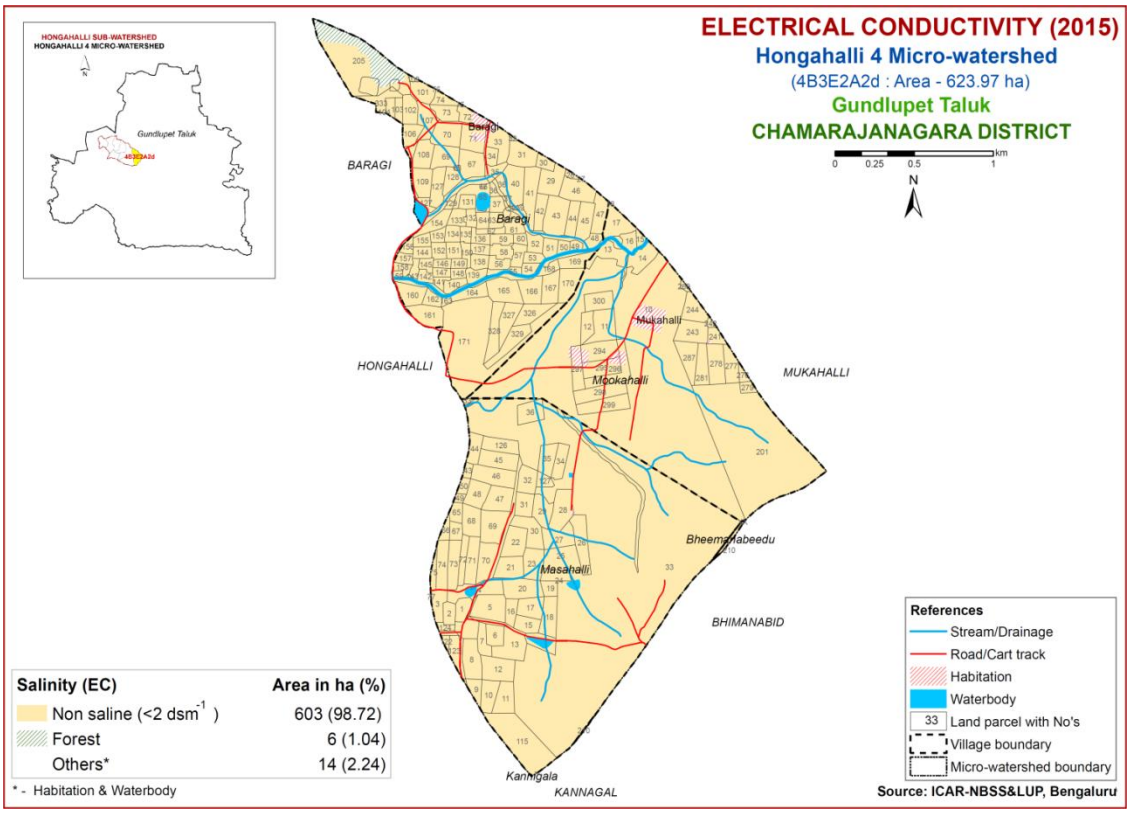


Fig.6.2 Electrical Conductivity (EC) map of Hongahalli-4 Microwatershed

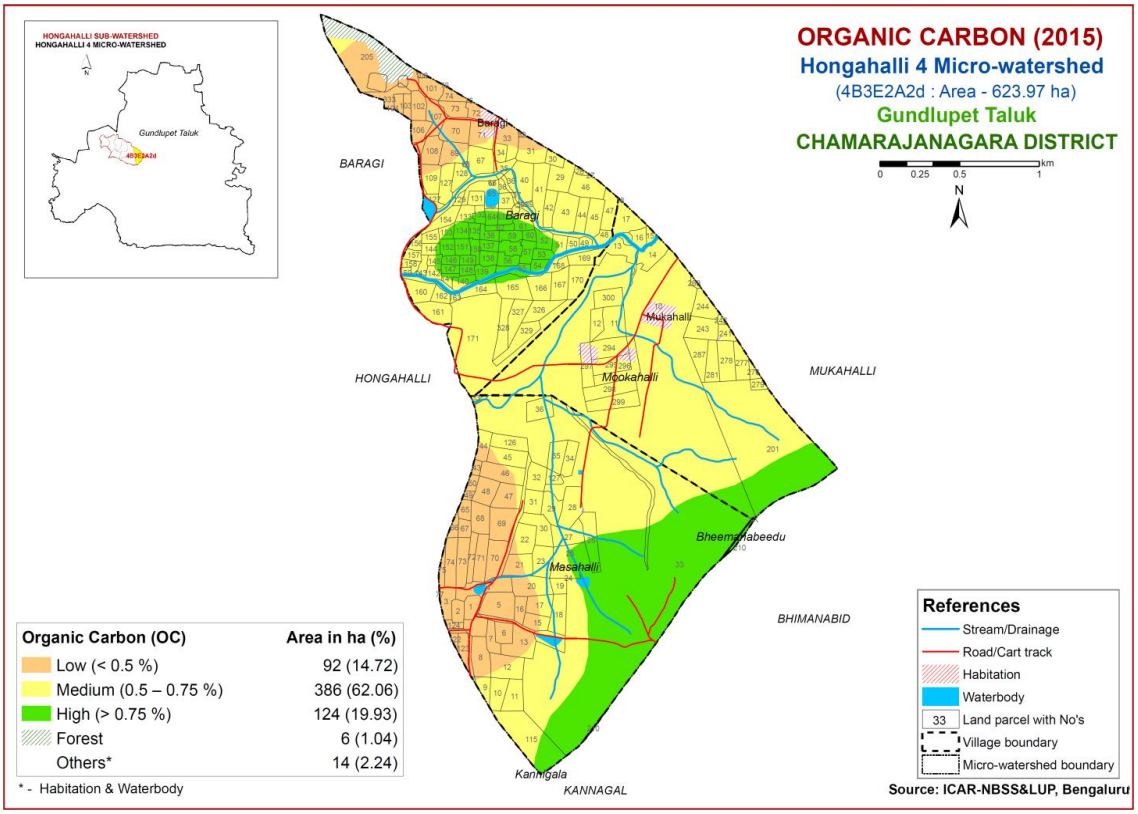


Fig.6.3 Soil Organic Carbon map of Hongahalli-4 Microwatershed

6.4 Available Phosphorus

Available phosphorus content is medium (23-57 kg/ha) in a maximum area of about 452 ha (73%) and occur in the major part of the microwatershed, whereas high (>57 kg/ha) in an area of about 151 ha (24%) and are distributed in the central, western and eastern part of the microwatershed (Fig. 6.4).

6.5 Available Potassium

Available potassium content is low (<145 kg/ha) in an area of about 43 ha (7%) and are distributed in the eastern and southwestern part of the microwatershed. Medium (145-337 kg/ha) in a maximum area of about 448 ha (72%) and is distributed in all parts of the microwatershed (Fig. 6.5). High available potassium content (>337 kg/ha) occupies an area of 112 ha (18%) and are distributed in the central and northeastern part of the microwatershed.

6.6 Available Sulphur

An area of about 489 ha (37%) is low (<10 ppm) in available sulphur content and are distributed in the major part of the microwatershed and medium (10-20 ppm) in an area of about 114 ha (18%) and are distributed in the northern, western and eastern part of the microwatershed (Fig. 6.6).

6.7 Available Boron

Available boron content is medium (0.5-1.0 ppm) in a maximum area of 544 ha (87%) and are distributed in the major part of the microwatershed. An area of about 60 ha (10%) is low (<0.5 ppm) in available boron and are distributed in the northern, central, and southern part of the microwatershed (Fig. 6.7).

6.8 Available Iron

Available iron content is sufficient (>4.5 ppm) in a maximum area of 561 ha (90%) and are distributed in the major part of the microwatershed and deficient (<4.5 ppm) in a small area of 42 ha (7%) and are distributed in the central and eastern part of the microwatershed (Fig 6.8).

6.9 Available Manganese

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

6.10 Available Copper

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

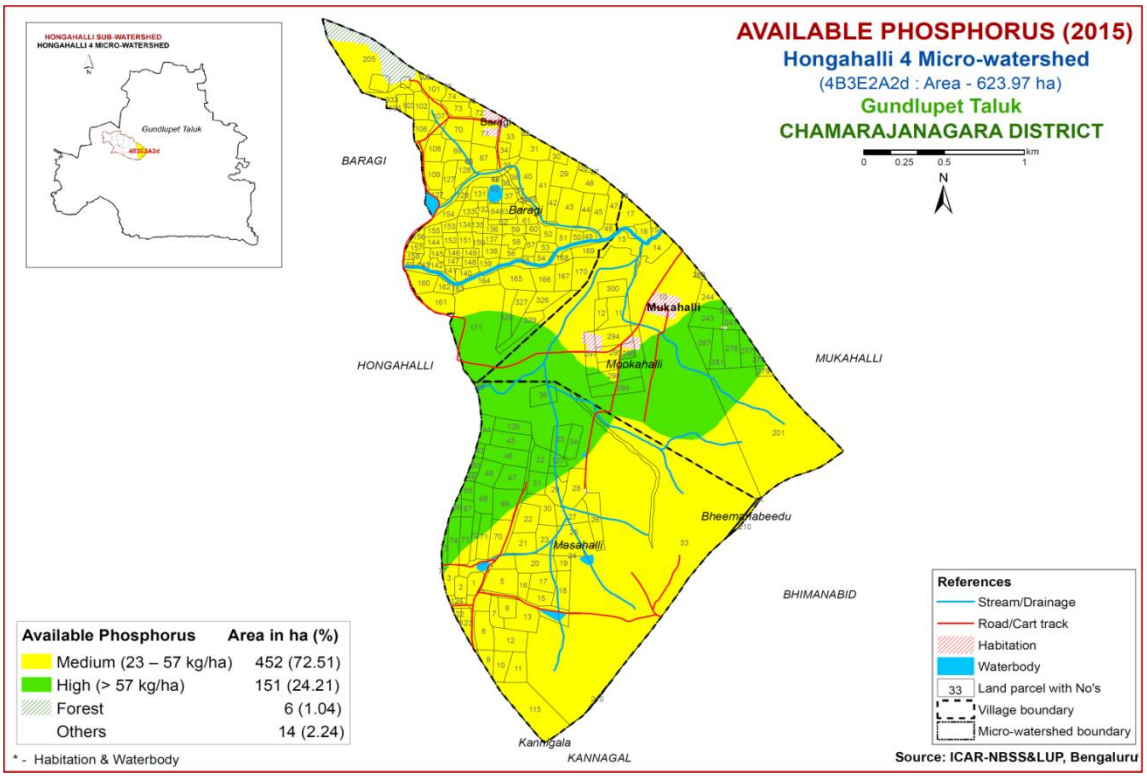


Fig.6.4 Soil Available Phosphorus map of Hongahalli-4 Microwatershed

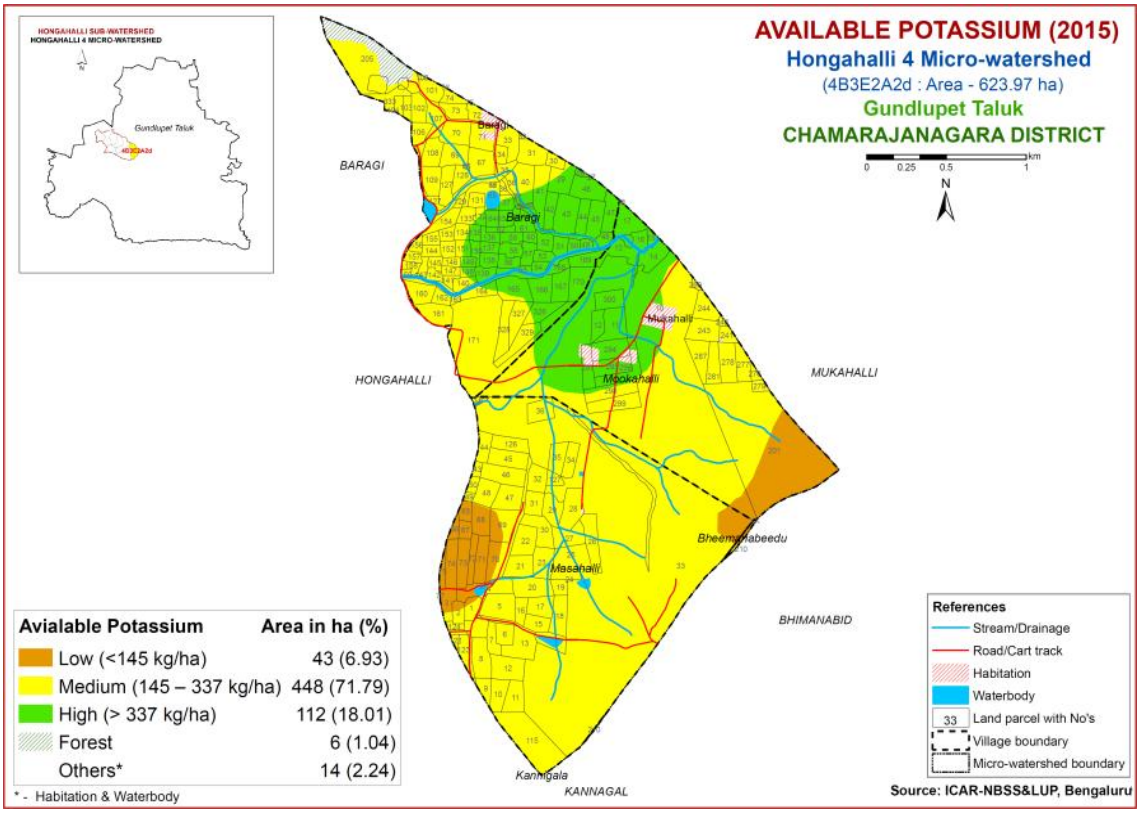


Fig.6.5 Soil Available Potassium map of Hongahalli-4 Microwatershed

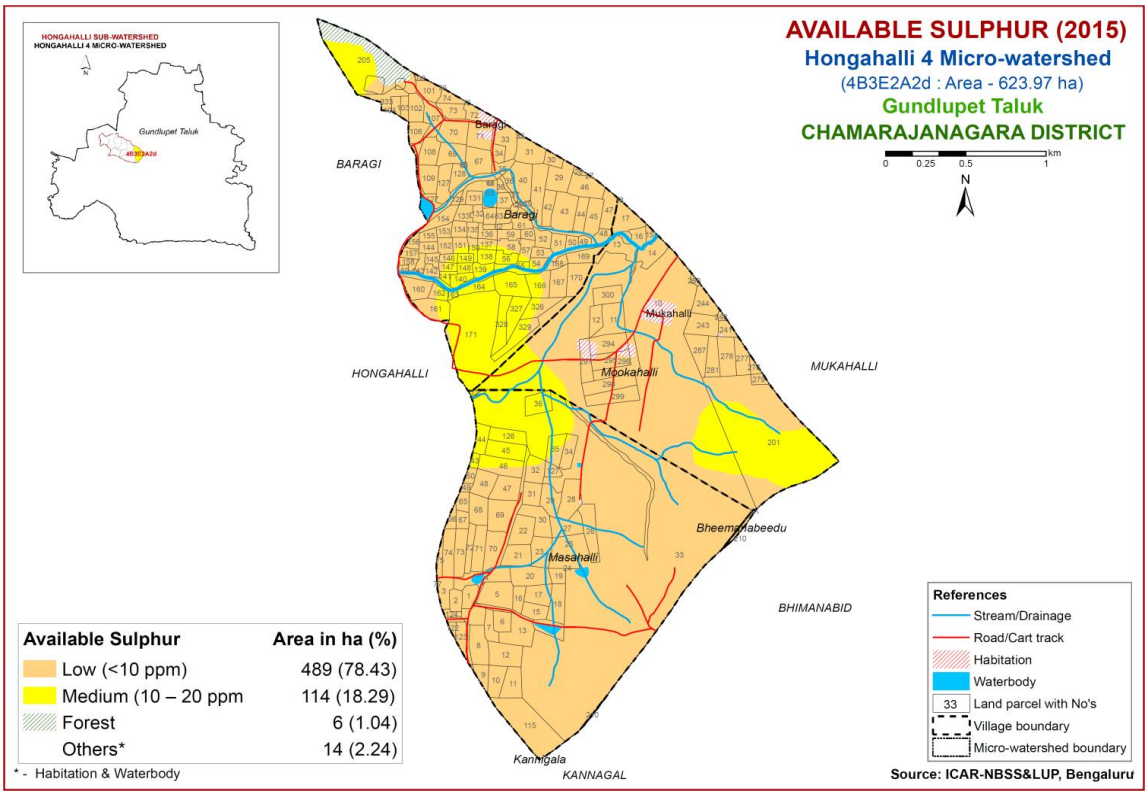


Fig.6.6 Soil Available Sulphur map of Hongahalli-4 Microwatershed

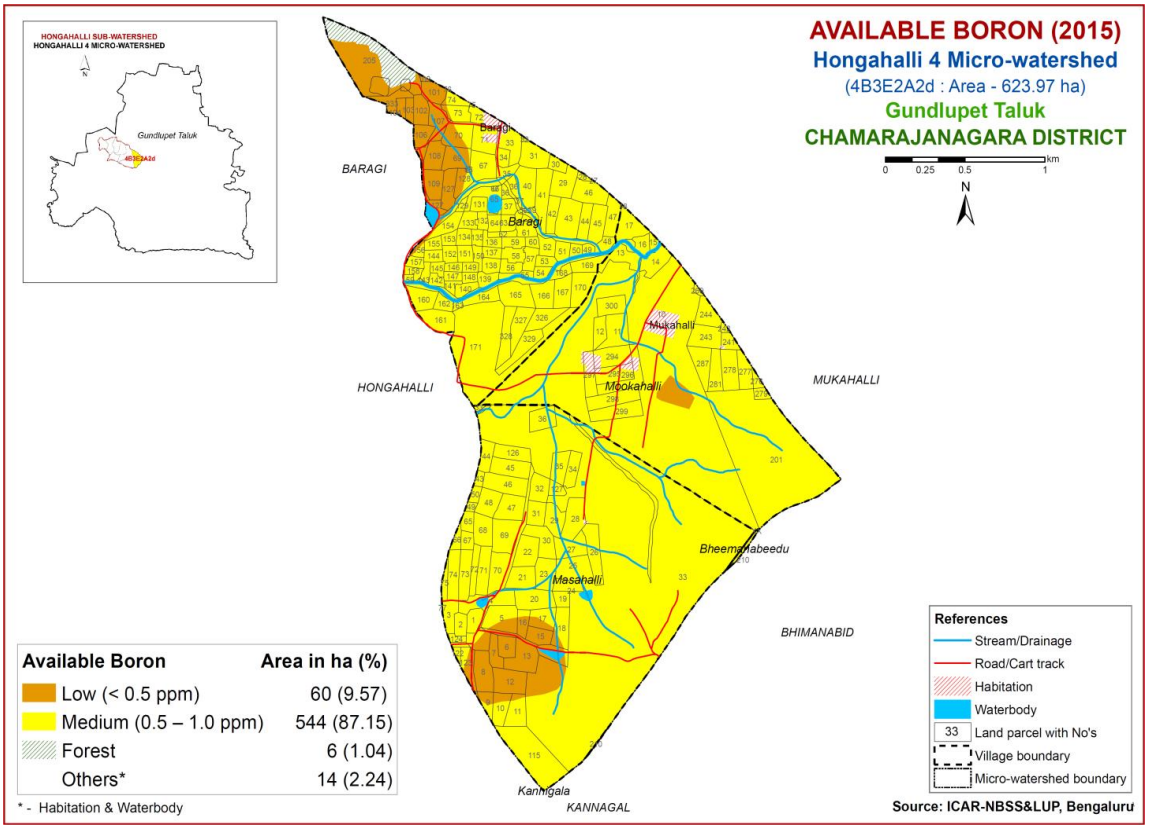


Fig.6.7 Soil Available Boron map of Hongahalli-4 Microwatershed

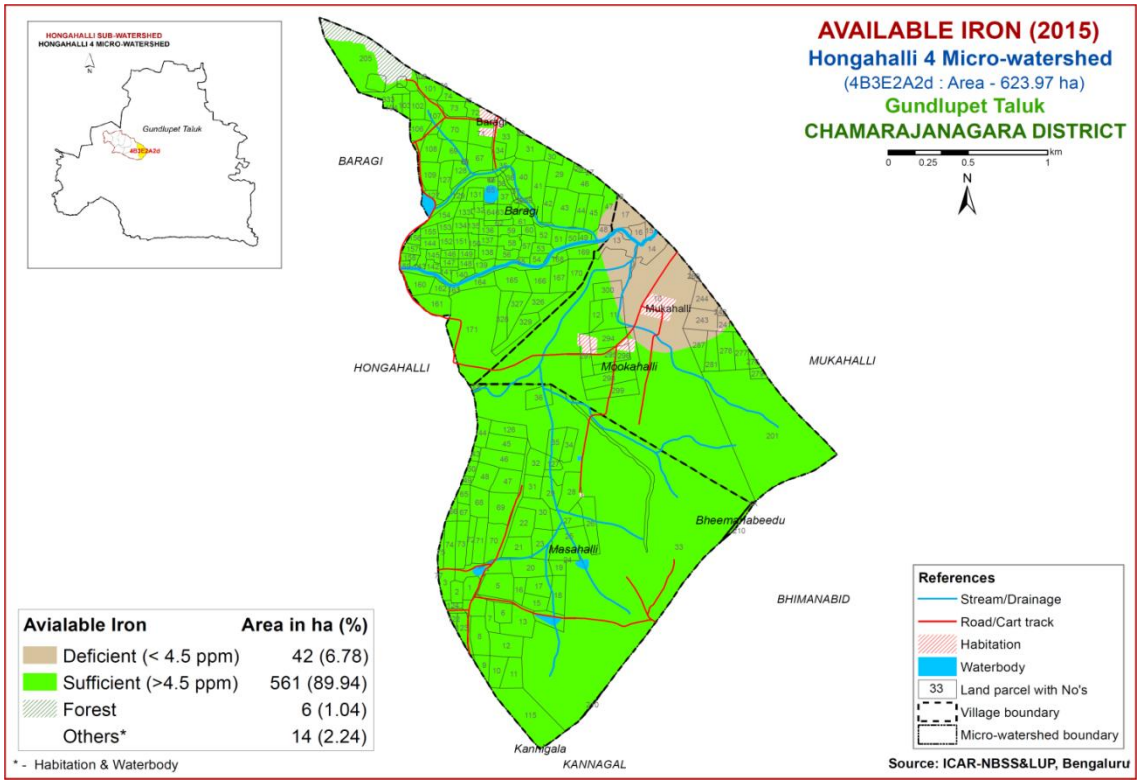


Fig.6.8 Soil Available Iron map of Hongahalli-4 Microwatershed

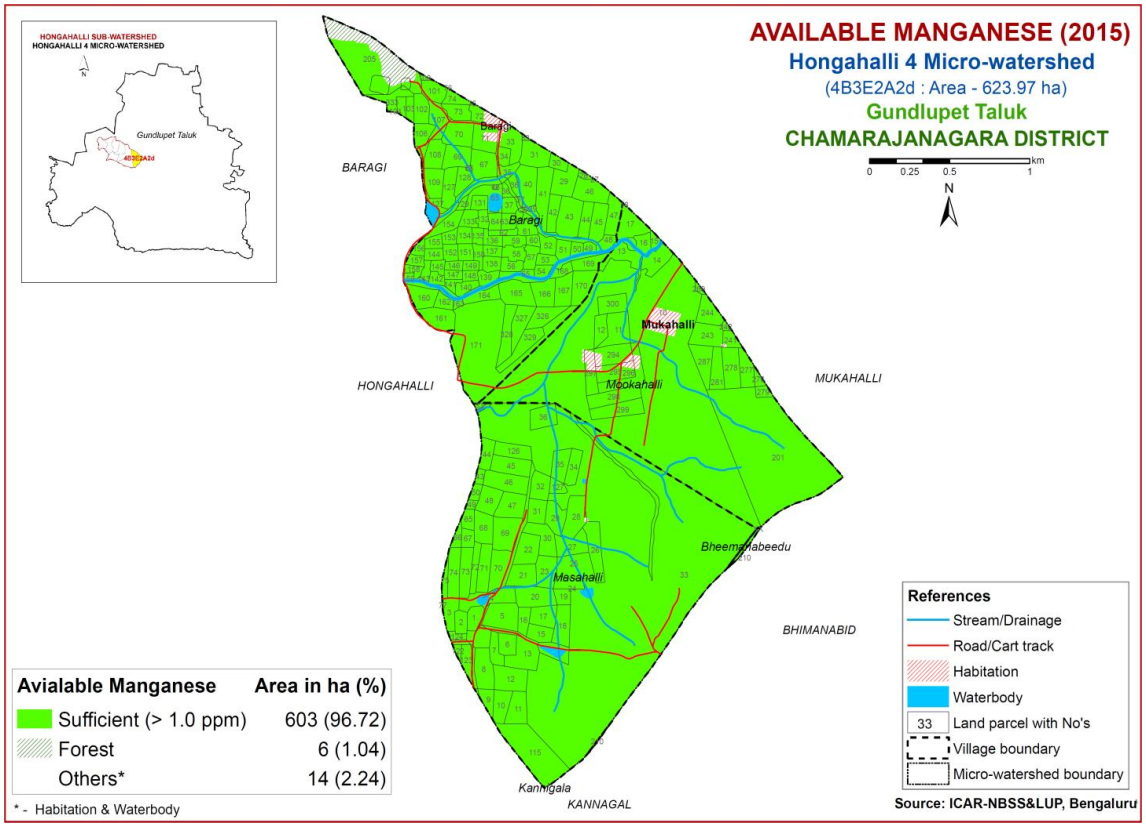


Fig.6.9 Soil Available Manganese map of Hongahalli-4 Microwatershed

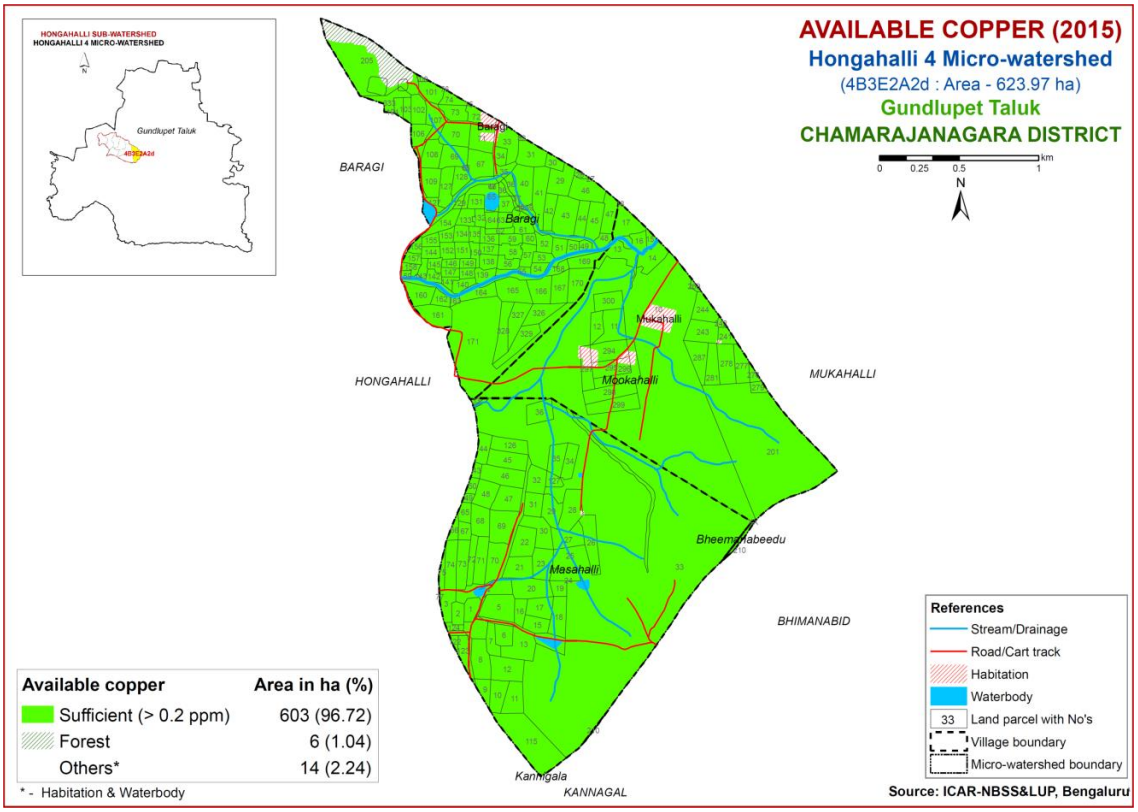


Fig.6.10 Soil Available Copper map of Hongahalli-4 Microwatershed

6.11 Available Zinc

Available zinc content is sufficient (>0.6 ppm) in 91 ha (15%) and is distributed in the northern and eastern part of the microwatershed. An area of 513 ha (82%) is deficient (<0.6 ppm) and are distributed in the major part of the microwatershed (Fig 6.11).

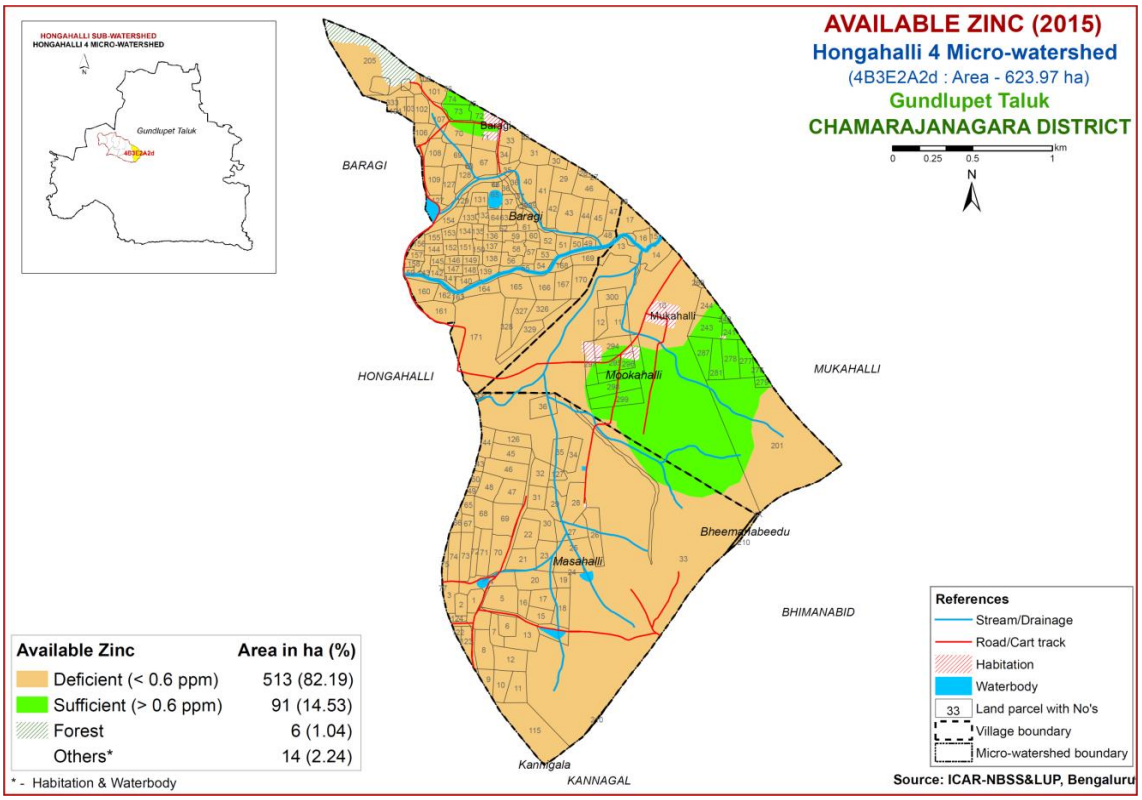


Fig.6.11 Soil Available Zinc map of Hongahalli-4 Microwatershed

Chapter 7

LAND SUITABILITY FOR MAJOR CROPS

The soil and land resource units (soil phases) of Hongahalli-4 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, S3, N1 and N2 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, 'w' for drainage and 'z' for calcareousness. These limitations are indicated as lower case letters to the Class symbol. For example, moderately suitable lands with the limitations of soil depth and erosion are designated as S2re. For the microwatershed, the soil mapping units were evaluated and classified up to subclass level.

Using the above criteria, the soil map units of the microwatershed were evaluated and land suitability maps for 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 bicolor*)

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

An area of about 85 ha (14%) is highly suitable (Class S1) for growing sorghum and are distributed in the central, northern and northeastern part the microwatershed. An area of about 287 ha (46%) is moderately suitable (Class S2) for growing sorghum and are distributed in the major part of the microwatershed. They have minor limitations of texture, gravelliness, calcareousness and rooting depth. An area of about 234 ha (37%) is

Table 7.1 Soil-Site Characteristics of Hongahalli-4 Microwatershed

Soil Map Units	Climate (P) (mm)	Growing period (Days)	Drain-age Class	Soil depth (cm)	Soil texture		Gravelliness		AWC (mm/m)	Slope (%)	Erosion	pH	EC (dSm^{-1})	ESP (%)	CEC [Cmol (p^{+})kg^{-1}]	BS (%)
					Sur-face	Sub-surface	Surface (%)	Sub-surface (%)								
SPRcB2g1	734	150	WD	25-50	sc	scl-sc	15-35	>35	<50	1-3	moderate	7.83	0.33	0.82	9.80	100
SPRhB1g1	734	150	WD	25-50	scl	scl-sc	15-35	>35	<50	1-3	slight	7.83	0.33	0.82	9.80	100
SPRhB2g2	734	150	WD	25-50	scl	scl-sc	35-60	>35	<50	1-3	moderate	7.83	0.33	0.82	9.80	100
SPRhB2g2St1R1	734	150	WD	25-50	scl	scl-sc	35-60	>35	<50	1-3	moderate	7.83	0.33	0.82	9.80	100
BMDbB2g1	734	150	WD	25-50	ls	sc	15-35	<15	50-100	1-3	moderate	8.28	0.23	0.83	18.13	100
BMDbB2g2	734	150	WD	25-50	ls	sc	35-60	<15	50-100	1-3	moderate	8.28	0.23	0.83	18.13	100
BMDcC2g1	734	150	WD	25-50	sl	sc	15-35	<15	50-100	3-5	moderate	8.28	0.23	0.83	18.13	100
BMDhC2g2St1	734	150	WD	25-50	scl	sc	35-60	<15	50-100	3-5	moderate	8.28	0.23	0.83	18.13	100
MGHiC2g1	734	150	WD	50-75	sc	scl	15-35	>35	<50	3-5	moderate	6.42	0.13	0.86	14.02	100
DRHhB2g1	734	150	WD	50-75	scl	scl	15-35	15-35	50-100	1-3	moderate	5.43	0.13	0.09	1.15	38
DRHhB2g2	734	150	WD	50-75	scl	scl	35-60	15-35	50-100	1-3	moderate	5.43	0.13	0.09	1.15	38
HPRhB2g1	734	150	WD	50-75	scl	scl-sc	15-35	15-35	50-100	1-3	moderate	8.36	0.36	1.78	24.17	100
HPRhB2g2St1R1	734	150	WD	50-75	scl	scl-sc	35-60	15-35	50-100	1-3	moderate	8.36	0.36	1.78	24.17	100
HPRiC2g1	734	150	WD	50-75	sc	scl-sc	15-35	15-35	50-100	3-5	moderate	8.36	0.36	1.78	24.17	100
KNGiB1g1	734	150	WD	75-100	sc	scl-sc	15-35	>35	<50	1-3	slight	5.41	0.23	0.59	6.82	84
KNGiC2g2	734	150	WD	75-100	sc	scl-sc	35-60	>35	<50	3-5	moderate	5.41	0.23	0.59	6.82	84
MDHhD3g2St1R2	734	150	WD	100-150	scl	sc-c	35-60	>35	100-150	5-10	severe	4.49	0.18	15.38	1.82	100
KDHhB1	734	150	WD	>150	scl	sc-c	-	<15	>200	1-3	slight	8.03	0.13	0.72	13.91	100
KDHhB1g1	734	150	WD	>150	scl	sc-c	15-35	<15	>200	1-3	slight	8.03	0.13	0.72	13.91	100
KDHiB2g2	734	150	WD	>150	sc	sc-c	35-60	<15	>200	1-3	moderate	8.03	0.13	0.72	13.91	100
KDHmB1	734	150	WD	>150	c	sc-c	-	<15	>200	1-3	slight	8.03	0.13	0.72	13.91	100
HGHbB2g1	734	150	WD	>150	ls	scl	15-35	<15	>200	1-3	moderate	7.37	0.18	1.50	8.66	100
HGHcB2g1R1	734	150	WD	>150	sl	scl	15-35	<15	>200	1-3	moderate	7.37	0.18	1.50	8.66	100
HGHhB1g1	734	150	WD	>150	scl	scl	15-35	<15	>200	1-3	slight	7.37	0.18	1.50	8.66	100
HGHhB2g1	734	150	WD	>150	scl	scl	15-35	<15	>200	1-3	moderate	7.37	0.18	1.50	8.66	100
HGHhB2g2R1	734	150	WD	>150	scl	scl	35-60	<15	>200	1-3	moderate	7.37	0.18	1.50	8.66	100
HGHiC2g2	734	150	WD	>150	sc	scl	35-60	<15	>200	3-5	moderate	7.37	0.18	1.50	8.66	100
BRGhB1g1	734	150	WD	>150	scl	c	15-35	<15	>200	1-3	slight					

BRGhB2g2	734	150	WD	>150	scl	c	35-60	<15	>200	1-3	moderate					
BRGhB2g2St1	734	150	WD	>150	scl	c	-	<15	>200	1-3	moderate					
BRGmB1	734	150	WD	>150	c	c	-	<15	>200	1-3	slight					
BRGmB2g1	734	150	WD	>150	c	c	15-35	<15	>200	1-3	moderate					
BMBmB1	734	150	MWD	>150	c	c	-	<15	>200	1-3	slight	7.59	0.48	1.57	10.83	100

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

marginally suitable (Class S3) for growing sorghum and are distributed in the central, northern, southern, southwestern and eastern part of the microwatershed with moderate limitations gravelliness, rooting depth and topography.

