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

CHUKKANAKALLU-2 (4D4A1Y1a) MICROWATERSHED

Koppal Taluk & 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

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

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

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PREFACE

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

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

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

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

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

ICAR-NBSS&LUP, Regional Centre, Bangalore has taken up a project sponsored by the Karnataka Watershed Development Project-II, (Sujala-III), Government of Karnataka funded by the World Bank under Component -1 Land Resource Inventry. This study was taken up to demonstrate the utility of such a database in reviewing, monitoring and evaluating all the land based watershed development programs on a scientific footing. To meet the requirements of various land use planners at grassroots level, the present study on "Land Resource Inventory and Socio-Economic Status of Farm Households for Watershed Planning and Development of for Chukkanakallu-2 microwatershed in Koppal Taluk, and 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
Date: 26-10-2019

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PART-A

LAND RESOURCE INVENTORY

Contents

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

The land resource inventory of Chukkanakallu-2 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 518 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 68 per cent is covered by soil, 1 per cent by rock outcrops and 31 per cent by habitation and water body. The salient findings from the land resource inventory are summarized briefly below

- *The soils belong to 9 soil series and 20 soil phases (management units) and 6 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 31 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 8 per cent of the soils are shallow (25-50 cm), 12 per cent of the soils are moderately shallow (50-75 cm), 11 per cent of the soils are moderately deep (75- 100 cm) and 37 per cent is deep to very deep (100 to >150 cm) soils.*
- *About 14 per cent loamy (sandy loam and sandy clay loam) and 54 per cent has clayey (sandy clay and clay) soils at the surface.*
- *About 45 per cent of the area has non-gravelly (<15%) soils, 19 per cent has gravelly (15-35 %) and 4 per cent has very gravelly (35-60 %) soils.*
- *With respect to available water capacity 5 per cent of the area has very low (<50mm/m), 36 per cent of the area has low (51-100 mm/m), 11 per cent medium*

(101-150 mm/m), 4 per cent high (151-200 mm/m) and 11 per cent very high (>200 mm/m) in available water capacity.

- *An area of about 17 per cent is nearly level (0-1%) and 51 per cent is very gently sloping (1-3%) lands.*
- *An area of about 37 per cent is slightly eroded (e1) and 30 per cent is moderately eroded (e2) lands.*
- *An area of about 39 per cent is slightly alkaline (pH 7.3-7.8), 8 per cent is moderately alkaline (pH 7.8-8.4), 9 per cent is strongly alkaline (pH 8.4-9.0) and 12 per cent is very strongly alkaline (pH >9.0) in reaction.*
- *The Electrical Conductivity (EC) of the soils are <2 dSm^{-1} indicating that the soils are non saline.*
- *Organic carbon is medium (0.5-0.75%) in 47 per cent and high (>0.75%) in 21 per cent area of the soils.*
- *Available phosphorus is medium (23-57 kg/ha) in the entire area of the microwatershed.*
- *Available potassium is low (<145 kg/ha) in 25 per cent, medium (145-337 kg/ha) in 41 per cent and high (>337 kg/ha) in 1 per cent area of the soils.*
- *Available sulphur is low (<10 ppm) in 67 per cent and medium (10-20 ppm) in <1 per cent area of the soils.*
- *Available boron is low (<0.5 ppm) in 2 per cent and medium (0.5-1.0) in 65 per cent area of the microwatershed.*
- *Available iron is deficient (<4.5 ppm) in 56 per cent and sufficient (>4.5 ppm) in 12 per cent area of the microwatershed.*
- *Available zinc is sufficient (>0.6 ppm) in the entire area of the microwatershed.*
- *Available manganese and copper are sufficient in the entire area of the microwatershed.*
- *The land suitability for 31 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	*65(13)*	*216(42)*		*Sapota*	*36(7)*	*94(18)*
Maize	*16(3)*	*266(52)*		*Pomegranate*	*36(7)*	*210(41)*
Bajra	*36(7)*	*274(53)*		*Musambi*	*65(13)*	*181(35)*
Groundnut	-	*58(11)*		*Lime*	*65(13)*	*181(35)*
Sunflower	*65(13)*	*181(35)*		*Amla*	*36(7)*	*273(53)*
Redgram	*36(7)*	*163(32)*		*Cashew*	-	*130(25)*
Bengal gram	*29(6)*	*280(54)*		*Jackfruit*	*36(7)*	*94(18)*
Cotton	*65(13)*	*216(42)*		*Jamun*	*36(7)*	*154(30)*
Chilli	*16(3)*	*149(29)*		*Custard apple*	*65(13)*	*244(47)*
Tomato	*16(3)*	*149(29)*		*Tamarind*	*36(7)*	*153(30)*
Brinjal	*94(18)*	*188(37)*		*Mulberry*	*16(3)*	*230(45)*
Onion	*94(18)*	*71(14)*		*Marigold*	*16(3)*	*265(52)*
Bhendi	*94(18)*	*188(37)*		*Chrysanthemum*	*16(3)*	*265(52)*
Drumstick	*36(7)*	*210(41)*		*Jasmine*	*16(3)*	*149(29)*
Mango	*36(7)*	*124(24)*		*Crossandra*	*36(7)*	*176(34)*
Guava	*20(4)*	*110(21)*				

- *Apart from the individual crop suitability, a proposed crop plan has been prepared for the 6 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 and drainage line treatment plan has been prepared that would help in identifying the sites to be treated and also the type of structures required.*
- *As part of the greening programme, several tree species have been suggested to be planted in marginal and submarginal lands, field bunds and also in the hillocks, mounds and ridges. That would help in supplementing the farm income, provide fodder and fuel, and generate lot of biomass 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 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 Chukkanakallu-2 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 Chukkanakallu-2 micro-watershed is located in the central part of Karnataka in Koppal taluk and district (Fig 2.1). It lies between $15^0$19' and $15^0$20' North latitudes and $76^0$08' and $76^0$10' East longitudes and covers an area of about 518 ha. It is about 5 km from Koppal town. It comprises and bounded by Koppal on the north, east and west and Huvinala and Bahaddhurabandi villages on the southern side of the microwatershed.

