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

BACHANAHALLI-3 (4D4A2Q3c) MICRO WATERSHED

Alavandi Hobli, Koppal Taluk and District, Karnataka

Karnataka Watershed Development Project – II

SUJALA – III

World Bank funded Project

The World Bank

ICAR – NATIONAL BUREAU OF SOIL SURVEY AND LAND USE PLANNING

ICAR - NBSS & LUP

WATERSHED DEVELOPMENT DEPARTMENT
GOVT. OF KARNATAKA, BANGALORE

About ICAR - NBSS&LUP

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

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

Citation: Rajendra Hegde, Ramesh Kumar, S.C., K.V. Niranjana, S. Srinivas, M.Lalitha, B.A. Dhanorkar, R.S. Reddy and S.K. Singh (2019). “Land Resource Inventory and Socio-Economic Status of Farm Households for Watershed Planning and Development of Bachanahalli-3 (4D4A2Q3c) Microwatershed, Alavandi Hobli, Koppal Taluk and District, Karnataka”, ICAR-NBSS&LUP Sujala MWS Publ.249, ICAR – NBSS & LUP, RC, Bangalore. p.105 & 35.

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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 for Bachanahalli-3 microwatershed in Koppal Taluk, Koppal 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 micro-watershed. 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 **S.K. SINGH**
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PART-A

LAND RESOURCE INVENTORY

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EXECUTIVE SUMMARY

The land resource inventory of Bachanahalli-3 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 these 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 456 ha in Koppal taluk and district, Karnataka. The climate is semiarid and categorized as drought - prone with an average annual rainfall of 662 mm, of which about 424 mm is received during south –west monsoon, 161 mm during north-east and the remaining 77 mm during the rest of the year. An area of about 99 per cent is covered by soils and 1 per cent by others. The salient findings from the land resource inventory are summarized briefly below.

- *The soils belong to 7 soil series and 11 soil phases (management units) and 5 land management units.*
- *The length of crop growing period is <90 days and starts from 2nd week of August to 2nd week of November.*
- *From the master soil map, several interpretative and thematic maps like land capability, soil depth, surface soil texture, soil gravelliness, available water capacity, soil slope and soil erosion were generated.*
- *Soil fertility status maps for macro and micronutrients were generated based on the surface soil samples collected at every 320 m grid interval.*
- *Land suitability for growing 28 major agricultural and horticultural crops were assessed and maps showing the degree of suitability along with constraints were generated.*
- *Entire area is suitable for agriculture.*
- *About 7 per cent of the soils are very shallow (<25 cm), 58 per cent of the soils are shallow (25-50 cm), 1 per cent is moderately shallow (50-75 cm), 32 per cent moderately deep (75- 100 cm) and 1 per cent deep soils (100-150 cm).*
- *An area of about 52 per cent loamy soils and 47 per cent has clayey soils at the surface.*
- *About 20 per cent of the area has non-gravelly (<15%) soils, 47 per cent has gravelly soils (15-35 % gravel) and 32 per cent very gravelly (35- 60% gravel) soils.*
- *With respect to available water capacity 97 per cent of the area has very low (<50 mm/m) and 2 per cent of the area has low (51-100 mm/m).*
- *Entire area is very gently sloping (1-3%) lands.*

- *An area of about 15 per cent is slightly eroded (e1) and 84 per cent is moderately eroded (e2) lands.*
- *An area of about 6 per cent slightly acid (pH 6.0-6.5), 32 per cent has neutral (pH 6.5 to 7.3) soils, 21 per cent slightly alkaline (pH 7.3 to 7.8), 38 per cent moderately alkaline (pH 7.8 to 8.4) and 2 per cent strongly alkaline (pH 8.4-9.0).*
- *The Electrical Conductivity (EC) of the soils are <2 dsm^{-1} indicating that the soils are non saline.*
- *Organic carbon is low (<0.5%) in 30 per cent, medium (0.5-0.75%) in 59 per cent and high (>0.75%) in 10 per cent area of the soils.*
- *Available phosphorus is low (<23 kg/ha) in 7 per cent, medium (23-57 kg/ha) in 76 per cent and high (>57 kg/ha) in 16 per cent of the soils.*
- *Available potassium is low (<145 kg/ha) in 24 per cent, medium (145-337 kg/ha) in 66 per cent and high (>337 kg/ha) in 9 per cent of the soils.*
- *Available sulphur is low (<10 ppm) in 31 per cent, medium (10-20 ppm) in 44 per cent and high (>20 ppm) in 24 per cent area of the soils.*
- *Available boron is low (<0.5 ppm) in about 65 per cent and medium (0.5-1.0 ppm) in 34 per cent area of the soils.*
- *Available iron is deficient in 52 per cent of the area and sufficient (>4.5 ppm) in 47 per cent of the area.*
- *Available zinc is deficient (<0.6 ppm) in 43 per cent of the area and sufficient (>0.6 ppm) in 56 per cent of the area.*
- *Available manganese and copper are sufficient in the entire area.*
- *The land suitability for 28 major agricultural and horticultural crops grown in the microwatershed was assessed and the areas that are highly suitable (class S1) and moderately suitable (class S2) are given below. It is however to be noted that a given soil may be suitable for various crops but what specific crop to be grown may be decided by the farmer looking to his capacity to invest on various inputs, marketing infrastructure, market price, and finally the demand and supply position.*

Land suitability for various crops in the microwatershed

Crop	Suitability Area in ha (%)			Crop	Suitability Area in ha (%)	
	Highly suitable (S1)	Moderately suitable (S2)			Highly suitable (S1)	Moderately suitable (S2)
Sorghum	-	*8 (2)*		*Pomegranate*	-	*3 (<1)*
Maize	-	*8 (2)*		*Guava*	-	*3 (<1)*
Bajra	-	*8 (2)*		*Jackfruit*	-	*3 (<1)*
Redgram	-	*3 (<1)*		*Jamun*	-	-
Bengal gram	-	*8 (2)*		*Musambi*	-	*3 (<1)*
Groundnut	-	*14 (3)*		*Lime*	-	*3 (<1)*
Sunflower	-	*3 (<1)*		*Cashew*	-	*144 (31)*
Cotton	-	*8 (2)*		*Custard apple*	-	*158 (35)*
Chilli	-	*8 (2)*		*Amla*	-	*158 (35)*
Tomato	-	*8 (2)*		*Tamarind*	-	-
Drumstick	-	*9 (2)*		*Marigold*	-	*8 (2)*
Mulberry	-	*153 (33)*		*Chrysanthemum*	-	*8 (2)*
Mango	-	-		*Jasmine*	-	*8 (2)*
Sapota	-	*3 (<1)*		*Crossandra*	-	*8 (2)*

Apart from the individual crop suitability, a proposed crop plan has been prepared for the 5 identified LMUs by considering only the highly and moderately suitable lands for different crops and cropping systems with food, fodder, fibre and other horticulture crops.

- *Maintaining soil-health is vital for 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 supplementing the farm income, provide fodder and fuel, and generate lot of biomass which in turn would help in maintaining the ecological balance and 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 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 potential and problem areas, developing sustainable land use plans, estimation of surface run off and water harvesting potential, preparation of soil and water conservation plans, land degradation/desertification etc. The Bureau is presently engaged in developing an LRI methodology using high resolution satellite remote sensing data and Digital Elevation Model (DEM) data to prepare Landscape Ecological Units (LEU) map representing agro-ecosystem as a whole. The LEU is preferred over landform as the base map for LRI. LEU is the assemblage of landform, slope and land use. An attempt was made to upscale the soil resource information from 1:250000 and 1:50000 scale to the LEU map in Goa and other states.

The land resource inventory aims to provide site-specific database for Bachanahalli-3 microwatershed in Koppal Taluk, Koppal 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 Bachanahalli-3 micro-watershed is located in the central part of Karnataka in Koppal taluk and district (Fig 2.1). It lies between $15^0$11' and $15^0$12' North latitudes and $76^0$0' and $76^0$2' East longitudes and covers an area of about 456 ha. It surrounded by Bochanahalli on the southwestern side, Betageri on the northern side, eastern and south and Marammanahalli on the western side of the microwatershed. It is about 75 km from Koppal town.

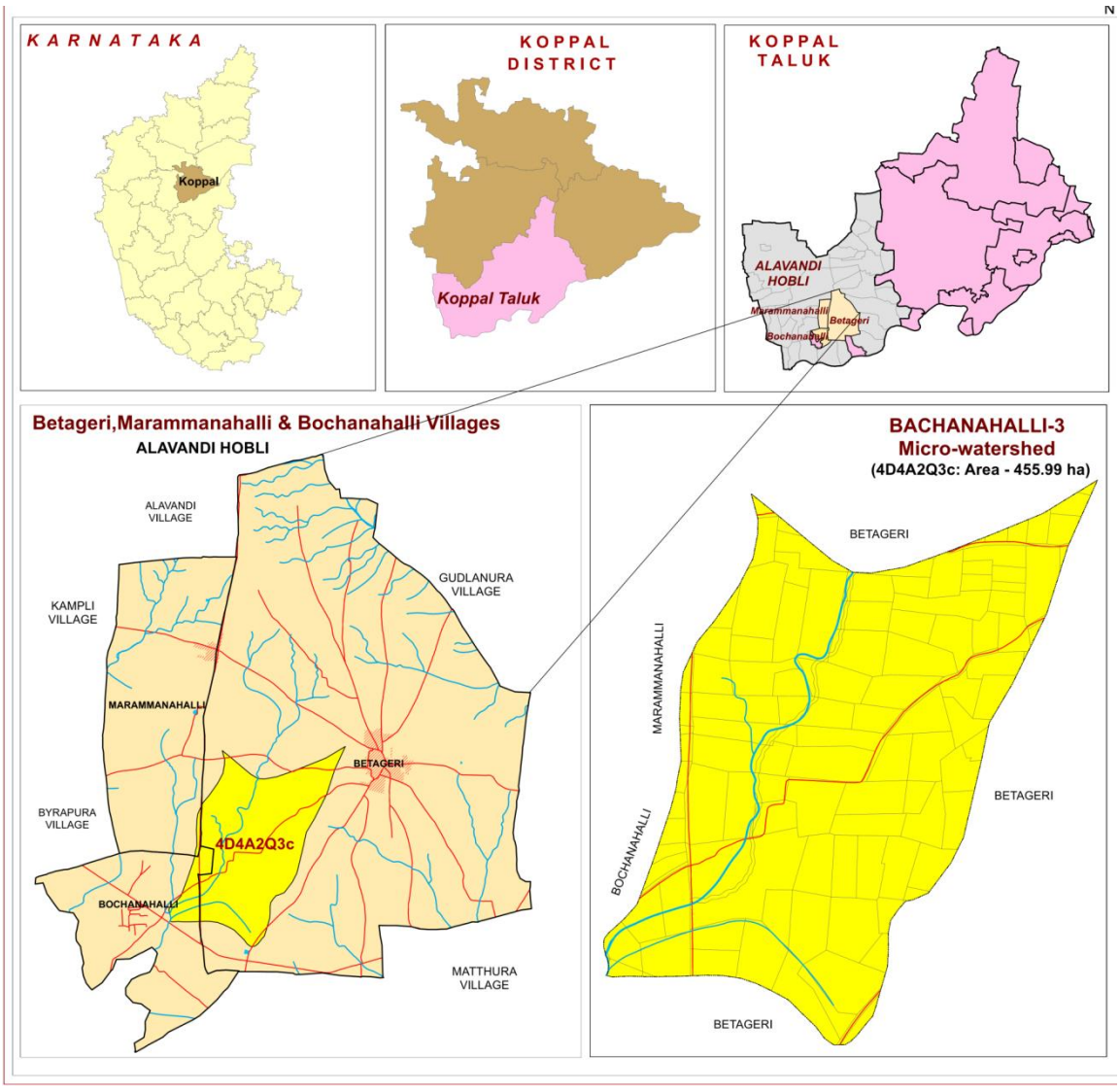


Fig.2.1 Location map of Bachanahalli-3 Microwatershed

2.2 Geology

Major rock formations observed in the microwatershed are granite gneiss (Fig. 2.2). Granite gneisses are essentially pink to gray and 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. Dolerite dykes and quartz veins are common with variable width and found to occur in Bachanahalli-3 village. The thickness of the alluvium generally is limited to less than a meter, except in river valleys where it is very deep extending to tens of meters. Such soils are transported and represent paleo black soils originally formed at higher elevation, but now occupying river valleys.

Fig.2.2 Granite and granite gneiss rocks

2.3 Physiography

Physiographically, the area has been identified as granite gneiss landscape based on geology. The microwatershed area has been further divided into mounds/ridges, summits and very gently sloping uplands and nearly level plains based on slope and its relief features. The elevation ranges from 511-533 m in the gently sloping uplands.

2.4 Drainage

The area is drained by several small seasonal streams that join Hire *halla* and Chenna *halla* along its course. Though, the streams are not perennial, during rainy season they carry large quantities of rain water. The microwatershed has only few small tanks which are not able to store the water flowing 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 area can be easily met. The drainage network is dendritic to sub parallel.

2.5 Climate

The district falls under semiarid tract of the state and is categorized as drought - prone with total annual rainfall of 662 mm (Table 2.1). Of this, a maximum of 424 mm precipitation is received during the south–west monsoon period from June to September, north-east monsoon contributes about 161 mm and prevails from October to early December and the remaining 77 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 45°C and in December and January, the temperatures will go down to 16°C. Rainfall distribution is shown in Figure 2.3. The average Potential Evapo Transpiration (PET) is 145 mm and varies from a low of 101 mm in December to 193 mm in the month of May. The PET is always higher than precipitation in all the months except in the month of September. Generally, the Length of crop Growing Period (LGP) is <90 days and starts from 2nd week of August to 2nd week of November.

Table 2.1 Mean Monthly Rainfall, PET, 1/2 PET at Koppal Taluk and District

Sl. No.	Months	Rainfall	PET	1/2 PET
1	January	1.60	116.70	58.35
2	February	1.50	129.20	64.60
3	March	14.10	169.80	84.90
4	April	18.10	180.60	90.30
5	May	41.60	193.50	96.75
6	June	85.80	167.90	83.95
7	July	72.10	156.20	78.10
8	August	110.50	152.50	76.25
9	September	155.60	138.50	69.25
10	October	116.30	122.30	61.15
11	November	36.00	106.40	53.20
12	December	9.10	101.00	50.50
TOTAL		**662.30**	**144.55**	

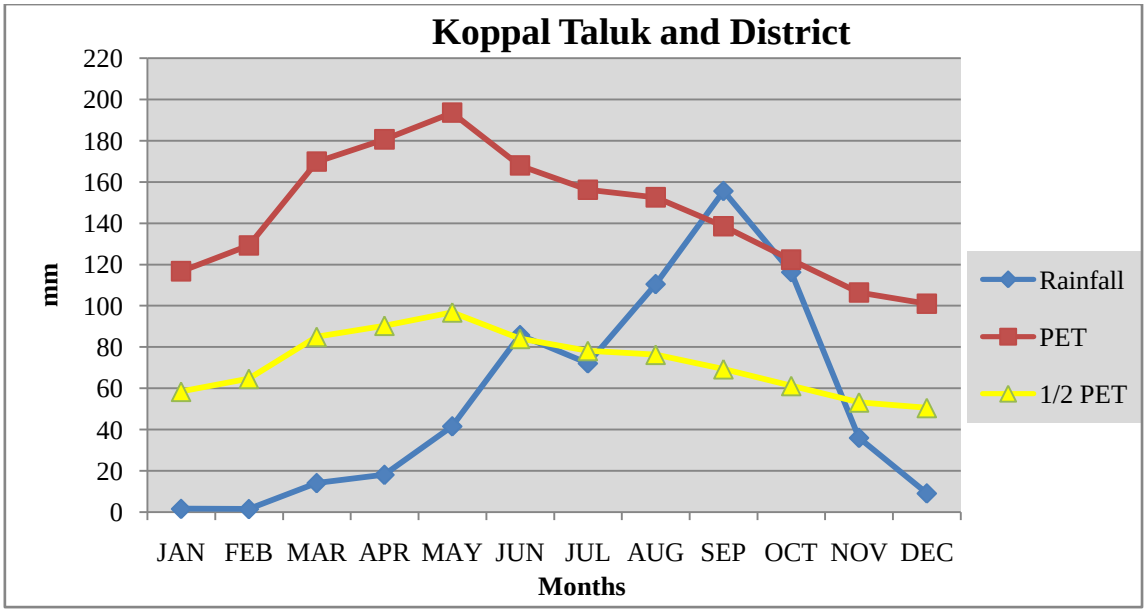


Fig. 2.3 Rainfall distribution in Koppal Taluk and District

2.6 Natural Vegetation

The natural vegetation is sparse comprising few tree species, shrubs and herbs. The mounds, ridges and boulders occupy sizeable areas which are under thin to moderately thick forest vegetation. Still, there are some remnants of the past forest cover which can be seen in patches in some ridges and hillocks in the microwatershed (Fig 2.4).

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

Fig 2.4 Natural vegetation of Bachanahalli-3 microwatershed

2.7 Land Utilization

About 91 per cent area (Table 2.2) in Koppal district is cultivated at present and about 17 per cent of the area is sown more than once. An area of about 3 per cent is currently barren. Forests occupy a small area of about 5 per cent and the tree cover is in a very poor state. Most of the mounds, ridges and boulder areas have very poor vegetative cover. Major crops grown in the area are sorghum, maize, bajra, cotton, safflower, sunflower, red gram, horse gram, onion, mulberry, pomegranate, sugarcane, bengalgram and groundnut (Fig 2.5). While carrying out land resource inventory, the land use/land cover particulars are collected from all the survey numbers and a current land use map of the microwatershed is prepared. The current land use map prepared shows the arable and non-arable lands, other land uses and different types of crops grown in the area. The current land use map of Bachanahalli-3 microwatershed is presented in Fig.2.6. Simultaneously, enumeration of existing wells (bore wells) and other conservation structures is made and their location in different survey numbers is marked on the cadastral map. Map showing the location of wells and other soil conservation structures in Bachanahalli-3 microwatershed is given in Fig 2.7.

Table 2.2 Land Utilization in Koppal District

Sl. No.	Agricultural land use	Area (ha)	Per cent
1	Total geographical area	552495	
2	Total cultivated area	500542	90.6
3	Area sown more than once	92696	16.8
4	Trees and groves	210	0.04
5	Cropping intensity	-	118
6	Forest	29451	5.33
7	Cultivable wasteland	2568	0.46
8	Permanent Pasture land	14675	2.66
9	Barren land	16627	3.01
10	Non agricultural land	40591	7.35
11	Current fallow	19660	3.56

Fig.2.5 (a) Different crops and cropping systems in Bachanahalli-3 Microwatershed

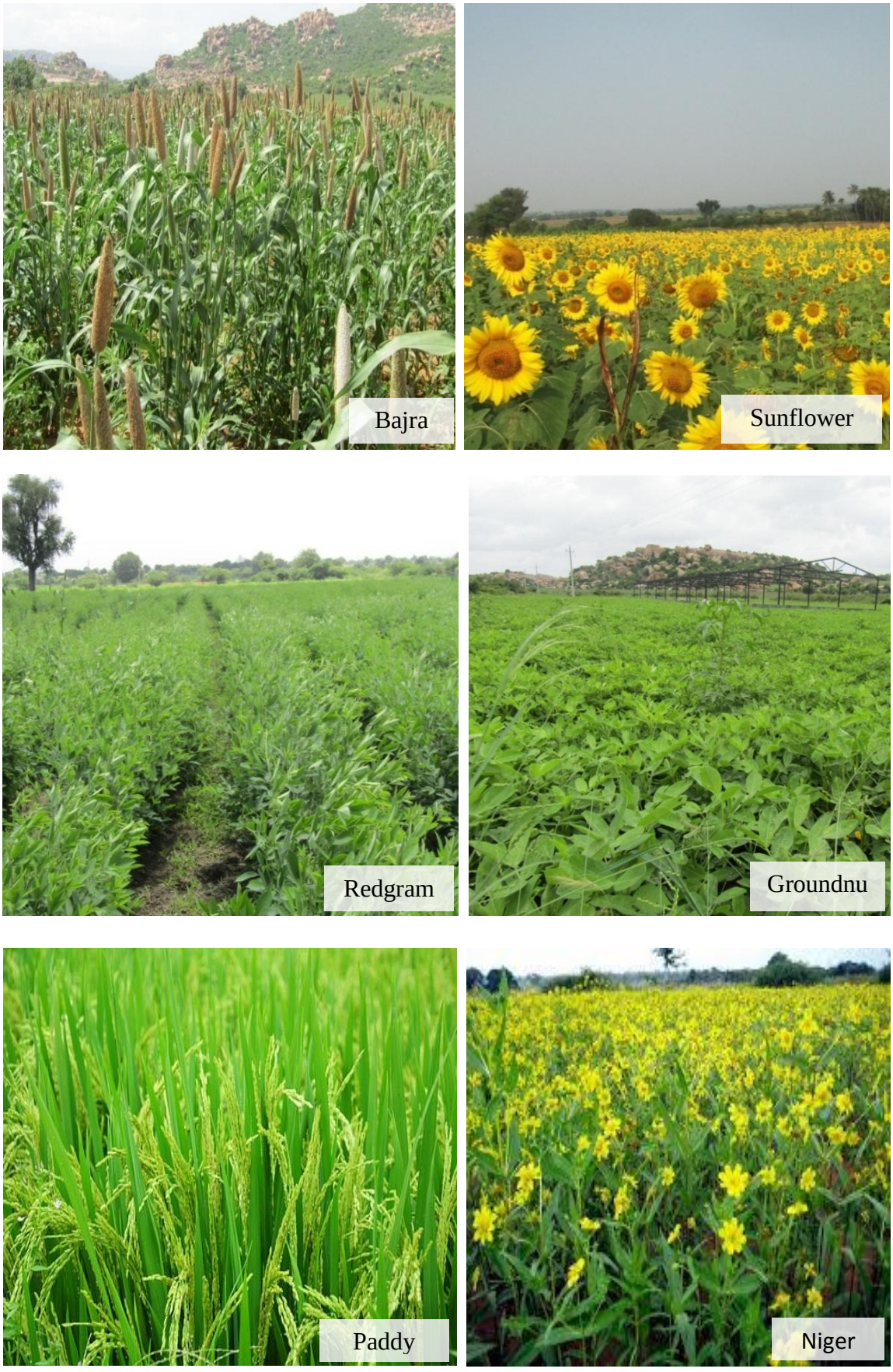


Fig.2.5 (b) Different crops and cropping systems in Bachanahalli-3 Microwatershed

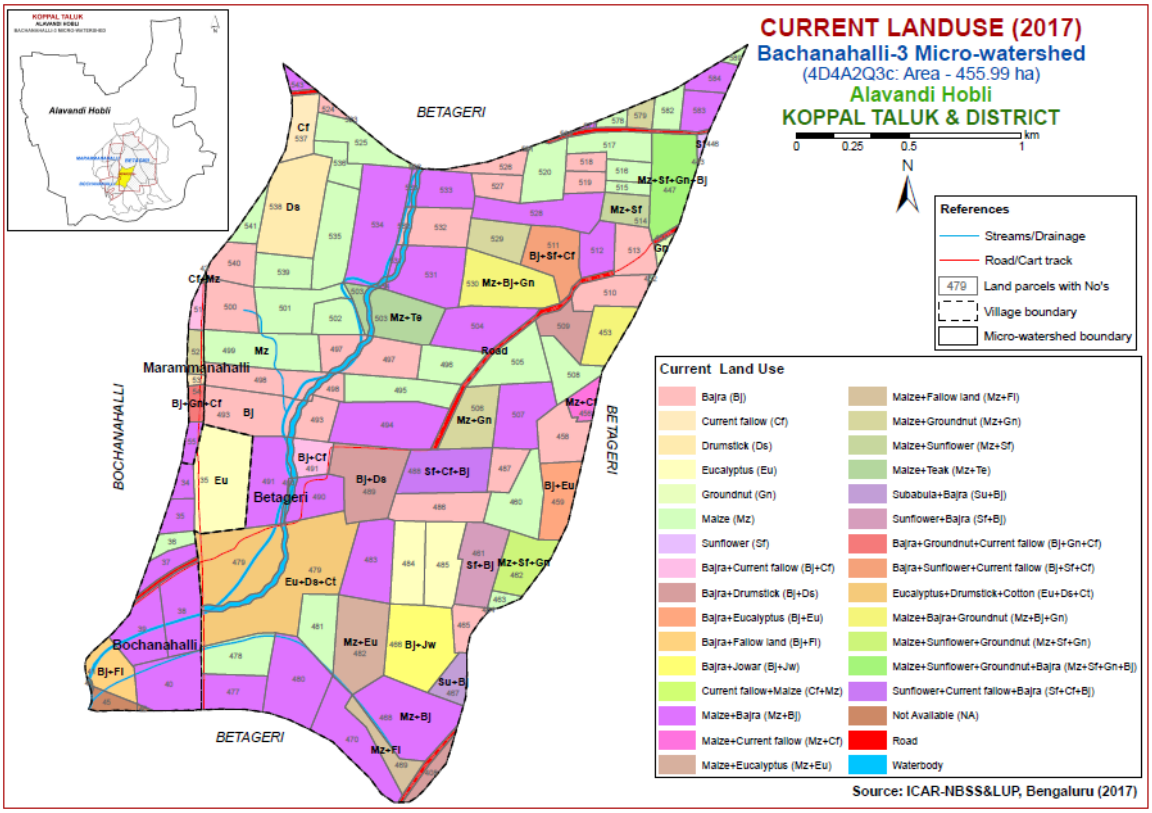


Fig.2.6 Current Land Use – Bachanahalli-3 Microwatershed

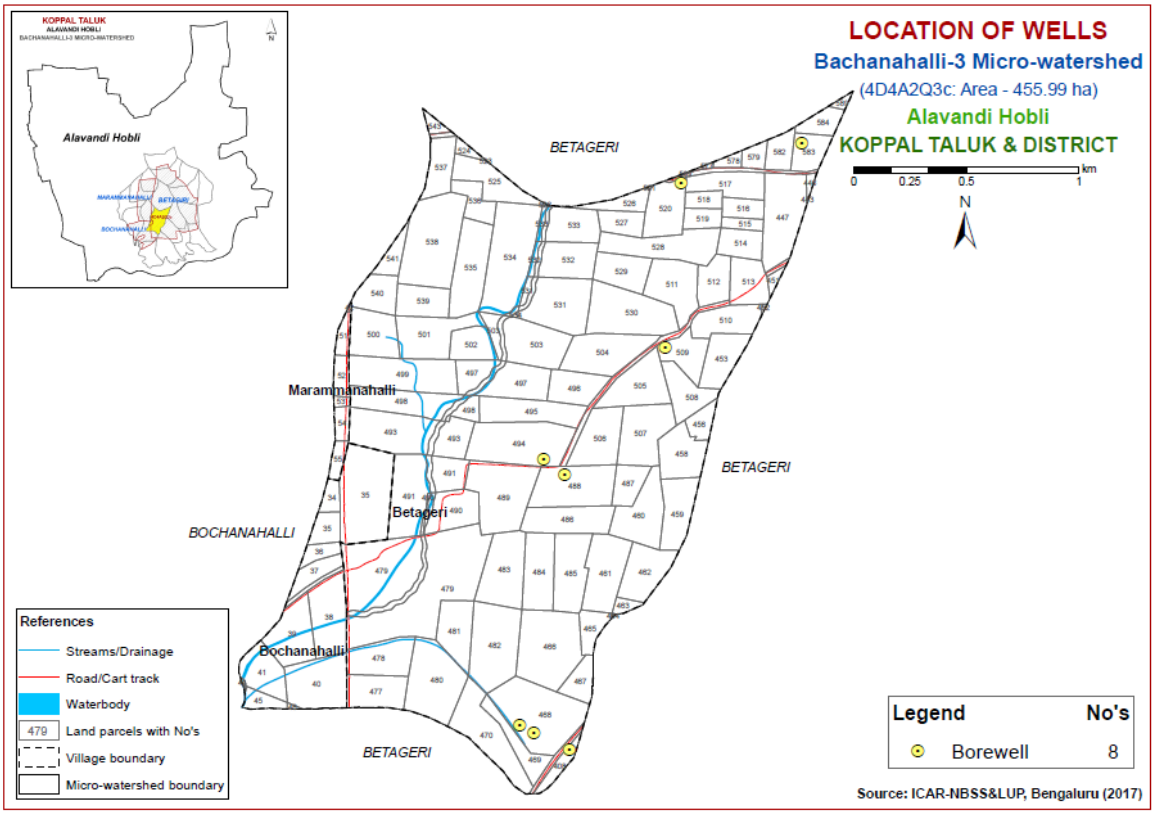


Fig. 2.7 Location of wells and conservation structures–Bachanahalli-3 Microwatershed

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 for a given level of management. This was achieved in Bachanahalli-3 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, erosion, drainage, occurrence of rock fragments etc.) followed by grouping of similar areas based on soil-site characteristics into homogeneous (management units) units and showing their extent and geographic distribution on the microwatershed cadastral map. The detailed soil survey at 1:7920 scale was carried out in 456 ha area. The methodology followed for carrying out land resource inventory was as per the guidelines given in Soil Survey Manual (IARI, 1971; Soil Survey Staff, 2006; Natarajan *et al.,* 2015) which is briefly described below.

3.1 Base Maps

The detailed survey of the land resources occurring in the microwatershed was carried out by using digitized cadastral map and satellite imagery as base supplied by the 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 were used in conjunction with the cadastral map to identify the geology, 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 used for initial traversing, identification of geology, landscapes 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 (FCC) of Cartosat-I and LISS-IV merged satellite data covering the microwatershed area was visually interpreted using image interpretation elements and all the available collateral data with local knowledge. The delineated physiographic boundaries were transferred on to a cadastral map overlaid on satellite imagery. Physiographically, the area has been identified as granite gneiss landscapes and is divided into mounds/ridges, summits and very gently sloping uplands and lowlands based on slope and image characteristics. They were further subdivided into

physiographic/ image interpretation units based on image characteristics. The image interpretation legend for physiography is given below.

Image Interpretation Legend for Physiography

G- Granite gneiss 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)

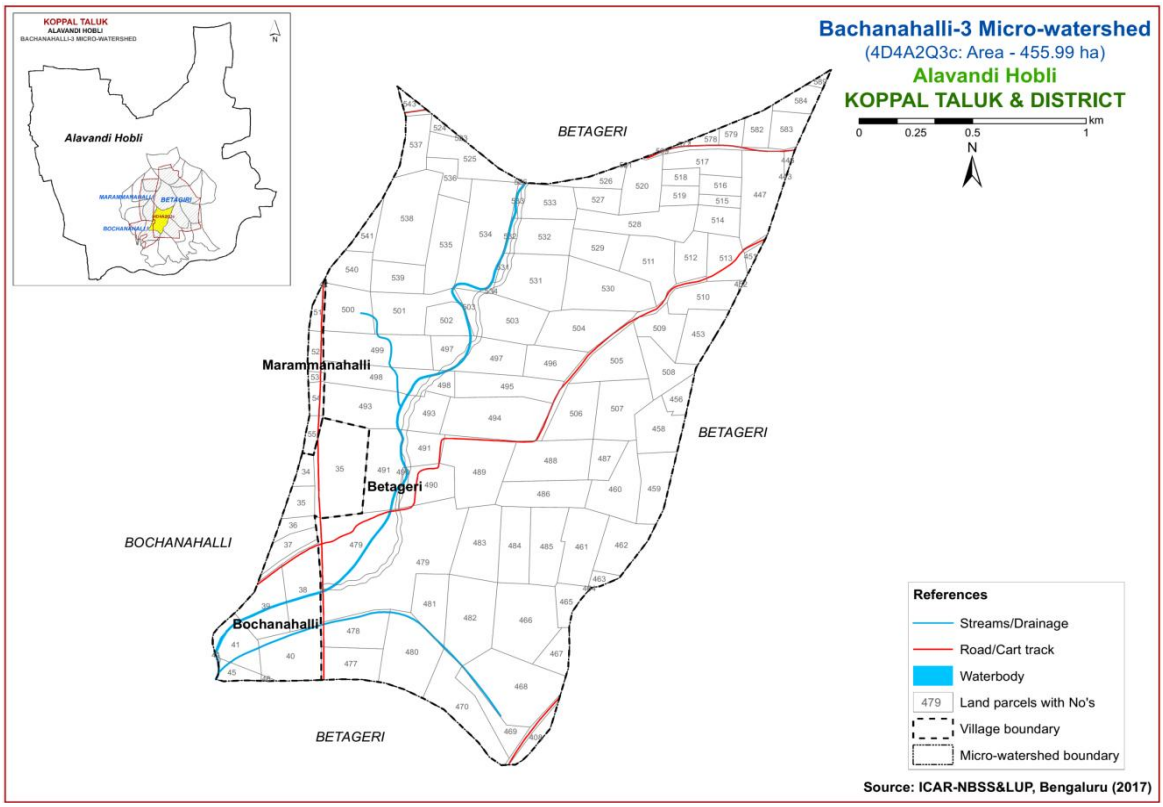


Fig 3.1 Scanned and Digitized Cadastral map of Bachanahalli-3 Microwatershed

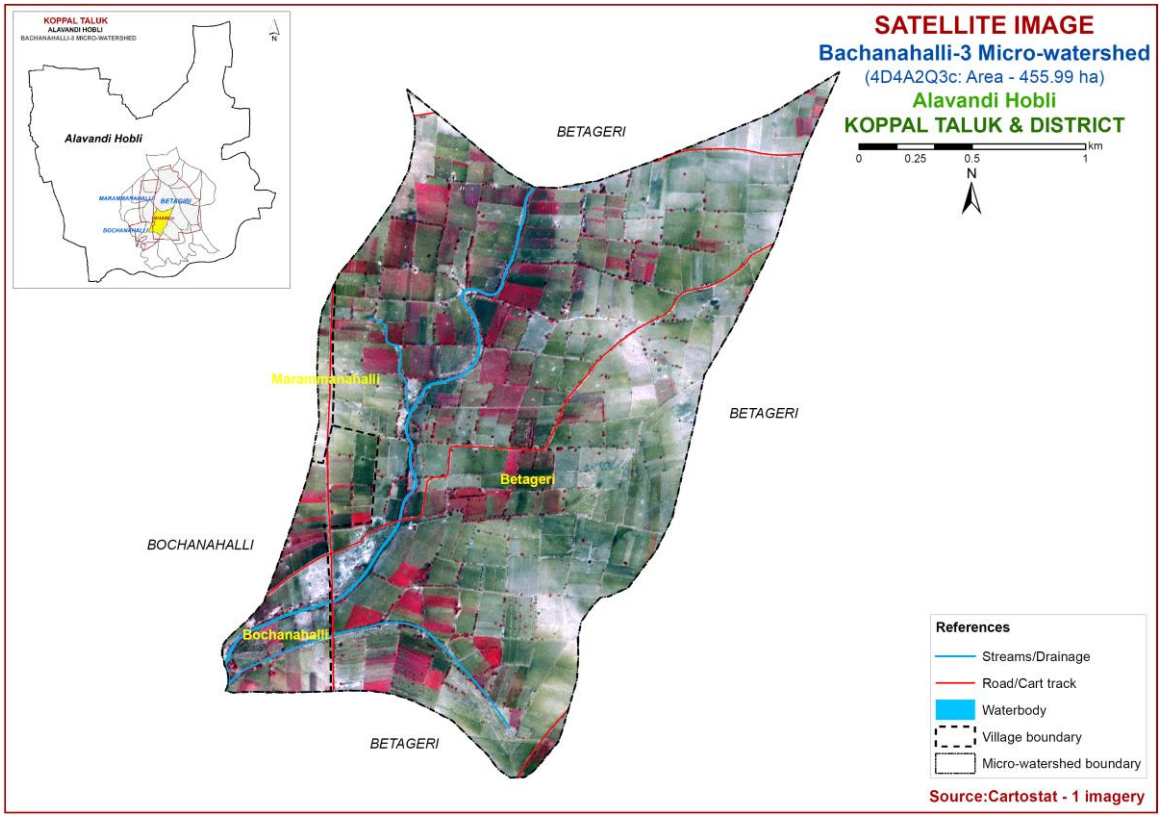


Fig.3.2 Satellite Image of Bachanahalli-3 Microwatershed

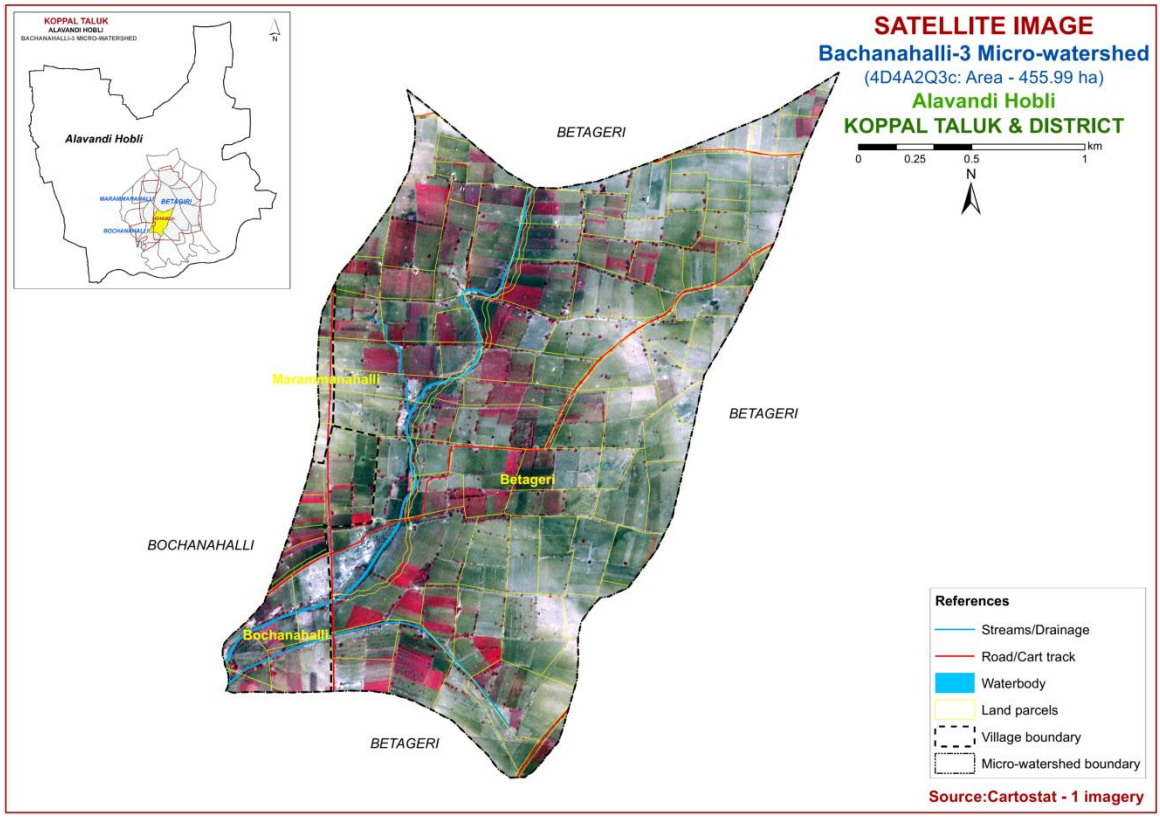


Fig.3.3 Cadastral map overlaid on IRS PAN+LISS IV merged imagery of Bachanahalli-3 Microwatershed

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 plains was carried out. Based on the variability observed on the surface, transects (Fig 3.4) were selected across the slope covering all the landform units in the microwatershed (Natarajan and Dipak Sarkar, 2010).

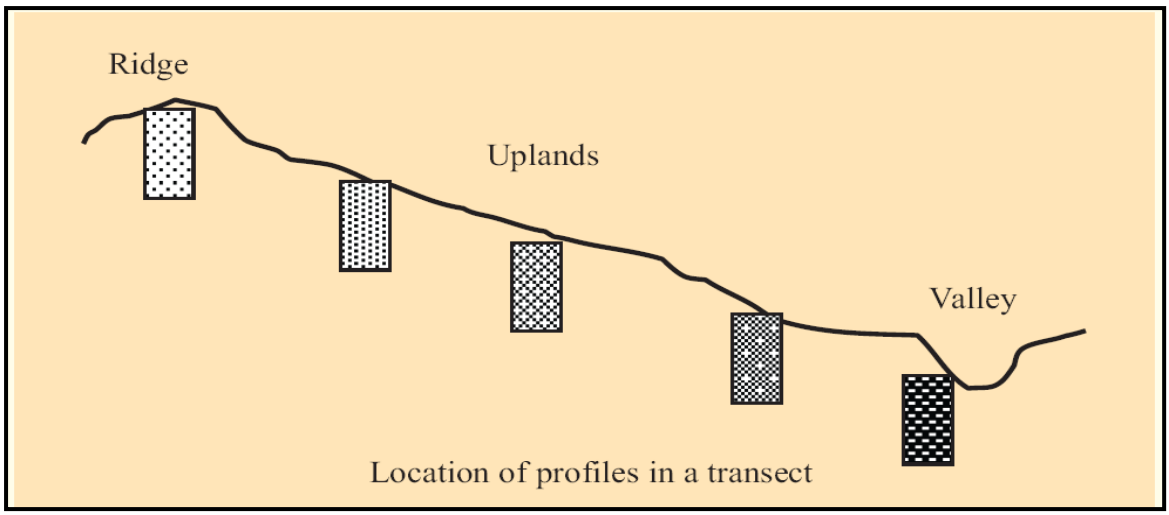


Fig: 3.4. Location of profiles in a transect

In the selected transect, soil profiles (Fig.3.4) were located at closely spaced intervals to take care of any change in the land features like break in slope, erosion, gravel, stones etc. In the selected sites, profiles (vertical cut showing the soil layers from surface to the rock) were opened 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 to validate the soil map unit boundaries.

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, amount and nature of gravel present, calcareousness, 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, 7 soil series were identified in Bachanahalli-3 microwatershed.

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

Sl. No	Soil Series	Depth (cm)	Colour (moist)	Texture	Gravel (%)	Horizon sequence	Calcareous-ness
Soils of Granite Gneiss Landscape							
1	BGT (Belagatti)	<25	10 YR3/1, 3/2, 4/2	gc	>35	Ap-Crk	es
2	Harve (HRV)	25-50	2.5YR3/4,3/6 5YR3/3,4/4,3/4	gscl	>35	Ap-Bt-Cr	-
3	CSR (Chikkasavanur)	25-50	7.5YR3/2,3/3,3/4	scl	<15	Ap-Bw-Cr	-
4	Mukhadahalli (MKH)	50-75	5YR3/3,3/4,4/3,5/4, 6/6 2.5YR3/4	gscl	>35	Ap-Bt-Cr	-
5	TGR (Tigari)	75-100	5YR 3/3, 4/3, 2.5YR 2/3, 3/3, 3/4	gscl	15-35	Ap-Bt-Cr	e-es
6	Bidanagere (BDG)	75-100	5YR3/3,3/4,4/3,5/4 2.5 YR 3/4	gc	35-60	Ap-Bt-Cr	-
7	Nagalapur (NGP)	100-150	5YR2.5/2,3/2, 2.5YR3/6,4/6	gsc-gc	>35	Ap-Bt-Cr	-

3.4 Soil Mapping

The area under each soil series was further separated into soil phases and their boundaries delineated on the cadastral map based on the variations observed in the texture of the surface soil, slope, erosion, presence of gravel, stoniness etc. A soil phase is a subdivision of soil series based mostly on surface features that affect its use and management. The soil mapping units are shown on the map (Fig.3.5) in the form of symbols. During the survey many soil profile pits, few mini pits 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 mini pits, road cuts, terrace cuts etc., were studied to validate the soil boundaries on the soil map.

The soil map shows the geographic distribution of 11 soil mapping units representing 7 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 11 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 soil phase will have similar management needs and have to be treated accordingly.

3.5 Laboratory Characterization

Soil samples for 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 in the year 2017 from farmer's fields in Bachanahalli-3 microwatershed (45 samples) for fertility status (major and

micronutrients) at 320 m grid interval were analyzed in the laboratory (Katyal and Rattan, 2003). By linking the soil fertility data to the survey numbers through GIS, soil fertility maps were generated using Kriging method for the microwatershed.

Table 3.2 Soil map unit description of Bachanahalli-3 Microwatershed

Soil map unit No*	Soil Series	Soil Phase	Mapping Unit Description	Area in ha (%)
Soils of granite and granite gneiss landscape				
	BGT	Belagatti soils are very shallow (<25 cm), well drained, have very dark gray to very dark grayish brown, calcareous gravelly clay black soils occurring on very gently to gently sloping uplands under cultivation		**30 (6.63)**
5		BGThB2g2	Sandy clay loam surface, slope 1-3%, moderate erosion, very gravelly (35-60%)	30 (6.63)
	HRV	Harve soils are shallow (25-50 cm), well drained, dark red to dark reddish brown, red gravelly loam soils occurring on nearly level to gently sloping uplands under cultivation		**110 (24.17)**
24		HRVhB1g2	Sandy clay loam surface, slope 1-3%, slight erosion, very gravelly (35-60%)	8 (1.81)
27		HRVhB2g2	Sandy clay loam surface, slope 1-3%, moderate erosion, very gravelly (35-60%)	48 (10.54)
30		HRViB1g2	Sandy clay surface, slope 1-3%, slight erosion, very gravelly (35-60%)	54 (11.82)
	CSR	Chikkasavanur soils are shallow (25-50 cm), well drained, have dark brown to light yellowish brown, red sandy clay loam soils occurring on nearly level to very gently sloping uplands under cultivation		**154 (33.84)**
39		CSRiB2	Sandy clay surface, slope 1-3%, moderate erosion	91 (20.0)
40		CSRiB2g1	Sandy clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	63 (13.84)
	MKH	Mukhadahalli soils are moderately shallow (50-75 cm), well drained, have dark brown to reddish brown red gravelly sandy clay loam soils occurring on very gently to gently sloping uplands under cultivation		**5 (1.03)**
91		MKHiB2g2	Sandy clay surface, slope 1-3%, moderate erosion, very gravelly (35-60%)	5 (1.03)
	TGR	Tigari soils are moderately deep (75-100 cm), well drained, have reddish brown to dark reddish brown red calcareous gravelly sandy clay loam soils occurring on very gently sloping uplands under cultivation		**3 (0.7)**
151		TGRiB2g1	Sandy clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	3 (0.7)
	BDG	Bidanagere soils are moderately deep (75-100 cm), well drained, have dark reddish brown red gravelly sandy clay		**144 (31.49)**

		soils occurring on nearly level to gently sloping uplands under cultivation		
188		BDGhB2g1	Sandy clay loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	143 (31.28)
189		BDGhB2g2	Sandy clay loam surface, slope 1-3%, moderate erosion, very gravelly (35-60%)	1 (0.21)
	NGP	Nagalapur soils are deep (100-150 cm), well drained, have dark reddish brown to dark red gravelly sandy clay to clay soils occurring on nearly level to gently sloping uplands under cultivation		**6 (1.31)**
258		NGPhB1g1	Sandy clay loam surface, slope 1-3%, slight erosion, gravelly (15-35%)	6 (1.31)
1000		Others	water body	**4 (0.83)**

*Soil map unit numbers are continuous for the taluk, not the microwatersheds

3.6 Land Management Units

The 11 soil phases identified and mapped in the microwatershed were regrouped into 5 Land Management Units (LMU'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 Management Units (LMU's) based on the management needs. One or more than one soil site characteristic having influence on the management have been chosen for identification and delineation of LMUs. For Bachanahalli-3 microwatershed, five soil and site characteristics, namely soil depth, soil texture, slope, erosion and gravel content have been considered for defining LMUs. The land use classes are expected to behave similarly for a given level of management.