Table 7.2 Crop suitability criteria for Sorghum

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

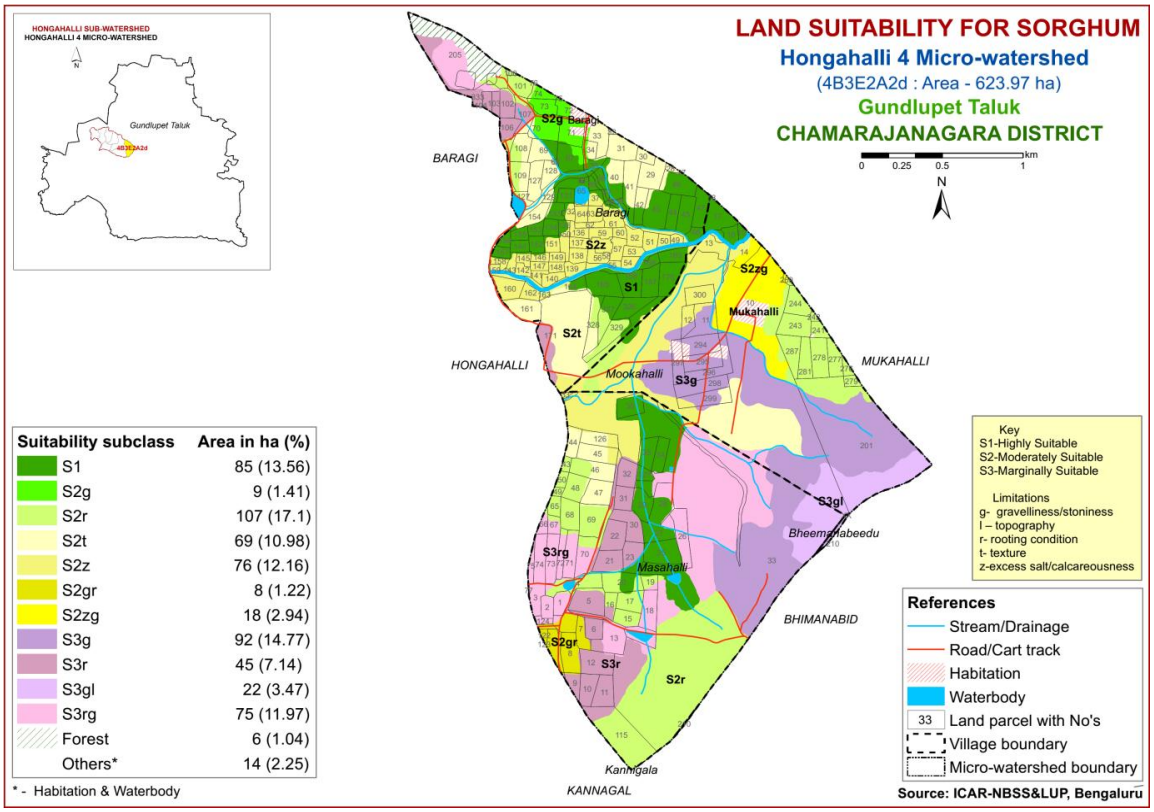


Fig. 7.1 Land Suitability map of Sorghum

7.2 Land Suitability for Maize (*Zea mays*)

Maize is the most important food crop grown in an area of 13.37 lakh ha in almost all the districts of the State. The crop requirements for growing maize (Table 7.3) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing maize was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.2.

An area of about 116 ha (19%) is highly suitable (Class S1) for growing maize and are distributed in the northern, western, central and northeastern part of the microwatershed, whereas moderately suitable (Class S2) lands cover an area of about 218 ha (35%) and occur in all parts of the microwatershed. They have minor limitations of rooting depth, gravelliness, texture and calcareousness. Marginally suitable lands (Class S3) for growing maize occupy a maximum area of about 271 ha (43%) and occur in the major part of the microwatershed. They have moderate limitations of gravelliness, rooting depth, topography, drainage and texture.

Table 7.3 Crop suitability criteria for Maize

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

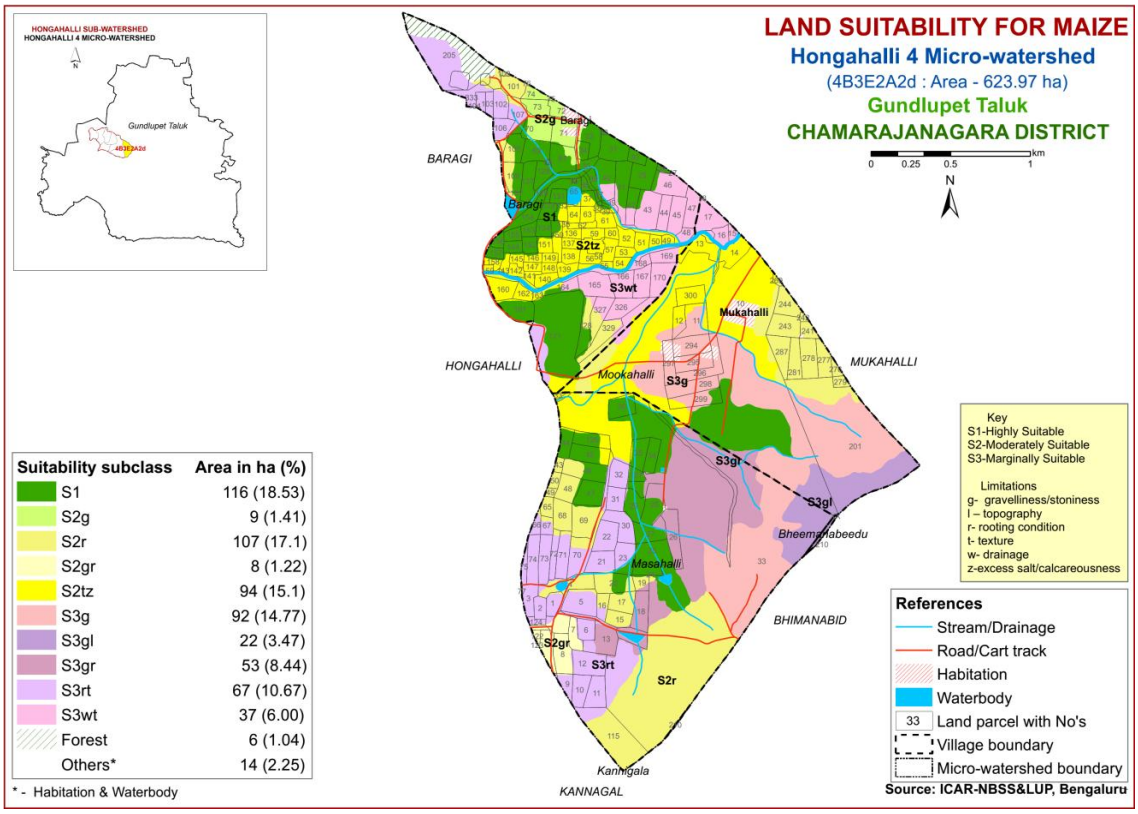


Fig. 7.2 Land Suitability map of Maize

7.3 Land suitability criteria for Red gram (*Cajanus Cajan)*

Redgram is the most important pulse crop grown in an area of 7.28 lakh ha in almost all the districts of the State. The crop requirements for growing red gram (Table 7.4) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing redgram was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.3.

An area of about 97 ha (16%) is highly suitable (Class S1) for growing redgram and are distributed in the central, northeastern, western and northwestern part of the microwatershed. Maximum area of about 320 ha (51%) is moderately suitable (Class S2) for growing redgram and are distributed in all parts of the microwatershed. They have minor limitations of gravelliness, rooting depth, drainage and calcareousness. Marginally suitable lands (Class S3) for growing redgram occupy an area of about 67 ha (11%) and occur in the central, eastern and southwestern part of the microwatershed. They have moderate limitations of rooting depth, gravelliness and topography. An area of about 120 ha (19%) is not suitable (N) and are distributed in the central, northern, western and southwestern part of the microwatershed with severe limitations of gravelliness, rooting depth and texture.

Table 7.4 Land suitability criteria for Red gram

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

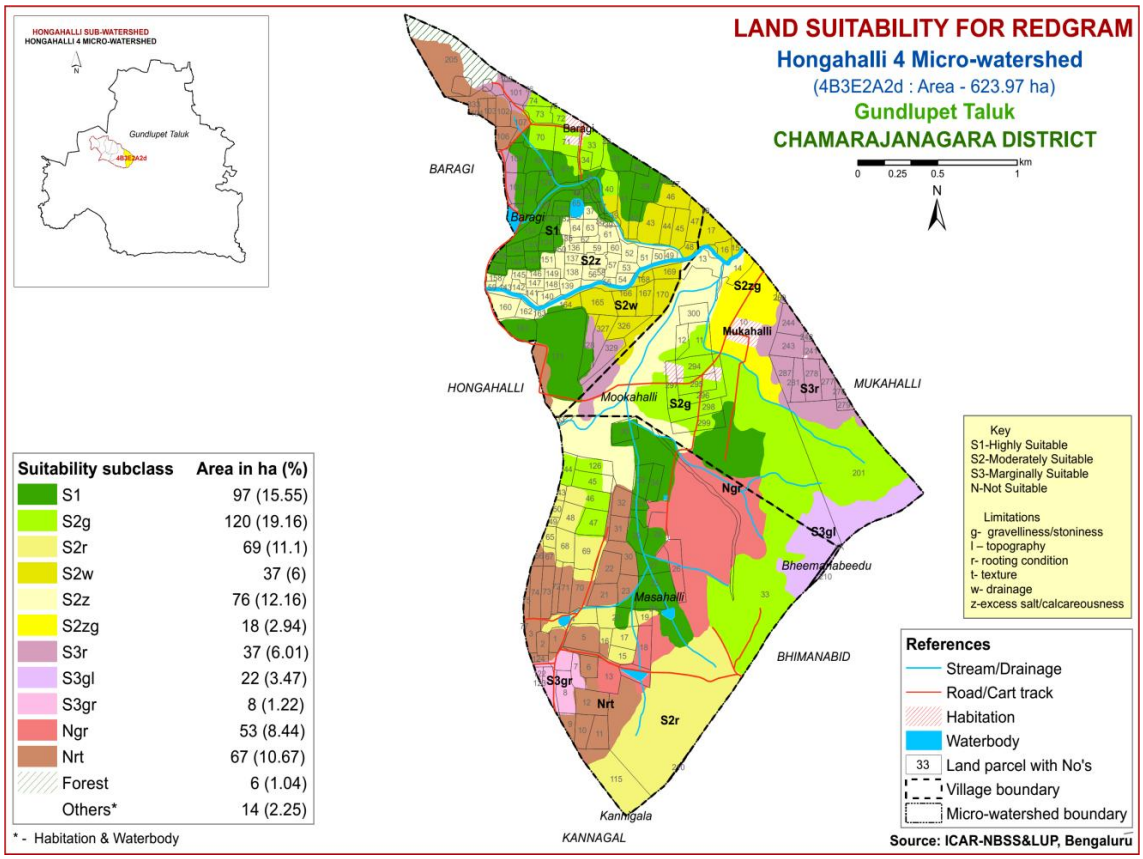


Fig. 7.3 Land Suitability map of Redgram

7.4 Land suitability for Horsegram (*Macrotyloma uniflorum*)

Horsegram is the most important pulse crop grown in an area of 1.81 lakh ha in almost all the districts of the State. The crop requirements for growing horsegram (Table 7.5) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing horsegram was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Fig. 7.4.

An area of about 97 ha (16%) is highly suitable (Class S1) for growing Horsegram and are distributed in the central, northeastern and western part the microwatershed. Maximum area of about 341 ha (55%) is moderately suitable (Class S2) for growing Horsegram and are distributed in the major part of the microwatershed. They have minor limitations of rooting depth, gravelliness, calcareousness and drainage. An area of about 166 ha (26%) is marginally suitable (Class S3) and are distributed in the northern, western southwestern, central and eastern part of the microwatershed with moderate limitations of gravelliness, rooting depth, and topography.

Table 7.5 Land suitability criteria for Horse gram

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

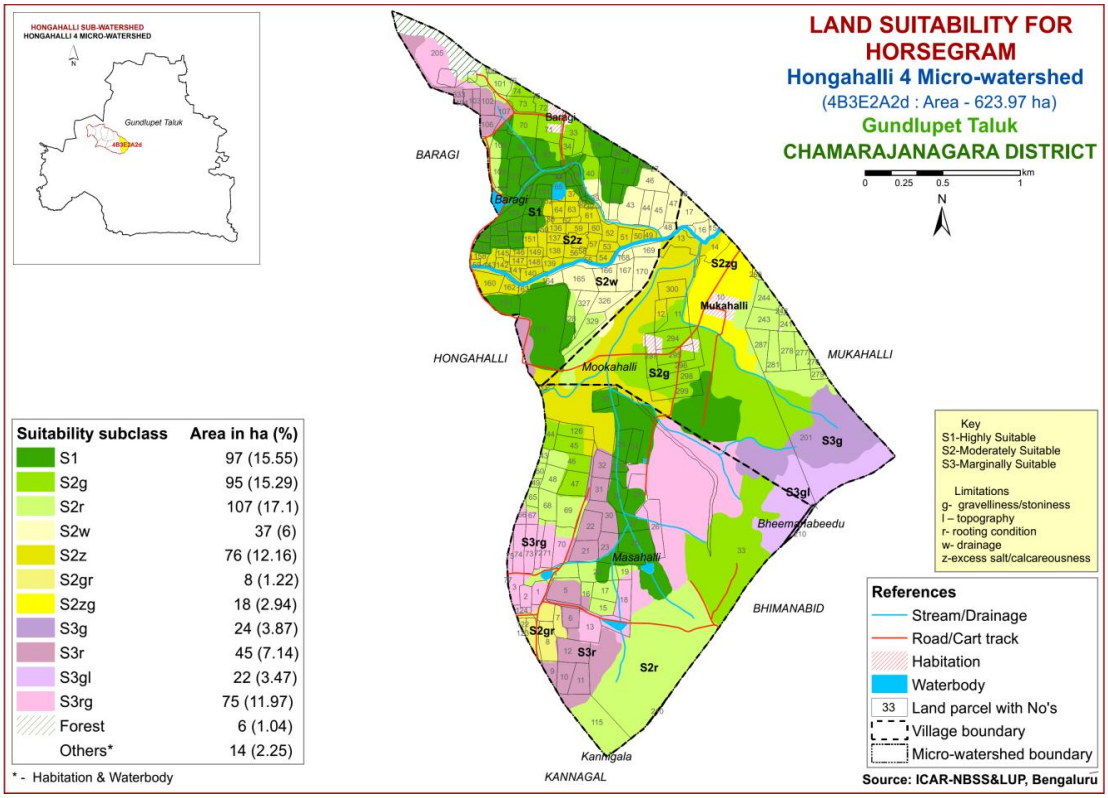


Fig. 7.4 Land Suitability map of Horsegram

7.5 Land Suitability for Sunflower (*Helianthus annus*)

Sunflower is the most important oilseed crop grown in an area of 3.56 lakh ha in the State in all the districts. The crop requirements for growing sunflower (Table 7.6) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing sunflower was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.5.

Table 7.6 Crop suitability criteria for Sunflower

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

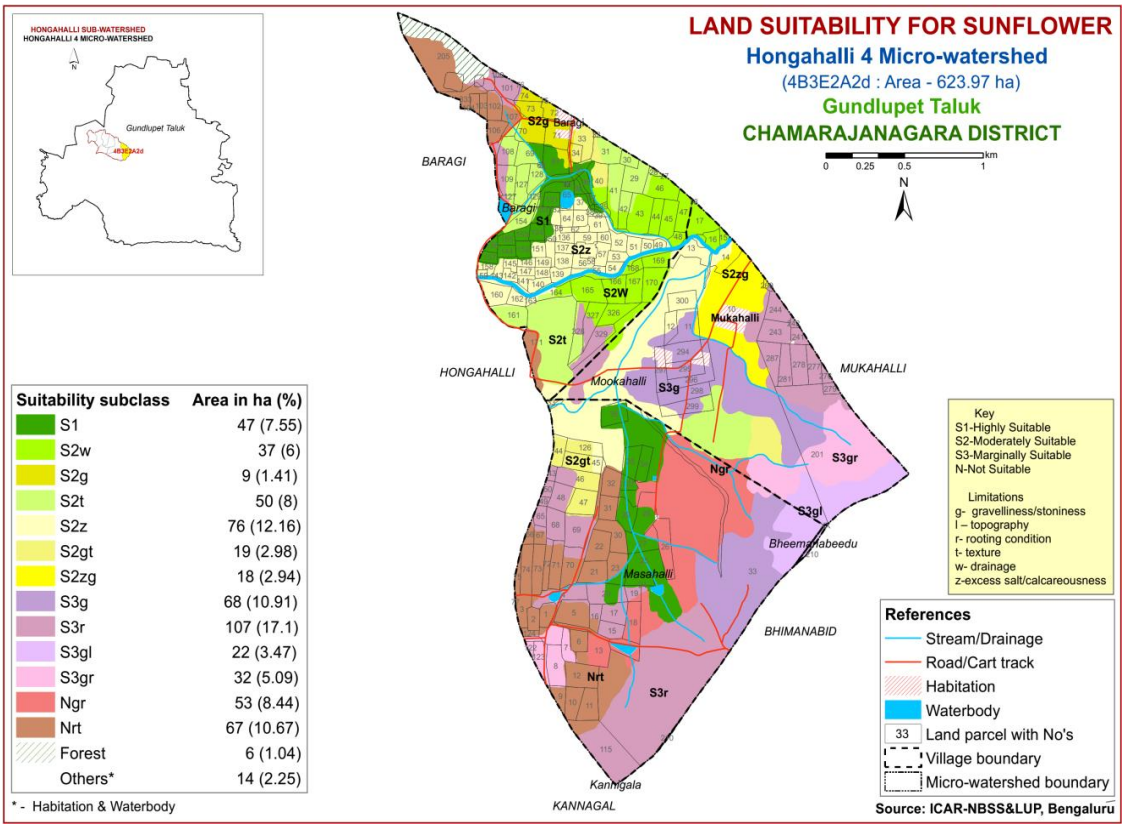


Fig. 7.5 Land Suitability map of Sunflower

Small area of about 47 ha (8%) is highly suitable (Class S1) for growing sunflower and is distributed in the central and northwestern part of the microwatershed. An area of about 209 ha (33%) is moderately suitable (Class S2) for sunflower and are distributed in the northern, northeastern, northwestern, central and western part of the microwatershed. They have minor limitations of texture, gravelliness, calcareousness and drainage. Marginally suitable (Class S3) lands for sunflower are found to occur in a maximum area of about 229 ha (37%) with moderate limitations of rooting depth, topography and gravelliness and are distributed in the major part of the microwatershed. An area of about 120 ha (19%) is not suitable (Class N) and are distributed in the central and southwestern part of the microwatershed with severe limitations of rooting depth, gravelliness and texture.

7.6 Land Suitability for Cotton (*Gossypium hirsutum*)

Cotton is the most important fibre crop grown in the State in about 8.75 lakh ha area in Raichur, Dharwad, Belgaum, Kalaburgi, Bijapur, Bidar, Bellary, Chitradurga and Chamarajnagar districts. The crop requirements for growing cotton (Table 7.7) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing cotton was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.6.

An area of about 85 ha (14%) 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 central, northeastern and northwestern part of the microwatershed. Moderately suitable (Class S2) lands are found to occur in an area of about 218 ha (35%). The soils have minor limitations of rooting depth, gravelliness and calcareousness. They are distributed in the northern, eastern, western, southern and central part of the microwatershed. Marginally suitable (Class S3) lands for cotton are found to occur in a maximum area of about 303 ha (48%) with moderate limitations of rooting depth, texture, topography and gravelliness and are distributed in all parts of the microwatershed.

Table 7.7 Crop 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 mod. well	imperfectly drained	Poor some what excessive	Stagnant/ excessive
Soil reaction	pH	6.5-7.5	7.6-8.0	8.1-9.0	>9.0 >6.5
Surface soil texture	Class	Sic, c	Sicl, cl	Si,sil,sc,scl,l	Sl, s,ls
Soil depth	Cm	100-150	60-100	30-60	<30
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

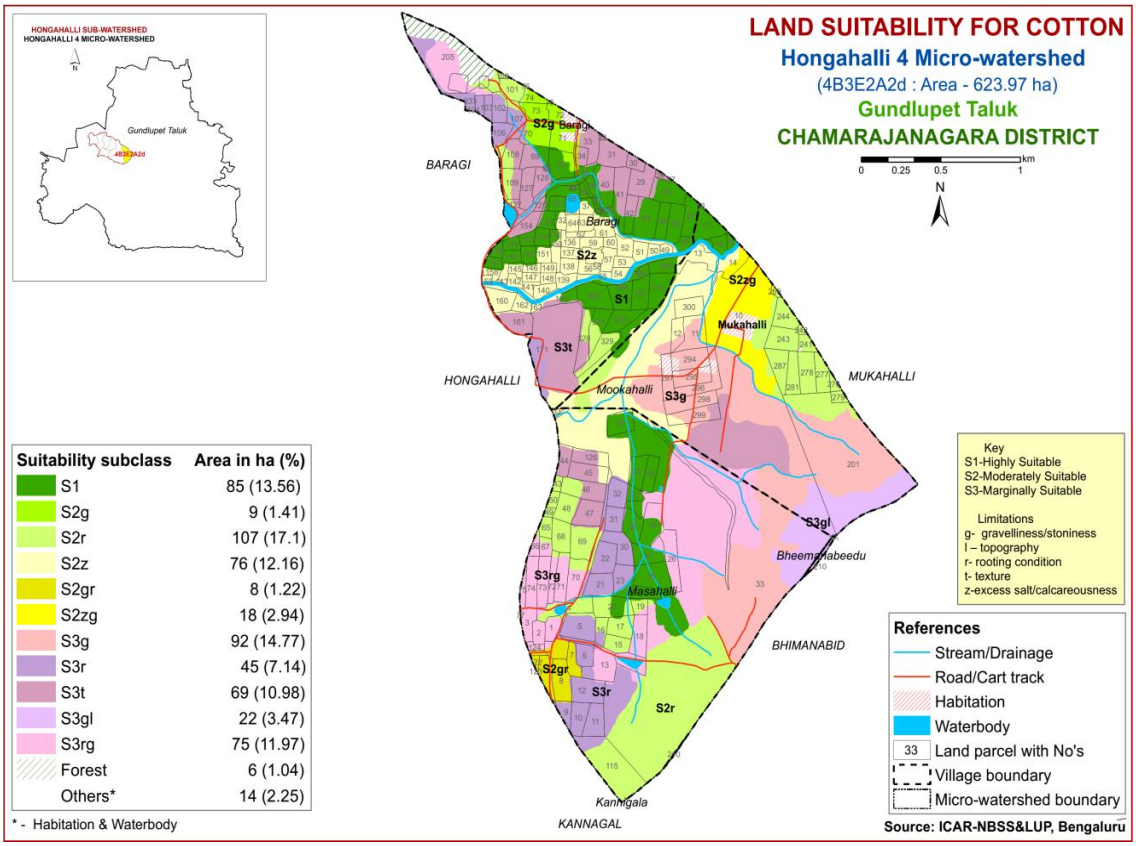


Fig. 7.6 Land Suitability map of Cotton

7.7 Land Suitability for Beans (*Phaseolus vulgaris*)

Beans is the most important vegetable crop grown in almost all the districts of Karnataka. The crop requirements for growing beans (Table 7.8) were matched with the soil–site characteristics (Table 7.1) and a land suitability map for growing beans was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.7.

An area of about 97 ha (16%) is highly suitable (Class S1) for growing beans and are distributed in the central, northeastern, western and northwestern part of the microwatershed. Maximum area of about 227 ha (36%) is moderately suitable (Class S2) for growing beans and are distributed in all parts of the microwatershed. They have minor limitations of gravelliness, drainage, calcareousness, texture and rooting depth. Marginally suitable lands (Class S3) for growing beans occupy an area of about 160 ha (26%) and occur in the northern, eastern, southwestern and central part of the microwatershed. They have moderate limitations of rooting depth and gravelliness. Not suitable (Class N) lands occur in an area of 120 ha (19%) and are distributed in the central, northern, western and southwestern part of the microwatershed with severe limitations of rooting depth and texture.

Table 7.8 Land suitability criteria for Beans

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)	ds m^{-1}	<1.0	1.0-2.0	>2.0	
Sodicity (ESP)	%	<10	10-15	15-20	>20

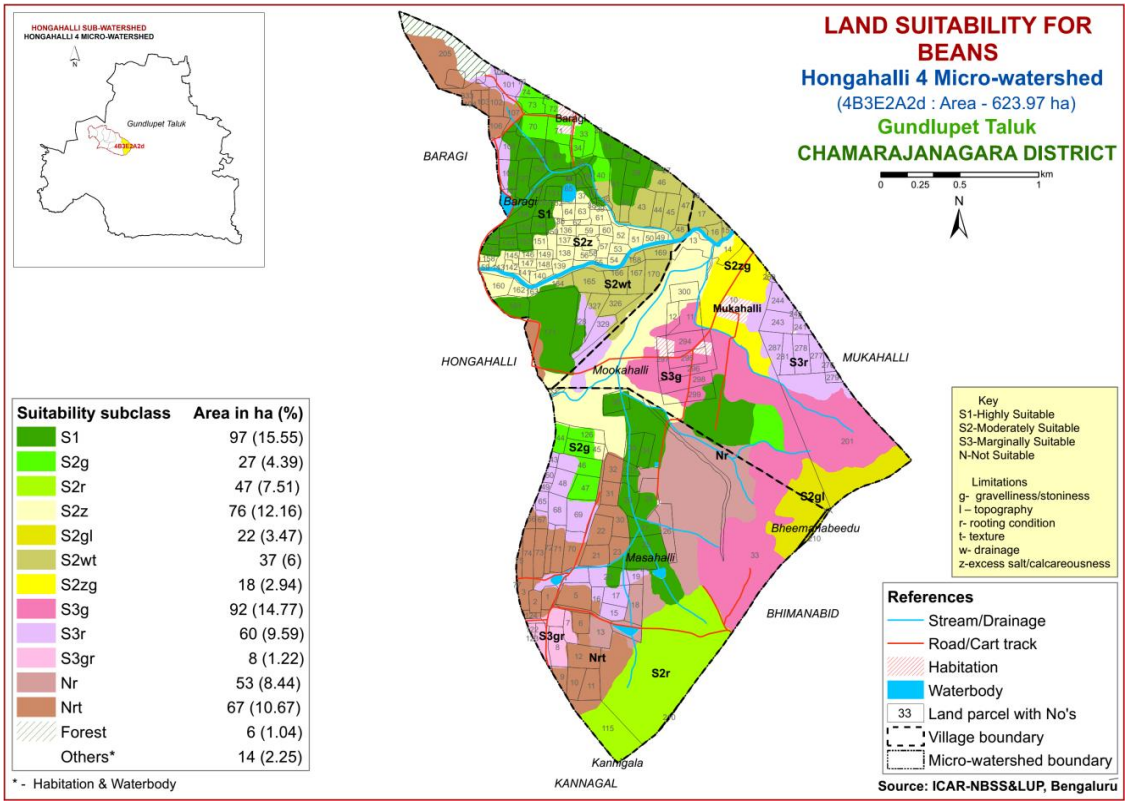


Fig. 7.7 Land Suitability map of Beans

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

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

An area of about 97 ha (16%) is highly suitable (Class S1) for growing field bean and are distributed in the central, northwestern and northeastern part of the microwatershed. Maximum area of about 273 ha (44%) is moderately suitable (Class S2) for growing field bean and are distributed in all parts of the microwatershed. They have minor limitations of gravelliness, drainage, calcareousness and rooting depth. Marginally suitable lands (Class S3) for growing field bean occupy an area of about 234 ha (37%) and occur in the northern, western, southwestern, central and eastern part of the microwatershed. They have moderate limitations of gravelliness, topography and rooting depth.

Table 7.9 Land suitability criteria for Field Bean

Crop requirement		Rating			
Soil –site characteristics	**Unit**	**Highly suitable(S1)**	**Moderately suitable(S2)**	**Marginally suitable(S3)**	**Not suitable(N)**
Slope	%	<3	3-5	5-10	>10
LGP	Days	>120	90-120	70-90	<70
Soil drainage	Class	Well drained/ mod.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)	ds m^{-1}	<1.0	1.0-2.0	>2.0	
Sodicity (ESP)	%	<10	10-15	15-20	>20

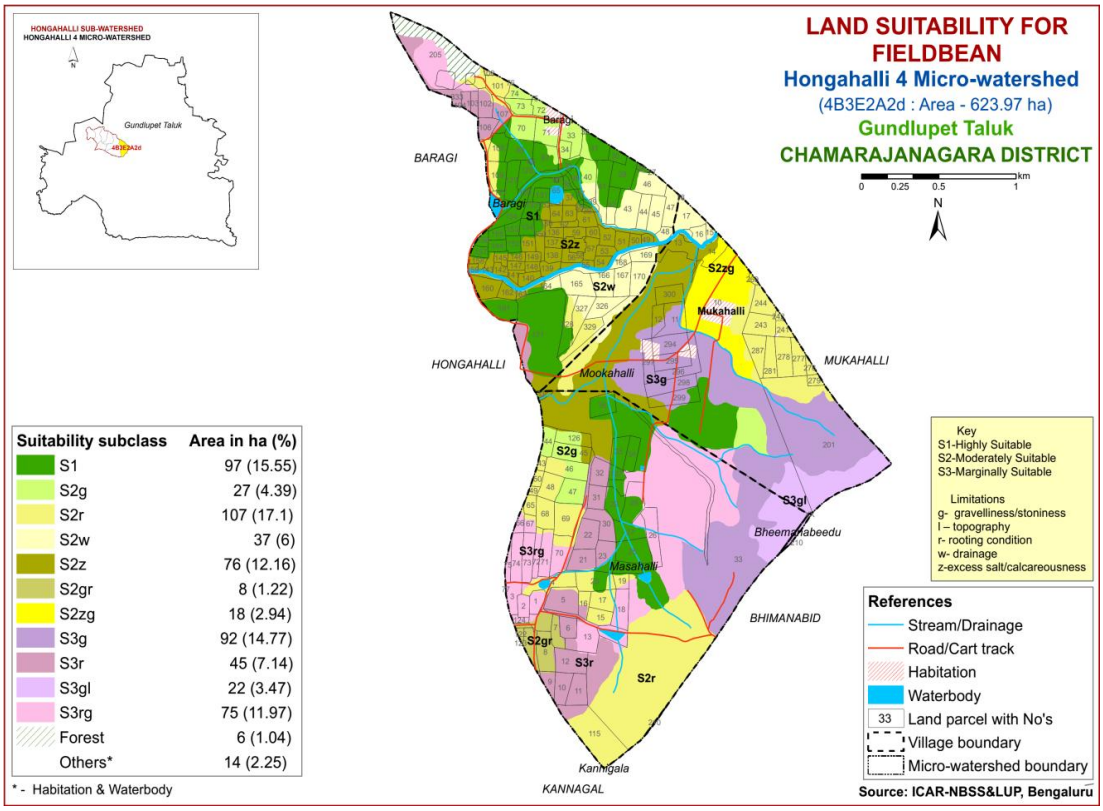


Fig. 7.8 Land Suitability map of Field beans

7.9 Land Suitability for Onion (*Allium cepa*)

Onion is the most important vegetable crop grown in an area of 1.6 lakh ha in Raichur, Dharwad, Belgaum, Gulbarga, Bijapur, Bidar, Bellary, Chitradurga and Tumakuru districts of the state. The crop requirements for growing onion (Table 7.10) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing Onion was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.9.

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 drained	Moderately /imperfectly	Poor drained	Very poorly drained
Soil reaction	pH	6.5-7.3	7.3-7.8,5.0-5.4	7.8-8.4,<5.0	>8.4
Surface soil texture	Class	Scl, sil, sl	sc,sicl,c(redsoil	sc,c(blacksoil	ls
Soil depth	Cm	>75	50-75	25-50	<25
Gravel content	% vol.	<15	15-35	35-60	60-80
Salinity (ECe)	ds m^{-1}	<1.0	1.0-2.0	2.0-4.0	<4
Sodicity (ESP)	%	<5	5-10	10-15	>15

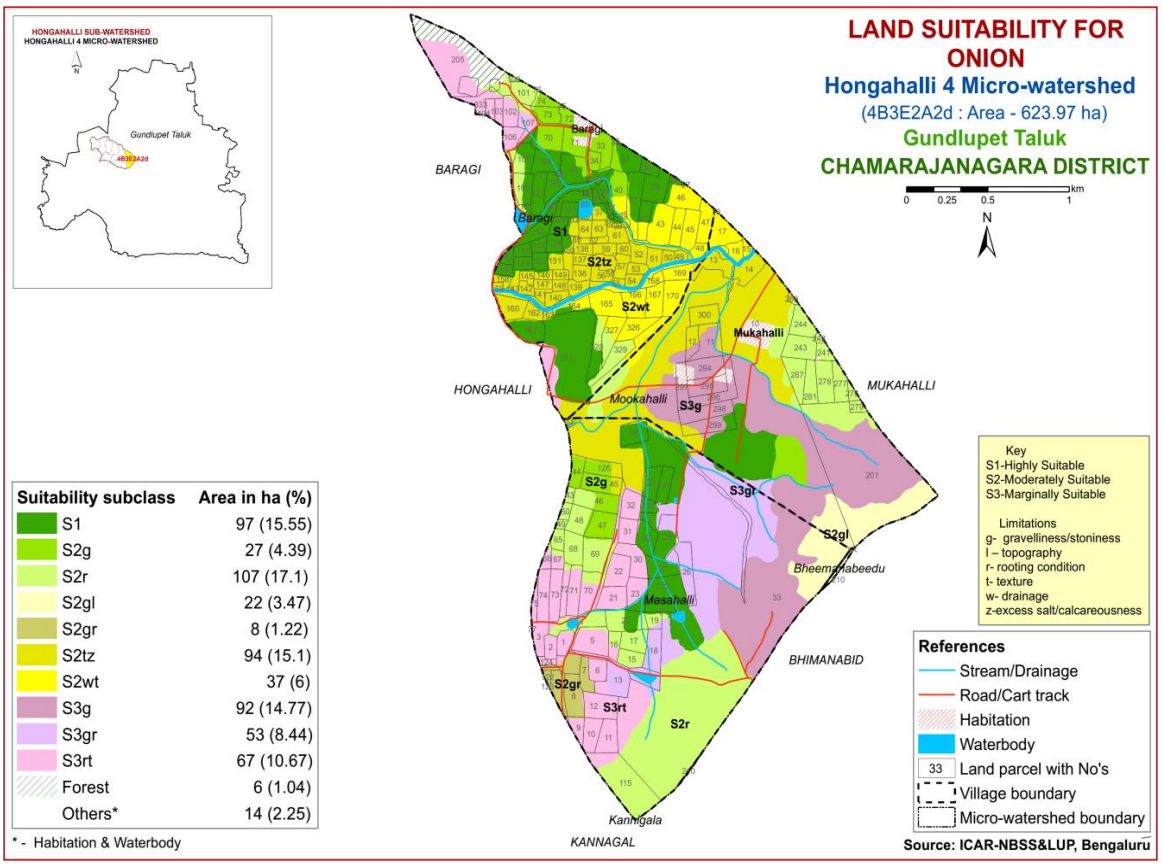


Fig. 7.9 Land Suitability map of Onion

An area of about 97 ha (16%) has soils that are highly suitable (Class S1) and are distributed in the central, northwestern and northeastern part of the microwatershed. Maximum area of about 295 ha (47%) has soils that are moderately suitable (Class S2) for growing onion with minor limitations of texture, rooting depth, drainage, calcareousness, topography and gravelliness. They are distributed in the major part of the microwatershed. The marginally suitable (Class S3) lands cover an area of about 212 ha (34%) and occur in the northern, western, central, southern and easten part of the microwatershed. They have moderate limitations of gravelliness, texture and rooting depth.

7.10 Land Suitability for Beetroot (*Beta vulgaris*)

Beetroot is the most important vegetable crop grown in an area of 2833 ha in almost all the districts of Karnataka. The crop requirements for growing beetroot (Table 7.11) were matched with the soil site characteristics (Table 7.1) and a land suitability map for growing beetroot was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.10.

The highly suitable (Class S1) lands for growing beetroot cover an area of about 97 ha (16%) and are distributed in the central, northwestern and northeastern part of the microwatershed. The moderately suitable (Class S2) lands are found to occur in a maximum area of about 258 ha (41%). They have minor limitations of gravelliness, topography, texture, calcareousness and rooting depth. They are distributed in the major part of the microwatershed. The marginally suitable (Class S3) lands cover an area of about 249 ha (40%) and occur in the northern, western, northeastern, central, eastern and southern part of the microwatershed. They have moderate limitations of gravelliness, texture, drainage and rooting depth.

Table 7.11 Land suitability criteria for Beet root

Crop requirement			**Rating**			
Soil –site characteristics		**Unit**	**Highly suitable(S1)**	**Moderately sauitable(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

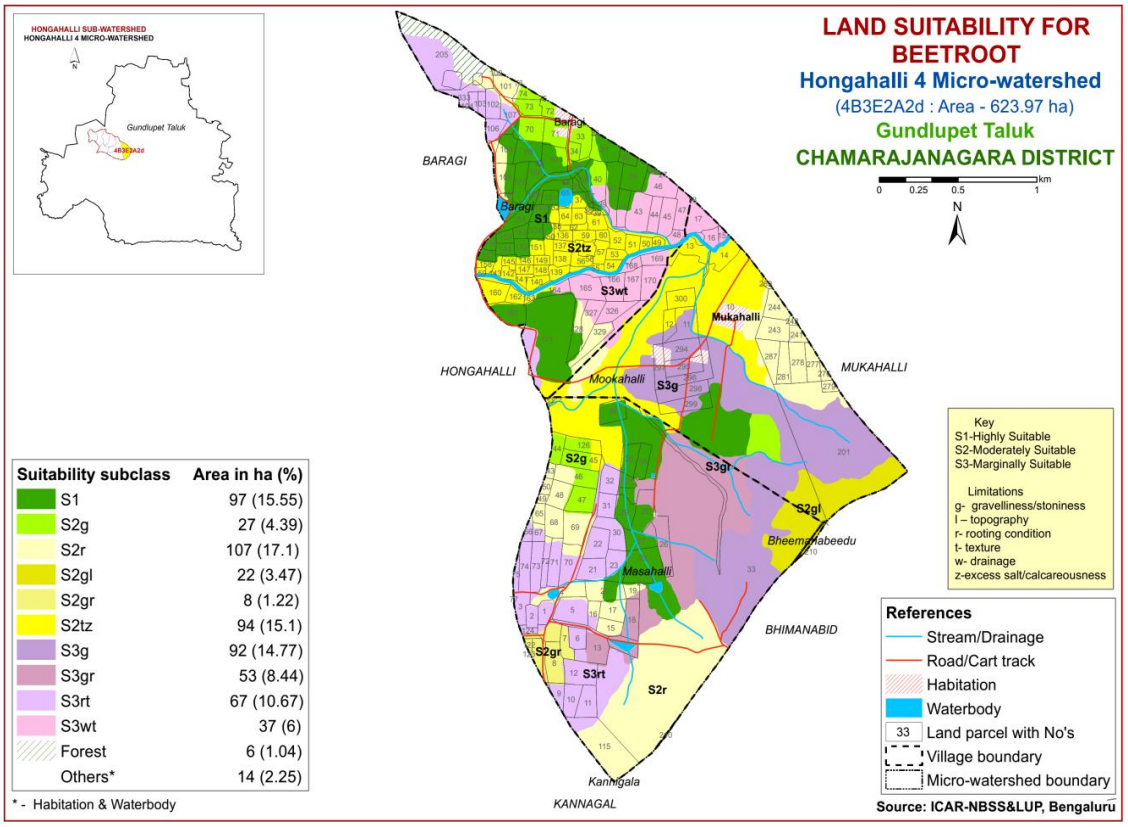


Fig. 7.10 Land Suitability map of Beet root

7.11 Land Suitability for Groundnut (*Arachis hypogaea*)

Groundnut is one of the major oilseed crop grown in an area of 6.54 lakh ha in Karnataka in most of the districts either as rainfed or irrigated crop. The crop requirements for growing groundnut (Table 7.12) were matched with the soil-site characteristics (Table 7.1) of the soils of the microwatershed and a land suitability map for growing groundnut was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.11.