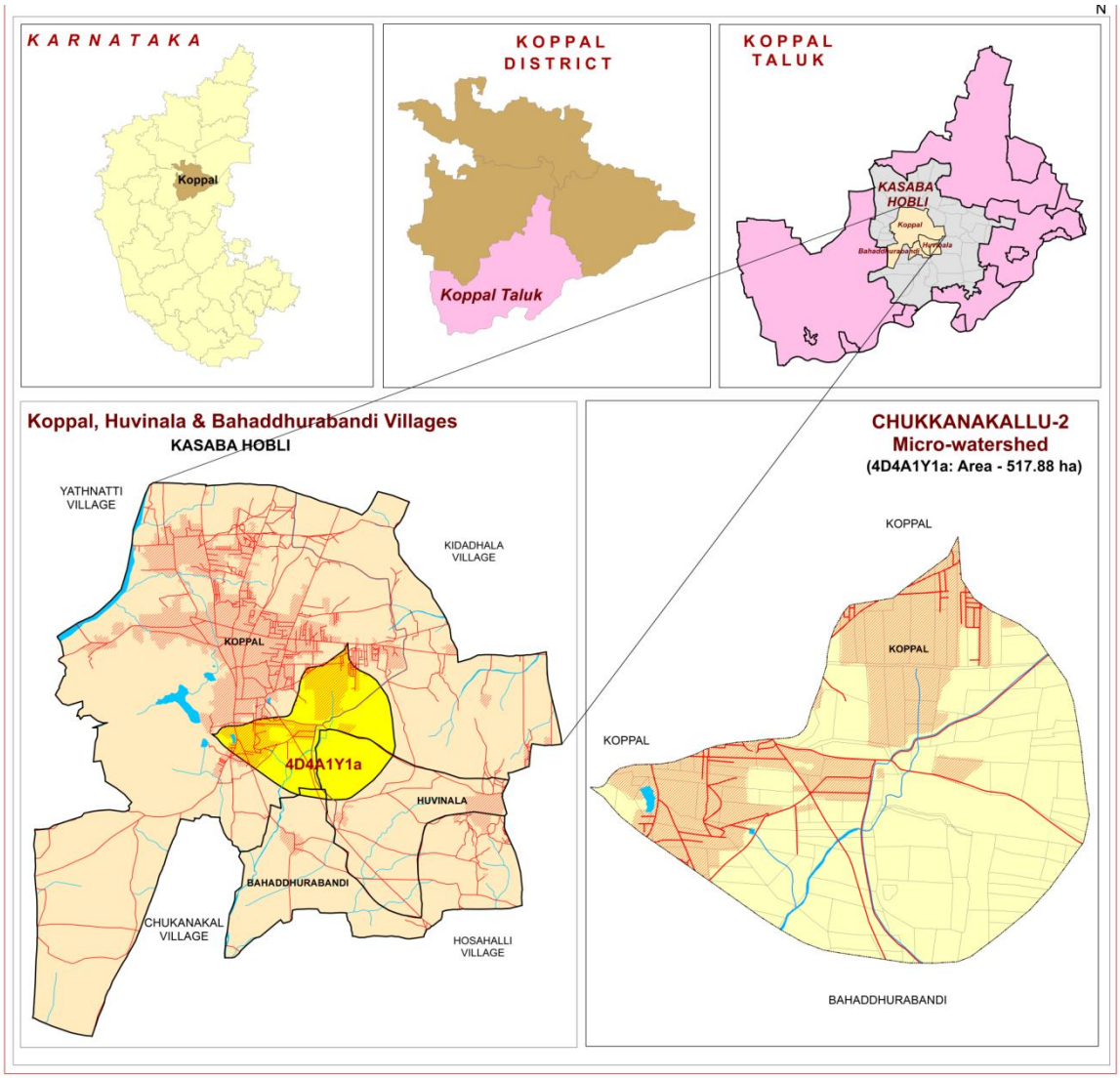


Fig.2.1 Location map of Chukkanakallu-2 Microwatershed

2.2 Geology

Major rock formations observed in the microwatershed are granite gneiss and alluvium (Fig.2.2 a and b). 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 Bikkanahalli 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.2.2a Granite and granite gneiss rocks

Fig.2.2b Alluvium

2.3 Physiography

Physiographically, the area has been identified as Granite gneiss and Alluvial landscapes based on geology. The microwatershed area has been further divided into mounds/ridges, summits, side slopes and very gently sloping uplands and nearly level plains based on slope and its relief features. The elevation ranges from 516 to 541 m in the gently sloping uplands. The mounds and ridges are mostly covered by rock outcrops.

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 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**	

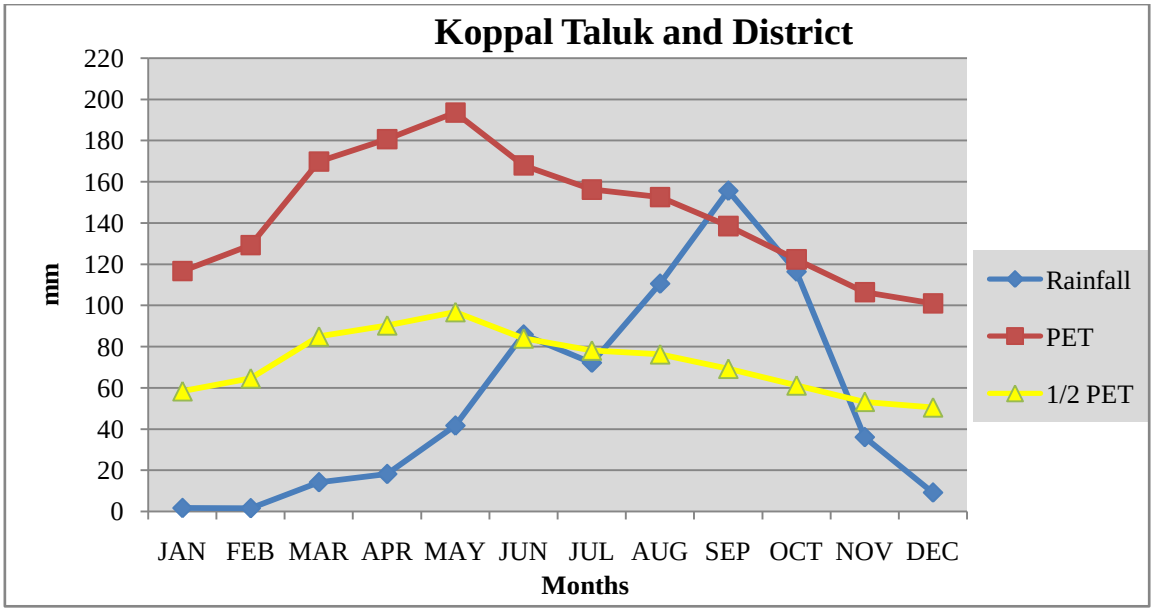


Fig. 2.3 Rainfall distribution in Koppal Taluk and District

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 Chukkanakallu-2 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 Chukkanakallu-2 microwatershed is presented in Fig.2.6. Simultaneously, enumeration of existing wells (bore wells) and conservation structures is made and their location in different survey numbers is marked on the cadastral map. Map showing the location of wells in Chukkanakallu-2 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 Chukkanakallu-2 Microwatershed

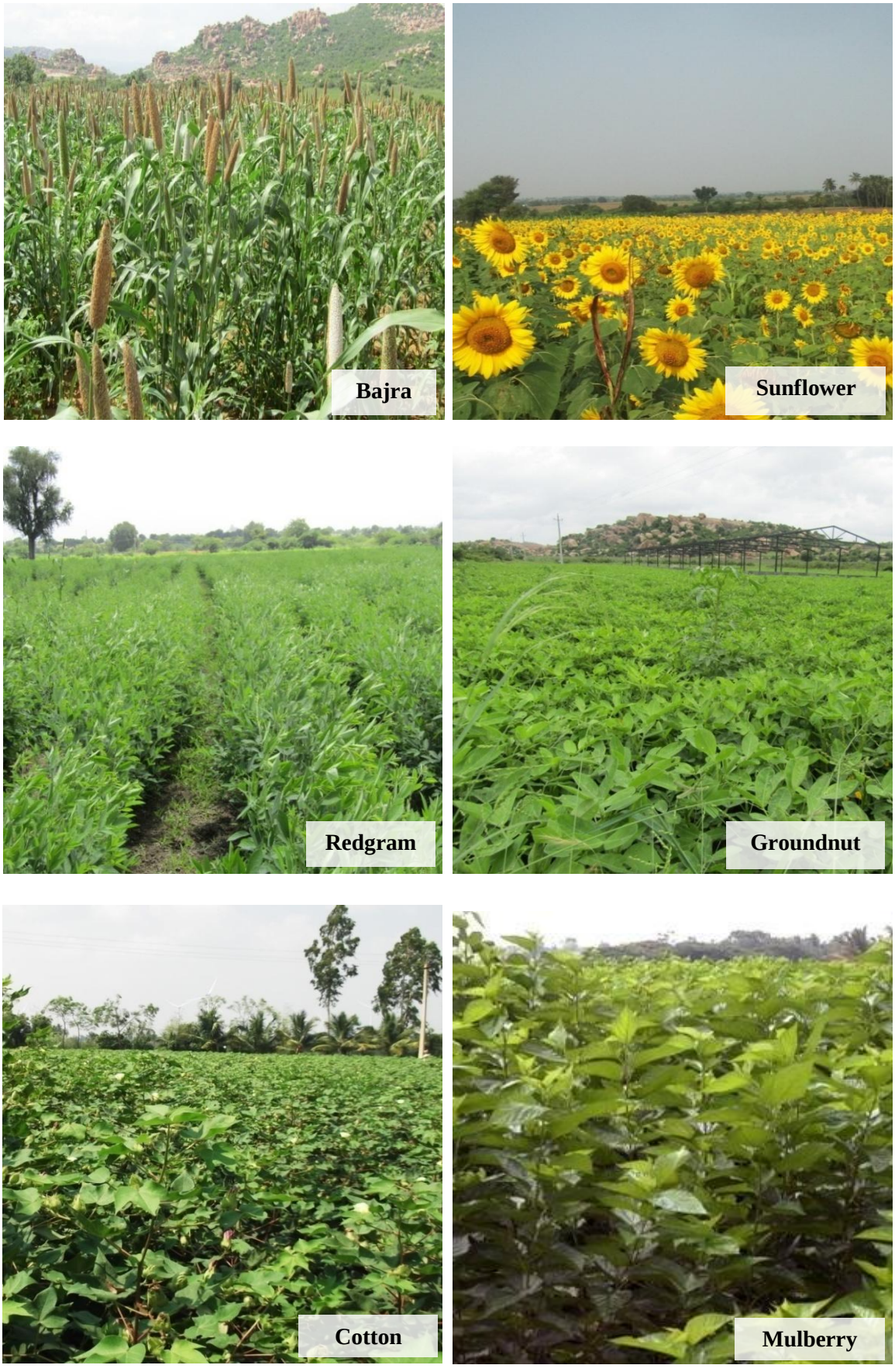


Fig.2.5 (b) Different crops and cropping systems in Chukkanakallu-2 Microwatershed