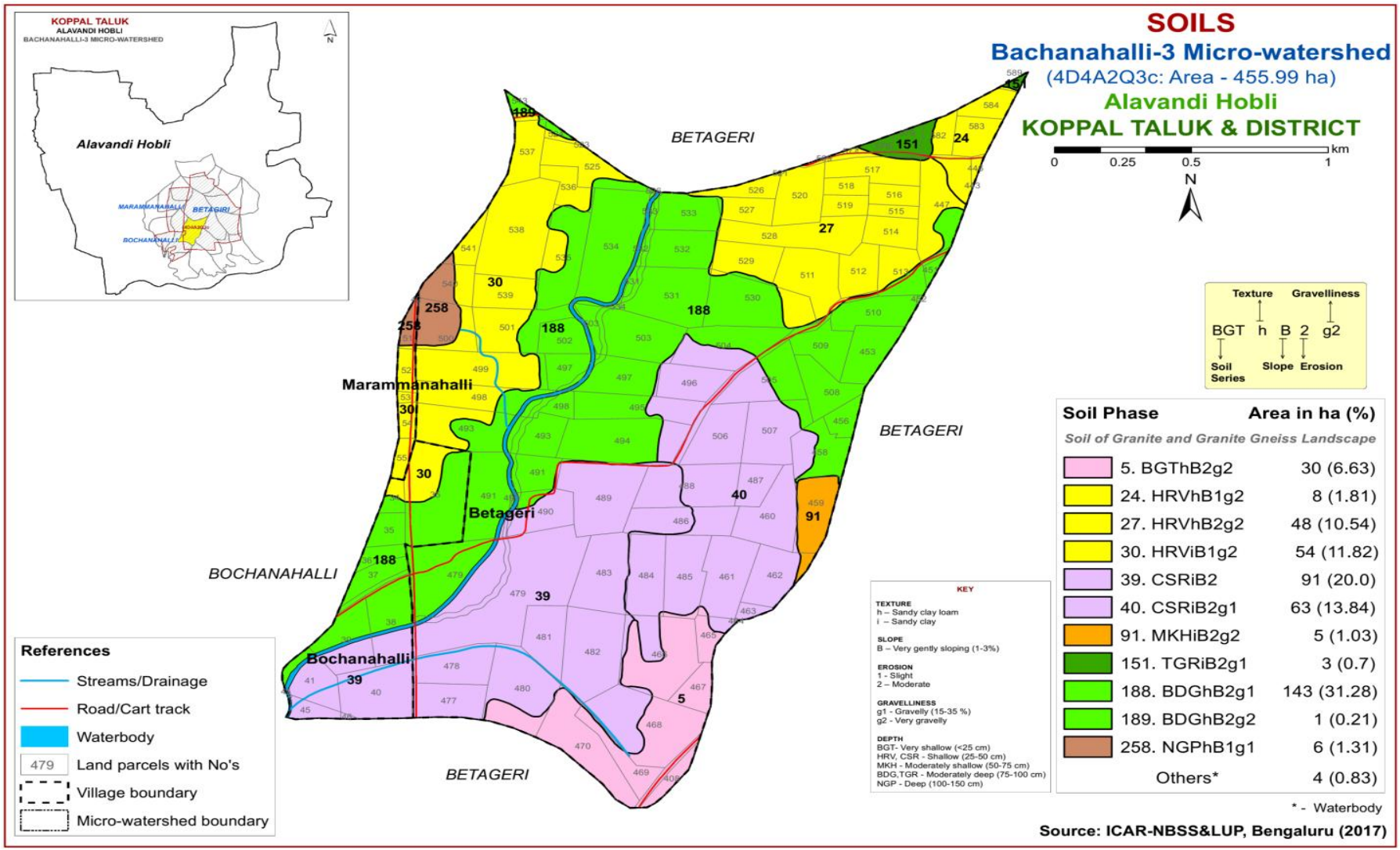


Fig 3.5 Soil Phase or Management Units-Bachanahalli-3 Microwatershed

Chapter 4

THE SOILS

Detailed information pertaining to the nature, extent and distribution of different kinds of soils occurring in Bachanahalli-3 microwatershed is provided in this chapter. The microwatershed area has been identified as granite gneiss landscapes based on geology. In all, 7 soil series were identified. Soil formation is the result of the combined effect of environmental and terrain factors that are reflected in soil morphology. The soil formation is dominantly influenced by the parent material, climate, time and relief.

A brief description of each of the 7 soil series identified followed by 11 soil phases (management units) mapped (Fig. 3.5) are furnished below. The physical and chemical characteristics of soil series identified in Bachanahalli-3 microwatershed are given in Table 4.1 along with soil classification. 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, 7 soil series were identified and mapped. Of these series, CSR series occupies maximum area of 154 ha (34%) followed by BDG 144 ha (31%), HRV 110 ha (24%), BGT 30 ha (7%), NGP 6 ha (1%), MKH 5ha (1%) and TGR 3 ha (1%). The brief description of the soil series along with the soil phases identified and mapped is given below.

4.1.1 Belagatti (BGT) Series: Belagatti soils are very shallow (< 25 cm), well drained, have dark gray to dark grayish brown, calcareous gravelly clay soils. They have developed from granite gneiss and occur on very gently sloping uplands. The Belagatti series has been classified as a member of the clayey mixed, isohyperthermic family of Lithic Ustorthents.

The thickness of the soil is less than 25 cm. Its colour is in 10 YR hue with value 3 to 4 and chroma 1 to 2. The texture is clay with more than 35 per cent gravel and the available water capacity is low (50-100 mm/m). Only one soil phase was identified and mapped.

Landscape and soil profile characteristics of Belagatti (BGT) Series

4.1.2 Harve (HRV) Series: Harve soils are shallow (25-50 cm), well drained, have reddish brown to dark red gravelly sandy clay loam soils. They have developed from granite gneiss and occur on very gently to moderately sloping uplands. The Harve series has been tentatively classified as a member of the loamy- skeletal, mixed, isohyperthermic family of Typic Haplustalfs.

The thickness of the solum ranges from 28 to 48 cm. The thickness of A-horizon ranges from 12 to 17 cm. Its colour is in 5YR and 2.5 YR hue with value 3 to 4 and chroma 4 to 6. The texture varies from loamy sand to sandy loam with 20 to 60 per cent gravel. The thickness of B-horizon ranges from 16 to 32 cm. Its colour is in 2.5 YR and 5 YR hue with value 3 to 4 and chroma 4 to 6. Its texture is sandy clay loam with gravel content of more than 35 per cent. The available water capacity is very low (<50mm/m). Three soil phases were identified and mapped.

Landscape and soil profile characteristics of Harve (HRV) Series

4.1.3 Chikkasavanur (CSR) Series: Chikkasavanur soils are shallow (25-50 cm), well drained, have dark brown to light yellowish brown sandy clay loam soils. They have developed from granite gneiss and occur on very gently sloping uplands. The Chikkasavanur series has been tentatively classified as a member of the fine-loamy, mixed, isohyperthermic family of Typic Haplustepts.

The thickness of the solum ranges from 32 to 49 cm. The thickness of A horizon ranges from 12 to 23 cm. Its colour is in 7.5 YR and 10 YR hue with value 2.5 to 4 and chroma 3 to 6. The texture varies from sandy loam to clay with 10 to 20 per cent gravel. The thickness of B horizon ranges from 16 to 32 cm. Its colour is in 7.5 YR and 5 YR hue with value 3 and chroma 2 to 4. Its texture is sandy clay loam with gravel content of < 15 per cent. The available water capacity is low (50-100 mm/m). Two soil phases were identified and mapped.

Landscape and soil profile characteristics of Chikkasavanur (CSR) Series

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

The thickness of the solum ranges from 51 to 72 cm. The thickness of A horizon ranges from 12 to 17 cm. Its colour is in 5 YR and 7.5 YR hue with value 3 to 4 and chroma 2 to 4. The texture varies from loamy sand to sandy loam with 20 to 45 per cent gravel. The thickness of B horizon ranges from 40 to 60 cm. Its colour is in 2.5 YR and 5 YR hue with value and chroma 3 to 6. Texture is sandy clay loam to sandy clay with 35 to 50 per cent gravel. The available water capacity is low (50-100 mm/m). Only one soil phase was identified and mapped.

Landscape and soil profile characteristics of Mukhadaha (MKH)

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

The thickness of the solum ranges from 77 to 100 cm. The thickness of A horizon ranges from 11 to 21 cm. Its colour is in 5 YR and 10 YR hue with value 3 to 4 and chroma 2 to 4. The texture is sandy clay to clay. The thickness of B horizon ranges from 56 to 87 cm. Its colour is in 2.5 YR and 5 YR hue with value and chroma 2 to 4. Its texture ranges from gravelly sandy clay loam to sandy clay and is calcareous. The available water capacity is low (51-100 mm/m). Only one soil phase was identified and mapped.

4.1.6 Bidanagere (BDG) Series: Bidanagere soils are moderately deep (75-100 cm), well drained, have dark reddish brown, gravelly clay soils. They have developed from weathered granite gneiss and occur on very gently sloping uplands under cultivation. The Bidanagere series has been classified as a member of the clayey-skeletal, mixed, isohyperthermic family of Rhodic Paleustalfs.

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

Landscape and soil profile characteristics of Bidanagere (BDG) Series

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

The thickness of the solum ranges from 105 to 145 cm. The thickness of A-horizon ranges from 14 to 20 cm. Its colour is in 7.5 YR hue with value and chroma 3 to 4. The texture ranges from sandy loam to sandy clay with 10 to 50 per cent gravel. The thickness of B horizon ranges from 90 to 128 cm. Its colour is in 2.5 YR, 5 YR and 7.5 YR hue with value 3 to 5 and chroma 3 to 6. Texture is sandy clay to clay with 35 to 80 per cent gravel. The available water capacity is low (51-100 mm/m). One soil phase was identified and mapped. Only one soil phase was identified and mapped.

Landscape and soil profile characteristics of Nagalapur (NGP) Series

Table: 4.1 Physical and Chemical Characteristics of Soil Series identified in Bachanahalli-3 microwatershed

Series Name: Belagatti (BGT), Pedon: A2/RM-5
Location: $15^0$19'10.8"N, $75^0$57'48.1"E, Kavalura village, Koppal Taluk and District
Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Clayey, mixed, isohyperthermic (calcareous) Lithic Ustorthents

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
0-23	Ap	36.14	20.34	43.52	10.87	6.93	5.97	8.42	3.94	40	c	29.53	17.97

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}							%	%
0-23	8.4			0.157	0.12	18.24			0.73	0.50		44.84	1.03	-	1.11

Contd…

Series Name: Mukahadahalli (MKH), Pedon: R-11
Location: $15^0$22'05.4"N, $76^0$04'10.3"E, Halageri village, Koppal taluk and district
Analysis at: NBSS&LUP, Regional Centre, Bangalore **Classification:** Clayey-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
0-19	Ap	65.71	8.83	25.46	9.27	9.06	14.42	21.52	11.43	70	scl	16.54	8.60
19-32	Bt	55.89	11.13	32.98	6.47	9.18	11.89	19.19	9.18	50	scl	19.24	12.78
32-58	Bt	47.95	10.41	41.63	17.52	3.78	9.13	9.55	7.97	50	sc	24.03	16.02

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}							%	%
0-19	7.38	-	-	0.09	0.2	0.00	8.97	4.32	0.26	0.22	13.77	14.84	0.58	93	1.49
19-32	7.5	-	-	0.106	0.41	0.00	15.98	3.27	0.16	0.50	19.91	20.88	0.63	95	2.38
32-58	7.46	-	-	0.173	0.49	0.00	19.71	4.53	0.23	1.32	25.79	25.76	0.62	100	5.11

Contd…

Series: Bidanagere (BDG), **Pedon**: RM-3
Location: $13^0$22'11"N, $76^0$38'03"E, (4D3D8G1a), Tharabenahalli village, Chikkanayakanahalli taluk, Tumakuru district.
Analysis at: NBSS&LUP, Regional Centre, Bengaluru **Classification:** Clayey-skeletal, mixed, isohyperthermic Rhodic 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
0-20	Ap	81.19	11.25	7.56	12.54	15.07	17.90	21.94	13.75	50	ls	-	-
20-35	Bt1	57.45	11.45	31.10	12.76	11.02	10.92	12.45	10.31	50	scl	-	-
35-92	Bt2	44.63	7.85	47.52	12.40	9.61	8.37	7.75	6.51	60	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}							%	%
0-20	6.24	-	-	0.06	0.60	0.00	1.61	0.26	0.10	0.01	1.98	3.76	0.50	52.56	0.35
20-35	5.99	-	-	0.02	0.40	0.00	4.25	0.46	0.08	0.28	5.07	8.02	0.26	63.18	3.46
35-92	6.70	-	-	0.03	0.20	0.00	5.45	0.31	0.10	0.22	6.09	9.90	0.21	61.48	2.24

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, land irrigability, 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 thematic maps generated are described below.

5.1 Land Capability Classification

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

Soil characteristics: Soil depth, soil texture, coarse fragments, soil reaction, available water capacity, calcareousness, salinity/alkali *etc*.

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

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

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

Class I: 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 severe limitations that reduce the choice of crops or that require special conservation practices.

Class IV: They are fairly good lands that have 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 recognized 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 11 soil map units identified in the Bachanahalli-3 microwatershed are grouped under three land capability classes and four land capability subclasses (Fig. 5.1).

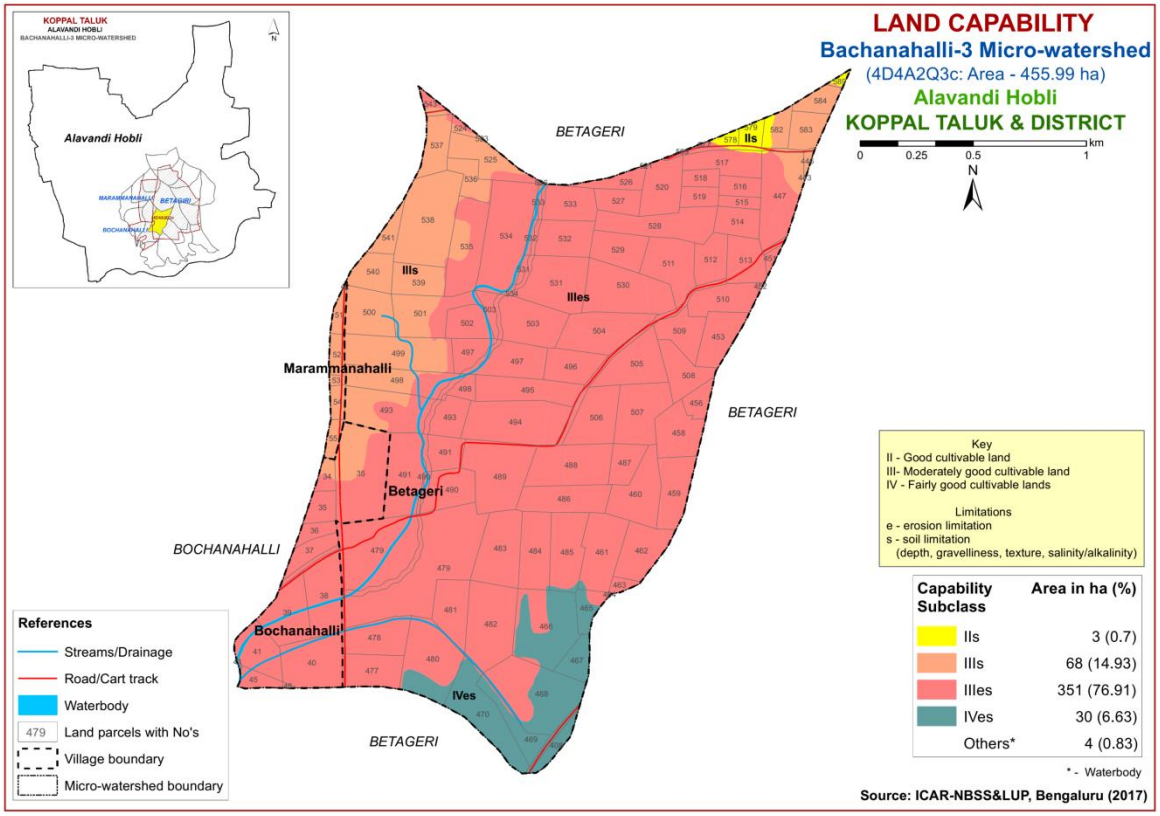


Fig. 5.1 Land Capability map of Bachanahalli-3 Microwatershed

Good lands (Class II) cover an area of about 3 ha (<1%) and distributed in the northeastern part of the microwatershed with minor problems of soil. Moderately good lands (Class III) occupy a maximum area of about 419 ha (92%) and distributed in all parts of the microwatershed with major limitations of soil and erosion. An area of 30 ha (7%) is covered by fairly good cultivable lands and are distributed in the southern part of the microwatershed with severe limitations of soil and erosion. An area of about 4 ha (1%) cover by habitation and water bodies.

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 (Fig. 5.2). The area extent and their geographical distribution in the microwatershed is given in Fig. 5.2.

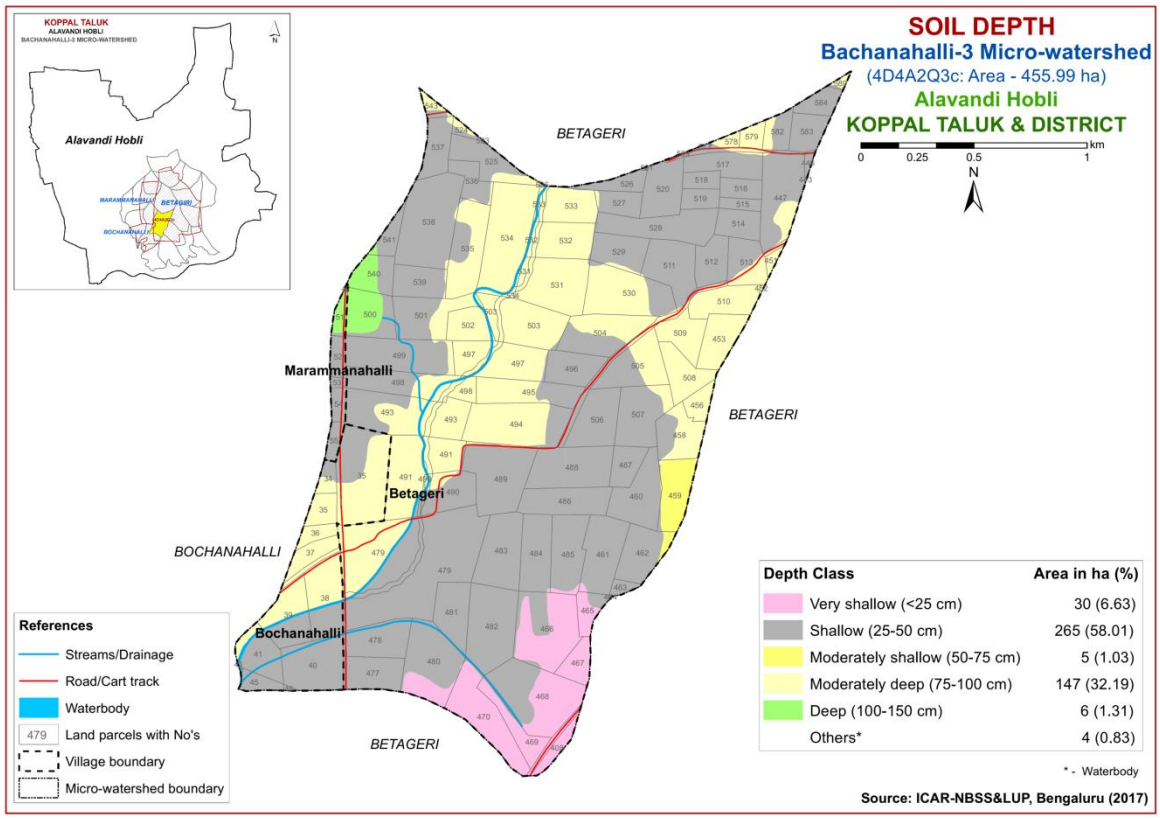


Fig. 5.2 Soil Depth map of Bachanahalli-3 Microwatershed

An area of about 30 ha (7%) is covered by very shallow soils (<25 cm) and are distributed in the southern and southeastern part of the microwatershed. Shallow soils

(25-50 cm) occupy a maximum area of about 265 ha (58%) and distributed in all parts of the microwatershed. Moderately shallow soils (50-75 cm) occupy about 5 ha (1%) and occur in the eastern part of the microwatershed. An area of about 147 ha (32%) is moderately deep (75-100 cm) and are distributed in the northern, eastern, central and western part of the microwatershed. Deep (100-150 cm) soils occupy an area of about 6 ha (1%) and are distributed in the western part of the microwatershed.

The most productive lands cover about 6 ha (1%) where all climatically adapted long duration crops be grown. The problem lands cover about 30 ha (7%) where only short duration crops can be grown. The probability of crop failure is very high.

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 behavior, 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 Fig 5.3.

A maximum area of about 236 ha (52%) is loamy at the surface and are distributed in the major part of the microwatershed. An area of about 216 ha (47%) is clayey at the surface and are distributed in the western, northwestern, northern, central, southern and eastern part of the microwatershed.

The most productive lands with respect to surface soil texture are clayey soils that (47%) 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 are loamy (52%) soils which also have high potential for soil-water retention and nutrient availability but have no drainage or other physical problems.

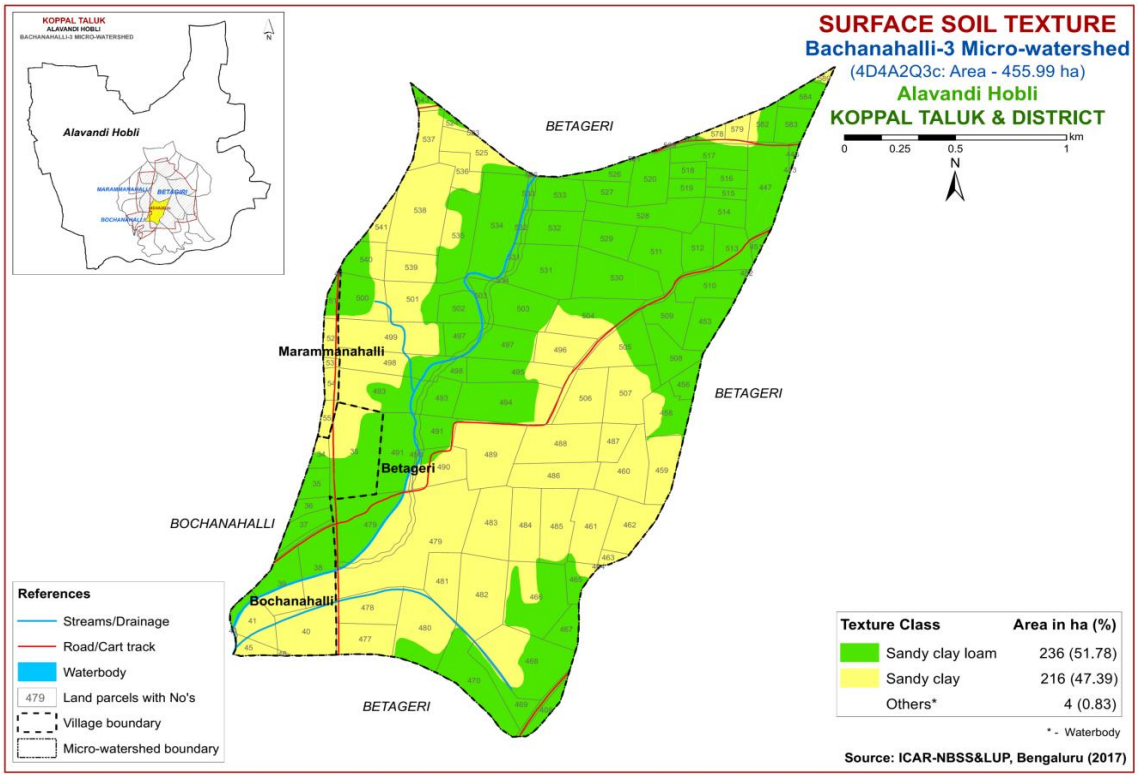


Fig. 5.3 Surface Soil Texture map of Bachanahalli-3 Microwatershed

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 Fig. 5.4.

The soils that are non-gravelly (<15% gravel) cover an area of about 91 ha (20 %) and distributed in the central and southern part of the microwatershed. Maximum area of about 215 ha (47%) is covered by gravelly (15-35% gravel) soils and are distributed in the major part of the microwatershed. An area of about 146 ha (32%) is covered by very gravelly (35-60%) soils and distributed in the western, northwestern, northeastern, eastern and southern part of the microwatershed (Fig. 5.4).

The most productive lands with respect to gravelliness are found to be 20 per cent are non gravelly (<15%) soils. These are most productive soils and have potential for growing both annual and perennial crops. The problem soils that are very gravelly to extremely gravelly (35-80%) covers maximum area of about 79 per cent where only short duration crops can be grown.

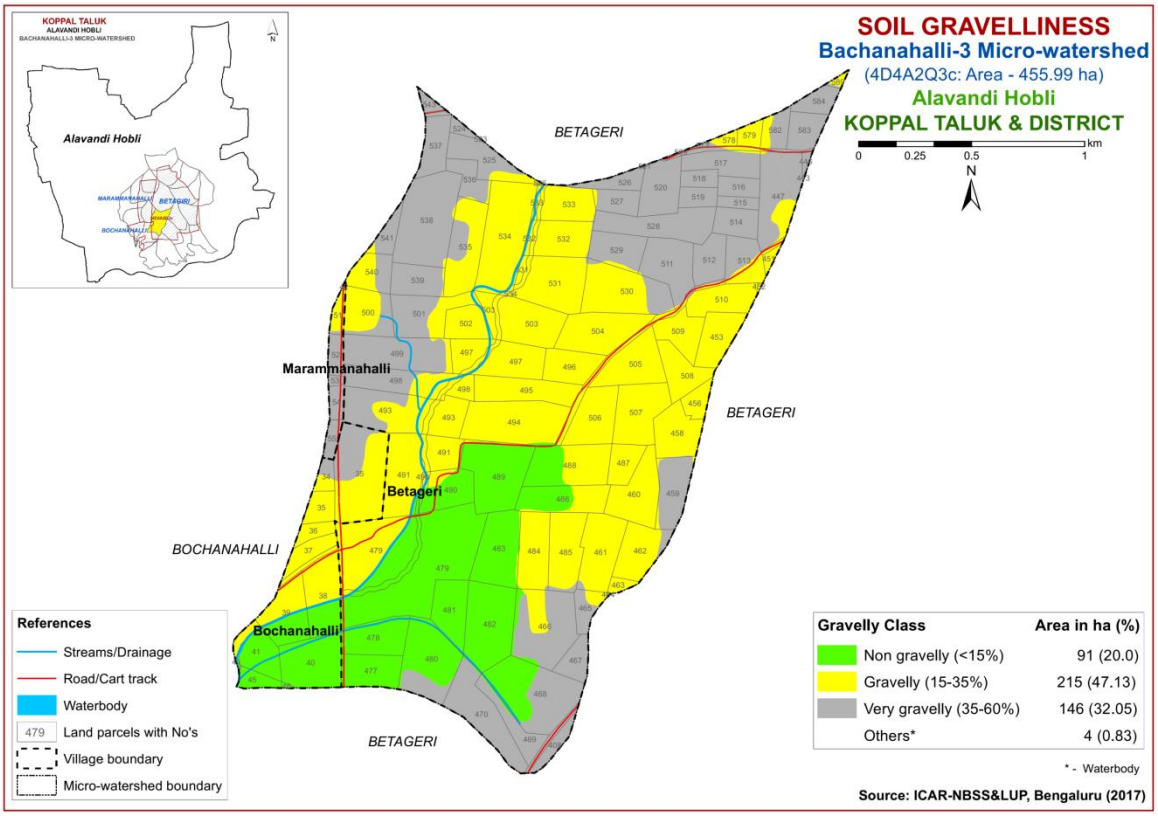


Fig. 5.4 Soil Gravelliness map of Bachanahalli-3 Microwatershed

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 shown in Fig. 5.5.

A maximum area of about 443 ha (97%) in the microwatershed has soils that are very low (<50 mm/m) in available water capacity and are distributed in the major part of the part of the microwatershed. A small area of about 9 ha (2%) has soils that are low (51 to 100 mm/m) in available water capacity and are distributed in the northeastern and western part of the microwatershed.

Entire area of about 452 ha (99%) 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.

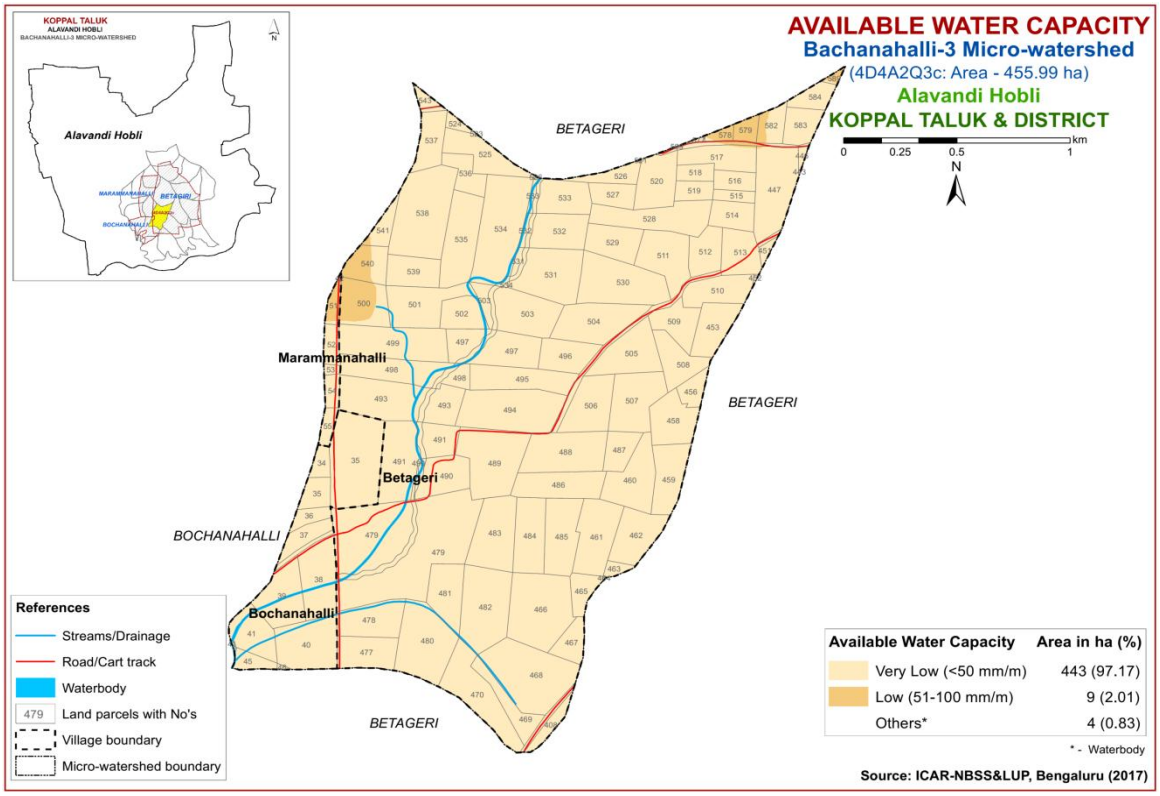


Fig. 5.5 Soil Available Water Capacity map of Bachanahalli-3 Microwatershed

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

Entire area of about 452 ha (99%) falls under very gently sloping (1-3%) lands and are distributed in the major part of the microwatershed. In all these areas, all climatically adapted annual and perennial crops can be grown without much soil and water conservation and other land development measures.

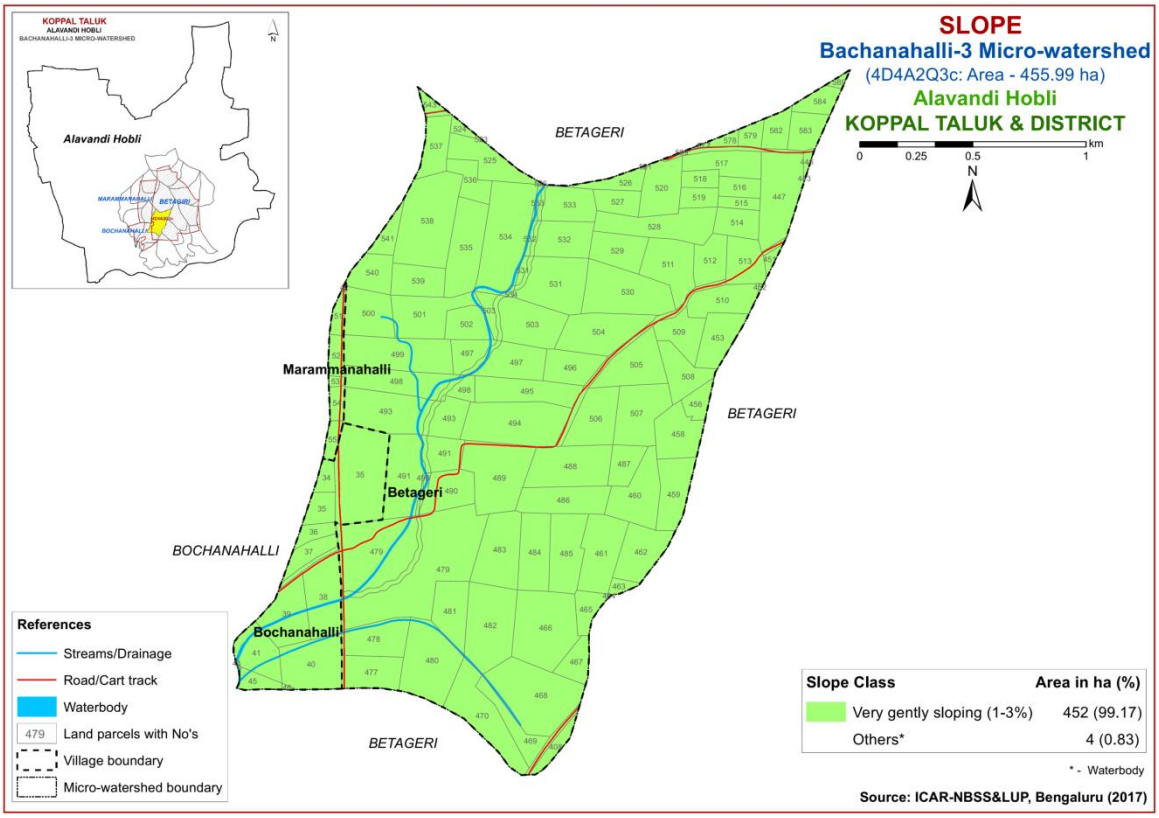


Fig. 5.6 Soil Slope map of Bachanahalli-3 Microwatershed

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.

Slightly eroded lands cover a maximum area of about 68 ha (15%) and distributed in the western and northeastern part of the microwatershed. An area of about 384 ha (84%) is moderately eroded (e2 class) and distributed in the major part of the microwatershed.

Moderately eroded lands are problematic and need appropriate soil and water conservation and other land development measures.

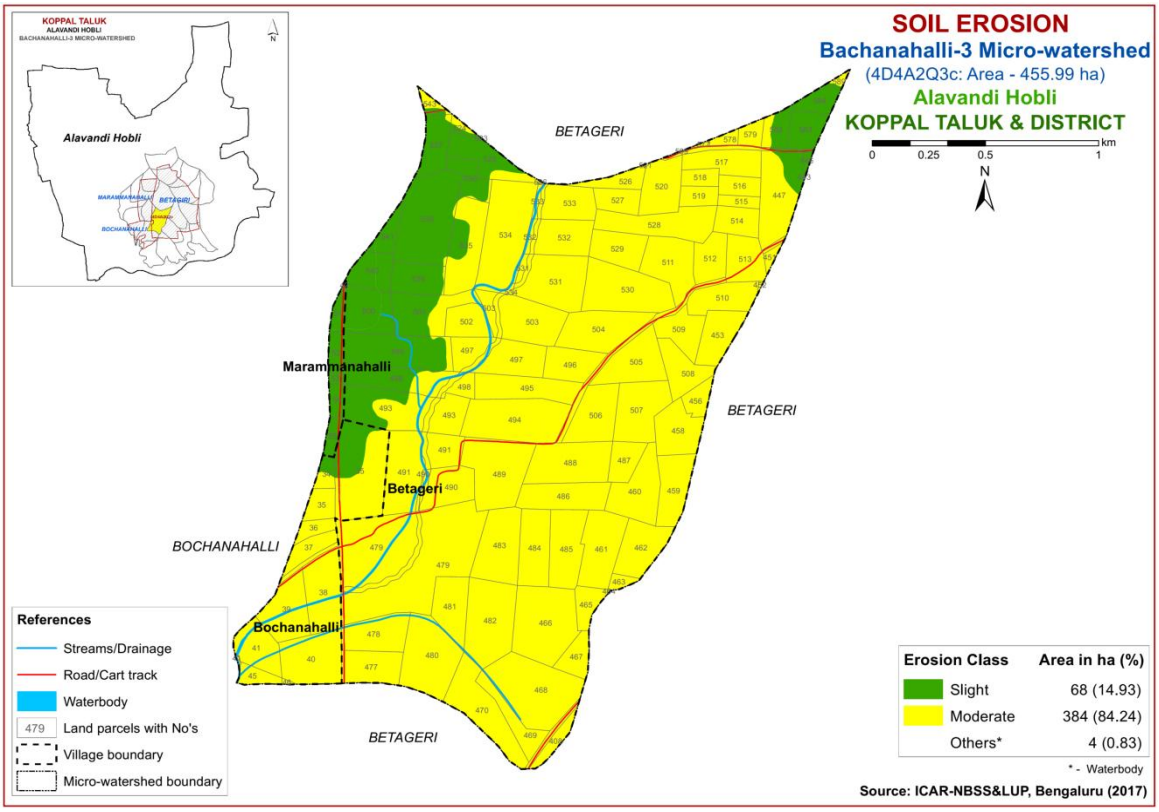


Fig. 5.7 Soil Erosion map of Bachanahalli-3 Microwatershed

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 characterized 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 320 m grid interval) all over the microwatershed through land resource inventory in the year 2017 were analyzed 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 by using the 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 Bachanahalli-3 microwatershed for soil reaction (pH) showed that slightly acidic (pH 6.0-6.5) soils cover an area of 27 ha (6 ha) and are distributed in the northeastern part of the microwatershed. Neutral soils cover an area of about 146 ha (32%) and are distributed in the eastern, northeastern and central part of the microwatershed. An area of about 98 ha (21%) is slightly alkaline (pH 7.3-7.8) and are distributed in the northern, central, northwestern, eastern and southern part of the microwatershed (Fig. 6.1). Maximum area of about 172 ha (38%) is moderately alkaline and are distributed in the major part of the microwatershed. Strongly alkaline (pH 8.4-9.0) soils cover an area of about10 ha (2%) and are distributed in the northern and western part of the microwatershed. Thus, major portion of the soils in the microwatershed are neutral to alkaline in reaction.

6.2 Electrical Conductivity (EC)

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

6.3 Organic Carbon

An area of about 135 ha (30%) is low (<0.5%) in organic carbon content and are distributed in the southern and northeastern part of the microwatershed. Maximum area of about 270 ha (59%) is medium (0.5-0.75%) and are distributed in the major part of the microwatershed. High (>0.75%) in OC cover an area of 47 ha (10%) and are distributed in the western, central and northern part of the microwatershed (Fig.6.3)

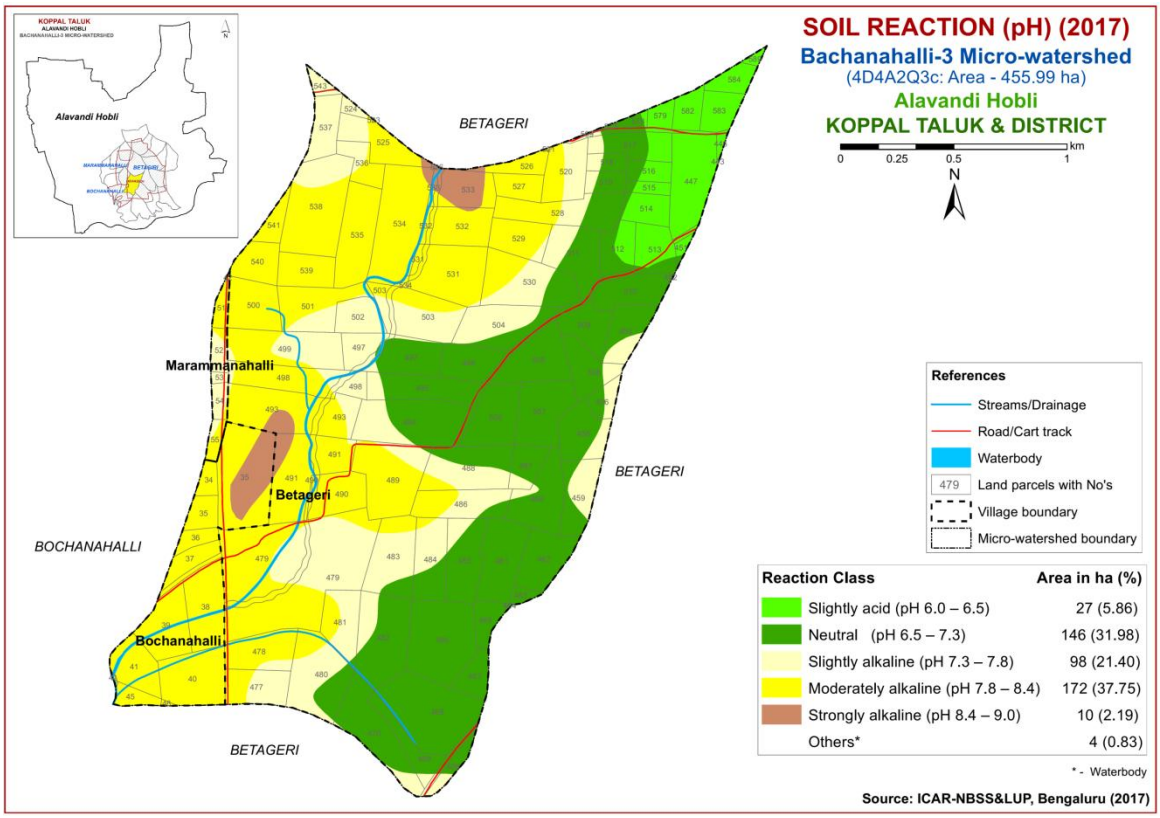


Fig.6.1 Soil Reaction (pH) map of Bachanahalli-3 Microwatershed

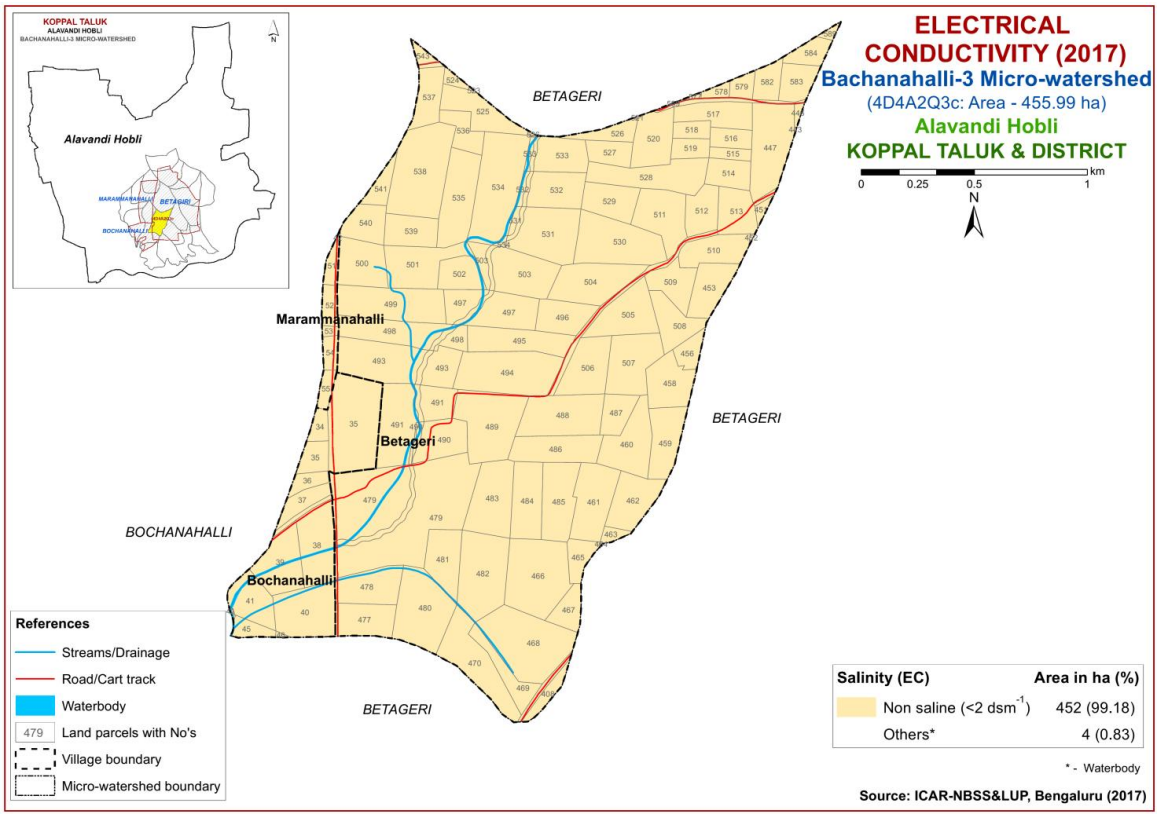


Fig.6.2 Electrical Conductivity (EC) map of Bachanahalli-3 Microwatershed

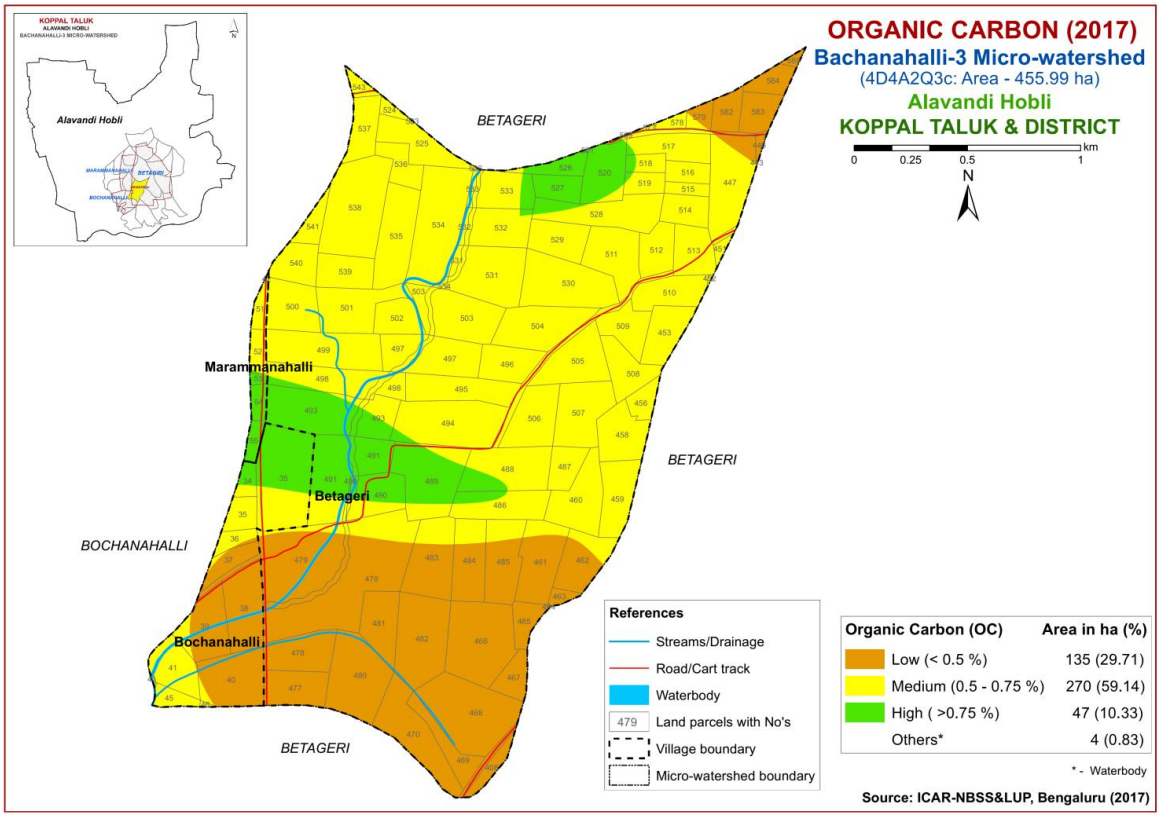


Fig.6.3 Soil Organic Carbon map of Bachanahalli-3 Microwatershed

6.4 Available Phosphorus

An area of about 33 ha (7%) is low (<23 kg/ha) in available phosphorus and are distributed in the northern and central part of the microwatershed. Available phosphorus is medium (23-57 kg/ha) in a maximum area of about 347 ha (76%) and are distributed in all parts of the microwatershed. An area of about 73 ha (16%) is high (>57 kg/ha) and are distributed in the northwestern, northeastern and eastern part of the microwatershed. The areas with high phosphorus content reduce 25 per cent from the recommended dose to avoid the excess application of fertilizer and apply additional 25% phosphorus in areas where it is low and medium (Fig 6.4).