Table 7.12 Crop suitability criteria for Groundnut

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

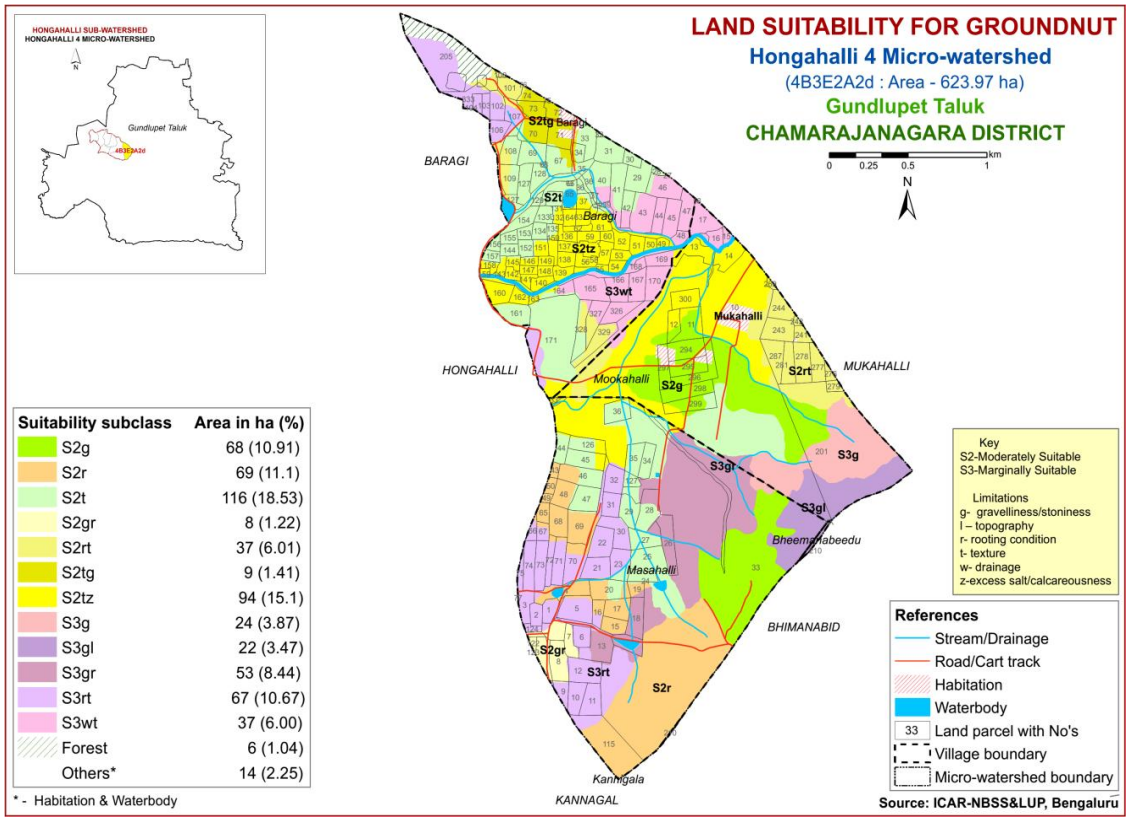


Fig. 7.11 Land Suitability map of Groundnut

The highly suitable (Class S1) lands for growing Groundnut are not available in the microwatershed. Maximum area of about 401 ha (64%) is moderately suitable (Class S2) for groundnut and are distributed in all parts of the microwatershed. They have minor limitations of rooting depth, gravelliness, calcareousness and texture. Marginally suitable lands (Class S3) for growing groundnut occupy an area of about 203 ha (32%) and are distributed in the northern, northeastern, western, eastern and southern part of the microwatershed. They have moderate limitations of topography, texture, drainage, gravelliness and rooting depth.

7.12 Land Suitability for Banana (*Musa paradisiaca*)

Banana is one of the major fruit crop grown in an area of 1.02 lakh ha in Karnataka State. The crop requirements for growing banana (Table 7.13) were matched with the soil-site characteristics (Table 7.1) of the soils of the microwatershed and a land suitability map for growing banana was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.12.

An area of about 97 ha (16%) is highly suitable (Class S1) for growing banana and are distributed in the central, northwestern, and northeastern part of the microwatershed. An area of about 248 ha (40%) is moderately suitable (Class S2) for growing banana and are distributed in the central, western, eastern, southern and northeastern part of the microwatershed and have minor limitations of drainage, texture,

topography, calcareousness and gravelliness. Marginally suitable (Class S3) lands for growing banana occupy a maximum area of about 259 ha (41%) and are distributed in the major part of the microwatershed. They have moderate limitations of rooting depth, texture and gravelliness.

Table 7.13 Crop suitability criteria for Banana

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

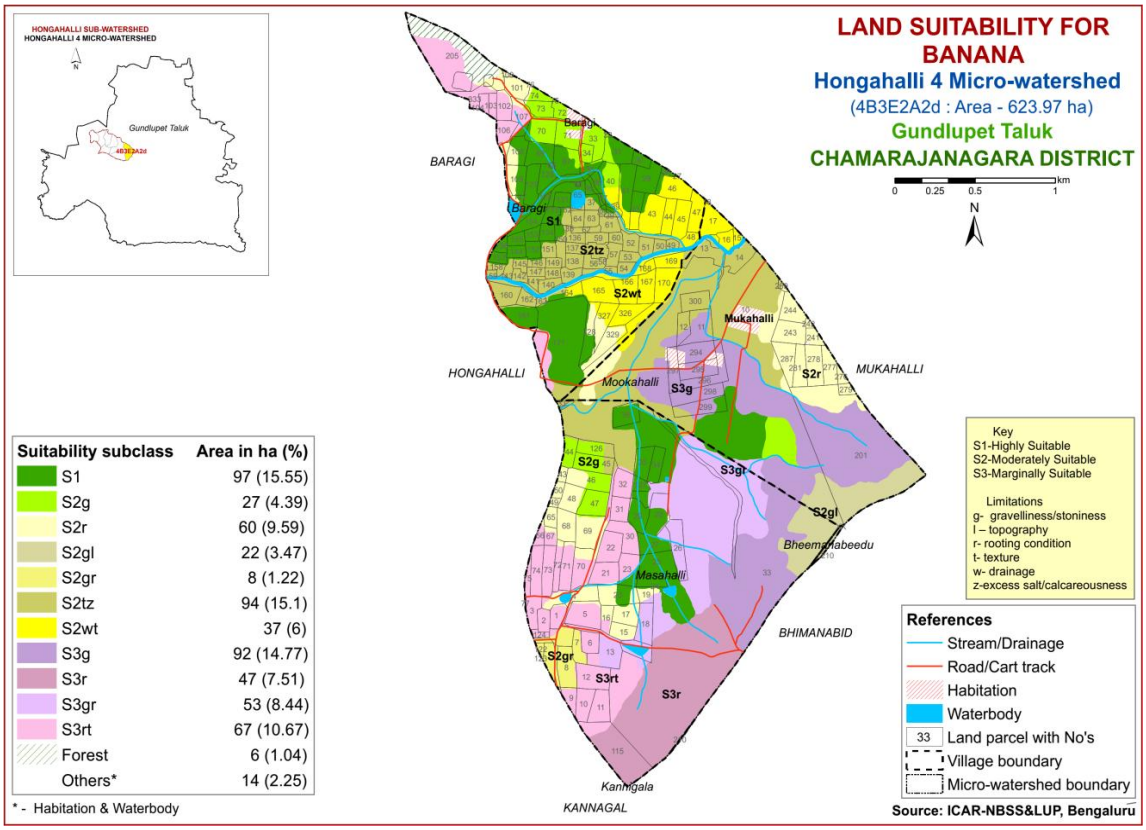


Fig. 7.12 Land Suitability map of Banana

7.13 Land Suitability for Potato (*Solanum tuberosum*)

Potato is the most important vegetable crop grown in an area of 0.41 lakh ha in Raichur, Dharwad, Belgaum, Chikkaballapur, Kolar, Gulbarga, Bijapur, Bidar, Bellary, Chitradurga and Chamarajnagar districts. The crop requirements for growing Potato (Table 7.14) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing Potato was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.13.

Table 7.14 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	-

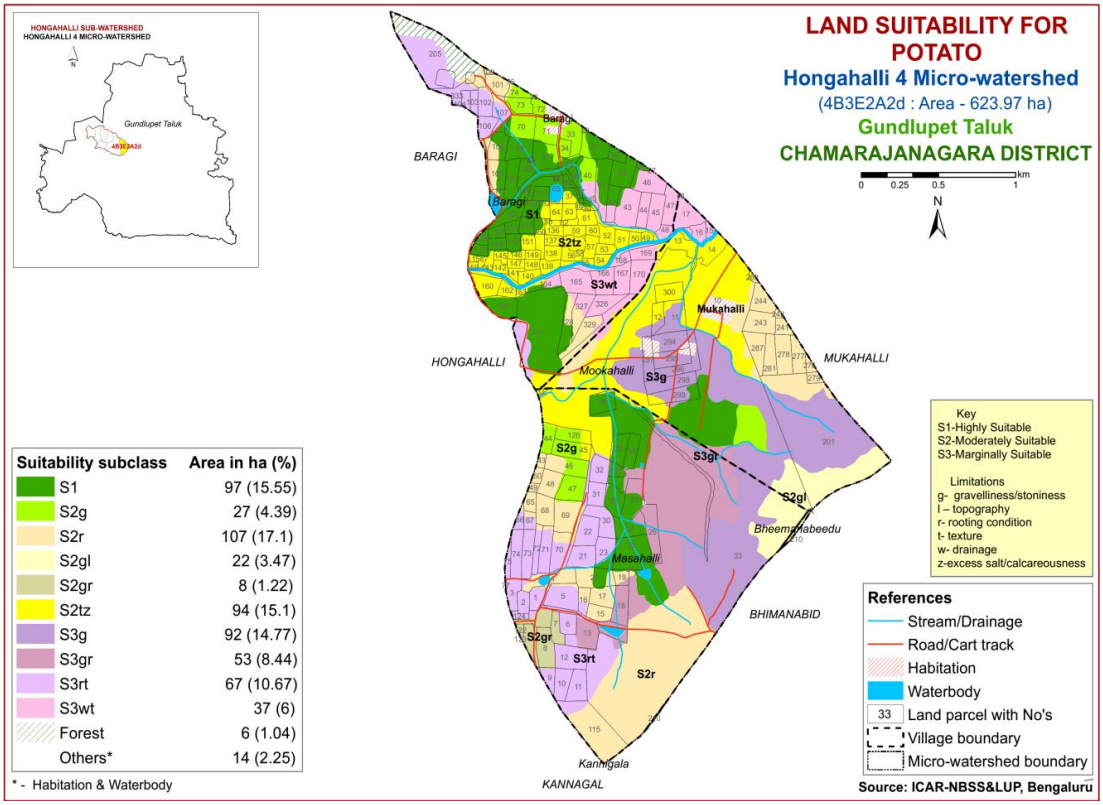


Fig. 7.13 Land Suitability map of Potato

The highly suitable (Class S1) lands for growing potato occupy an area of about 97 ha (16%) and are distributed in the central, northwestern and northeastern part of the microwatershed. Maximum area of about 258 ha (41%) is moderately suitable (Class S2) for potato and is distributed in the major part of the microwatershed. They have minor limitations of rooting depth, topography, texture, calcareousness and gravelliness. Marginally suitable lands (Class S3) for growing potato occupy an area of about 249 ha (40%) and occur in the northern, northeastern, central, western, southwestern and eastern part of the microwatershed. They have moderate limitations of rooting depth, texture, drainage and gravelliness.

7.14 Land Suitability for Turmeric (*Curcuma longa*)

Turmeric is the most important spice crop grown in an area of 0.19 lakh ha in almost all the districts of the State. The crop requirements for growing turmeric (Table 7.15) were matched with the soil-site characteristics (Table 7.1) of the soils of the microwatershed and a land suitability map for growing turmeric was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.14.

The highly suitable (Class S1) lands for growing turmeric cover an area about 97 ha (16%) and are distributed in the central, northwestern and northeastern part of the microwatershed. The moderately suitable (Class S2) lands are found to occur in a maximum area of about 258 ha (41%). They have minor limitations of gravelliness, topography, texture, calcareousness and rooting depth. They are distributed in the major part of the microwatershed. The marginally suitable (Class S3) lands cover an area of about 249 ha (40%) and occur in the northern, northeastern, central, eastern, western, southwestern and southern part of the microwatershed. They have moderate limitations of gravelliness, texture, drainage and rooting depth.

Table 7.15 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		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	Stonyheavy 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

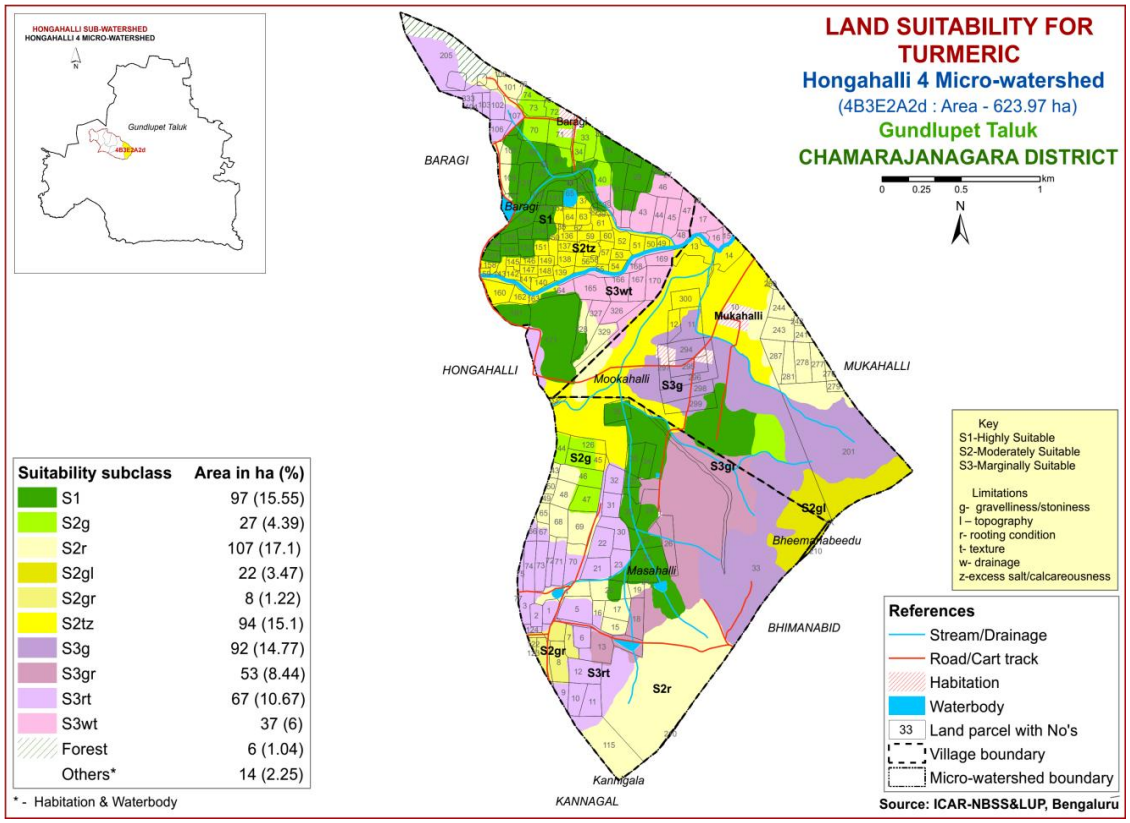


Fig. 7.14 Land Suitability map of Turmeric

7.15 Land suitability for Guava (*Psidium guajava*)

Guava is the most important fruit crop grown in an area of 0.06 lakh ha in almost all the districts of the State. The crop requirements (Table 7.16) for growing guava were matched with the soil-site characteristics (7.1) and a land suitability map for growing guava was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.15.

An area of about 97 ha (16%) in the microwatershed is highly suitable (Class S1) for growing guava and are distributed in the central, northwestern and northeastern part of the microwatershed. Small area of about 18 ha (3%) is moderately suitable (Class S2) for growing guava and are distributed in the central and northeastern part of the microwatershed and have minor limitation of gravelliness. Marginally suitable (Class S3) lands cover a maximum area of about 369 ha (59%) and are distributed in the major part of the microwatershed. They have moderate limitations of rooting depth, topography, texture, calcareousness, drainage and gravelliness. An area of about 120 ha (19%) is not suitable (N) for growing guava and occur in the northern, western, central, eastern and southern part of the microwatershed with severe limitations of rooting depth and texture.

Table 7.16 Crop suitability criteria for Guava

Crop requirement			Rating			
Soil –site characteristics		Unit	Highly suitable(S1)	Moderately suitable (S2)	Marginally suitable(S3)	Not suitable(N)
Climate	Temperature in growing season	^{0}C	28-32	33-36 24-27	37-42 20-23	
Soil moisture	Growing period	Days	>150	120-150	90-120	<90
Soil aeration	Soil drainage	Class	Well drained	Mod. to imperfectly	poor	Very poor
Nutrient availability	Texture	Class	Scl, l, cl, sil	Sl,sicl,sic.,sc,c	C (<60%)	C (>60%)
	pH	1:2.5	6.0-7.5	7.6-8.0:5.0-5.9	8.1-8.5:4.5-4.9	>8.5:<4.5
	$CaCO_3$ in root zone	%	Non calcareous	<10	10-15	>15
Rooting conditions	Soil depth	Cm	>100	75-100	50-75	<50
	Gravel content	%vol.	<15	15-35	>35	
Soil toxicity	Salinity	dS/m	<2.0	2.0-4.0	4.0-6.0	
	Sodicity	%	Non sodic	10-15	15-25	>25
Erosion	Slope	%	<3	3-5	5-10	>10

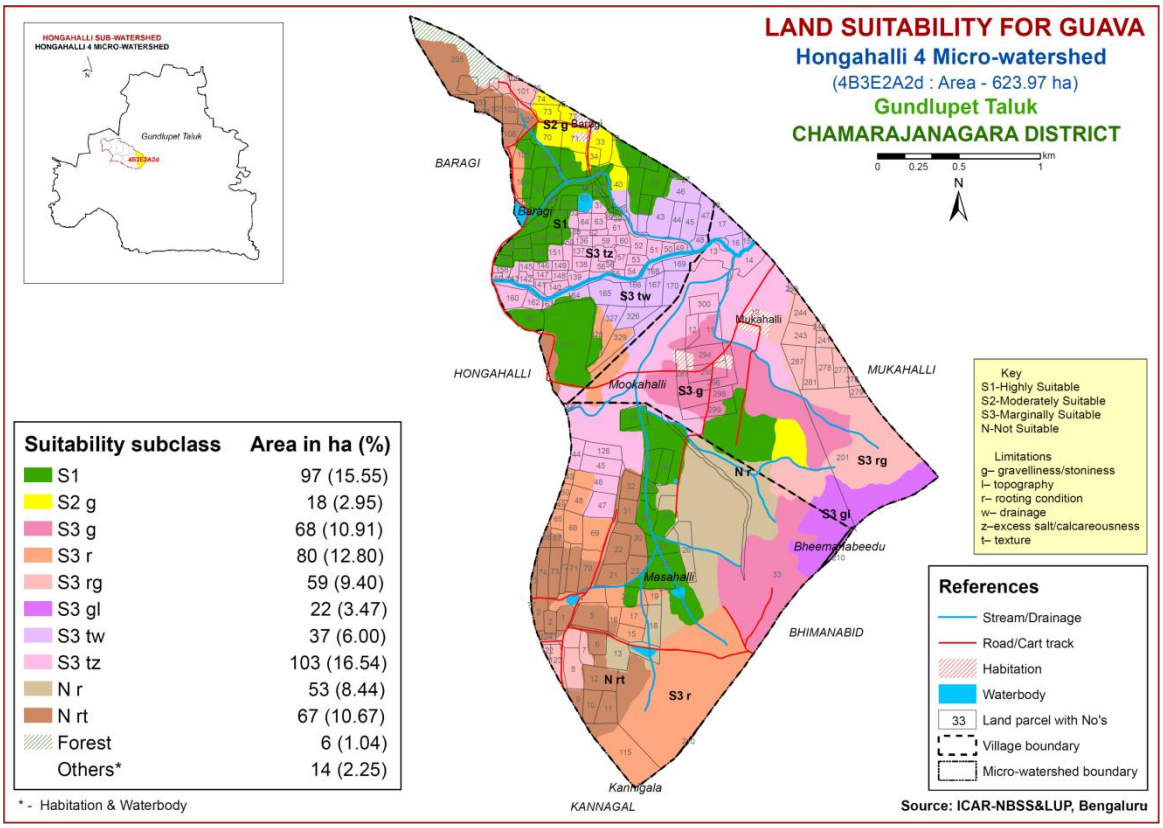


Fig. 7.15 Land Suitability map of Guava

7.16 Land suitability for Mango (*Mangifera indica*)

Mango is the most important fruit crop grown in an area of 1.73 lakh ha in almost all the districts of the State. The crop requirements (Table 7.17) for growing mango were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing mango was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed is given in Figure 7.16.

An area of about 97 ha (16%) in the microwatershed is highly suitable (Class S1) for growing mango and are distributed in the northeastern, northwestern and central part of the microwatershed. An area of about 27 ha (4%) is moderately suitable (Class S2) for growing mango and are distributed in the central, western and northeastern part of the microwatershed. They have minor limitation of gravelliness. An area of 221 ha (35%) is marginally suitable (Class S3) for growing mango with moderate limitations of gravelliness, topography, drainage, texture, calcareousness and rooting depth. They are distributed in the northeastern, central, western and eastern part of the microwatershed. Maximum area of about 258 ha (41%) is not suitable (Class N) for growing mango and occur in all parts of the microwatershed with severe limitations of rooting depth and texture.

Table 7.17 Crop suitability criteria for Mango

Crop requirement			**Rating**			
Soil-site characteristics		**Unit**	**Highly suitable(S1)**	**Moderately suitable(S2)**	**Marginally suitable(S3)**	**Not suitable(N)**
Climate	Temp. in growing season	^{0}C	28-32	24-27 33-35	36-40	20-24
	Min.temp. before flowering	^{0}C	10-15	15-22	>22	
Soil moisture	Growing period	Days	>180	150-180	120-150	<120
Soil aeration	Soil drainage	Class	Well drained	Mod. To imperfectly drained	Poor drained	Very poorly drained
	Water table	M	>3	2.50-3.0	2.5-1.5	<1.5
Nutrient availability	Texture	Class	sc, l, sil, cl	sl,sc,sic,l,c	c (<60%)	c (>60%),
	pH	1:2.5	5.5-7.5	7.6-8.5,5.0-5.4	8.6-9.0,4.0-4.9	>9.0<4.0
	OC	%	High	medium	low	
	$CaCO_3$ in root zone	%	Non calcareous	<5	5-10	>10
Rooting conditions	Soil depth	cm	>200	125-200	75-125	<75
	Gravel content	%vol	Non-gravelly	<15	15-35	>35
Soil toxicity	Salinity	dS/m	Non saline	<2.0	2.0-3.0	>3.0
	Sodicity	%	Non sodic	<10	10-15	>15
Erosion	Slope	%	<3	3-5	5-10	

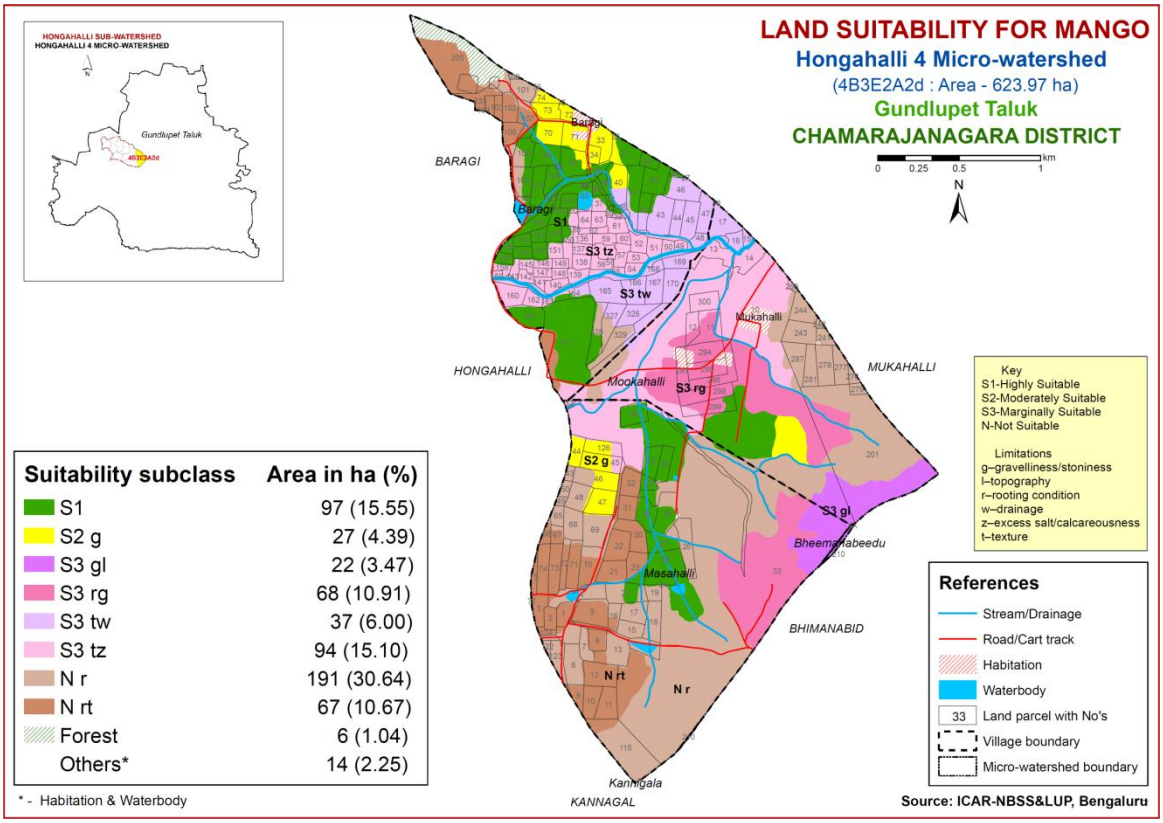


Fig. 7.16 Land Suitability map of Mango

7.17 Land suitability for Sapota (*Manilkara zapota*)

Sapota is the most important fruit crop grown in an area of 29373 ha in almost all the districts of the State. The crop requirements (Table 7.18) for growing sapota were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing sapota was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.17.

An area of about 97 ha (16%) in the microwatershed is highly suitable (Class S1) for growing Sapota and are distributed in the northwestern, central and northeastern part of the microwatershed. Small area of about 27 ha (4%) is moderately suitable (Class S2) and are distributed in the northeastern, central, and western part of the microwatershed. They have minor limitation of gravelliness. Maximum area of about 360 ha (58%) is marginally suitable (Class S3) for growing sapota and are distributed in the major part of the microwatershed. They have moderate limitations of rooting depth, texture, gravelliness, topography, calcareousness and drainage. An area of about 120 ha (19%) is not suitable (Class N) for growing sapota and occur in the northern, western, central, and southern part of the microwatershed with severe limitations of rooting depth and texture.

Table 7.18 Crop suitability criteria for Sapota

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

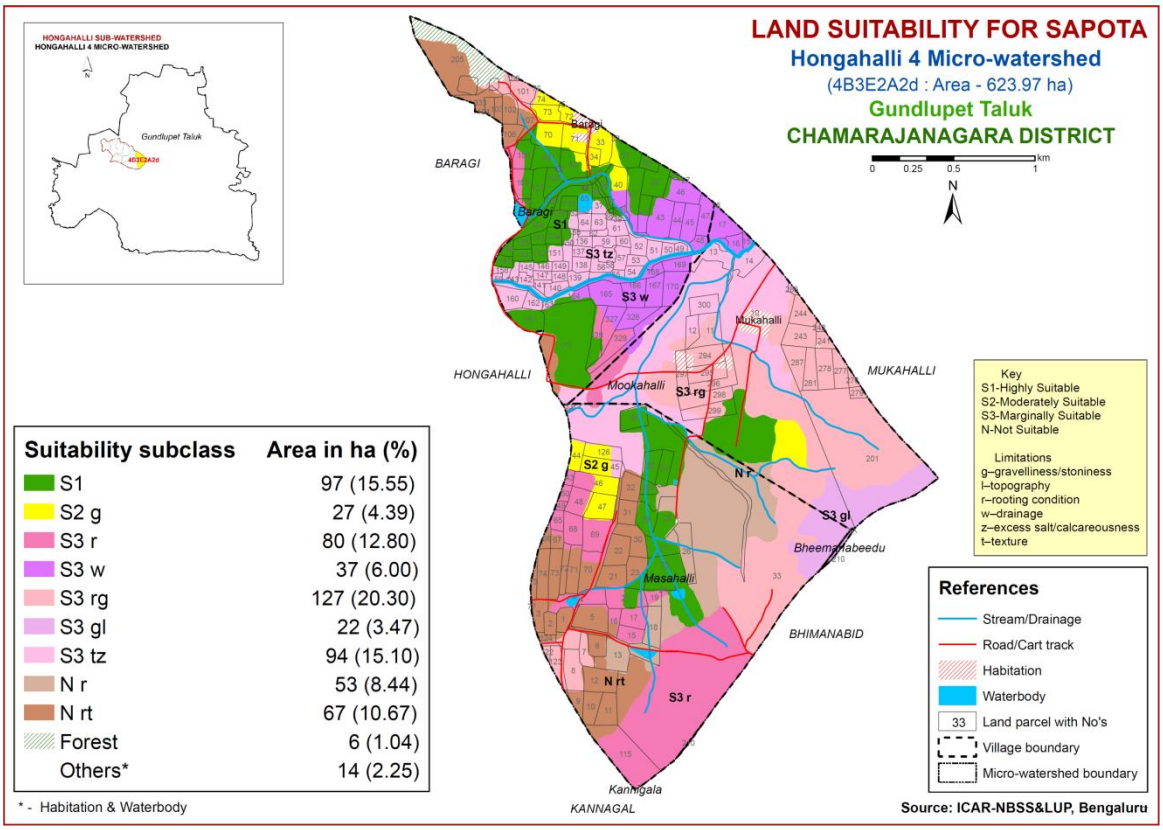


Fig. 7.17 Land Suitability map of Sapota

7. 18 Land Suitability for Jackfruit (*Artocarpus heterophyllus*)

Jackfruit is the most important fruit crop grown in an area of 5368 ha in almost all the districts of the State. The crop requirements for growing jackfruit were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing jackfruit (Table 7.19) was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.18.

A minor area of about 86 ha (14%) is highly suitable (Class S1) for growing Jackfruit and are distributed in the central, northwestern and northeastern part of the microwatershed. Moderately suitable (Class S2) lands occupy a small area of 38 ha (6%) and are distributed in the northeastern, central and western part of the microwatershed with minor limitations of gravelliness and topography. Marginally suitable (Class S3) lands for growing Jackfruit occupy a maximum area of about 360 ha (58%) and are distributed in the major part of the microwatershed. They have moderate limitations of rooting depth, drainage, texture, calcareousness, topography and gravelliness. An area of about 119 ha (19%) is not suitable (Class N) and are distributed in the northern, western, eastern and southern part of the microwatershed with severe limitation of rooting depth.

Table 7.19 Land suitability criteria for Jackfruit

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

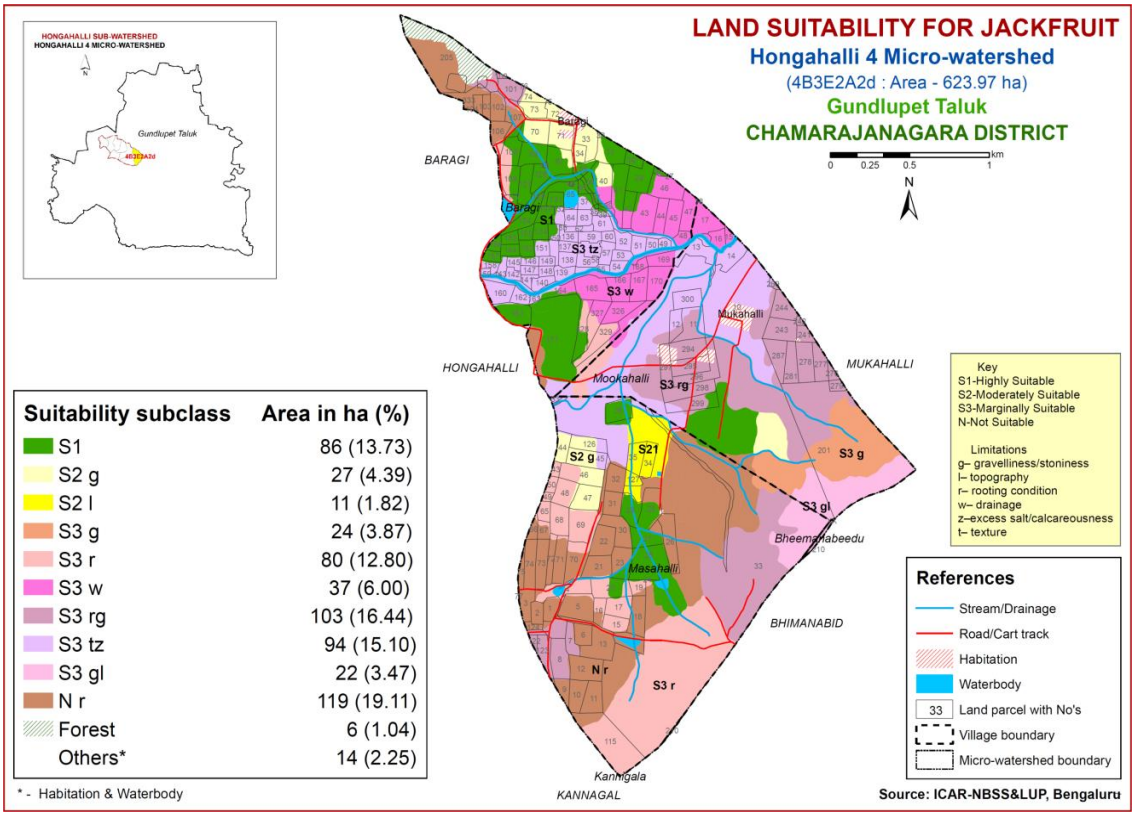


Fig. 7.18 Land Suitability map of Jackfruit

7.19 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 (Table 7.1) and a land suitability map for growing jamun (Table 20) was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.19.

An area of about 76 ha (12%) is highly suitable (Class S1) for growing Jamun and are distributed in the northeastern, northwestern and central part of the microwatershed. An area of about 131 ha (21%) is moderately suitable (Class S2) for growing Jamun and are distributed in the northern, northwestern, central, western and northeastern part of the microwatershed. They have minor limitations of gravelliness, texture and calcareousness. Maximum area of about 276 ha (44%) is marginally suitable (Class S3) for growing Jamun and are distributed in the major part of the microwatershed. They have moderate limitations of gravelliness, drainage, topography and rooting depth. An area of about 119 ha (19%) is not suitable (N) and are distributed in the northern, western, central and southwestern part of the microwatershed with severe limitation of rooting depth.

Table 7.20 Land suitability criteria for Jamun

Crop requirement			Rating			
Soil –site characteristics		Unit	Highly suitable(S1)	Moderately suitable(S2)	Marginally suitable(S3)	Not suitable (N)
Soil aeration	Soil drainage	Class	Well	Mod. well	Poorly	V.Poorly
Nutrient availability	Texture	Class	scl, cl, sc, c (red)	sl, c (black)	ls	-
	pH	1:2.5	6.0-7.8	5.0-6.0	7.8-8.4	>8.4
Rooting conditions	Soil depth	Cm	>150	100-150	50-100	<50
	Gravel content	% vol.	<15	15-35	35-60	>60
Erosion	Slope	%	0-3	3-5	5-10	>10

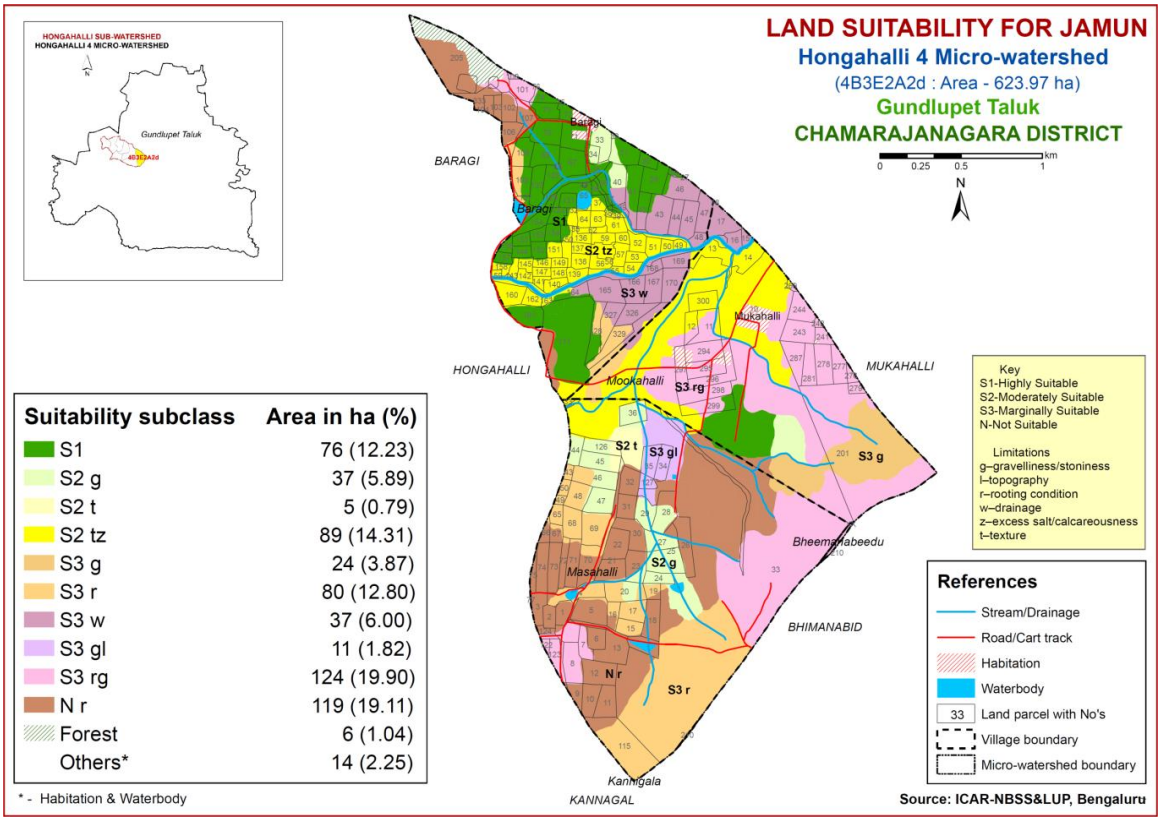


Fig. 7.19 Land Suitability map of Jamun

7.20 Land Suitability for Musambi (*Citrus limetta*)

Musambi is one of the important fruit crop grown in an area of 3446 ha in almost all the districts of the State. The crop requirements for growing musambi were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing musambi (Table 7.21) was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.20.