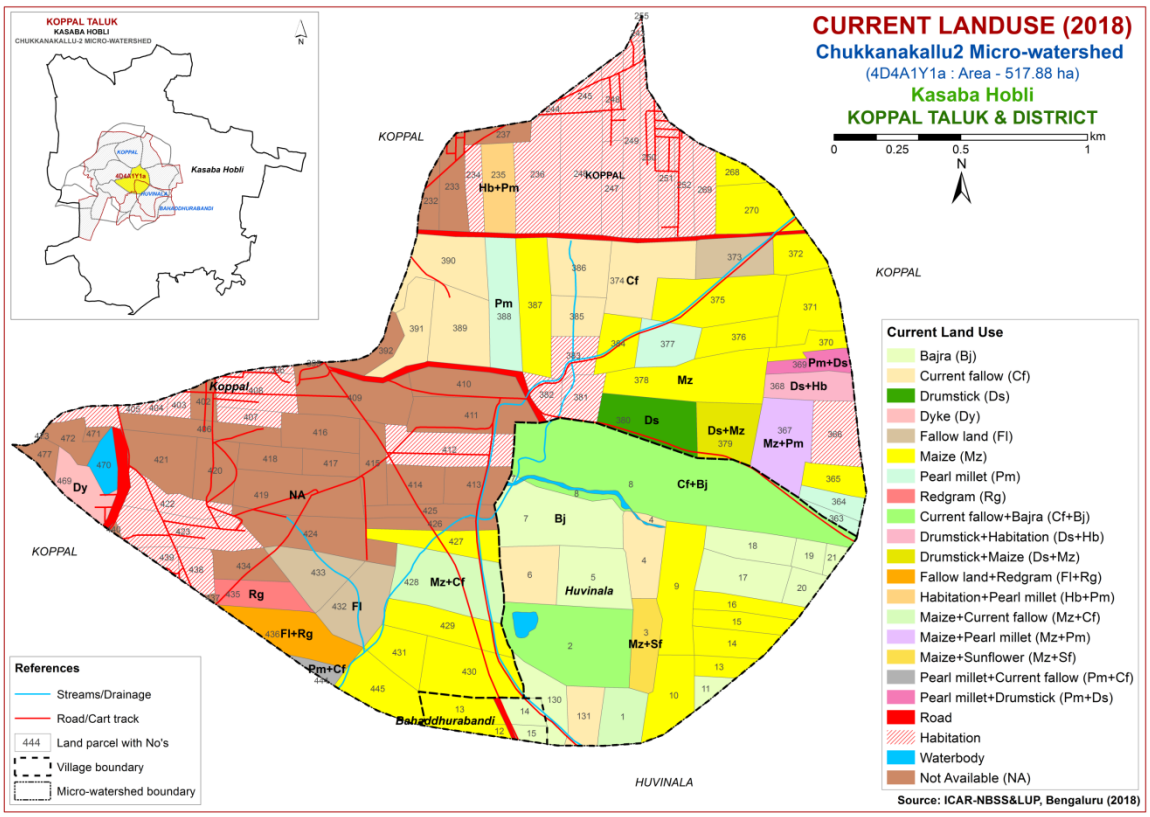


Fig.2.6 Current Land Use map of Chukkanakallu-2 Microwatershed

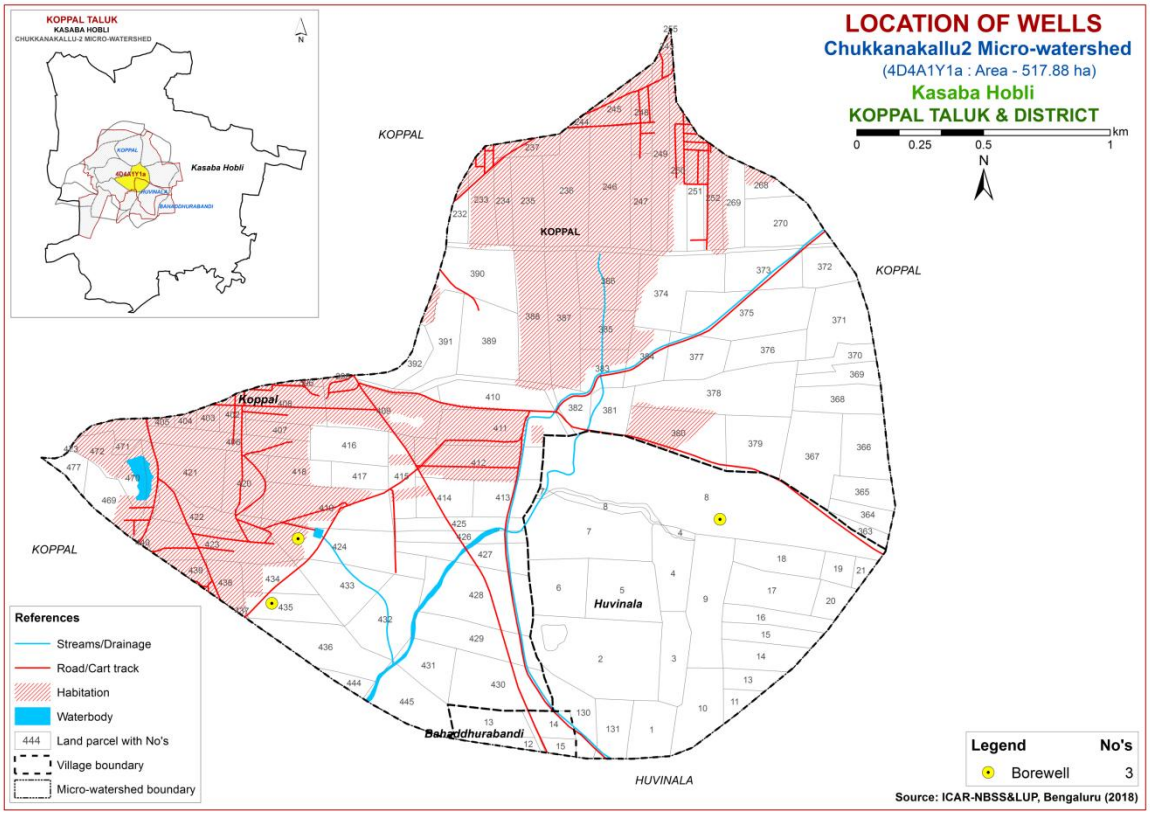


Fig.2.7 Location of wells map of Chukkanakallu-2 Microwatershed

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 Chukkanakallu-2 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 518 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 and alluvial landscapes and is divided into landforms such as ridges, mounds and uplands based on slope. 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)

G3 Valleys/ lowlands
- G31 Valleys, pink tones
- G32 Valleys gray mixed with pink tones

DSe -Alluvial landscape

DSe 1 Summit
- DSe 11 Nearly level Summit with dark grey tone
- DSe 12 Nearly level Summit with medium grey tone
- DSe 13 Nearly level Summit with whitish grey tone
- DSe 14 Nearly level Summit with whitish tone (Calcareousness)
- DSe 15 Nearly level Summit with pinkish grey tone
- DSe 16 Nearly level Summit with medium pink tone
- DSe 17 Nearly level Summit with bluish white tone
- DSe 18 Nearly level Summit with greenish grey tone

DSe 2 Very genetly sloping
- DSe 21 Very gently sloping, whitish tone
- DSe 22 Very gently sloping, greyish pink tone
- DSe 23 Very gently sloping, whitish grey tone
- DSe 24 Very gently sloping, medium grey tone
- DSe 25 Very gently sloping, medium pink tone
- DSe 26 Very gently sloping, dark grey tone
- DSe 27 Very gently sloping, bluish grey tone
- DSe 28 Very gently sloping, greenish grey tone
- DSe 29 Very gently sloping, Pinkish grey