6.5 Available Potassium

An area of about 111 ha (24%) is low (<145 kg/ha) and are distributed in the central, southern and eastern part of the microwatershed. Maximum area of about 300 ha (66%) is medium (145-337 kg/ha) in available potassium content and distributed in the major part of the microwatershed. An area of about 40 ha (9%) is high in available potassium content and distributed in the northwestern part of the microwatershed. The areas with high potassium content reduce 25 per cent from the recommended dose to avoid the excess application of fertilizer and apply additional 25% potassium in areas where it is low and medium (Fig 6.5).

6.6 Available Sulphur

Soil analysis of available sulphur content in Bachanahalli-3 microwatershed showed that an area of about 143 ha (31%) is low (<10 ppm) in available sulphur and distributed in the western, central and eastern part of the microwatershed. Maximum area of about 201 ha (44%) is medium (10-20 ppm) and distributed in the major part of the microwatershed (Fig. 6.6). An area of about 108 ha (24%) is high (>20 ppm) in available sulphur and are distributed in the northern part of the microwatershed. The areas that are low and medium in available sulphur need to be applied with magnesium sulphate or gypsum or factomphos (p) fertilizer (13% sulphur) for 2-3 years for the deficiency to be corrected.

6.7 Available Boron

Soil analysis of available boron content in Bachanahalli-3 microwatershed showed that maximum area of about 298 ha (65%) is low (<0.5 ppm) in available boron content and are distributed in the major part of the microwatershed. An area of about 154 ha (34%) is medium (0.5-1.0 ppm) in available boron content and are distributed in the northern, northeastern, northwestern, western, eastern and southern part of the microwatershed (Fig. 6.7).

6.8 Available Iron

Available iron content in the soils of the Bachanahalli-3 microwatershed is deficient (<4.5 ppm) in a maximum area of about 239 ha (52%) and are distributed in the major part of the microwatershed. An area of about 214 ha (47%) showed sufficiency (>4.5 ppm) with respect to iron content and distributed in the eastern and central 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).

6.11 Available Zinc

Available zinc content is deficient (<0.6 ppm) in an area of about 195 ha (43%) and distributed in the western, central, southern and southeastern part of the microwatershed. Maximum area of about 258 ha (56%) is sufficient (>0.6) in zinc content and distributed in the major part of the microwatershed (Fig 6.11).

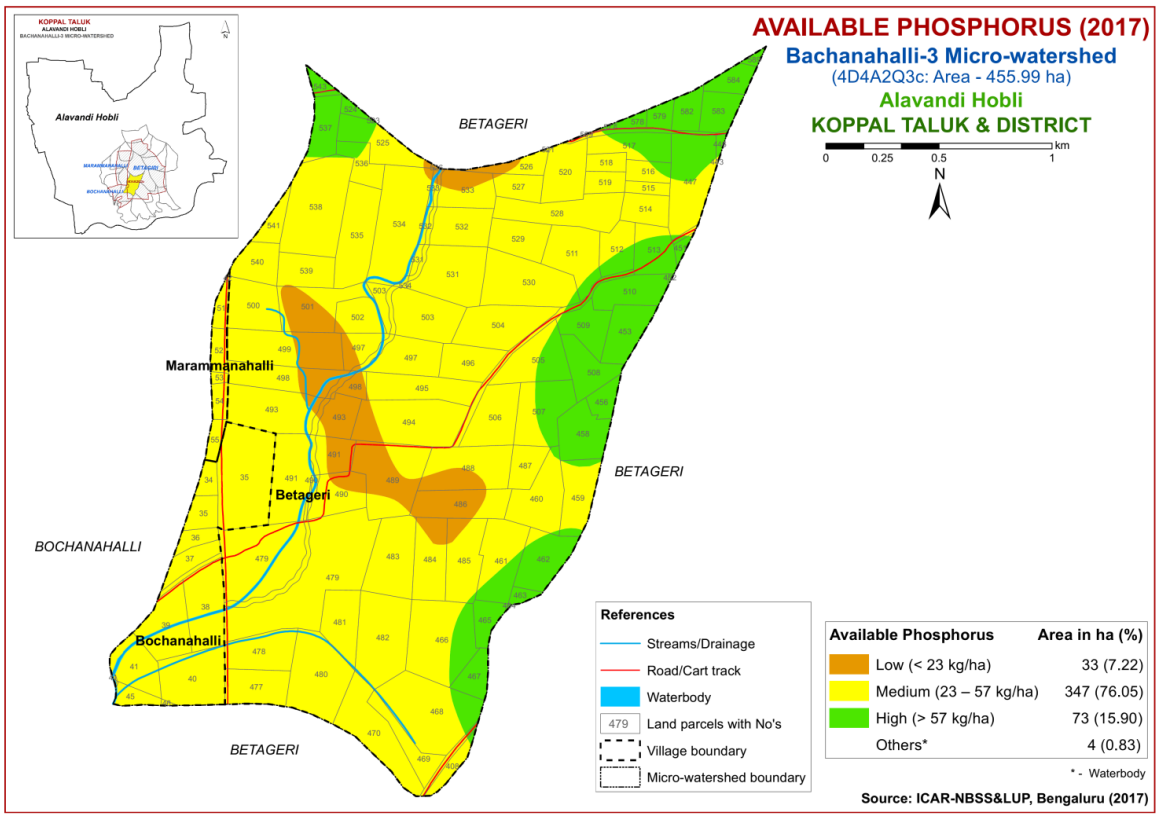


Fig.6.4 Soil Available Phosphorus map of Bachanahalli-3 Microwatershed

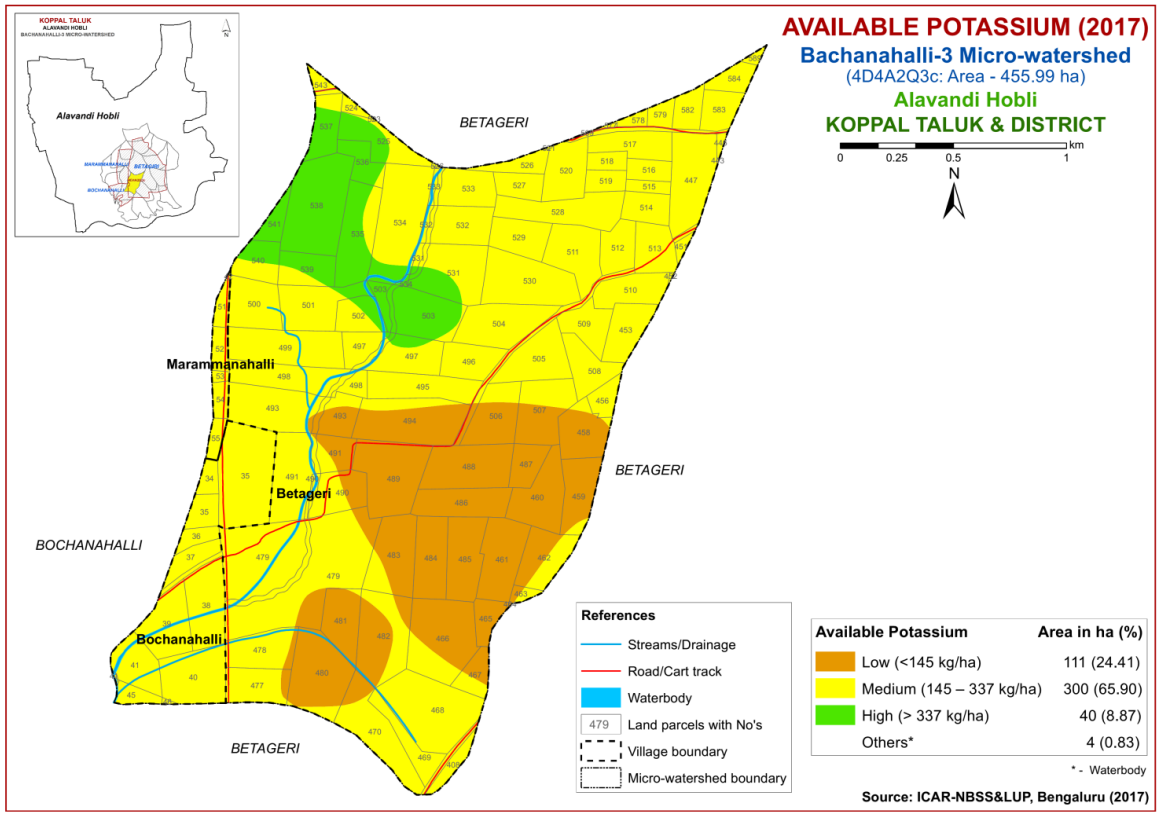


Fig. 6.5 Soil Available Potassium map of Bachanahalli-3 Microwatershed

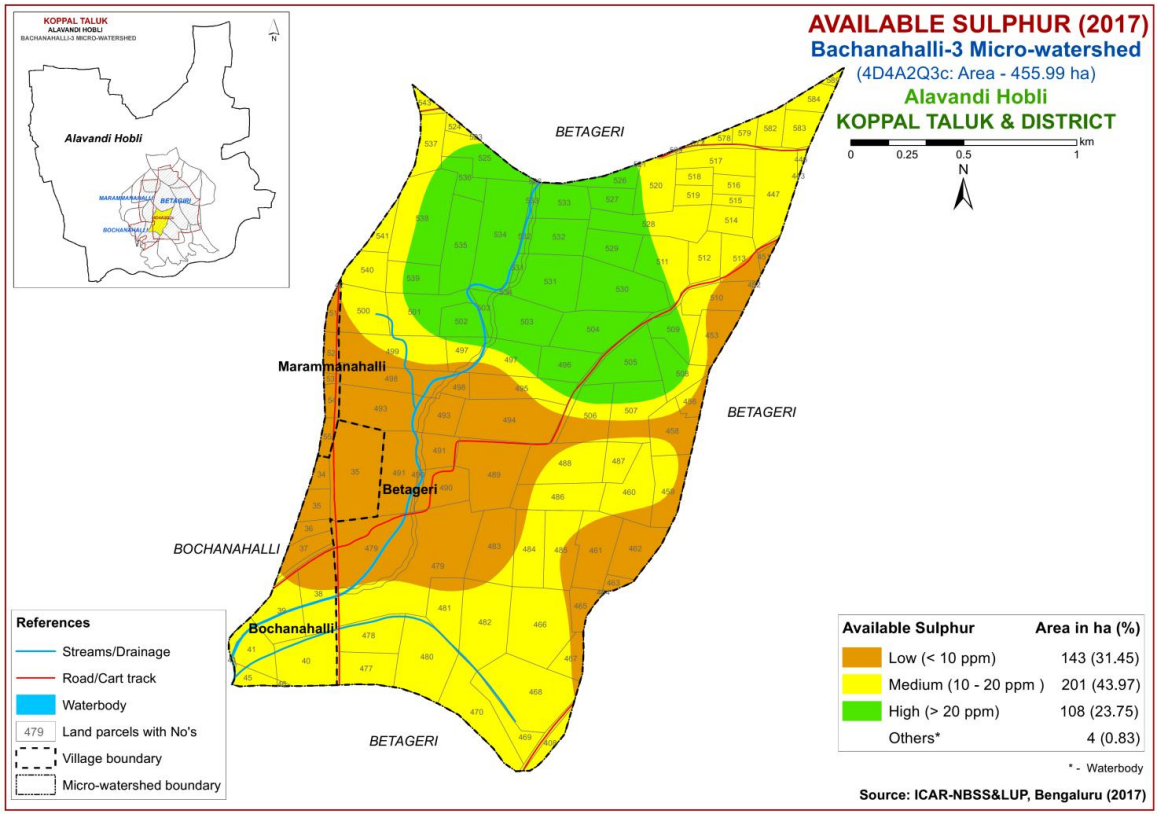


Fig.6.6 Soil Available Sulphur map of Bachanahalli-3 Microwatershed

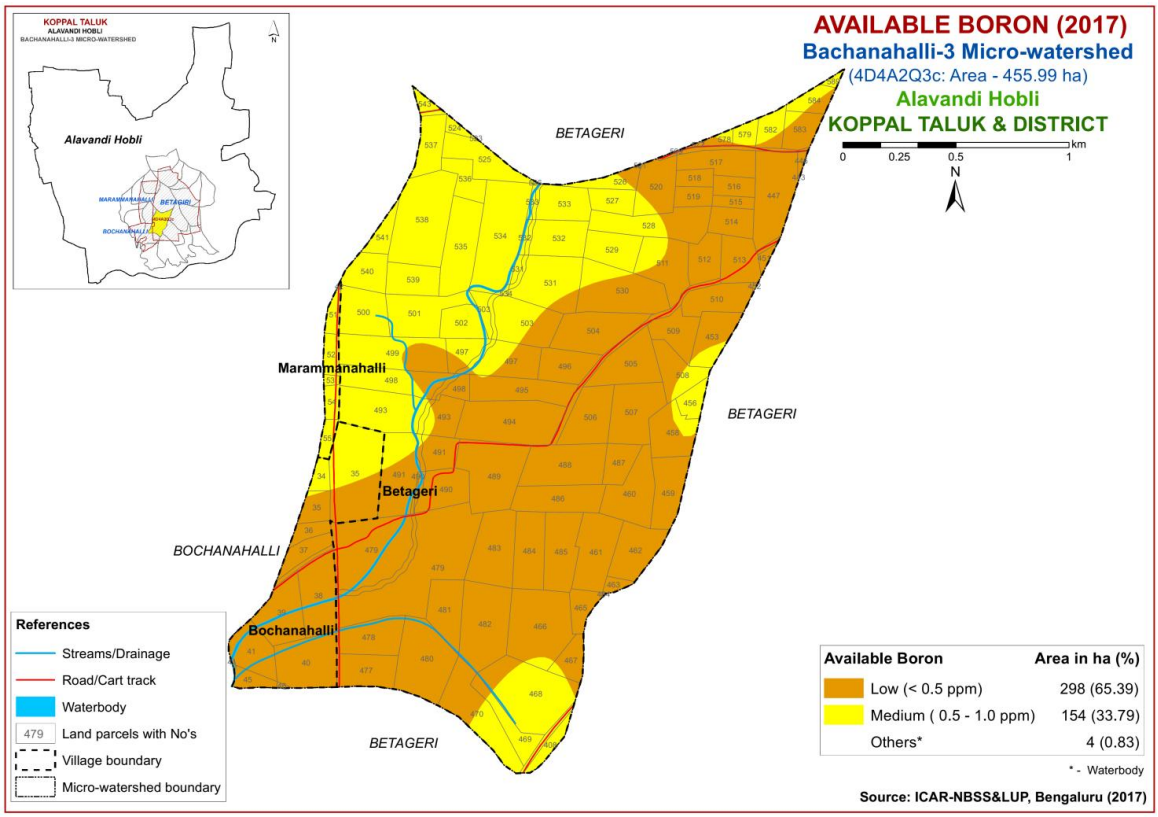


Fig.6.7 Soil Available Boron map of Bachanahalli-3 Microwatershed

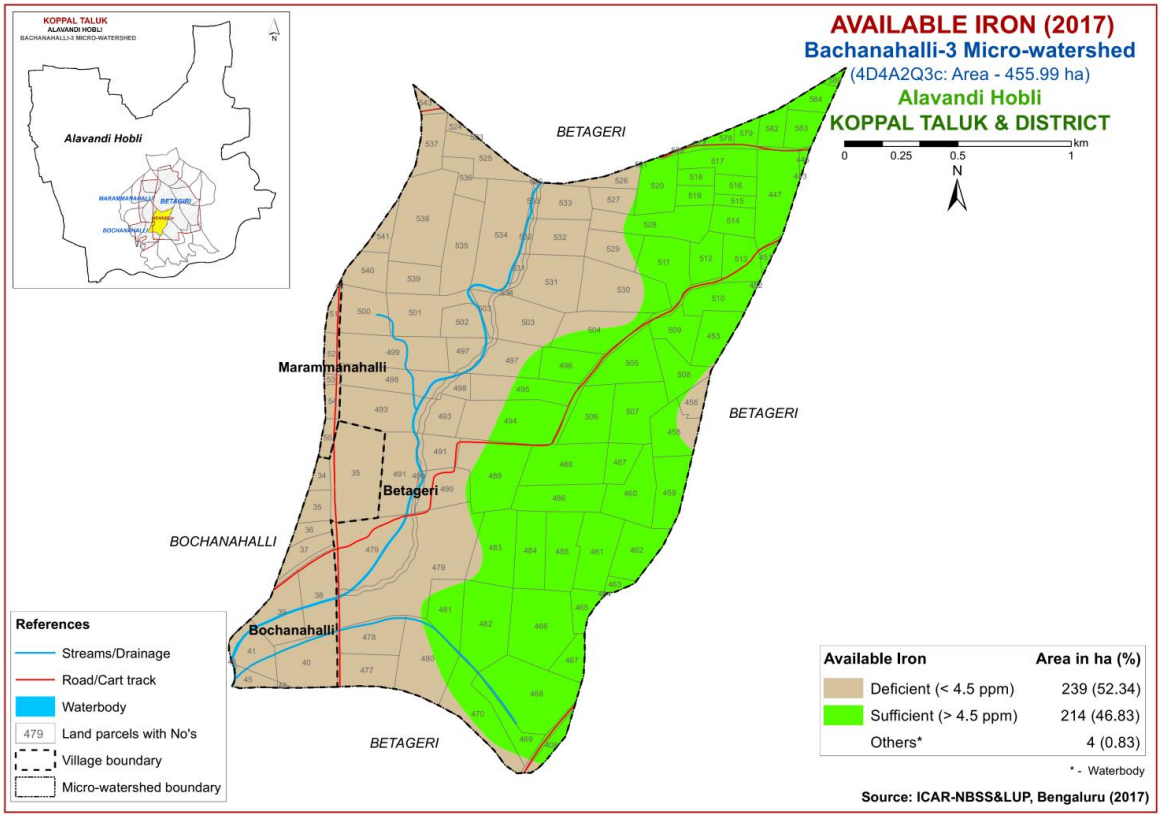


Fig.6.8 Soil Available Iron map of Bachanahalli-3 Microwatershed

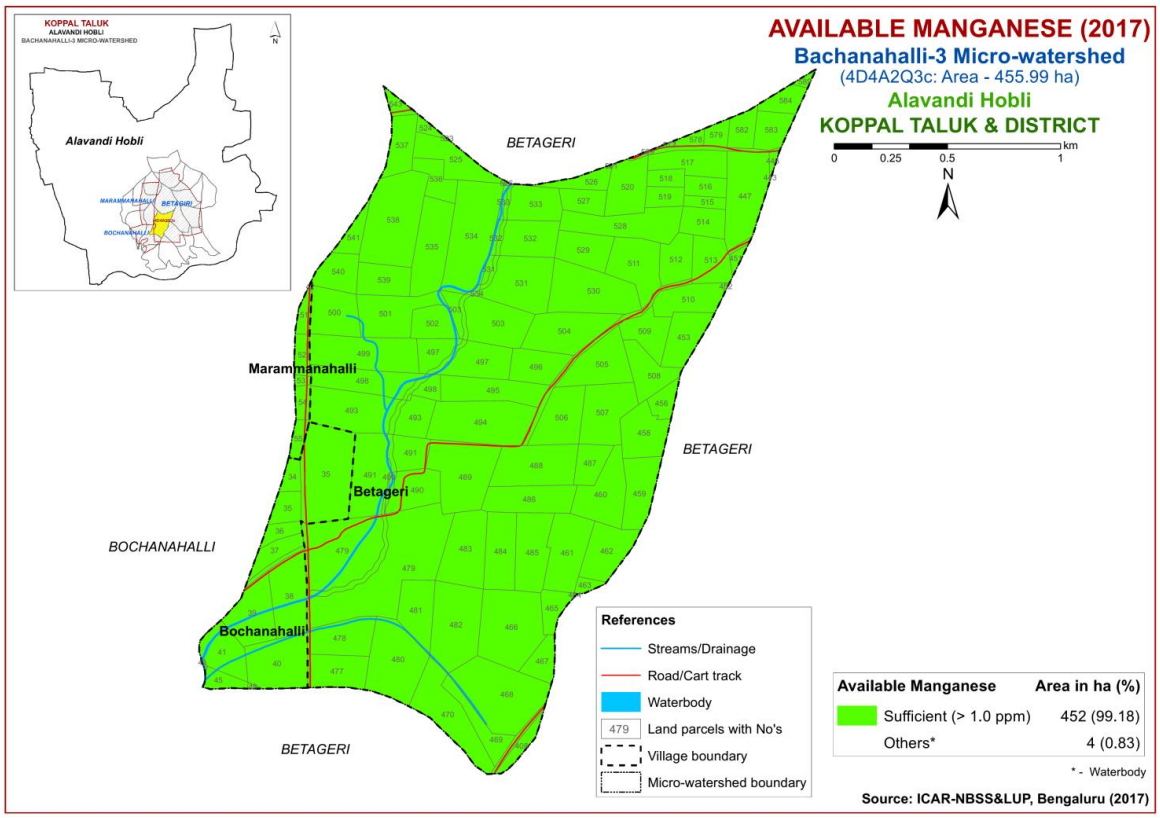


Fig.6.9 Soil Available Manganese map of Bachanahalli-3 Microwatershed

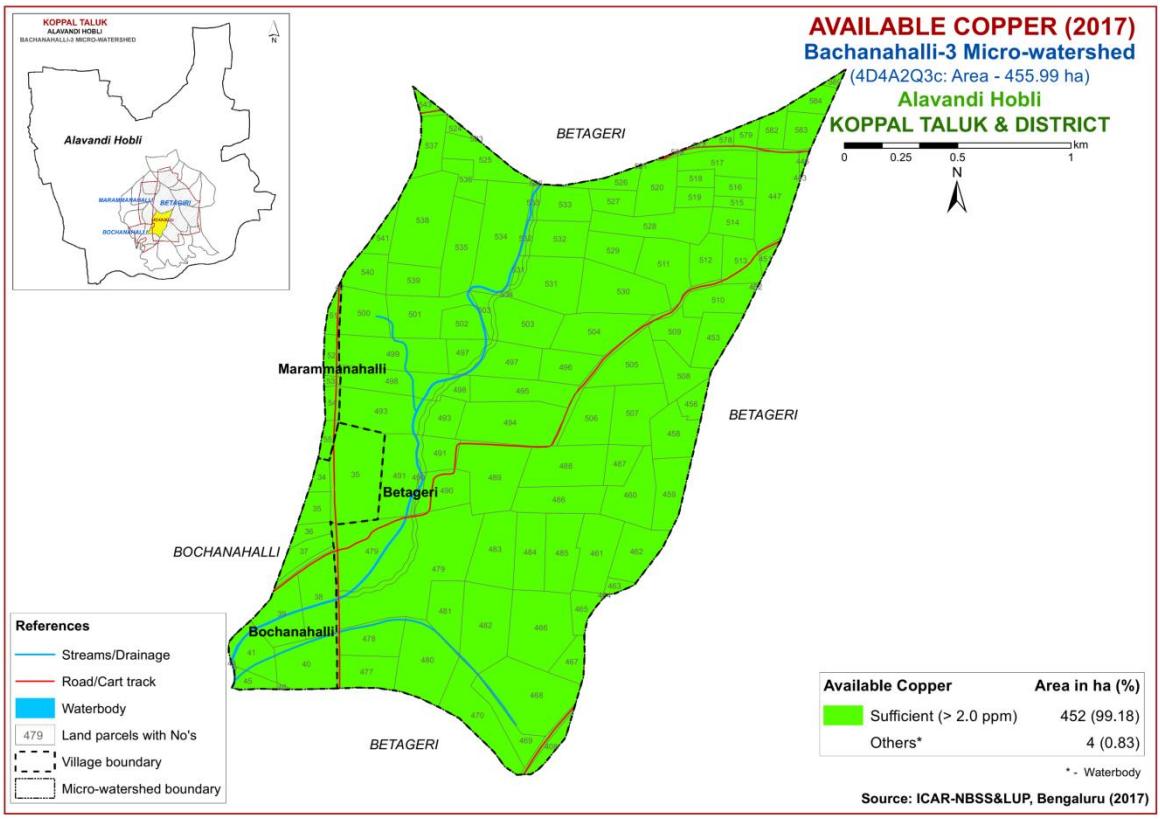


Fig.6.10 Soil Available Copper map of Bachanahalli-3 Microwatershed

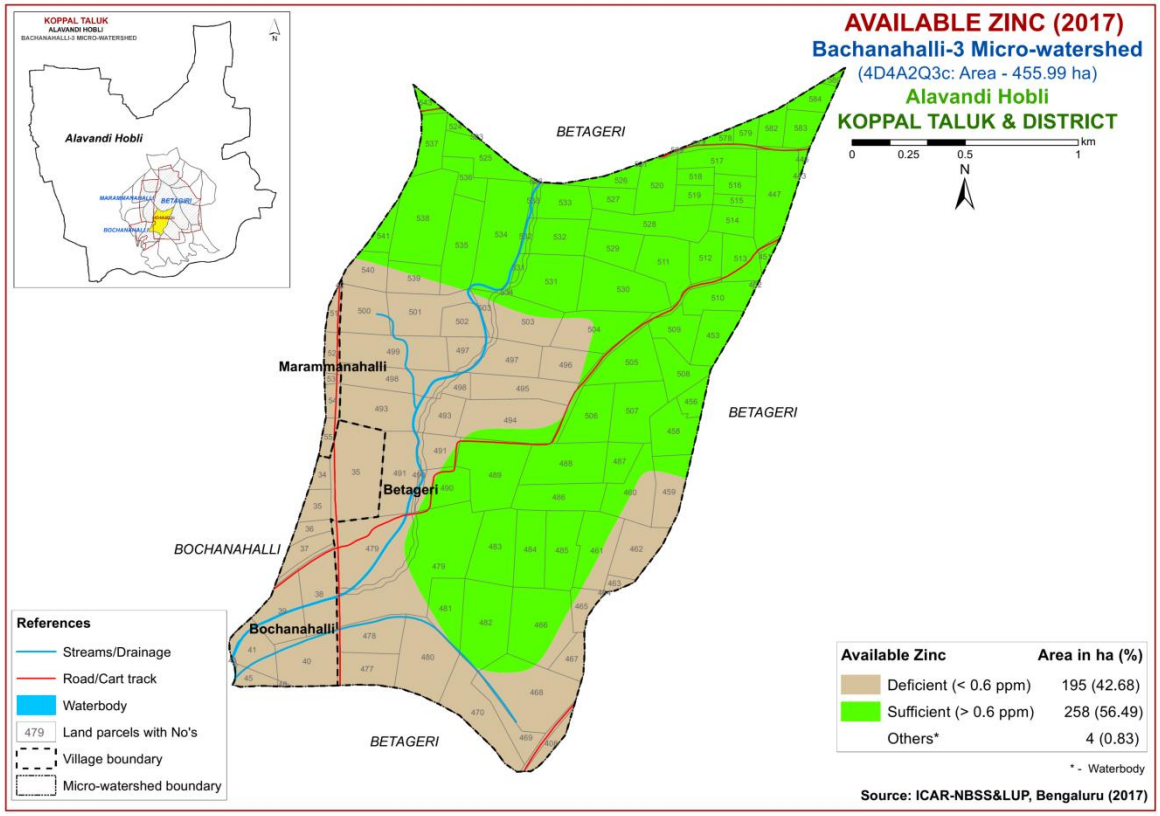


Fig.6.11 Soil Available Zinc map of Bachanahalli-3 Microwatershed

Chapter 7

LAND SUITABILITY FOR MAJOR CROPS

The soil and land resource units (soil phases) of Bachanahalli-3 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 and N1 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, 's' for sodium, 'z' for calcareousness and 'w' for drainage. These limitations are indicated as lower case letters to the class symbol. For example, moderately suitable lands with the limitations of soil depth and erosion are designated as S2re. For the microwatershed, the soil mapping units were evaluated and classified up to subclass level.

Using the above criteria, the soil map units of the microwatershed were evaluated and land suitability maps for 28 major agricultural and horticultural crops were generated. The detailed information on the kind of suitability of each of the soil phase for the crops assessed are given village/ survey number wise for the microwatershed in Appendix-III.

7.1 Land Suitability for Sorghum (*Sorghum bicolor*)

Sorghum is one of the major crops grown in Karnataka in an area of 10.47 lakh ha in Bijapur, Gulbarga, Raichur, Bidar, Belgaum, Dharwad, Bellary, Chitradurga, Mysore and Chamarajnagar districts. The crop requirements for growing sorghum (Table 7.2) were matched with the soil-site characteristics (Table 7.1) of the soils of the microwatershed and 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.

There are no highly suitable (Class S1) lands for growing sorghum in the microwatershed. An area of about 8 ha (2%) is moderately suitable (Class S2) for growing sorghum and are distributed in the northeastern and eastern part of the microwatershed with minor limitations of calcareousness, texture, gravelliness and rooting condition. Maximum area of about 414 ha (91%) is marginally suitable (Class S3)

for growing sorghum and are distributed in the major part of the microwatershed. They have moderate limitations of gravelliness and rooting condition. Area currently not suitable (Class N1) for growing sorghum cover about 30 ha (7%) and are distributed in the northern, central and eastern part of the microwatershed with severe limitations of rooting condition and gravelliness.

Table 7.2 Crop suitability criteria for Sorghum

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

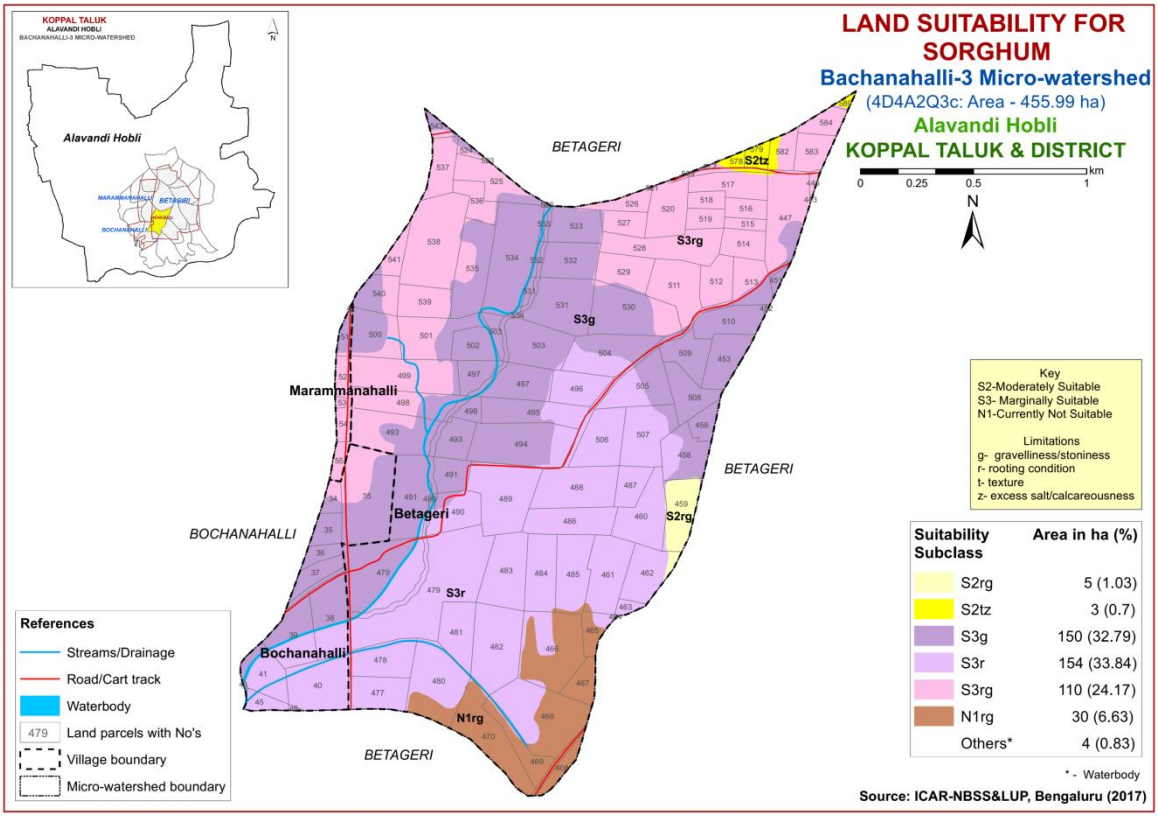


Fig. 7.1 Land Suitability map of Sorghum

Table 7.1 Soil-Site Characteristics of Bachanahalli-3 Microwatershed

Soil Map Units	Climate (P) (mm)	Growing period (Days)	Drainage Class	Soil depth (cm)	Soil texture		Gravelliness		AWC (mm/m)	Slope (%)	Erosion	pH	EC (dSm^{-1})	ESP	CEC [Cmol p^{+})kg^{-1}]	BS (%)
					Surf-ace	Sub-surface	Sur-face	Sub-surface								
BGThB2g2	662	<90	WD	<25	scl	gc	35-60	>35	50-100	1-3	moderate	8.40	0.16	1.11	44.84	-
HRVhB1g2	662	<90	WD	25-50	scl	gscl	35-60	>35	<50	1-3	slight	-	-	-	-	-
HRVhB2g2	662	<90	WD	25-50	scl	gscl	35-60	>35	<50	1-3	moderate	-	-	-	-	-
HRViB1g2	662	<90	WD	25-50	sc	gscl	35-60	>35	<50	1-3	slight	-	-	-	-	-
CSRiB2	662	<90	WD	25-50	sc	scl	<15	<15	50-100	1-3	moderate	-	-	-	-	-
CSRiB2g1	662	<90	WD	25-50	sc	scl	15-35	<15	50-100	1-3	moderate	-	-	-	-	-
MKHiB2g2	662	<90	WD	50-75	sc	gscl	35-60	>35	50-100	1-3	moderate	7.38	0.09	1.49	14.84	93
TGRiB2g1	662	<90	WD	75-100	sc	gsc	15-35	15-35	50-100	1-3	moderate	-	-	-	-	-
BDGhB2g1	662	<90	WD	75-100	scl	gc	15-35	35-60	<50	1-3	moderate	6.24	0.06	0.35	3.76	53
BDGhB2g2	662	<90	WD	75-100	scl	gc	35-60	35-60	<50	1-3	moderate	6.24	0.06	0.35	3.76	53
NGPhB1g1	662	<90	WD	100-150	scl	gsc-gc	15-35	>35	50-100	1-3	slight	-	-	-	-	-

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

7.2 Land Suitability for Maize (*Zea mays*)

Maize is one of the most important food crop grown in an area of 13.37 lakh ha in almost all the districts of the State. The crop requirements for growing maize (Table 7.3) 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 are given in Figure 7.2.

There are no highly suitable (Class S1) lands for growing maize in the microwatershed. An area of about 8 ha (2%) is moderately suitable (Class S2) and are distributed in the northeastern and eastern part of the microwatershed with minor limitations of gravelliness, calcareousness and rooting condition. Marginally suitable (Class S3) lands cover a maximum area of about 414 ha (91%) and occur in the major part of the microwatershed. They have moderate limitations of gravelliness and rooting condition. Currently not suitable (Class N1) lands cover an area of about 30 ha (7%) and are distributed in the southern and southeastern part of the microwatershed with severe limitations of gravelliness and rooting condition.

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)	dSm^{-1}	<1.0	1.0-2.0	2.0-4.0	
Sodicity (ESP)	%	<10	10-15	>15	

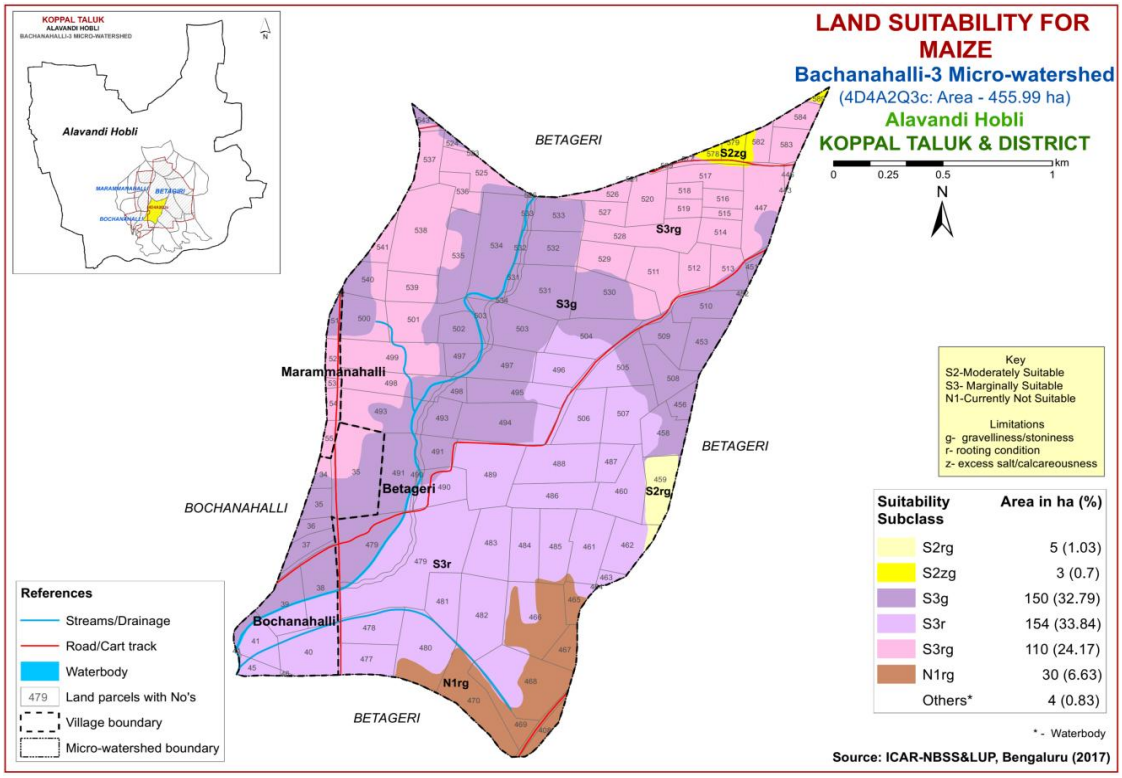


Fig. 7.2 Land Suitability map of Maize

7.3 Land Suitability for Bajra (*Pennisetum glaucum)*

Bajra is one of the major food crop grown in an area of 2.34 lakh ha in the northern districts of the Karnataka. The crop requirements (Table 7.4) for growing bajra were matched with the soil-site characteristics (Table 7.1) of the soils of the microwatershed and a land suitability map for growing bajra was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.3.

There are no highly suitable (Class S1) lands available for growing bajra in the microwatershed. An area of about 8 ha (2%) is moderately suitable (Class S2) and are distributed in the northeastern and eastern part of the microwatershed with minor limitations of calcareousness, gravelliness and rooting condition. Marginally suitable (Class S3) lands cover a maximum area of about 414 ha (91%) and occur in the major part of the microwatershed. They have moderate limitations of calcareousness, gravelliness and rooting condition. An area of about 30 ha (7%) is currently not suitable for growing bajra and are distributed in southern and southeastern part of the microwatershed with severe limitations of rooting condition and gravelliness.

Table 7.4 Crop suitability criteria for Bajra

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	5.5-8.0	5.0-5.5 7.8-8.4	8.4-9.0	>9.0
Surface soil texture	Class	c(red), sicl, sc,sl, cl	l, c (black) scl, sil, sic	sl, ls	s, fragmental skeletal
Soil depth	cm	100-75	50-75	25-50	<25
Gravel content	% vol.	15-35	35-60	60-80	-
Salinity (EC)	dSm^{-1}	2-4	4-8	8-10	>10
Sodicity (ESP)	%	5-8	8-10	10-15	>15

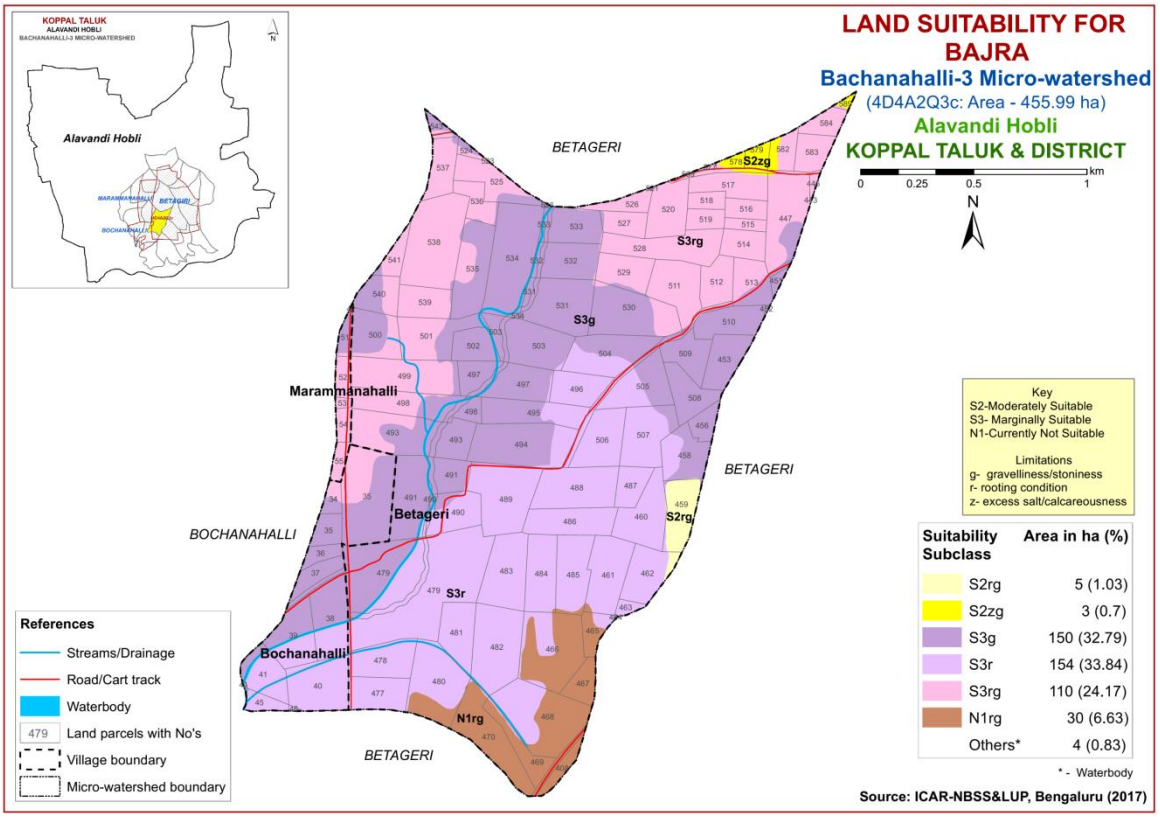


Fig. 7.3 Land Suitability map of Bajra

7.4 Land Suitability for Redgram (*Cajanus cajan*)

Redgram is one of the most important pulse crop grown in an area of 7.28 lakh ha in almost all the districts of the State. The crop requirements for growing redgram (Table 7.5) 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 7.4.

There are no highly suitable (Class S1) lands for growing red gram in the microwatershed. A small area of about 3 ha is moderately suitable (Class S2) for growing red gram and are distributed in the northeastern part of the microwatershed. They have minor limitations of rooting condition and calcareousness. Marginally suitable lands (Class S3) occupy maximum area of about 160 ha (34%) and occur in the eastern, central, northern and western part of the microwatershed. They have moderate limitations of rooting condition and gravelliness. An area currently not suitable (Class N1) for growing red gram cover about 294 ha (65%) and are distributed in the major part of the microwatershed with severe limitations of rooting condition and gravelliness.

Table 7.5 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)	dsm^{-1}	<1.0	1.0-2.0	>2.0	
Sodicity (ESP)	%	<10	10-15	>15	

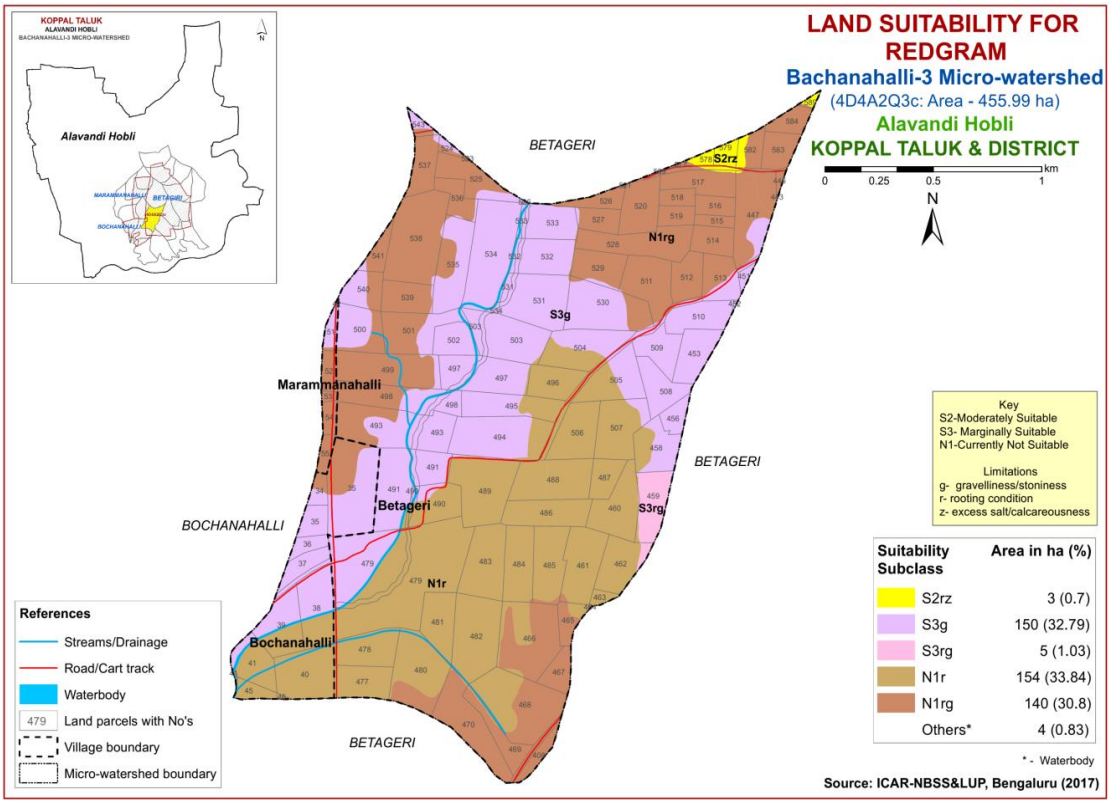


Fig. 7.4 Land Suitability map of Redgram

7.5 Land Suitability for Bengal gram (*Cicer arietinum*)

Bengal gram is one of the major pulse crop grown in an area of 9.39 lakh ha in northern Karnataka in Bijapur, Gulbarga, Raichur, Bidar, Belgaum, Dharwad and Bellary districts. The crop requirements for growing Bengal gram (Table 7.6) were matched with the soil-site characteristics (Table 7.1) of the soils of the microwatershed and a land suitability map for growing Bengal gram was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.5.