An area of about 97 ha (16%) is highly suitable (Class S1) for growing Musambi and are distributed in the northeastern, northwestern and central part of the

microwatershed. An area of about 158 ha (25%) is moderately suitable (Class S2) for growing Musambi and are distributed in the northern, northeastern, northwestern, central and western part of the microwatershed. They have minor limitations of drainage, calcareousness and gravelliness. Marginally suitable (Class S3) lands for growing Musambi occupy a maximum area of about 229 ha (37%) and are distributed in the major part of the microwatershed. They have moderate limitations of rooting depth, gravelliness and topography. An area of about 119 ha (19%) is not suitable (Class N) and are distributed in the northern, western, central and southwestern part of the microwatershed with severe limitation of rooting depth.

Table 7.21 Crop suitability criteria for Musambi

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

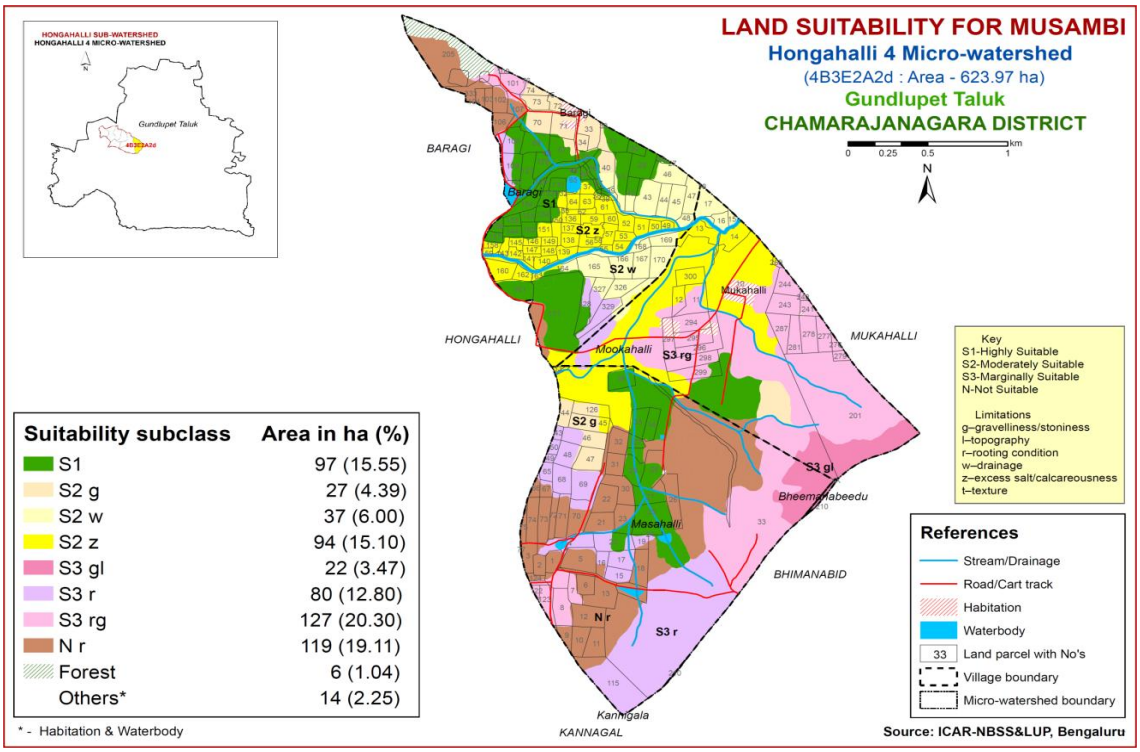


Fig. 7.20 Land Suitability map of Musambi

7.21 Land Suitability for Lime (*Citrus sp*)

Lime is one of the most important fruit crop grown in an area of 0.11 lakh ha in almost all the districts of the State. The crop requirements for growing lime (Table 7.22) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing lime was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7. 21.

An area of about 97 ha (16%) is highly suitable (Class S1) for growing Lime and are distributed in the northeastern, northwestern and central part of the microwatershed. An area of about 158 ha (25%) is moderately suitable (Class S2) for growing lime and are distributed in the northeastern, western, central and eastern part of the microwatershed. They have minor limitations of drainage, calcareousness and gravelliness. Marginally suitable (Class S3) lands for growing Lime occupy a maximum area of about 229 ha (37%) and are distributed in the major part of the microwatershed. They have moderate limitations of rooting depth, gravelliness and topography. An area of about 119 ha (19%) is not suitable (Class N) and are distributed in the northern, central, southwestern and western part of the microwatershed.

Table 7.22 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	

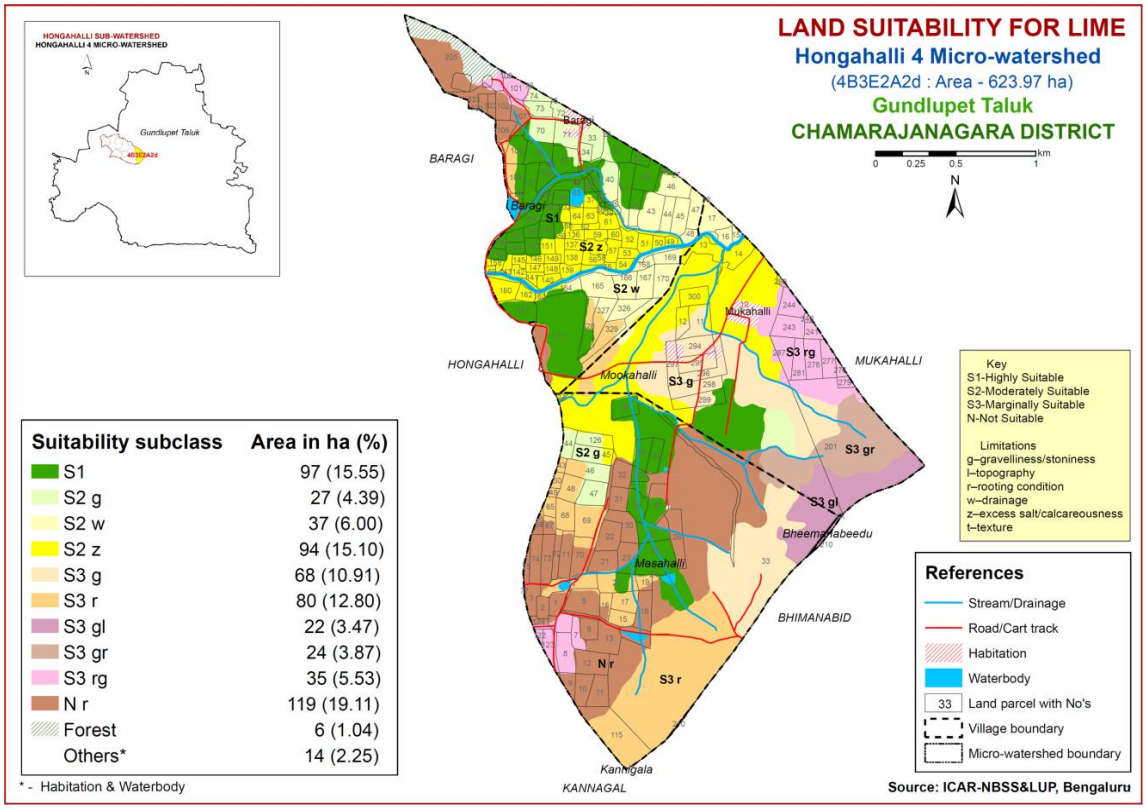


Fig. 7.21 Land Suitability map of Lime

7.22 Land Suitability for Cashew (*Anacardium occidentale)*

Cashew is one of the most important plantation nut crop grown in an area of 0.7 lakh ha in almost all the districts of the State. The crop requirements for growing cashew (Table 7.23) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing cashew was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.22.

An area of about 97 ha (16%) is highly suitable (Class S1) for growing cashew and are distributed in the northeastern, northwestern and central part of the microwatershed. Small area of 68 ha (11%) is moderately suitable (Class S2) for growing cashew and are distributed in the central and southeastern part of the microwatershed. They have minor limitations of rooting depth and gravelliness. The marginally suitable (Class S3) lands cover an area of about 188 ha (30%) and occur in the northern, western, central, eastern and southern part of the microwatershed. They have moderate limitations of rooting depth, topography and gravelliness. Maximum area of about 250 ha (40%) is not suitable (Class N) and are distributed in the major part of the microwatershed with severe limitations of rooting depth, texture, calcareousness and drainage.

Table 7.23 Land suitability criteria for Cashew

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

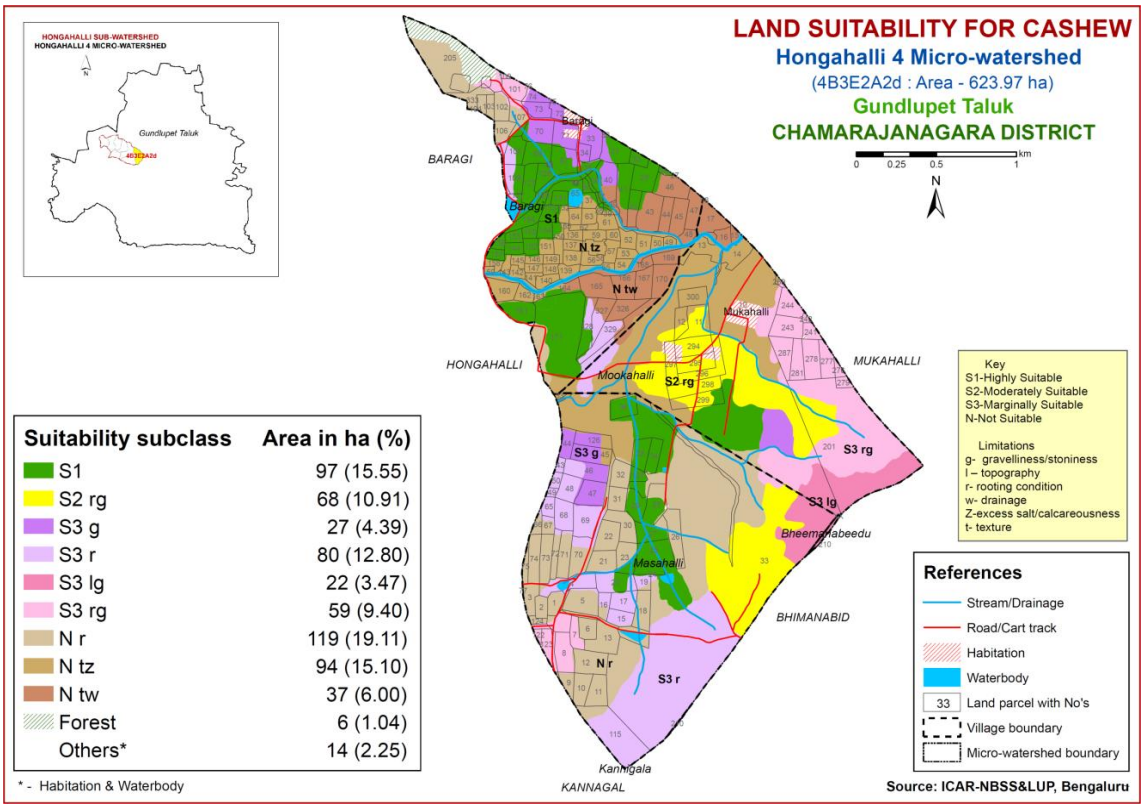


Fig. 7.22 Land Suitability map of Cashew

7.23 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 (Table7.24) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing custard apple was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.23.

An area of 97 ha (16%) is highly suitable (Class S1) for growing custard apple and are distributed in the northwestern, northeastern and central part of the microwatershed. Maximum area of about 386 ha (62%) has soils that are moderately suitable (Class S2) for growing custard apple with minor limitations of gravelliness,

drainage, calcareousness and rooting depth and are distributed in all parts of the microwatershed. An area of about 120 ha (19%) is marginally suitable (Class S3) for growing custard apple and are distributed in the northern, western, central and southeastern part of the microwatershed with moderate limitations of rooting depth and gravelliness.

Table 7.24 Land suitability criteria for Custard apple

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

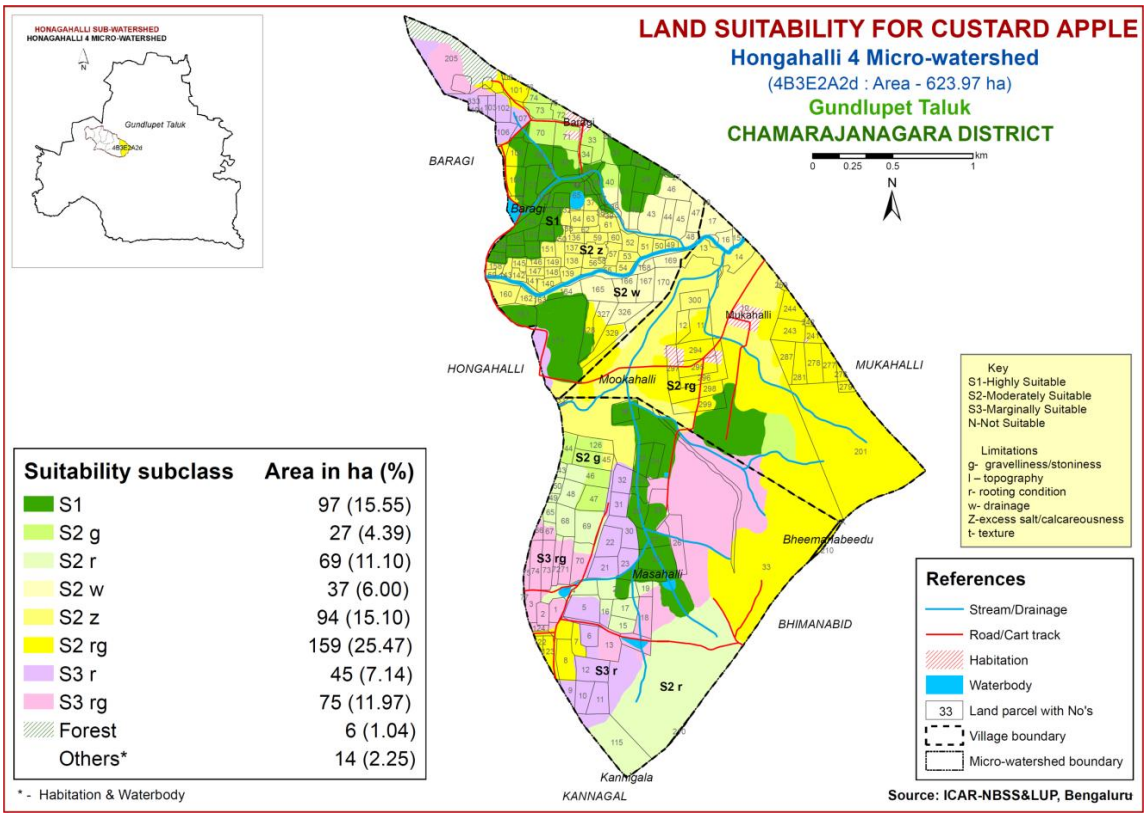


Fig. 7.23 Land Suitability map of Custard Apple

7.24 Land Suitability for Amla (*Phyllanthus emblica*)

Amla is one of the medicinal fruit crop grown in 151 ha area in all the districts of the State. The crop requirements for growing amla (Table 7.25) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing amla was

generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.24.

An area of about 97 ha (16%) is highly suitable (Class S1) for growing Amla and are distributed in the northeastern, northwestern and central part of the microwatershed. Maximum area of about 364 ha (59%) has soils that are moderately suitable (Class S2) for growing Amla with minor limitations of gravelliness, drainage, calcareousness and rooting depth and are distributed in the major part of the microwatershed. An area of 142 ha (23%) is marginally suitable (Class S3) with moderate limitations of rooting depth, topography and gravelliness and are distributed in the northern, western, central, southwestern and eastern part of the microwatershed.

Table 7.25 Land suitability criteria for Amla

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

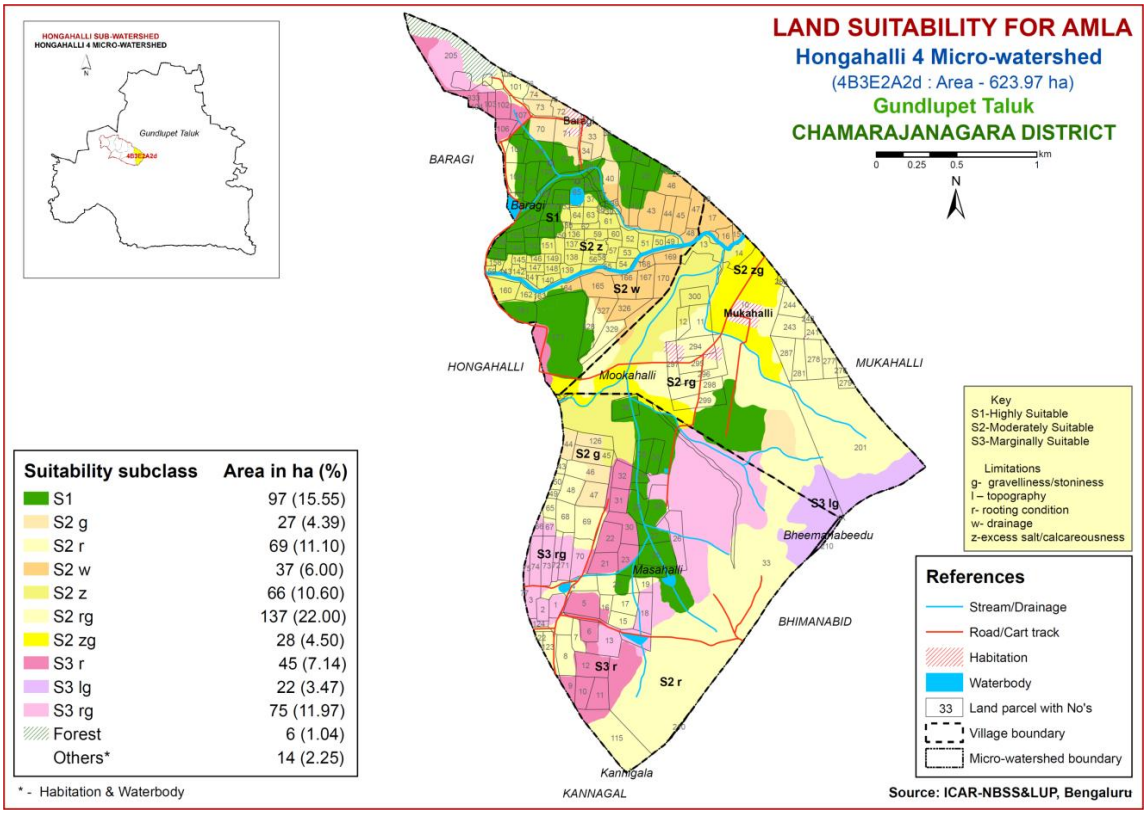


Fig. 7.24 Land Suitability map of Amla

7.25 Land Suitability for Tamarind (*Tamarindus indica*)

Tamarind is the most important spice crop grown in almost all the districts of the state. The crop requirements for growing tamarind (Table 7.26) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing tamarind was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Fig. 7.25.

Table 7.26 Land suitability criteria for Tamarind

Crop requirement			Rating			
Soil –site characteristics		Unit	Highly suitable(S1)	Moderately suitable(S2)	Marginally suitable(S3)	Not suitable(N)
Soil aeration	Soil drainage	Class	Well drained	Mod.well drained	Poorly drained	V.Poorly drained
Nutrient availability	Texture	Class	scl,cl,sc,c(red)	sl, c (black)	ls	-
	pH	1:2.5	6.0-7.3	5.0-6.0,7.3-7.8	7.8-8.4	>8.4
Rooting conditions	Soil depth	Cm	>150	100-150	75-100	<50
	Gravel content	%vol.	<15	15-35	35-60	60-80
Erosion	Slope	%	0-3	3-5	5-10	>10

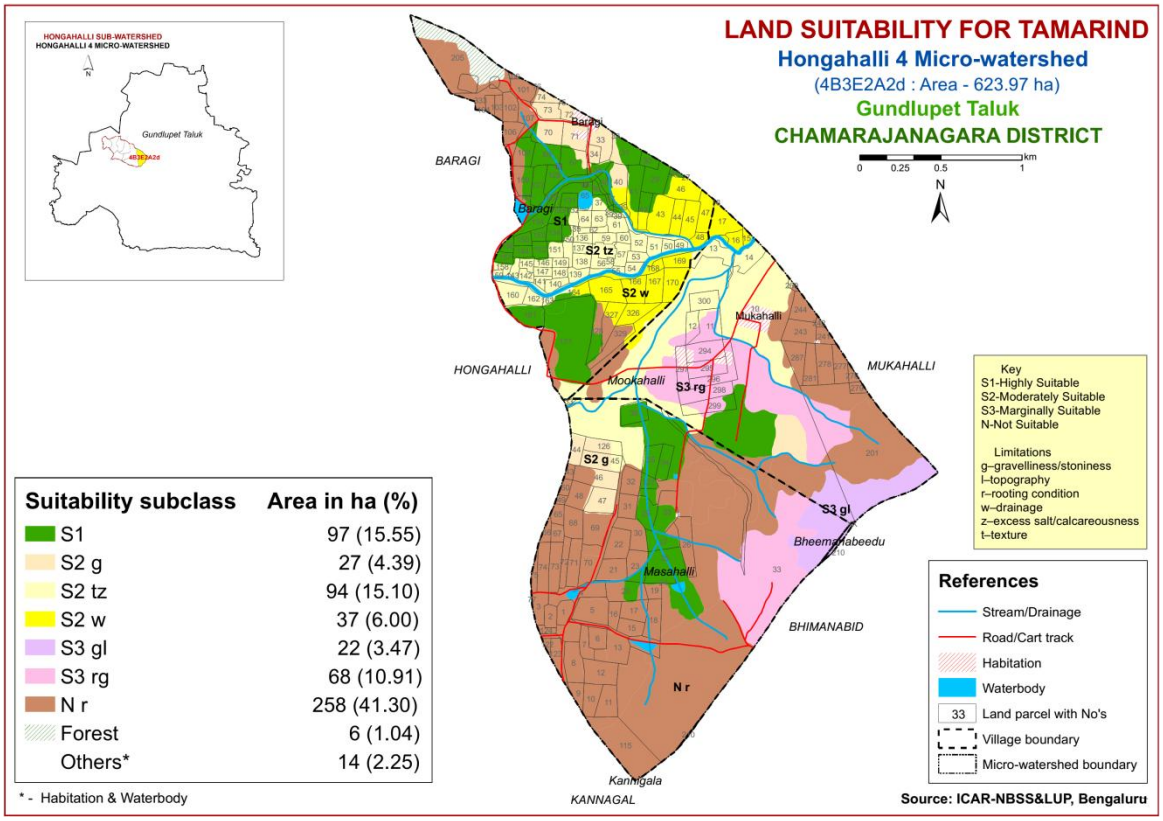


Fig. 7.25 Land Suitability map of Tamarind

An area of about 97 ha (16%) is highly suitable (Class S1) for growing Tamarind and are distributed in the northeastern, northwestern and central part of the microwatershed. An area of about 158 ha (25%) is moderately suitable (Class S2) for growing Tamarind and are distributed in the northeastern, central and western part of the

microwatershed. They have minor limitations of gravelliness, texture, calcareousness and drainage. Marginally suitable (Class S3) lands for growing Tamarind occupy a small area of about 90 ha (14%) and are distributed in the central and western part of the microwatershed. They have moderate limitations of rooting depth, topography, and gravelliness. Maximum area of about 258 ha (41%) is not suitable (Class N) for growing Tamarind and occur in the major part of the microwatershed with severe limitation of rooting depth.

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

Marigold is the most important flower crop grown in an area of 9108 ha in almost all the districts of the State. The crop requirements (Table 7.27) for growing marigold were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing marigold was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.26.

An area of about 97 ha (16%) is highly suitable (Class S1) for growing Marigold and are distributed in the northwestern, central, and northeastern part of the microwatershed. Maximum area of about 341 ha (55%) is moderately suitable (Class S2) for growing Marigold and are distributed in the major part of the microwatershed. They have minor limitations of texture, gravelliness, drainage, rooting depth and calcareousness. Marginally suitable (Class S3) lands for growing Marigold occupy an area of about 166 ha (26%) and are distributed in the northern, western, central, eastern and southwestern part of the microwatershed. They have moderate limitation of gravelliness, topography, texture and rooting depth.

Table 7.27 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	-

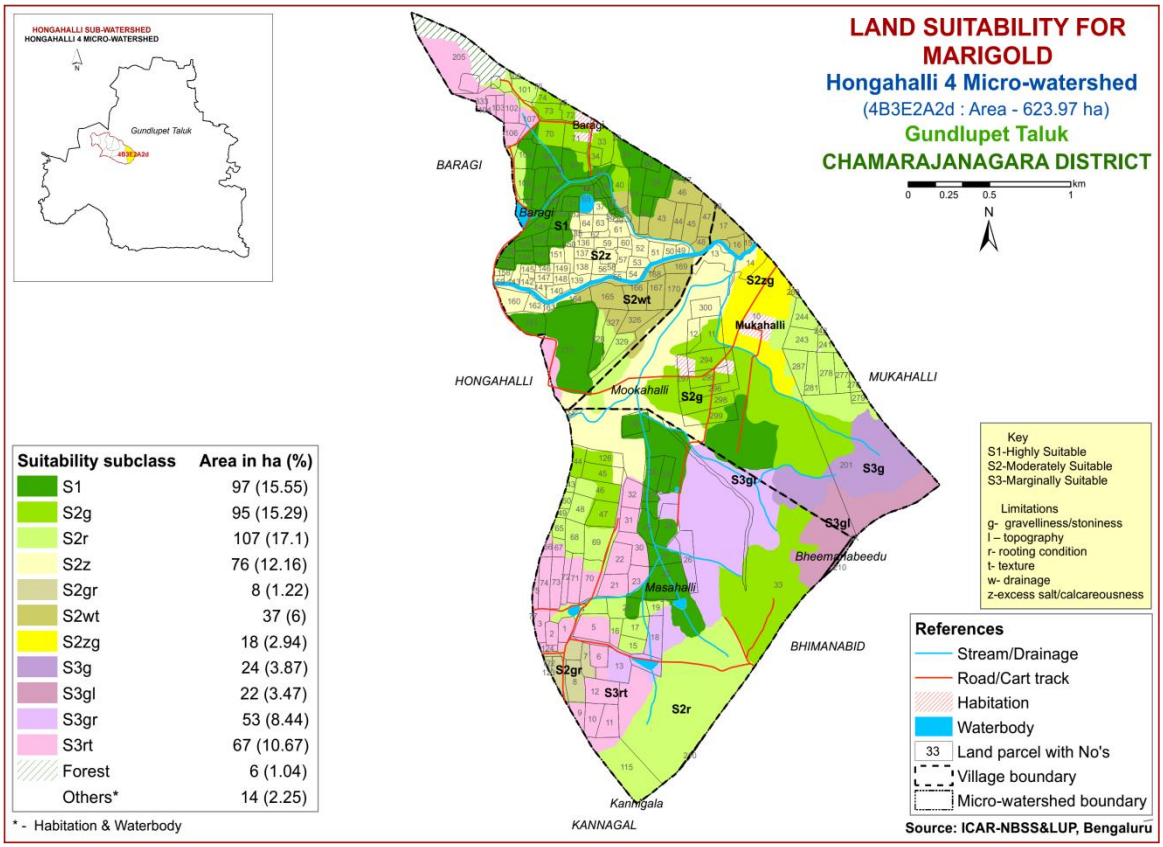


Fig. 7.26 Land Suitability map of Marigold

7.27 Land Suitability for Chrysanthemum (*Dendranthema grandiflora*)

Chrysanthemum is the most important flower crop grown in an area of 4978 ha in almost all the districts of the State. The crop requirements (Table 7.28) for growing chrysanthemum were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing chrysanthemum was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.27.

An area of about 97 ha (16%) is highly suitable (Class S1) for growing Chrysanthemum and are distributed in the central, northwestern and northeastern part of the microwatershed. Maximum area of about 273 ha (44%) is moderately suitable (Class S2) for growing Chrysanthemum and are distributed in the major part of the microwatershed. They have minor limitations of texture, gravelliness, rooting depth, calcareousness and drainage. Marginally suitable (Class S3) lands for growing Chrysanthemum occupy an area of about 234 ha (38%) and are distributed in the northern, central, western, eastern and southwestern part of the microwatershed. They have moderate limitations of gravelliness, topography, rooting depth and texture.

Table 7.28 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	

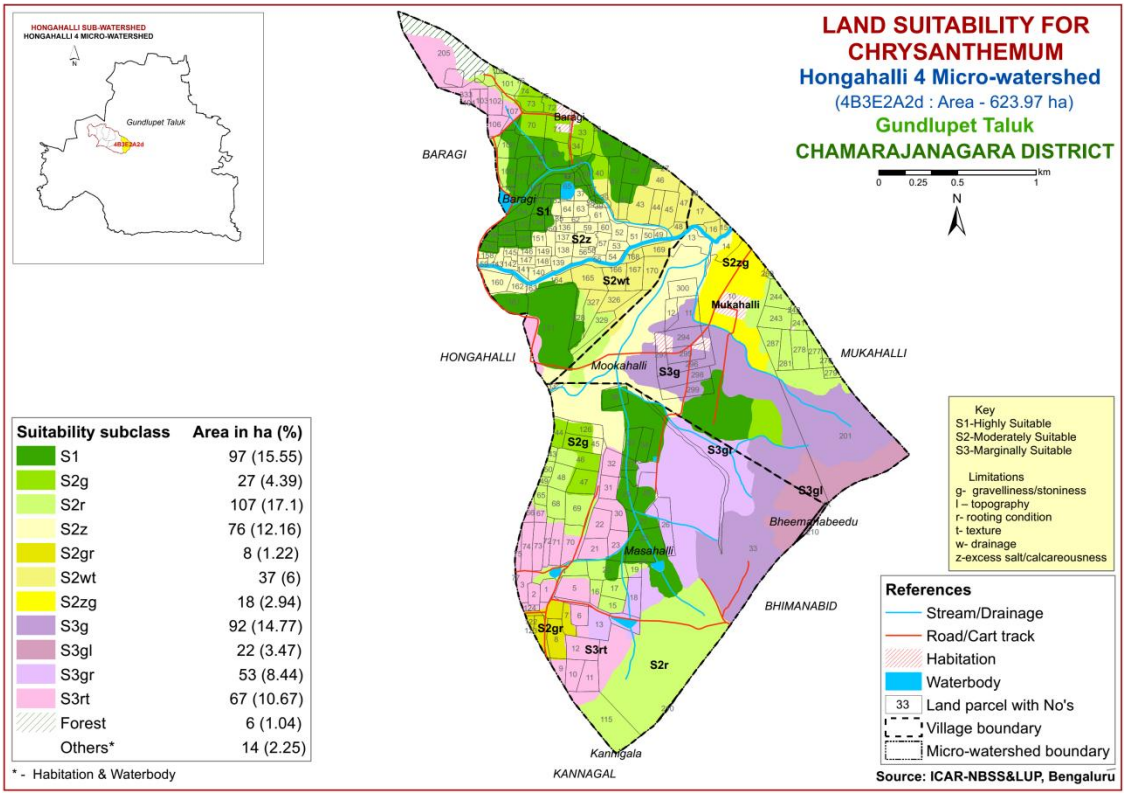


Fig. 7.27 Land Suitability map of Chrysanthemum

7.28 Land Use Classes (LUCs)

The 33 soil map units identified in Hongahalli-4 microwatershed have been grouped into 8 Land Use Classes (LUC's) for the purpose of preparing a Proposed Crop Plan. Land Use Classes are grouped based on the similarities in respect of the type of soil, the depth of the soil, the surface soil texture, gravel content, AWC, slope, erosion etc. and

a Land Use Classes map (Fig. 7.28) has been generated. These Land Use Classes are expected to behave similarly for a given level of management.

The map units that have been grouped into 8 Land Use Classes along with brief description of soil and site characteristics are given below.

LUC NO.	Soil map unit number	Soil map units	Soil and site characteristics
1	18, 19, 20, 21, 22, 23, 24, 25, 26, 27 (>150 cm)	KDHhB1 KDHhB1g1 KDHiB2g2 KDHmB1 HGHbB2g1 HGHcB2g1R1 HGHhB1g1 HGHhB2g1 HGHhB2g2R1 HGHiC2g2	Very deep soils (>150 cm), 1-5 % slopes, non gravelly to very gravelly (<15-60%), slight to moderate erosion.
2	28, 29, 30, 31, 32 (>150 cm)	BRGhB1g1 BRGhB2g2 BRGhB2g2St1 BRGmB1 BRGmB2g1	Very deep soils (>150 cm), 1-3 % slopes, non gravelly to very gravelly (<15-60%), slight to moderate erosion.
3	33 (>150 cm)	BMBmB1	Very deep soils (>150 cm), 1-3% slopes, non gravelly (<15%), slight erosion.
4	15, 16 (75-100 cm)	KNGiB1g1 KNGiC2g2	Moderately deep (75-100 cm), 1-5 % slopes, gravelly to very gravelly (15-60%), slight to moderate erosion.
5	9, 10, 11, 12, 13, 14 (50-75 cm)	MGHiC2g1 DRHhB2g1 DRHhB2g2 HPRhB2g1 HPRhB2g2St1R1 HPRiC2g1	Moderately shallow soils (50-75 cm), 1-5 % slopes, gravelly to very gravelly (15-60%), moderate erosion.
6	1, 2, 3, 4 (25-50cm)	SPRcB2g1 SPRhB1g1 SPRhB2g2 SPRhB2g2St1R1	Shallow soils (25-50 cm), 1-3 % slopes, gravelly to very gravelly (15-60%), slight to moderate erosion.
7	5, 6, 7, 8 (25-50 cm)	BMDbB2g1 BMDbB2g2 BMDcC2g1 BMDhC2g2St1	Shallow soils (25-50 cm), 1-5 % slopes, gravelly to very gravelly (15-60%), moderate erosion.
8	17 (100- 150 cm)	MDHhD3g2St1R2	Deep soils (100-150 cm), 5-10 % slopes, very gravelly (35-60%), severe erosion.

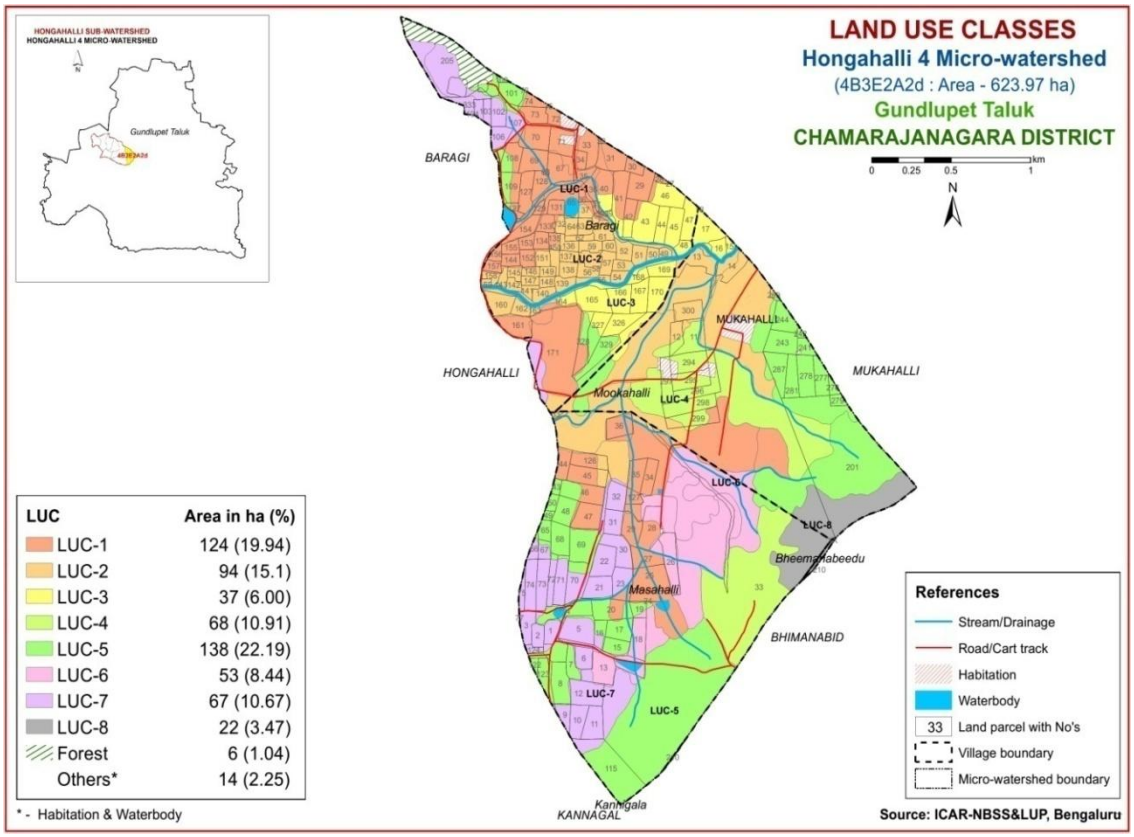


Fig. 7.28 Land Use Classes Map Hongahalli-4 Microwatershed

7.29 Proposed Crop Plan for Hongahalli-4 Microwatershed

After assessing the land suitability for the 27 crops, the proposed crop plan has been prepared for the 8 identified LUCs 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 7.29.