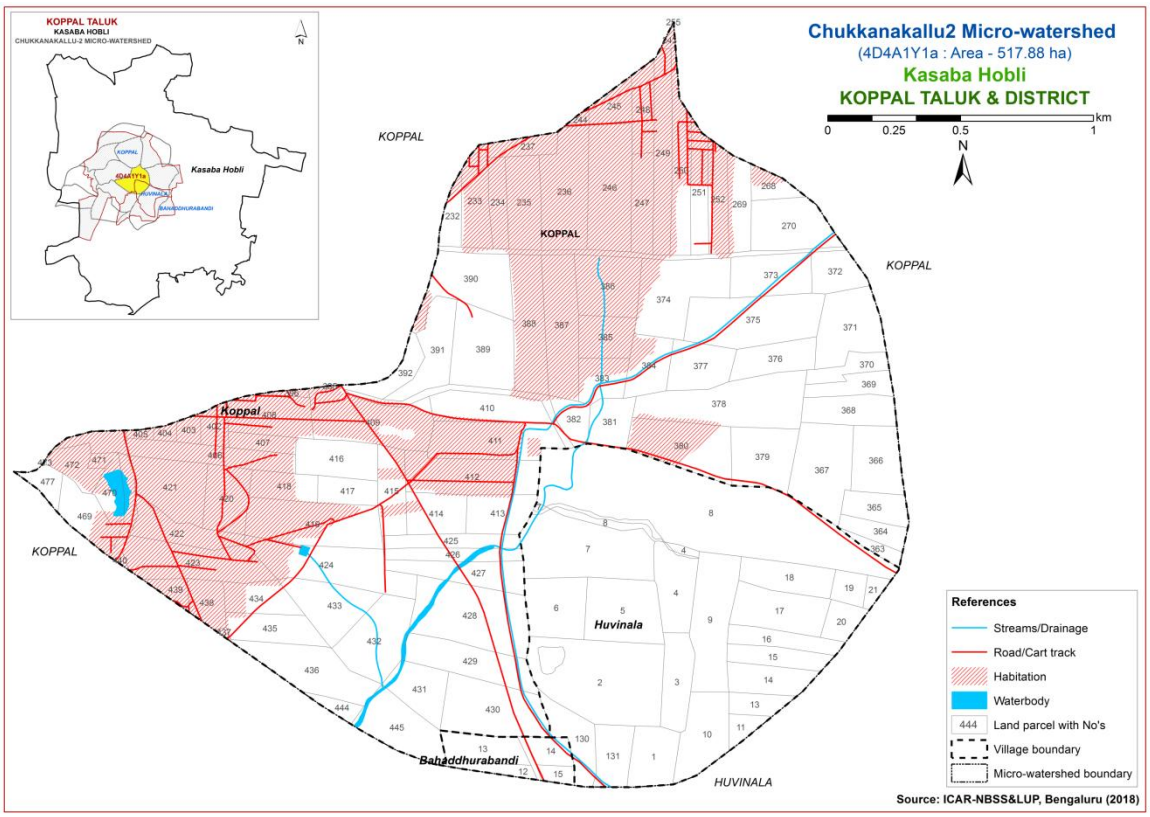


Fig 3.1 Scanned and Digitized Cadastral map of Chukkanakallu-2 Microwatershed

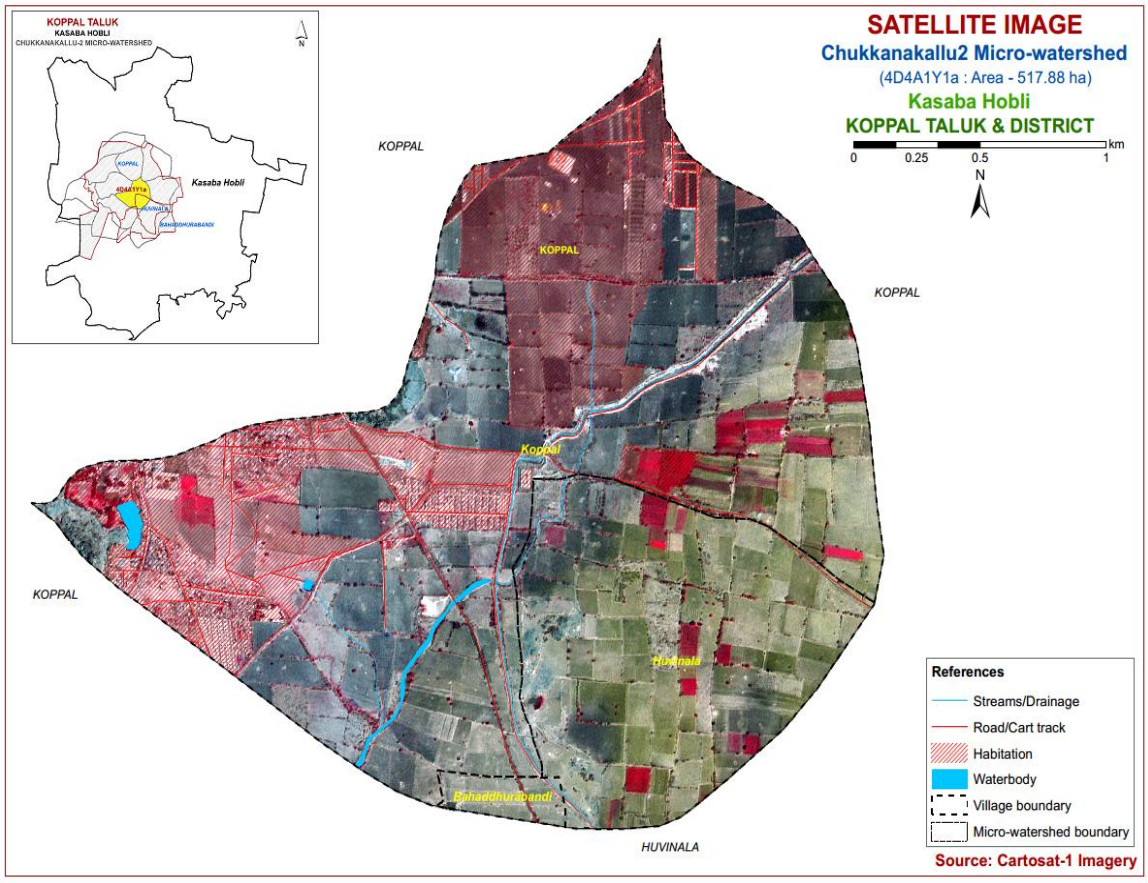


Fig.3.2 Satellite Image of Chukkanakallu-2 Microwatershed

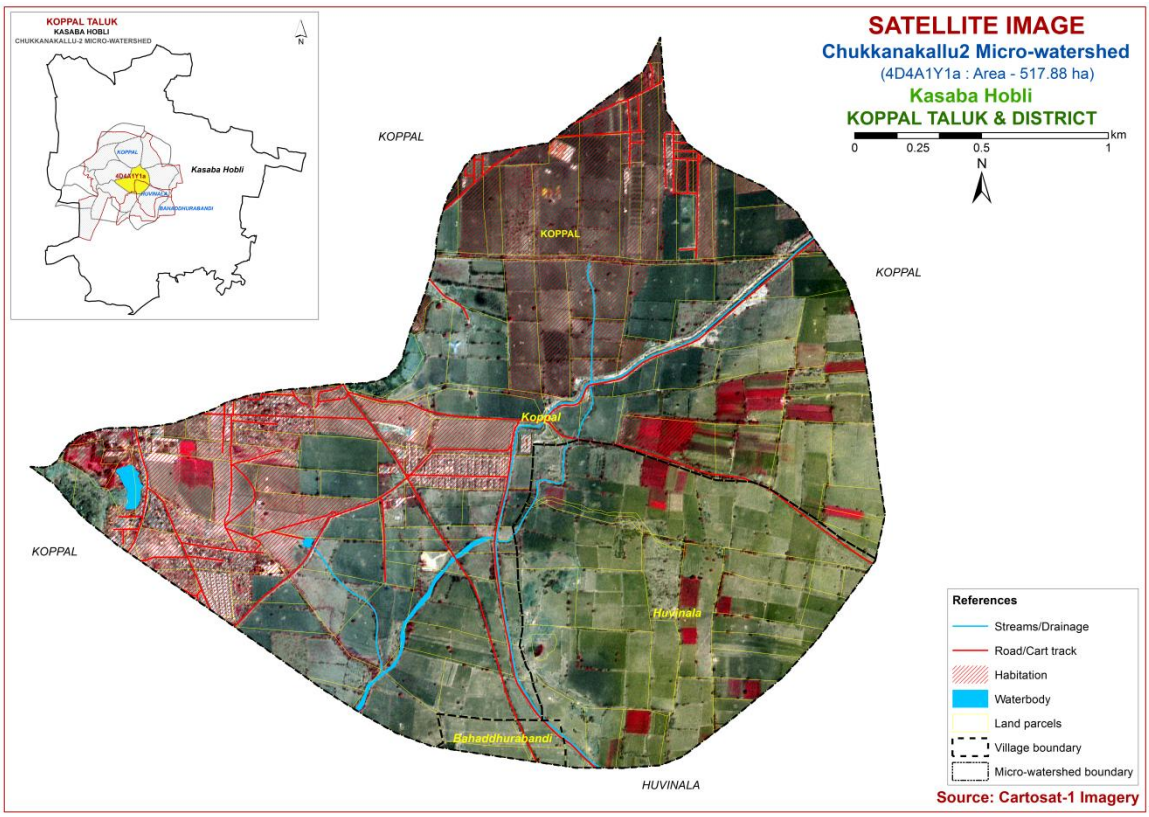


Fig.3.3 Cadastral map overlaid on IRS PAN+LISS IV merged imagery of Chukkanakallu-2 Microwatershed

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).