There are no highly suitable (Class S1) lands for growing Bengal gram in the microwatershed. An area of about 8 ha (2%) is moderately suitable (Class S2) and are distributed in the northeastern and eastern part of the microwatershed. They have minor limitations of texture, rooting condition and calcareousness. Marginally suitable (Class S3) lands occupy a maximum of about 414 ha (91%) and are distributed in the major part of the microwatershed with major limitations of rooting condition, texture and gravelliness. An area currently not suitable (Class N1) for growing bengal gram cover about 30 ha (7%) and are distributed in the southern and southeastern part of the microwatershed with severe limitations of rooting condition and gravelliness.

Table 7.6 Crop suitability criteria for Bengal 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	>100	90-100	70-90	<70
Soil drainage	Class	Well drained	Mod. to well drained; Imperfectly drained	Poorly drained; excessively drained	Very Poorly drained
Soil reaction	pH	6.0-7.5	5.5-5.77.6-8.0	8.1-9.0;4.5-5.4	>9.0
Surface soil texture	Class	l, scl, sil, cl,	sicl, sic, c	sl, c>60%	s, fragmental
Soil depth	cm	>75	51-75	25-50	<25
Gravel content	% vol.	<15	15-35	35-60	>60
Salinity (EC)	dSm^{-1}	<1.0	1.0-2.0	>2.0	
Sodicity (ESP)	%	<10	10-15	>15	

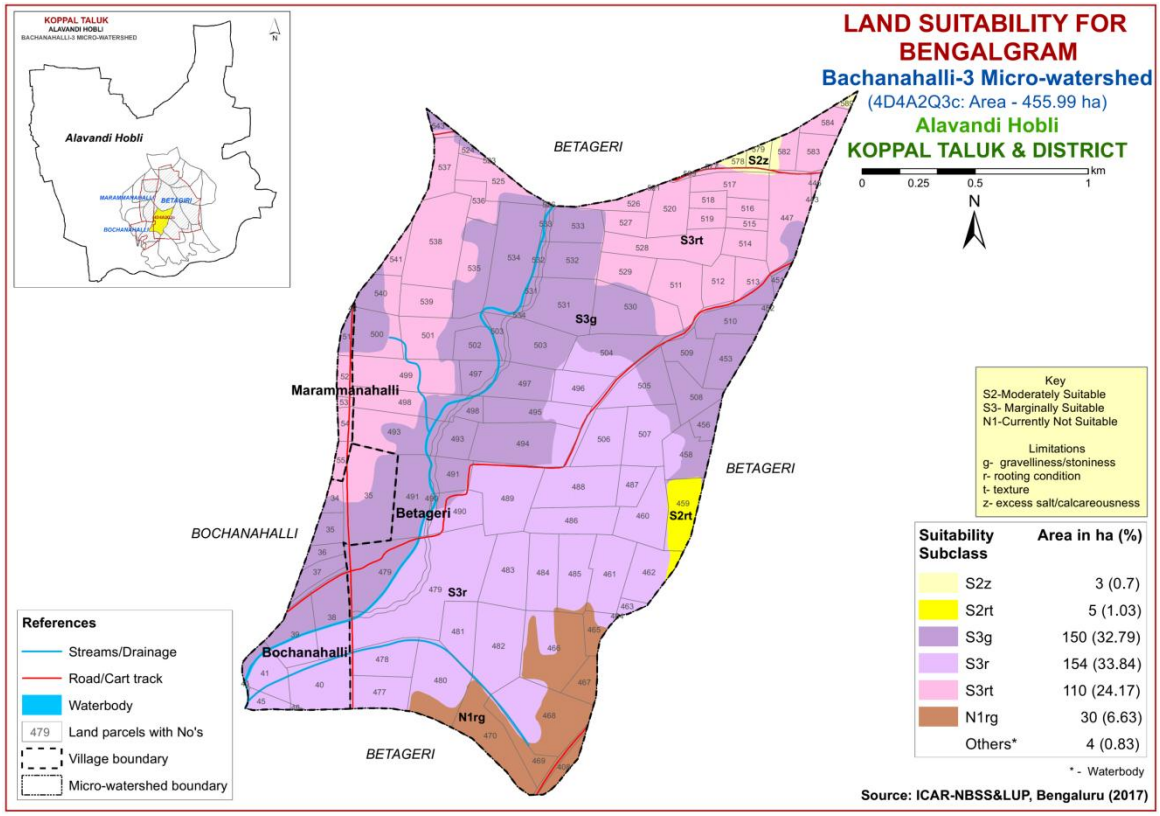


Fig. 7.5 Land Suitability map of Bengal gram

7.6 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 7.7) 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 7.6.

There are no highly suitable (Class S1) lands available for growing groundnut in the microwatershed. An area of about 14 ha (3%) is moderately suitable (Class S2) and are distributed in the northeastern, western and eastern part of the microwatershed. They have minor limitations of gravelliness, rooting condition and calcareousness. Marginally suitable (Class S3) lands occupy a maximum area of about 408 ha (90%) and are distributed in all parts of the microwatershed with moderate limitations of rooting condition and gravelliness. An area currently not suitable (Class N1) for growing groundnut cover about 30 ha (7%) and are distributed in the southern and southeastern part of the microwatershed with severe limitations of rooting condition and gravelliness.

Table 7.7 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	

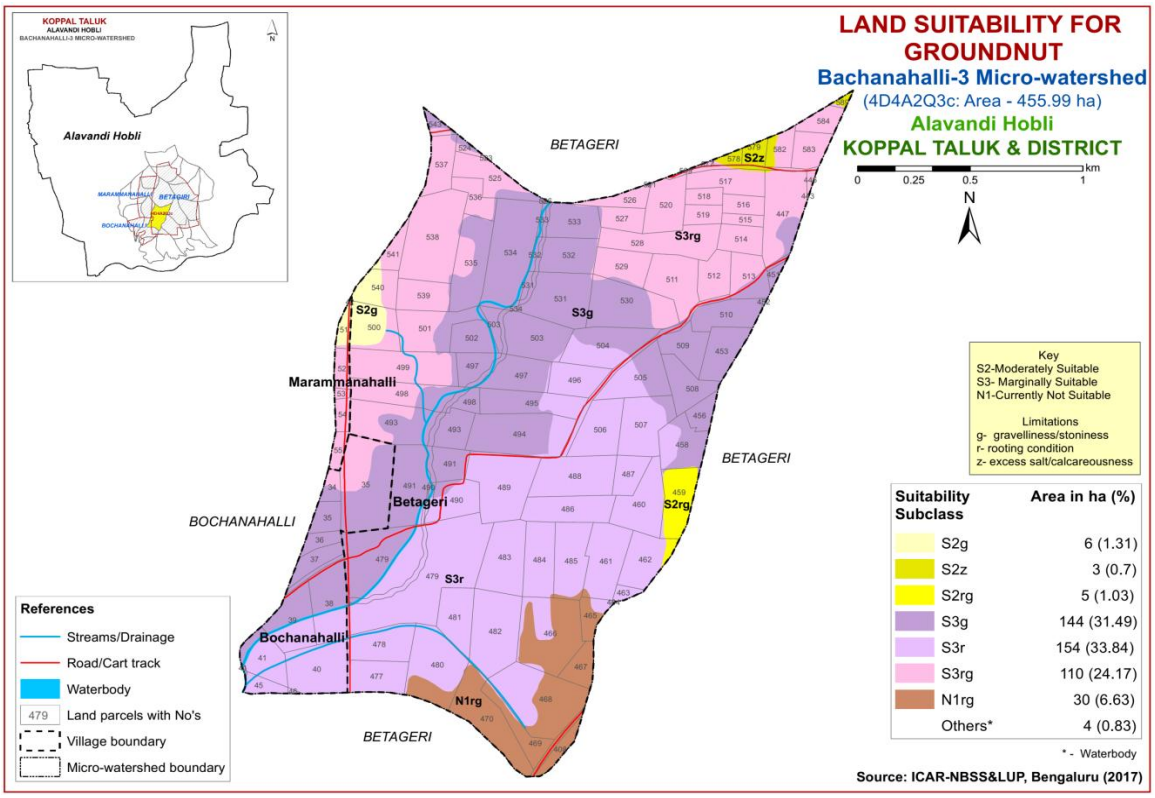


Fig. 7.6 Land Suitability map of Groundnut

7.7 Land Suitability for Sunflower (*Helianthus annus*)

Sunflower is one of the most important oilseed crop grown in an area of 3.56 lakh ha in the State in all the districts. The crop requirements for growing sunflower (Table 7.8) 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 7.7.

There are no highly suitable (Class S1) lands for growing sunflower in the microwatershed. An area of about 3 ha (<1%) is moderately suitable (Class S2) and are distributed in the northeastern part of the microwatershed. They have minor limitations of rooting condition and calcareousness. Marginally suitable (Class S3) lands occupy a maximum area of about 160 ha (34%) and are distributed in the central, western, northern, eastern and northwestern part of the microwatershed with moderate limitations of rooting condition and gravelliness. A maximum area currently not suitable (Class N1) for growing sunflower cover about 294 ha (65%) and are distributed in the major part of the microwatershed with severe limitations of rooting condition and gravelliness.

Table 7.8 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 drained	imperfectly drained	Poorly drained
Soil reaction	pH	6.5-8.0	8.1-8.5:5.5-6.4	8.6-9.0;4.5-5.4	>9.0:<4.5
Surface soil texture	Class	l, cl, sil, sc	scl, sic, c,	c (>60%), sl	ls, s
Soil depth	cm	>100	75-100	50-75	<50
Gravel content	%vol.	<15	15-35	35-60	>60
Salinity (EC)	dSm^{-1}	<1.0	1.0-2.0	>2.0	
Sodicity (ESP)	%	<10	10-15	>15	

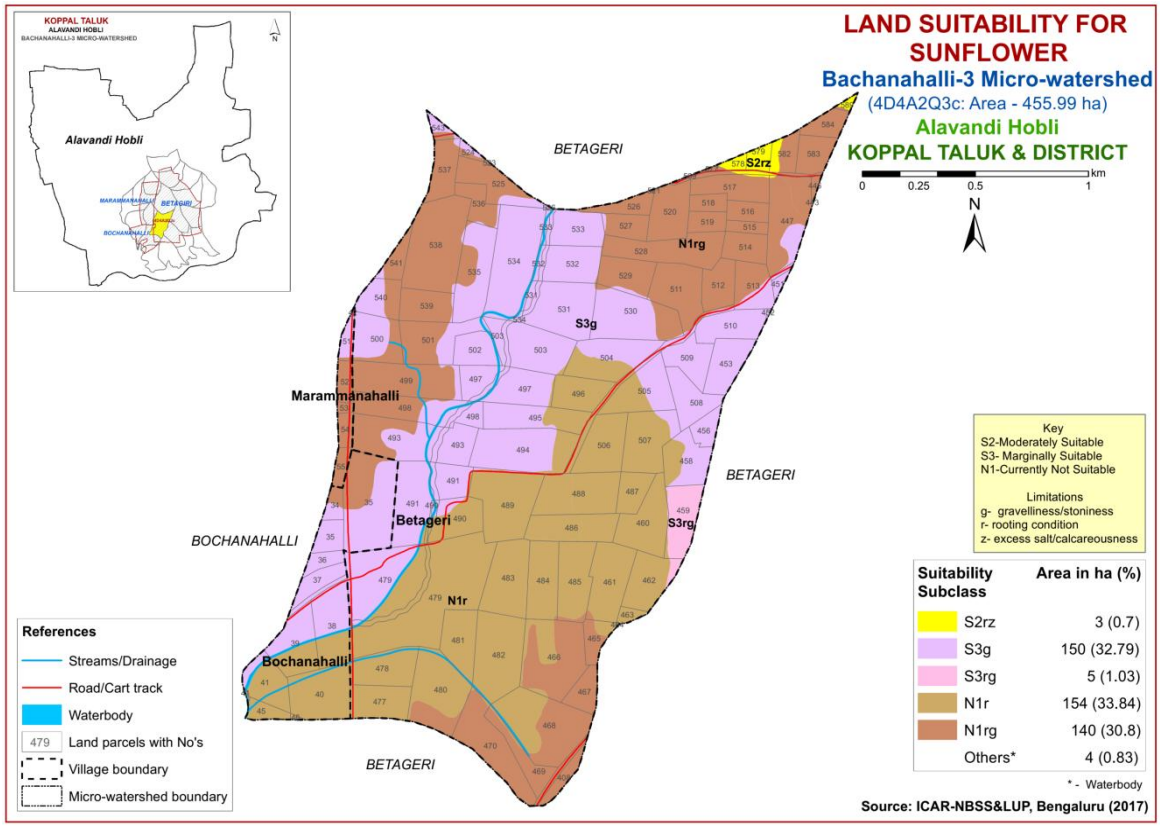


Fig. 7.7 Land Suitability map of Sunflower

7.8 Land Suitability for Cotton (*Gossypium hirsutum*)

Cotton is one of the most important fibre crop grown in the State in about 8.75 lakh ha area in Raichur, Dharwad, Belgaum, Gulbarga, Bijapur, Bidar, Bellary, Chitradurga and Chamarajnagar districts. The crop requirements for growing cotton (Table 7.9) 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 7.8.

There are no highly suitable (Class S1) lands for growing cotton in the microwatershed. An area of about 8 ha (2%) is moderately suitable (Class S2) and are distributed in the northeastern and eastern part of the microwatershed. They have minor limitations of gravelliness, rooting condition and calcareousness. Marginally suitable (Class S3) lands occupy a maximum area of about 414 ha (91%) and are distributed in all parts of the microwatershed with major limitations of rooting condition, texture and gravelliness. Area currently not suitable (Class N1) for growing cotton cover about 30 ha (7%) and are distributed in the southern and southeastern part of the microwatershed with severe limitations of rooting condition and gravelliness.

Table 7.9 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 moderately well	Imperfectly drained	Poor somewhat excessive	Stagnant/ Excessive
Soil reaction	pH	6.5-7.5	7.6-8.0	8.1-9.0	>9.0>6.5
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

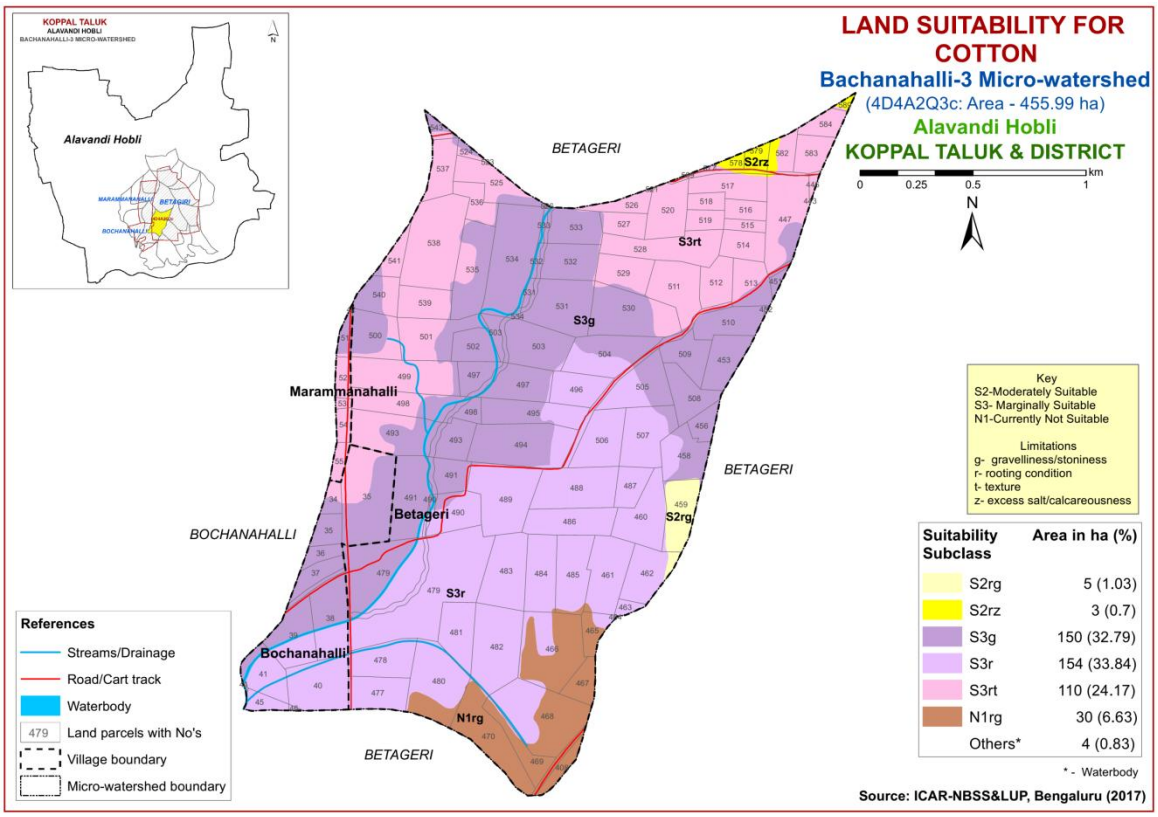


Fig. 7.8 Land Suitability map of Cotton

7.9 Land Suitability for Chilli (*Capsicum annuum L*)

Chilli is one of the major fruit and spice crop grown in an area of 0.42 lakh ha in Karnataka State. The crop requirements for growing chilli (Table 7.10) were matched with the soil-site characteristics (Table 7.1) of the soils of the microwatershed and a land suitability map for growing chilli was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.9.

There are no highly suitable (S1) lands for growing chilli in the microwatershed. Moderately (S2) suitable lands cover a small area of about 8 ha (2%) and are distributed in the eastern and northeastern part of the microwatershed with minor limitations of gravelliness, calcareousness and rooting condition. Marginally suitable (Class S3) lands cover a maximum area of about 414 ha (91%) and are distributed in the major part of the microwatershed. They have moderate limitations of gravelliness and rooting condition. Area currently not suitable (Class N1) for growing chilli cover about 30 ha (7%) and are distributed in the southern and southeastern part of the microwatershed with severe limitations of rooting condition and gravelliness.

Table 7.10 Crop suitability criteria for Chilli

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 13-15	35-40 10-12	>40 <10
Slope	%	<3	3-5	5-10	>10
LGP	Days	>150	120-150	90-120	<90
Soil drainage	Class	Well drained	Moderately drained	Imp./ poor drained/excessively	Very poorly drained
Soil reaction	pH	6.5-7.8 6.0-7.0	7.8-8.4	8.4-9.0 5.0-5.9	>9.0
Surface soil texture	Class	scl, cl, sil	sl, sc, sic,c(m/k)	c(ss), ls, s	
Soil depth	cm	>75	50-75	25-50	<25
Gravel content	% vol.	<15	15-35	35-60	>60
Salinity (ECe)	dsm^{-1}	<1.0	1.0-2.0	2.0-4.0	<4
Sodicity (ESP)	%	<5	5-10	10-15	

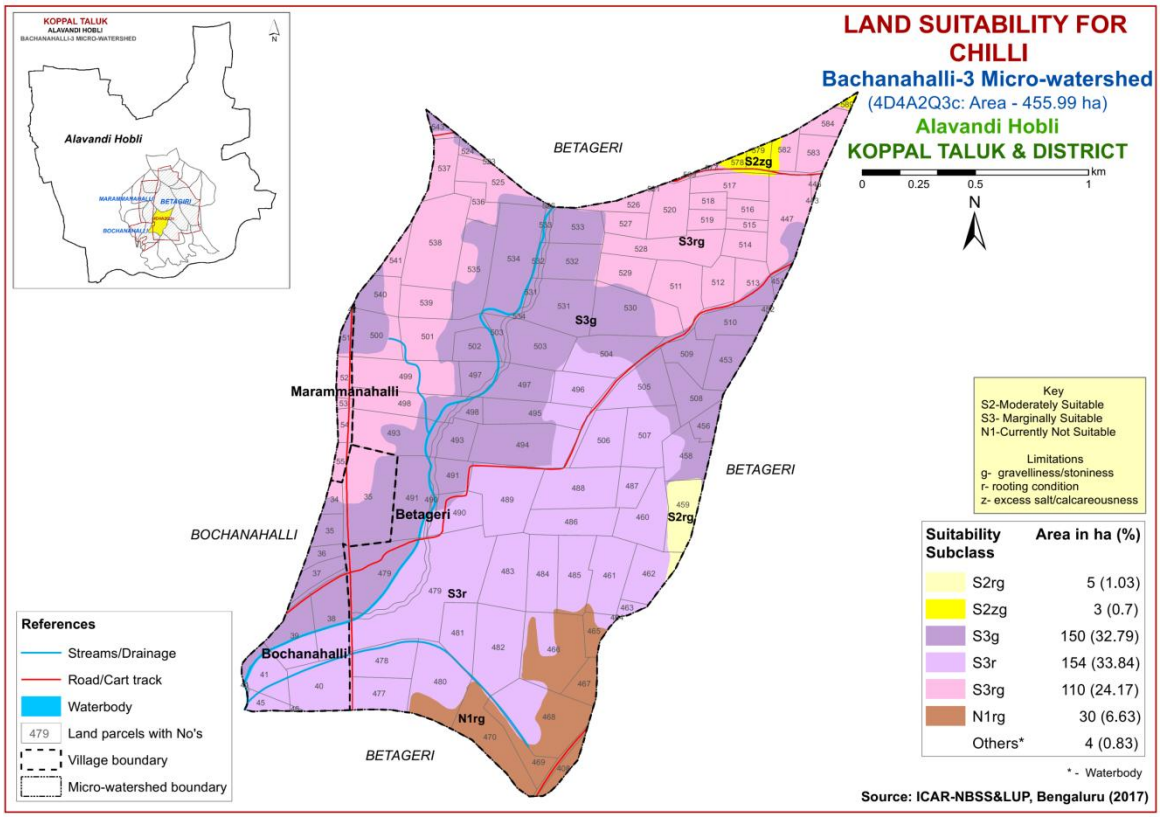


Fig. 7.9 Land Suitability map of Chilli

7.10 Land Suitability for Tomato (*Solanum lycopersicum*)

Tomato is one of the most important vegetable and fruit crop grown in an area of 0.65 lakh ha in almost all the districts of the State. The crop requirements (Table 7.11) for

growing tomato were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing tomato was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.10.

There are no highly suitable (Class S1) lands for growing tomato in the microwatershed. A small area of about 8 ha (2%) is moderately suitable (Class S2) for growing tomato and are distributed in the northeastern and eastern part of the microwatershed. They have minor limitations of rooting condition, calcareousness and gravelliness. Marginally suitable (Class S3) lands cover a maximum area of about 414 ha (91%) and are distributed in the major part of the microwatershed. They have moderate limitations of gravelliness and rooting condition. Area currently not suitable (Class N1) for growing tomato cover about 30 ha (7%) and are distributed in the southern and southeastern part of the microwatershed with severe limitations of rooting condition and gravelliness.

Table 7.11 Crop suitability criteria for Tomato

Crop requirement			**Rating**			
Soil-site characteristics		**Unit**	**Highly suitable(S1)**	**Moderately suitable(S2)**	**Marginally suitable(S3)**	**Not suitable(N)**
Climate	Temperature in growing season	^{0}C	25-28	29-32 20-24	15-19 33-36	<15 >36
Soil moisture	Growing period	Days	>150	120-150	90-120	
Soil aeration	Soil drainage	Class	Well drained	Moderately well drained	Imperfectly drained	Poorly drained
Nutrient availability	Texture	Class	l, sl, cl, scl	sic, sicl, sc, c (m/k)	c (ss)	ls, s
	pH	1:2.5	6.0-7.0	5.0-5.9:7.1-8.5	<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	slight	strongly	
	Sodicity (ESP)	%	<10	10-15	>15	-
Erosion	Slope	%	1-3	3-5	5-10	>10

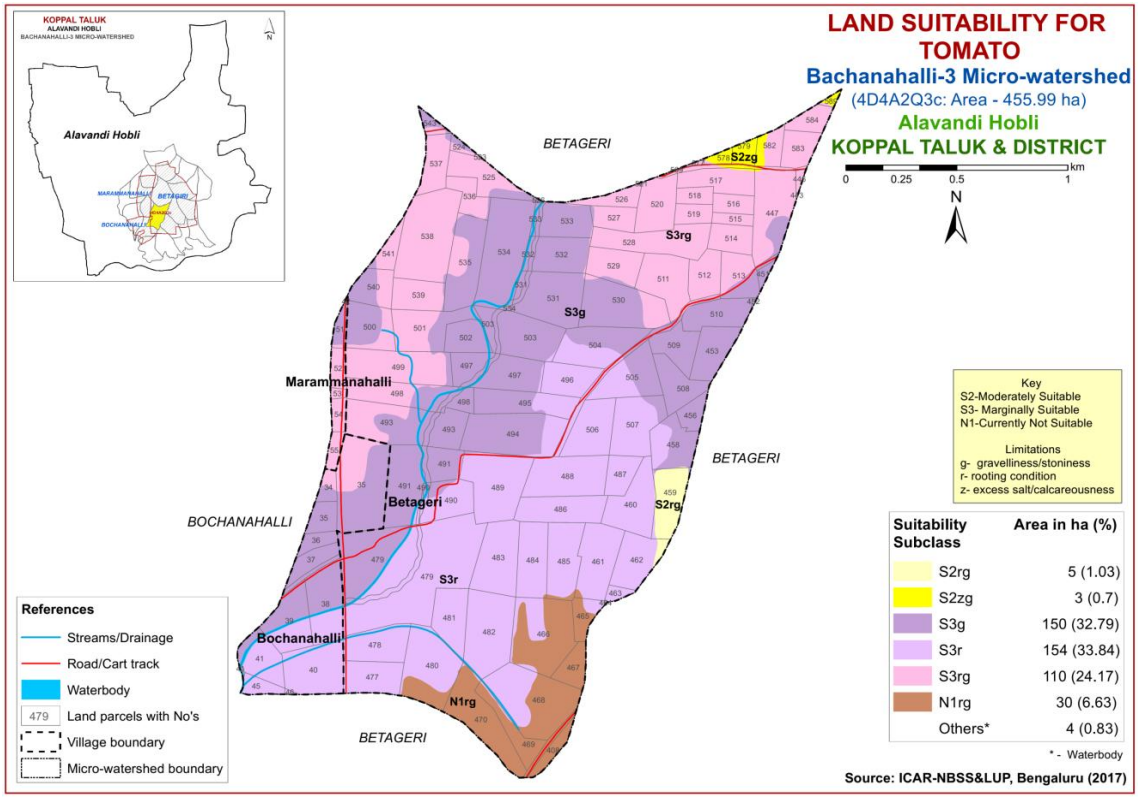


Fig. 7.10 Land Suitability map of Tomato

7.11 Land Suitability for Drumstick (*Moringa oleifera)*

Drumstick is one of the most important vegetable crop grown in 2403 ha area in the state. The crop requirements for growing drumstick (Table 7.12) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing drumstick was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.11.

No highly suitable lands are available for growing drumstick in the microwatershed. A small area of about 9 ha (2%) in the microwatershed has soils that are moderately suitable (Class S2) and are distributed in the northeastern and western part of the microwatershed. They have minor limitations of gravelliness, rooting condition and calcareousness. Marginally suitable (Class S3) lands cover an area of about 149 ha (33%) and occur in the northern, northwestern, central, eastern and western part of the microwatershed. They have moderate limitations of rooting condition and gravelliness. Maximum area of about 294 ha (65%) is currently not suitable (Class N1) and are distributed in the major part of the microwatershed with severe limitations of rooting condition and gravelliness.

Table 7.12 Land suitability criteria for Drumstick

Crop requirement			Rating			
Soil-site characteristics		**Unit**	**Highly suitable(S1)**	**Moderately suitable(S2)**	**Marginally suitable(S3)**	**Not suitable(N)**
Soil aeration	Soil drainage	Class	Well drained	Moderately well drained	Poorly drained	V. Poorly drained
Nutrient availability	Texture	Class	sc, scl, cl, c (red)	sl, c (black)	ls	s
	pH	1:2.5	5.5-6.5	5-5.5:6.5-7.3	7.8-8.4	>8.4
Rooting conditions	Soil depth	cm	>100	75-100	50-75	<50
	Gravel content	% vol.	0-35	35-60	60-80	>80
Erosion	Slope	%	0-3	3-10	-	>10

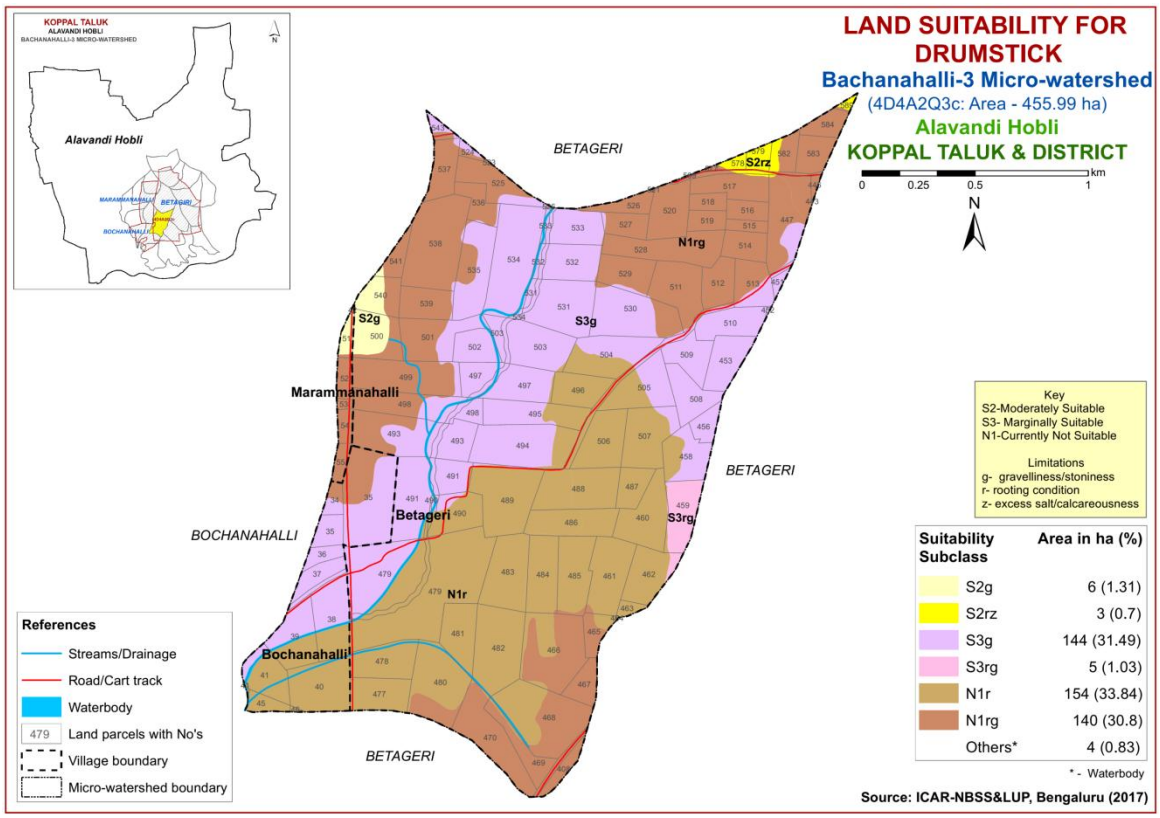


Fig. 7.11 Land Suitability map of Drumstick

7.12 Land Suitability for Mulberry (*Morus nigra*)

Mulberry is the most important leaf crop grown for rearing silkworms in about 1.66 lakh ha in all the districts of the state. The crop requirements for growing mulberry (Table 7.13) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing mulberry was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.12.

There are no highly suitable (Class S1) lands for growing mulberry in the microwatershed. An area of about 153 ha (33%) in the microwatershed has soils that are

moderately suitable (Class S2) and are distributed in the northern, northwestern, northeastern, central, western and eastern part of the microwatershed. They have minor limitations of gravelliness and calcareousness. Marginally suitable lands cover a small area of about 5 ha (1%) and occur in the eastern part of the microwatershed. They have major limitations of rooting condition and gravelliness. Maximum area of about 294 ha (65%) is currently not suitable (Class N1) for growing mulberry and are distributed in the major part of the microwatershed with severe limitations of rooting condition and gravelliness.

Table 7.13 Land suitability criteria for Mulberry

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

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

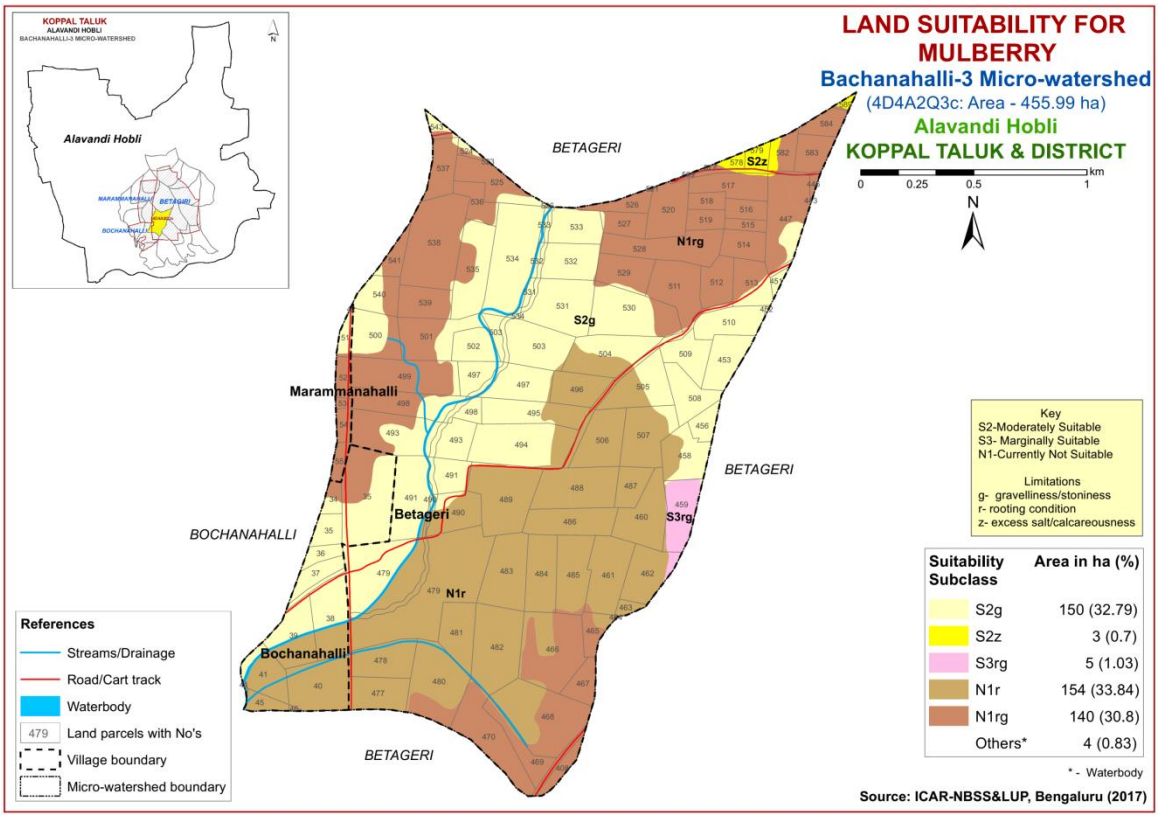


Fig. 7.12 Land Suitability map of Mulberry

7.13 Land suitability for Mango (*Mangifera indica*)

Mango is one of the most important fruit crop grown in about 1.73 lakh ha in almost all the districts of the State. The crop requirements (Table 7.14) 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 are given in Figure 7.13.

There are no highly (Class S1) and moderately suitable (Class S2) lands for growing mango in the microwatershed. Marginally suitable (Class S3) lands cover an area of about 153 ha (34%) and occur in the northern, northeastern, northwestern, western, central and eastern part of the microwatershed. They have minor limitations of rooting condition, gravelliness and calcareousness. Maximum area of about 299 ha (66%) is currently not suitable (Class N1) for growing mango and occur in the major part of the microwatershed with severe limitations of rooting condition and gravelliness.

Table 7.14 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	

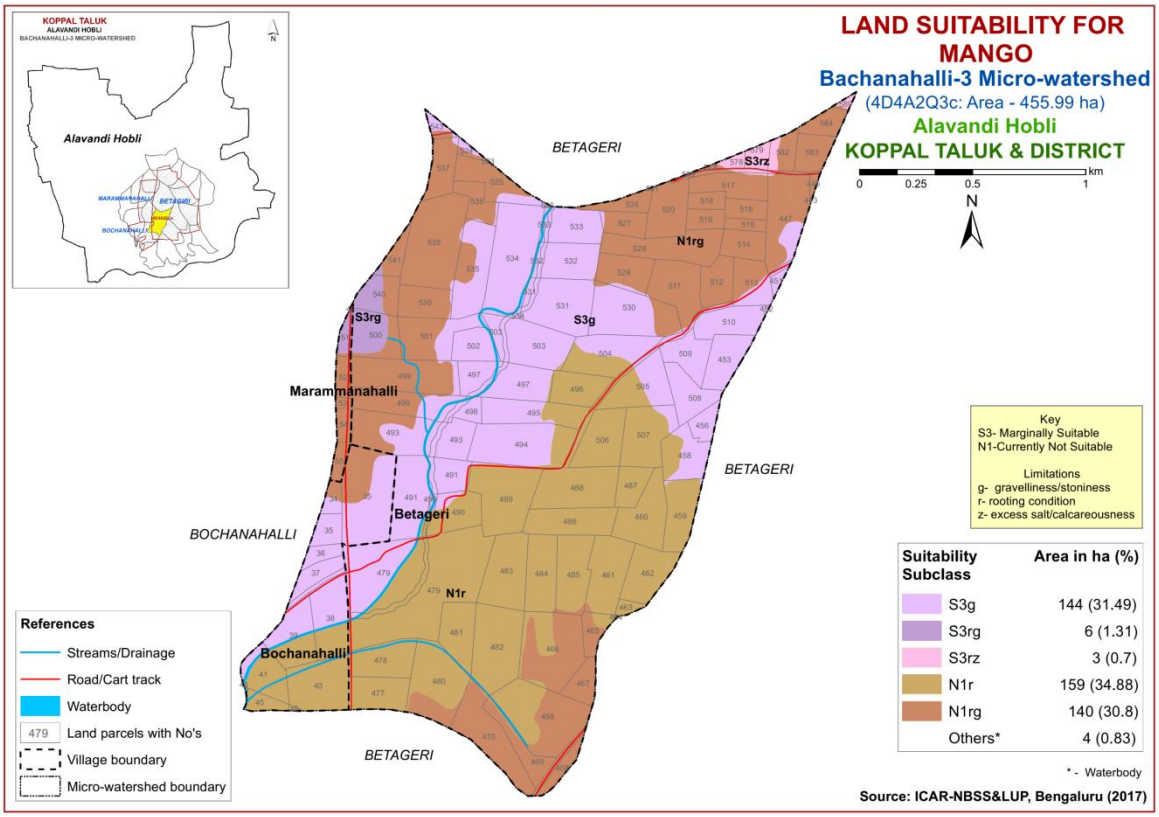


Fig. 7.13 Land Suitability map of Mango

7.14 Land suitability for Sapota (*Manilkara zapota*)

Sapota is one of the most important fruit crop grown in an area of about 29373 ha in almost all the districts of the state. The crop requirements (Table 7.15) 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 geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.14.

There are no highly suitable (Class S1) lands for growing sapota in the microwatershed. Moderately suitable (Class S2) lands occupy a minor area of about 3 ha (<1%) and are distributed in the northeastern part of the microwatershed. They have minor limitations of rooting condition and calcareousness. Marginally suitable (Class S3) lands occupy an area of about 160 ha (34%) and are distributed in the northern, northeastern, northwestern, western, central and eastern part of the microwatershed with major limitations of gravelliness and rooting condition. Maximum area of about 294 ha (65%) is currently not suitable (Class N1) for growing sapota and are distributed in the major part of the microwatershed with severe limitations of rooting condition and gravelliness.

Table 7.15 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

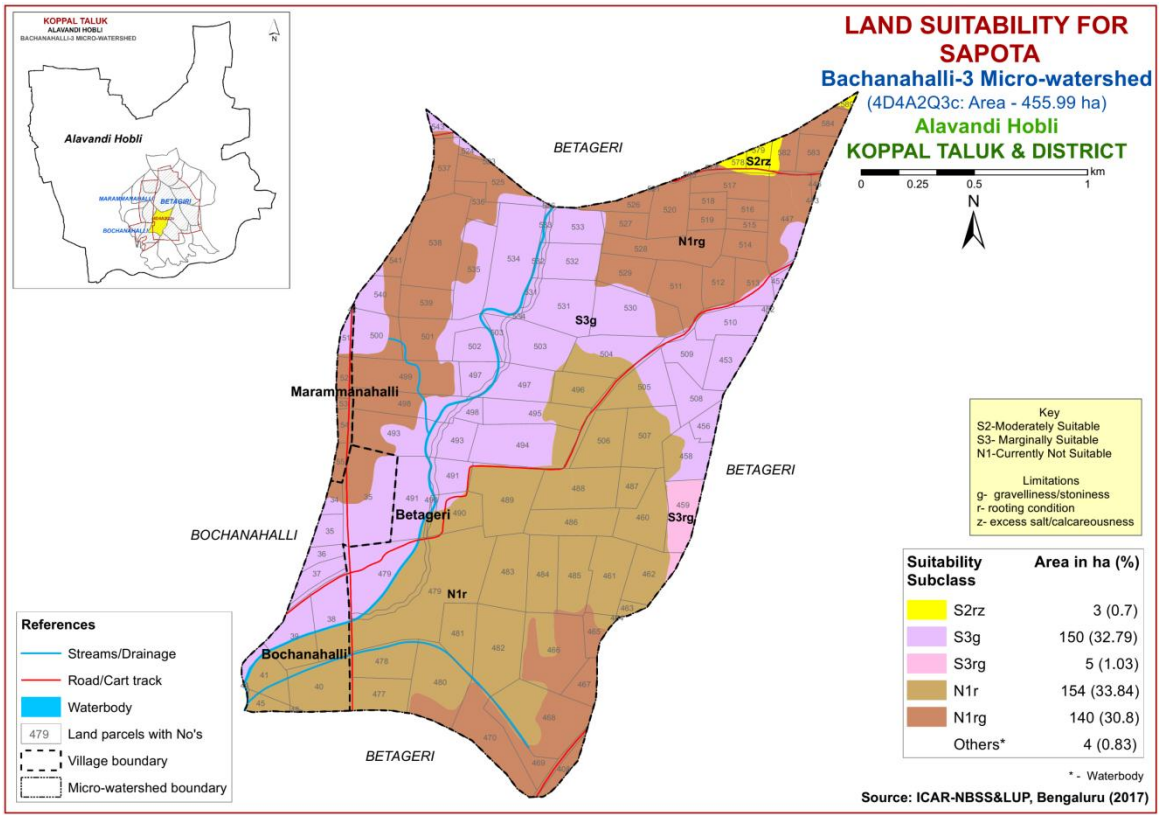


Fig. 7.14 Land Suitability map of Sapota

7.15 Land Suitability for Pomegranate (*Punica granatum*)

Pomegranate is one of the commercially grown fruit crop in about 18488 ha in Karnataka mainly in Bijapur, Bagalkot, Koppal, Gadag and Chitradurga districts. The

crop requirements for growing pomegranate (Table 7.16) were matched with the soil-site characteristics (Table 7.1) of the soils of the microwatershed and a land suitability map for growing pomegranate was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.15.

There are no highly suitable (Class S1) lands for growing pomegranate in the microwatershed. Moderately suitable (Class S2) lands occupy a minor area of about 3 ha (<1%) and are distributed in the northeastern part of the microwatershed. They have minor limitations of rooting condition and calcareousness. Marginally suitable (Class S3) lands for growing pomegranate occupy a maximum area of about 160 ha (34%) and are distributed in the northern, northwestern, northeastern, western, central and eastern part of the microwatershed with moderate limitations of gravelliness and rooting condition. Maximum area of about 294 ha (65%) is currently not suitable (Class N1) for growing pomegranate and are distributed in the major part of the microwatershed with severe limitations of rooting condition and gravelliness.