Table 7.29 Proposed Crop Plan for Hongahalli-4 Microwatershed

LUC No	Mapping Units	Survey Number	Soil Characteristics	Field Crops/Forestry	Suitable Horticulture Crops under Irrigation	Horticulture Crops with suitable Interventions	Suitable Interventions
LUC 1	KDHhB1 KDHhB1g1 KDHiB2g2 KDHmB1 HGHbB2g1 HGHcB2g1R1 HGHhB1g1 HGHhB2g1 HGHhB2g2R1 HGHiC2g2	**Baragi:**28,29,30,31,32,33,34,35,36,40,41,42,65,66,67,68,69,70,71,72,73,74,75,108,109,127,128,129,131,133,134,135,144,152,153,154,155,156,157,161,171,328 **Masahalli:**126,127,24,25,27,28,29,34,35,36,44,45,46,47	Very deep soils (>150 cm), 1-5 % slopes, non gravelly to very gravelly (<15-60%), slight to moderate erosion, rocky	Maize, Sorghum, Redgram, Cotton, Sugarcane, Sunflower, **Multiple crop rotation:** Redgram+ Maize Redgram+ Groundnut Pulses+ Ragi Pulses+ Sorghum	Mango, Sapota, Guava, Turmeric, Banana, Lime, Tomato, Beans, Bhendi	**Flower crops:** Marigold, Chrysanthemum **Perennial components:** Mango, Sapota, Custard apple, Amla, Lime, Musambi. **Vegetables:** Chillies, Bhendi	Drip irrigation, Mulching, crop suitable conservation practices
LUC 2	BRGhB1g1 BRGhB2g2 BRGhB2g2St1 BRGmB1 BRGmB2g1	**Baragi:**37,38,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,132,136,137,138,139,140,141,142,143,145,146,147,148,149,150,151,158,159,160,162,163 **Mookahalli:** 12,13,14,269,300	Very deep soils (>150 cm), 1-3 % slopes, non gravelly to very gravelly (<15-60%), slight to moderate erosion, stony	Sorghum, Redgram, Cotton, Sunflower, Sugarcane **Multiple crop rotation:** Redgram+ Fodder sorghum Pulses+ Sorghum	**Vegetables:** Beetroot, Banana, Lime, Tomato, Beans, Bhendi	**Flower crops:** Marigold, Chrysanthemum **Perenial components:**, Amla, Custard apple, Lime, **Vegetables:** Chillies, Bhendi	Drip irrigation, Mulching, crop suitable conservation practises
LUC 3	BMBmB1	**Baragi:**27,39,43,44,45,46,47,48,164,165,166,167,168,169,170,326,327 **Mookahalli:** 15,16,17,18	Very deep soils (>150 cm), 1-3% slopes, non gravelly (<15%), slight erosion.	-do-	-do-	-do-	-do-
LUC 4	KNGiB1g1 KNGiC2g2	**Mookahalli:**10,11,294,295,296,297,298,299	Moderately deep soils (75-100 cm), 1-5 % slopes, gravelly to very	Maize, Sorghum, Cotton, Ragi, Sunflower, Pulses+ Sorghum	Field bean, Beetroot, Onion, Turmeric,	**Perenial components:** Sapota, Guava **Flower crops:**	Drip irrigation, Mulching, Crop suitable

			gravelly (15-60%), slight to moderate erosion.		Tomato	Marigold, Chrysanthemum **Vegetables:** Bhendi, Chillies	conservation practices
LUC 5	MGHiC2g1 DRHhB2g1 DRHhB2g2 HPRhB2g1 HPRhB2g2St1R1 HPRiC2g1	**Baragi:** 100,101,329,76 **Kannigala:** 333 **Masahalli:**4,7,8,15,16,17,19,20, 33,43,48,49,50,65,68,69,115,122, 123 **Mookahalli:**201,241,242,243,244 ,276,277,278,279,281,287	Moderately shallow soils (50-75 cm), 1-5 % slopes, gravelly to very gravelly (15-60%), moderate erosion, stony and rocky	Ragi, Groundnut, Maize, Sorghum, Pulses+ Sorghum	Field bean, Beetroot, Onion, Turmeric, Tomato, Banana	Custard apple, Ber, Aonla **Flower crops:** Marigold, Gillardia Chrysanthemum, **Vegetables:** Bhendi, Cluster-bean	Drip irrigation, Mulching, Crop suitable conservation practices
LUC 6	SPRcB2g1 SPRhB1g1 SPRhB2g2 SPRhB2g2St1R1	**Masahalli**: 13,14-TANK,18,26	Shallow soils (25-50 cm), 1-3 % slopes, gravelly to very gravelly (15-60%), slight to moderate erosion, stony and rocky	Groundnut, Horsegram	Custard apple, Amla	Custard apple, Ber	Drip irrigation, Mulching, Crop suitable conservation practices
LUC 7	BMDbB2g1 BMDbB2g2 BMDcC2g1 BMDhC2g2St1	**Baragi:**102,103,104,106,107,333, TANK **Masahalli:**1,2,3,9,10,11,12,16, 21,22,23,30,31,32,5,6,66,67,70,71 ,72,73,74, 75,77, 124,	Shallow soils (25-50 cm), 1-5 % slopes, gravelly to very gravelly (15-60%), moderate erosion, stony	Bengal gram, Horsegram	Custard apple, Amla	Custard apple, Ber	Drip irrigation, Mulching, Crop suitable conservation practices
LUC 8	MDHhD3g2St1R2	**Bheemanabeedu:** 210	Deep soils (100-150 cm), 5-10 % slopes, very gravelly (35-60%), severe erosion, stony and rocky	**Silviculture:** Acasia auriculiformis, Glycirdia, Simaruba, Agave, Cassia **Grasses**: Styloxanthes hamata, Styloxanthes scabra, Styloxanthus hamata, Khus grass	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 characteristics 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 unfavorable conditions occur

Characteristics of Hongahalli-4 Microwatershed

- The soil phases identified in the microwatershed belonged to the soil series of BRG 94 ha (15%), HPR 85 ha (14%), HGH 69 ha (11%), KNG 68 ha (11%), BMD 67 ha (11%), KDN 56 ha (9%), SPR 53 ha (8%), BMB 37 ha (6%), DRH 30 ha (5%), MGH 24 ha (4%) and MDH 22 ha (3%).
- As per land capability classification entire area in the microwatershed falls under arable land category (Class II, III & IV). The major limitations identified in the arable lands were soil and erosion.
- On the basis of soil reaction, maximum area of about 193 ha (31%) is moderately to slightly acid (pH 5.5-6.5). 215 ha (34%) is neutral (pH 6.5 -7.3) and 196 ha (31%) area is slightly to moderately alkaline (pH 7.3-8.4).

❖ **Soil Health Management**

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

Acid soils

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

Liming materials:

1. $CaCO_3$ (Calcium Carbonate).
2. Dolomite [Ca Mg $(Co_3)_2$]
3. Quick lime (Cao)
4. Slaked lime [Ca $(OH)_2$]

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

Alkaline soils

(Slightly alkaline to moderately alkaline soils)

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

Neutral soils

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

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

Soil Degradation

Soil erosion is one of the major factor affecting the soil health in the microwatershed. Out of total 624 ha area in the microwatershed, an area of about 413 ha is suffering from moderate to severe erosion. These areas need immediate soil and water conservation and, other land development and land husbandry practices for restoring soil health.

Dissemination of Information and Communication of Benefits

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

Inputs for Net Planning (Saturation Plan) and Interventions needed

Net planning (Saturation Plan) in IWMP is focusing on preparation of

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

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

- **Soil Depth:** The depth of a soil decides the amount of moisture and nutrients it can hold, what crops can be taken up or not, depending on the rooting depth and the length of growing period available for raising any crop. Deeper the soil, better for a wide variety of crops. If sufficient depth is not available for growing deep rooted crops, either choose medium or short duration crops or deeper planting pits need to be opened and additional good quality soil brought from outside has to be filled into the planting pits.
- **Surface soil texture:** Lighter soil texture in the top soil means, better rain water infiltration, less run-off and soil moisture conservation, less capillary rise and less evaporation losses. Lighter surface textured soils are amenable to good soil tilth and are highly suitable for crops like groundnut, 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 Hongahalli-4 microwatershed.

- **Organic Carbon:** The OC content (an index of available Nitrogen) is high in (>0.75%) in about 124 ha (20%), medium (0.5-0.75%) in 386 ha (62%) area and low (<0.5%) in 92 ha (15%). The areas that are medium and low 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 478 ha area where OC is low to medium (<0.5-0.75%). 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**: Available Phosphorus is medium (23-57 kg/ha) in 452 ha (73%) of the microwatershed. In 151 ha (24%) area, the available phosphorus is high (>57 kg/ha). For all the crops 25% additional P needs to be applied where available P is medium.
- **Available Potassium:** Available potassium is medium (145-337 kg/ha) in a maximum area of 448 ha (72%) of the microwatershed, an area of about 112 ha (18%) is high (>337 kg/ha) in available potassium and low in 43 ha (7%). Hence, in all these plots, where available potassium is low and medium, for all the crops, additional 25 % potassium may be applied.
- **Available Sulphur:** Available sulphur is a very critical nutrient for oilseed crops. Medium in 114 ha (18%) and low in 489 ha (78%). These areas need to be applied with magnesium sulphate or gypsum or Factamphos (p) fertitilizer (13% sulphur) for 2-3 years for the deficiency to be corrected.
- **Available Boron:** An area of 60 ha (10%) is low and 544 (87%) ha medium. For these areas, application of sodium borate @ 10 kg/ha as soil application or 0.2 % borax as foliar spray is recommended.
- **Available Iron:** An area of 561 ha (90%) is sufficient in available iron and deficient in 42 ha (7%) area of the microwatershed. For the deficient areas, iron sulphate @ 25 kg/ha need to be applied for 2-3 years.
- **Available Zinc:** An area of 91 ha (15%) is sufficient in available zinc and deficient in 513 ha (82%) of the microwatershed. Application of zinc sulphate @25 kg/ha is to be recommended for deficient areas.
- **Soil acidity:** The microwatershed has 193 ha (31%) area with soils that are moderately to slightly acid. These areas need application of lime (Calcium Carbonate).
- **Soil Alkalinity:** The microwatershed has 196 ha (31%) area with soils that are slightly to moderately 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.

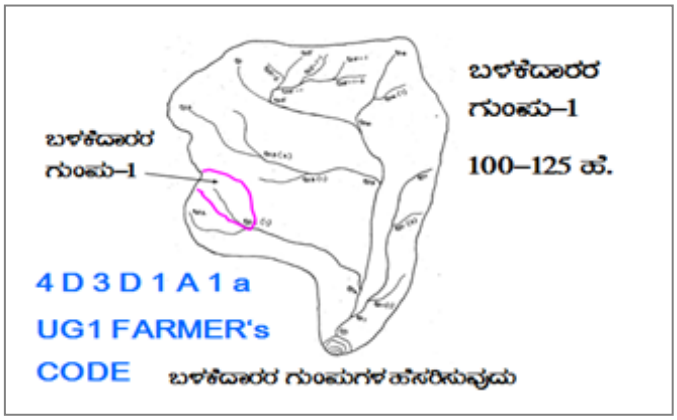
- **Land Suitability for various crops:** Areas that are highly, moderately and marginally suitable for growing various crops are indicated. Along with the suitability, various constraints that are limiting the productivity are also indicated. For example, in case of cotton, gravel content, rooting depth and salinity/alkalinity are the major constraints in various plots. With suitable management interventions, the productivity can be enhanced. In order to increase the water holding capacity of light textured soils, growing of green manure crops and application of organic manure is recommended.

Chapter 9

SOIL AND WATER CONSERVATION TREATMENT PLAN

For preparing soil and water conservation treatment plan for Hongahalli-4 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
- Available water capacity
- Soil slope
- Soil gravelliness
- Land capability
- Present land use and land cover
- Crop suitability
- Rainfall
- Hydrology
- Water Resources
- Socio-economic data
- Contour plan with existing features- network of waterways, pothissa boundaries, cut up/ minor terraces etc.
- Cadastral map (1:7920 scale)
- Satellite imagery (1:7920 scale)



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

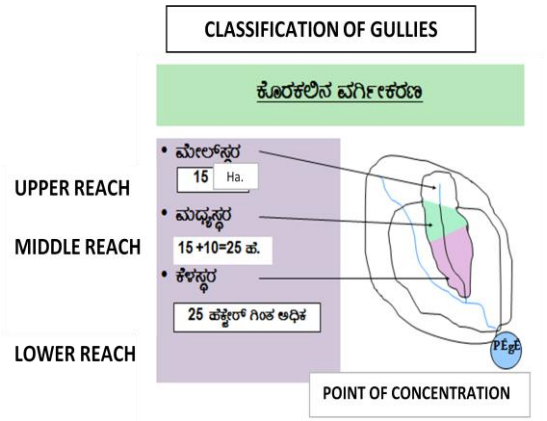
The treatment plan recommended for arable lands is briefly described below

9.1.1 Arable Land Treatment

A. BUNDING

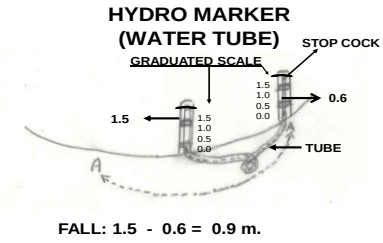
Steps for Survey and Preparation of Treatment Plan	
• Cadastral map (1:7920 scale) is enlarged to a scale of 1:2500 scale • Existing network of waterways, pothissa boundaries, grass belts, natural drainage lines/ watercourse, cut ups/ terraces are marked on the cadastral map to the scale • Drainage lines 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)

USER GROUP-1



Measurement of Land Slope

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



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

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

Note: (i) The above intervals are maximum.

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

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

Section of the Bund

Bund section is decided considering the soil texture class and gravelliness class (bg_0... b=loamy sand, g_0 = <15% gravel). The recommended Sections for different soils are given below.

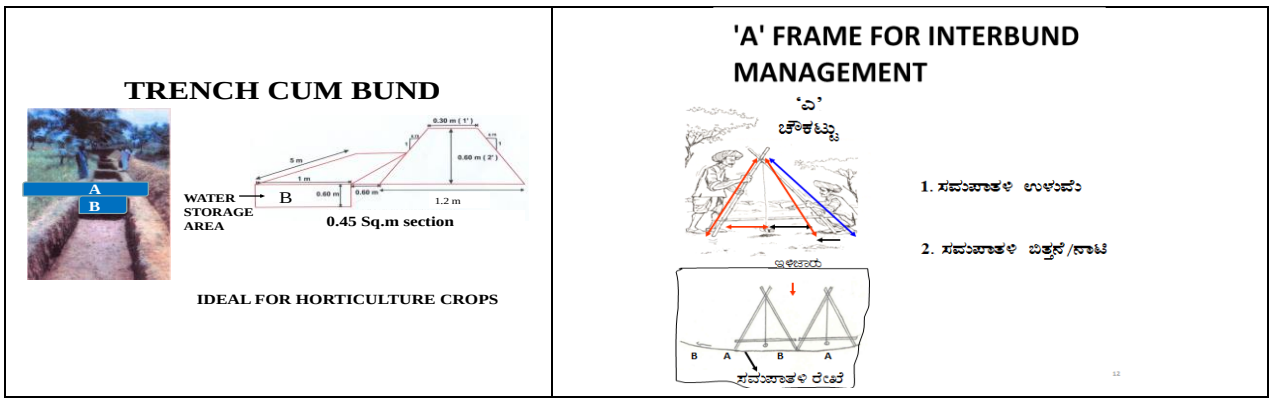
Recommended Bund Section

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 soils	
0.3	1.2	0.6	0.75:1	0.45		
0.3	1.5	0.6	01:01	0.54	Red sandy loam	
0.3	2.1	0.6	1.5:1	0.72	Very shallow black clayey soils	
0.45	2	0.75	01:01	0.92		
0.45	2.4	0.75	1.3:1	1.07	Shallow black clayey soils	
0.6	3.1	0.7	1.78:1	1.29	Medium black clayey soils	
0.5	3	0.85	1.47:1	1.49		

Formation of Trench cum Bund

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

Details of Borrow Pit dimensions are given below:



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

C. Farm Ponds

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

D. Diversion Channel

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

9.1.2 Non-Arable Land Treatment

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

9.1.3 Treatment of Natural Water Course/ Drainage Lines

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

9.2 Recommended Soil and Water Conservation Measures

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

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

A map (Fig. 9.1) showing soil and water conservation plan with different kinds of structures recommended has been prepared which shows the spatial distribution and extent of area. An area of about 384 ha (61%) needs Trench cum bunding and 198 ha (32%) needs Graded bunding and an area of 22 ha (3%) needs Terracing.

The conservation plan prepared may be presented to all the stakeholders including farmers and after considering their suggestions, the conservation plan for the microwatershed may be finalised in a participatory approach.

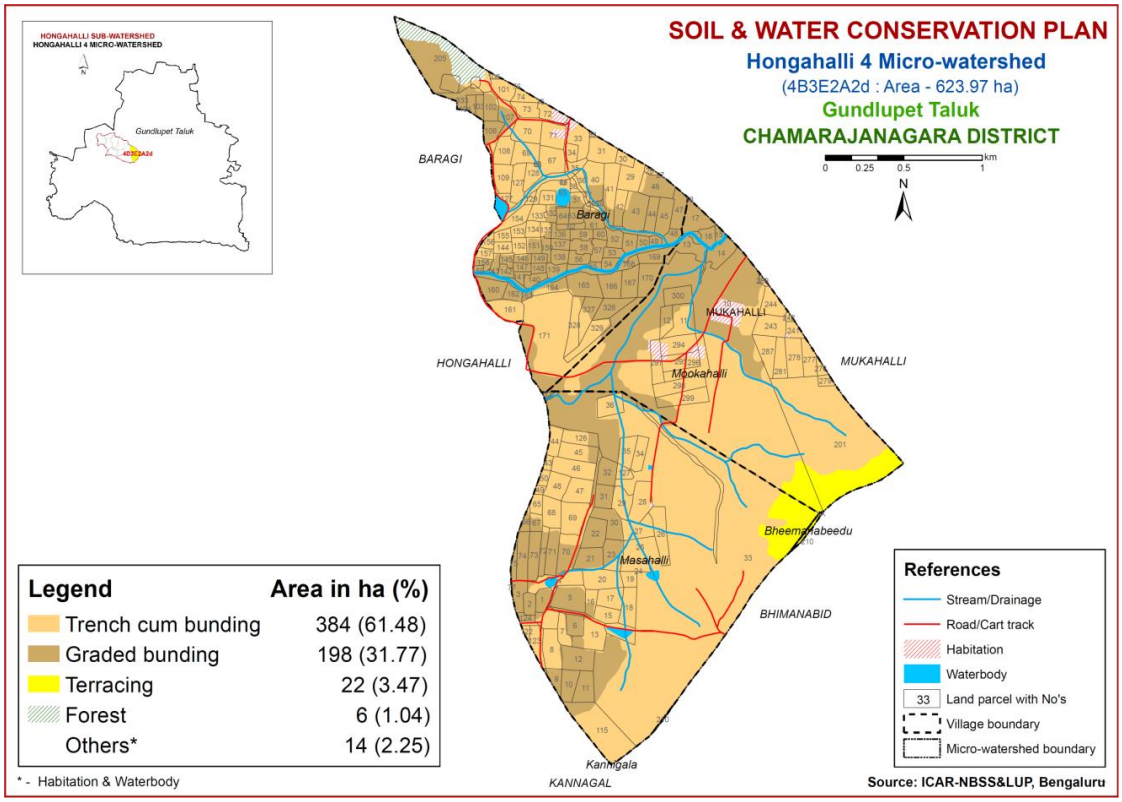


Fig. 9.1 Soil and Water Conservation Plan map of Hongahalli-4 Microwatershed

9.3 Greening of Microwatershed

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

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

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

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

References

1. FAO (1976) Framework for Land Evaluation, Food and Agriculture Organization, Rome.72 pp.
2. FAO (1983) Guidelines for Land Evaluation for Rainfed Agriculture, FAO, Rome, 237 pp.
3. IARI (1971) Soil Survey Manual, All India Soil and Land Use Survey Organization, IARI, New Delhi, 121 pp.
4. Katyal, J.C. and Rattan, R.K. (2003) Secondary and Micronutrients; Research Gap and Future Needs. Fert. News 48 (4); 9-20.
5. Naidu, L.G.K., Ramamurthy, V., Challa, O., Hegde, R. and Krishnan, P. (2006) Manual Soil Site Suitability Criteria for Major Crops, NBSS Publ. No. 129, NBSS & LUP, Nagpur, 118 pp.
6. Natarajan, A. and Dipak Sarkar (2010) Field Guide for Soil Survey, National Bureau of Soil Survey and Land Use Planning (ICAR), Nagpur, India.
7. Natarajan, A., Rajendra Hegde, Raj, J.N. and Shivananda Murthy, H.G. (2015) Implementation Manual for Sujala-III Project, Watershed Development Department, Bengaluru, Karnataka.
8. Sarma, V.A.K., Krishnan, P. and Budihal, S.L. (1987) Laboratory Manual, Tech. Bull. 23, NBSS &LUP, Nagpur.
9. Sehgal, J.L. (1990) Soil Resource Mapping of Different States of India; Why and How?, National Bureau of Soil Survey and Land Use Planning, Nagpur, 49 pp.
10. Shivaprasad, C.R., R.S. Reddy, J. Sehgal and M. Velayuthum (1998) Soils of Karntaka for Optimising Land Use, NBSS Publ. No. 47b, NBSS & LUP, Nagpur, India.
11. Soil Survey Staff (2006) Keys to Soil Taxonomy, Tenth edition, U.S. Department of Agriculture/ NRCS, Washington DC, U.S.A.
12. Soil Survey Staff (2012) Soil Survey Manual, Handbook No. 18, USDA, Washington DC, USA.

Appendix I

Hongahalli-4 Microwatershed

Soil Phase Information

Village	Survey No.	Area (ha)	Soil Phase	LUC	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	WELLS	Land Capability	Conservation Plan
Baragi	27	0	BMBmB1	LUC-3	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	NA	Not Available	II es	Graded bunding
Baragi	28	0.3	HGHbB2g1	LUC-1	Very deep (>150 cm)	Loamy sand	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	NA	Not Available	III es	Trench cum bunding
Baragi	29	2.52	HGHbB2g1	LUC-1	Very deep (>150 cm)	Loamy sand	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar+Cotton (Jw+Ct)	Not Available	III es	Trench cum bunding
Baragi	30	0.87	HGHbB2g1	LUC-1	Very deep (>150 cm)	Loamy sand	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	III es	Trench cum bunding
Baragi	31	2.48	HGHbB2g1	LUC-1	Very deep (>150 cm)	Loamy sand	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	III es	Trench cum bunding
Baragi	32	0.1	HGHhB2g2R1	LUC-1	Very deep (>150 cm)	Sandy clay loam	Very gravelly (35-60%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	NA	Not Available	III es	Trench cum bunding
Baragi	33	2.46	HGHhB2g2R1	LUC-1	Very deep (>150 cm)	Sandy clay loam	Very gravelly (35-60%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	III es	Trench cum bunding
Baragi	34	0.8	HGHhB2g2R1	LUC-1	Very deep (>150 cm)	Sandy clay loam	Very gravelly (35-60%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	III es	Trench cum bunding
Baragi	35	0.88	KDHhB1g1	LUC-1	Very deep (>150 cm)	Sandy clay loam	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	II es	Trench cum bunding
Baragi	36	0.99	KDHhB1g1	LUC-1	Very deep (>150 cm)	Sandy clay loam	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	II es	Trench cum bunding
Baragi	37	1.02	BRGmB1	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	NA	Not Available	II es	Graded bunding
Baragi	38	0.21	BRGmB1	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	II es	Graded bunding
Baragi	39	0.53	BMBmB1	LUC-3	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	NA	1 Bore well	II es	Graded bunding
Baragi	40	2.71	HGHhB2g2R1	LUC-1	Very deep (>150 cm)	Sandy clay loam	Very gravelly (35-60%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Marigold+Redgram (Mg+Rg)	Not Available	III es	Trench cum bunding
Baragi	41	2.96	HGHbB2g1	LUC-1	Very deep (>150 cm)	Loamy sand	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Banana+Turmeric (Bn+Tu)	Not Available	III es	Trench cum bunding
Baragi	42	1.51	HGHbB2g1	LUC-1	Very deep (>150 cm)	Loamy sand	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar+Cotton (Jw+Ct)	Not Available	III es	Trench cum bunding
Baragi	43	3.38	BMBmB1	LUC-3	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	II es	Graded bunding
Baragi	44	1.5	BMBmB1	LUC-3	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	II es	Graded bunding
Baragi	45	2.15	BMBmB1	LUC-3	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	II es	Graded bunding
Baragi	46	2.71	BMBmB1	LUC-3	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	II es	Graded bunding
Baragi	47	1.95	BMBmB1	LUC-3	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar+Marigold (Jw+Mg)	Not Available	II es	Graded bunding
Baragi	48	0.78	BMBmB1	LUC-3	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	II es	Graded bunding

Village	Survey No.	Area (ha)	Soil Phase	LUC	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	WELLS	Land Capability	Conservation Plan
Baragi	49	0.53	BRGmB1	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	II es	Graded bunding
Baragi	50	0.62	BRGmB1	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	II es	Graded bunding
Baragi	51	1.06	BRGmB1	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	II es	Graded bunding
Baragi	52	1.16	BRGmB1	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	II es	Graded bunding
Baragi	53	0.8	BRGmB1	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	NA	Not Available	II es	Graded bunding
Baragi	54	0.77	BRGmB1	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	NA	Not Available	II es	Graded bunding
Baragi	55	0.77	BRGmB1	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	NA	Not Available	II es	Graded bunding
Baragi	56	1	BRGmB1	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	II es	Graded bunding
Baragi	57	1.14	BRGmB1	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	NA	Not Available	II es	Graded bunding
Baragi	58	1.23	BRGmB1	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	II es	Graded bunding
Baragi	59	0.95	BRGmB1	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	II es	Graded bunding
Baragi	60	0.56	BRGmB1	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	II es	Graded bunding
Baragi	61	1.16	BRGmB1	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	II es	Graded bunding
Baragi	62	0.66	BRGmB1	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	II es	Graded bunding
Baragi	63	0.93	BRGmB1	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	II es	Graded bunding
Baragi	64	0.83	BRGmB1	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	II es	Graded bunding
Baragi	65	2.1	KDHhB1g1	LUC-1	Very deep (>150 cm)	Sandy clay loam	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	II es	Trench cum bunding
Baragi	66	0.07	KDHhB1g1	LUC-1	Very deep (>150 cm)	Sandy clay loam	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	NA	Not Available	II es	Trench cum bunding
Baragi	67	2.59	KDHhB1g1	LUC-1	Very deep (>150 cm)	Sandy clay loam	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Onion+Cotton (On+Ct)	2 Bore well	II es	Trench cum bunding
Baragi	68	0.09	HGHhB2g1	LUC-1	Very deep (>150 cm)	Sandy clay loam	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	NA	Not Available	III es	Trench cum bunding
Baragi	69	2.22	HGHhB2g1	LUC-1	Very deep (>150 cm)	Sandy clay loam	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Marigold (Mg)	Not Available	III es	Trench cum bunding
Baragi	70	2.54	KDHiB2g2	LUC-1	Very deep (>150 cm)	Sandy clay	Very gravelly (35-60%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Banana (Bn)	Not Available	III es	Trench cum bunding
Baragi	71	2.36	KDHiB2g2	LUC-1	Very deep (>150 cm)	Sandy clay	Very gravelly (35-60%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Tomato+Onion (To+On)	Not Available	III es	Trench cum bunding
Baragi	72	1.47	KDHiB2g2	LUC-1	Very deep (>150 cm)	Sandy clay	Very gravelly (35-60%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	III es	Trench cum bunding

Village	Survey No.	Area (ha)	Soil Phase	LUC	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	WELLS	Land Capability	Conservation Plan
Baragi	73	1.49	KDHiB2g2	LUC-1	Very deep (>150 cm)	Sandy clay	Very gravelly (35-60%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	III es	Trench cum bunding
Baragi	74	0.97	KDHiB2g2	LUC-1	Very deep (>150 cm)	Sandy clay	Very gravelly (35-60%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	III es	Trench cum bunding
Baragi	75	0.04	KDHiB2g2	LUC-1	Very deep (>150 cm)	Sandy clay	Very gravelly (35-60%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	NA	Not Available	III es	Trench cum bunding
Baragi	76	0	HPRhB2g2St1 R1	LUC-5	Moderately shallow (50-75 cm)	Sandy clay loam	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	NA	Not Available	III es	Trench cum bunding
Baragi	100	0.17	HPRhB2g2St1 R1	LUC-5	Moderately shallow (50-75 cm)	Sandy clay loam	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	NA	Not Available	III es	Trench cum bunding
Baragi	101	1.68	HPRhB2g2St1 R1	LUC-5	Moderately shallow (50-75 cm)	Sandy clay loam	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	III es	Trench cum bunding
Baragi	102	1.63	BMDcC2g1	LUC-7	Shallow (25-50 cm)	Sandy loam	Gravelly (15-35%)	Very low (<50 mm/m)	Gently sloping (3-5%)	Moderate	Cotton+Groundnut (Ct+Gn)	Not Available	IV es	Graded bunding
Baragi	103	0.73	BMDcC2g1	LUC-7	Shallow (25-50 cm)	Sandy loam	Gravelly (15-35%)	Very low (<50 mm/m)	Gently sloping (3-5%)	Moderate	Cotton (Ct)	Not Available	IV es	Graded bunding
Baragi	104	0.65	BMDcC2g1	LUC-7	Shallow (25-50 cm)	Sandy loam	Gravelly (15-35%)	Very low (<50 mm/m)	Gently sloping (3-5%)	Moderate	Cotton (Ct)	Not Available	IV es	Graded bunding
Baragi	106	1.43	BMDcC2g1	LUC-7	Shallow (25-50 cm)	Sandy loam	Gravelly (15-35%)	Very low (<50 mm/m)	Gently sloping (3-5%)	Moderate	Cotton+Marigold (Ct+Mg)	Not Available	IV es	Graded bunding
Baragi	107	2.15	BMDcC2g1	LUC-7	Shallow (25-50 cm)	Sandy loam	Gravelly (15-35%)	Very low (<50 mm/m)	Gently sloping (3-5%)	Moderate	Cotton+Current Fallow land (Ct+CFL)	Not Available	IV es	Graded bunding
Baragi	108	1.96	HGHhB2g1	LUC-1	Very deep (>150 cm)	Sandy clay loam	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Marigold (Mg)	1 Bore well	III es	Trench cum bunding
Baragi	109	1.98	HGHhB2g1	LUC-1	Very deep (>150 cm)	Sandy clay loam	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Marigold (Mg)	Not Available	III es	Trench cum bunding
Baragi	127	2.54	HGHhB2g1	LUC-1	Very deep (>150 cm)	Sandy clay loam	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar+Onion (Jw+on)	1 Bore well	III es	Trench cum bunding
Baragi	128	1.35	HGHhB2g1	LUC-1	Very deep (>150 cm)	Sandy clay loam	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	NA	Not Available	III es	Trench cum bunding
Baragi	129	0.36	HGHhB1g1	LUC-1	Very deep (>150 cm)	Sandy clay loam	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	NA	Not Available	II es	Trench cum bunding
Baragi	131	0.91	KDHhB1g1	LUC-1	Very deep (>150 cm)	Sandy clay loam	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Cotton (Ct)	Not Available	II es	Trench cum bunding
Baragi	132	0.77	BRGmB1	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	II es	Graded bunding
Baragi	133	1.06	KDHhB1g1	LUC-1	Very deep (>150 cm)	Sandy clay loam	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	II es	Trench cum bunding
Baragi	134	0.98	KDHhB1g1	LUC-1	Very deep (>150 cm)	Sandy clay loam	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	II es	Trench cum bunding
Baragi	135	0.7	KDHhB1g1	LUC-1	Very deep (>150 cm)	Sandy clay loam	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	II es	Trench cum bunding
Baragi	136	0.85	BRGmB1	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	II es	Graded bunding
Baragi	137	0.79	BRGmB1	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	II es	Graded bunding
Baragi	138	1.03	BRGmB1	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	II es	Graded bunding

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Baragi	139	0.97	BRGmB1	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	NA	Not Available	II es	Graded bunding
Baragi	140	0.95	BRGmB1	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	II es	Graded bunding
Baragi	141	0.56	BRGmB1	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	II es	Graded bunding
Baragi	142	0.67	BRGmB1	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	II es	Graded bunding
Baragi	143	0.58	BRGmB1	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	NA	Not Available	II es	Graded bunding
Baragi	144	0.86	KDHhB1g1	LUC-1	Very deep (>150 cm)	Sandy clay loam	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	II es	Trench cum bunding
Baragi	145	0.69	BRGmB1	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	II es	Graded bunding
Baragi	146	0.63	BRGmB1	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	II es	Graded bunding
Baragi	147	0.63	BRGmB1	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	II es	Graded bunding
Baragi	148	0.62	BRGmB1	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	NA	Not Available	II es	Graded bunding
Baragi	149	0.6	BRGmB1	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	NA	Not Available	II es	Graded bunding
Baragi	150	0.73	BRGmB1	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	II es	Graded bunding
Baragi	151	0.99	BRGmB1	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	II es	Graded bunding
Baragi	152	0.96	KDHhB1g1	LUC-1	Very deep (>150 cm)	Sandy clay loam	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	II es	Trench cum bunding
Baragi	153	0.75	KDHhB1g1	LUC-1	Very deep (>150 cm)	Sandy clay loam	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	II es	Trench cum bunding
Baragi	154	1.7	HGHhB1g1	LUC-1	Very deep (>150 cm)	Sandy clay loam	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Marigold (Mg)	Not Available	II es	Trench cum bunding
Baragi	155	0.82	KDHhB1g1	LUC-1	Very deep (>150 cm)	Sandy clay loam	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	NA	Not Available	II es	Trench cum bunding
Baragi	156	0.63	KDHhB1g1	LUC-1	Very deep (>150 cm)	Sandy clay loam	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Cotton (Ct)	Not Available	II es	Trench cum bunding
Baragi	157	0.72	KDHhB1g1	LUC-1	Very deep (>150 cm)	Sandy clay loam	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Cotton (Ct)	Not Available	II es	Trench cum bunding
Baragi	158	0.64	BRGmB1	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Cotton (Ct)	Not Available	II es	Graded bunding
Baragi	159	0.28	BRGmB1	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Cotton (Ct)	Not Available	II es	Graded bunding
Baragi	160	2.08	BRGmB2g1	LUC-2	Very deep (>150 cm)	Clay	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Current Fallow land (CFL)	Not Available	III es	Graded bunding
Baragi	161	2.51	HGHbB2g1	LUC-1	Very deep (>150 cm)	Loamy sand	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	III es	Trench cum bunding
Baragi	162	0.94	BRGmB2g1	LUC-2	Very deep (>150 cm)	Clay	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Current Fallow land (CFL)	Not Available	III es	Graded bunding

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Baragi	163	0.28	BRGmB2g1	LUC-2	Very deep (>150 cm)	Clay	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Current Fallow land (CFL)	Not Available	III es	Graded bunding
Baragi	164	1.54	BMBmB1	LUC-3	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Cotton+Current Fallow land (Ct+CFL)	Not Available	II es	Graded bunding
Baragi	165	2.97	BMBmB1	LUC-3	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar+Cotton (Jw+Ct)	Not Available	II es	Graded bunding
Baragi	166	2.15	BMBmB1	LUC-3	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar+Cotton (Jw+Ct)	Not Available	II es	Graded bunding
Baragi	167	2.03	BMBmB1	LUC-3	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Cotton (Ct)	Not Available	II es	Graded bunding
Baragi	168	0.78	BMBmB1	LUC-3	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	II es	Graded bunding
Baragi	169	1.56	BMBmB1	LUC-3	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	II es	Graded bunding
Baragi	170	2.45	BMBmB1	LUC-3	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Sorghum+Banana (Sg+Bn)	1 Bore well	II es	Graded bunding
Baragi	171	18.46	HGHcB2g1R1	LUC-1	Very deep (>150 cm)	Sandy loam	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton+Jowar+Marigold (Ct+Jw+Mg)	Not Available	III es	Trench cum bunding
Baragi	205	13.54	Forest	Forest	Forest	Forest	Forest	Forest	Forest	Forest	Cottton+Groundnut+Current fallowland+Forest (Ct+Gn+CFL+F)	Not Available	Forest	Forest
Baragi	326	2.03	BMBmB1	LUC-3	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Cotton+Marigold(Ct+Mg)	Not Available	II es	Graded bunding
Baragi	327	2.22	BMBmB1	LUC-3	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar+Marigold+Cotton (Jw+Mg+Ct)	Not Available	II es	Graded bunding
Baragi	328	2.33	HGHcB2g1R1	LUC-1	Very deep (>150 cm)	Sandy loam	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	III es	Trench cum bunding
Baragi	329	2.38	HPRhB2g1	LUC-5	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar (Jw)	Not Available	III e	Trench cum bunding
Baragi	333	1.55	BMDcC2g1	LUC-7	Shallow (25-50 cm)	Sandy loam	Gravelly (15-35%)	Very low (<50 mm/m)	Gently sloping (3-5%)	Moderate	NA	Not Available	IV es	Graded bunding
Masahalli	1	1.23	BMDbB2g2	LUC-7	Shallow (25-50 cm)	Loamy sand	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Very low (<50 mm/m)	Jowar+Cotton (Jw+Ct)	Not Available	III es	Graded bunding
Masahalli	2	1.06	BMDbB2g2	LUC-7	Shallow (25-50 cm)	Loamy sand	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Very low (<50 mm/m)	Cotton+Marigold(Ct+Mg)	Not Available	III es	Graded bunding
Masahalli	3	1.54	BMDbB2g2	LUC-7	Shallow (25-50 cm)	Loamy sand	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Very low (<50 mm/m)	Cotton+Marigold (Ct+Mg)	Not Available	III es	Graded bunding
Masahalli	4	3.09	DRHhB2g1	LUC-5	Moderately shallow (50-75cm)	Sandy clay loam	Gravelly (15-35%)	Very gently sloping (1-3%)	Moderate	Low (51-100 mm/m)	Marigold (Mg)	Not Available	III e	Trench cum bunding
Masahalli	5	3.17	BMDcC2g1	LUC-7	Shallow (25-50 cm)	Sandy loam	Gravelly (15-35%)	Gently sloping (3-5%)	Moderate	Very low (<50 mm/m)	Jowar+Marigold (Jw+Mg)	Not Available	IV es	Graded bunding
Masahalli	6	1.42	BMDcC2g1	LUC-7	Shallow (25-50 cm)	Sandy loam	Gravelly (15-35%)	Gently sloping (3-5%)	Moderate	Very low (<50 mm/m)	Cotton+Marigold(Ct+Mg)	Not Available	IV es	Graded bunding
Masahalli	7	1.3	DRHhB2g2	LUC-5	Moderately shallow (50-75 cm)	Sandy clay loam	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Low (51-100 mm/m)	Cotton+Current Fallow land (Ct+CFL)	Not Available	III es	Trench cum bunding
Masahalli	8	2.71	DRHhB2g2	LUC-5	Moderately shallow (50-75 cm)	Sandy clay loam	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Low (51-100 mm/m)	Cotton+Marigold(Ct+Mg)	Not Available	III es	Trench cum bunding
Masahalli	9	1.09	BMDcC2g1	LUC-7	Shallow (25-50 cm)	Sandy loam	Gravelly (15-35%)	Gently sloping (3-5%)	Moderate	Very low (<50 mm/m)	Marigold (Mg)	Not Available	IV es	Graded bunding