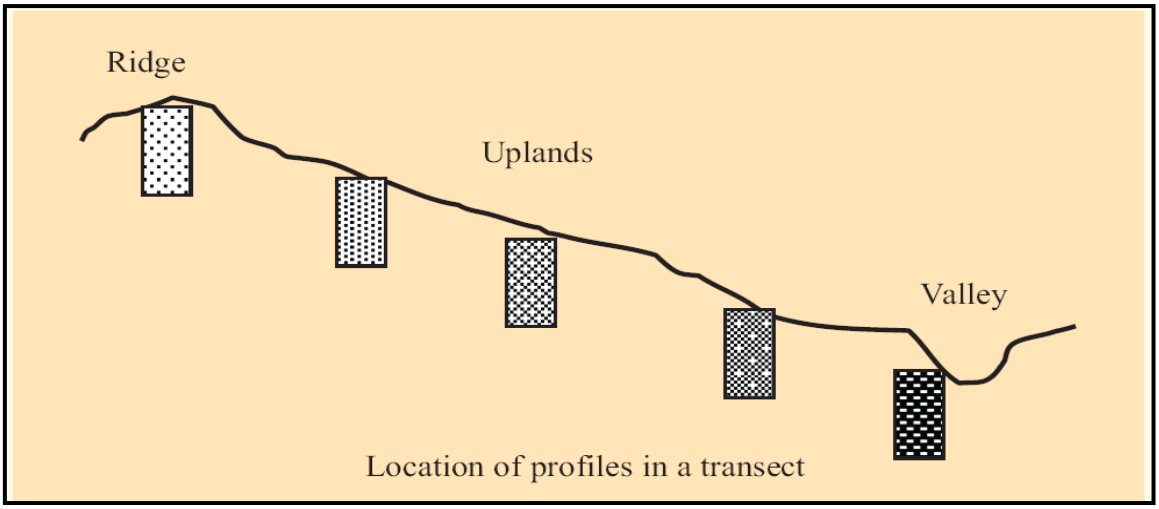


Fig: 3.4. Location of profiles in a transect

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, 9 soil series were identified in Chukkanakallu-2 microwatershed.

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

Soils of Granite Gneiss Landscape							
Sl. No	**Soil Series**	**Depth (cm)**	**Colour (moist)**	**Texture**	**Gravel (%)**	**Horizon sequence**	**Calcareo-usness**
1	Lakkur (LKR)	50-75	2.5YR 2.5/3, 2.5/4, 3/4, 3/6	gsc	35-60	Ap-Bt-Bc-Cr	-
2	Kethanapura (KTP)	50-75	2.5YR3/4,3/6	gsc	15-35	Ap-Bt-Cr	-
3	Giddadapalya (GDP)	100-150	2.5YR3/4, 3/6	gsc-gc	>35	Ap-Bt-Cr	-
4	Hallikere (HLK)	>150	5YR3/3,3/4 7.5YR3/3,3/4	c	<15	Ap-Bt	-
5	Niduvalalu (NDL)	>150	2.5YR2.5/3,2.5/4, 3/3,4/6	gsc	>35	Ap-Bt	-
Soils of Alluvial landscape							
6	Muttal (MTL)	25-50	10YR 3/2, 3/3, 4/2 7.5YR3/2,3/3,6/4	gc	15-35	Ap-Bw-Ck	e-ev
7	Dambarahalli (DRL)	75-100	10YR 2/1, 3/1, 4/3	c	<15	Ap-Bss-Ck	e-es
8	Gatareddihal (GRH)	100-150	10YR 2/1, 3/1, 2.5Y 4/3, 5/4	c	<15	Ap-Bss-BC-C	es
9	Kavalur (KVR)	100-150	10 YR 2/2, 3/1, 3/2, 3/3, 4/4	c	<15	Ap-Bss-Bck-Cr	es-ev

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 20 mapping units representing 9 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 20 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 Land Management Units

The 20 soil phases identified and mapped in the microwatershed were regrouped into 6 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 LMU's. For Chukkanakallu-2 microwatershed, five soil and site characteristics, namely the 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.

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 2018 from farmer's fields in Chukkanakallu-2 microwatershed (49 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 Chukkanakallu-2 Microwatershed

Soil map unit No*	Soil Series	Soil Phase Symbol	Mapping Unit Description	Area in ha (%)
Soils of Granite gneiss Landscape				
	LKR	Lakkur soils are moderately shallow (50-75 cm), well drained, have dark reddish brown to dark red, red gravelly sandy clay soils occurring on very gently to moderately sloping uplands under cultivation.		**28(5.39)**
43		LKRcB2g1	Sandy loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	1(0.14)
44		LKRcB2g2	Sandy loam surface, slope 1-3%, moderate erosion, very gravelly (35-60%)	20(3.92)
452		LKRhB2g1	Sandy clay loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	7(1.33)
	KTP	Kethanapura soils are moderately shallow (50-75 cm), well drained, have dark reddish brown, red gravelly sandy clay soils occurring on very gently sloping uplands under cultivation.		**35(6.85)**
74		KTPiB1g1	Sandy clay surface, slope 1-3%, slight erosion, gravelly (15-35%)	35(6.85)
	GDP	Giddadapalya soils are deep (100-150 cm), well drained, have dark reddish brown to dark red gravelly sandy clay to clay soils occurring on very gently sloping uplands under cultivation.		**16(3.01)**

Soil map unit No*	Soil Series	Soil Phase Symbol	Mapping Unit Description	Area in ha (%)
267		GDPcB2	Sandy loam surface, slope 1-3%, moderate erosion	16(3.01)
	HLK	Hallikere soils are very deep (>150 cm), well drained, have dark brown to dark reddish brown clayey soils occurring on nearly level to very gently sloping uplands under cultivation.		**20(3.86)**
272		HLKiA1	Sandy clay surface, slope 0-1%, slight erosion	20(3.86)
	NDL	Niduvalalu soils are very deep (>150 cm), well drained, have red to dark reddish brown, red gravelly sandy clay soils occurring on nearly level to very gently sloping uplands under cultivation.		**94(18.06)**
293		NDLhA1g1	Sandy clay loam surface, slope 0-1%, slight erosion, gravelly (15-35%)	28(5.33)
297		NDLiA1	Sandy clay surface, slope 0-1%, slight erosion	23(4.44)
299		NDLiB1g1	Sandy clay surface, slope 1-3%, slight erosion, gravelly (15-35%)	7(1.37)
300		NDLiB2	Sandy clay surface, slope 1-3%, moderate erosion	36(6.92)
Soils of Alluvial Landscape				
	MTL	Muttal soils are shallow (25-50 cm), well drained, have very dark grayish brown to dark brown, calcareous black gravelly clay soils occurring on nearly level to gently sloping plains under cultivation.		**42(8.04)**
304		MTLiB2	Sandy clay surface, slope 1-3%, moderate erosion	14(2.68)
307		MTLmB1	Clay surface, slope 1-3%, slight erosion	6(1.19)
311		MTLmB2g1	Clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	22(4.17)
	DRL	Dambarahalli soils are moderately deep (75-100 cm), moderately well drained, have dark brown to very dark gray, calcareous black cracking clay soils occurring on nearly level to very gently sloping plains under cultivation.		**57(11)**
344		DRLmA1	Clay surface, slope 0-1%, slight erosion	10(1.98)
348		DRLmB1	Clay surface, slope 1-3%, slight erosion	27(5.17)
350		DRLmB2	Clay surface, slope 1-3%, moderate erosion	20(3.85)
	GRH	Gatareddihal soils are deep (100-150 cm), moderately well drained, have light olive brown to very dark gray, calcareous black, sodic cracking clay soils occurring on nearly level to very gently sloping plains under cultivation.		**30.17(5.71)**
370		GRHmA1	Clay surface, slope 0-1%, slight erosion	7(1.31)
372		GRHmB1g1	Clay surface, slope 1-3%, slight erosion,	0.17(0.03)