Table 7.16 Crop suitability criteria for Pomegranate

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

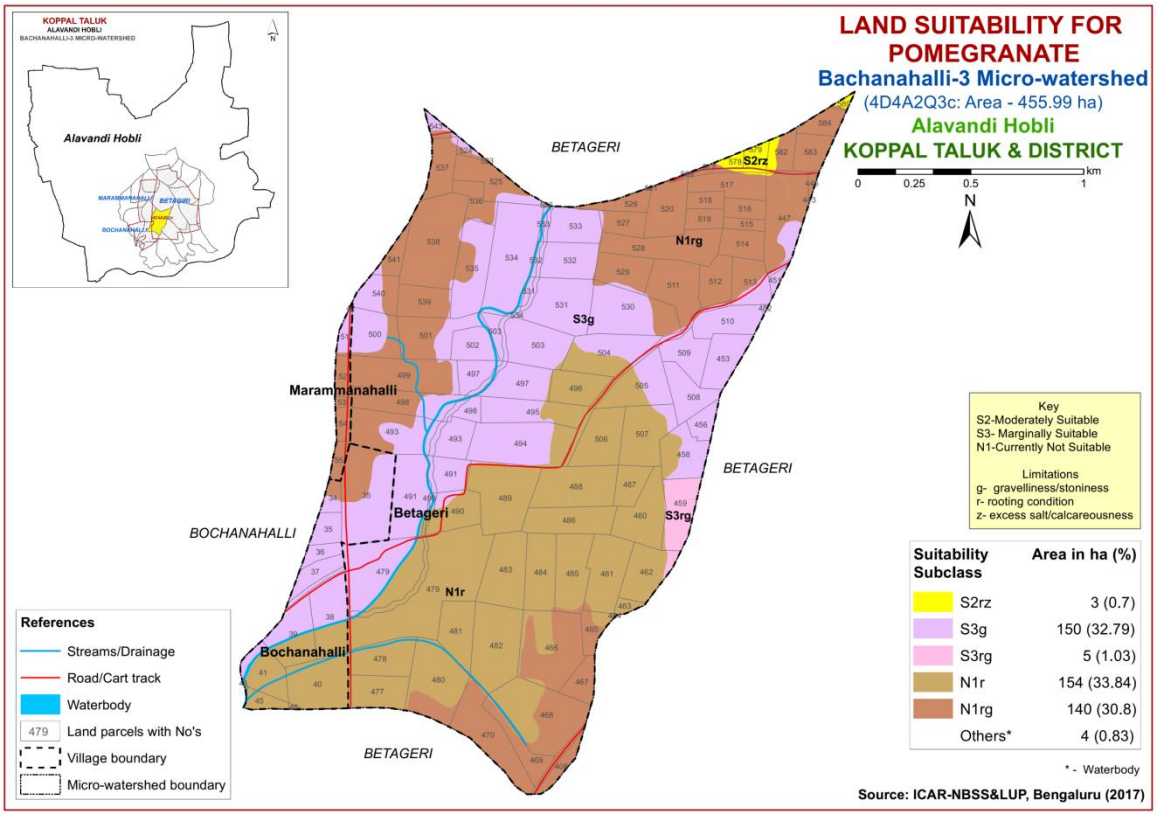


Fig. 7.15 Land Suitability map of Pomegranate

7.16 Land suitability for Guava (*Psidium guajava*)

Guava is one of the most important fruit crop grown in an area of about 6558 ha in almost all the districts of the state. The crop requirements (Table 7.17) for growing guava were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing guava was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.16.

There are no highly suitable (Class S1) lands for growing guava in the microwatershed. Moderately suitable (Class S2) lands occupy a small area of about 3 ha (<1%) and are distributed in the northeastern part of the microwatershed. They have minor limitations of rooting condition and calcareousness. Marginally suitable (Class S3) lands for growing pomegranate occupy an area of about 160 ha (34%) and are distributed in the northern, northeastern, northwestern, central, western and eastern part of the microwatershed with moderate limitations of gravelliness and rooting condition. An area of about 294 ha (65%) is currently not suitable (Class N1) for growing guava and distributed in the major part of the microwatershed with severe limitations of rooting condition and gravelliness.

Table 7.17 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

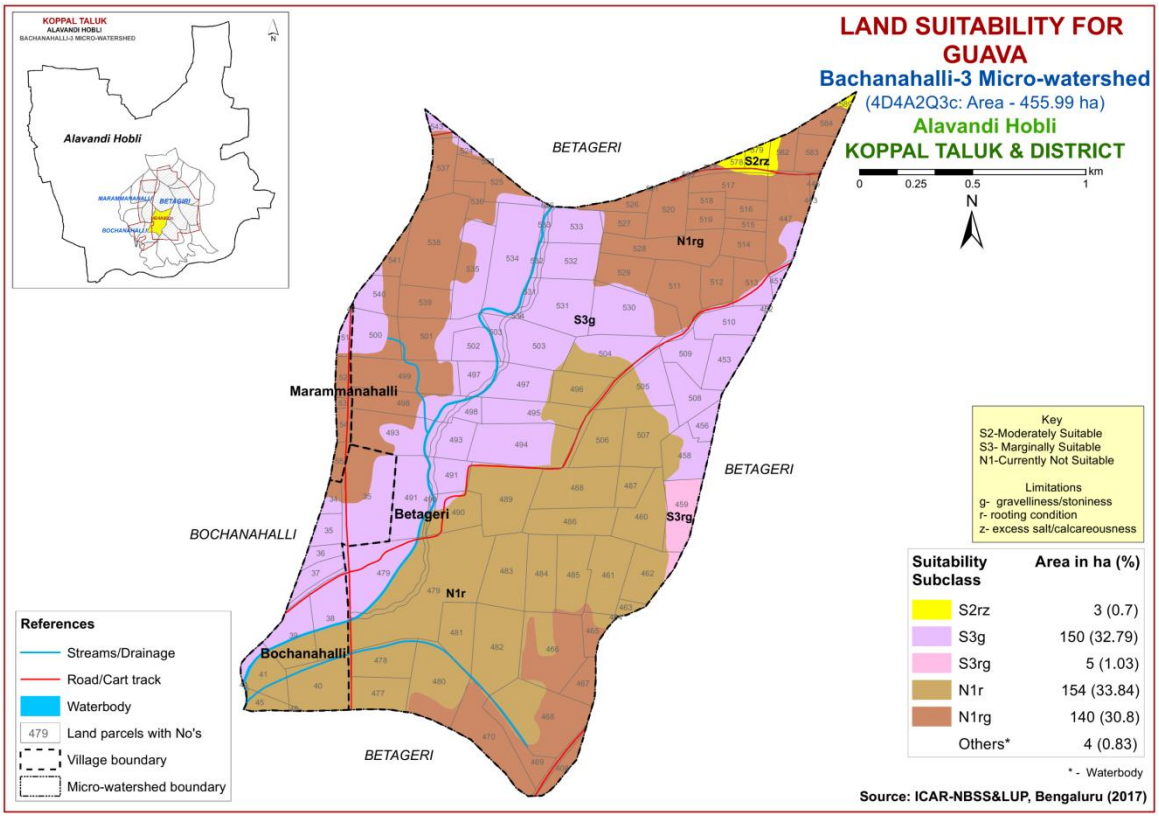


Fig. 7.16 Land Suitability map of Guava

7.17 Land Suitability for Jackfruit (*Artocarpus heterophyllus*)

Jackfruit is one of the most important fruit crop grown in 5368 ha in all the districts of the state. The crop requirements (Table.7.18) for growing jackfruit were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing jackfruit was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in figure 7.17.

There are no highly suitable (Class S1) lands for growing jackfruit in the microwatershed. Moderately suitable (Class S2) lands occupy a minor area of about 3 ha (<1%) and are distributed in the northeastern part of the microwatershed. They have minor limitations of rooting condition and calcareousness. Marginally suitable (Class S3) lands for growing jackfruit occupy an area of about 160 ha (34%) and are distributed in the northern, western, central and eastern part of the microwatershed with major limitations of gravelliness and rooting condition. An area of about 294 ha (65%) is currently not suitable (Class N1) for growing jackfruit and are distributed in the major part of the microwatershed with severe limitations of rooting condition and gravelliness.

Table 7.18 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	-

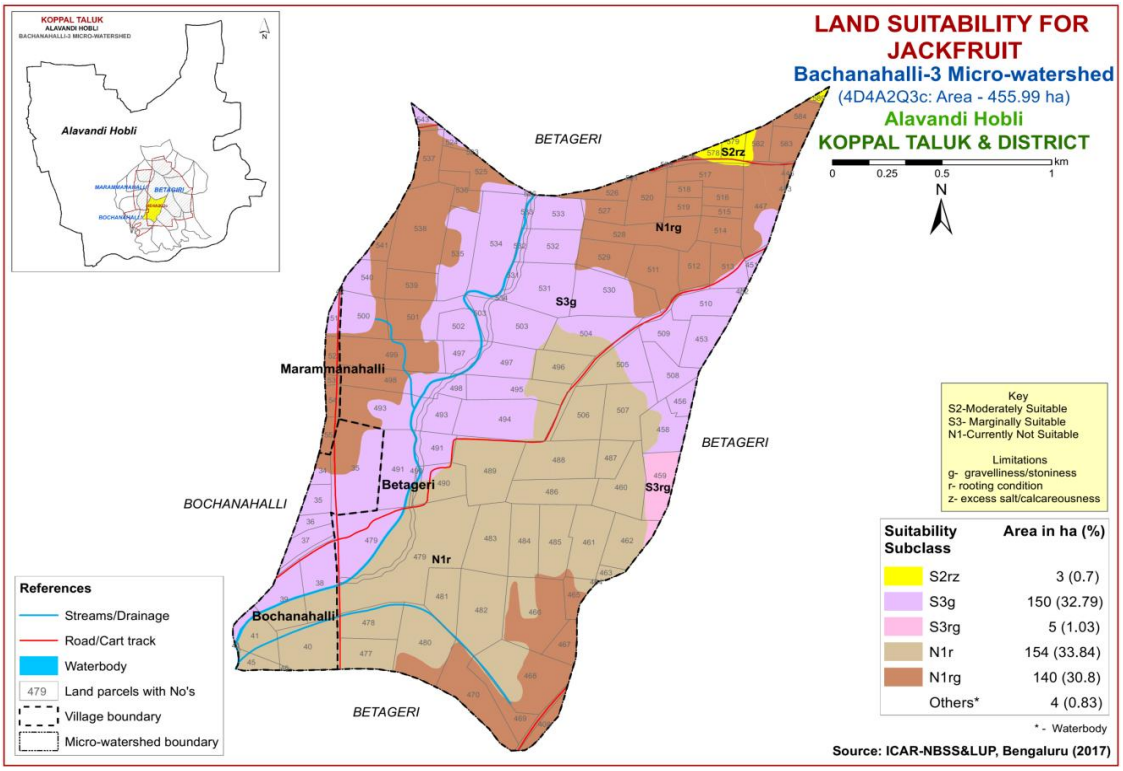


Fig. 7.17 Land Suitability map of Jackfruit

7.18 Land Suitability for Jamun (*Syzygium cumini*)

Jamun is an important fruit crop grown in almost all the districts of the state. The crop requirements (Table 7.19) for growing jamun were matched with the soil-site characteristics and a land suitability map for growing jamun was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.18.

There are no highly (Class S1) and moderately suitable (Class S2) lands for growing Jamun in the microwatershed. Marginally suitable (Class S3) lands cover a area of about 158 ha (35%) and occur in the northern, northwestern, northeastern, western, central and eastern part of the microwatershed. They have major limitations of rooting condition, gravelliness and calcareousness. Maximum area of about 294 ha (65%) is currently not suitable (Class N1) for growing jamun and are distributed in the major part of the microwatershed with severe limitations of rooting condition and gravelliness.

Table 7.19 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

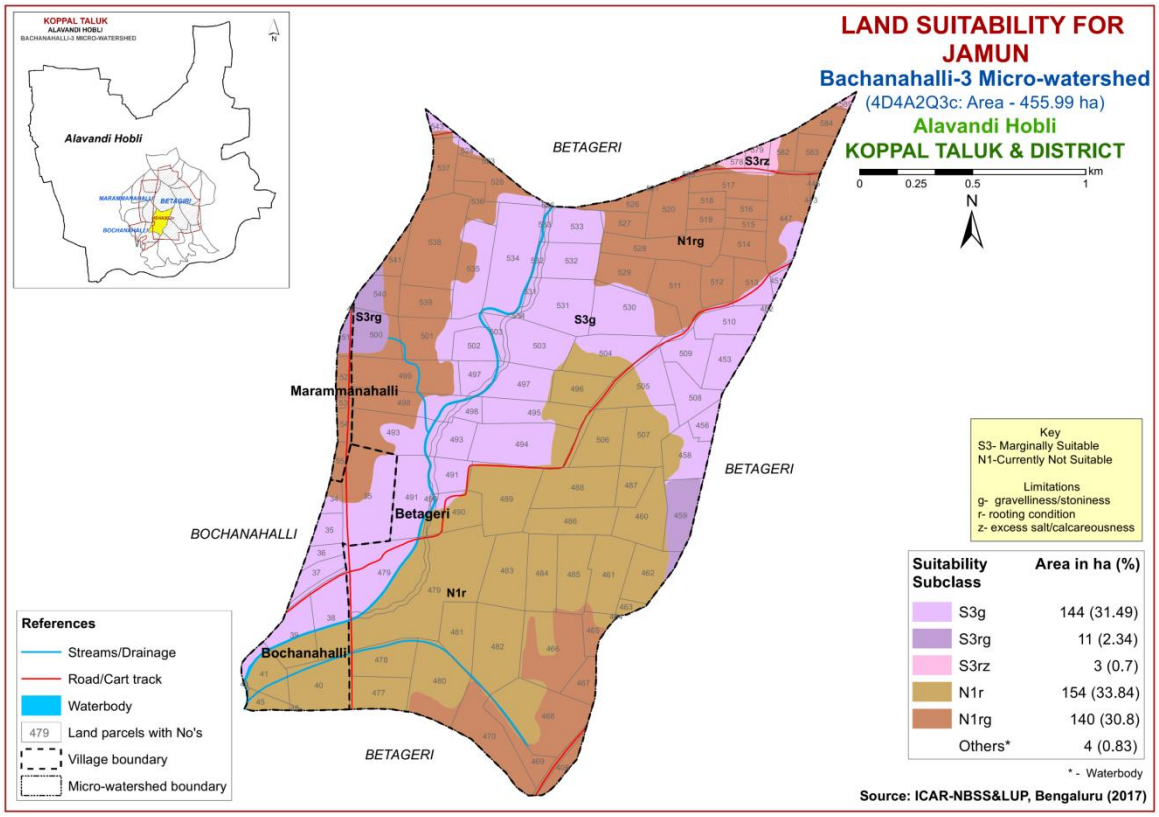


Fig. 7.18 Land Suitability map of Jamun

7.19 Land Suitability for Musambi (*Citrus limetta*)

Musambi is one of the most important fruit crop grown in an area of 5446 ha in almost all the districts of the state. The crop requirements (Table 7.20) for growing musambi were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing musambi was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.19.

There are no highly suitable (Class S1) lands for growing musambi in the microwatershed. A minor area of 3 ha (<1%) is moderately suitable (Class S2) and are distributed in the northeastern part of the microwatershed. They have minor limitations of

rooting condition and calcareousness. Maximum area of about 160 ha (34%) is marginally suitable (Class S3) for growing musambi and are distributed in the northern, northwestern, western, central and eastern part of the microwatershed with major limitations of gravelliness and rooting condition. Maximum area of about 294 ha (65%) is currently not suitable (Class N1) for growing musambi and are distributed in the major part of the microwatershed with severe limitations of rooting condition and gravelliness.

Table 7.20 Crop suitability criteria for Musambi

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 calcareous	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	

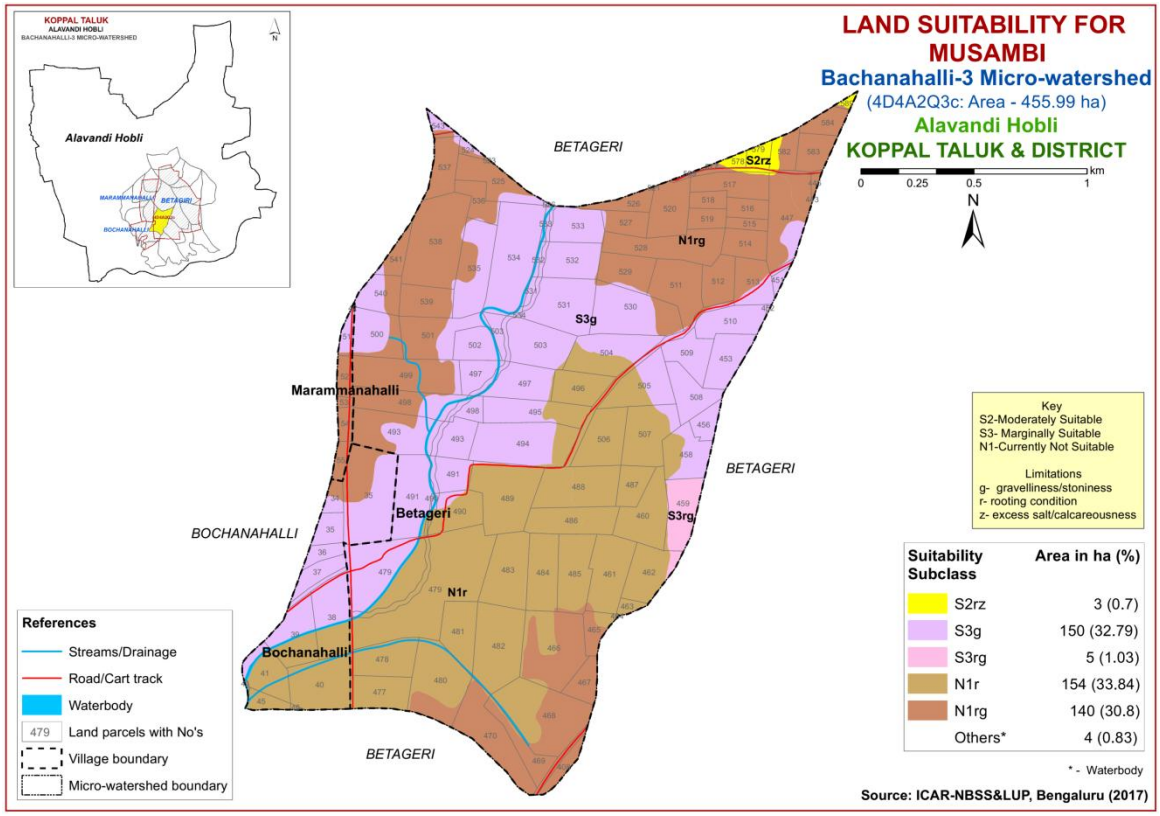


Fig. 7.19 Land Suitability map of Musambi

7.20 Land Suitability for Lime (*Citrus sp*)

Lime is one of the most important fruit crop grown in an area of 11752 ha in almost all the districts of the State. The crop requirements for growing lime (Table 7.21) 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 geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.20.

There are no highly suitable (Class S1) lands for growing lime in the microwatershed. A minor area of about 3 ha (<1%) is moderately suitable (Class S2) and occur in the northeastern part of the microwatershed. They have minor limitations of rooting condition and calcareousness. An area of about 160 ha (34%) is marginally suitable (Class S3) for growing lime and are distributed in the northern, central, western and eastern part of the microwatershed with major limitations of gravelliness and rooting condition. An area of about 294 ha (65%) is currently not suitable (Class N1) for growing lime and distributed in the major part of the microwatershed with severe limitations of rooting condition and gravelliness.

Table 7.21 Crop suitability criteria for Lime

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

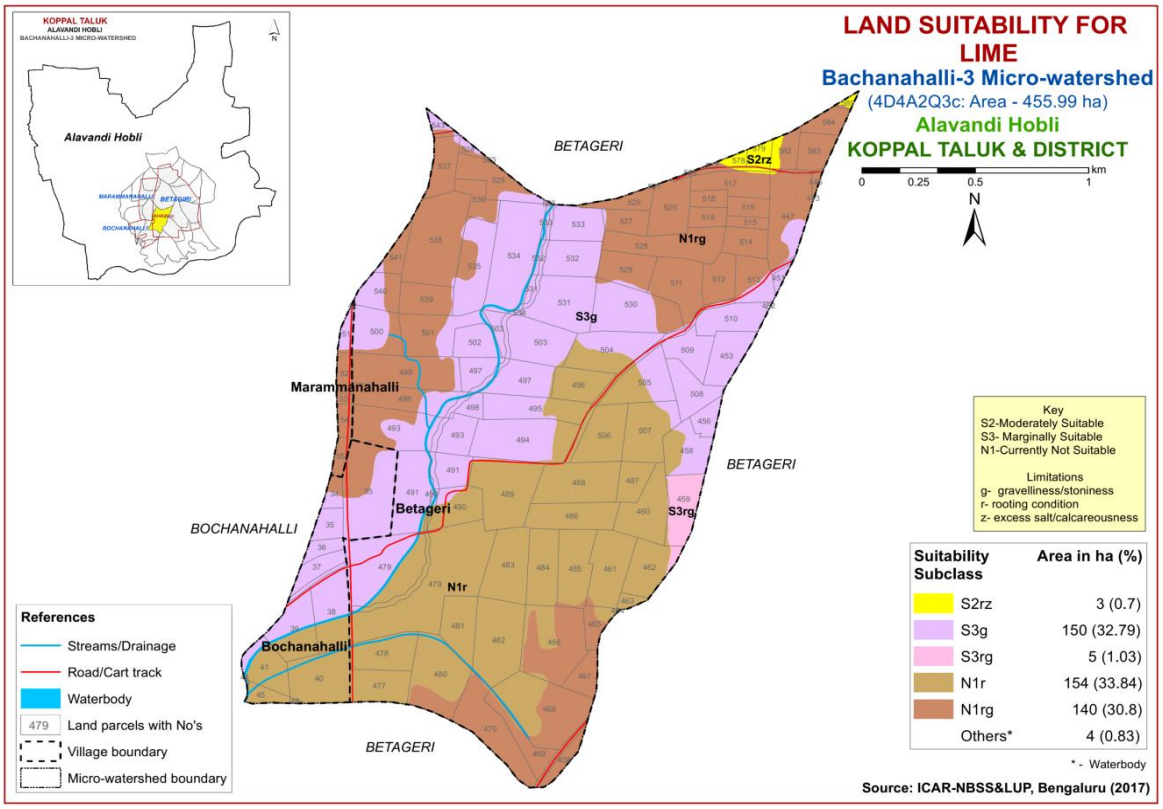


Fig. 7.20 Land Suitability map of Lime

7.21 Land Suitability for Cashew (*Anacardium occidentale)*

Cashew is one of the most important nut crop grown in an area of 7052 ha in almost all the districts of the State. The crop requirements for growing cashew (Table 7.22) 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 geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.21.

There are no highly suitable (Class S1) lands for growing cashew in the microwatershed. Moderately suitable (class S2) lands cover an area of about 144 ha (31%) and are distributed in the northern, northwestern, central, western and eastern part of the microwatershed with minor limitations of rooting condition and gravelliness. An area of about 11ha (2%) is marginally suitable (Class S3) for growing cashew and distributed in the western and eastern part of the microwatershed with major limitations of gravelliness and rooting condition. Maximum area of about 297 ha (65%) is currently not suitable (Class N1) for growing cashew and distributed in the major part of the microwatershed with severe limitations of rooting condition, gravelliness and calcareousness.

Table 7.22 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	

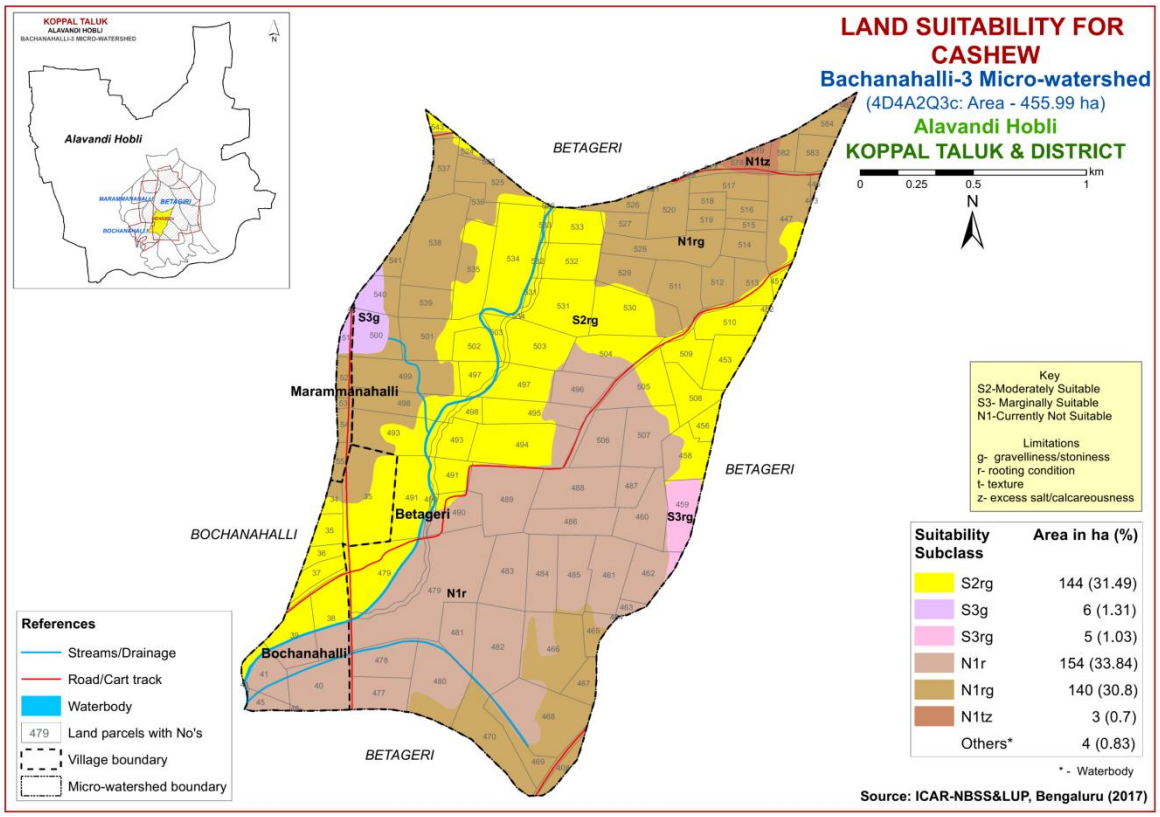


Fig. 7.21 Land Suitability map of Cashew

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

Custard apple is one of the most important fruit crop grown in 1426 ha in almost all the districts of the State. The crop requirements(Table 7.23) for growing custard apple 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 geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.22.

There are no highly suitable lands (Class S1) for growing custard apple in the microwatershed. An area of about 158 ha (35%) is moderately suitable (Class S2) and occur in the northwestern, northeastern, northern, central, western and eastern parts of the microwatershed. They have minor limitations of gravelliness, rooting condition and calcareousness. An area of about 264 ha (58%) is marginally suitable (Class S3) and are distributed in the major part of the microwatershed with major limitations of gravelliness and rooting condition. An area of about 30 ha (7%) is currently not suitable (Class N1) for growing custard apple and are distributed in the southern and southeastern part of the microwatershed with severe limitations of rooting condition and gravelliness.

Table 7.23 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	-

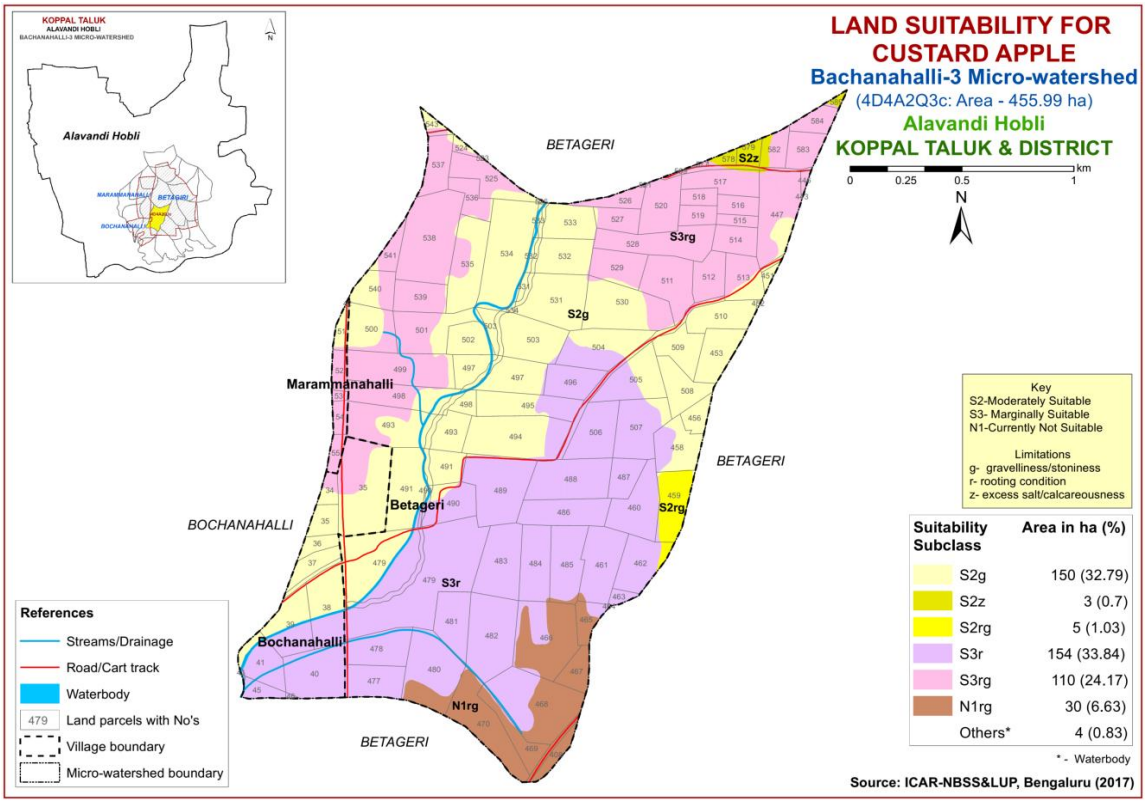


Fig. 7.22 Land Suitability map of Custard Apple

7.23 Land Suitability for Amla (*Phyllanthus emblica*)

Amla is one of the most important fruit and medicinal crop grown in an area of 151 ha and distributed in almost all the districts of the state. The crop requirements (Table 7.24) for growing amla 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 geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.23.

There are no highly suitable (Class S1) lands for growing amla in the microwatershed. An area of about 158 ha (35%) is moderately suitable (Class S2) and occur in the northern, northeastern, northwestern, western, central and eastern parts of the microwatershed. They have minor limitations of gravelliness, rooting condition and calcareousness. An area of about 264 ha (58%) is marginally suitable (Class S3) for growing amla and are distributed in the major part of the microwatershed with major limitations of gravelliness and rooting condition. An area of about 30 ha (7%) is currently not suitable (Class N1) for growing amla and distributed in the southern and southeastern part of the microwatershed with severe limitations of rooting condition and gravelliness.

Table 7.24 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

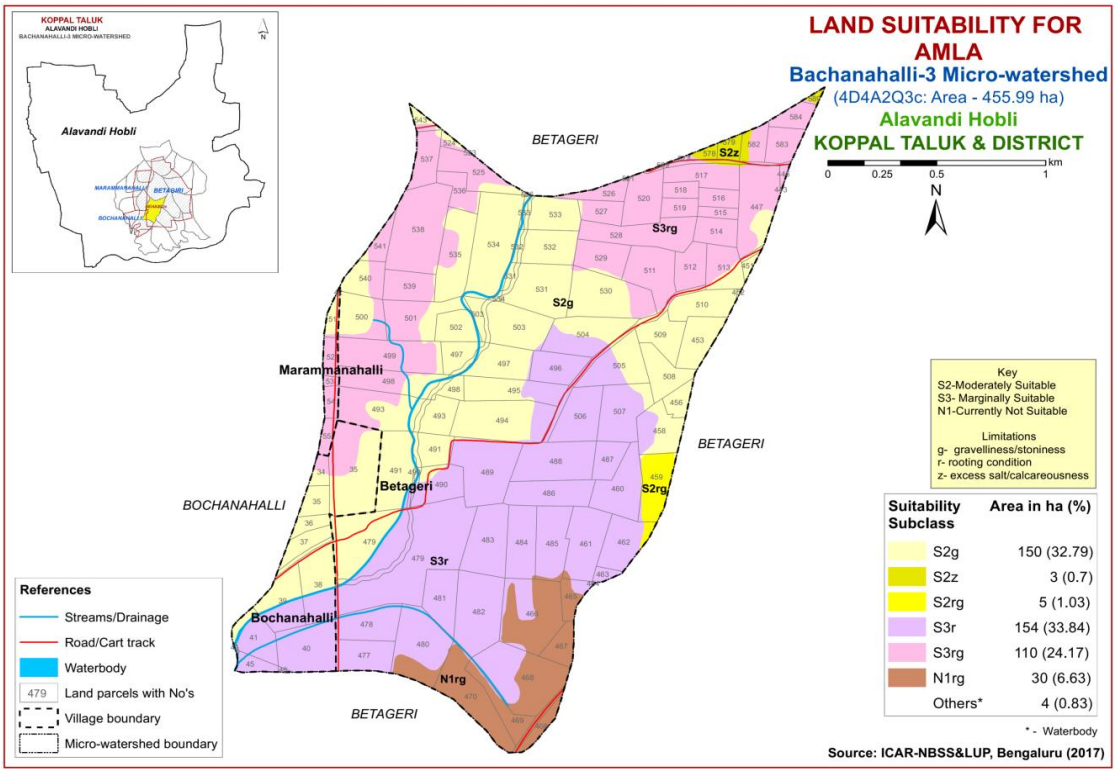


Fig. 7.23 Land Suitability map of Amla

7.24 Land Suitability for Tamarind (*Tamarindus indica*)

Tamarind is one of the most important spice crop grown in 14897 ha in all the districts of the state. The crop requirements (Table 7.25) for growing tamarind 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 are given in Figure 7.24.

There are no highly (Class S1) and moderately suitable (Class S2) lands for growing tamarind in the microwatershed. An area of about 153 ha (33%) is marginally suitable (Class S3) and occur in the northern, northeastern, northwestern, western, central and eastern part of the microwatershed. They have major limitations of rooting condition, gravelliness and calcareousness. Maximum area of about 299 ha (66%) is currently not suitable (Class N1) for growing tamarind and are distributed in the major part of the microwatershed with severe limitations of rooting condition and gravelliness.

Table 7.25 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	<75
	Gravel content	% vol.	<15	15-35	35-60	60-80
Erosion	Slope	%	0-3	3-5	5-10	>10

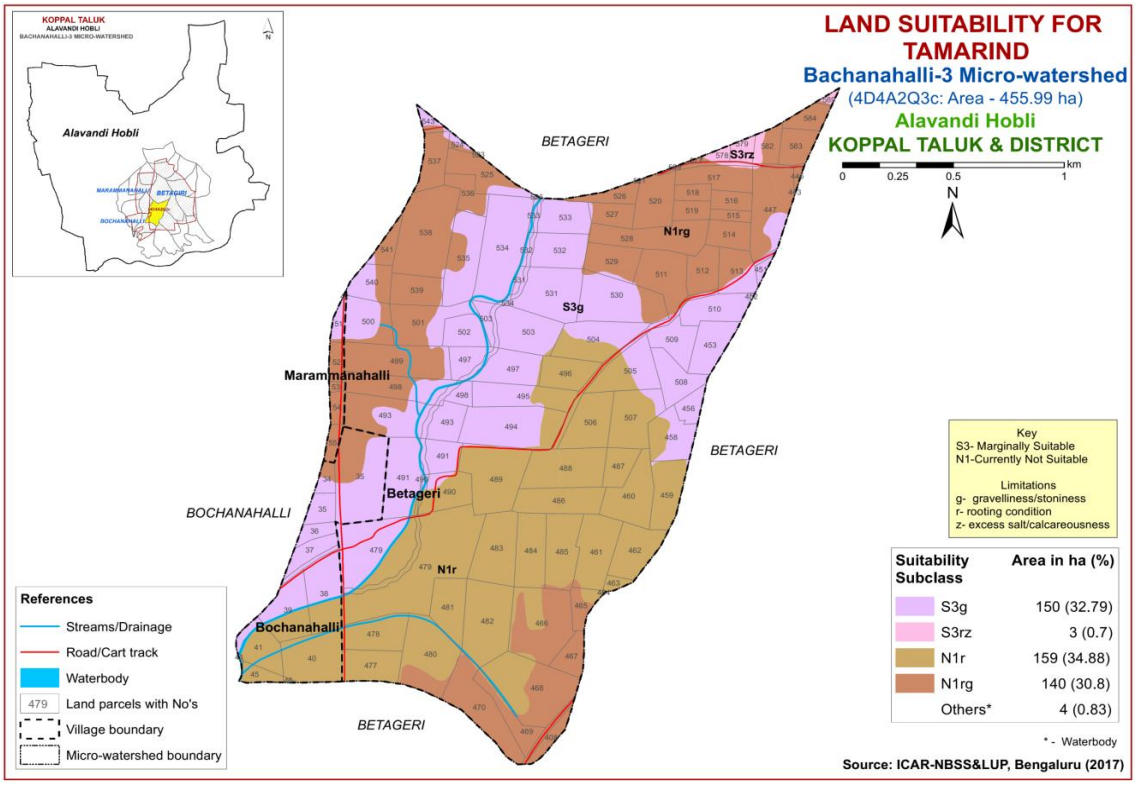


Fig. 7.21 Land Suitability map of Tamarind

7.25 Land Suitability for Marigold (*Tagetes erecta*)

Marigold is one of the most important flower crop grown in an area of 9108 ha in almost all the districts of the state. The crop requirements (Table 7.26) for growing marigold were matched with the soil-site characteristics and a land suitability map for growing marigold was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.25.

There are no highly suitable (Class S1) lands for growing marigold in the microwatershed. A small area of about 8 ha (2%) is moderately suitable (Class S2) and occur in the eastern and northeastern part of the microwatershed. They have minor limitations of rooting condition, gravelliness and calcareousness. Maximum area of about 414 ha (91 %) is marginally suitable (Class S3) and are distributed in the major part of the microwatershed with major limitations of gravelliness and rooting condition. An area of about 30 ha (7%) is currently not suitable (Class N1) for growing marigold and are distributed in the southern and southeastern part of the microwatershed with severe limitations of rooting condition and gravelliness.

Table 7.26 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	^{0}C	18-23	17-15 24-35	35-40 10-14	>40 <10
Soil aeration	Soil drainage	Class	Well drained	Moderately well drained	Imperfectly drained	Poorly drained
Nutrient availability	Texture	Class	l,sl,scl,cl,sil	sicl,sc,sic,c	c	ls, s
	pH	1:2.5	7.0-7.5	5.5-5.9 7.6-8.5	<5 >8.5	-
	$CaCO_3$ in root zone	%	Non calcareous	Slightly calcareous	Strongly calcareous	-
Rooting conditions	Soil depth	cm	>75	50-75	25-50	<25
	Gravel content	% vol.	<15	15-35	>35	-
Soil toxicity	Salinity	ds/m	Non saline	Slightly	Strongly	-
	Sodicity (ESP)	%	<10	10-15	>15	-
Erosion	Slope	%	1-3	3-5	5-10	-

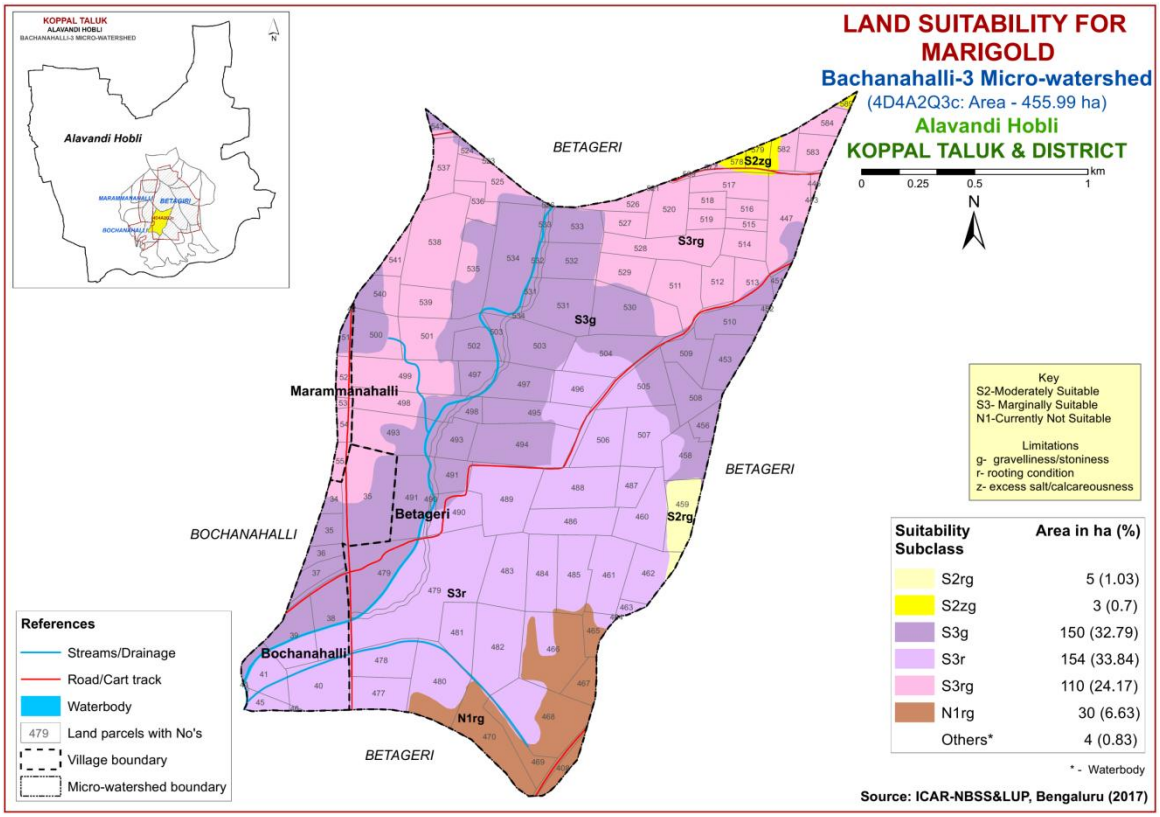


Fig. 7.25 Land Suitability map of Marigold

7.26 Land Suitability for Chrysanthemum (*Chrysanthemum indicum*)

Chrysanthemum is one of the most important flower crop grown in an area of 4978 ha in almost all the districts of the State. The crop requirements (Table 7.27) 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 geographic distribution of different suitability subclasses in the microwatershed is given in Figure 7.26.

There are no highly suitable (Class S1) lands for growing chrysanthemum in the microwatershed. An area of about 8 ha (2%) is moderately suitable (Class S2) and occur in the northeastern and eastern part of the microwatershed. They have minor limitations of rooting condition, gravelliness and calcareousness. Maximum area of about 414 ha (91 %) is marginally suitable (Class S3) and are distributed in the major part of the microwatershed with major limitations of gravelliness and rooting condition. An area of about 30 ha (7%) is currently not suitable (Class N1) for growing marigold and distributed in the southern and southeastern part of the microwatershed with severe limitations of rooting condition and gravelliness.

Table 7.27 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	^{0}C	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	

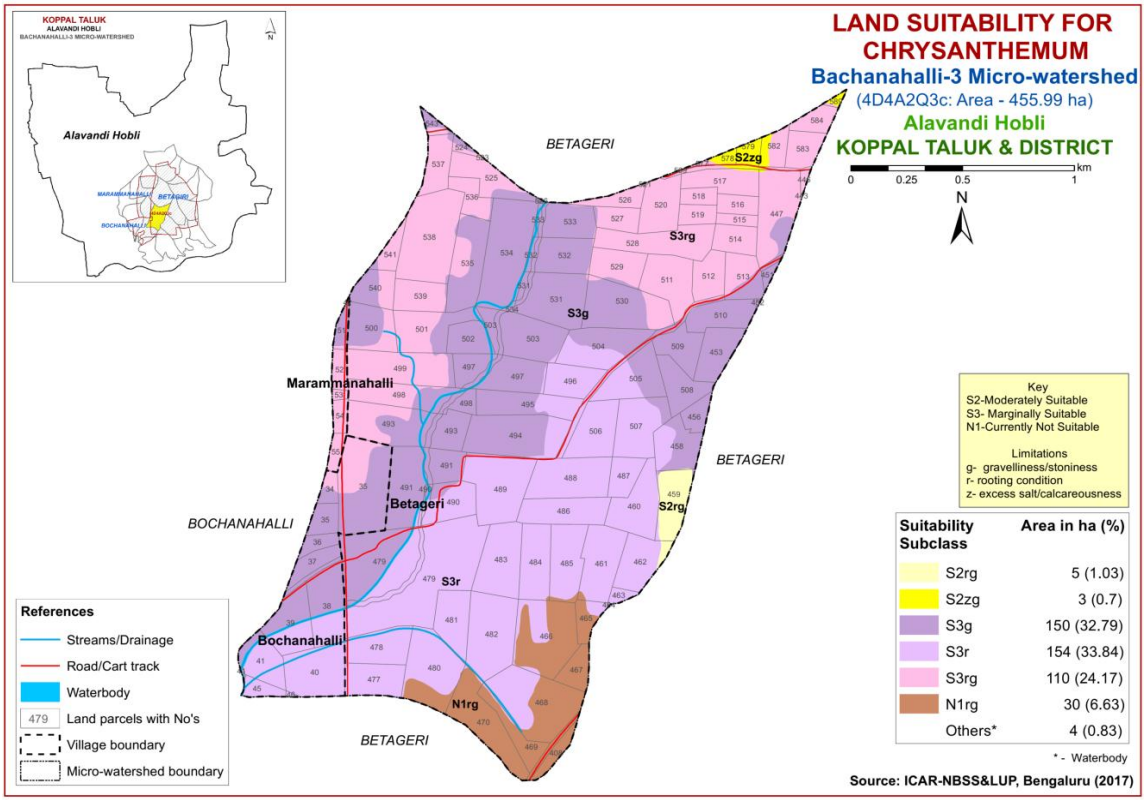


Fig. 7.26 Land Suitability map of Chrysanthemum

7. 27 Land Suitability for Jasmine *(Jasminum sp.)*

Jasmine is one of the most important flower crop grown in an area of 803 ha in almost all the districts of the State. The crop requirements (Table 7.28) for growing jasmine were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing jasmine was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.27.

There are no highly suitable (Class S1) lands for growing jasmine in the microwatershed. Moderately suitable (Class S2) lands cover a small area of about 8 ha (2%) and occur in the eastern and northeastern part of the microwatershed. They have minor limitations of rooting condition, gravelliness and calcareousness. Maximum area of about 414 ha (91%) is marginally suitable (Class S3) for growing jasmine and occur in the major part of the microwatershed. They have moderate limitations of gravelliness and rooting condition. An area of about 30 ha (7%) is currently not suitable (Class N1) for growing jasmine and distributed in the southern and southeastern part of the microwatershed with severe limitations of rooting condition and gravelliness.