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Masahalli	10	1.91	BMDcC2g1	LUC-7	Shallow (25-50 cm)	Sandy loam	Gravelly (15-35%)	Gently sloping (3-5%)	Moderate	Very low (<50 mm/m)	Jowar+Marigold (Jw+Mg)	Not Available	IV es	Graded bunding
Masahalli	11	2.25	BMDcC2g1	LUC-7	Shallow (25-50 cm)	Sandy loam	Gravelly (15-35%)	Gently sloping (3-5%)	Moderate	Very low (<50 mm/m)	Jowar+Marigold (Jw+Mg)	Not Available	IV es	Graded bunding
Masahalli	12	2.98	BMDcC2g1	LUC-7	Shallow (25-50 cm)	Sandy loam	Gravelly (15-35%)	Gently sloping (3-5%)	Moderate	Very low (<50 mm/m)	Cotton+Marigold (Ct+Mg)	Not Available	IV es	Graded bunding
Masahalli	13	3.02	SPRhB2g2	LUC-6	Shallow (25-50 cm)	Sandy clay loam	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Very low (<50 mm/m)	Cotton+Marigold (Ct+Mg)	Not Available	III es	Trench cum bunding
Masahalli	14	1.7	SPRhB2g2	LUC-6	Shallow (25-50 cm)	Sandy clay loam	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Very low (<50 mm/m)	Jowar (Jw)	Not Available	III es	Trench cum bunding
Masahalli	15	1.49	DRHhB2g1	LUC-5	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Very gently sloping (1-3%)	Moderate	Low (51-100 mm/m)	Current Fallow land (CFL)	1 Bore well	III e	Trench cum bunding
Masahalli	16	1.14	DRHhB2g1	LUC-5	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Very gently sloping (1-3%)	Moderate	Low (51-100 mm/m)	NA	Not Available	III e	Trench cum bunding
Masahalli	17	1.98	DRHhB2g1	LUC-5	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Very gently sloping (1-3%)	Moderate	Low (51-100 mm/m)	Jowar (Jw)	Not Available	III e	Trench cum bunding
Masahalli	18	2.33	SPRhB2g2	LUC-6	Shallow (25-50 cm)	Sandy clay loam	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Very low (<50 mm/m)	Jowar (Jw)	Not Available	III es	Trench cum bunding
Masahalli	19	0.94	DRHhB2g1	LUC-5	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Very gently sloping (1-3%)	Moderate	Low (51-100 mm/m)	Jowar (Jw)	Not Available	III e	Trench cum bunding
Masahalli	20	2.94	DRHhB2g1	LUC-5	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Very gently sloping (1-3%)	Moderate	Low (51-100 mm/m)	Jowar (Jw)	1 Bore well	III e	Trench cum bunding
Masahalli	21	2.29	BMDbB2g1	LUC-7	Shallow (25-50 cm)	Loamy sand	Gravelly (15-35%)	Very gently sloping (1-3%)	Moderate	Very low (<50 mm/m)	Jowar+Cotton (Jw+Ct)	Not Available	III es	Graded bunding
Masahalli	22	2.54	BMDbB2g1	LUC-7	Shallow (25-50 cm)	Loamy sand	Gravelly (15-35%)	Very gently sloping (1-3%)	Moderate	Very low (<50 mm/m)	Current Fallow land (CFL)	2 Bore well	III es	Graded bunding
Masahalli	23	2.38	BMDbB2g1	LUC-7	Shallow (25-50 cm)	Loamy sand	Gravelly (15-35%)	Very gently sloping (1-3%)	Moderate	Very low (<50 mm/m)	Jowar+Tomato (Jw+To)	Not Available	III es	Graded bunding
Masahalli	24	1.24	KDHmB1	LUC-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very gently sloping (1-3%)	Slight	Very high (>200 mm/m)	Jowar (Jw)	1 Bore well	II e	Trench cum bunding
Masahalli	25	3.14	KDHmB1	LUC-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very gently sloping (1-3%)	Slight	Very high (>200 mm/m)	Jowar (Jw)	Not Available	II e	Trench cum bunding
Masahalli	26	2.84	SPRhB1g1	LUC-6	Shallow (25-50 cm)	Sandy clay loam	Gravelly (15-35%)	Very gently sloping (1-3%)	Slight	Very low (<50 mm/m)	Jowar+Cotton (Jw+Ct)	Not Available	III s	Trench cum bunding
Masahalli	27	2.4	KDHmB1	LUC-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very gently sloping (1-3%)	Slight	Very high (>200 mm/m)	Jowar (Jw)	Not Available	II e	Trench cum bunding
Masahalli	28	2.93	KDHmB1	LUC-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very gently sloping (1-3%)	Slight	Very high (>200 mm/m)	Jowar+Banana (Jw+Bn)	1 Bore well	II e	Trench cum bunding
Masahalli	29	2.01	KDHmB1	LUC-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very gently sloping (1-3%)	Slight	Very high (>200 mm/m)	Cotton (Ct)	Not Available	II e	Trench cum bunding
Masahalli	30	2.46	BMDbB2g1	LUC-7	Shallow (25-50 cm)	Loamy sand	Gravelly (15-35%)	Very gently sloping (1-3%)	Moderate	Very low (<50 mm/m)	Current Fallow land (CFL)	Not Available	III es	Graded bunding
Masahalli	31	1.65	BMDbB2g1	LUC-7	Shallow (25-50 cm)	Loamy sand	Gravelly (15-35%)	Very gently sloping (1-3%)	Moderate	Very low (<50 mm/m)	Jowar+Current Fallow Land (Jw+CFL)	1 Bore well	III es	Graded bunding
Masahalli	32	1.88	BMDbB2g1	LUC-7	Shallow (25-50 cm)	Loamy sand	Gravelly (15-35%)	Very gently sloping (1-3%)	Moderate	Very low (<50 mm/m)	Jowar+Cotton (Jw+Ct)	Not Available	III es	Graded bunding
Masahalli	33	144.07	HPRiC2g1	LUC-5	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Gently sloping (3-5%)	Moderate	Low (51-100 mm/m)	Forest+Jowar+Cotton +Current Fallow Land (F+Jw+Ct+CFL)	2 Bore well	III es	Trench cum bunding

Village	Survey No.	Area (ha)	Soil Phase	LUC	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	WELLS	Land Capability	Conservation Plan
Masahalli	34	1.58	KDHhB1	LUC-1	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Very gently sloping (1-3%)	Slight	Very high (>200 mm/m)	Banana+Turmeric (Bn+Tu)	1 Bore well	II e	Trench cum bunding
Masahalli	35	1.87	KDHhB1	LUC-1	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Very gently sloping (1-3%)	Slight	Very high (>200 mm/m)	Banana +Sorghum (Bn+Sg)	1 Bore well	II e	Trench cum bunding
Masahalli	36	2.08	KDHmB1	LUC-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very gently sloping (1-3%)	Slight	Very high (>200 mm/m)	Coconut+Turmeric (CN+Tu)	2 Bore well	II e	Trench cum bunding
Masahalli	43	0.48	DRHhB2g1	LUC-5	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Very gently sloping (1-3%)	Moderate	Low (51-100 mm/m)	Marigold (Mg)	Not Available	III e	Trench cum bunding
Masahalli	44	1.47	HGHiC2g2	LUC-1	Very deep (>150 cm)	Sandy clay	Very gravelly (35-60%)	Gently sloping (3-5%)	Moderate	Very high (>200 mm/m)	Marigold (Mg)	2 Bore well	III es	Trench cum bunding
Masahalli	45	2.51	HGHiC2g2	LUC-1	Very deep (>150 cm)	Sandy clay	Very gravelly (35-60%)	Gently sloping (3-5%)	Moderate	Very high (>200 mm/m)	Jowar+Marigold (Jw+Mg)	1 Bore well	III es	Trench cum bunding
Masahalli	46	2.95	HGHiC2g2	LUC-1	Very deep (>150 cm)	Sandy clay	Very gravelly (35-60%)	Gently sloping (3-5%)	Moderate	Very high (>200 mm/m)	Jowar+Marigold (Jw+Mg)	1 Bore well	III es	Trench cum bunding
Masahalli	47	2.52	HGHiC2g2	LUC-1	Very deep (>150 cm)	Sandy clay	Very gravelly (35-60%)	Gently sloping (3-5%)	Moderate	Very high (>200 mm/m)	Marigold (Mg)	Not Available	III es	Trench cum bunding
Masahalli	48	2.08	DRHhB2g1	LUC-5	Moderately shallow (50-75cm)	Sandy clay loam	Gravelly (15-35%)	Very gently sloping (1-3%)	Moderate	Low (51-100 mm/m)	Marigold (Mg)	Not Available	III e	Trench cum bunding
Masahalli	49	0.35	DRHhB2g1	LUC-5	Moderately shallow (50-75cm)	Sandy clay loam	Gravelly (15-35%)	Very gently sloping (1-3%)	Moderate	Low (51-100 mm/m)	Marigold (Mg)	Not Available	III e	Trench cum bunding
Masahalli	50	0.61	DRHhB2g1	LUC-5	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Very gently sloping (1-3%)	Moderate	Low (51-100 mm/m)	Marigold (Mg)	Not Available	III e	Trench cum bunding
Masahalli	65	0.93	DRHhB2g1	LUC-5	Moderately shallow (50-75cm)	Sandy clay loam	Gravelly (15-35%)	Very gently sloping (1-3%)	Moderate	Low (51-100 mm/m)	Marigold (Mg)	Not Available	III e	Trench cum bunding
Masahalli	66	0.69	BMDbB2g2	LUC-7	Shallow (25-50 cm)	Loamy sand	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Very low (<50 mm/m)	Marigold (Mg)	Not Available	III es	Graded bunding
Masahalli	67	0.87	BMDbB2g2	LUC-7	Shallow (25-50 cm)	Loamy sand	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Very low (<50 mm/m)	Marigold (Mg)	Not Available	III es	Graded bunding
Masahalli	68	2.18	DRHhB2g1	LUC-5	Moderately shallow (50-75cm)	Sandy clay loam	Gravelly (15-35%)	Very gently sloping (1-3%)	Moderate	Low (51-100 mm/m)	Marigold (Mg)	Not Available	III e	Trench cum bunding
Masahalli	69	3.19	DRHhB2g1	LUC-5	Moderately shallow (50-75cm)	Sandy clay loam	Gravelly (15-35%)	Very gently sloping (1-3%)	Moderate	Low (51-100 mm/m)	Jowar+Marigold (Jw+Mg)	Not Available	III e	Trench cum bunding
Masahalli	70	2.51	BMDbB2g2	LUC-7	Shallow (25-50 cm)	Loamy sand	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Very low (<50 mm/m)	Cotton+Marigold(Ct+Mg)	Not Available	III es	Graded bunding
Masahalli	71	2.2	BMDbB2g2	LUC-7	Shallow (25-50 cm)	Loamy sand	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Very low (<50 mm/m)	Cotton+Marigold(Ct+Mg)	Not Available	III es	Graded bunding
Masahalli	72	1.28	BMDbB2g2	LUC-7	Shallow (25-50 cm)	Loamy sand	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Very low (<50 mm/m)	Cotton+Marigold(Ct+Mg)	Not Available	III es	Graded bunding
Masahalli	73	2.21	BMDbB2g2	LUC-7	Shallow (25-50 cm)	Loamy sand	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Very low (<50 mm/m)	Cotton+Marigold(Ct+Mg)	Not Available	III es	Graded bunding
Masahalli	74	2.25	BMDbB2g2	LUC-7	Shallow (25-50 cm)	Loamy sand	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Very low (<50 mm/m)	Marigold+Redgram (Mg+Rg)	Not Available	III es	Graded bunding
Masahalli	75	0.73	BMDbB2g2	LUC-7	Shallow (25-50 cm)	Loamy sand	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Very low (<50 mm/m)	Marigold (Mg)	Not Available	III es	Graded bunding
Masahalli	77	0.03	BMDbB2g2	LUC-7	Shallow (25-50 cm)	Loamy sand	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Very low (<50 mm/m)	NA	Not Available	III es	Graded bunding
Masahalli	115	8.13	HPRiC2g1	LUC-5	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Gently sloping (3-5%)	Moderate	Low (51-100 mm/m)	Forest (F)	Not Available	III es	Trench cum bunding

Village	Survey No.	Area (ha)	Soil Phase	LUC	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	WELLS	Land Capability	Conservation Plan
Masahalli	122	0.34	DRHhB2g2	LUC-5	Moderately shallow (50-75 cm)	Sandy clay loam	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Low (51-100 mm/m)	Marigold (Mg)	Not Available	III es	Trench cum bunding
Masahalli	123	1.22	DRHhB2g2	LUC-5	Moderately shallow (50-75 cm)	Sandy clay loam	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Low (51-100 mm/m)	Cotton+Marigold (Ct+Mg)	Not Available	III es	Trench cum bunding
Masahalli	124	0.47	BMDbB2g2	LUC-7	Shallow (25-50 cm)	Loamy sand	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Very low (<50 mm/m)	NA	Not Available	III es	Graded bunding
Masahalli	126	1.93	HGHiC2g2	LUC-1	Very deep (>150 cm)	Sandy clay	Very gravelly (35-60%)	Gently sloping (3-5%)	Moderate	Very high (>200 mm/m)	Marigold (Mg)	Not Available	III es	Trench cum bunding
Masahalli	127	0.79	KDHhB1	LUC-1	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Very gently sloping (1-3%)	Slight	Very high (>200 mm/m)	Onion+Turmeric (On+Tu)	1 Bore well	II e	Trench cum bunding
Mookahalli	10	95.53	KNGiB1g1	LUC-4	Moderately deep (75-100 cm)	Sandy clay	Gravelly (15-35%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Jowar+Cotton+Turmeric+Current Fallow land (Jw+Ct+Tu+CFL)	9 Bore well	III s	Trench cum bunding
Mookahalli	11	2.89	KNGiB1g1	LUC-4	Moderately deep (75-100 cm)	Sandy clay	Gravelly (15-35%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Coconut (CN)	1 Bore well	III s	Trench cum bunding
Mookahalli	12	1.38	BRGmB1	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Coconut (CN)	Not Available	II es	Graded bunding
Mookahalli	13	2.08	BRGmB2g1	LUC-2	Very deep (>150 cm)	Clay	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar+Banana (Jw+Bn)	Not Available	III es	Graded bunding
Mookahalli	14	2.15	BRGhB2g2St1	LUC-2	Very deep (>150 cm)	Sandy clay loam	Very gravelly (35-60%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar+Banana (Jw+Bn)	Not Available	III es	Graded bunding
Mookahalli	15	0.48	BMBmB1	LUC-3	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	NA	Not Available	II es	Graded bunding
Mookahalli	16	0.98	BMBmB1	LUC-3	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	NA	Not Available	II es	Graded bunding
Mookahalli	17	2.54	BMBmB1	LUC-3	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar+Marigold (Jw+Mg)	Not Available	II es	Graded bunding
Mookahalli	18	0.02	BMBmB1	LUC-3	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	NA	Not Available	II es	Graded bunding
Mookahalli	201	36	MGHiC2g1	LUC-5	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Very low (<50 mm/m)	Gently sloping (3-5%)	Moderate	Cotton+Jowar+Marigold+Current Fallow land(Ct+Jw+Mg+CFL)	Not Available	IV es	Trench cum bunding
Mookahalli	241	0.95	HPRhB2g2St1R1	LUC-5	Moderately shallow (50-75cm)	Sandy clay loam	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Marigold (Mg)	Not Available	III es	Trench cum bunding
Mookahalli	242	0.24	HPRhB2g2St1R1	LUC-5	Moderately shallow (50-75cm)	Sandy clay loam	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Tomato (To)	Not Available	III es	Trench cum bunding
Mookahalli	243	2.6	HPRhB2g2St1R1	LUC-5	Moderately shallow (50-75 cm)	Sandy clay loam	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut+Onion (Gn+On)	1 Bore well	III es	Trench cum bunding
Mookahalli	244	2.03	HPRhB2g2St1R1	LUC-5	Moderately shallow (50-75cm)	Sandy clay loam	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Marigold+Onion (Mg+On)	2 Bore well	III es	Trench cum bunding
Mookahalli	269	0.25	BRGhB2g2St1	LUC-2	Very deep (>150 cm)	Sandy clay loam	Very gravelly (35-60%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	NA	Not Available	III es	Graded bunding
Mookahalli	276	0.5	HPRhB2g2St1R1	LUC-5	Moderately shallow (50-75cm)	Sandy clay loam	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Tomato (To)	Not Available	III es	Trench cum bunding
Mookahalli	277	1.81	HPRhB2g2St1R1	LUC-5	Moderately shallow (50-75cm)	Sandy clay loam	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Tomato+Onion (To+On)	2 Bore well	III es	Trench cum bunding
Mookahalli	278	2.56	HPRhB2g2St1R1	LUC-5	Moderately shallow (50-75cm)	Sandy clay loam	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton+Current Fallow land (Ct+CFL)	Not Available	III es	Trench cum bunding

Village	Survey No.	Area (ha)	Soil Phase	LUC	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	WELLS	Land Capability	Conservation Plan
Mookahalli	279	0.64	HPRhB2g2St1R1	LUC-5	Moderately shallow (50-75cm)	Sandy clay loam	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	III es	Trench cum bunding
Mookahalli	281	1.92	HPRhB2g2St1R1	LUC-5	Moderately shallow (50-75cm)	Sandy clay loam	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar+Cotton (Jw+Ct)	Not Available	III es	Trench cum bunding
Mookahalli	287	2.38	HPRhB2g2St1R1	LUC-5	Moderately shallow (50-75cm)	Sandy clay loam	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar+Cotton (Jw+Ct)	Not Available	III es	Trench cum bunding
Mookahalli	294	2.7	KNGiB1g1	LUC-4	Moderately deep (75-100 cm)	Sandy clay	Gravelly (15-35%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Coconut+JSorghum (CN+Sg)	Not Available	III s	Trench cum bunding
Mookahalli	295	2.36	KNGiB1g1	LUC-4	Moderately deep (75-100 cm)	Sandy clay	Gravelly (15-35%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Coconut (CN)	Not Available	III s	Trench cum bunding
Mookahalli	296	2.7	KNGiB1g1	LUC-4	Moderately deep (75-100 cm)	Sandy clay	Gravelly (15-35%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Coconut+Jowar (CN+Jw)	Not Available	III s	Trench cum bunding
Mookahalli	297	1.9	KNGiB1g1	LUC-4	Moderately deep (75-100 cm)	Sandy clay	Gravelly (15-35%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Coconut+Turmeric (CN+Tu)	Not Available	III s	Trench cum bunding
Mookahalli	298	2.73	KNGiB1g1	LUC-4	Moderately deep (75-100 cm)	Sandy clay	Gravelly (15-35%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Coconut+Current Fallow land (CN+CFL)	Not Available	III s	Trench cum bunding
Mookahalli	299	2.74	KNGiB1g1	LUC-4	Moderately deep (75-100 cm)	Sandy clay	Gravelly (15-35%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Coconut+Jowar (CN+Jw)	Not Available	III s	Trench cum bunding
Mookahalli	300	1.98	BRGmB2g1	LUC-2	Very deep (>150 cm)	Clay	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar (Jw)	1 Bore well	III es	Graded bunding
Bheemanabeedu	210	0.59	MDHhD3g2St1R2	LUC-8	Deep (100-150 cm)	Sandy clay loam	Very gravelly (35-60%)	Low (51-100 mm/m)	Moderately sloping (5-10%)	Severe	Forest (F)	Not Available	IVes	TERRACING
Kannigala	333	0	HPRiC2g1	LUC-5	Moderately shallow (50-75cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Gently sloping (3-5%)	Moderate	NA	Not Available	III es	Trench cum bunding

Appendix II

Hongahalli-4 Microwatershed

Soil Fertility Information

Village	Survey Number	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Baragi	27	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)
Baragi	28	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)
Baragi	29	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)
Baragi	30	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	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)
Baragi	31	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	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)
Baragi	32	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)
Baragi	33	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)
Baragi	34	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	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)
Baragi	35	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	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)
Baragi	36	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	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)
Baragi	37	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)
Baragi	38	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)
Baragi	39	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)
Baragi	40	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	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)
Baragi	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)
Baragi	42	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)
Baragi	43	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)
Baragi	44	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)
Baragi	45	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)
Baragi	46	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)
Baragi	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)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Baragi	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)

Village	Survey Number	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Baragi	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)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Baragi	50	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)
Baragi	51	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)
Baragi	52	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	High (>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)
Baragi	53	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	High (>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)
Baragi	54	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	High (>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)
Baragi	55	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	High (>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)
Baragi	56	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	High (>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)
Baragi	57	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	High (>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)
Baragi	58	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	High (>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)
Baragi	59	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	High (>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)
Baragi	60	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	High (>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)
Baragi	61	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	High (>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)
Baragi	62	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	High (>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)
Baragi	63	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	High (>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)
Baragi	64	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	High (>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)
Baragi	65	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	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)
Baragi	66	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	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)
Baragi	67	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	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)
Baragi	68	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	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)
Baragi	69	Slightly alkaline (pH 7.3-7.8)	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)
Baragi	70	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)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Baragi	71	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)
Baragi	72	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)	Sufficient (>0.6 ppm)

Village	Survey Number	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Baragi	73	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)	Sufficient (>0.6 ppm)
Baragi	74	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)	Sufficient (>0.6 ppm)
Baragi	75	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)	Sufficient (>0.6 ppm)
Baragi	76	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)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Baragi	100	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)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Baragi	101	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)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Baragi	102	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)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Baragi	103	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)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Baragi	104	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)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Baragi	106	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)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Baragi	107	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)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Baragi	108	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)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Baragi	109	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	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)
Baragi	127	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	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)
Baragi	128	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	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)
Baragi	129	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	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)
Baragi	131	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	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)
Baragi	132	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	High (>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)
Baragi	133	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	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)
Baragi	134	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	High (>0.75 %)	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)
Baragi	135	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	High (>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)
Baragi	136	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	High (>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)
Baragi	137	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	High (>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)
Baragi	138	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	High (>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 Number	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Baragi	139	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	High (>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)
Baragi	140	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23-57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Baragi	141	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23-57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Baragi	142	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	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)
Baragi	143	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	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)
Baragi	144	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	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)
Baragi	145	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	High (>0.75 %)	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)
Baragi	146	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	High (>0.75 %)	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)
Baragi	147	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23-57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Baragi	148	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	High (>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)
Baragi	149	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	High (>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)
Baragi	150	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	High (>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)
Baragi	151	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	High (>0.75 %)	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)
Baragi	152	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	High (>0.75 %)	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)
Baragi	153	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	High (>0.75 %)	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)
Baragi	154	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	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)
Baragi	155	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	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)
Baragi	156	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	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)
Baragi	157	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	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)
Baragi	158	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	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)
Baragi	159	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	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)
Baragi	160	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	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)
Baragi	161	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	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)
Baragi	162	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	Medium (23-57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)

Village	Survey Number	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Baragi	163	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	Medium (23-57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Baragi	164	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	Medium (23-57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Baragi	165	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)
Baragi	166	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)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Baragi	167	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)
Baragi	168	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)
Baragi	169	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)
Baragi	170	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)
Baragi	171	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Baragi	205	Neutral (pH 6.5-7.3)	Forest	Forest	Forest	Forest	Forest	Forest	Forest	Forest	Forest	Forest
Baragi	326	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)
Baragi	327	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	Medium (23-57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Baragi	328	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Baragi	329	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Baragi	333	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)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Masahalli	1.23	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)
Masahalli	1.06	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)
Masahalli	1.54	Moderately acid (pH 5.5-6.0)	Non saline (<2 dsm)	Low (<0.5 %)	Medium (23-57 kg/ha)	Low (<145 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)
Masahalli	3.09	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)	Medium (0.5-1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Masahalli	3.17	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)	Medium (0.5-1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Masahalli	1.42	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)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Masahalli	1.3	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)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Masahalli	2.71	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)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Masahalli	1.09	Moderately acid (pH 5.5-6.0)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	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)

Village	Survey Number	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Masahalli	1.91	Moderately acid (pH 5.5-6.0)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	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)
Masahalli	2.25	Moderately acid (pH 5.5-6.0)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	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)
Masahalli	2.98	Moderately acid (pH 5.5-6.0)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	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)
Masahalli	3.02	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)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Masahalli	1.7	Moderately acid (pH 5.5-6.0)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	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)
Masahalli	1.49	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)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Masahalli	1.14	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)
Masahalli	1.98	Slightly acid (pH 6.0-6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	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)
Masahalli	2.33	Slightly acid (pH 6.0-6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	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)
Masahalli	0.94	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	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)
Masahalli	2.94	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)
Masahalli	2.29	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)
Masahalli	2.54	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	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)
Masahalli	2.38	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	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)
Masahalli	1.24	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	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)
Masahalli	3.14	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	High (>0.75 %)	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)
Masahalli	2.84	Slightly acid (pH 6.0-6.5)	Non saline (<2 dsm)	High (>0.75 %)	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)
Masahalli	2.4	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	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)
Masahalli	2.93	Slightly acid (pH 6.0-6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	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)
Masahalli	2.01	Slightly acid (pH 6.0-6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	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)
Masahalli	2.46	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	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)
Masahalli	1.65	Slightly acid (pH 6.0-6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	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)
Masahalli	1.88	Slightly acid (pH 6.0-6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	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)
Masahalli	144.07	Slightly acid (pH 6.0-6.5)	Non saline (<2 dsm)	High (>0.75 %)	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)

Village	Survey Number	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Masahalli	1.58	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>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)
Masahalli	1.87	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Masahalli	2.08	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Masahalli	0.48	Slightly acid (pH 6.0-6.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Masahalli	1.47	Slightly acid (pH 6.0-6.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Masahalli	2.51	Slightly acid (pH 6.0-6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Masahalli	2.95	Slightly acid (pH 6.0-6.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Masahalli	2.52	Slightly acid (pH 6.0-6.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (>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)
Masahalli	2.08	Moderately acid (pH 5.5-6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (>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)
Masahalli	0.35	Slightly acid (pH 6.0-6.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (>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)
Masahalli	0.61	Moderately acid (pH 5.5-6.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (>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)
Masahalli	0.93	Slightly acid (pH 6.0-6.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Low (<145 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)
Masahalli	0.69	Slightly acid (pH 6.0-6.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Low (<145 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)
Masahalli	0.87	Slightly acid (pH 6.0-6.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Low (<145 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)
Masahalli	2.18	Slightly acid (pH 6.0-6.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Low (<145 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)
Masahalli	3.19	Slightly acid (pH 6.0-6.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (>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)
Masahalli	2.51	Slightly acid (pH 6.0-6.5)	Non saline (<2 dsm)	Low (<0.5 %)	Medium (23-57 kg/ha)	Low (<145 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)
Masahalli	2.2	Slightly acid (pH 6.0-6.5)	Non saline (<2 dsm)	Low (<0.5 %)	Medium (23-57 kg/ha)	Low (<145 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)
Masahalli	1.28	Slightly acid (pH 6.0-6.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Low (<145 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)
Masahalli	2.21	Slightly acid (pH 6.0-6.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Low (<145 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)
Masahalli	2.25	Slightly acid (pH 6.0-6.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Low (<145 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)
Masahalli	0.73	Slightly acid (pH 6.0-6.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Low (<145 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)
Masahalli	0.03	Slightly acid (pH 6.0-6.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Low (<145 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)
Masahalli	8.13	Slightly acid (pH 6.0-6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	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)

Village	Survey Number	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Masahalli	0.34	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)
Masahalli	1.22	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)	Low (<0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Masahalli	0.47	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)
Masahalli	1.93	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Masahalli	0.79	Slightly acid (pH 6.0-6.5)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	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)
Mookahalli	10	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>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)
Mookahalli	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)	Medium (0.5-1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mookahalli	12	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)
Mookahalli	13	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)
Mookahalli	14	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)
Mookahalli	15	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)
Mookahalli	16	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)
Mookahalli	17	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)
Mookahalli	18	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)
Mookahalli	201	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	Medium (23-57 kg/ha)	Low (<145 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)
Mookahalli	241	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	Medium (145-337 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)
Mookahalli	242	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	Medium (145-337 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)
Mookahalli	243	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	Medium (145-337 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)
Mookahalli	244	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	Medium (23-57 kg/ha)	Medium (145-337 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)
Mookahalli	269	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	Medium (23-57 kg/ha)	Medium (145-337 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)
Mookahalli	276	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>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)	Sufficient (>0.6 ppm)
Mookahalli	277	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>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)	Sufficient (>0.6 ppm)
Mookahalli	278	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>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)	Sufficient (>0.6 ppm)
Mookahalli	279	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	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)	Sufficient (>0.6 ppm)

Village	Survey Number	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Mookahalli	281	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>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)	Sufficient (>0.6 ppm)
Mookahalli	287	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	Medium (145-337 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)
Mookahalli	294	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)
Mookahalli	295	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)	Sufficient (>0.6 ppm)
Mookahalli	296	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)	Sufficient (>0.6 ppm)
Mookahalli	297	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)	Sufficient (>0.6 ppm)
Mookahalli	298	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>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)	Sufficient (>0.6 ppm)
Mookahalli	299	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>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)	Sufficient (>0.6 ppm)
Mookahalli	300	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)
Bheemanabeedu	210	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23-57 kg/ha)	Low (<145 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)
Kannigala	333	Slightly acid (pH 6.0-6.5)	Non saline (<2 dsm)	High (>0.75 %)	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)

Appendix III

Hongahalli-4 Microwatershed

Soil Suitability Information

Village	Sy. No	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	Sun flower	Red gram	Amla	Jack fruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Onion	Marigold	Chrysanthemum	Banana	Horsegram	Field-bean	Turmeric	Beet root	Sugar cane	Soya bean
Kadacharana	1(1)	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	S3wt	S2wt	S2wt	S2wt	S2wt	S2w	S2w	S3wt	S3wt	Others	Others
Kadacharana	1(2)	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	S2t	S1	S1	S1	S1	S1	S1	S1	S1	Others	Others
Kadacharana	2	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S3t	S1
Kadacharana	3	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S3t	S1
Kadacharana	4	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S3t	S1
Kadacharana	5	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2t	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S3t	S1
Kadacharana	6	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2t	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S3t	S1
Kadacharana	7	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2t	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S3t	S1
Kadacharana	8	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S3t	S1
Kadacharana	9	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S3t	S1
Kadacharana	10	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	S2tz	S2tz	S2z	S2z	S2tz	S2z	S2z	S2tz	S2tz	Others	Others
Kadacharana	17	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2tz	S2tz	S2z	S2z	S2tz	S2z	S2z	S2tz	S2tz	S3t	S1
Kadacharana	18	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S3wt	S2wt	S2wt	S2wt	S2wt	S2w	S2w	S3wt	S3wt	S3t	S1
Kadacharana	21	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2t	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S3t	S1
Kadacharana	22	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S3t	S1
Kadacharana	24	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S3t	S1
Kadacharana	25	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S3wt	S2wt	S2wt	S2wt	S2wt	S2w	S2w	S3wt	S3wt	S3t	S1
Kadacharana	26	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S3wt	S2wt	S2wt	S2wt	S2wt	S2w	S2w	S3wt	S3wt	S3t	S1
Kadacharana	27	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S3wt	S2wt	S2wt	S2wt	S2wt	S2w	S2w	S3wt	S3wt	S3t	S1
Kadacharana	28	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S3wt	S2wt	S2wt	S2wt	S2wt	S2w	S2w	S3wt	S3wt	S3t	S1
Kadacharana	29	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S3wt	S2wt	S2wt	S2wt	S2wt	S2w	S2w	S3wt	S3wt	S3t	S1
Kadacharana	30	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S3wt	S2wt	S2wt	S2wt	S2wt	S2w	S2w	S3wt	S3wt	S3t	S1
Kadacharana	31	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2tz	S2tz	S2z	S2z	S2tz	S2z	S2z	S2tz	S2tz	S3t	S1
Kadacharana	32	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2tz	S2tz	S2z	S2z	S2tz	S2z	S2z	S2tz	S2tz	S3t	S1
Kadacharana	33	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2tz	S2tz	S2z	S2z	S2tz	S2z	S2z	S2tz	S2tz	S3t	S1
Kadacharana	34	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2tz	S2tz	S2z	S2z	S2tz	S2z	S2z	S2tz	S2tz	S3t	S1
Kadacharana	35	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2tz	S2tz	S2z	S2z	S2tz	S2z	S2z	S2tz	S2tz	S3t	S1
Kadacharana	36	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2tz	S2tz	S2z	S2z	S2tz	S2z	S2z	S2tz	S2tz	S3t	S1
Kadacharana	37	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2tz	S2tz	S2z	S2z	S2tz	S2z	S2z	S2tz	S2tz	S3t	S1
Kadacharana	38	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2tz	S2tz	S2z	S2z	S2tz	S2z	S2z	S2tz	S2tz	S3t	S1
Kadacharana	39	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2tz	S2tz	S2z	S2z	S2tz	S2z	S2z	S2tz	S2tz	S3t	S1
Kadacharana	40	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2tz	S2tz	S2z	S2z	S2tz	S2z	S2z	S2tz	S2tz	S3t	S1
Kadacharana	41	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2tz	S2tz	S2z	S2z	S2tz	S2z	S2z	S2tz	S2tz	S3t	S1
Kadacharana	42	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	S2tz	S2tz	S2z	S2z	S2tz	S2z	S2z	S2tz	S2tz	Others	Others
Kadacharana	43	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2tz	S2tz	S2z	S2z	S2tz	S2z	S2z	S2tz	S2tz	S3t	S1
Kadacharana	44	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2tz	S2tz	S2z	S2z	S2tz	S2z	S2z	S2tz	S2tz	S3t	S1
Kadacharana	45	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2tz	S2tz	S2z	S2z	S2tz	S2z	S2z	S2tz	S2tz	S3t	S1
Kadacharana	46	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	S2tz	S2tz	S2z	S2z	S2tz	S2z	S2z	S2tz	S2tz	Others	Others

Village	Sy. No	Mango	Maize	Sapota	Sorghum	Guava	Cotton	Tamarind	Lime	Sun flower	Red gram	Amla	Jack fruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Onion	Marigold	Chrysanthemum	Banana	Horsegram	Field-bean	Turmeric	Beet root	Sugar cane	Soya bean
Kadacharana	47	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S3t	S1
Kadacharana	48	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S3t	S1
Kadacharana	49	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S3t	S1
Kadacharana	55	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S3t	S1
Kadacharana	56	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S3t	S1
Kadacharana	57	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2tg	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S3t	S1
Kadacharana	58	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2tg	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S3t	S1
Kadacharana	59	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2tg	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S3t	S1
Kadacharana	60	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2tg	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S3t	S1
Kadacharana	61	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2tg	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S3t	S1
Kadacharana	62	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2tg	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S3t	S1
Kadacharana	63	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2rt	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3t	S1
Kadacharana	64	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2rt	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3t	S1
Kadacharana	65	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2rt	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3t	S1
Kadacharana	66	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S3rt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	S3rt	S3rt	S3t	S1
Kadacharana	67	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S3rt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	S3rt	S3rt	S3t	S1
Kadacharana	68	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S3rt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	S3rt	S3rt	S3t	S1
Kadacharana	69	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S3rt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	S3rt	S3rt	S3t	S1
Kadacharana	70	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S3rt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	S3rt	S3rt	S3t	S1
Kadacharana	71	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S3t	S1
Kadacharana	72	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S3t	S1
Kadacharana	73	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S3t	S1
Kadacharana	74	S3t	S3t	S3t	S2e	S3t	S2e	S2t	S2e	S2e	S2t	S2e	S3t	S2e	Nt	S2t	S2e	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S3t	S2e
Kadacharana	75	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S3t	S1
Kadacharana	76	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S3t	S1
Kadacharana	77	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2tz	S2tz	S2z	S2z	S2tz	S2z	S2z	S2tz	S2tz	S3t	S1
Kadacharana	78	S3t	S3t	S3t	S2e	S3t	S2e	S2t	S2e	S2e	S2t	S2e	S3t	S2e	Nt	S2t	S2e	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S3t	S2e
Kadacharana	79	S3t	S3t	S3t	S2e	S3t	S2e	S2t	S2e	S2e	S2t	S2e	S3t	S2e	Nt	S2t	S2e	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S3t	S2e
Kadacharana	80	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S3t	S1
Kadacharana	86	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2tz	S2tz	S2z	S2z	S2tz	S2z	S2z	S2tz	S2tz	S3t	S1
Kadacharana	87	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2tz	S2tz	S2z	S2z	S2tz	S2z	S2z	S2tz	S2tz	S3t	S1
Kadacharana	88	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2tz	S2tz	S2z	S2z	S2tz	S2z	S2z	S2tz	S2tz	S3t	S1
Kadacharana	89	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2tz	S2tz	S2z	S2z	S2tz	S2z	S2z	S2tz	S2tz	S3t	S1
Kadacharana	90	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2tz	S2tz	S2z	S2z	S2tz	S2z	S2z	S2tz	S2tz	S3t	S1
Kadacharana	91	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2tz	S2tz	S2z	S2z	S2tz	S2z	S2z	S2tz	S2tz	S3t	S1
Kadacharana	92	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2tz	S2tz	S2z	S2z	S2tz	S2z	S2z	S2tz	S2tz	S3t	S1
Kadacharana	93	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2tz	S2tz	S2z	S2z	S2tz	S2z	S2z	S2tz	S2tz	S3t	S1
Kadacharana	94	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S3t	S1
Kadacharana	95	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2tz	S2tz	S2z	S2z	S2tz	S2z	S2z	S2tz	S2tz	S3t	S1
Kadacharana	96	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2tz	S2tz	S2z	S2z	S2tz	S2z	S2z	S2tz	S2tz	S3t	S1
Kadacharana	97	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2tz	S2tz	S2z	S2z	S2tz	S2z	S2z	S2tz	S2tz	S3t	S1
Kadacharana	98	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2tz	S2tz	S2z	S2z	S2tz	S2z	S2z	S2tz	S2tz	S3t	S1

Village	Sy. No	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	Sun flower	Red gram	Amla	Jack fruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Onion	Marigold	Chrysanthemum	Banana	Horsegram	Field-bean	Turmeric	Beetroot	Sugarcane	Soya bean
Kadacharana	99	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2tz	S2tz	S2z	S2z	S2tz	S2z	S2z	S2tz	S2tz	S3t	S1
Kadacharana	100	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2tz	S2tz	S2z	S2z	S2tz	S2z	S2z	S2tz	S2tz	S3t	S1
Kadacharana	101	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2tz	S2tz	S2z	S2z	S2tz	S2z	S2z	S2tz	S2tz	S3t	S1
Kadacharana	102	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S3t	S1
Kadacharana	103	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S3t	S1
Kadacharana	114	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S3t	S1
Kadacharana	120	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	S2t	S1	S1	S1	S1	S1	S1	S1	S1	Others	Others
Kadacharana	236	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S3t	S1
Kadacharana	239	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S3t	S1
Kadacharana	240	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2tz	S2tz	S2z	S2z	S2tz	S2z	S2z	S2tz	S2tz	S3t	S1
Kadacharana	241	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2tz	S2tz	S2z	S2z	S2tz	S2z	S2z	S2tz	S2tz	S3t	S1
Kadacharana	242	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2tz	S2tz	S2z	S2z	S2tz	S2z	S2z	S2tz	S2tz	S3t	S1
Kadacharana	243	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S3t	S1
Gopanapalli G	5	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2tz	S2tz	S2z	S2z	S2tz	S2z	S2z	S2tz	S2tz	S3t	S1
Gopanapalli G	8	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2tz	S2tz	S2z	S2z	S2tz	S2z	S2z	S2tz	S2tz	S3t	S1
Gopanapalli G	14	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S3wt	S2wt	S2wt	S2wt	S2wt	S2w	S2w	S3wt	S3wt	S3t	S1
Gopanapalli G	15	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S3wt	S2wt	S2wt	S2wt	S2wt	S2w	S2w	S3wt	S3wt	S3t	S1
Gopanapalli G	16	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S3wt	S2wt	S2wt	S2wt	S2wt	S2w	S2w	S3wt	S3wt	S3t	S1
Gopanapalli G	17	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S3wt	S2wt	S2wt	S2wt	S2wt	S2w	S2w	S3wt	S3wt	S3t	S1
Gopanapalli G	18	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S3wt	S2wt	S2wt	S2wt	S2wt	S2w	S2w	S3wt	S3wt	S3t	S1
Gopanapalli G	19	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S3wt	S2wt	S2wt	S2wt	S2wt	S2w	S2w	S3wt	S3wt	S3t	S1
Gopanapalli G	20	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S3wt	S2wt	S2wt	S2wt	S2wt	S2w	S2w	S3wt	S3wt	S3t	S1
Gopanapalli G	21	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S3t	S1
Gopanapalli G	22	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	Forest	Forest	Forest	Forest	Forest	Forest	Forest	Forest	Forest	S3t	S1
Gopanapalli G	23	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S3wt	S2wt	S2wt	S2wt	S2wt	S2w	S2w	S3wt	S3wt	S3t	S1
Gopanapalli G	24	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S3wt	S2wt	S2wt	S2wt	S2wt	S2w	S2w	S3wt	S3wt	S3t	S1
Gopanapalli G	25	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S3t	S1
Gopanapalli G	26	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2rt	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3t	S1
Gopanapalli G	27	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S3rt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	S3rt	S3rt	S3t	S1
Gopanapalli G	28	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S3rt	S3rt	S3rt	S3rt	S3rt	S3rg	S3rg	S3rt	S3rt	S3t	S1
Gopanapalli G	29	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S3rt	S3rt	S3rt	S3rt	S3rt	S3rg	S3rg	S3rt	S3rt	S3t	S1
Gopanapalli G	30	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S3rt	S3rt	S3rt	S3rt	S3rt	S3rg	S3rg	S3rt	S3rt	S3t	S1
Gopanapalli G	31	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3t	S1
Gopanapalli G	32	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S3rt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	S3rt	S3rt	S3t	S1
Gopanapalli G	33	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S3rt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	S3rt	S3rt	S3t	S1
Gopanapalli G	34	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2gr	S2gr	S2gr	S2gr	S2gr	S2gr	S2gr	S2gr	S2gr	S3t	S1
Gopanapalli G	35	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2gr	S2gr	S2gr	S2gr	S2gr	S2gr	S2gr	S2gr	S2gr	S3t	S1
Gopanapalli G	36	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S3rt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	S3rt	S3rt	S3t	S1
Gopanapalli G	37/1	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S3rt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	S3rt	S3rt	S3t	S1
Gopanapalli G	37/2	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S3rt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	S3rt	S3rt	S3t	S1
Gopanapalli G	37/3	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S3rt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	S3rt	S3rt	S3t	S1