Soil map unit No*	Soil Series	Soil Phase Symbol	Mapping Unit Description	Area in ha (%)
			gravelly (15-35%)	
373		GRHmB2	Clay surface, slope 1-3%, moderate erosion	23(4.37)
	KVR	Kavalur soils are deep (100-150 cm), moderately well drained, have dark yellowish brown to very dark grayish brown, calcareous black cracking clay soils occurring on nearly level to very gently sloping plains under cultivation.		**30(5.77)**
388		KVRmB1	Clay surface, slope 1-3%, slight erosion	30(5.77)
999	Rock outcrops			**8(1.51)**
1000	Others	Habitation and water body		**160(30.81)**

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

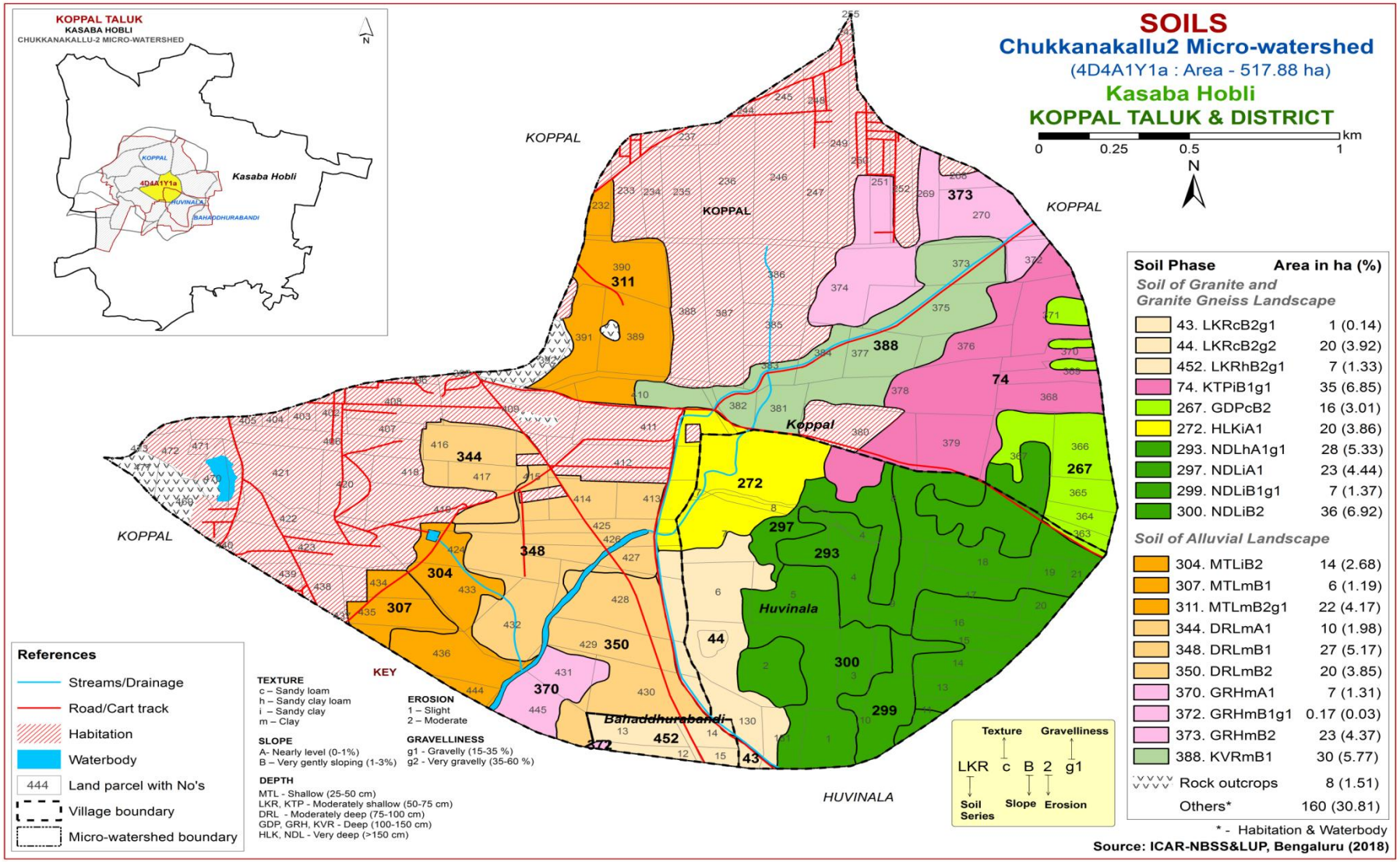


Fig 3.5 Soil Phase or Management Units of Chukkanakallu-2 Microwatershed

Chapter 4

THE SOILS

Detailed information pertaining to the nature, extent and distribution of different kinds of soils occurring in Chukkanakallu-2 microwatershed is provided in this chapter. The microwatershed area has been identified as granite gneiss and alluvial landscape based on geology. In all, 9 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 9 soil series identified followed by 20 soil phases (management units) mapped (Fig. 3.5) are furnished below. The physical and chemical characteristics of soil series identified in Chukkanakallu-2 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 and Granite gneiss Landscape

In this landscape, 5 soil series were identified and mapped. Of these series, NDL series occupies maximum area of 94 ha (18%) followed by KTP 35 ha (7%), LKR 28 ha (5%), HLK 20 ha (4%) and GDP 16 ha (3%). The brief description of the soil series along with the soil phases identified and mapped is given below.

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

The thickness of the solum ranges from 51 to 74 cm. The thickness of A horizon ranges from 12 to 18 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 clay loam with 15 to 50 per cent gravel. The thickness of B horizon ranges from 39 to 58 cm. Its colour is in 2.5 YR hue with value 3 to 4 and chroma 4 to 6. Texture is sandy clay with 40 to 60 per cent gravel. The available water capacity is low (51-100 mm/m). Three soil phases were identified and mapped.

Landscape and soil profile characteristics of Lakkur (LKR) Series

4.1.2 Kethanapura (KTP) Series: Kethanapura soils are moderately shallow (50-75 cm), well drained, have dark reddish brown, gravelly sandy clay soils. They have developed from weathered granite gneiss and occur on very gently to gently sloping uplands. The Kethanapura series has been classified as a member of the fine, mixed, isohyperthermic family of Rhodic Paleustalfs.

The thickness of the solum ranges from 53 to 72 cm. The thickness of A-horizon ranges from 11 to 16 cm. Its colour is in 5YR and 2.5 YR hue with value 3 to 4 and chroma 3 to 6. The texture varies from loamy sand to sandy clay loam with 15 to 40 per cent gravel. The thickness of B-horizon varies from 41 to 56 cm. Its colour is in 2.5 YR hue with value 3 to 4 and chroma 4 to 6. Texture is dominantly sandy clay loam with 15 to 35 per cent gravel. The available water capacity is medium (101-150 mm/m). Only one soil phase was identified and mapped.

Landscape and soil profile characteristics of Kethanapura (KTP) Series

4.1.3 Giddadapalya (GDP) Series: Giddadapalya soils are deep (100-150 cm), well drained, have dark reddish brown to dark red gravelly sandy clay to clay soils. They have developed from weathered granite gneiss and occur on very gently sloping uplands under cultivation. The Giddadapalya series has been classified as a member of the fine, mixed, isohyperthermic family of Rhodic Paleustalfs.

The thickness of the solum ranges from 106 to 145 cm. The thickness of A-horizon ranges from 12 to 13 cm. Its colour is in 5 YR hue with value and chroma 3 to 4. The texture ranges from sandy loam with 10 to 15 per cent gravel. The thickness of B-horizon ranges from 106 to 123 cm. Its colour is in 2.5 YR hue with value 3 to 4 and chroma 3 to 6. Texture is sandy clay to clay with 35 to 75 per cent gravel. The available water capacity is low (51-100 mm/m). Only one soil phase was identified and mapped.

Landscape and soil profile characteristics of Giddadapalya (GDP) Series.