Table 7.28 Land suitability criteria for jasmine (irrigated)

Crop requirement			Rating			
Soil-site characteristics		**Unit**	**Highly suitable(S1)**	**Moderately suitable(S2)**	**Marginally suitable(S3)**	**Not suitable(N)**
Climate	Temperature in growing season	^{0}C	18-23	17-15 24-35	35-40 10-14	
Soil aeration	Soil drainage	Class	Well drained	Moderately drained	Imperfectly drained	Poorly drained
Nutrient availability	Texture	Class	scl,l,scl,cl,sil	sicl,sc,sic,c (m/k)	c(ss),	ls, s
	pH	1:2.5	6.0-7.5	5.5-5.9:7.6-8.5	<5: >8.5	
	$CaCO_3$ in root zone	%	Non calcareous	Slightly calcareous	Strong calcareous	
Rooting conditions	Soil depth	cm	>75	50-75	25-50	<25
	Gravel content	% vol.	<15	15-35	>35	
Soil toxicity	Salinity	ds/m	Non saline	Slight	Strongly	
	Sodicity	%	Non sodic	Slight	Strongly	
Erosion	Slope	%	1-3	3-5	5-10	

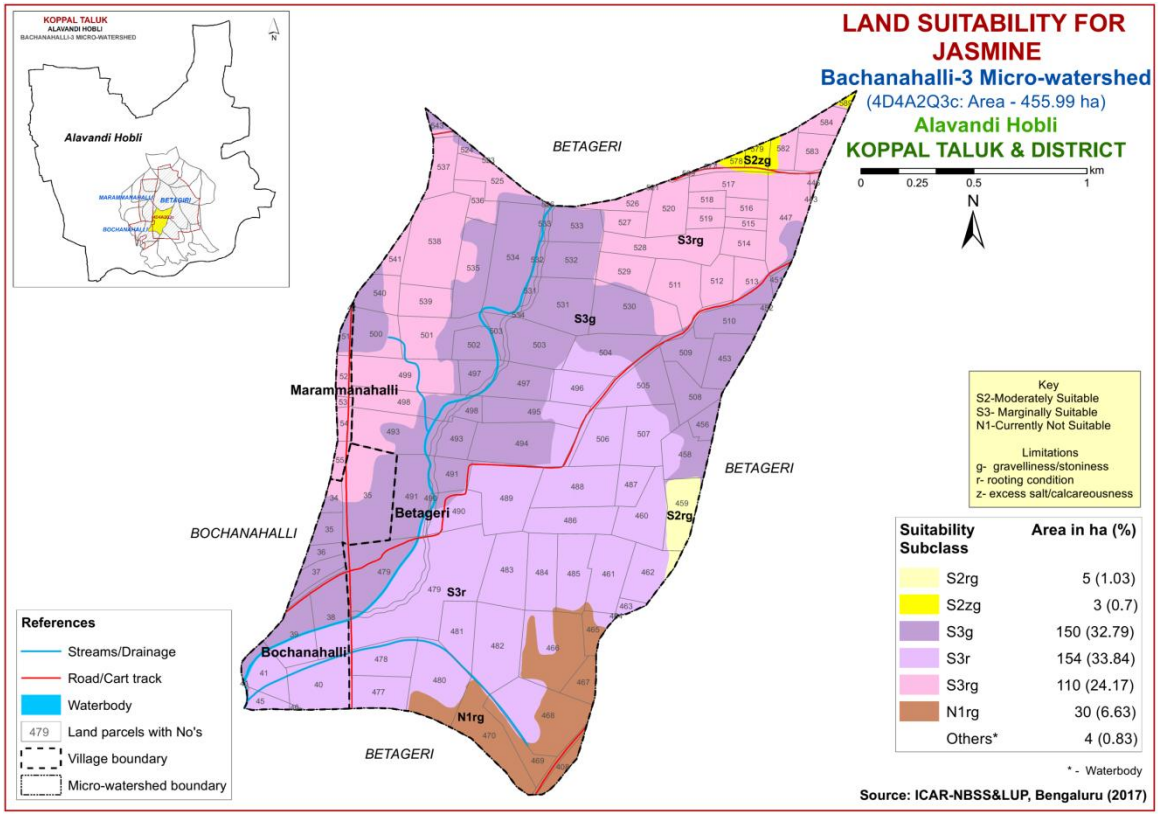


Fig. 7.27 Land Suitability map of Jasmine

7. 28 Land Suitability for Crossandra *(Crossandra infundibuliformis)*

Crossandra is one of the most important flower crop grown in almost all the districts of the State. Land suitability map for growing crossandra was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.28.

There are no highly (Class S1) suitable lands for growing crossandra in the microwatershed. Moderately suitable (Class S2) lands cover an area of about 8 ha (2%) and occur in the northeastern and eastern part of the microwatershed. They have minor limitations of rooting condition, gravelliness and calcareousness. Maximum area of about 414 ha (91%) is marginally suitable (Class S3) for growing crossandra and occur in the major part of the microwatershed. They have moderate limitations of gravelliness and rooting condition. An area of about 30 ha (7%) is currently not suitable (Class N1) for growing crossandra and distributed in the southern and southeastern part of the microwatershed with severe limitations of rooting condition and gravelliness.

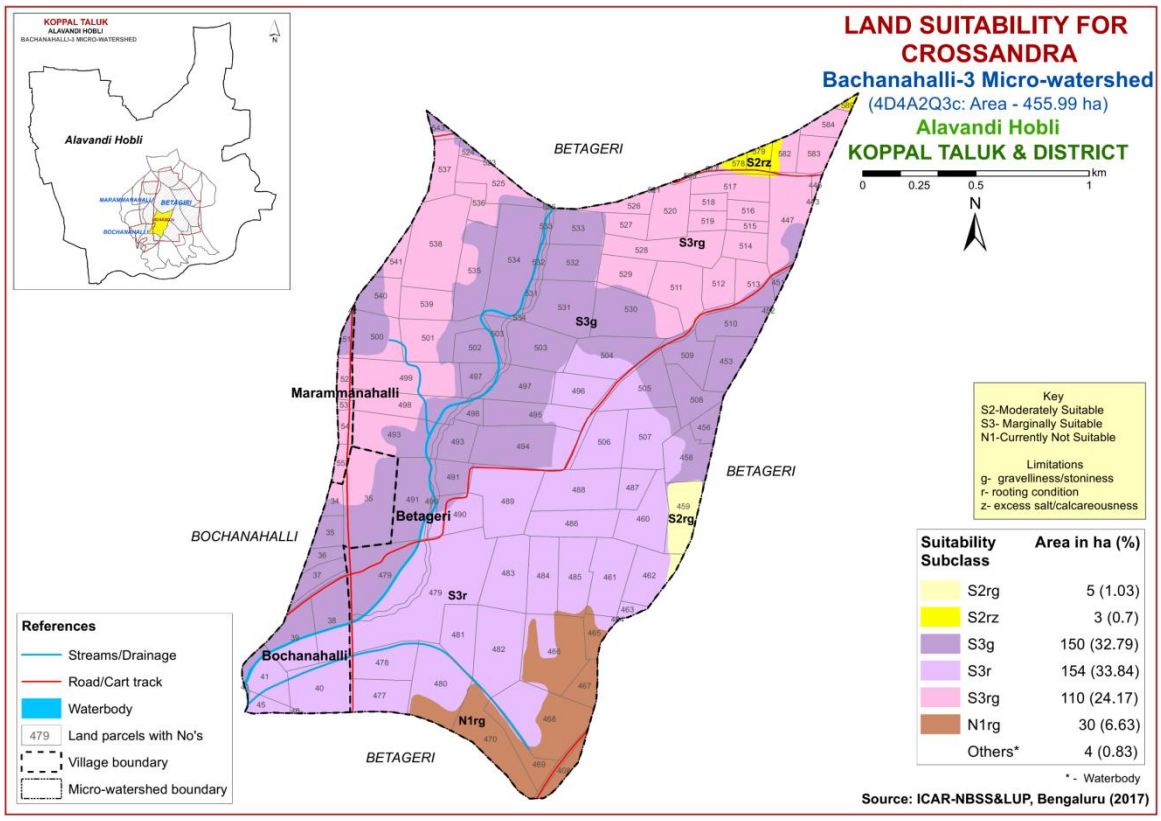


Fig. 7.28 Land Suitability map of Crossandra

7.29 Land Management Units (LMUs)

The 11 soil map units identified in Bachanahalli-3 microwatershed have been grouped into 5 Land Management Units (LMUs) for the purpose of preparing a Proposed Crop Plan. Land Management Units are grouped based on the similarities in respect of the type of soil, the depth of the soil, the surface soil texture, gravel content, AWC, slope, erosion etc. and a Land Management Unit map (Fig.7.29) has been generated. These Land Management Units are expected to behave similarly for a given level of management.

The map units that have been grouped into 5 Land Management Units along with brief description of soil and site characteristics are given below.

LMU	Mapping unit	Soil and site characteristics
1	188.BDGhB2g1 189.BDGhB2g2 258.NGPhB1g1	Moderately deep (75-100 cm), red gravelly sandy clay loam soils, 1-3% slope, slight to moderate erosion, gravelly (15-35%) to very gravelly (35-60%).
2	151.TGRiB2g1	Moderately deep (75-100 cm), red calcareous sandy clay soils, 1-3% slope, moderate erosion, gravelly (15-35%).
3	91.MKHiB2g2	Moderately shallow (50-75 cm), red gravelly sandy clay soils, 1-3% slope, moderate erosion, very gravelly (35-60%).
4	24.HRVhB1g2 27.HRVhB2g2 30.HRViB1g2 39.CSRiB2 40.CSRiB2g1	Shallow (25-50 cm), gravelly red sandy clay loam to sandy clay soils, 1-3% slope, slight to moderate erosion, gravelly (15-35%) to very gravelly (35-60%).
5	5.BGThB2g2	Very shallow (<25 cm), gravelly black calcareous sandy clay loam soils, 1-3% slope, moderate erosion, very gravelly (35-60%).

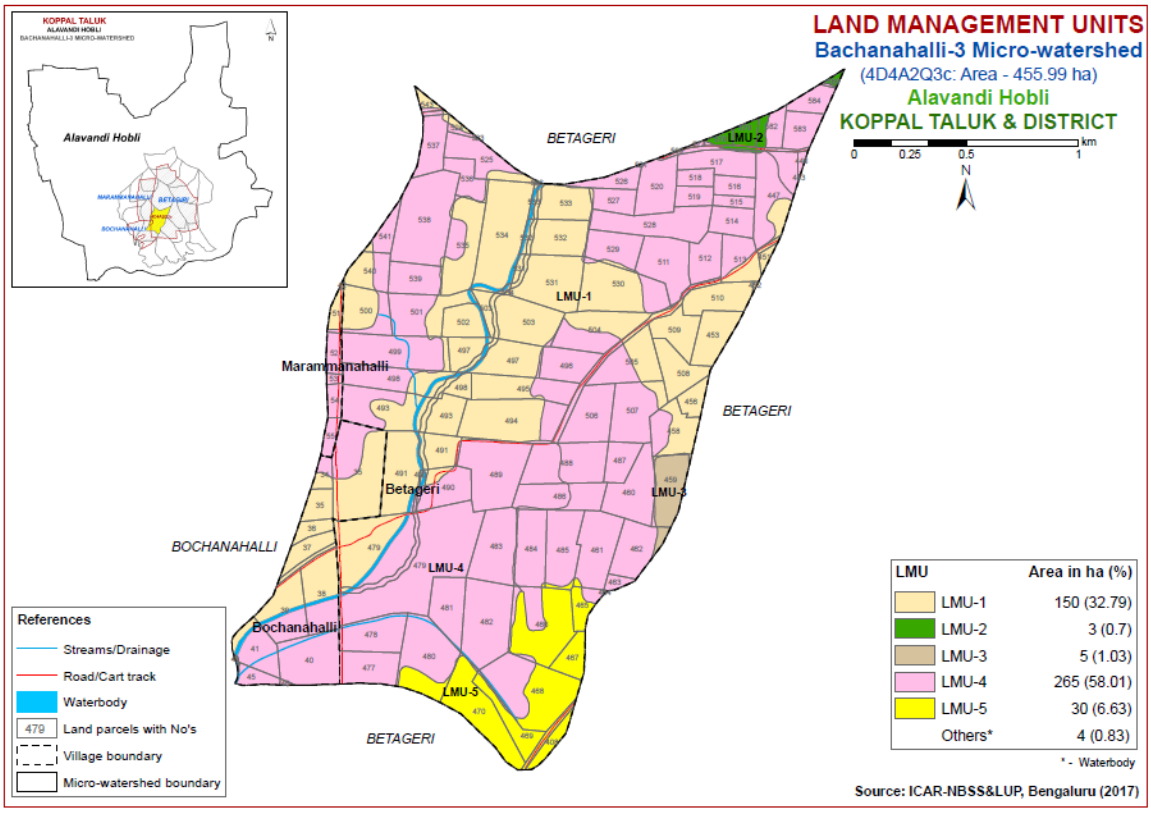


Fig 7.29 Land Management Units map of Bachanahalli-3 microwatershed

7.30 Proposed Crop Plan for Bachanahalli-3 Microwatershed

After assessing the land suitability for the 28 crops, the proposed crop plan has been prepared for the 5 identified LMUs by considering only the highly (Class S1) and moderately (Class S2) suitable lands for each of the 28 crops. The resultant proposed crop plan is presented in Table 7.28.

Table 7.28 Proposed Crop Plan for Bachanahalli-3 Microwatershed

LMU	Soil Map Units	Survey Number	Soil and site characteristics	Field Crops	Horticulture Crops	Suitable Interventions
LMU 1 150 ha (33%)	188.BDGhB2g1 189.BDGhB2g2 258.NGPhB1g1	**Betageri:**451,452,453,456,458,491,493,494,495,497,500,502,503,504,505,508,509,510,524,530,531,532,533,534,535,540,543 **Bochanahalli:**34,35,36,37,38,39 **Marammanahalli :** 42,51	Moderately deep (75-100 cm), red gravelly sandy clay loam soils, 1-3% slope, slight to moderate erosion, gravelly (15-35%) to very gravelly (35-60%).	Groundnut, Red gram, Bajra, Horsegram, Castor	**Fruit crops:** Musambi, Lime, Jamun, Jackfruit Amla, Custard apple **Vegetables:** Drumstick	Drip irrigation, mulching, suitable soil and water conservation practises (Crescent Bunding with Catch Pit etc)
LMU 2 3 ha (<1%)	151.TGRiB2g1	**Betageri :** 578,579,589	Moderately deep (75-100 cm), red calcareous sandy clay soils, 1-3% slope, moderate erosion, gravelly (15-35%).	Sorghum, Bajra, Groundnut, Redgram, Castor	**Fruit crops:** Pomegranate, Sapota, Jackfruit, Jamun, Lime, Musambi, Amla, Custard apple **Vegetables:** Drumstick, Tomato, Chilli, Brinjal **Flowers:** Marigold, Chrysanthemum, Jasmine	Drip irrigation, mulching, suitable soil and water conservation practises (Crescent Bunding with Catch Pit etc)
LMU 3 5 ha (1%)	91.MKHiB2g2	**Betageri :** 459	Moderately shallow (50-75 cm), red gravelly sandy clay soils, 1-3% slope, moderate erosion, very gravelly (35-60%).	Sorghum, Groundnut, Bajra, Castor	**Fruit crops:** Amla, Cashew, Custard apple	Drip irrigation, mulching, suitable soil and water conservation practises (Crescent Bunding with Catch Pit etc)

LMU 4 265 ha (58%)	24.HRVhB1g2 27.HRVhB2g2 30.HRViB1g2 39.CSRiB2 40.CSRiB2g1	**Betageri:**443,446,447,460,461,462,463,464,477,478,479,480,481,482,483,484,485,486,487,488,489,490,496,498,499,501,506,507,511,512,513,514,515,516,517,518,519,520,521,523,525,526,527,528,529,536,537,538,539,541,569,577,582,583,584 **Bochanahalli :** 40,41,45,46 **Marammanahalli:**52,53,54,55	Shallow (25-50 cm), gravelly red sandy clay loam to sandy clay soils, 1-3% slope, slight to moderate erosion, gravelly (15-35%) to very gravelly (35-60%).	Horsegram, Bajra	**Agri-Silvi-Pasture:** Custard apple, Amla, Hybrid Napier, *Styloxanthes hamata*, Glyricidia, *Styloxanthes scabra*	Use of short duration varieties, sowing across the slope and split application of nitrogen fertilizers
LMU 5 30 ha (7%)	5.BGThB2g2	**Betageri :** 408,465,466,467,468,469,470	Very shallow (<25 cm), gravelly black calcareous sandy clay loam soils, 1-3% slope, moderate erosion, very gravelly (35-60%).	-	**Agri-Silvi-Pasture:** Hybrid Napier, *Styloxanthes hamata*, *Styloxanthes scabra*	Sowing across the slope, drip irrigation and mulching is recommended

Chapter 8

SOIL HEALTH MANAGEMENT

8.1 Soil Health

Soil health is basic to plant health and plant health is basic to human and bovine 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 unfavourable conditions occur

Characteristics of Bachanahalli-3 Microwatershed

- The soil phases with sizeable area identified in the microwatershed belonged to the soil series of CSR 154 ha (34%), BDG 144 ha (31%), HRV 110 ha (24%), BGT 30 ha (7%), NGP 6 ha (1%), MKH 5ha (1%) and TGR 3 ha (1%).
- As per land capability classification, entire area in the microwatershed falls under arable land category (Class II, III and IV). The major limitations identified in the arable lands were soil and erosion.
- On the basis of soil reaction, an area of about 27 ha (6%) is slightly acid (pH 6.0-6.5), 146 ha (32%) is neutral (pH 6.5-7.3), 98 ha (21%) is slightly alkaline (pH 7.3-

7.8), 172 ha (38%) is moderately alkaline (pH 7.8-8.4) and 10 ha (2%) is strongly alkaline (pH 8.4-9.0) Thus, major portion of the area is neutral to alkaline in reaction.

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

Acid soils occupy an area of about 27 ha in the microwatershed. The following measures recommended for reclaiming acid soils

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

Liming materials:

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

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

Alkaline soils

An area of about 280 ha (61%) is under alkaline soils. The following actions are recommended.

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 – 5 kg/ha (once in three years).

Neutral soils

Neutral soils cover about 146 ha (32%) and the following actions are recommended.

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. An area of about 384 ha (84%) is under moderate erosion. The areas with moderate erosion 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 in IWMP is focusing on preparation of

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

In this connection, how various outputs of Sujala-III are of use in addressing these objectives of Net Planning 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 Bachanahalli-3 Microwatershed.
- **Organic Carbon:** An area of about 135 ha (30%) is low (<0.5%), 270 ha (59%) is medium (0.5-0.75%) and 47 ha (10%) is high (>0.75) in OC content. The areas that are low and medium in OC needs to be further improved by applying farmyard manure and rotating crops with cereals and legumes or mixed cropping.
- **Promoting green manuring:** Growing of green manuring crops costs Rs. 1250/ha (green manuring seeds) and about Rs. 2000/ha towards cultivation that totals to Rs. 3250/- per ha. On the other hand, application of organic manure @ 10 tons/ha costs Rs. 5000/ha. The practice needs to be continued for 2-3 years or more. Nitrogen fertilizer needs to be supplemented by 25% in addition to the recommended level in 405 ha area where OC is less than 0.75 per cent. 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 low (<23 kg/ha) in 33 ha (7%), medium (23-57 kg/ha) in 347 ha (76%) and high (>57 kg/ha) in 73 ha (16%) of the soils. The areas with high phosphorus content reduce 25% from the RDF to avoid the excess application of fertilizer and apply additional 25% phosphorus in areas where it is low and medium.
- **Available Potassium:** Available potassium is low (<145 kg/ha) in 111 ha (24%), medium (145-337 kg/ha) in 300 ha (66%) and high (>337 kg/ha) in 40 ha (9%) area of the microwatershed. The areas with high potassium content reduce 25% from the RDF to avoid the excess application of fertilizer and apply additional 25% potassium in areas where it is low and medium.
- **Available Sulphur:** Available sulphur is a very critical nutrient for oilseed crops. Available sulphur is low (<10 ppm) in 143 ha (31%), medium (10-20 ppm) in 201 ha (44%) and high (>20 ppm) in 108 ha (24%). Areas with low and medium in available sulphur need to be applied with magnesium sulphate or gypsum or Factamphos (p) fertitilizer (13% sulphur) for 2-3 years for the deficiency to be corrected.
- **Available iron:** It is deficient (<4.5 ppm) in 239 ha (52%) and sufficient (>4.5 ppm) in 214 ha (47%) area of the microwatershed. To manage iron deficiency, iron sulphate @ 25 kg/ha needs to be applied for 2-3 years.
- **Available Zinc:** It is deficient (<0.6 ppm) in 195 ha (43%) and sufficient (>0.6 ppm) in 258 ha (56%) area of the microwatershed. Application of zinc sulphate @ 25kg/ha is to be followed in areas that are deficient in available zinc.
- **Available Boron:** An area of about 298 ha (65%) is low (<0.5 ppm) in available boron and 154 ha (34%) is medium (0.5-1.0 ppm) in available boron content. The areas with

low and medium in boron content need to be applied with sodium borate @ 10kg/ha as a soil application or 0.2% borax as foliar spray to correct the deficiency.

- **Available manganese**: It is sufficient in the entire area of the microwatershed**.**
- **Available copper:** It is sufficient in the entire area of the microwatershed**.**
- **Soil acidity:** The microwatershed has 27 ha (6%) area with soils that are slightly acid. These areas need application of lime (Calcium Carbonate).
- **Soil alkalinity:** An area of about 280 ha (61%) in the microwatershed has soils that are alkaline. These areas need application of gypsum and wherever calcium is in excess, iron pyrites and element sulphur can be recommended. Management practices like treating repeatedly with good quality water to drain out the excess salts and provision of subsurface drainage and growing of salt tolerant crops like Casuarina, Acasia, Neem, Ber etc, are recommended.

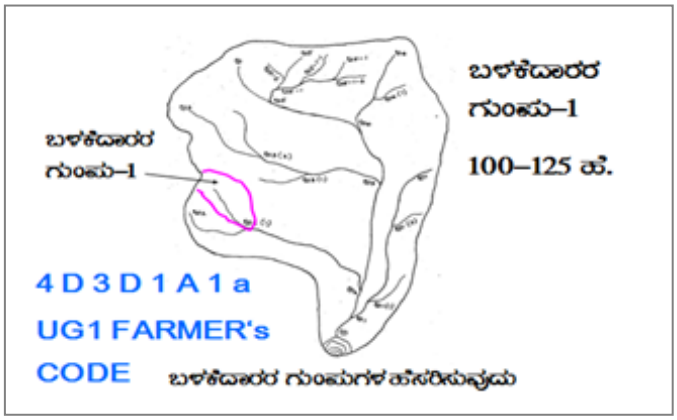
  Land Suitability for various crops: Areas that are highly, moderately and marginally suitable for growing various crops are indicated. Along with the suitability, various constraints that are limiting the productivity are also indicated. For example, in case of cotton, gravel content, rooting depth and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

Chapter 9

SOIL AND WATER CONSERVATION TREATMENT PLAN

For preparing soil and water conservation treatment plan for Bachanahalli-3 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 maps
- Rainfall map
- Hydrology
- Water Resources
- Socio-economic data



- Contour plan with existing features- network of waterways, pothissa boundaries, cut up/ minor terraces etc.
- Cadastral map (1:7920 scale)
- Satellite imagery (1:7920 scale)

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

Steps for Survey and Preparation of Treatment Plan

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

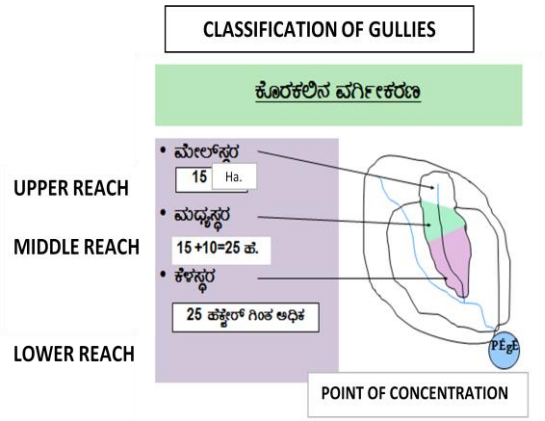
- Naming of user groups and farmers
- Identification of arable and non arable lands
- Identification of drainage lines and gullies
- Identification of non treatable areas
- Identification of priority areas in the arable lands
- Treatment plan for arable lands
- Location of water harvesting and recharge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

9.1 Treatment Plan

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

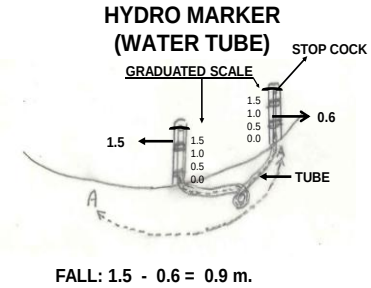
9.1.1 Arable Land Treatment

A. BUNDING

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

Measurement of Land Slope

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



FALL: 1.5 - 0.6 = 0.9 m.

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.

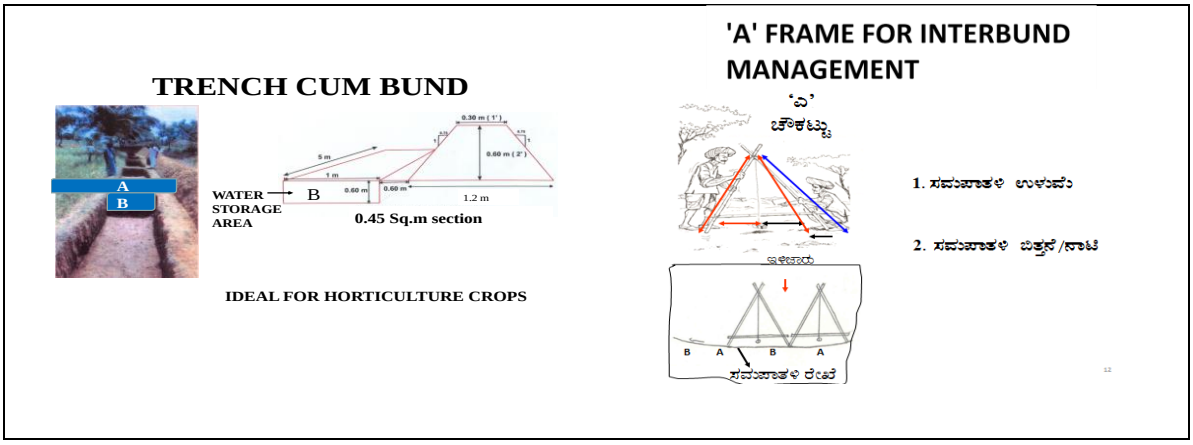
Recommended Bund Section

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 clayey black soils	
0.45	2	0.75	01:01	0.92		
0.45	2.4	0.75	1.3:1	1.07	Shallow clayey black soils	
0.6	3.1	0.7	1.78:1	1.29	Medium clayey black soils	
0.5	3	0.85	1.47:1	1.49		

Formation of Trench cum Bund

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

Details of Borrow Pit dimensions are given below



Size of Borrow 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. Waterways

a) Existing waterways are marked on the cadastral map (1:7920 scale) and their dimensions are recorded.

b) Considering the contour plan of the MWS, additional waterways/ modernization of the existing ones can be thought of.

c) 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 .

9.1.3 Treatment of Natural Water Course/ Drainage Lines

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

9.2 Recommended Soil and Water Conservation Measures

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

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

A map (Fig. 9.1) showing soil and water conservation plan with different kinds of structures recommended has been prepared which shows the spatial distribution and extent of area. A maximum area of about 452 ha (99%) needs Trench cum bunding. 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 finalized in a participatory approach.

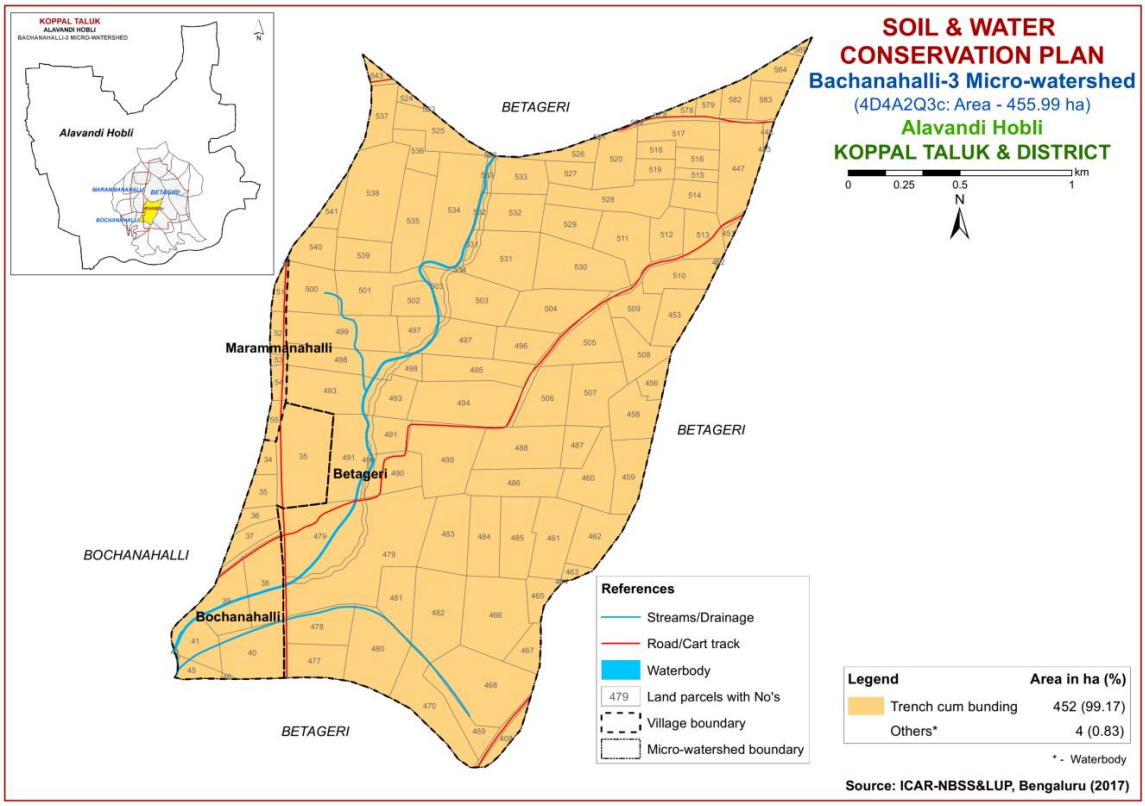


Fig. 9.1 Soil and Water Conservation Plan map of Bachanahalli-3 Microwatershed

9.3 Greening of Microwatershed

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

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

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

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

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Appendix I

Bachanahali 3_2Q3c appendix

Soil Phase Information

Village	Survey NO	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	WELLS	Land Capability	Conservation Plan
Betageri	408	1.39	BGThB2g2	LMU-5	Very shallow (<25 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Drumstick (Bj+Ds)	1	IVes	Trench cum bunding
Betageri	443	0.02	HRVhB1g2	LMU-4	Shallow (25-50 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Bajra (Bj)	Not Available	IIIs	Trench cum bunding
Betageri	446	0.31	HRVhB1g2	LMU-4	Shallow (25-50 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Sunflower (Sf)	Not Available	IIIs	Trench cum bunding
Betageri	447	7.22	HRVhB2g2	LMU-4	Shallow (25-50 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Sunflower+Groundnut+Bajra(Mz+Sf+Gn+Bj)	Not Available	IIIes	Trench cum bunding
Betageri	451	0.48	BDGhB2g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut (Gn)	Not Available	IIIes	Trench cum bunding
Betageri	452	0.07	BDGhB2g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	Trench cum bunding
Betageri	453	3.84	BDGhB2g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Bajra+Groundnut (Mz+Bj+Gn)	Not Available	IIIes	Trench cum bunding
Betageri	456	1.61	BDGhB2g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Current fallow (Mz+Cf)	Not Available	IIIes	Trench cum bunding
Betageri	458	4.44	BDGhB2g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIIes	Trench cum bunding
Betageri	459	4.44	MKHiB2g2	LMU-3	Moderately shallow (50-75 cm)	Sandy clay	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Eucalyptus (Bj+Eu)	Not Available	IIIes	Trench cum bunding
Betageri	460	5.57	CSRiB2g1	LMU-4	Shallow (25-50 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	Trench cum bunding
Betageri	461	5.93	CSRiB2g1	LMU-4	Shallow (25-50 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Sunflower+Bajra (Sf+Bj)	Not Available	IIIes	Trench cum bunding
Betageri	462	4.64	CSRiB2g1	LMU-4	Shallow (25-50 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Sunflower+Groundnut (Mz+Sf+Gn)	Not Available	IIIes	Trench cum bunding
Betageri	463	0.68	CSRiB2g1	LMU-4	Shallow (25-50 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	Trench cum bunding
Betageri	464	0.02	CSRiB2g1	LMU-4	Shallow (25-50 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	Trench cum bunding
Betageri	465	1.94	BGThB2g2	LMU-5	Very shallow (<25 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IVes	Trench cum bunding
Betageri	466	9.26	BGThB2g2	LMU-5	Very shallow (<25 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Jowar (Bj+Jw)	Not Available	IVes	Trench cum bunding
Betageri	467	2.18	BGThB2g2	LMU-5	Very shallow (<25 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Subabula+Bajra (Su+Bj)	Not Available	IVes	Trench cum bunding
Betageri	468	10.05	BGThB2g2	LMU-5	Very shallow (<25 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Bajra (Mz+Bj)	2	IVes	Trench cum bunding
Betageri	469	2.85	BGThB2g2	LMU-5	Very shallow (<25 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Fallow land (Mz+Fl)	Not Available	IVes	Trench cum bunding
Betageri	470	6.89	BGThB2g2	LMU-5	Very shallow (<25 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Maize (Bj+Mz)	Not Available	IVes	Trench cum bunding
Betageri	477	4.08	CSRiB2	LMU-4	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Maize (Bj+Mz)	Not Available	IIIes	Trench cum bunding
Betageri	478	4.63	CSRiB2	LMU-4	Shallow (25-50 cm)	Sandy clay	Non gravelly	Very Low (<50	Very gently	Moderate	Maize (Mz)	Not	IIIes	Trench cum

Village	Survey NO	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	WELLS	Land Capability	Conservation Plan
							(<15%)	mm/m)	sloping (1-3%)			Available		bunding
Betageri	479	26.02	CSRiB2	LMU-4	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Eucalyptus+Drumstick+Cotton (Eu+Ds+Ct)	Not Available	IIIes	Trench cum bunding
Betageri	480	7.95	CSRiB2	LMU-4	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Bajra (Mz+Bj)	Not Available	IIIes	Trench cum bunding
Betageri	481	4.22	CSRiB2	LMU-4	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	Trench cum bunding
Betageri	482	8.1	CSRiB2	LMU-4	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Eucalyptus (Mz+Eu)	Not Available	IIIes	Trench cum bunding
Betageri	483	6.34	CSRiB2	LMU-4	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Maize (Bj+Mz)	Not Available	IIIes	Trench cum bunding
Betageri	484	4.96	CSRiB2g1	LMU-4	Shallow (25-50 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Eucalyptus (Eu)	Not Available	IIIes	Trench cum bunding
Betageri	485	5.44	CSRiB2g1	LMU-4	Shallow (25-50 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Eucalyptus (Eu)	Not Available	IIIes	Trench cum bunding
Betageri	486	5.03	CSRiB2	LMU-4	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIIes	Trench cum bunding
Betageri	487	2.44	CSRiB2g1	LMU-4	Shallow (25-50 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIIes	Trench cum bunding
Betageri	488	6.94	CSRiB2g1	LMU-4	Shallow (25-50 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Sunflower+Current fallow+Bajra (Sf+Cf+Bj)	1	IIIes	Trench cum bunding
Betageri	489	8.25	CSRiB2	LMU-4	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Drumstick (Bj+Ds)	Not Available	IIIes	Trench cum bunding
Betageri	490	3.98	CSRiB2	LMU-4	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Bajra (Mz+Bj)	Not Available	IIIes	Trench cum bunding
Betageri	491	8.56	BDGhB2g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Maize (Bj+Mz)	Not Available	IIIes	Trench cum bunding
Betageri	493	9.49	BDGhB2g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIIes	Trench cum bunding
Betageri	494	8.72	BDGhB2g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Bajra (Mz+Bj)	1	IIIes	Trench cum bunding
Betageri	495	5.13	BDGhB2g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	Trench cum bunding
Betageri	496	3.57	CSRiB2g1	LMU-4	Shallow (25-50 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	Trench cum bunding
Betageri	497	6.42	BDGhB2g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIIes	Trench cum bunding
Betageri	498	6.2	HRViB1g2	LMU-4	Shallow (25-50 cm)	Sandy clay	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Bajra (Bj)	Not Available	IIIs	Trench cum bunding
Betageri	499	7.43	HRViB1g2	LMU-4	Shallow (25-50 cm)	Sandy clay	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIIs	Trench cum bunding
Betageri	500	4.61	NGPhB1g1	LMU-1	Deep (100-150 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Bajra (Bj)	Not Available	IIIs	Trench cum bunding
Betageri	501	5.61	HRViB1g2	LMU-4	Shallow (25-50 cm)	Sandy clay	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIIs	Trench cum bunding
Betageri	502	2.89	BDGhB2g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	Trench cum bunding
Betageri	503	6.58	BDGhB2g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Teak (Mz+Te)	Not Available	IIIes	Trench cum bunding

Village	Survey NO	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	WELLS	Land Capability	Conservation Plan
Betageri	504	6.21	BDGhB2g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Maize (Bj+Mz)	Not Available	IIIes	Trench cum bunding
Betageri	505	5.37	BDGhB2g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	Trench cum bunding
Betageri	506	5.06	CSRiB2g1	LMU-4	Shallow (25-50 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Groundnut (Mz+Gn)	Not Available	IIIes	Trench cum bunding
Betageri	507	5.9	CSRiB2g1	LMU-4	Shallow (25-50 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Maize (Bj+Mz)	Not Available	IIIes	Trench cum bunding
Betageri	508	3.65	BDGhB2g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	Trench cum bunding
Betageri	509	3.34	BDGhB2g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Drumstick (Bj+Ds)	1	IIIes	Trench cum bunding
Betageri	510	3.9	BDGhB2g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIIes	Trench cum bunding
Betageri	511	5.33	HRVhB2g2	LMU-4	Shallow (25-50 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Sunflower+Current fallow (Bj+Sf+Cf)	Not Available	IIIes	Trench cum bunding
Betageri	512	3.07	HRVhB2g2	LMU-4	Shallow (25-50 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Bajra (Mz+Bj)	Not Available	IIIes	Trench cum bunding
Betageri	513	3.58	HRVhB2g2	LMU-4	Shallow (25-50 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIIes	Trench cum bunding
Betageri	514	2.63	HRVhB2g2	LMU-4	Shallow (25-50 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Sunflower (Mz+Sf)	Not Available	IIIes	Trench cum bunding
Betageri	515	1.02	HRVhB2g2	LMU-4	Shallow (25-50 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	Trench cum bunding
Betageri	516	1.74	HRVhB2g2	LMU-4	Shallow (25-50 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	Trench cum bunding
Betageri	517	3.73	HRVhB2g2	LMU-4	Shallow (25-50 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	Trench cum bunding
Betageri	518	1.36	HRVhB2g2	LMU-4	Shallow (25-50 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIIes	Trench cum bunding
Betageri	519	1.62	HRVhB2g2	LMU-4	Shallow (25-50 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIIes	Trench cum bunding
Betageri	520	4.41	HRVhB2g2	LMU-4	Shallow (25-50 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	1	IIIes	Trench cum bunding
Betageri	521	0.03	HRVhB2g2	LMU-4	Shallow (25-50 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	Trench cum bunding
Betageri	523	0	HRViB1g2	LMU-4	Shallow (25-50 cm)	Sandy clay	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Maize+Bajra (Mz+Bj)	Not Available	IIIs	Trench cum bunding
Betageri	524	0.61	BDGhB2g2	LMU-1	Shallow (25-50 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIIes	Trench cum bunding
Betageri	525	4.26	HRViB1g2	LMU-4	Shallow (25-50 cm)	Sandy clay	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIIs	Trench cum bunding
Betageri	526	1.95	HRVhB2g2	LMU-4	Shallow (25-50 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIIes	Trench cum bunding
Betageri	527	2.25	HRVhB2g2	LMU-4	Shallow (25-50 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIIes	Trench cum bunding
Betageri	528	6.33	HRVhB2g2	LMU-4	Shallow (25-50 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Bajra (Mz+Bj)	Not Available	IIIes	Trench cum bunding

Village	Survey NO	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	WELLS	Land Capability	Conservation Plan
Betageri	529	3.76	HRVhB2g2	LMU-4	Shallow (25-50 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Groundnut (Mz+Gn)	Not Available	IIIes	Trench cum bunding
Betageri	530	7.81	BDGhB2g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Maize+Groundnut (Bj+Mz+Gn)	Not Available	IIIes	Trench cum bunding
Betageri	531	7.03	BDGhB2g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Maize (Bj+Mz)	Not Available	IIIes	Trench cum bunding
Betageri	532	4.57	BDGhB2g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIIes	Trench cum bunding
Betageri	533	4.09	BDGhB2g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Maize (Bj+Mz)	Not Available	IIIes	Trench cum bunding
Betageri	534	10	BDGhB2g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Bajra (Mz+Bj)	Not Available	IIIes	Trench cum bunding
Betageri	535	6.45	BDGhB2g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	Trench cum bunding
Betageri	536	2.42	HRViB1g2	LMU-4	Shallow (25-50 cm)	Sandy clay	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIIs	Trench cum bunding
Betageri	537	3.15	HRViB1g2	LMU-4	Shallow (25-50 cm)	Sandy clay	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow (Cf)	Not Available	IIIs	Trench cum bunding
Betageri	538	10.26	HRViB1g2	LMU-4	Shallow (25-50 cm)	Sandy clay	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Drumstick (Ds)	Not Available	IIIs	Trench cum bunding
Betageri	539	3.44	HRViB1g2	LMU-4	Shallow (25-50 cm)	Sandy clay	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIIs	Trench cum bunding
Betageri	540	3.07	NGPhB1g1	LMU-1	Deep (100-150 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Bajra (Bj)	Not Available	IIIs	Trench cum bunding
Betageri	541	1.66	HRViB1g2	LMU-4	Shallow (25-50 cm)	Sandy clay	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIIs	Trench cum bunding
Betageri	543	0.64	BDGhB2g2	LMU-1	Moderately deep (75-100 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Bajra (Mz+Bj)	Not Available	IIIes	Trench cum bunding
Betageri	569	0.05	HRVhB2g2	LMU-4	Shallow (25-50 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIIes	Trench cum bunding
Betageri	577	0.13	HRVhB2g2	LMU-4	Shallow (25-50 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Maize (Bj+Mz)	Not Available	IIIes	Trench cum bunding
Betageri	578	0.68	TGRiB2g1	LMU-2	Moderately deep (75-100 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIs	Trench cum bunding
Betageri	579	1.19	TGRiB2g1	LMU-2	Moderately deep (75-100 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut+Maize (Gn+Mz)	Not Available	IIs	Trench cum bunding
Betageri	582	2.02	HRVhB1g2	LMU-4	Shallow (25-50 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIIs	Trench cum bunding
Betageri	583	2.6	HRVhB1g2	LMU-4	Shallow (25-50 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Bajra+Maize (Bj+Mz)	1	IIIs	Trench cum bunding
Betageri	584	1.91	HRVhB1g2	LMU-4	Shallow (25-50 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Bajra+Maize (Bj+Mz)	Not Available	IIIs	Trench cum bunding
Betageri	589	0.37	TGRiB2g1	LMU-2	Moderately deep (75-100 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIs	Trench cum bunding
Bochanahalli	34	1.15	BDGhB2g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Maize (Bj+Mz)	Not Available	IIIes	Trench cum bunding
Bochanahalli	35	11.79	BDGhB2g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Maize (Bj+Mz)	Not Available	IIIes	Trench cum bunding

Village	Survey NO	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	WELLS	Land Capability	Conservation Plan
Bochanahalli	36	1.26	BDGhB2g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	Trench cum bunding
Bochanahalli	37	2.03	BDGhB2g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Maize (Bj+Mz)	Not Available	IIIes	Trench cum bunding
Bochanahalli	38	5.68	BDGhB2g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Maize (Bj+Mz)	Not Available	IIIes	Trench cum bunding
Bochanahalli	39	5.17	BDGhB2g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Maize (Bj+Mz)	Not Available	IIIes	Trench cum bunding
Bochanahalli	40	6.28	CSRiB2	LMU-4	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Maize (Bj+Mz)	Not Available	IIIes	Trench cum bunding
Bochanahalli	41	3.85	CSRiB2	LMU-4	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Maize (Bj+Mz)	Not Available	IIIes	Trench cum bunding
Bochanahalli	45	1.32	CSRiB2	LMU-4	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Sugarcane (Bj+Sc)	Not Available	IIIes	Trench cum bunding
Bochanahalli	46	0.11	CSRiB2	LMU-4	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Bajra (Mz+Bj)	Not Available	IIIes	Trench cum bunding
Maramm anahalli	42	0.05	NGPhB1g1	LMU-1	Deep (100-150 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow+Maize (Cf+Mz)	Not Available	IIIs	Trench cum bunding
Maramm anahalli	51	1.06	NGPhB1g1	LMU-1	Deep (100-150 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Bajra+Current fallow (Bj+Cf)	Not Available	IIIs	Trench cum bunding
Maramm anahalli	52	1.35	HRViB1g2	LMU-4	Shallow (25-50 cm)	Sandy clay	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Maize+Groundnut (Mz+Gn)	Not Available	IIIs	Trench cum bunding
Maramm anahalli	53	0.35	HRViB1g2	LMU-4	Shallow (25-50 cm)	Sandy clay	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow (Cf)	Not Available	IIIs	Trench cum bunding
Maramm anahalli	54	1.07	HRViB1g2	LMU-4	Shallow (25-50 cm)	Sandy clay	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Bajra+Groundnut+Current fallow (Bj+Gn+Cf)	Not Available	IIIs	Trench cum bunding
Maramm anahalli	55	1.05	HRViB1g2	LMU-4	Shallow (25-50 cm)	Sandy clay	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Maize+Bajra (Mz+Bj)	Not Available	IIIs	Trench cum bunding

Appendix II

Bachanahali 3_2Q3c appendix

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
Betageri	408	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	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 (> 2.0 ppm)	Deficient (< 0.6 ppm)
Betageri	443	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	446	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)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	447	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)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	451	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)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	452	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)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	453	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)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	456	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 (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	458	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	459	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Betageri	460	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)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	461	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	462	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Betageri	463	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Betageri	464	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Betageri	465	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Betageri	466	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	467	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Betageri	468	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	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 (> 2.0 ppm)	Deficient (< 0.6 ppm)
Betageri	469	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	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 (> 2.0 ppm)	Deficient (< 0.6 ppm)
Betageri	470	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Betageri	477	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 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
Betageri	478	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Betageri	479	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Betageri	480	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Betageri	481	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	482	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	483	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	484	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	485	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	486	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	Low (<145 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	487	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)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	488	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	489	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	Low (< 23 kg/ha)	Low (<145 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	490	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)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	491	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)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Betageri	493	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)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Betageri	494	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Betageri	495	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 (> 2.0 ppm)	Deficient (< 0.6 ppm)
Betageri	496	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)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Betageri	497	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)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Betageri	498	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)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Betageri	499	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 (> 2.0 ppm)	Deficient (< 0.6 ppm)
Betageri	500	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)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Betageri	501	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Betageri	502	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)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 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
Betageri	503	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)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Betageri	504	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)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	505	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)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	506	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	507	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	508	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	509	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	510	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)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	511	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)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	512	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)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	513	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	514	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)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	515	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)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	516	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)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	517	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)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	518	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)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	519	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)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	520	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)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	521	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	523	Moderately alkaline (pH 7.8 – 8.4)	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)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	524	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)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	525	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)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	526	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	527	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 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
Betageri	528	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)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	529	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)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	530	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)	High (> 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	531	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)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	532	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)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	533	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	534	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)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	535	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)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	536	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)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	537	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	538	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)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	539	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)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Betageri	540	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)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Betageri	541	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	543	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)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	569	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)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	577	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)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	578	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)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	579	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 (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	582	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 (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	583	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)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	584	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 (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Betageri	589	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 (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Bochanahalli	34	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)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 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
Bochanahalli	35	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)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Bochanahalli	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)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Bochanahalli	37	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Bochanahalli	38	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Bochanahalli	39	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Bochanahalli	40	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Bochanahalli	41	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)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Bochanahalli	45	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)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Bochanahalli	46	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)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Marammanahalli	42	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)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Marammanahalli	51	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)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Marammanahalli	52	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 (> 2.0 ppm)	Deficient (< 0.6 ppm)
Marammanahalli	53	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)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Marammanahalli	54	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)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Marammanahalli	55	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)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)