Village	Sy. No	Mango	Maize	Sapota	Sorghum	Guava	Cotton	Tamarind	Lime	Sun flower	Red gram	Amla	Jack fruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Onion	Marigold	Chrysanthemum	Banana	Horsegram	Field-bean	Turmeric	Beet root	Sugar cane	Soya bean
Gopanapalli G	38	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S3gr	S3gr	S3gr	S3gr	S3gr	S3rg	S3rg	S3gr	S3gr	S3t	S1
Gopanapalli G	39	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S3gr	S3gr	S3gr	S3gr	S3gr	S3rg	S3rg	S3gr	S3gr	S3t	S1
Gopanapalli G	40	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3t	S1
Gopanapall G	41	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3t	S1
Jilladapalli	1	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3t	S1
Jilladapalli	2	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S3gr	S3gr	S3gr	S3gr	S3gr	S3rg	S3rg	S3gr	S3gr	S3t	S1
Jilladapalli	3	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3t	S1
Jilladapalli	7	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3t	S1
Jilladapalli	12	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S3rt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	S3rt	S3rt	S3t	S1
Jilladapalli	13	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S3rt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	S3rt	S3rt	S3t	S1
Jilladapalli	14	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S3rt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	S3rt	S3rt	S3t	S1
Jilladapalli	15	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S3t	S1
Jilladapalli	16	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S3t	S1
Jilladapalli	17	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S3gr	S3gr	S3gr	S3gr	S3gr	S3rg	S3rg	S3gr	S3gr	S3t	S1
Jilladapalli	18	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S3t	S1
Jilladapalli	19	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S3t	S1
Jilladapalli	20	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S3t	S1
Jilladapalli	21	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S3rt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	S3rt	S3rt	S3t	S1
Jilladapalli	22	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S3rt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	S3rt	S3rt	S3t	S1
Jilladapalli	23	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S3rt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	S3rt	S3rt	S3t	S1
Jilladapalli	24	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S2r	S3t	S1
Jilladapalli	25	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S3t	S1
Jilladapalli	26	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S3t	S1
Jilladapalli	27	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S3t	S1
Jilladapalli	28	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3t	S1
Jilladapalli	41	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2t	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S3t	S1
Jilladapalli	42	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2t	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S3t	S1
Bidharachea	35	Nr	S3r	Nr	S3r	Nrt	S3r	Nr	Nr	S3r	S3r	S3r	Nrt	S3r	Nt	Nr	Nr	S2t	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g	Nrt	S3r
Bidharachea	36	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2t	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S3t	S1
Bidharachea	37	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3t	S1
Bidharachea	38	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3t	S1
Bidharachea	39	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3t	S1
Bidharachea	40	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3t	S1
Bidharachea	43	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S3rt	S3rt	S3rt	S3rt	S3rt	S3rg	S3rg	S3rt	S3rt	S3t	S1
Bidharachea	44	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S3rt	S3rt	S3rt	S3rt	S3rt	S3rg	S3rg	S3rt	S3rt	S3t	S1
Bidharachea	45	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3t	S1
Bidharachea	49	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S2t	S1	S3t	S1	Nt	S2t	S1	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3t	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: *Hongahalli-4 micro-watershed (Hongahalli sub-watershed, Gundlupet taluk, Chamarajanagar district) is located in between $11^0$47' – $11^0$49' North latitudes and $76^0$34' – $76^0$37' East longitudes, covering an area of about 624 ha, bounded by Baragi, Mukahalli, Hongahalli, Bhimanabid and Kannagal 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 eco system services were quantified.*

Results: *The socio-economic outputs for the Hongahalli-4 micro-watershed (Hongahalli sub-watershed, Gundlupet taluk, Chamarajanagar district) are presented here.*

Social Indicators;

- *Male and female ratio is 54.3 to 45.7 per cent to the total sample population.*
- *Younger age 18 to 50 years group of population is around 54.3 per cent to the total population.*
- *Literacy population is around 80 per cent.*
- *Social groups belong to scheduled caste (SC) is around 10 per cent.*
- *Liquefied petroleum gas (LPG) is the source of energy for a cooking among 90 per cent.*
- *About 60 per cent of households have a yashaswini health card.*
- *Majority of farm households (10%) are having MGNREGA card for rural employment.*
- *Dependence on ration cards for food grains through public distribution system is around 90 per cent.*
- *Swach bharath program providing closed toilet facilities around 70 per cent of sample households.*
- *Institutional participation is only 5.7 per cent of sample households.*
- *Women participation in decisions making are around 70 per cent of households.*

Economic Indicators;

- *The average land holding is 0.35 ha indicates that majority of farm households are belong to marginal and small farmers. The dry land account for 83.7 per cent and irrigated land 16.3 per cent of total cultivated area among the sample farmers.*
- *Agriculture is the main occupation among 71.5 per cent and agriculture is the main and agriculture labour is subsidiary occupation for 25.7 per cent of sample households.*
- *The average value of domestic assets is around Rs. 11091 per household. Mobile and television are popular media mass communication.*
- *The average farm assets value is around Rs. 129881 per household, about 60.0 per cent of sample farmers having plough and sprayer (38.1%).*
- *The average livestock value is around Rs. 17800 per household; about 61.5 per cent of household are having livestock.*
- *The average per capita food consumption is around 644.2 grams (1600.3 kilo calories) against national institute of nutrition (NIN) recommendation at 827 gram. Around 80.0 per cent of sample households are consuming less than the NIN recommendation.*
- *The annual average income is around Rs. 39063 per household. About 70.0 per cent of farm households are below poverty line.*
- *The per capita average monthly expenditure is around Rs.911.*

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. 900 per ha/year. The total cost of annual soil nutrients is around Rs. 505064 per year for the total area of 623.97 ha.*
- *The average value of ecosystem service for food grain production is around Rs. 17634/ ha/year. per hectare food grain production services is maximum in onion (Rs. 120823) followed by beans (Rs. 18414), tomato (Rs. 18090), ragi (Rs. 16396), groundnut (Rs. 7604), beetroot (Rs. 4803), sunflower (Rs. 3973), cotton (Rs. 16407), horse gram (Rs. 457), maize and sorghum is negative return.*
- *The average value of ecosystem service for fodder production is around Rs. 10209/ ha/year. Per hectare fodder production services is maximum in maize (Rs. 20150), followed by sorghum (Rs. 17290), ragi (Rs. 5200), horse gram (Rs. 4940) and groundnut (Rs. 3467).*
- *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 beans (Rs. 601445) followed by maize (Rs. 69501), cotton (Rs. 54585), sorghum (Rs. 43020), sunflower (Rs*

33256), horse gram (Rs. 25342), groundnut (Rs. 24111), tomato (Rs 21143), onion (Rs. 20155) and ragi (Rs. 18534).

Economic Land Evaluation;

- *The major cropping pattern are maize (23.5 %) followed by cotton (21.3 %), sorghum (7.0 %), horse gram (15.1 %) groundnut (6.6 %), sunflower (5.8 %), onion (5.8 %), ragi (6.6 %), tomato (5.8 %), beans (1.4 %) and beetroot (1.0 %).*
- *In Honganahalli-4 micro-watershed, major soil are soil of alluvial landscape of Berambadi (BMD) soil are shallow soil depth well drained covered around 8.4 per cent of areas; crops are groundnut (23.3 %), horse gram (4.1 %), onion (20.4 %), ragi (23.3 %), sorghum (8.6 %) and tomato (20.4 %). Magoonahalli (MGH) soil is moderately shallow soil depth cover around 3.9 per cent of areas, crops is cotton (50%) and horse gram (50 %). Kannigala (KNG) soil is moderately deep soil depth cover around 10.9 per cent of areas; the major crops are beans (16.2 %), maize (16.2 %) and sunflower (67.6 %). Beemanabeedu (BMB) soil is very deep soil depth cover around 6.0 % of areas; the crops are horse gram (50 %) and sorghum (50 %). Honnegaudanahalli (HGH) soil series are very deep soil depth cover around 11 per cent of area; crops are cotton (86.6 %) and maize (13.4 %). Bargi (BRG) soil is very deep soil depth cover around 15.1 % of area crops is beetroot.*
- *The total cost of cultivation and benefit cost ratio (BCR) in study area for groundnut cultivation in BDM soil Rs.44396/ha (with BCR of 1.25).*
- *In maize the cost of cultivation range between in HGH soil Rs. 75392/ha (with BCR of 0.95) and Rs.11452/ha in KNG soil (with BCR of 1.01).*
- *In horse gram the cost of cultivation range between is Rs. 43608/ha in BMD soil (with of 1.67) and Rs. 13237/ha in BMB soil (with BCR of 2.1.46).*
- *In sorghum the cost of cultivation in between Rs. 40260/ha in BMB soil (with BCR of 1.10) and Rs. 38385/ha in BMD soil (with BCR of 1.15).*
- *In cotton the cost of cultivation between Rs. 54700/ha in HGH soil (with BCR of 1.43) and Rs. 44599/ha in MGH soil (with BCR of 1.38).*
- *In sunflower the cost of cultivation in KNG soil is Rs.35547/ha (with BCR of 1.11).*
- *In ragi the cost of cultivation in BMD soil Rs. 22604/ha (with BCR of 1.80).*
- *In tomato the cost of cultivation in BDM soil Rs. 70830/ha (with BCR of 1.26).*
- *In onion the cost of cultivation in BMD soil is Rs. 108887/ha (with BCR of 2.11).*
- *In beetroot the cost of cultivation in BRG soil is Rs.73414/ha (with BCR of 1.07).*
- *In beans the cost of cultivation in KNG soil is Rs. 123611/ha (with BCR of 1.15) and sunflower cultivation in KNG soil is Rs. 40260/ha (with BCR of 1.11).*
- *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 soil to maximize returns.*

Suggestions;

- *Involving farmers is watershed planning helps in strengthing institutional participation.*
- *The per capita food consumption and monthly income is very low. Diversifying income generation activities from crop and livestock production in order to reduce risk related to drought and market prices.*
- *Majority of farmers reported that they are not getting timely support/extension services from the concerned development departments.*
- *By strengthing agricultural extension for providing timely advice improved technology there is scope to increase in net income of farm households.*
- *By adopting recommended package of practices by following the soil test fertiliser recommendation, there is scope to increase yield in groundnut (49.3%), horse gram(15.7 to 57.8%), onion (69.6 %) ragi (57.4 %) sorghum (41.3 to 58.1 %) tomato(80.7%), cotton (17.5 to 27.7 %), maize (25.6 to 37.6 %), sunflower (39.3 %) and beetroot (90.6 %).*

Chapter 2

INTRODUCTION

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

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

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

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

Objectives of the study

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

Chapter 3

METHODOLOGY

Study area

Hongahalli-4 micro-watershed is located in Southern Dry Zone of Karnataka (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 800-900 m. 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 of the zone are rice, ragi, sugarcane, pulses and minor millets. It's represented Agri and Ecological Region (AER) –3 having LGP 120-150 days.

Hongahalli-4 micro-watershed (Hongahalli sub-watershed, Gundlupet taluk, Chamarajanagar district) is located in between $11^0$47' – $11^0$49' North latitudes and $76^0$34' – $76^0$37' East longitudes, covering an area of about 624 ha, bounded by Baragi, Mukahalli, Hongahalli, Bhimanabid and Kannagal 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).

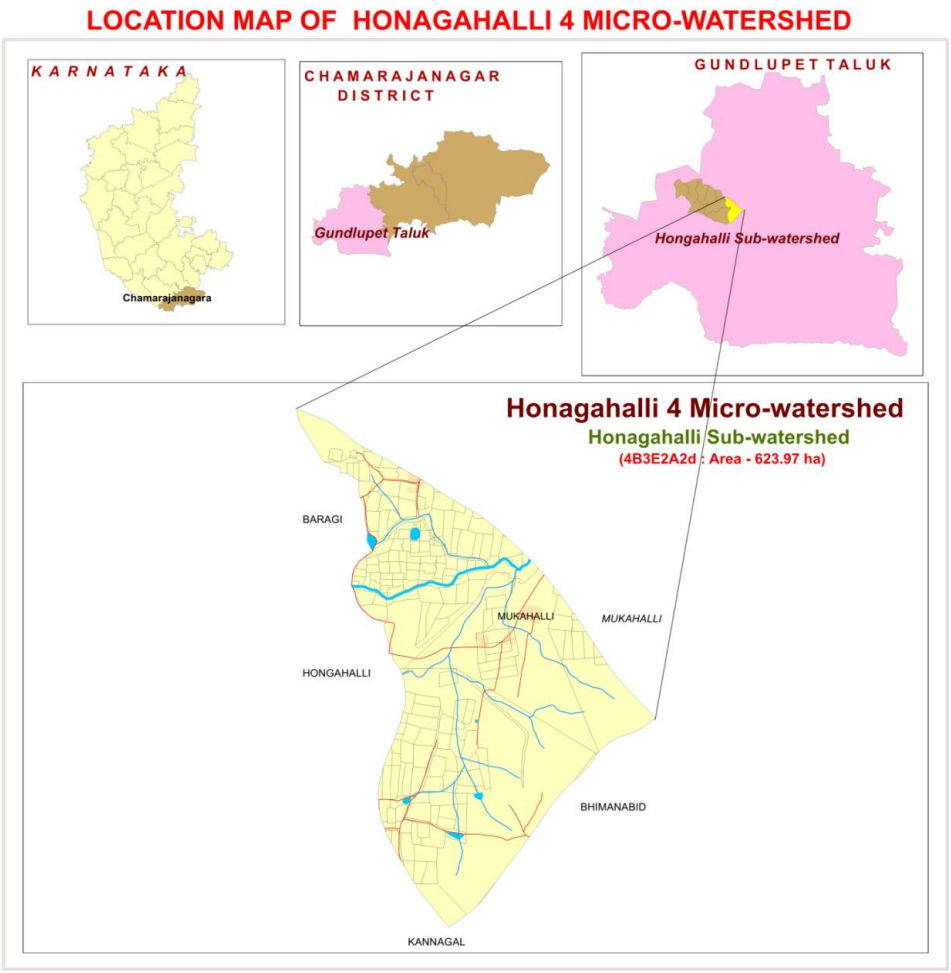


Figure 1: Location of study area

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.

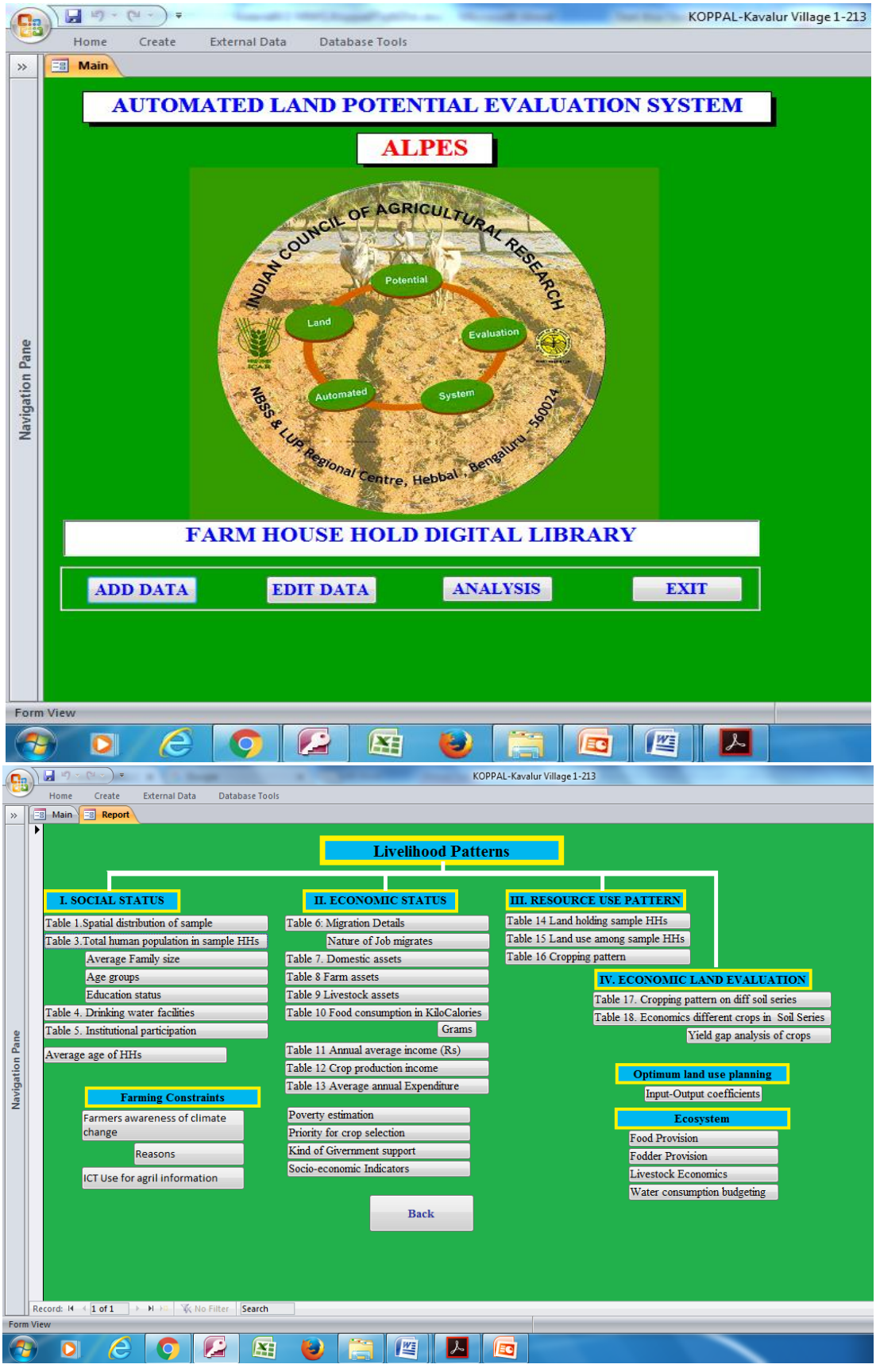


Figure 2: ALPES FRAMEWORK

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.

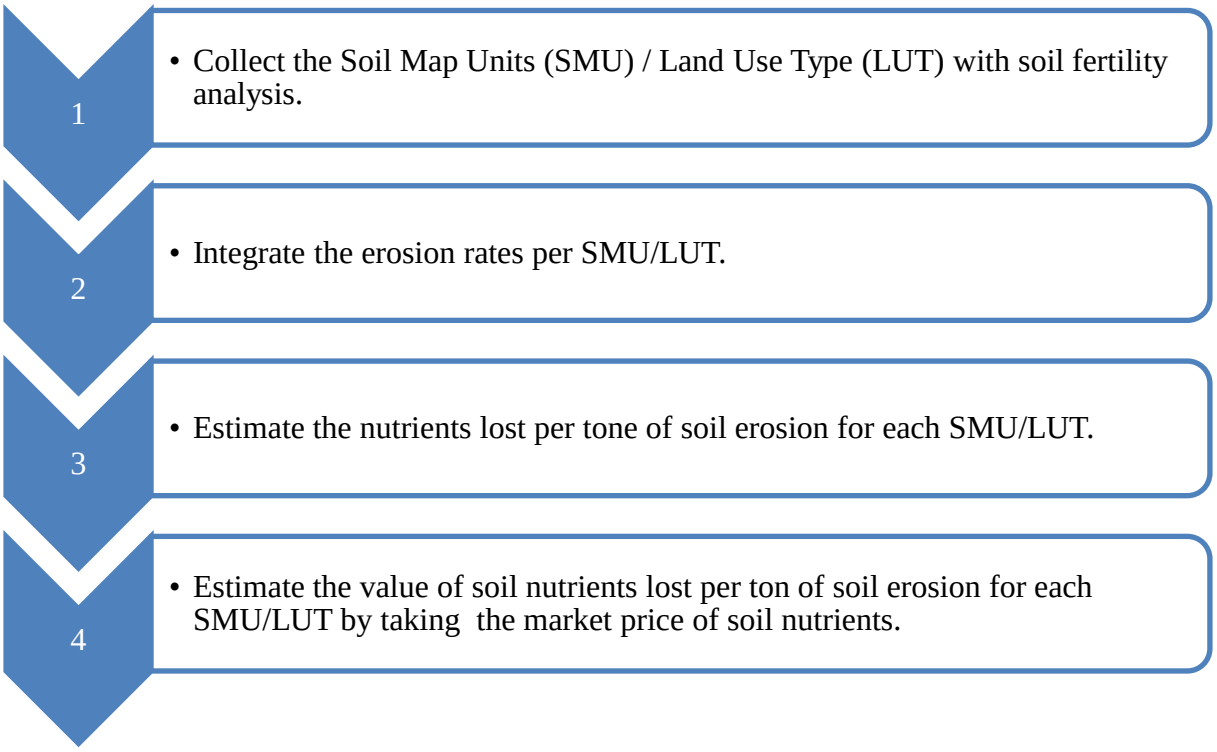
Operational Cost = cost of seeds, fertilizers, pesticides. Cost of human and bullock labour, cost of machinery, cost of irrigation water + interest on working capital.
Gross returns = Yield (Quintals/hectare)*Price (Rs/Quintal)
Net returns = Gross returns-Operational cost.
Benefit Cost Ratio = Net returns/Total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



Chapter 4

RESULT AND DISCUSSION

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 35, out of which 54.3 per cent were males and 45.7 per cent females. Average family size of the households is 3.5. Age is an important factor, which affects the potential employment and mobility status of respondents. The data on age wise distribution of farmers in the sample households indicated that majority of the farmers are coming under the age group of more than 50 years (40 %) followed by, 30 to 50 years (28.6 %), 18 to 30 years (25.7 %) and 0 to18 years (5.7 %). 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 20 per cent of respondents were illiterate and 80 per cent literate (Table 1).

Table 1: Human population among sample households in Hongahalli 4 Microwatershed

Particulars	**Units**	**Value**
Total human population in sample HHs	Number	35
Male	% to total Population	54.3
Female	% to total Population	45.7
Average family size	Number	3.5
Age group		
0 to 18 years	% to total Population	5.7
18 to 30 years	% to total Population	25.7
30 to 50 years	% to total Population	28.6
>50 years	% to total Population	40
Average age	Age in years	43
Education Status		
Illiterates	% to total Population	20.0
Literates	% to total Population	80.0
Primary School (<5 class)	% to total Population	40.0
Middle School (6- 8 class)	% to total Population	14.2
High School (9- 10 class)	% to total Population	11.4
Others	% to total Population	14.2

The ethnic groups among the sample farm households found to be 60 per cent belonging to other backward caste (OBC) followed by 20 per cent belonging to general caste, 10 per cent belonging to scheduled caste (SC) and only 10 per cent belong to

scheduled tribe (ST) (Table 2 and Figure 3). About 90.0 per cent of sample households are using liquefied petroleum gas (LGP) as source of fuel for cooking. All the sample farmers are having electricity connection. About 60 per cent are sample households having health cards. Only 10 per cent are having MNREGA job cards for employment generation. About 90 per cent of farm households are having ration cards for taking food grains from public distribution system. About 70 per cent of farm households are having toilet facilities.

Table 2: Basic needs of sample households in Hongahalli 4 Microwatershed

Particulars	Units	Value
Social groups		
SC	% of Households	10.0
ST	% of Households	10.0
OBC	% of Households	60.0
General	% of Households	20.0
Types of fuel use for cooking		
Fire wood	% of Households	10.0
LPG gas	% of Households	90.0
Energy supply for home		
Electricity	% of Households	100
Number of households having Health card		
Yes	% of Households	60.0
No	% of Households	40.0
MGNREGA Card		
Yes	% of Households	10.0
No	% of Households	90.0
Ration Card		
Yes	% of Households	90.0
No	% of Households	10.0
Households with toilet		
Yes	% of Households	70.0
No	% of Households	30.0
Drinking water facilities		
Tube well	% of Households	100.0

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

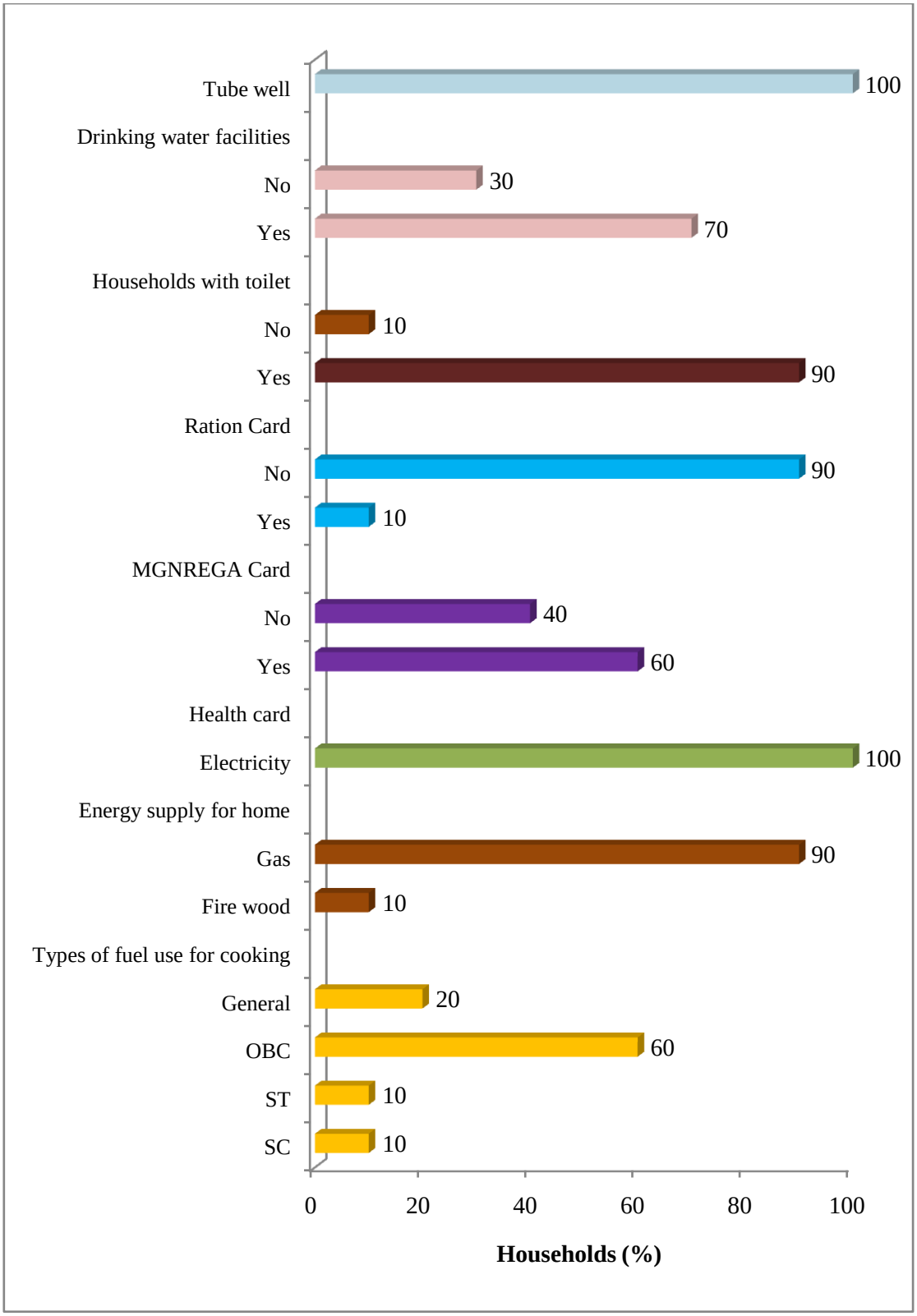


Figure 3: Basic needs of sample households in Hongahalli 4 microwatershed

Only 5.7 per cent of the farmers are participating in community based of credit co-operative societies (Table 3).

Table 3: Institutional participation among the sample population in Hongahalli 4 Microwatershed

Particulars	Units	Value
No. Of people participating	% to total	5.7
Co-operative Societies - Credit	% to total	5.7
No. Of people not participating	% to total	94.3

The occupational pattern (Table 4) among sample households shows that agriculture is the main occupation around 69.7 per cent of farmers followed by agriculture is the main and agriculture labour is a subsidiary occupation was 27.3 per cent. Private Service is the main occupation was around 3.0 per cent.

Table 4: Occupational pattern in sample population in Hongahalli 4 Microwatershed

Occupation		% to total
Main	**Subsidiary**	
Agriculture	Agriculture	69.7
	Agriculture Labour	27.3
Private service		3.0
Grand Total		100
Family labour Availability		**Man days/Month**
Male		39.0
Female		26.0
Total		65.0

The important assets especially with reference to domestic assets were analyzed and are given in Table 5 and Figure 4. The important domestic assets possessed by all categories of farmers are television (100 %) followed by mobile phones (80 %), mixer/grinder (50 %), motorcycle (50 %) and bicycle (30 %). The average value of domestic assets is around Rs 11091 per household.

Table 5: Domestic assets among the sample households in Hongahalli 4 Microwatershed

Particulars	% of households	Average value in Rs
Bicycle	30	800
Mixer/grinder	50	2280
Mobile Phone	80	3075
Motor cycle	50	41400
Television	100	7900
Average value	11091	

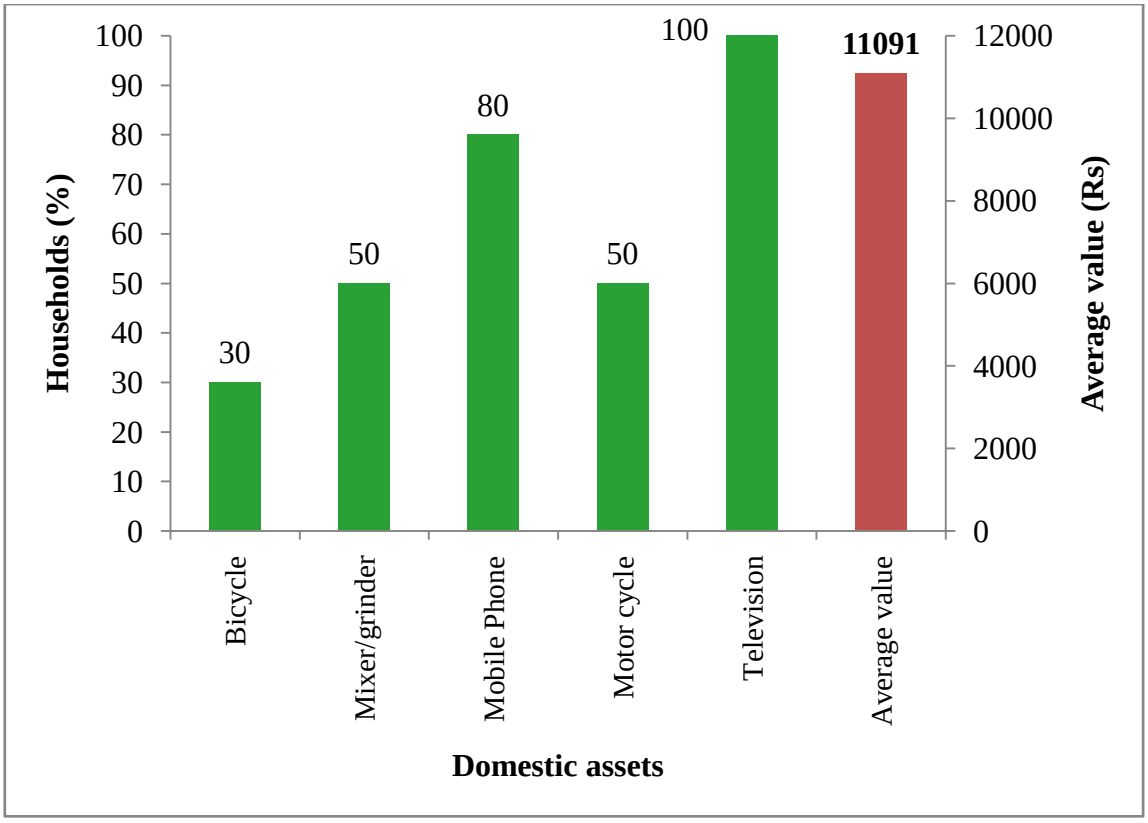


Figure 4: Domestic assets among the sample households in Hongahalli 4 Microwatershed

The most popularly owned farm equipments were sickles, plough, cattle shed; pump sets, chaff cutter, bullock cart, sprayer and thresher. Plough and sickle were commonly present in all the sampled farmers; these were primary implements in agriculture. The per cent of households owned plough (50 %), bullock cart (10 %), sprayer (10 %), and tractor (10 %) was found highest among the sample farmers. The average value of farm assets is around Rs 129881 per households (Table 6 and Figure 5).

Table 6: Farm assets among samples households in Hongahalli 4 Microwatershed

Particulars	% of households	Average value in Rs
Bullock cart	10.0	15000
Plough	50.0	2025
Sprayer	10.0	2500
Tractor	10.0	500000
Average value	129881	

Livestock is an integral component of the conventional farming systems (Table 7 and Figure 6). The highest livestock population is bullocks (25 %) followed by local dry cow (25%), local milching cow (25%), crossbred dry cow (12.5%) and crossbred milching cow (12.5%). The average livestock value was Rs 17800 per household.

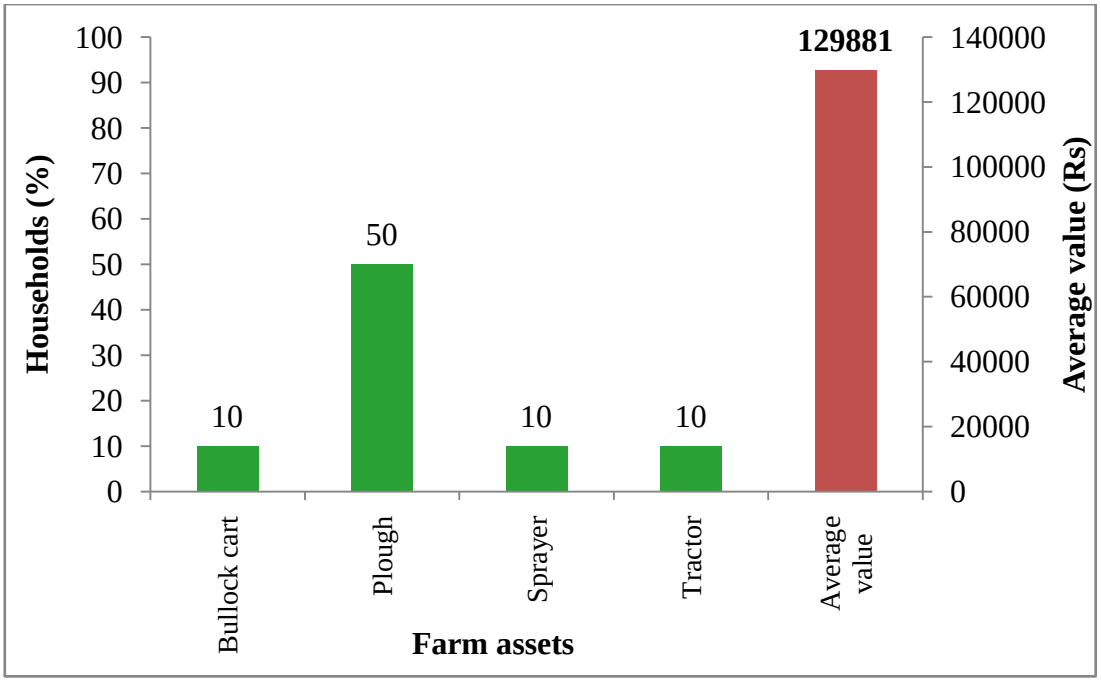


Figure 5: Farm assets among samples households in Hongahalli 4 Microwatershed

Table 7: Livestock assets among sample households in Hongahalli 4 Microwatershed

Particulars	% of livestock population	Average value in Rs
Local Dry Cow	25.0	4500
Local Milching Cow	25.0	22500
Crossbred Dry Cow	12.5	6000
Crossbred Milching Cow	12.5	31000
Milching Buffalos	25.0	25000
Average value	17800	

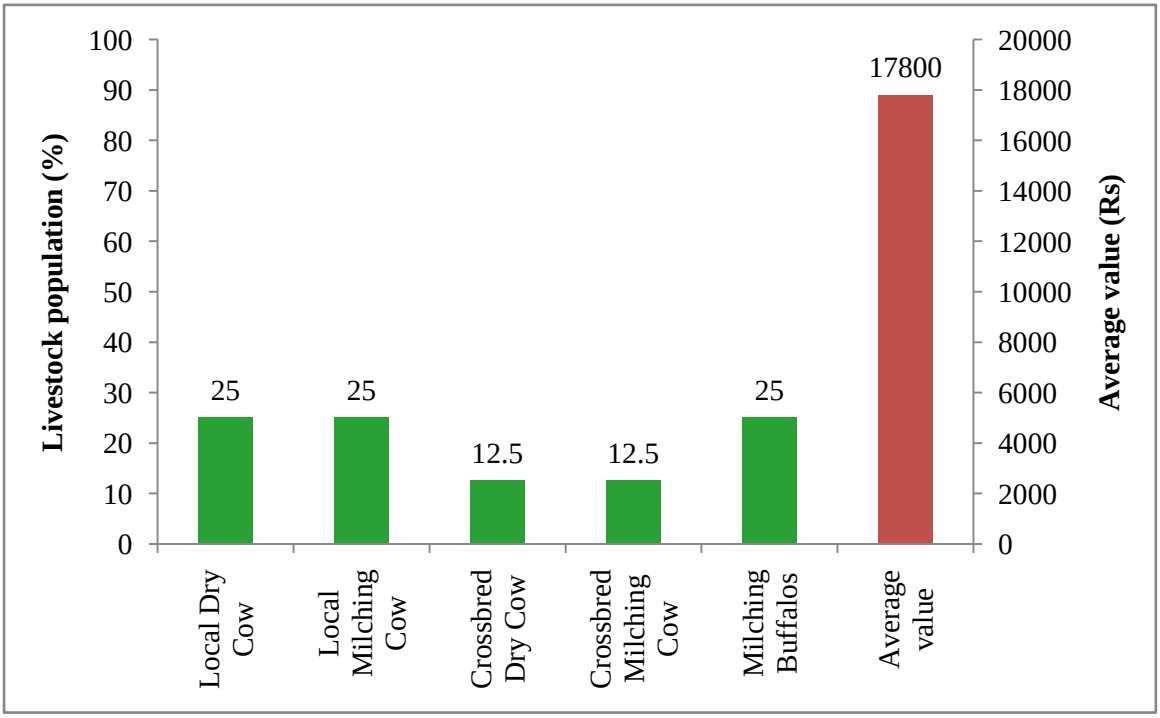


Figure 6: Livestock assets among sample households in Hongahalli 4 Microwatershed

Average milk produced in sample households is 1710 litters/ annum. Among the farm households, maize, sorghum, horse gram, ragi and groundnut are the main crops for domestic food and fodder for animals. About 1466 kg /ha of average fodder is available per season for the livestock feeding (Table 8).