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

The thickness of the solum is more than 150 cm. The thickness of A horizon ranges from 11 to 14 cm. Its colour is in 7.5 YR and 5 YR hue with value 3 to 4 and chroma 3 to 4. The texture varies from sandy loam to sandy clay loam. The thickness of B horizon is more than 150 cm. Its colour is in 7.5 YR and 5 YR hue with value and chroma 3 to 4. Its texture is clay. The available water capacity is high (151-200 mm/m). Only one soil phase was identified and mapped.

Landscape and soil Profile Characteristics of Hallikere (HLK) Series

4.1.5 Niduvalalu (NDL) Series: Niduvalalu soils are very deep (>150 cm), well drained, have dark red and dark reddish brown gravelly sandy clay soils. They have developed from weathered granite gneiss and occur on nearly level to very gently sloping uplands under cultivation. The Niduvalalu series has been classified as a member of the clayey-skeletal, mixed, isohyperthermic family of Rhodic Paleustalfs.

The thickness of the solum is more than 150 cm. The thickness of A-horizon ranges from 11 to 15 cm. Its colour is in 5 YR hue with value 3 to 4 and chroma 4 to 6. The texture varies from sandy loam to sandy clay loam with 10 to 30 per cent gravel. The thickness of B-horizon ranges from 150 to 160 cm. Its colour is in 2.5 YR hue with value 2.5 to 4 and chroma 4 to 6. Its texture is sandy clay and ranges from gravelly sandy clay with 20 to 75 per cent gravel. The available water capacity is low (51-100 mm/m). Four soil phases were identified and mapped.

Landscape and soil Profile Characteristics of Niduvalalu (NDL) Series

4.2 Soils of Alluvial Landscape

In this landscape, 4 soil series were identified and mapped. Of these series, DRL series occupies maximum area of 57 ha (11%) followed MTL 42 ha (8%), GRH 30 ha (6%) and KVR 30 ha (6%).The brief description of the soil series along with the soil phases identified and mapped is given below.

4.2.1 Muttal (MTL) Series: Muttal soils are shallow (25-50 cm), well drained, have dark brown to very dark grayish brown, calcareous gravelly clay soils. They have developed from alluvium and occur on nearly level to very gently sloping plains. The Muttal series has been classified as a member of the clayey, mixed, (calc), isohyperthermic family of (Paralithic) Haplustepts.

The thickness of the solum ranges from 30 to 50 cm. The thickness of A horizon ranges from 15 to 18 cm. Its colour is in 7.5 YR and 10 YR hue with value 2 to 3 and chroma 2.5 to 4. The texture varies from sandy clay to clay with 10 to 15 per cent gravel. The thickness of B horizon ranges from 18 to 32 cm. Its colour is in 10 YR and 7.5 YR hue with value 2 to 6 and chroma 2 to 4. Its texture is sandy clay to clay. The available water capacity is low (51-100 mm/m). Three soil phases were identified and mapped.

Landscape and soil profile characteristics of Muttal (MTL) Series

4.2.2 Dambarahalli (DRL) Series: Dambarahalli soils are moderately deep (75-100 cm), moderately well drained, have black and very dark gray to dark brown calcareous cracking clay soils. They have developed from alluvium and occur on very gently to gently sloping plains under cultivation. The Dambarahalli series has been classified as a member of the very fine, smectitic, (calc), isohyperthermic family of Typic Haplusterts.

The thickness of the solum ranges from 75 to 99 cm. The thickness of A horizon ranges from 13 to 24 cm. Its colour is in 10 YR hue with value 3 to 4 and chroma 1 to 2. The texture is clay. The thickness of B horizon ranges from 54 to 85 cm. Its colour is in

10 YR hue with value 2 to 4 and chroma 1 to 3. Its texture is clay and is calcareous. The available water capacity is high (151-200 mm/m). Three soil phases were identified and mapped.

Landscape and soil profile characteristics of Dambarahalli (DRL) Series

4.2.3 Gatareddihal (GRH) Series: Gatareddihal soils are deep (100-150 cm), moderately well drained have black or dark grey to light olive brown, calcareous sodic clay soils. They are developed from alluvium and occur on nearly level to very gently sloping plains under cultivation. The Gatareddihal series has been classified as member of the very fine, smectitic, (calc), isohyperthermic family of Sodic Haplusterts.

The thickness of the solum ranges from 102 to 149 cm. The thickness of A-horizon ranges from 12 to 19 cm. Its colour is in 7.5 YR, 10 YR hue with value 3 to 4 and chroma 1 to 6. The texture is sandy clay loam to clay. The thickness of B-horizon ranges from 86 to 117 cm. Its colour is in 10 YR and 7.5 YR hue with value 3 and chroma 2 to 6. Texture is clay with less than 15 per cent gravel. The available water capacity is very high (>200 mm/m). Three soil phases were identified and mapped.

Landscape and soil profile characteristics of Gatareddihal (GRH) Series

4.2.4 Kavalur (KVR) Series: Kavalur soils are deep (100-150 cm), moderately well drained, have dark yellowish brown to very dark brown and very dark gray, calcareous black cracking clay soils. They have developed from alluvium and occur on very gently sloping plains. The Kavalur series has been classified as a member of the fine, smectitic, (calc), isohyperthermic family of Typic Haplusterts.

The thickness of the solum is 113 to 143 cm. The thickness of A horizon ranges from 9 to 24 cm. Its colour is in 10 YR hue with value 3 and chroma 1. The texture is clay with no gravel. The thickness of B horizon ranges from 89 to 134 cm. Its colour is in 10 YR hue with value 3 and chroma 1. Its texture is clay. The available water capacity is very high (>200 mm/m). Only one soil phase was identified and mapped.

Landscape and soil profile characteristics of Kavalur (KVR) series

Table: 4.1 Physical and Chemical Characteristics of Soil Series identified in Chukkanakallu-2 microwatershed

Soil Series: Lakkur (LKR), **Pedon:** RM-8.

Location: $15^0$04'26.3"N, $75^0$37'84.1"E, (4D4A3I1f), Belhatti village, Shirahatti taluk, Gadag distrtict

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

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-21	Ap	74.00	8.34	17.66	9.62	11.57	15.76	23.13	13.92	20	sl	-	-
21-35	Bt	54.37	10.48	35.14	16.33	8.64	9.69	11.59	8.11	40	sc	-	-
35-56	Bc	48.37	13.46	38.17	10.96	7.69	9.17	11.28	9.27	60	sc	-	-

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-21	8.18	-	-	0.30	0.56	0.94	-	-	0.31	0.55	0.86	12.19	0.69	100.00	4.51
21-35	8.17	-	-	0.30	0.52	1.29	-	-	0.19	0.84	1.03	22.18	0.63	100.00	3.79
35-56	7.95	-	-	0.46	0.48	1.99	-	-	0.24	0.58	0.82	22.94	0.60	100.00	2.53

Contd…

Series Name: Kethanapura (KTP), **Pedon:** R-9
Location: $15^0$25'28.81"N, $76^0$22'00.76" E Jabbaragudda village, Koppal Taluk and District
Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Fine, 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
0-18	Ap	83.64	10.52	5.84	25.61	22.36	15.24	13.52	6.91	10	ls	7.92	2.58
18-38	Bt1	46.06	5.63	48.31	21.58	9.54	3.53	4.15	7.26	30	sc	19.62	14.48
38-73	Bt2	52.31	6.91	40.78	24.56	12.74	5.96	5.55	3.49	30	sc	17.73	11.95

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-18	6.42	-		0.07	1.24	-	2.95	0.93	0.57	0.02	4.48	4.41	0.75	100.00	0.05
18-38	6.63	-	-	0.09	0.70	-	11.71	3.53	0.98	0.08	16.31	16.59	0.34	98.30	0.50
38-73	6.88	-	-	0.15	0.48	-	11.36	3.30	0.72	0.13	15.50	15.75	0.39	98.42	0.80

Contd…

Series Name: Giddadapalya (GDP), **Pedon:** R-8
Location: $15^0$25'26"N, $76^0$10'59"E, Kalakeri village, Koppal Taluk and District
Analysis at: NBSS&LUP, Regional Centre, Bangalore. Classification: Fine, 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
0-16	Ap	74.95	9.24	15.81	18.43	18.94	13.85	14.97	8.76	-	sl	11.88	5.09
16-43	Bt1	41.69	13.89	44.42	9.84	10.90	7.41	7.62	5.93	-	c	23.13	14.53
43-61	Bt2	47.67	6.13	46.19	21.14	10.15	5.29	6.45	4.65	-	sc	21.60	11.87
61-83	Bt3	52.52	7.10	40.38	24.42	10.59	5.66	7.55	4.30	40	sc	19.51	11.35
83-119	Bt4	43.76	11.59	44.65	20.15	7.56	5.77	5.46	4.83	60	c	20.80	12.06
119-139	Bt5	54.93	9.84	35.23	29.70	10.49	5.50	5.92	3.32	50	sc	15.24	11.97