Appendix III

Bachanahali 3_2Q3c appendix

Soil Suitability Information

Village	Survey Number	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	Bengalgram	Sunflower	Redgram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Jasmine	Crossandra	Drumstick	Mulberry
Betageri	408	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg
Betageri	443	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Betageri	446	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Betageri	447	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Betageri	451	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g
Betageri	452	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g
Betageri	453	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g
Betageri	456	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g
Betageri	458	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g
Betageri	459	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg	S3rg	S3rg
Betageri	460	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	N1r	N1r	N1r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Betageri	461	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	N1r	N1r	N1r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Betageri	462	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	N1r	N1r	N1r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Betageri	463	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	N1r	N1r	N1r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Betageri	464	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	N1r	N1r	N1r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Betageri	465	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg
Betageri	466	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg
Betageri	467	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg
Betageri	468	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg
Betageri	469	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg
Betageri	470	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg
Betageri	477	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	N1r	N1r	N1r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Betageri	478	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	N1r	N1r	N1r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Betageri	479	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	N1r	N1r	N1r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Betageri	480	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	N1r	N1r	N1r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Betageri	481	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	N1r	N1r	N1r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Betageri	482	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	N1r	N1r	N1r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Betageri	483	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	N1r	N1r	N1r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Betageri	484	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	N1r	N1r	N1r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Betageri	485	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	N1r	N1r	N1r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Betageri	486	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	N1r	N1r	N1r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Betageri	487	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	N1r	N1r	N1r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Betageri	488	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	N1r	N1r	N1r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Betageri	489	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	N1r	N1r	N1r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Betageri	490	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	N1r	N1r	N1r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Betageri	491	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g
Betageri	493	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g
Betageri	494	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g
Betageri	495	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g

Village	Survey Number	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	Bengalgram	Sunflower	Redgram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Jasmine	Crossandra	Drumstick	Mulberry
Betageri	496	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	N1r	N1r	N1r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Betageri	497	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g
Betageri	498	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Betageri	499	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Betageri	500	S3rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3rg	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g
Betageri	501	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Betageri	502	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g
Betageri	503	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g
Betageri	504	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g
Betageri	505	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g
Betageri	506	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	N1r	N1r	N1r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Betageri	507	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	N1r	N1r	N1r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Betageri	508	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g
Betageri	509	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g
Betageri	510	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g
Betageri	511	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Betageri	512	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Betageri	513	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Betageri	514	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Betageri	515	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Betageri	516	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Betageri	517	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Betageri	518	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Betageri	519	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Betageri	520	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Betageri	521	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Betageri	523	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Betageri	524	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g
Betageri	525	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Betageri	526	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Betageri	527	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Betageri	528	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Betageri	529	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Betageri	530	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g
Betageri	531	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g
Betageri	532	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g
Betageri	533	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g
Betageri	534	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g
Betageri	535	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g
Betageri	536	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Betageri	537	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Betageri	538	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Betageri	539	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg

Village	Survey Number	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	Bengalgram	Sunflower	Redgram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Jasmine	Crossandra	Drumstick	Mulberry
Betageri	540	S3rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3rg	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g
Betageri	541	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Betageri	543	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g
Betageri	569	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Betageri	577	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Betageri	578	S3rz	S2zg	S2rz	S2tz	S2rz	S2rz	S3rz	S2rz	S2z	S2rz	S2rz	S2z	S2rz	S2z	N1tz	S3rz	S2rz	S2z	S2zg	S2zg	S2zg	S2zg	S2rz	S2zg	S2zg	S2rz	S2rz	S2z
Betageri	579	S3rz	S2zg	S2rz	S2tz	S2rz	S2rz	S3rz	S2rz	S2z	S2rz	S2rz	S2z	S2rz	S2z	N1tz	S3rz	S2rz	S2z	S2zg	S2zg	S2zg	S2zg	S2rz	S2zg	S2zg	S2rz	S2rz	S2z
Betageri	582	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Betageri	583	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Betageri	584	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Betageri	589	S3rz	S2zg	S2rz	S2tz	S2rz	S2rz	S3rz	S2rz	S2z	S2rz	S2rz	S2z	S2rz	S2z	N1tz	S3rz	S2rz	S2z	S2zg	S2zg	S2zg	S2zg	S2rz	S2zg	S2zg	S2rz	S2rz	S2z
Bochanahalli	34	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g
Bochanahalli	35	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g
Bochanahalli	36	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g
Bochanahalli	37	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g
Bochanahalli	38	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g
Bochanahalli	39	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g
Bochanahalli	40	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	N1r	N1r	N1r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Bochanahalli	41	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	N1r	N1r	N1r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Bochanahalli	45	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	N1r	N1r	N1r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Bochanahalli	46	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	N1r	N1r	N1r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Marammanahalli	42	S3rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3rg	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g
Marammanahalli	51	S3rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3rg	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g
Marammanahalli	52	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Marammanahalli	53	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Marammanahalli	54	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Marammanahalli	55	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg

PART-B

SOCIO-ECONOMIC STATUS OF FARM HOUSEHOLDS

CONTENTS

LIST OF TABLES

Chapter 1

SALIENT FINDINGS OF THE SURVEY

- *The result indicated that 30 farmers were sampled in Bachanahalli-3 micro-watershed among them 14 (46.67%) were marginal farmers, 5 (16.67%) were small farmers, 9 (30%) were semi medium farmers and 2 (6.67%) were medium farmers.*
- *The data indicated that there were 82 (58.99%) men and 57 (41.01%) were women among the sampled households. The average family size of marginal farmers was 4, small farmer was 4, semi medium farmer was 5, and medium farmers were 4.*
- *The data indicated that 18 (12.95%) people were in 0-15 years of age, 59 (42.45%) were in 16-35 years of age, 50 (35.97 %) were in 36-60 years of age and 12 (8.63%) were above 61 years of age.*
- *The results indicated that the Bachanahalli-3 had 31.65 per cent illiterates, 38.13 per cent of them had primary school education, 2.16 per cent of them had middle school education, 17.99 per cent of them had high school education, 5.04 per cent of them had PUC education, 0.72 per cent of them had ITI, 2.88 per cent of them had degree education and 1.44 per cent of them had other education.*
- *The results indicated that, 100 per cent of households practicing agriculture and only 3.33 per cent of the household heads were doing other work.*
- *The results indicated that agriculture was the major occupation for 59.71 per cent of the household members, 21.58 per cent were agricultural labourers, 2.88 per cent of them were in private sector and 11.51 per cent of them were students and 0.72 percent of households were general labours, doing household industry and artisans respectively.*
- *In case of marginal farmers 61.29 per cent were agriculturist, 16.13 percent were agricultural labour and 12.90 per cent were students. In case of small farmers, 54.55 per cent of the household members were practicing agriculture and 31.82 per cent were agricultural labour and 9.09 per cent of them were students. In case of semi medium farmers 60.87 per cent of the household members were practicing agriculture, 21.74 per cent of them were agricultural labours and 13.04 per cent of them were students. In case of medium farmers, 55.56 per cent of the household members were performing agriculture and 33.33 per cent of them were agricultural labour.*
- *The results showed that 100 per cent of the households have not participated in any local institutions.*
- *The results indicated that 36.67 per cent of the households possess Katcha house, 13.33 per cent of them possess Pucca house and 46.67 per cent of them possess Semi Pacca house. Only 3.33 per cent of them possess Thatched house.*

- *The results showed that 100 per cent of the households possess TV, 66.67 per cent of the households possess mixer grinder, 20 per cent of the households possess bicycle, 66.67 per cent of the households possess motor cycle, 6.67 per cent of the households possess auto and 100 per cent of the households possess mobile phones.*
- *The results showed that the average value of television was Rs. 2,766, mixer grinder was Rs. 1125, bicycle Rs.6433, motor cycle was Rs.34045, Auto was Rs.39000 and mobile phone was Rs.1186.*
- *The results indicated that 26.67 per cent of the households possess bullock cart, 40 per cent of them possess plough, 13.33 cent of the households possess tractor, 43.33 per cent of the households possess sprayer, 90 per cent of them possess weeder, 13.33 per cent of them were possess chaff cutter, 6.67 per cent of them were possess harvester and 16.67 per cent of the households possess Earth remover/Duster.*
- *The results showed that the average value of plough was Rs.1655, the average value of bullock cart was Rs. 21000, the average value of tractor Rs. 312500, the average value of sprayer was Rs.3788, the average value of weeder Rs. 42, the average value of chaff cutter Rs.1187, and the average value of duster was Rs. 19720.*
- *The results indicated that, 33.33 per cent of the households possess bullocks and 6.67 per cent of the households possess local cow and crossbred cow, 10 per cent of the household possess buffalo and 3.33 per cent of the households possess sheep and poultry birds respectively.*
- *In case of marginal farmers, 21.43 per cent of the households possess bullock and 7.14 per cent of the households possess local cow, buffalo and sheep respectively. In case of small farmers, 20 per cent of households possess bullock and crossbred cow correspondingly. In case of semi medium farmers, 44.44 per cent of the households possess bullock, 22.22 per cent possess buffalo and 11.11 per cent possess poultry birds. In medium farmers, 100 per cent of the households possess bullock and 50 per cent possess local cow and crossbred cow respectively.*
- *The results indicated that, average own labour men available in the micro-watershed was 1.87, average own labour (women) available was 1.50, average hired labour (men) available was 10.30 and average hired labour (women) available was 8.30.*
- *In case of marginal farmers, average own labour men available was 1.86, average own labour (women) was 1.29, average hired labour (men) was 6.86 and average hired labour (women) available was 5.43. In case of small farmers, average own labour men available was 1.80, average own labour (women) was 1.40, average hired labour (men) was 13.60 and average hired labour (women) available was 9.60. In case of semi medium farmers, average own labour men*

available was 2, average own labour (women) was 1.78, average hired labour (men) was 15 and average hired labour (women) available was 13.89. In medium farmers average own labour men available was 1.50, average own labour (women) was 2, average hired labour (men) was 5 and average hired labour (women) available was 8.30.

- *The results indicated that, 90 per cent of the household opined that hired labour was adequate and 10 per cent of the household opined that hired labour was inadequate. About 100 per cent of the marginal farmers, 80 per cent of small, 88.89 per cent of semi medium and 50 per cent of the medium have opined that the hired labour was adequate and 20 per cent of small farmers, 11.11 per cent of semi medium farmers and 50 per medium farmers were opined that hired labour was inadequate.*
- *The results indicated that, households of the Bachanahalli-3 micro-watershed possess 17.33 ha (47.84%) of dry land and 18.90 ha (52.16%) of irrigated land. Marginal farmers possess 9.37 ha (91.25 %) of dry land and 0.90 ha (8.75%) of irrigated land. Small farmers possess 2.95 ha (53.28%) of dry land and 2.59 ha (46.72%) of irrigated land. Semi medium farmers possess 12.91 ha (100%) of irrigated land. Medium farmers possess 5.01 ha (66.72%) of dry land and 2.50 ha (33.28%) of irrigated land.*
- *The results indicated that, the average value of dry land was Rs. 369,173.29 and average value of irrigated was Rs. 423,216.96. In case of marginal famers, the average land value was Rs. 490,799.13 for dry land and 1,223,873.86 for irrigated land. In case of small famers, the average land value was Rs. 439,863.03 for dry land Rs. 540,312.49 for irrigated land. In case of semi medium famers, the average land value was Rs.387147.34 for irrigated land. In case of medium famers, the average land value was Rs. 99838.32 for dry land and the average land value was Rs. 200162.07 for irrigated land.*
- *The results indicated that, there were 15 functioning and 2 defunctioning bore wells in the micro-watershed.*
- *The results indicated that, bore well was the major irrigation source for 53.33 per cent of the farmers and 3.33 per cent of the farmers were using canal for irrigation.*
- *The results indicated that on an average the depth of the bore well was 69.70 meters.*
- *The results indicated that, in case of marginal farmers there were 2.75 ha of irrigated land, in case of small farmers there was 3.40 ha of irrigated land, semi medium farmers were having 20.80 ha of irrigated land and medium farmers were having 2.50 ha of irrigated land. On an average there were 29.45 ha of irrigated land.*

- *The results indicated that, farmers have grown Bajra (8.20 ha), Bengal gram (1.85 ha), Cotton (4.05 ha), Sorghum (0.81 ha), Maize (12.76 ha), Red gram (3.03 ha), Sugarcane (2.59 ha) and Sunflower (3.35 ha) in kharif season and Bajra (1.30 ha), Bengal gram (4.14 ha), Cotton (1.21 ha), Maize (1.73 ha) and Sunflower (0.81 ha) in Rabi season.*
- *Marginal farmers have grown Bajra, Bengalgram, Cotton, Sorghum, Maize and Red gram. Small farmers have grown Bajra, cotton, Sugarcane and Sunflower. Semi medium farmers have grown Cotton, Maize, Red gram, Sugarcane and Sunflower. Medium farmers have grown Bajra and maize.*
- *The results indicated that, the cropping intensity in Bachanahalli-3 micro-watershed was found to be 99.69 per cent. In case of Marginal farmers, semi medium farmers and medium farmers it was 100 per cent, and in case of small farmers it was found 97.83 per cent.*
- *The results indicated that, the total cost of cultivation for bajra was Rs. 20833.39. The gross income realized by the farmers was Rs. 24479.15. The net income from bajra cultivation was Rs. 3645.76, thus the benefit cost ratio was found to be 1:1.17.*
- *The results indicated that, the total cost of cultivation for maize was Rs. 38319.32. The gross income realized by the farmers was Rs. 40292.44. The net income from maize cultivation was Rs. 1973.12, thus the benefit cost ratio was found to be 1:1.05.*
- *The results indicated that, the total cost of cultivation for sorghum was Rs. 13240.65. The gross income realized by the farmers was Rs. 38532.00. The net income from sorghum cultivation was Rs. 25291.35. Thus the benefit cost ratio was found to be 1:2.91.*
- *The results indicated that, the total cost of cultivation for bengalgram was Rs. 28575.40. The gross income realized by the farmers was Rs. 85887.53. The net income from bengalgram cultivation was Rs. 57312.12. Thus the benefit cost ratio was found to be 1:3.01.*
- *The results indicated that, the total cost of cultivation for redgram was Rs. 20323.71. The gross income realized by the farmers was Rs. 32403.40. The net income from redgram cultivation was Rs. 12079.69. Thus the benefit cost ratio was found to be 1:1.59.*
- *The results indicated that, the total cost of cultivation for cotton was Rs. 36144.93. The gross income realized by the farmers was Rs. 65076.27. The net income from cotton cultivation was Rs. 28931.33. Thus the benefit cost ratio was found to be 1:1.8.*
- *The results indicated that, the total cost of cultivation for Sunflower was Rs. 30493.76. The gross income realized by the farmers was Rs. 54715.48. The net*

income from Sunflower cultivation was Rs. 24221.72. Thus the benefit cost ratio was found to be 1:1.79.

- *The results indicated that, the total cost of cultivation for Sugarcane was Rs. 568202.98. The gross income realized by the farmers was Rs. 1728897.05. The net income from Sugarcane cultivation was Rs. 1160694.07. Thus the benefit cost ratio was found to be 1:3.04.*
- *The results indicated that, 135 tons of dry fodder was available in micro-watershed for 52 days and 68 tons of green fodder was available for 54 days.*
- *The results indicated that, 18.18 per cent of the households opined that dry fodder was adequate and 24.24 per cent of the households opined that dry fodder was inadequate also the data revealed that 33.33 per cent of the farmers opined that green fodder is adequate and 12.12 per cent of the farmers opined that green fodder is inadequate.*
- *The results indicated that the average income from service/salary was Rs. 9,090.91, business Rs. 4,848.48, wage Rs. 1,696.97, agriculture Rs. 118,028.79 and non farm income Rs. 1,333.33 and dairy farm Rs. 1,298.18.*
- *The results indicated that the average expenditure from service/salary was Rs. 6,666.67, business Rs. 4,545.45, wage Rs. 1,060.61, agriculture Rs. 74,606.06 and dairy farm Rs. 545.45.*
- *The results indicated that, sampled households have grown 45 coconut trees in their field.*
- *The results indicated that, households have planted 76 Neem, 3 Banyan trees and 6 Eucalyptus trees in their field and also grown 3 Neem tree in the backyard.*
- *The results indicated that, Bengal gram, Cotton, Sorghum, Maize, Red gram, Sugarcane and Sunflower were sold to the extent of 100 per cent and only Bajra was sold to the extent of 93.98 per cent.*
- *The results indicated that, 54.29 percent of the households have sold their produce to agents/ traders, 42.86 percent of the households sold their produce in local/village merchant, 51.43 percent of the households sold their produce to regulated market and 2.86 percent of the households sold their produce to cooperative marketing society and outside the state respectively.*
- *. The results indicated that 16.67 per cent of the households have used cart as a mode of transport, 47.22 per cent have used tractor and 27.78 per cent have used Truck and 8.33 households have used head load as a mode of transport.*
- *The results indicated that, 66.67 percent used fire wood, 30.56 percent of the households used LPG and 2.78 percent of the households used Biogas as a source of fuel.*
- *The results indicated that, bore well was the major source for drinking water for 29.73 per cent and 62.16 per cent of households used piped supply water for drinking purpose.*

- *The results indicated that, electricity was the major source of light for 97.30 per cent of the households in micro-watershed.*
- *The results indicated that, 43.24 per cent of the households possess sanitary toilet i.e. 50 per cent of marginal, 30 per cent of small, 50 per cent of semi medium and 33.33 per cent of medium had sanitary toilet facility.*
- *The results indicated that, 91.89 per cent of the sampled households possessed BPL card and 5.41 per cent of the sample households possess APL card.*
- *The results indicated that, 37.84 per cent of the households participated in NREGA programme which included 7.14 percent of the marginal, 10 per cent of the small, 100 per cent of the semi medium and 66.67 percent of the medium farmers.*
- *The results indicated that, cereals, pulses, oilseeds, vegetables, fruits, milk, Egg and meat were adequate for 100 percent, 16.22 percent, 45.95 percent, 43.24 percent, 2.70 percent, 54.05 percent, 43.43 percent, and 43.24 percent of the households respectively.*
- *The results indicated that, cereals, pulses, oilseeds, vegetables, fruits, milk, egg and meat were inadequate for 2.63 per cent, 76.32 per cent, 7.89 per cent, 18.42 per cent, 23.68 per cent, 36.84 per cent, 44.74 per cent and 31.58 per cent of the households respectively.*
- *The data regarding farming constraints experienced by households in Bachanahalli-3 micro-watershed is presented in Table 49. The results indicated that, Lower fertility status of the soil was the constraint experienced by 5.26 per cent of the households, wild animal menace on farm field (42.11%), frequent incidence of pest and diseases (42.11%), inadequacy of irrigation water (15.79%), high cost of Fertilizers and plant protection chemicals (52.63%), high rate of interest on credit (47.37%), low price for the agricultural commodities (13.16%), lack of marketing facilities in the area (52.63%), inadequate extension services (5.26%), lack of transport for safe transport of the agricultural produce to the market (47.37%), less rainfall (100%) and Source of Agri-technology information (Newspaper/TV/Mobile (55.26%).*

Chapter 2

INTRODUCTION

Soil and water are the two precious natural resources which are essential for crop production and existence of life on earth. Rainfed agriculture is under severe stress due to various constraints related to agriculture like uneven and erratic distribution of rainfall, indiscriminate use of fertilizers, chemicals and pesticides, adoption of improper land management practices, soil erosion, decline in soil fertility, decline in ground water resources leading to low crop productivity. The area under rainfed agriculture has to be managed effectively using the best available practices to enhance the production of food, fodder and fuel. This is possible if the land resources are characterized at each parcel of land through detailed land resource inventory using the best available techniques of remote sensing, GPS and GIS. The watershed development programs are aimed at the sustainable distribution of its resources and the process of creating and implementing plans, programs, and projects to sustain and enhance watershed functions that affect the plant, animal and human communities within a watershed boundary.

World Bank funded KWDP II, SUJALA III project was implemented in with Broad objective of demonstrating more effective watershed management through greater integration of programmes related to rain-fed agriculture, innovative and science based approaches and strengthen institutional capacities and If successful, it is expected that the systems and tools could be mainstreamed into the overall IWMP in the State of Karnataka and in time, throughout other IWMP operations in India. With this background the socio-economic survey has been carried out with following specific objectives:

1. To understand the demographic features of the households in the micro-watershed
2. To understand the extent of family labour available and additional employment opportunities available within the village.
3. To know the status of assets of households in the micro-watershed for suggesting possible improvements.
4. To study the cropping pattern, cropped area and productivity levels of different households in micro-watershed.
5. To determine the type and extent of livestock owned by different categories of HHs
6. Availability of fodder and level of livestock management.

Scope and importance of survey

Survey helps in identification of different socio-economic and resource use-patterns of farmers at the Micro watershed. Household survey provides demographic features, labour force, and levels of education; land ownership and asset position (including livestock and other household assets) of surveyed households; and cropping patterns, input intensities, and average crop yields from farmers' fields. It also discusses crop utilization and the degree of commercialization of production in the areas; farmers' access to and utilization of credit from formal and informal sources; and the level of adoption and use of soil, water,and pest management technologies.

Chapter 3

METHODOLOGY

The description of the methods, components selected for the survey and procedures followed in conducting the baseline survey are furnished under the following heads.

Description of the study area

Koppal district is an administrative district in the state of Karnataka in India. In the past Koppal was referred to as 'Kopana Nagara'. Koppal, now a district headquarters is ancient Kopana a major holy place of the Jainas. The district occupies an area of 7,190 km² and has a population of 1,196,089, which 16.58% were urban as of 2001. The Koppal district was formed after split of Raichur district.

Geographers are very particular about the physiography or relief of a region. It plays a very important role in the spatial analysis of agricultural situation of the study area. The undulating topography with black cotton soil shrips, cut across by numerous nalas or streams is the major characteristic feature of the study region. Three physiographic divisions have made considering the local conditions of landforms and crops grown in the district. On the basis of physiography, Koppal district can be divided into three major divisions. They are (a) Koppal & Yelburga plateau, (b) Maidan division, (c) Tungabhadra valley. The district is part of Krishna basin the main streams draining the area are Maskinala, Ilkal-nadi and Hirenala. These are Ephemaral in nature, these come under Tungabhadra sub-basin. The drainage exhibit dentritic to subdentric with drainage density varies from 1.4 to7.0kms/sq.km.

According to the 2011 census Koppal district has a population of 1,391,292, roughly equal to the nation of Swaziland or the US state of Hawaii. This gives it a ranking of 350th in India (out of a total of 640). The district has a population density of 250 inhabitants per square kilometre (650/sq mi). Its population growth rate over the decade 2001-2011 was 16.32%. Koppal has a sex ratio of 983 females for every 1000 males, and a literacy rate of 67.28%.

Description of the micro-watershed

The Bachanahalli-3 micro-watershed (Bettageri sub-watershed, Koppal Taluk and District) is located at North latitude 150 11’ 11.701” and 150 12’ 53.583” and East longitude 760 0’ 50.165” and 760 2’ 25.985” covering an area of 456.2 ha and spread across Bochanahalli, Bettageri and Marammanahalli villages.

Methodology followed in assessing socio-economic status of households

In order to assess the socio-economic condition of the farmers in the watershed a comprehensive questionnaire was prepared. Major components such as demographic conditions, migration details, food consumption and family expenditure pattern, material possession, land holding, land use management, cropping pattern, cost of cultivation of crops, livestock management. The statistical components such as frequency and percentage were used to analyze the data. About 30 households located in the micro-watershed were interviewed for the survey.

Chapter 4

SALIENT FEATURES OF THE SURVEY

This chapter deals with systematic presentation of results of the survey. Keeping in view the objectives, the salient features of the survey are presented under the following headings.

Households sampled for socio-economic survey: The data on households sampled for socio economic survey in Bachanahalli-3 micro-watershed is presented in Table 1 and it indicated that 30 farmers were sampled in Bachanahalli-3 micro-watershed among them 14 (46.67%) were marginal farmers, 5 (16.67%) were small farmers, 9 (30%) were semi medium farmers and 2 (6.67%) were medium farmers.

Table 1: Households sampled for socio economic survey in Bachanahalli-3 micro-watershed

Sl.No.	Particulars	MF (14)		SF (5)		SMF (9)		MDF (2)		All (30)	
		N	%	N	%	N	%	N	%	N	%
1	Farmers	14	46.67	5	16.67	9	30	2	6.67	30	100

Population characteristics: The population characteristics of households sampled for socio-economic survey in Bachanahalli-3 micro-watershed is presented in Table 2. The data indicated that there were 82 (58.99%) men and 57 (41.01%) were women among the sampled households. The average family size of marginal farmers was 4, small farmer was 4, semi medium farmer was 5 and medium farmers were 4.

Table 2: Population characteristics of Bachanahalli-3 micro-watershed

Sl.No.	Particulars	MF (62)		SF (22)		SMF (46)		MDF (9)		All (139)	
		N	%	N	%	N	%	N	%	N	%
1	Male	37	59.68	12	54.55	27	58.70	6	66.67	82	58.99
2	Female	25	40.32	10	45.45	19	41.30	3	33.33	57	41.01
Total		62	100	22	100	46	100	9	100	139	100
Average family size		4		4		5		4		5	

Age wise classification of population: The age wise classification of household members in Bachanahalli-3 micro-watershed is presented in Table 3. The data indicated that 18 (12.95%) people were in 0-15 years of age, 59 (42.45%) were in 16-35 years of age, 50 (35.97 %) were in 36-60 years of age and 12 (8.63%) were above 61 years of age.

Table 3: Age wise classification of household members in Bachanahalli-3 micro-watershed

Sl.No.	Particulars	MF (62)		SF (22)		SMF (46)		MDF (9)		All (139)	
		N	%	N	%	N	%	N	%	N	%
1	0-15 years	7	11.29	2	9.09	8	17.39	1	11.11	18	12.95
2	16-35 years	25	40.32	11	50.00	19	41.30	4	44.44	59	42.45
3	36-60 years	23	37.10	8	36.36	16	34.78	3	33.33	50	35.97
4	> 61 years	7	11.29	1	4.55	3	6.52	1	11.11	12	8.63
Total		62	100	22	100	46	100	9	100	139	100

Education level of household members: Education level of household members in Bachanahalli-3 micro-watershed is presented in Table 4. The results indicated that the Bachanahalli-3 had 31.65 per cent illiterates, 38.13 per cent of them had primary school education, 2.16 per cent of them had middle school education, 17.99 per cent of them had high school education, 5.04 per cent of them had PUC education, 0.72 per cent of them had ITI, 2.88 per cent of them had degree education and 1.44 per cent of them had other education.

Table 4: Education level of household members in Bachanahalli-3 micro-watershed

Sl.No.	Particulars	MF (62)		SF (22)		SMF (46)		MDF (9)		All (139)	
		N	%	N	%	N	%	N	%	N	%
1	Illiterate	22	35.48	4	18.18	16	34.78	2	22.22	44	31.65
2	Primary School	22	35.48	8	36.36	18	39.13	5	55.56	53	38.13
3	Middle School	1	1.61	1	4.55	1	2.17	0	0.00	3	2.16
4	High School	9	14.52	7	31.82	9	19.57	0	0.00	25	17.99
5	PUC	4	6.45	0	0.00	1	2.17	2	22.22	7	5.04
6	ITI	1	1.61	0	0.00	0	0.00	0	0.00	1	0.72
7	Degree	3	4.84	0	0.00	1	2.17	0	0.00	4	2.88
8	Others	0	0.00	2	9.09	0	0.00	0	0.00	2	1.44
Total		62	100	22	100	46	100	9	100	139	100

Occupation of household heads: The data regarding the occupation of the household heads in Bachanahalli-3 micro-watershed is presented in Table 5. The results indicated that, 100 per cent of households practicing agriculture and only 3.33 per cent of the household heads were doing other work.

Table 5: Occupation of household heads in Bachanahalli-3 micro-watershed

Sl.No.	Particulars	MF (14)		SF (5)		SMF (9)		MDF (2)		All (30)	
		N	%	N	%	N	%	N	%	N	%
1	Agriculture	14	100	5	100	9	100	2	100	30	100
2	Others	1	7.14	0	0	0	0	0	0	1	3.33
Total		15	100	5	100	9	100	2	100	31	100

Occupation of the household members: The data regarding the occupation of the household members in Bachanahalli-3 micro-watershed is presented in Table 6. The results indicated that agriculture was the major occupation for 59.71 per cent of the household members, 21.58 per cent were agricultural labourers, 2.88 per cent of them were in private sector and 11.51 per cent of them were students and 0.72 percent of households were general labours, doing household industry and artisans respectively. In case of marginal farmers 61.29 per cent were agriculturist, 16.13 percent were agricultural labour and 12.90 per cent were students. In case of small farmers, 54.55 per cent of the household members were practicing agriculture and 31.82 per cent were agricultural labour and 9.09 per cent of them were students. In case of semi medium farmers 60.87 per cent of the household members were practicing agriculture, 21.74 per cent of them were agricultural labours and 13.04 per cent of them were students. In case of medium farmers, 55.56 per cent of the household members were performing agriculture and 33.33 per cent of them were agricultural labour.

Table 6: Occupation of family members in Bachanahalli-3 micro-watershed

Sl. No.	Particulars	MF (62)		SF (22)		SMF (46)		MDF (9)		All (139)	
		N	%	N	%	N	%	N	%	N	%
1	Agriculture	38	61.29	12	54.55	28	60.87	5	55.56	83	59.71
2	Agricultural Labour	10	16.13	7	31.82	10	21.74	3	33.33	30	21.58
3	General Labour	0	0	0	0	1	2.17	0	0	1	0.72
4	Household industry	1	1.61	0	0	0	0	0	0	1	0.72
5	Artisans	0	0	1	4.55	0	0	0	0	1	0.72
6	Government Service	1	1.61	0	0	0	0	0	0	1	0.72
7	Private Service	3	4.84	0	0	1	2.17	0	0	4	2.88
8	Student	8	12.90	2	9.09	6	13.04	0	0	16	11.51
9	Others	1	1.61	0	0	0	0	0	0	1	0.72
10	Children	0	0	0	0	0	0	1	11.11	1	0.72
Total		62	100	22	100	46	100	9	100	139	100

Institutional participation of the household members: The data regarding the institutional participation of the household members in Bachanahalli-3 micro-watershed is presented in Table 7. The results showed that 100 per cent of the households have not participated in any local institutions.

Table 7: Institutional Participation of household members in Bachanahalli-3 micro-watershed

Sl. No.	Particulars	MF (62)		SF (22)		SMF (46)		MDF (9)		All (139)	
		N	%	N	%	N	%	N	%	N	%
1	No Participation	62	100	22	100	46	100	9	100	139	100
Total		62	100	22	100	46	100	9	100	139	100

Type of house owned: The data regarding the type of house owned by the households in Bachanahalli-3 micro-watershed is presented in Table 8. The results indicated that 36.67 per cent of the households possess Katcha house, 13.33 per cent of them possess Pucca house and 46.67 per cent of them possess Semi Pacca house. Only 3.33 per cent of them possess Thatched house.

Table 8: Type of house owned by households in Bachanahalli-3 micro-watershed

Sl.No.	Particulars	MF (14)		SF (5)		SMF (9)		MDF (2)		All (30)	
		N	%	N	%	N	%	N	%	N	%
1	Thatched	0	0	0	0	1	11.11	0	0	1	3.33
2	Katcha	5	35.71	2	40	2	22.22	2	100	11	36.67
3	Pucca/RCC	2	14.29	0	0	2	22.22	0	0	4	13.33
4	Semi pacca	7	50.00	3	60	4	44.44	0	0	14	46.67
Total		14	100	5	100	9	100	2	100	30	100

Durable Assets owned by the households: The data regarding the Durable Assets owned by the households in Bachanahalli-3 micro-watershed is presented in Table 9. The results showed that 100 per cent of the households possess TV, 66.67 per cent of the households possess mixer grinder, 20 per cent of the households possess bicycle, 66.67 per cent of the households possess motor cycle, 6.67 per cent of the households possess auto and 100 per cent of the households possess mobile phones.

Table 9: Durable Assets owned by households in Bachanahalli-3 micro-watershed

Sl.No.	Particulars	MF (14)		SF (5)		SMF (9)		MDF (2)		All (30)	
		N	%	N	%	N	%	N	%	N	%
1	Television	14	100	5	100	8	88.89	3	33.33	30	100
2	Mixer/Grinder	10	71.43	4	80	5	55.56	1	50	20	66.67
3	Bicycle	4	28.57	0	0	2	22.22	0	0	6	20
4	Motor Cycle	8	57.14	5	100	6	66.67	1	50	20	66.67
5	Auto	0	0	0	0	2	22.22	0	0	2	6.67
6	Mobile Phone	14	100	5	100	9	100	2	100	30	100

Average value of durable assets: The data regarding the average value of durable assets owned by the households in Bachanahalli-3 micro-watershed is presented in Table 10. The results showed that the average value of television was Rs. 2,766, mixer grinder was Rs. 1125, bicycle Rs.6433, motor cycle was Rs.34045, Auto was Rs.39000 and mobile phone was Rs.1186.

Table 10: Average value of durable assets owned by households in Bachanahalli-3 micro-watershed

Average Value (Rs.)

Sl.No.	Particulars	MF (14)	SF (5)	SMF (9)	MDF (2)	All (30)
1	Television	2,428	2,800	2,500	5,000	2,766
2	Mixer/Grinder	1,040	1,125	1,120	2,000	1,125
3	Bicycle	9,300	0	700	0	6,433
4	Motor Cycle	33,750	36,000	27,650	65,000	34,045
5	Auto	0	0	39,000	0	39,000
6	Mobile Phone	814	1,071	1,576	1,750	1,186

Farm Implements owned: The data regarding the farm implements owned by the households in Bachanahalli-3 micro-watershed is presented in Table 11. About 26.67 per cent of the households possess bullock cart, 40 per cent of them possess plough, 13.33 cent of the households possess tractor, 43.33 per cent of the households possess sprayer, 90 per cent of them possess weeder, 13.33 per cent of them were possess chaff cutter, 6.67 per cent of them were possess harvester and 16.67 per cent of the households possess Earth remover/Duster.

Table 11: Farm Implements owned by households in Bachanahalli-3 micro-watershed

Sl.No.	Particulars	MF (14)		SF (5)		SMF (9)		MDF (2)		All (30)	
		N	%	N	%	N	%	N	%	N	%
1	Bullock Cart	3	21.43	1	20	3	33.33	1	50	8	26.67
2	Plough	5	35.71	1	20	6	66.67	0	0	12	40
3	Tractor	0	0	2	40	2	22.22	0	0	4	13.33
4	Sprayer	4	28.57	2	40	7	77.78	0	0	13	43.33
5	Weeder	14	100	4	80	8	88.89	1	50	27	90
6	Harvester	0	0	2	40	0	0	0	0	2	6.67
7	Chaff Cutter	1	7.14	1	20	1	11.11	1	50	4	13.33
8	Earth remover/Duster	1	7.14	2	40	2	22.22	0	0	5	16.67

Average value of farm implements: The data regarding the average value of farm Implements owned by the households in Bachanahalli-3 micro-watershed is presented in

Table 12. The results showed that the average value of plough was Rs.1655, the average value of bullock cart was Rs. 21000, the average value of tractor Rs. 312500, the average value of sprayer was Rs.3788, the average value of weeder Rs. 42, the average value of chaff cutter Rs.1187, and the average value of duster was Rs. 19720.

Table 12: Average value of farm implements owned by households in Bachanahalli-3 micro-watershed (Avg value in Rs)

Sl.No.	Particulars	MF (14)	SF (5)	SMF (9)	MDF (2)	All (30)
1	Bullock Cart	21,666	20,000	19,333	25,000	21,000
2	Plough	1,475	1,500	1,875	0	1,655
3	Tractor	0	325,000	300,000	0	312,500
4	Sprayer	1,900	3,000	5,222	0	3,788
5	Weeder	40	25	53	50	42
6	Harvester	0	24,000	0	0	24,000
7	Chaff Cutter	250	2,000	2,000	500	1,187
8	Earth remover/Duster	600	24,000	25,000	0	19,720

Livestock possession by the households: The data regarding the Livestock possession by the households in Bachanahalli-3 micro-watershed is presented in Table 13. The results indicated that, 33.33 per cent of the households possess bullocks and 6.67 per cent of the households possess local cow and crossbred cow, 10 per cent of the household possess buffalo and 3.33 per cent of the households possess sheep and poultry birds respectively.

In case of marginal farmers, 21.43 per cent of the households possess bullock and 7.14 per cent of the households possess local cow, buffalo and sheep respectively. In case of small farmers, 20 per cent of households possess bullock and crossbred cow correspondingly. In case of semi medium farmers, 44.44 per cent of the households possess bullock, 22.22 per cent possess buffalo and 11.11 per cent possess poultry birds. In medium farmers, 100 per cent of the households possess bullock and 50 per cent possess local cow and crossbred cow respectively.

Table 13: Livestock possession by households in Bachanahalli-3 micro-watershed

Sl.No.	Particulars	MF (14)		SF (5)		SMF (9)		MDF (2)		All (30)	
		N	%	N	%	N	%	N	%	N	%
1	Bullock	3	21.43	1	20	4	44.44	2	100	10	33.33
2	Local cow	1	7.14	0	0	0	0	1	50	2	6.67
3	Crossbred cow	0	0	1	20	0	0	1	50	2	6.67
4	Buffalo	1	7.14	0	0	2	22.22	0	0	3	10
5	Sheep	1	7.14	0	0	0	0	0	0	1	3.33
6	Poultry birds	0	0.00	0	0	1	11.11	0	0	1	3.33
7	blank	9	64.29	2	40	3	33.33	0	0	14	46.67

Average Labour availability: The data regarding the average labour availability in Bachanahalli-3 micro-watershed is presented in Table 14. The results indicated that, average own labour men available in the micro-watershed was 1.87, average own labour

(women) available was 1.50, average hired labour (men) available was 10.30 and average hired labour (women) available was 8.30.

In case of marginal farmers, average own labour men available was 1.86, average own labour (women) was 1.29, average hired labour (men) was 6.86 and average hired labour (women) available was 5.43. In case of small farmers, average own labour men available was 1.80, average own labour (women) was 1.40, average hired labour (men) was 13.60 and average hired labour (women) available was 9.60. In case of semi medium farmers, average own labour men available was 2, average own labour (women) was 1.78, average hired labour (men) was 15 and average hired labour (women) available was 13.89. In medium farmers average own labour men available was 1.50, average own labour (women) was 2, average hired labour (men) was 5 and average hired labour (women) available was 8.30.

Table 14: Average Labour availability in Bachanahalli-3 micro-watershed

Sl.No.	Particulars	MF (14)	SF (5)	SMF (9)	MDF (2)	All (30)
		N	N	N	N	N
1	Own labour Male	1.86	1.80	2.00	1.50	1.87
2	Own Labour Female	1.29	1.40	1.78	2.00	1.50
3	Hired labour Male	6.86	13.60	15.00	5.00	10.30
4	Hired labour Female	5.43	9.60	13.89	0.00	8.30

Adequacy of Hired Labour: The data regarding the adequacy of hired labour in Bachanahalli-3 micro-watershed is presented in Table 15. The results indicated that, 90 per cent of the household opined that hired labour was adequate and 10 per cent of the household opined that hired labour was inadequate. About 100 per cent of the marginal farmers, 80 per cent of small, 88.89 per cent of semi medium and 50 per cent of the medium have opined that the hired labour was adequate and 20 per cent of small farmers, 11.11 per cent of semi medium farmers and 50 per medium farmers were opined that hired labour was inadequate.

Table 15: Adequacy of Hired Labour in Bachanahalli-3 micro-watershed

Sl.No.	Particulars	MF (14)		SF (5)		SMF (9)		MDF (2)		All (30)	
		N	%	N	%	N	%	N	%	N	%
1	Adequate	14	100	4	80	8	88.89	1	50	27	90
2	Inadequate	0	0	1	20	1	11.11	1	50	3	10

Distribution of land (ha): The data regarding the distribution of land (ha) in Bachanahalli-3 micro-watershed is presented in Table 16. The results indicated that, households of the Bachanahalli-3 micro-watershed possess 17.33 ha (47.84%) of dry land and 18.90 ha (52.16%) of irrigated land. Marginal farmers possess 9.37 ha (91.25 %) of dry land and 0.90 ha (8.75%) of irrigated land. Small farmers possess 2.95 ha (53.28%) of dry land and 2.59 ha (46.72%) of irrigated land. Semi medium farmers possess 12.91 ha (100%) of irrigated land. Medium farmers possess 5.01 ha (66.72%) of dry land and 2.50 ha (33.28%) of irrigated land.

Table 16: Distribution of land (Ha) in Bachanahalli-3 micro-watershed

Sl. No.	Particulars	MF (14)		SF (5)		SMF (9)		MDF (2)		All (30)	
		ha	%	ha	%	ha	%	ha	%	ha	%
1	Dry	9.37	91.25	2.95	53.28	0.00	0	5.01	66.72	17.33	47.84
2	Irrigated	0.90	8.75	2.59	46.72	12.91	100	2.50	33.28	18.90	52.16
Total		10.27	100	5.54	100	12.91	100	7.50	100	36.22	100

Average land value (Rs./ha): The data regarding the average land value (Rs./ha) in Bachanahalli-3 micro-watershed is presented in Table 17. The results indicated that, the average value of dry land was Rs. 369,173.29 and average value of irrigated was Rs. 423,216.96. In case of marginal famers, the average land value was Rs. 490,799.13 for dry land and 1,223,873.86 for irrigated land. In case of small famers, the average land value was Rs. 439,863.03 for dry land Rs. 540,312.49 for irrigated land. In case of semi medium famers, the average land value was Rs.387147.34 for irrigated land. In case of medium famers, the average land value was Rs. 99838.32 for dry land and the average land value was Rs. 200162.07 for irrigated land.

Table 17: Average land value (Rs. /ha) in Bachanahalli-3 micro-watershed

Sl.No.	Particulars	MF (14)	SF (5)	SMF (9)	MDF (2)	All (30)
		N	N	N	N	N
1	Dry	490,799.13	439,863.03	0	99,838.32	369,173.29
2	Irrigated	1,223,873.86	540,312.49	387,147.34	200,162.07	423,216.96

Status of bore wells: The data regarding the status of bore wells in Bachanahalli-3 micro-watershed is presented in Table 18. The results indicated that, there were 15 functioning and 2 defunctioning bore wells in the micro-watershed.

Table 18: Status of bore wells in Bachanahalli-3 micro-watershed

Sl.No.	Particulars	MF (14)	SF (5)	SMF (9)	MDF (2)	All (30)
		N	N	N	N	N
1	De-functioning	0	0	1	1	2
2	Functioning	3	3	9	0	15

Source of irrigation: The data regarding the source of irrigation in Bachanahalli-3 micro-watershed is presented in Table 19. The results indicated that, bore well was the major irrigation source for 53.33 per cent of the farmers and 3.33 per cent of the farmers were using canal for irrigation.

Table 19: Source of irrigation in Bachanahalli-3 micro-watershed

Sl.No.	Particulars	MF (14)		SF (5)		SMF (9)		All (30)	
		N	%	N	%	N	%	N	%
1	Bore Well	3	21.43	4	80	9	100	16	53.33
2	Canal	1	7.14	0	0	0	0	1	3.33

Depth of water: The data regarding the depth of water in Bachanahalli-3 micro-watershed is presented in Table 20.The results indicated that on an average the depth of the bore well was 69.70 meters.

Table 20: Depth of water in Bachanahalli-3 micro-watershed

Sl.No.	Particulars	MF (14)	SF (5)	SMF (9)	MDF (2)	All (30)
		N	N	N	N	N
1	Bore Well	29.57	111.56	120.97	15.24	69.70

Irrigated Area (ha): The data regarding the irrigated area (ha) in Bachanahalli-3 micro-watershed is presented in Table 21. The results indicated that, in case of marginal farmers there were 2.75 ha of irrigated land, in case of small farmers there was 3.40 ha of irrigated land, semi medium farmers were having 20.80 ha of irrigated land and medium farmers were having 2.50 ha of irrigated land. On an average there were 29.45 ha of irrigated land.

Table 21: Irrigated Area (ha) in Bachanahalli-3 micro-watershed

Sl.No.	Particulars	MF (14)	SF (5)	SMF (9)	MDF (2)	All (30)
		Area (ha)	Area (ha)	Area (ha)	Area (ha)	Area (ha)
1	Kharif	2.26	2.59	12.91	2.50	20.26
2	Rabi	0.49	0.81	7.89	0.00	9.19
Total		2.75	3.40	20.80	2.50	29.45

Cropping pattern: The data regarding the cropping pattern in Bachanahalli-3 micro-watershed is presented in Table 22. The results indicated that, farmers have grown Bajra (8.20 ha), Bengal gram (1.85 ha), Cotton (4.05 ha), Sorghum (0.81 ha), Maize (12.76 ha), Red gram (3.03 ha), Sugarcane (2.59 ha) and Sunflower (3.35 ha) in kharif season and Bajra (1.30 ha), Bengal gram (4.14 ha), Cotton (1.21 ha), Maize (1.73 ha) and Sunflower (0.81 ha) in Rabi season. Marginal farmers have grown bajra, Bengalgram, Cotton, Sorghum, Maize and Red gram. Small farmers have grown Bajra, cotton, Sugarcane and Sunflower. Semi medium farmers have grown Cotton, Maize, Red gram, Sugarcane and Sunflower. Medium farmers have grown Bajra and maize.

Table 22: Cropping pattern in Bachanahalli-3 micro-watershed Area (ha)

Sl.No.	Particulars	MF (14)	SF (5)	SMF (9)	MDF (2)	All (30)
1	Kharif - Bajra	2.34	3.36	0	2.50	8.20
2	Kharif - Bengal gram	1.85	0	0	0	1.85
3	Kharif - Cotton	1.21	1.62	1.21	0	4.05
4	Kharif - Sorghum	0.81	0	0	0	0.81
5	Kharif - Maize	1.91	0	5.84	5.01	12.76
6	Kharif - Red gram	1.73	0	1.30	0	3.03
7	Kharif - Sugarcane	0	0.97	1.62	0	2.59
8	Kharif - Sunflower	0.40	0	2.95	0	3.35
9	Rabi - Bengal gram	0.49	0	3.64	0	4.14
10	Rabi - Cotton	0	0	1.21	0	1.21
11	Rabi - Maize	0	0	1.73	0	1.73
12	Rabi - Bajra	0	0	1.30	0	1.30
13	Rabi - Sunflower	0	0.81	0	0	0.81
Total		10.77	6.76	20.80	7.51	45.83

Cropping intensity: The data regarding the cropping intensity in Bachanahalli-3 micro-watershed is presented in Table 23. The results indicated that, the cropping intensity in Bachanahalli-3 micro-watershed was found to be 99.69 per cent. In case of Marginal farmers, semi medium farmers and medium farmers it was 100 per cent, and in case of small farmers it was found 97.83 per cent.

Table 23: Cropping intensity (%) in Bachanahalli-3 micro-watershed

Sl.No.	Particulars	MF (14)	SF (5)	SMF (10)	MDF (2)	All (31)
1	Cropping Intensity	100	97.83	100	100	99.69

Cost of Cultivation of Bajra: The data regarding the cost of cultivation of groundnut in Bachanahalli-3 micro-watershed is presented in Table 24. The results indicated that, the total cost of cultivation for bajra was Rs. 20833.39. The gross income realized by the farmers was Rs. 24479.15. The net income from bajra cultivation was Rs. 3645.76, thus the benefit cost ratio was found to be 1:1.17.