Table 8: Milk produced and fodder availability of sample households in Hongahalli 4 Microwatershed

Particulars	
Name of the Livestock	**Ltr./Lactation/animal**
Crossbred Milching Cow	2880
Local Milching Cow	540
Average Milk produced	1710
Fodder produces (kg/ha.)	**Fodder yield**
Maize	658
Sorghum	1563
Groundnut	2193
Horsegram	1667
Ragi	1250
Average fodder availability	1523
Livestock having households (%)	61.5
Livestock population (Numbers)	13

A woman participation in decision making is in this Microwatershed is presented in Table 9. About 20 per cent of women participation in local organisation activates, about 10 per cent women earning for her family requirement and 70 per cent of women taking decision in her family and agriculture related activities.

Table 9: Women empowerment of sample households in Hongahalli 4 Microwatershed % to grand total

Particulars	**Yes**	**No**
Women participation in local organization activities	20.0	80.0
Women elected as panchayat member	10.0	90.0
Women earning for her family requirement	10.0	90.0
Women taking decision in her family and agriculture related activities	70.0	30.0

The food intake in terms of kilo calorie (kcal) per person per day was calculated and presented in the Table 10 and Figure 7. More quantity of cereals is consumed by sample farmers which accounted for 1098 kcal per person. The other important food items consumed was followed by cooking oil 194.6 kcal, pulses 124.0 kcal, milk 92.6

kcal, egg 69.2 vegetables 13.6 kcal and meat 8.8 kcal In the sampled households, farmers were consuming less (1600 kcal) than NIN- recommended food requirement (2250 kcal).

Table 10: Per capita daily consumption of food among the sample households in Hongahalli 4 Microwatershed

Particulars	NIN recommendation (gram/ per day/ person)	Present level of consumption (gram/ per day/ person)	Kilo Calories /day/person
Cereals	396	322.9	1098.0
Pulses	43	36.2	124.0
Milk	200	142.5	92.6
Vegetables	143	56.5	13.6
Cooking Oil	31	34.1	194.1
Egg	0.5	46.1	69.2
Meat	14.2	5.9	8.8
Total	**827.7**	**644.2**	**1600.3**
Threshold of NIN recommendation		827 gram	2250 Kcal*
% Below NIN		80.0	100.0
% Above NIN		20.0	0.0

Note: * day/person

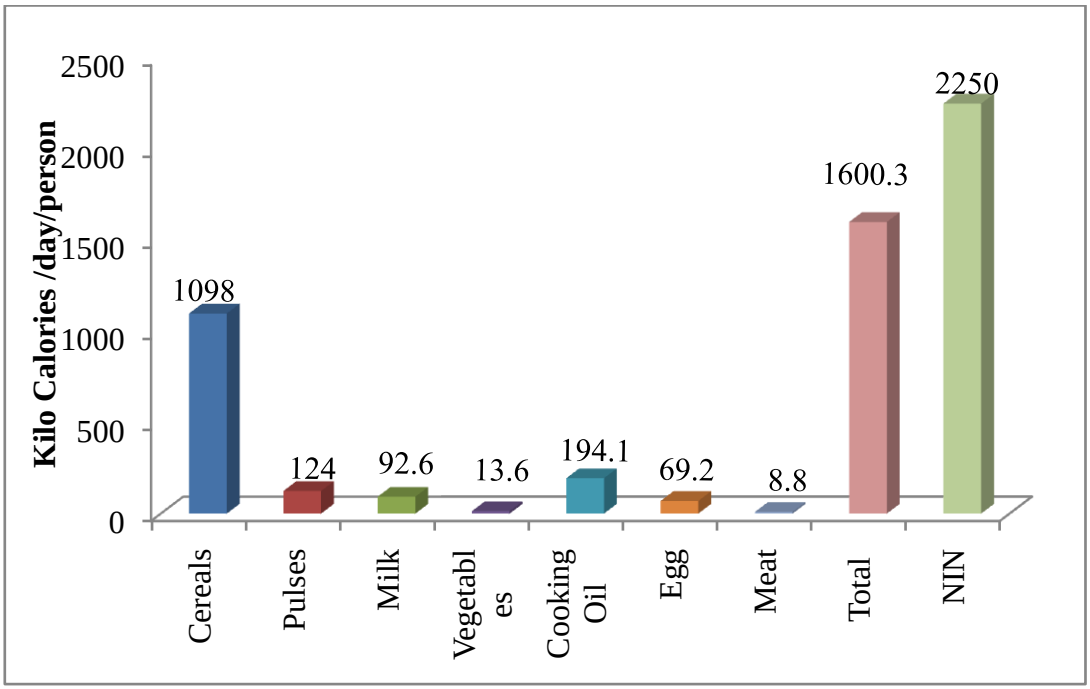


Figure 7: Per capita daily consumption of food among the sample households in Hongahalli 4 Microwatershed

Annual income of the sample HHs: The average annual household income is around Rs 39063. Major source of income to the farmer Rs in the study area is from livestock (Rs. 27193) and crop production Rs.11870. The monthly per capita income is Rs.930 which is more 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 11).

Table 11: Annual average income of HHs from various sources in Hongahalli 4 Microwatershed

Particulars	Income *
Nonfarm income (Rs)	0
Livestock income (Rs)	27193 (30)
Crop Production (Rs)	11870 (100)
Total Annual Income (Rs)	***39063***
Average monthly per capita income (Rs)	930
Threshold for Poverty level (Rs 975 per month/person)	
% of households above poverty line	30.0
% of households below poverty line	70.0

* Figure in the parenthesis indicates % of Households

The average annual expenditure of farm households indicated that farmers in the study area spend highest on food (Rs. 26410) followed by education (Rs. 1000), clothing (Rs. 2650), social function (Rs. 3800) and health (Rs. 4400). Now a day's education is most important among all of us. In today's competitive world, education is a necessity for man after food, clothing, and shelter. It is the only fundamental way by which a desired change in the society can happen. The average per capita monthly expenditure is around Rs 911 and about 70 per cent of farm households are below poverty line and 30 per of farm households are above poverty line (Table 12 and Figure 8).

Table 12: Average annual expenditure of sample HHs in Hongahalli 4 Microwatershed

Particulars	Value in Rupees	Per cent
Food	26410	69
Education	1000	2.6
Clothing	2650	6.9
Social functions	3800	10.0
Health	4400	11.0
Total Expenditure (Rs/year)	38260	100.0
Monthly per capita expenditure (Rs)	911	

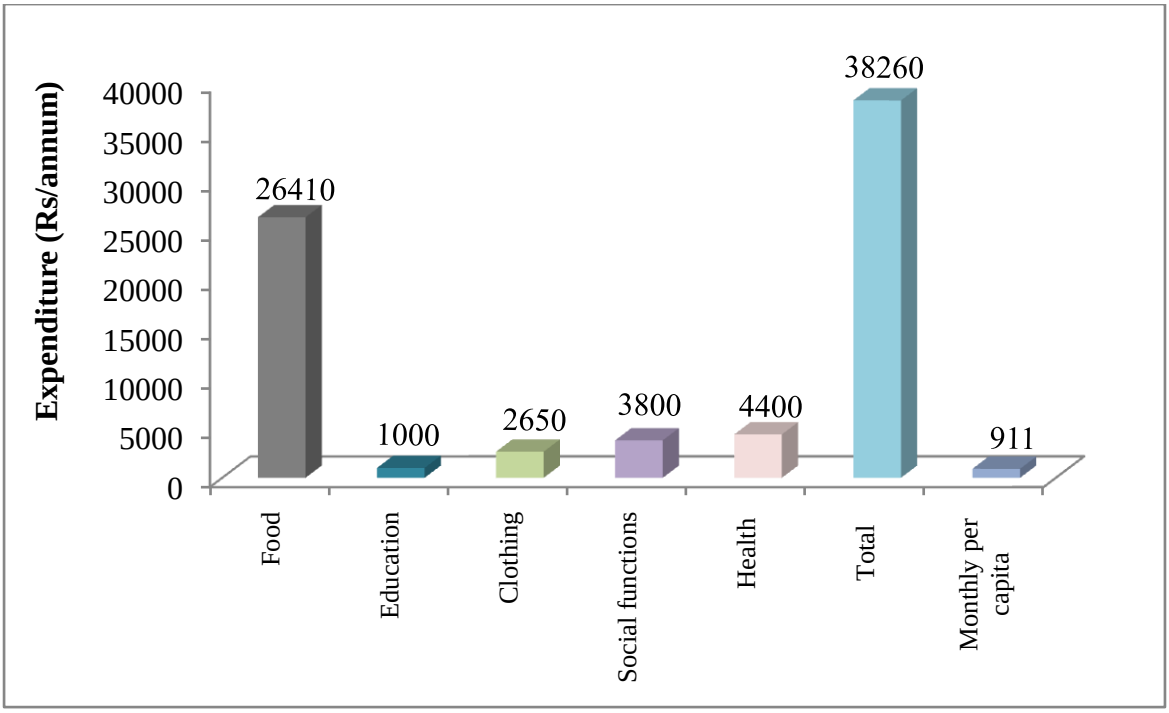


Figure 8: Average annual expenditure of sample HHs in Hongahalli 4 Microwatershed

Land use: The total land holding in the Hongahalli 4 Microwatershed is 3.5 ha (Table 13). Of which 2.9 ha is dry land and 0.6 ha is irrigated land. The average land holding per household is worked out to be 0.35 ha.

Table 13: Land use among samples households in Hongahalli 4 Microwatershed

Particulars	Per cent	Area in ha
Irrigated land	16.3	0.6
Dry land	83.7	2.9
Fallow land	0.00	0.00
Total land holding	100	3.5
Average land holding	0.35	

In the Microwatershed, the prevalent present land uses under perennial plants are coconut trees (56.4%) followed by neem trees (18 %) banyan tree (alada) (2.6%) and tamarind (2.6 %) (Table14).

Table 14: Number of trees/plants covered in sample farm households in Hongahalli 4 Micro watershed

Particulars	Number Trees/Plants	Per cent
Banyan tree(Alada)	1	2.6
Coconut	22	56.4
Neem trees	7	18.0
Tamarind	1	2.5
Teak	8	20.5
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 cotton (21.3 %) followed by sorghum (7%), groundnut(6.6%), sunflower (5.8 %), onion (5.8%), maize (1.4 %) and beetroot (1%) which are taken during kharif and maize (22.2 %), horse gram (15.1 %), ragi (6.6%), tomato (5.8%) and beans (1.4%) during rabi season respectively. The cropping intensity was 208 per cent (Table 15 and Figure 9).

Table 15: Present cropping pattern and cropping intensity in Hongahalli 4 microwatershed

% to Grand Total

Crops	**Kharif**	**Rabi**	**Grand Total**
Beans	0.0	1.4	1.4
Beetroot	1.0	0.0	1.0
Cotton	21.3	0.0	21.3
Groundnut	6.6	0.0	6.6
Horsegram	0.0	15.1	15.1
Maize	1.4	22.2	23.6
Onion	5.8	0.0	5.8
Ragi	0.0	6.6	6.6
Sorghum	7.0	0.0	7.0
Sunflower	5.8	0.0	5.8
Tomato	0.0	5.8	5.8
Grand Total	48.9	51.1	100.0
Cropping intensity (%)	208		

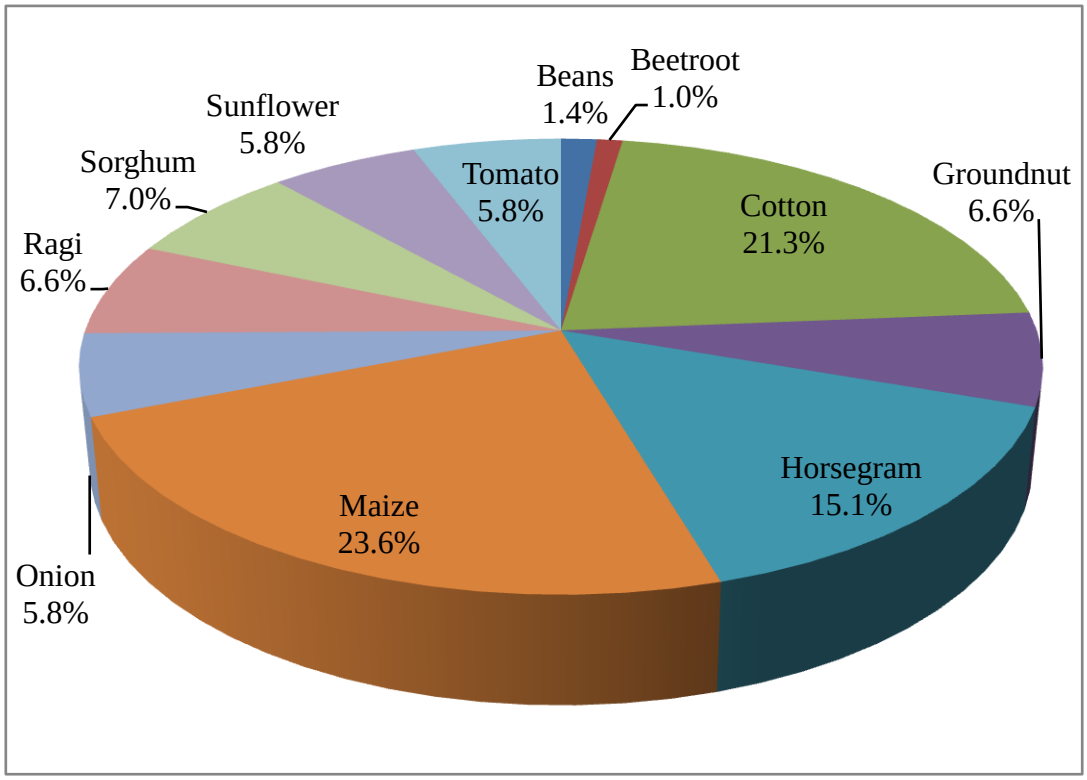


Figure 9: Present cropping pattern in Hongahalli 4 Microwatershed

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 Hongahalli 4 Microwatershed, 11 soil series are identified and mapped (Table 16). The distribution of major soil series are Shivapura covering an area around 53 ha (8.44 %) followed by Berambadi 67 ha (10.66 %), Magoonahalli 24 ha (3.87 %), Devarahalli 30 ha (4.81%), Hullipura 85 ha (13.52 %), Kannigala 68ha (10.91 %), Maddinahundi 22 ha (3.47%) 56 ha (8.96 %), Kalligaudanahalli 56 ha (8.96%), Honnegaudanahalli 69 ha (10.98 %), Bargi 94 ha (15.1%) and Beemanabeedu 37 ha (6.0 %) (Table 16).

Table 16: Distribution of soil series in Honganahalli 4 Microwatershed

Soil No	Soil Series	Mapping unit description	Area in ha (%)
1	SPR	Shivapura soils are shallow (25-50 cm), well drained, have dark reddish brown gravelly sandy clay loam to sandy clay soils occurring on very gently sloping uplands and very strongly sloping hills, mounds and ridges.	53 (8.44)
2	BMD	Berambadi soils are shallow (25-50 cm), well drained, dark brown to dark greyish brown clayey soils occurring on very gently to gently sloping uplands under cultivation	67 (10.66)
3	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 gently sloping uplands	24 (3.87)
4	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 sloping uplands under cultivation	30 (4.81)
5	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	85 (13.52)
6	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 to gently sloping uplands	68 (10.91)
7	MDH	Maddinahundi soils are deep (100-150 cm), well drained, have dark reddish brown gravelly sandy clay soils occurring on moderately sloping uplands under cultivation.	22 (3.47)
8	KDH	Kalligaudanahalli soils are very deep (>150 cm), well drained, have dark red to dark reddish brown and dark brown sandy clay to clay soils occurring on very gently sloping uplands under cultivation.	56 (8.96)
9	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.	69 (10.98)
10	BRG	Bargi soils are very deep (>150 cm), well drained, have very dark brown to very dark grayish brown clay soils occurring on very	94 (15.1)

		gently sloping uplands under cultivation.	
11	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 very gently sloping lowlands under cultivation	37 (6.00)
12	Forest		6(1.04)
13	Habitation		14(2.25)

Present cropping pattern on different soil series are given in Table 17. Crops grown on Berambadi soils are groundnut, horsegram, onion, ragi, sorghum and tomato on Magoonahalli soils is grown. Cotton and horsegram are grown on Kannigala soils. Beans, maize and sunflower on Beemanabeedu soils are grow. Horsegram and Bengal gram on Honnegaudanahalli soils are grow cotton and maize. Bargi soils are growing beetroot.

Table 17: Cropping pattern on major soil series in Hongahalli 4 Microwatershed.

(Area in percent)

Soil Series	Soil Depth	Crops	Dry		Irrigated		Grand Total
			Kharif	Rabi	Kharif	Rabi	
BMD	Shallow (25-50 cm)	Groundnut	23.3	0.0	0.0	0.0	23.3
		Horsegram	0.0	4.1	0.0	0.0	4.1
		Onion	0.0	0.0	20.4	0.0	20.4
		Ragi	0.0	23.3	0.0	0.0	23.3
		Sorghum	8.6	0.0	0.0	0.0	8.6
		Tomato	0.0	0.0	0.0	20.4	20.4
MGH	Moderately Shallow (50-75 cm)	Cotton	50.0	0.0	0.0	0.0	50.0
		Horsegram	0.0	50.0	0.0	0.0	50.0
KNG	Moderately deep (75-100 cm)	Beans	0.0	0.0	0.0	16.2	16.2
		Maize	16.2	0.0	0.0	0.0	16.2
		Sunflower	67.6	0.0	0.0	0.0	67.6
BMB	Very deep (>150 cm)	Horsegram	0.0	50.0	0.0	0.0	50.0
		Sorghum	50.0	0.0	0.0	0.0	50.0
HGH	Very deep (>150 cm)	Cotton	86.6	0.0	0.0	0.0	86.6
		Maize	0.0	13.4	0.0	0.0	13.4
BRG	Very deep (>150 cm)	Beetroot	100.0	0.0	0.0	0.0	100.0

Table 18: Alternative land use options for different size group of farmers (Benefit Cost Ratio) in Hongahalli 4 Microwatershed

Soil Series	Small farmers
BMD	Groundnut (2.3),Horse gram (2.2),Onion (2.1), Ragi (2.2), Sorghum (1.5) & Tomato (1.3)
MGH	Cotton & Horse gram
KNG	Beans (1.3), Maize (1.3) & Sunflower (1.1)
BMB	Horse gram (2.4) & Sorghum (1.3)
HGH	Cotton (1.4) & Maize (2.5)
BRG	Beetroot (1.4)

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 Microwatershed are given below (Table 18).

The productivity of different crops grown in Hongahalli-4 Microwatershed under potential yield of the crops is given in Table 19.

The data on cost of cultivation and benefit cost ratio (BCR) of different crops is given in Table 19. The total cost of cultivation in study area for horse gram cost of cultivation range between is Rs 43608/ha in BMD soil (with of 1.67) and Rs 13237/ha in BMB soil (with BCR of 2.1.46), cotton range between Rs. 54700/ha in HGH soil (with BCR of 1.43) and Rs 44599/ha in MGH soil (with BCR of 1.38), sorghum range between Rs 40260/ha in BMB soil (with BCR of 1.10) and Rs.38385/ha in BMD soil (with BCR of 1.15), maize range between in HGH soil Rs 75392/ha (with BCR of 0.95) and Rs.11452/ha in KNG soil (with BCR of 1.01), groundnut cost of cultivation in BDM soil is Rs.44396/ha (with BCR of 1.25), sunflower cost of cultivation in KNG soil is Rs.35547/ha (with BCR of 1.11), ragi cultivation in BMD soil is Rs. 22604/ha (with BCR of 1.80), tomato cost of cultivation in BDM soil Rs. 70830/ha (with BCR of 1.26), onion cost of cultivation in BMD soil is Rs 108887/ha (with BCR of 2.11), beetroot cost of cultivation in BRG soil is Rs.73414/ha (with BCR of 1.07) and beans cost of cultivation in KNG soil is Rs 123611/ha (with BCR of 1.15).

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 19. 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 746854 in beetroot and a minimum of Rs 6015 in horse gram cultivation.

Table 19: Economic land evaluation and bridging yield gap for different crops in Hongahalli 4 microwatershed

Particulars	BMD (25-50 cm)						MGH (50-75 cm)		KNG (75-100 cm)			BMB (>150 cm)		BRG (>150 cm)	HGH (>150 cm)	
	Ground nut	Horse gram	Onion	Ragi	Sorg hum	Tom ato	Cot ton	Horse gram	Beans	Maize	Sun flower	Horse gram	Sorg hum	Beet root	Cot ton	Maize
Total cost (Rs/ha)	44396	43608	108887	22604	38385	70830	44599	24116	123611	114526	35547	13237	40260	73414	54700	75392
Gross Return (Rs/ha)	55467	72865	229710	40733	44107	88920	61750	25935	142025	115267	39520	19348	44460	78217	70735	71500
Net returns (Rs/ha)	11071	29257	120823	18130	5722	18090	17151	1819	18414	741	3973	6112	4200	4803	16035	-3892
BCR	1.25	1.67	2.11	1.80	1.15	1.26	1.38	1.08	1.15	1.01	1.11	1.46	1.10	1.07	1.43	0.95
Farmers Practices (FP)																
FYM (t/ha)	2.2	0.0	5.0	0.0	6.0	0.0	2.1	0.0	0.0	10.4	2.5	0.0	2.1	6.9	4.8	0.0
Nitrogen (kg/ha)	48.8	0.0	80.6	48.8	0.0	80.6	51.6	51.6	117.2	117.2	43.8	42.7	42.7	0.0	69.3	70.7
Phosphorus (kg/ha)	110.2	0.0	150.6	110.2	0.0	150.6	56.8	56.8	136.7	136.7	78.8	47.9	47.9	0.0	137.6	156.3
Potash (kg/ha)	75.1	0.0	35.6	75.1	0.0	35.6	40.1	40.1	0.0	0.0	21.3	62.5	62.5	0.0	113.6	148.0
Grain (Qtl/ha)	8.8	12.5	75.0	13.2	11.9	100.0	12.5	8.3	125.0	62.5	10.0	4.2	16.7	27.8	14.3	52.6
Price of Yield (Rs/Qtl)	6000	3500	3100	3000	3000	900	5000	3000	1150	1600	4000	3500	2500	2850	5000	1300
Soil test based fertilizer Recommendation (STBR)																
FYM (t/ha)	8.6	0.0	29.6	8.6	7.4	24.7	12.4	0.0	12.4	8.6	6.6	0.0	7.4	19.8	12.4	8.6
Nitrogen (kg/ha)	30.9	24.7	154.4	92.6	81.5	191.4	148.2	24.7	37.5	123.5	55.2	24.7	81.5	55.6	148.2	123.5
Phosphorus (kg/ha)	61.8	37.1	74.1	43.2	56.8	148.2	74.1	37.1	59.3	61.8	44.5	37.1	56.8	98.8	55.6	46.3
Potash (kg/ha)	30.9	24.7	123.5	44.5	39.5	138.3	92.6	30.9	37.1	24.1	37.1	18.5	29.6	44.5	74.1	32.1
Grain (Qtl/ha)	17.3	9.9	247.0	30.9	28.4	518.7	17.3	9.9	9.9	84.0	16.5	9.9	28.4	296.4	17.3	84.0
% of Adoption/yield gap (STBR-FP) / (STBR)																
FYM (%)	74.6	0.0	83.1	100.0	19.7	100.0	83.1	0.0	100.0	-20.5	62.0	0.0	71.9	64.9	61.2	100.0
Nitrogen (%)	-58.0	100.0	47.8	47.3	100.0	57.9	65.2	-108.8	-212.1	5.1	20.7	-72.9	47.6	100.0	53.2	42.7
Phosphorus (%)	-78.5	100.0	-103.3	-154.9	100.0	-1.6	23.4	-53.2	-130.6	-121.4	-77.1	-29.3	15.7	100.0	-147.6	-237.4
Potash (%)	-143.3	100.0	71.2	-68.9	100.0	74.2	56.7	-29.9	0.0	100.0	42.6	-237.4	0.0	100.0	-53.3	-361.0
Grain (%)	49.3	-26.5	69.6	57.4	58.1	80.7	27.7	15.7	-1165.2	25.6	39.3	57.8	41.3	90.6	17.5	37.3
Value of yield and Fertilizer (Rs)																
Additional Cost (Rs/ha)	3221	2421	23915	5611	5726	27977	13239	-1375	8728	-4513	3031	-1574	5526	18719	4111	2123
Additional Benefits (Rs/ha)	51108	-9170	533200	53151	49501	376830	23950	4640	-132388	34368	25867	19997	29346	765573	15146	40753
Net change Income (Rs/ha)	47888	-11591	509285	47540	43775	348853	10711	6015	-141116	38881	22836	21570	23819	746854	11036	38630

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 20 and Figure 10. The average value of soil nutrient loss is around Rs 900 per ha/year. The total cost of annual soil nutrients is around Rs 505064 per year for the total area of 123.7 ha.

Table 20 Estimation of onsite cost of soil erosion in Hongahalli 4 Microwatershed

Particulars	Quantity(kg)		Value (Rs)	
	Per ha	Total	Per ha	Total
Organic matter	119.9	67252	755.2	423686
Phosphorus	0.1	40	3.1	1757
Potash	2	1136	40.5	22727
Iron	0.1	38	3.2	1813
Manganese	0.1	66	32.4	18167
Cupper	0.01	7	6.5	3658
Zinc	0.0	2	0.1	75
Sulphur	1.5	826	58.9	33046
Boron	0.01	3	0.2	136
Total	123.7	69370	900.3	505064

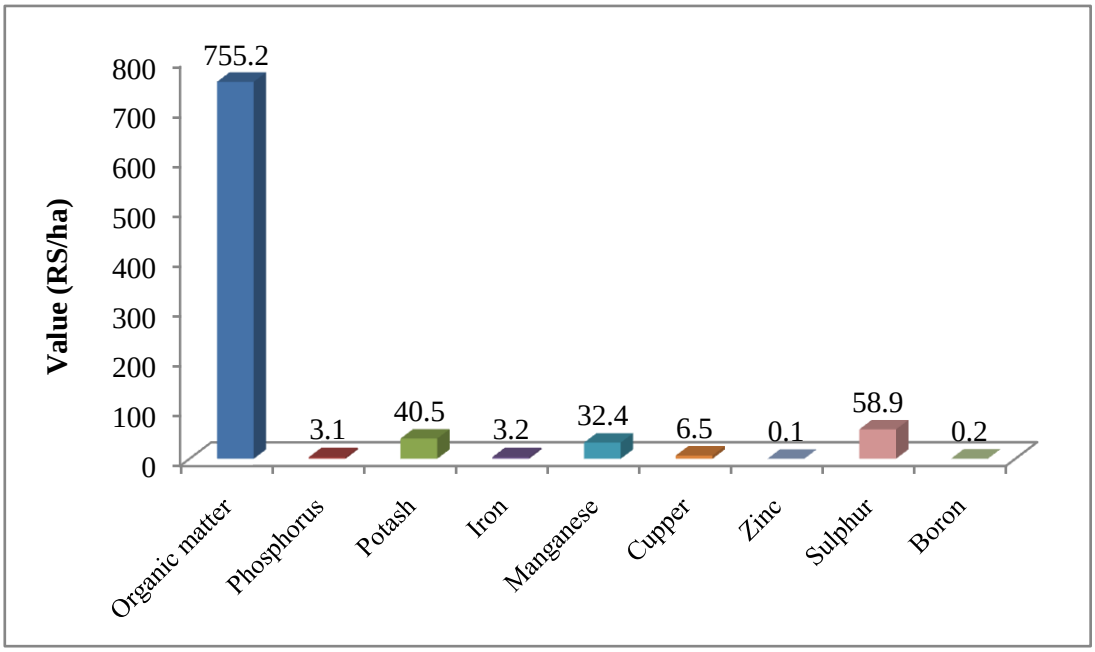


Figure 10: Estimation of onsite cost of soil erosion in Hongahalli 4 Microwatershed Table

The average value of ecosystem service for food grain production is around Rs 17634/ ha/year (Table 21 and Figure 11). Per hectare food grain production services is maximum in onion (Rs120823) followed by beans (Rs 18414), tomato (Rs.18090), ragi (Rs 16396), groundnut (Rs 7604), beetroot (Rs 4803), sunflower (Rs 3973), cotton (Rs 16407), horse gram (Rs 457), maize and sorghum is negative return.

Table 21: Ecosystem services of food production in Hongahalli 4 Microwatershed

Production items	Crops	Area in ha	Yield (Qtl/ha)	Price (Rs/Qtl)	Gross Returns (Rs/ha)	Cost of Cultivation (Rs/ha)	Net Returns (Rs/ha)
Cereals	Maize	0.3	56.9	1450	82469	94959	-12490
	Ragi	0.5	13.0	3000	39000	22604	16396
	Sorghum	0.7	14.1	2750	38814	39323	-508
Pulses	Horsegram	1.1	8.2	3333	27444	26987	457
Oil seeds	Groundnut	0.5	8.7	6000	52000	44396	7604
	Sunflower	0.4	9.9	4000	39520	35547	3973
Vegetables	Beans	0.1	123.5	1150	142025	123611	18414
	Beetroot	0.1	27.4	2850	78217	73414	4803
	Onion	0.4	74.1	3100	229710	108887	120823
	Tomato	0.4	98.8	900	88920	70830	18090
Commercial Crops	Cotton	1.5	13.5	5000	67740	51333	16407
Average value		5.8	40.7	3048	80533	62899	17634

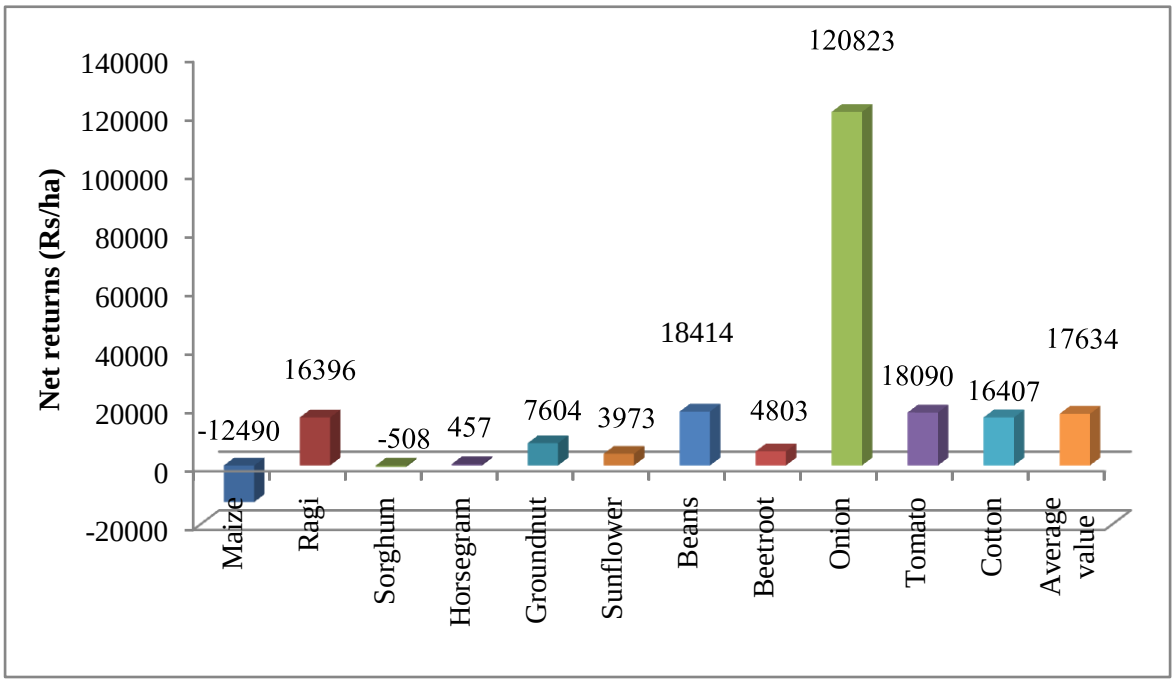


Figure 11: Ecosystem services of food grain production in Hongahalli 4 Microwatershed

The average value of ecosystem service for fodder production is around Rs 10209/ ha/year (Table 22). Per hectare fodder production services is maximum in maize (Rs

20150), followed by sorghum (Rs. 17290), ragi (Rs. 5200), horse gram (Rs. 4940) and groundnut (Rs. 3467).

Table 22: Ecosystem services of fodder production in Hongahalli 4 Microwatershed

Production items	Crops	Area in ha	Yield (Qtl/ha)	Price (Rs/Qtl)	Net returns (Rs)
Cereals	Maize	0.3	16.8	1200	20150
	Ragi	0.5	4.3	1200	5200
	Sorghum	0.6	14.4	1200	17290
Pulses	Horsegram	1.1	6.2	800	4940
Oil seeds	Groundnut	0.5	4.3	800	3467
Average value		3.0	9.2	1040	10209

The water demand for production of different crops was worked out in arriving at the ecosystem services of water support to crop growth. The data on water requirement for producing one quintal of grain is considered for estimating the total value of water required for crop production. The per hectare value of water used and value of water was maximum (Table 23 and Figure 12) in beans (Rs 601445) followed by maize (Rs 69501), cotton (Rs 54585), sorghum (Rs 43020), sunflower (Rs 33256), horse gram (Rs 25342), groundnut (Rs 24111), tomato (Rs 21143), onion (Rs 20155) and ragi (Rs 18534).

Table 23: Ecosystem services of water supply in Hongahalli 4 Microwatershed

Crops	Yield (Qtl/ha)	Virtual water (cubic meter) per ha	Value of Water(Rs/ha)	Water consumption (Cubic meter Rs/Qtl)
Beans	123.5	60145	601445	487
Cotton	13.5	5458	54585	403
Groundnut	8.7	2411	24111	278
Horsegram	8.2	2534	25342	308
Maize	56.9	6950	69501	122
Onion	74.1	2016	20155	27
ragi	13.0	1589	15886	122
Sorghum	14.1	4302	43020	305
Sunflower	9.9	3326	33256	337
Tomato	98.8	2114	21143	21
Average value	42.1	9084	90844	241

The main farming constraints in Hongahalli 4 micro-watershed to be found are less rainfall, lack of good quality seeds, non availability fertilizers, high crop pests & diseases, animal pests & diseases, lack of transportation, lack of storage, damage of crops by wild animals and non availability of plant protection chemicals. Majority of farmers depend up on bank and money lender of the sources of loan for purpose of crop production. Farmers to sell the agriculture produce through village market, regulated 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 24).

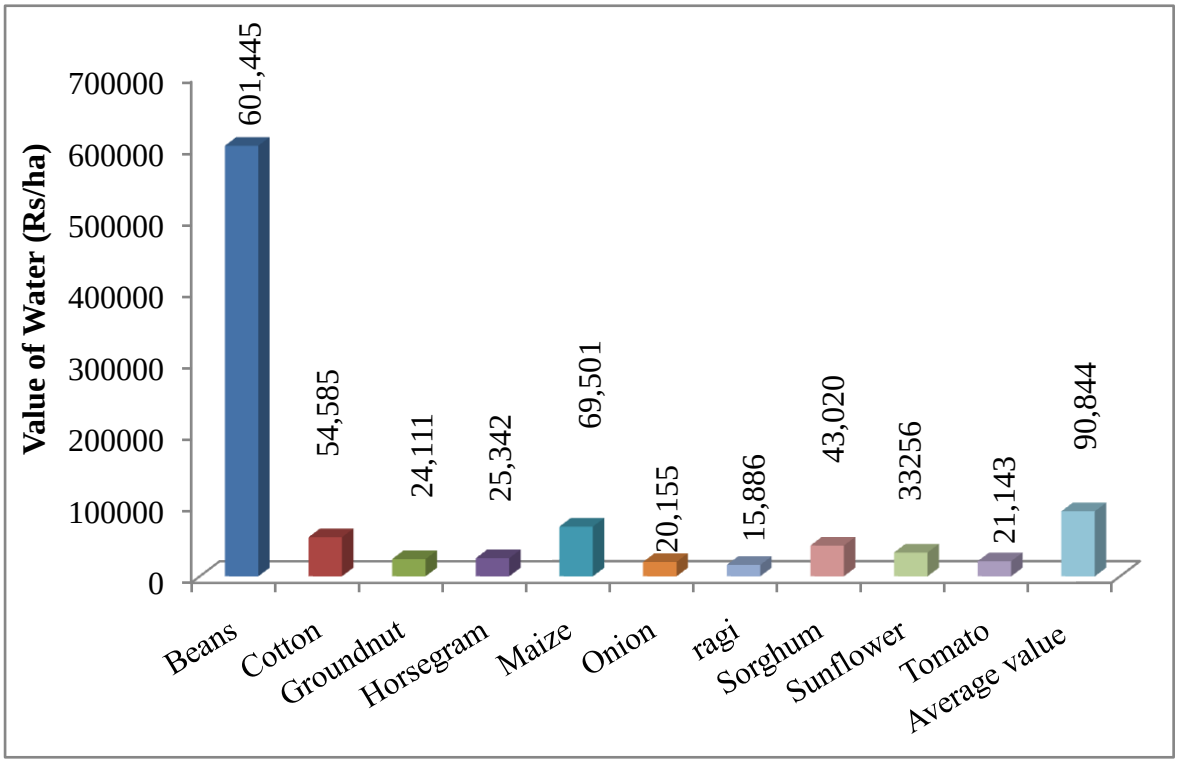


Figure 12: Ecosystem services of water supply in Hongahalli 4 Microwatershed

Table 24: Farming constraints related land resources of sample households in Hongahalli 4 Microwatershed

Sl.No	Particulars	Per cent
1	Less Rainfall	100.0
2	Lack of good quality seeds	25.0
3	Non availability Fertilizers	5.0
4	Lack of transportation	20.0
5	Lack of storage	5.0
6	Damage of crops by Wild Animals	75.0
7	Non availability of Plant Protection Chemicals	50.0
8	**Source of loan**	
	Money Leander	100.0
9	**Market for selling**	
	Village market	100.0
10	**Sources of Agri-Technology information**	
	Newspaper	100.0

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.