Table 24: Cost of Cultivation of Bajra in Bachanahalli-3 micro-watershed

Sl. No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	23.29	4819.37	23.13
2	Bullock		Pairs/day	2.22	1211.48	5.82
3	Tractor		Hours	2.46	1742.17	8.36
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	9.17	1138.37	5.46
6	Seed Inter Crop		Kgs.	0.00	0.00	0.00
7	FYM		Quintal	1.80	1802.92	8.65
8	Fertilizer + micronutrients		Quintal	4.24	3660.31	17.57
9	Pesticides (PPC)		Kgs / ltrs	0.00	0.00	0.00
10	Irrigation		Number	2.46	0.00	0.00
11	Depreciation charges			0.00	51.33	0.25
12	Land revenue and Taxes			0.00	106.72	0.51
II	**Cost B1**					
13	Interest on working capital				792.49	3.80
14	**Cost B1 = (Cost A1 + sum of 15 and 16)**				15325.17	73.56
III	**Cost B2**					
15	Rental Value of Land				341.67	1.64
16	**Cost B2 = (Cost B1 + Rental value)**				15666.84	75.20
IV	**Cost C1**					
17	Family Human Labour			16.40	3270.11	15.70
18	**Cost C1 = (Cost B2 + Family Labour)**				18936.95	90.90
V	**Cost C2**					
19	Risk Premium				2.50	0.01
20	**Cost C2 = (Cost C1 + Risk Premium)**				18939.45	90.91
VI	**Cost C3**					
21	Managerial Cost				1893.94	9.09
22	**Cost C3 = (Cost C2 + Managerial Cost)**				20833.39	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		15.99	24479.15	
		b) Main Crop Sales Price (Rs.)			1531.25	
b.	Gross Income (Rs.)				24479.15	
c.	Net Income (Rs.)				3645.76	
d.	Cost per Quintal (Rs./q.)				1303.20	
e.	Benefit Cost Ratio (BC Ratio)				1:1.17	

Cost of Cultivation of Maize: The data regarding the cost of cultivation of maize in Bachanahalli-3 micro-watershed is presented in Table 25. The results indicated that, the total cost of cultivation for maize was Rs. 38319.32. The gross income realized by the farmers was Rs. 40292.44. The net income from maize cultivation was Rs. 1973.12, thus the benefit cost ratio was found to be 1:1.05.

Table 25: Cost of Cultivation of Maize in Bachanahalli-3 micro-watershed

Sl.No	Particulars		Units	Phy Units	Value (Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	19.92	3415.26	8.91
2	Bullock		Pairs/day	2.00	1012.62	2.64
3	Tractor		Hours	3.29	2340.25	6.11
4	Machinery		Hours	0.16	148.91	0.39
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	19.09	2589.96	6.76
6	FYM		Quintal	1.28	2271.40	5.93
7	Fertilizer + micronutrients		Quintal	8.20	5949.39	15.53
8	Pesticides (PPC)		Kgs / ltrs	0.72	649.10	1.69
9	Irrigation		Number	8.20	0.00	0.00
10	Depreciation charges			0.00	1262.41	3.29
11	Land revenue and Taxes			0.00	44.79	0.12
II	**Cost B1**					
12	Interest on working capital				1376.48	3.59
13	**Cost B1 = (Cost A1 + sum of 15 and 16)**				21060.56	54.96
III	**Cost B2**					
14	Rental Value of Land				239.39	0.62
15	**Cost B2 = (Cost B1 + Rental value)**				21299.95	55.59
IV	**Cost C1**					
16	Family Human Labour			61.94	13524.97	35.30
17	**Cost C1 = (Cost B2 + Family Labour)**				34824.92	90.88
V	**Cost C2**					
18	Risk Premium				10.82	0.03
19	**Cost C2 = (Cost C1 + Risk Premium)**				34835.74	90.91
VI	**Cost C3**					
20	Managerial Cost				3483.57	9.09
21	**Cost C3 = (Cost C2 + Managerial Cost)**				38319.32	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		26.74	39836.21	
		b) Main Crop Sales Price (Rs.)			1490.00	
	By Product	e) Main Product (q)		0.79	456.23	
		f) Main Crop Sales Price (Rs.)			580.00	
b.	Gross Income (Rs.)				40292.44	
c.	Net Income (Rs.)				1973.12	
d.	Cost per Quintal (Rs./q.)				1433.26	
e.	Benefit Cost Ratio (BC Ratio)				1:1.05	

Cost of cultivation of Sorghum: The data regarding the cost of cultivation of sorghum in Bachanahalli-3 micro-watershed is presented in Table 26. The results indicated that, the total cost of cultivation for sorghum was Rs. 13240.65. The gross income realized by the farmers was Rs. 38532.00. The net income from sorghum cultivation was Rs. 25291.35. Thus the benefit cost ratio was found to be 1:2.91.

Table 26: Cost of Cultivation of Sorghum in Bachanahalli-3 micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	9.88	1482.00	11.19
2	Bullock		Pairs/day	4.94	2470.00	18.65
3	Tractor		Hours	0.00	0.00	0.00
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	7.41	666.90	5.04
6	FYM		Quintal	0.00	0.00	0.00
7	Fertilizer + micronutrients		Quintal	2.47	2470.00	18.65
8	Pesticides (PPC)		Kgs /ltrs	0.00	0.00	0.00
9	Irrigation		Number	0.00	0.00	0.00
10	Depreciation charges			0.00	652.08	4.92
11	Land revenue and Taxes			0.00	2.47	0.02
II	**Cost B1**					
12	Interest on working capital				376.67	2.84
13	**Cost B1 = (Cost A1 + sum of 15 and 16)**				8120.12	61.33
III	**Cost B2**					
14	Rental Value of Land				333.33	2.52
15	**Cost B2 = (Cost B1 + Rental value)**				8453.45	63.84
IV	**Cost C1**					
16	Family Human Labour			19.76	3581.50	27.05
17	**Cost C1 = (Cost B2 + Family Labour)**				12034.95	90.89
V	**Cost C2**					
18	Risk Premium				2.00	0.02
19	**Cost C2 = (Cost C1 + Risk Premium)**				12036.95	90.91
VI	**Cost C3**					
20	Managerial Cost				1203.70	9.09
21	**Cost C3 = (Cost C2 + Managerial Cost)**				13240.65	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		16.06	38532.00	
		b) Main Crop Sales Price (Rs.)			2400.00	
b.	Gross Income (Rs.)				38532.00	
c.	Net Income (Rs.)				25291.35	
d.	Cost per Quintal (Rs./q.)				824.71	
e.	Benefit Cost Ratio (BC Ratio)				1:2.91	

Cost of cultivation of Bengalgram: The data regarding the cost of cultivation of bengalgram in Bachanahalli-3 micro-watershed is presented in Table 27. The results indicated that, the total cost of cultivation for bengalgram was Rs. 28575.40. The gross income realized by the farmers was Rs. 85887.53. The net income from bengalgram cultivation was Rs. 57312.12. Thus the benefit cost ratio was found to be 1:3.01.

Table 27: Cost of Cultivation of Bengalgram in Bachanahalli-3 micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	24.33	3332.25	11.66
2	Bullock		Pairs/day	1.75	782.51	2.74
3	Tractor		Hours	1.21	972.12	3.40
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	106.71	8307.24	29.07
6	FYM		Quintal	0.00	0.00	0.00
7	Fertilizer + micronutrients		Quintal	5.16	4092.90	14.32
8	Pesticides (PPC)		Kgs / ltrs	1.45	1292.51	4.52
9	Irrigation		Number	11.12	0.00	0.00
10	Depreciation charges			0.00	939.22	3.29
11	Land revenue and Taxes			0.00	1.65	0.01
II	**Cost B1**					
12	Interest on working capital				1643.24	5.75
13	**Cost B1 = (Cost A1 + sum of 15 and 16)**				21363.64	74.76
III	**Cost B2**					
14	Rental Value of Land				366.67	1.28
15	**Cost B2 = (Cost B1 + Rental value)**				21730.30	76.05
IV	**Cost C1**					
16	Family Human Labour			21.20	4246.34	14.86
17	**Cost C1 = (Cost B2 + Family Labour)**				25976.64	90.91
V	**Cost C2**					
18	Risk Premium				1.00	0.00
19	**Cost C2 = (Cost C1 + Risk Premium)**				25977.64	90.91
VI	**Cost C3**					
20	Managerial Cost				2597.76	9.09
21	**Cost C3 = (Cost C2 + Managerial Cost)**				28575.40	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		18.32	85018.42	
		b) Main Crop Sales Price (Rs.)			4641.67	
	By Product	e) Main Product (q)		1.11	869.10	
		f) Main Crop Sales Price (Rs.)			783.33	
b.	Gross Income (Rs.)				85887.53	
c.	Net Income (Rs.)				57312.12	
d.	Cost per Quintal (Rs./q.)				1560.10	
e.	Benefit Cost Ratio (BC Ratio)				1:3.01	

Cost of cultivation of Redgram: The data regarding the cost of cultivation of redgram in Bachanahalli-3 micro-watershed is presented in Table 28. The results indicated that, the total cost of cultivation for redgram was Rs. 20323.71. The gross income realized by the farmers was Rs. 32403.40. The net income from redgram cultivation was Rs. 12079.69. Thus the benefit cost ratio was found to be 1:1.59.

Table 28: Cost of Cultivation of Redgram in Bachanahalli-3 micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	10.30	1638.00	8.06
2	Bullock		Pairs/day	1.39	762.49	3.75
3	Tractor		Hours	1.65	1179.66	5.80
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	5.36	556.78	2.74
6	FYM		Quintal	0.00	0.00	0.00
7	Fertilizer + micronutrients		Quintal	7.21	6118.32	30.10
8	Pesticides (PPC)		Kgs / ltrs	1.03	824.06	4.05
9	Irrigation		Number	7.72	0.00	0.00
10	Depreciation charges			0.00	241.50	1.19
11	Land revenue and Taxes			0.00	2.74	0.01
II	**Cost B1**					
12	Interest on working capital				900.14	4.43
13	**Cost B1 = (Cost A1 + sum of 15 and 16)**				12223.69	60.14
III	**Cost B2**					
14	Rental Value of Land				333.33	1.64
15	**Cost B2 = (Cost B1 + Rental value)**				12557.02	61.79
IV	**Cost C1**					
16	Family Human Labour			32.55	5917.08	29.11
17	**Cost C1 = (Cost B2 + Family Labour)**				18474.10	90.90
V	**Cost C2**					
18	Risk Premium				2.00	0.01
19	**Cost C2 = (Cost C1 + Risk Premium)**				18476.10	90.91
VI	**Cost C3**					
20	Managerial Cost				1847.61	9.09
21	**Cost C3 = (Cost C2 + Managerial Cost)**				20323.71	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		6.80	32403.40	
		b) Main Crop Sales Price (Rs.)			4766.67	
b.	Gross Income (Rs.)				32403.40	
c.	Net Income (Rs.)				12079.69	
d.	Cost per Quintal (Rs./q.)				2989.70	
e.	Benefit Cost Ratio (BC Ratio)				1:1.59	

Cost of cultivation of Cotton: The data regarding the cost of cultivation of cotton in Bachanahalli-3 micro-watershed is presented in Table 29. The results indicated that, the total cost of cultivation for cotton was Rs. 36144.93. The gross income realized by the farmers was Rs. 65076.27. The net income from cotton cultivation was Rs. 28931.33. Thus the benefit cost ratio was found to be 1:1.8.

Table 29: Cost of Cultivation of Cotton in Bachanahalli-3 micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	32.85	5413.42	14.98
2	Bullock		Pairs/day	2.06	1029.17	2.85
3	Tractor		Hours	0.74	444.60	1.23
4	Machinery		Hours	0.25	247.00	0.68
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	4.78	4536.57	12.55
6	FYM		Quintal	2.33	2332.78	6.45
7	Fertilizer + micronutrients		Quintal	6.50	5430.71	15.02
8	Pesticides (PPC)		Kgs / liters	1.32	1202.07	3.33
9	Irrigation		Number	9.16	0.00	0.00
10	Depreciation charges			0.00	2716.01	7.51
11	Land revenue and Taxes			0.00	5.76	0.02
II	**Cost B1**					
12	Interest on working capital				1644.25	4.55
13	**Cost B1 = (Cost A1 + sum of 15 and 16)**				25002.33	69.17
III	**Cost B2**					
14	Rental Value of Land				386.67	1.07
15	**Cost B2 = (Cost B1 + Rental value)**				25389.00	70.24
IV	**Cost C1**					
16	Family Human Labour			33.59	7270.03	20.11
17	**Cost C1 = (Cost B2 + Family Labour)**				32659.03	90.36
V	**Cost C2**					
18	Risk Premium				200.00	0.55
19	**Cost C2 = (Cost C1 + Risk Premium)**				32859.03	90.91
VI	**Cost C3**					
20	Managerial Cost				3285.90	9.09
21	**Cost C3 = (Cost C2 + Managerial Cost)**				36144.93	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		13.17	65076.27	
		b) Main Crop Sales Price (Rs.)			4940.00	
b.	Gross Income (Rs.)				65076.27	
c.	Net Income (Rs.)				28931.33	
d.	Cost per Quintal (Rs./q.)				2743.80	
e.	Benefit Cost Ratio (BC Ratio)				1:1.8	

Cost of cultivation of Sunflower: The data regarding the cost of cultivation of Sunflower in Bachanahalli-3 micro-watershed is presented in Table 30. The results indicated that, the total cost of cultivation for Sunflower was Rs. 30493.76. The gross income realized by the farmers was Rs. 54715.48. The net income from Sunflower cultivation was Rs. 24221.72. Thus the benefit cost ratio was found to be 1:1.79.

Table 30: Cost of Cultivation of Sunflower in Bachanahalli-3 micro-watershed

Sl.No	Particulars		Units	Phy Units	Value (Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	22.95	3694.00	12.11
2	Bullock		Pairs/day	2.39	1223.94	4.01
3	Tractor		Hours	1.54	1045.25	3.43
4	Machinery		Hours	0.15	90.92	0.30
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	4.72	3061.08	10.04
6	FYM		Quintal	2.31	790.50	2.59
7	Fertilizer + micronutrients		Quintal	7.43	6240.41	20.46
8	Pesticides (PPC)		Kgs / ltrs	1.17	1218.74	4.00
9	Irrigation		Number	8.56	0.00	0.00
10	Depreciation charges			0.00	3343.78	10.97
11	Land revenue and Taxes			0.00	4.61	0.02
II	**Cost B1**					
12	Interest on working capital				1357.57	4.45
13	**Cost B1 = (Cost A1 + sum of 15 and 16)**				22070.79	72.38
III	**Cost B2**					
14	Rental Value of Land				373.33	1.22
15	**Cost B2 = (Cost B1 + Rental value)**				22444.12	73.60
IV	**Cost C1**					
16	Family Human Labour			25.17	5275.08	17.30
17	**Cost C1 = (Cost B2 + Family Labour)**				27719.20	90.90
V	**Cost C2**					
18	Risk Premium				2.40	0.01
19	**Cost C2 = (Cost C1 + Risk Premium)**				27721.60	90.91
VI	**Cost C3**					
20	Managerial Cost				2772.16	9.09
21	**Cost C3 = (Cost C2 + Managerial Cost)**				30493.76	100.0
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		12.00	54715.48	
		b) Main Crop Sales Price (Rs.)			4560.00	
b.	Gross Income (Rs.)				54715.48	
c.	Net Income (Rs.)				24221.72	
d.	Cost per Quintal (Rs./q.)				2541.36	
e.	Benefit Cost Ratio (BC Ratio)				1:1.79	

Cost of cultivation of Sugarcane: The data regarding the cost of cultivation of Sugarcane in Bachanahalli-3 micro-watershed is presented in Table 31. The results indicated that, the total cost of cultivation for Sugarcane was Rs. 568202.98. The gross income realized by the farmers was Rs. 1728897.05. The net income from Sugarcane cultivation was Rs. 1160694.07. Thus the benefit cost ratio was found to be 1:3.04.

Table 31: Cost of Cultivation of Sugarcane in Bachanahalli-3 micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	39.31	6494.04	1.14
2	Bullock		Pairs/day	0.00	0.00	0.00
3	Tractor		Hours	2.16	1451.12	0.26
4	Machinery		Hours	0.31	308.75	0.05
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	17290.00	432249.98	76.07
6	FYM		Quintal	1.24	1235.00	0.22
7	Fertilizer + micronutrients		Quintal	12.35	10013.79	1.76
8	Pesticides (PPC)		Kgs / ltrs	1.13	905.67	0.16
9	Irrigation		Number	13.28	0.00	0.00
10	Depreciation charges			0.00	5111.87	0.90
11	Land revenue and Taxes			0.00	7.82	0.00
II	**Cost B1**					
12	Interest on working capital				53328.65	9.39
13	**Cost B1 = (Cost A1 + sum of 15 and 16)**				511106.70	89.95
III	**Cost B2**					
14	Rental Value of Land				366.67	0.06
15	**Cost B2 = (Cost B1 + Rental value)**				511473.37	90.02
IV	**Cost C1**					
16	Family Human Labour			26.66	5073.79	0.89
17	**Cost C1 = (Cost B2 + Family Labour)**				516547.16	90.91
V	**Cost C2**					
18	Risk Premium				1.00	0.00
19	**Cost C2 = (Cost C1 + Risk Premium)**				516548.16	90.91
VI	**Cost C3**					
20	Managerial Cost				51654.82	9.09
21	**Cost C3 = (Cost C2 + Managerial Cost)**				568202.98	100.0
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		1615.7	1728897.05	
		b) Main Crop Sales Price (Rs.)			1070.00	
b.	Gross Income (Rs.)				1728897.05	
c.	Net Income (Rs.)				1160694.07	
d.	Cost per Quintal (Rs./q.)				351.66	
e.	Benefit Cost Ratio (BC Ratio)				1:3.04	

Fodder availability: The data regarding the fodder availability in Bachanahalli-3 micro-watershed is presented in Table 32. The results indicated that, 135 tons of dry fodder was available in micro-watershed for 52 days and 68 tons of green fodder was available for 54 days.

Table 32: Fodder availability in Bachanahalli-3 micro-watershed

Sl. No.	Particulars	MF (14)		SF (6)		SMF (10)		MDF (2)		All (32)	
		Q(t)	D(days)	Q(t)	D(days)	Q(t)	D(days)	Q(t)	D(days)	Q(t)	D(days)
1	Dry Fodder	13	25	8	31	28	79	86	175	135	52
2	Green Fodder	14	35	6	33	33	75	15	180	68	54

Adequacy of fodder: The data regarding the adequacy of fodder in Bachanahalli-3 micro-watershed is presented in Table 33. The results indicated that, 18.18 per cent of the households opined that dry fodder was adequate and 24.24 per cent of the households opined that dry fodder was inadequate also the data revealed that 33.33 per cent of the farmers opined that green fodder is adequate and 12.12 per cent of the farmers opined that green fodder is inadequate.

Table 33: Adequacy of fodder in Bachanahalli-3 micro-watershed

Sl.No.	Particulars	MF (14)		SF (7)		SMF(10)		MDF (2)		All (33)	
		N	%	N	%	N	%	N	%	N	%
1	Adequate-Dry Fodder	4	28.57	0	0	2	20	0	0	6	18.18
2	Inadequate-Dry Fodder	0	0	2	28.57	4	40	2	100	8	24.24
3	Adequate-Green Fodder	5	35.71	0	0	4	40	2	100	11	33.33
4	Inadequate-Green Fodder	0	0	2	28.57	2	20	0	0	4	12.12

Average Annual gross income of households: The results of the overall average annual gross income of the household in Bachanahalli-3 were presented in Table 34. The results indicated that the average income from service/salary was Rs. 9,090.91, business Rs. 4,848.48, wage Rs. 1,696.97, agriculture Rs. 118,028.79 and non farm income Rs. 1,333.33 and dairy farm Rs. 1,298.18.

Table 34: Average Annual gross income of households in Bachanahalli-3 micro-watershed (Avg value in Rs.)

Sl.No.	Particulars	MF (14)	SF (7)	SMF (10)	MDF (2)	All (33)
		Rs.	Rs.	Rs.	Rs.	Rs.
1	Service/salary	7,142.86	14,285.71	10,000	0	9,090.91
2	Business	9,285.71	0	0	15,000	4,848.48
3	Wage	3,571.43	0	600	0	1,696.97
4	Agriculture	97,164.29	104,321.43	165,540	74,500	118,028.79
5	Non Farm income	0	1,714.29	3,200	0	1,333.33
6	Dairy Farm	0	3,600	1,764	0	1,298.18
	Income(Rs.)	117,164.29	123,921.43	181,104.00	89,500	136,296.67

Average Annual expenditure of households: The results of the overall average annual expenditure of the household in Bachanahalli-3 were presented in Table 35. The results

indicated that the average expenditure from service/salary was Rs. 6,666.67, business Rs. 4,545.45, wage Rs. 1,060.61, agriculture Rs. 74,606.06 and dairy farm Rs. 545.45.

Table 35: Average Annual expenditure of households in Bachanahalli-3 micro-watershed (Avg value in Rs.)

Sl.No.	Particulars	MF (14)	SF (7)	SMF (10)	MDF (2)	All (33)
		Rs.	Rs.	Rs.	Rs.	Rs.
1	Service/salary	80,000	30,000	80,000	0	6,666.67
2	Business	50,000	40,000	0	5,000	4,545.45
3	Wage	35,000	0	0	0	1,060.61
4	Agriculture	66,928.57	62,857.14	94,090.91	25,000	74,606.06
5	Dairy Farm	0	10,000	8,000	0	545.45
Total		231,928.57	142,857.14	182,090.91	30,000	586,876.62
Average		16,566.33	20,408.16	18,209.09	15,000	17,784.14

Horticulture species grown: The data regarding horticulture species grown in Bachanahalli-3 micro-watershed is presented in Table 36. The results indicated that, sampled households have grown 45 coconut trees in their field.

Table 36: Horticulture species grown in Bachanahalli-3 micro-watershed

Sl. No.	Particulars	MF (14)		SF (7)		SMF (10)		All (33)	
		F	B	F	B	F	B	F	B
1	Coconut	20	0	10	0	15	0	45	0

Forest species grown: The data regarding forest species grown in Bachanahalli-3 micro-watershed is presented in Table 37. The results indicated that, households have planted 76 Neem, 3 Banyan trees and 6 Eucalyptus trees in their field and also grown 3 Neem tree in the backyard.

Table 37: Forest species grown in Bachanahalli-3 micro-watershed

Sl.No.	Particulars	MF (14)		SF (7)		SMF (10)		MDF (2)		All (33)	
		F	B	F	B	F	B	F	B	F	B
1	Eucalyptus	0	0	0	0	0	0	6	0	6	0
2	Neem	14	0	19	0	23	2	20	1	76	3
3	Banyan	2	0	0	0	1	0	0	0	3	0

Marketing of the agricultural produce: The data regarding marketing of the agricultural produce in Bachanahalli-3 micro-watershed is presented in Table 38. The results indicated that, Bengal gram, Cotton, Sorghum, Maize, Red gram, Sugarcane and Sunflower were sold to the extent of 100 per cent and only Bajra was sold to the extent of 93.98 per cent.

Marketing Channels used for sale of agricultural produce: The data regarding marketing channels used for sale of agricultural produce in Bachanahalli-3 micro-watershed is presented in Table 39. The results indicated that, 54.29 percent of the households have sold their produce to agents/ traders, 42.86 percent of the households

sold their produce in local/village merchant, 51.43 percent of the households sold their produce to regulated market and 2.86 percent of the households sold their produce to cooperative marketing society and outside the state respectively.

Table 38: Marketing of the agricultural produce in Bachanahalli-3 micro-watershed

Sl. No	Crops	Output obtained (q)	Output retained (q)	Output sold (q)	Output sold (%)	Avg. Price obtained (Rs/q)
1	Bajra	216	13.0	203	93.98	1490
2	Bengal Gram	132	132	132	100	3956.25
3	Cotton	59	0	59	100	4940
4	Sorghum	13	0	13	100	2400
5	Maize	362	362	362	100	827.78
6	Red Gram	21	0	21.0	100	4766.67
7	Sugarcane	4100	0	4100	100	1070
8	Sunflower	71	0	71	100	4560

Table 39: Marketing Channels used for sale of agricultural produce in Bachanahalli-3 micro-watershed

Sl. No.	Particulars	MF (14)		SF (9)		SMF (10)		MDF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%
1	Agent/Traders	9	64.29	2	22.22	8	80	0	0	19	54.29
2	Local/village Merchant	5	35.71	2	22.22	8	80	0	0	15	42.86
3	Regulated Market	1	7.14	6	66.67	9	90	2	100	18	51.43
4	Cooperative marketing Society	0	0.00	1	11.11	0		0	0	1	2.86
5	Outside the State	0	0	0	0	1	1	0	0	1	2.86

Mode of transport of agricultural produce: The data regarding mode of transport of agricultural produce in Bachanahalli-3 micro-watershed is presented in Table 40. The results indicated that 22.22 per cent of the households have used cart as a mode of transport, 94.44 per cent have used tractor and 25 per cent have used Truck and 8.33 households have used head load as a mode of transport.

Table 41: Mode of transport of agricultural produce in Bachanahalli-3 micro-watershed

Sl.No.	Particulars	MF (14)		SF (9)		SMF (10)		MDF (3)		All (36)	
		N	%	N	%	N	%	N	%	N	%
1	Head Load	3	21.43	0	0	0	0	0	0	3	8.33
2	Cart	6	42.86	0	0	2	20	0	0	8	22.22
3	Tractor	6	42.86	10	111.11	16	160	2	66.67	34	94.44
4	Truck	0	0	1	11.11	8	80	0	0	9	25

Usage pattern of fuel for domestic use: The data regarding usage pattern of fuel for domestic use in Bachanahalli-3 micro-watershed is presented in Table 41. The results indicated that, 66.67 percent used fire wood, 30.56 percent of the households used LPG and 2.78 percent of the households used Biogas as a source of fuel.

Table 41: Usage pattern of fuel for domestic use in Bachanahalli-3 micro-watershed

Sl.No.	Particulars	MF (14)		SF (9)		SMF (10)		MDF (3)		All (36)	
		N	%	N	%	N	%	N	%	N	%
1	Fire Wood	12	85.71	5	55.56	4	40	3	100	24	66.67
2	Biogas	0	0	1	11.11	0	0	0	0	1	2.78
3	LPG	3	21.43	3	33.33	5	50	0	0	11	30.56

Source of drinking water: The data regarding source of drinking water in Bachanahalli-3 micro-watershed is presented in Table 42. The results indicated that, bore well was the major source for drinking water for 62.16 per cent and 29.73 per cent of households were used piped supply water for drinking purpose.

Table 42: Source of drinking water in Bachanahalli-3 micro-watershed

Sl.No.	Particulars	MF (14)		SF (10)		SMF (10)		MDF (3)		All (37)	
		N	%	N	%	N	%	N	%	N	%
1	Piped supply	7	50	2	20.00	1	10	1	33.33	11	29.73
2	Bore Well	7	50	7	70.00	7	70	2	66.67	23	62.16

Source of light: The data regarding source of light in Bachanahalli-3 micro-watershed is presented in Table 43. The results indicated that, electricity was the major source of light for 97.30 per cent of the households in micro-watershed.

Table 43: Source of light in Bachanahalli-3 micro-watershed

Sl.No.	Particulars	MF (14)		SF (10)		SMF (10)		MDF (3)		All (37)	
		N	%	N	%	N	%	N	%	N	%
1	Electricity	14	100	9	90	10	100	3	100	36	97.30

Existence of Sanitary toilet facility: The data regarding existence of sanitary toilet facilit**y** in Bachanahalli-3 micro-watershed is presented in Table 44. The results indicated that, 43.24 per cent of the households possess sanitary toilet i.e. 50 per cent of marginal, 30 per cent of small, 50 per cent of semi medium and 33.33 per cent of medium had sanitary toilet facility.

Table 44: Existence of Sanitary toilet facility in Bachanahalli-3 micro-watershed

Sl.No.	Particulars	MF (14)		SF (10)		SMF (10)		MDF (3)		All (37)	
		N	%	N	%	N	%	N	%	N	%
1	Sanitary toilet facility	7	50	3	30	5	50	1	33.33	16	43.24

Possession of PDS card: The data regarding possession of PDS card in Bachanahalli-3 micro-watershed is presented in Table 45. The results indicated that, 91.89 per cent of the sampled households possessed BPL card and 5.41 per cent of the sample households possess APL card.

Table 45: Possession of PDS card in Bachanahalli-3 micro-watershed

Sl.No.	Particulars	MF (14)		SF (10)		SMF (10)		MDF (3)		All (37)	
		N	%	N	%	N	%	N	%	N	%
1	APL	0	0	1	10	1	10	0	0	2	5.41
2	BPL	14	100	8	80	9	90	3	100	34	91.89

Participation in NREGA programme: The data regarding participation in NREGA programme in Bachanahalli-3 micro-watershed is presented in Table 46. The results indicated that, 37.84 per cent of the households participated in NREGA programme which included 7.14 percent of the marginal, 10 per cent of the small, 100 per cent of the semi medium and 66.67 percent of the medium farmers.

Table 46: Participation in NREGA programme in Bachanahalli-3 micro-watershed

Sl. No.	Particulars	MF(14)		SF (10)		SMF (10)		MDF (3)		All (37)	
		N	%	N	%	N	%	N	%	N	%
1	Participation in NREGA programme	1	7.14	1	10	10	100	2	66.67	14	37.84

Adequacy of food items: The data regarding adequacy of food items in Bachanahalli-3 micro-watershed is presented in Table 47. The results indicated that, cereals, pulses, oilseeds, vegetables, fruits, milk, Egg and meat were adequate for 100 percent, 16.22 percent, 45.95 percent, 43.24 percent, 2.70 percent, 54.05 percent, 43.43 percent, and 43.24 percent of the households respectively.

Table 47: Adequacy of food items in Bachanahalli-3 micro-watershed

Sl.No.	Particulars	MF (14)		SF (10)		SMF (10)		MDF (3)		All (37)	
		N	%	N	%	N	%	N	%	N	%
1	Cereals	14	100	10	100	10	100	3	100	37	100
2	Pulses	2	14.29	1	10	2	20	1	33.33	6	16.22
3	Oilseed	9	64.29	1	10	7	70	0	0	17	45.95
4	Vegetables	9	64.29	2	20	5	50	0	0	16	43.24
5	Fruits	0	0.00	0	0	1	10	0	0	1	2.70
6	Milk	11	78.57	2	20	5	50	2	66.67	20	54.05
7	Egg	9	64.29	2	20	5	50	0	0	16	43.24
8	Meat	9	64.29	2	20	4	40	1	33.33	16	43.24

Response on Inadequacy of food items: The data regarding inadequacy of food items in Bachanahalli-3 micro-watershed is presented in Table 48. The results indicated that, cereals, pulses, oilseeds, vegetables, fruits, milk, egg and meat were inadequate for 2.63 per cent, 76.32 per cent, 7.89 per cent, 18.42 per cent, 23.68 per cent, 36.84 per cent, 44.74 per cent and 31.58 per cent of the households respectively.

Table 48: Response on Inadequacy of food items in Bachanahalli-3 micro-watershed

Sl.No.	Particulars	MF (14)		SF (10)		SMF (11)		MDF (3)		All (38)	
		N	%	N	%	N	%	N	%	N	%
1	Cereals	0	0	0	0	1	9.09	0	0	1	2.63
2	Pulses	12	85.71	9	90	6	54.55	2	66.67	29	76.32
3	Oilseed	1	7.14	1	10	1	9.09	0	0.00	3	7.89
4	Vegetables	3	21.43	3	30	0	0.00	1	33.33	7	18.42
5	Fruits	4	28.57	3	30	2	18.18	0	0	9	23.68
6	Milk	3	21.43	6	60	5	45.45	0	0	14	36.84
7	Egg	4	28.57	5	50	5	45.45	3	100	17	44.74
8	Meat	3	21.43	2	20	6	54.55	1	33.33	12	31.58

Farming constraints: The data regarding farming constraints experienced by households in Bachanahalli-3 micro-watershed is presented in Table 49. The results indicated that, Lower fertility status of the soil was the constraint experienced by 5.26 per cent of the households, wild animal menace on farm field (42.11%), frequent incidence of pest and diseases (42.11%), inadequacy of irrigation water (15.79%), high cost of Fertilizers and plant protection chemicals (52.63%), high rate of interest on credit (47.37%), low price for the agricultural commodities (13.16%), lack of marketing facilities in the area (52.63%), inadequate extension services (5.26%), lack of transport for safe transport of the agricultural produce to the market (47.37%), less rainfall (100%) and Source of Agri-technology information(Newspaper/TV/Mobile (55.26%).

Table 49: Farming constraints Experienced in Bachanahalli-3 micro-watershed

Sl. No.	Particulars	MF (14)		SF (10)		SMF (11)		MDF (3)		All (38)	
		N	%	N	%	N	%	N	%	N	%
1	Lower fertility status of the soil	0	0	0	0	2	18.18	0	0	2	5.26
2	Wild animal menace on farm field	8	57.14	3	30	5	45.45	0	0	16	42.11
3	Frequent incidence of pest and diseases	5	35.71	6	60	4	36.36	1	33.33	16	42.11
4	Inadequacy of irrigation water	2	14.29	2	20	2	18.18	0	0	6	15.79
5	High cost of Fertilizers and plant protection chemicals	13	92.86	4	40	3	27.27	0	0	20	52.63
6	High rate of interest on credit	8	57.14	3	30	6	54.55	1	33.33	18	47.37
7	Low price for the agricultural commodities	3	21.43	1	10	1	9.09	0	0	5	13.16
8	Lack of marketing facilities in the area	9	64.29	4	40	5	45.45	2	66.67	20	52.63
9	Inadequate extension services	0	0	2	20	0	0	0	0	2	5.26
10	Lack of transport for safe transport of the Agril produce to the market.	4	28.57	8	80	5	45.45	1	33.33	18	47.37
11	Less rainfall	14	100	10	100	11	100	3	100	38	100
12	Source of Agri-technology information(Newspaper/TV/Mobile)	6	42.86	8	80	4	36.36	3	100	21	55.26

Chapter 5

SUMMARY

The result indicated that 30 farmers were sampled in Bachanahalli-3 micro-watershed among them 14 (46.67%) were marginal farmers, 5 (16.67%) were small farmers, 9 (30%) were semi medium farmers and 2 (6.67%) were medium farmers. The data indicated that there were 82 (58.99%) men and 57 (41.01%) were women among the sampled households. The average family size of marginal farmers was 4, small farmer was 4, semi medium farmer was 5, and medium farmers were 4.

The data indicated that 18 (12.95%) people were in 0-15 years of age, 59 (42.45%) were in 16-35 years of age, 50 (35.97 %) were in 36-60 years of age and 12 (8.63%) were above 61 years of age. The results indicated that the Bachanahalli-3 had 31.65 per cent illiterates, 38.13 per cent of them had primary school education, 2.16 per cent of them had middle school education, 17.99 per cent of them had high school education, 5.04 per cent of them had PUC education, 0.72 per cent of them had ITI, 2.88 per cent of them had degree education and 1.44 per cent of them had other education.

The results indicated that, 100 per cent of households practicing agriculture and only 3.33 per cent of the household heads were doing other work. The results indicated that agriculture was the major occupation for 59.71 per cent of the household members, 21.58 per cent were agricultural labourers, 2.88 per cent of them were in private sector and 11.51 per cent of them were students and 0.72 percent of households were general labours, doing household industry and artisans respectively.

In case of marginal farmers 61.29 per cent were agriculturist, 16.13 percent were agricultural labour and 12.90 per cent were students. In case of small farmers, 54.55 per cent of the household members were practicing agriculture and 31.82 per cent were agricultural labour and 9.09 per cent of them were students. In case of semi medium farmers 60.87 per cent of the household members were practicing agriculture, 21.74 per cent of them were agricultural labours and 13.04 per cent of them were students. In case of medium farmers, 55.56 per cent of the household members were performing agriculture and 33.33 per cent of them were agricultural labour.

The results showed that 100 per cent of the households have not participated in any local institutions. The results indicated that 36.67 per cent of the households possess Katcha house, 13.33 per cent of them possess Pucca house and 46.67 per cent of them possess Semi Pacca house. Only 3.33 per cent of them possess Thatched house.

The results showed that 100 per cent of the households possess TV, 66.67 per cent of the households possess mixer grinder, 20 per cent of the households possess bicycle, 66.67 per cent of the households possess motor cycle, 6.67 per cent of the households possess auto and 100 per cent of the households possess mobile phones. The results showed that the average value of television was Rs. 2,766, mixer grinder was Rs. 1125,

bicycle Rs.6433, motor cycle was Rs.34045, Auto was Rs.39000 and mobile phone was Rs.1186.

The results indicated that 26.67 per cent of the households possess bullock cart, 40 per cent of them possess plough, 13.33 cent of the households possess tractor, 43.33 per cent of the households possess sprayer, 90 per cent of them possess weeder, 13.33 per cent of them were possess chaff cutter, 6.67 per cent of them were possess harvester and 16.67 per cent of the households possess Earth remover/Duster. The results showed that the average value of plough was Rs.1655, the average value of bullock cart was Rs. 21000, the average value of tractor Rs. 312500, the average value of sprayer was Rs.3788, the average value of weeder Rs. 42, the average value of chaff cutter Rs.1187, and the average value of duster was Rs. 19720.

The results indicated that, 33.33 per cent of the households possess bullocks and 6.67 per cent of the households possess local cow and crossbred cow, 10 per cent of the household possess buffalo and 3.33 per cent of the households possess sheep and poultry birds respectively. In case of marginal farmers, 21.43 per cent of the households possess bullock and 7.14 per cent of the households possess local cow, buffalo and sheep respectively. In case of small farmers, 20 per cent of households possess bullock and crossbred cow correspondingly. In case of semi medium farmers, 44.44 per cent of the households possess bullock, 22.22 per cent possess buffalo and 11.11 per cent possess poultry birds. In medium farmers, 100 per cent of the households possess bullock and 50 per cent possess local cow and crossbred cow respectively.

The results indicated that, average own labour men available in the micro-watershed was 1.87, average own labour (women) available was 1.50, average hired labour (men) available was 10.30 and average hired labour (women) available was 8.30. In case of marginal farmers, average own labour men available was 1.86, average own labour (women) was 1.29, average hired labour (men) was 6.86 and average hired labour (women) available was 5.43. In case of small farmers, average own labour men available was 1.80, average own labour (women) was 1.40, average hired labour (men) was 13.60 and average hired labour (women) available was 9.60. In case of semi medium farmers, average own labour men available was 2, average own labour (women) was 1.78, average hired labour (men) was 15 and average hired labour (women) available was 13.89. In medium farmers average own labour men available was 1.50, average own labour (women) was 2, average hired labour (men) was 5 and average hired labour (women) available was 8.30.

The results indicated that, 90 per cent of the household opined that hired labour was adequate and 10 per cent of the household opined that hired labour was inadequate. About 100 per cent of the marginal farmers, 80 per cent of small, 88.89 per cent of semi medium and 50 per cent of the medium have opined that the hired labour was adequate

and 20 per cent of small farmers, 11.11 per cent of semi medium farmers and 50 per medium farmers were opined that hired labour was inadequate.

The results indicated that, households of the Bachanahalli-3 micro-watershed possess 17.33 ha (47.84%) of dry land and 18.90 ha (52.16%) of irrigated land. Marginal farmers possess 9.37 ha (91.25 %) of dry land and 0.90 ha (8.75%) of irrigated land. Small farmers possess 2.95 ha (53.28%) of dry land and 2.59 ha (46.72%) of irrigated land. Semi medium farmers possess 12.91 ha (100%) of irrigated land. Medium farmers possess 5.01 ha (66.72%) of dry land and 2.50 ha (33.28%) of irrigated land.

The results indicated that, the average value of dry land was Rs. 369,173.29 and average value of irrigated was Rs. 423,216.96. In case of marginal famers, the average land value was Rs. 490,799.13 for dry land and 1,223,873.86 for irrigated land. In case of small famers, the average land value was Rs. 439,863.03 for dry land Rs. 540,312.49 for irrigated land. In case of semi medium famers, the average land value was Rs.387147.34 for irrigated land. In case of medium famers, the average land value was Rs. 99838.32 for dry land and the average land value was Rs. 200162.07 for irrigated land. The results indicated that, there were 15 functioning and 2 defunctioning bore wells in the micro-watershed . The results indicated that, bore well was the major irrigation source for 53.33 per cent of the farmers and 3.33 per cent of the farmers were using canal for irrigation.

The results indicated that on an average the depth of the bore well was 69.70 meters. The results indicated that, in case of marginal farmers there were 2.75 ha of irrigated land, in case of small farmers there was 3.40 ha of irrigated land, semi medium farmers were having 20.80 ha of irrigated land and medium farmers were having 2.50 ha of irrigated land. On an average there were 29.45 ha of irrigated land.

The results indicated that, farmers have grown Bajra (8.20 ha), Bengal gram (1.85 ha), Cotton (4.05 ha), Sorghum (0.81 ha), Maize (12.76 ha), Red gram (3.03 ha), Sugarcane (2.59 ha) and Sunflower (3.35 ha) in kharif season and Bajra (1.30 ha), Bengal gram (4.14 ha), Cotton (1.21 ha), Maize (1.73 ha) and Sunflower (0.81 ha) in Rabi season. Marginal farmers have grown bajra, Bengalgram, Cotton, Sorghum, Maize and Red gram. Small farmers have grown Bajra, cotton, Sugarcane and Sunflower. Semi medium farmers have grown Cotton, Maize, Red gram, Sugarcane and Sunflower. Medium farmers have grown Bajra and maize.

The results indicated that, the cropping intensity in Bachanahalli-3 micro-watershed was found to be 99.69 per cent. In case of Marginal farmers, semi medium farmers and medium farmers it was 100 per cent, and in case of small farmers it was found 97.83 per cent. The results indicated that, the total cost of cultivation for bajra was Rs. 20833.39. The gross income realized by the farmers was Rs. 24479.15. The net income from bajra cultivation was Rs. 3645.76, thus the benefit cost ratio was found to be 1:1.17.

The results indicated that, the total cost of cultivation for maize was Rs. 38319.32. The gross income realized by the farmers was Rs. 40292.44. The net income from maize cultivation was Rs. 1973.12, thus the benefit cost ratio was found to be 1:1.05. The results indicated that, the total cost of cultivation for sorghum was Rs. 13240.65. The gross income realized by the farmers was Rs. 38532.00. The net income from sorghum cultivation was Rs. 25291.35. Thus the benefit cost ratio was found to be 1:2.91. The results indicated that, the total cost of cultivation for bengalgram was Rs. 28575.40. The gross income realized by the farmers was Rs. 85887.53. The net income from bengalgram cultivation was Rs. 57312.12. Thus the benefit cost ratio was found to be 1:3.01. The results indicated that, the total cost of cultivation for redgram was Rs. 20323.71. The gross income realized by the farmers was Rs. 32403.40. The net income from Redgram cultivation was Rs. 12079.69. Thus the benefit cost ratio was found to be 1:1.59.

The results indicated that, the total cost of cultivation for cotton was Rs. 36144.93. The gross income realized by the farmers was Rs. 65076.27. The net income from cotton cultivation was Rs. 28931.33. Thus the benefit cost ratio was found to be 1:1.8. The results indicated that, the total cost of cultivation for Sunflower was Rs. 30493.76. The gross income realized by the farmers was Rs. 54715.48. The net income from Sunflower cultivation was Rs. 24221.72. Thus the benefit cost ratio was found to be 1:1.79.

The results indicated that, the total cost of cultivation for Sugarcane was Rs. 568202.98. The gross income realized by the farmers was Rs. 1728897.05. The net income from Sugarcane cultivation was Rs. 1160694.07. Thus the benefit cost ratio was found to be 1:3.04. The results indicated that, 135 tons of dry fodder was available in micro-watershed for 52 days and 68 tons of green fodder was available for 54 days.

The results indicated that, 18.18 per cent of the households opined that dry fodder was adequate and 24.24 per cent of the households opined that dry fodder was inadequate also the data revealed that 33.33 per cent of the farmers opined that green fodder is adequate and 12.12 per cent of the farmers opined that green fodder is inadequate. The results indicated that the average income from service/salary was Rs. 9,090.91, business Rs. 4,848.48, wage Rs. 1,696.97, agriculture Rs. 118,028.79 and non farm income Rs. 1,333.33 and dairy farm Rs. 1,298.18.

The results indicated that the average expenditure from service/salary was Rs. 6,666.67, business Rs. 4,545.45, wage Rs. 1,060.61, agriculture Rs. 74,606.06 and dairy farm Rs. 545.45. The results indicated that, sampled households have grown 45 coconut trees in their field. The results indicated that, households have planted 76 Neem, 3 Banyan trees and 6 Eucalyptus trees in their field and also grown 3 Neem tree in the backyard. The results indicated that, Bengal gram, Cotton, Sorghum, Maize, Red gram, Sugarcane and Sunflower were sold to the extent of 100 per cent and only Bajra was sold to the extent of 93.98 per cent.

The results indicated that, 54.29 percent of the households have sold their produce to agents/ traders, 42.86 percent of the households sold their produce in local/village merchant, 51.43 percent of the households sold their produce to regulated market and 2.86 percent of the households sold their produce to cooperative marketing society and outside the state respectively. The results indicated that 16.67 per cent of the households have used cart as a mode of transport, 47.22 per cent have used tractor and 27.78 per cent have used Truck and 8.33 households have used head load as a mode of transport.

The results indicated that, 66.67 percent used fire wood, 30.56 percent of the households used LPG and 2.78 percent of the households used Biogas as a source of fuel. The results indicated that, bore well was the major source of drinking water for 29.73 per cent and 62.16 per cent of households used piped supply water for drinking purpose. The results indicated that, electricity was the major source of light for 97.30 per cent of the households in micro-watershed.

The results indicated that, 43.24 per cent of the households possess sanitary toilet i.e. 50 per cent of marginal, 30 per cent of small, 50 per cent of semi medium and 33.33 per cent of medium had sanitary toilet facility. The results indicated that, 91.89 per cent of the sampled households possessed BPL card and 5.41 per cent of the sample households possess APL card. The results indicated that, 37.84 per cent of the households participated in NREGA programme which included 7.14 percent of the marginal, 10 per cent of the small, 100 per cent of the semi medium and 66.67 percent of the medium farmers.

The results indicated that, cereals, pulses, oilseeds, vegetables, fruits, milk, Egg and meat were adequate for 100 percent, 16.22 percent, 45.95 percent, 43.24 percent, 2.70 percent, 54.05 percent, 43.43 percent, and 43.24 percent of the households respectively. The results indicated that, cereals, pulses, oilseeds, vegetables, fruits, milk, egg and meat were inadequate for 2.63 per cent, 76.32 per cent, 7.89 per cent, 18.42 per cent, 23.68 per cent, 36.84 per cent, 44.74 per cent and 31.58 per cent of the households respectively.

The data regarding farming constraints experienced by households in Bachanahalli-3 micro-watershed is presented in Table 49. The results indicated that, Lower fertility status of the soil was the constraint experienced by 5.26 per cent of the households, wild animal menace on farm field (42.11%), frequent incidence of pest and diseases (42.11%), inadequacy of irrigation water (15.79%), high cost of Fertilizers and plant protection chemicals (52.63%), high rate of interest on credit (47.37%), low price for the agricultural commodities (13.16%), lack of marketing facilities in the area (52.63%), inadequate extension services (5.26%), lack of transport for safe transport of the agricultural produce to the market (47.37%), less rainfall (100%) and Source of Agri-technology information (Newspaper/TV/Mobile (55.26%).