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}							%	%
0-16	7.88	-	-	0.103	0.79	-	5.98	1.35	0.05	0.22	7.60	7.8	0.49	97	2.87
16-43	7.81	-	-	0.117	0.66	-	13.99	1.97	0.08	0.46	16.50	16.9	0.38	98	2.74
43-61	7.74	-	-	0.132	0.51	-	12.70	2.18	0.08	0.69	15.64	15.9	0.34	98	4.36
61-83	7.72	-	-	0.142	0.39	-	11.46	2.22	0.08	0.66	14.41	14.6	0.36	99	4.53
83-119	7.58	-	-	0.115	0.22	-	11.30	2.70	0.09	0.73	14.82	15.3	0.34	97	4.79
119-139	7.50	-	-	0.113	0.22	-	10.03	2.19	0.07	0.65	12.95	13.2	0.37	98	4.89

Contd…

Series Name: Niduvalalu (NDL), **Pedon:** R-20
Location: $15^0$12'78.8"N, $75^0$57'44.0" E Raghunathanahalli village, Koppal Taluk and District
Analysis at: NBSS&LUP, Regional Centre, Bangalore. **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
0-16	Ap	79.83	7.02	13.15	9.36	11.02	19.54	28.59	11.33	35-40	sl	14.30	5.17
16-31	Bt1	54.75	10.89	34.36	12.81	7.47	12.17	11.95	10.35	55-60	scl	24.67	14.17
31-44	Bt2	44.64	2.31	53.06	17.06	8.48	7.19	8.05	3.86	65-70	c	30.02	17.19
44-79	Bt3	47.28	2.50	50.21	24.17	8.20	6.07	5.96	2.88	65-70	sc	27.19	14.87
79-107	Bt4	47.79	8.17	44.04	13.38	5.72	11.11	11.87	5.72	60-65	sc	25.96	14.23
107-140	Bt5	46.16	3.57	50.27	21.75	7.57	6.40	6.72	3.73	60-65	sc	27.28	15.13
140-180	Bt6	49.47	3.94	46.59	22.49	8.21	6.29	7.78	4.69	65-70	sc	27.56	14.76

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}							%	%
0-16	7.46	-	-	0.08	0.76		6.26	4.05	0.12	0.09	10.52	11.45	0.87	91.88	0.32
16-31	7.84	-	-	0.28	1.05	2.86	-	-	0.18	1.41	-	27.36	0.80	100.00	2.06
31-44	7.69	-	-	0.46	0.81	2.99	-	-	0.24	2.63	-	32.59	0.61	100.00	3.23
44-79	7.92	-	-	0.11	0.35	1.69	16.29	3.51	0.14	2.63	22.57	22.56	0.45	100.03	4.66
79-107	7.86	-	-	0.09	0.23	1.43	12.98	2.83	0.10	1.82	17.73	17.88	0.41	99.19	4.07
107-140	8.20	-	-	0.07	0.23	1.17	16.26	3.41	0.13	1.85	21.65	20.82	0.41	104.01	3.56
140-180	8.11	-	-	0.20	0.15	1.82	-	-	0.11	1.29	-	20.71	0.44	100.00	2.49

Contd…

Series Name: Muttal (MTL), **Pedon:** RM-13
Location: $15^0$14'30.8"N, $75^0$56'50.6"E, Gatareddihalla village, Koppal Taluk and District
Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Clayey, mixed, (calc), isohyperthermic (Paralithic) Haplustepts

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-20	Ap	39.05	13.74	47.21	3.05	5.05	8.21	14.63	8.11	15-30	c	29.95	17.94
20-34	Bwk	28.77	19.57	51.66	4.81	4.71	4.92	9.09	5.24	10	c	33.44	21.56

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	8.27	-	-	0.202	0.79	6.10	-	-	0.62	0.25	-	36.64	0.78	-	0.69
20-34	8.36	-	-	0.177	0.99	23.04	-	-	0.29	0.38	-	39.60	0.77	-	0.96

Contd…

Series Name: Dombarahalli (DRL), **Pedon:** R-8
Location: $15^0$13'96.2"N, $75^0$57'48.6" E Ragunathanahalli village, Koppal taluk and district
Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Very fine, smectitic, (calc), isohyperthermic Typic Haplusterts

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-15	Ap	28.25	19.48	52.27	4.76	4.44	4.87	8.23	5.95	-	c	39.86	27.20
15-27	BA1	21.55	20.00	58.45	3.76	2.76	3.43	6.30	5.30	-	c	46.35	34.84
27-45	Bss1	14.86	20.89	64.25	2.46	2.23	2.23	3.91	4.02	-	c	57.99	41.06
45-80	Bss2	10.42	19.04	70.54	1.74	1.97	1.27	2.78	2.66	-	c	66.36	36.24

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-15	8.78	-	-	0.42	0.32	12.35	-	-	0.59	4.25	-	49.70	0.95	100.00	5.62
15-27	9.03	-	-	0.61	0.30	12.48	-	-	0.30	8.96	-	57.23	0.98	100.00	10.07
27-45	9.10	-	-	0.67	0.34	11.70	-	-	0.25	11.85	-	60.71	0.95	100.00	14.05
45-80	9.18	-	-	0.86	0.32	13.39	-	-	0.27	15.40	-	63.33	0.90	100.00	18.45

Contd…

Series Name: Gatareddihal (GRH), **Pedon:** R-7
Location: $15^0$14'20.8"N, $76^0$04'28.4" E Gudlanur village, Koppal Taluk and District
Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Very fine, smectitic, (calc), isohyperthermic Sodic Haplusterts

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-18	Ap	20.07	19.71	60.23	1.76	3.75	3.64	3.42	7.50	-	c	41.70	29.56
18-51	Bss1	15.11	17.47	67.42	3.16	3.04	2.25	3.38	3.27	-	c	59.43	38.52
51-80	Bss2	13.19	18.74	68.07	1.80	2.93	2.37	3.04	3.04	-	c	60.69	40.91
80-107	Bss3	17.54	19.50	62.96	2.46	4.13	3.24	4.25	3.46	-	c	57.25	37.31
107-131	BC	9.42	17.48	73.10	1.48	1.82	1.36	1.93	2.84	-	c	64.62	43.98

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-18	9.08	-	-	0.23	0.33	6.89	-	-	0.70	6.36	-	63.21	1.05	100.00	7.11
18-51	9.19	-	-	0.61	0.49	9.10	-	-	0.54	14.20	-	66.05	0.98	100.00	15.98
51-80	9.27	-	-	0.56	0.29	9.36	-	-	0.49	14.75	-	65.63	0.96	100.00	17.07
80-107	9.28	-	-	0.57	0.39	9.62	-	-	0.44	14.64	-	63.95	1.02	100.00	17.49
107-131	9.04	-	-	1.08	0.31	8.32	-	-	0.52	16.40	-	68.36	0.94	100.00	17.30

Contd…

Series Name: Kavalura (KVR), **Pedon:** A2/RM-9
Location: $15^0$18'86.8"N, $75^0$56'56.3"E, Kavalura village, Koppal Taluk and District
Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Fine, smectitic, (calc), isohyperthermic Typic Haplusterts

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
0-24	Ap	36.18	17.80	46.02	7.04	7.47	6.62	9.28	5.76	10	c	28.20	18.75
24-50	Bss1	38.79	15.36	45.85	6.25	6.25	9.70	10.67	5.93	05	c	27.16	18.81
50-85	Bss2	36.80	14.66	48.54	9.63	8.23	7.03	7.58	4.33	<5	c	30.16	22.17
85-124	Bss3	22.66	17.24	60.09	4.18	3.85	5.28	5.06	4.29	<5	c	40.34	31.42

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}							%	%
0-24	8.4	-	-	0.265	0.2	8.04	-	-	0.97	0.65		43.25	0.94		0.60
24-50	9.27	-	-	0.23	0.37	8.04	-	-	0.31	3.21		41.66	0.91		3.08
50-85	9.44	-	-	0.297	0.41	8.64	-	-	0.35	6.43		43.99	0.91		5.85
85-124	9.37	-	-	0.46	0.41	11.40	-	-	0.42	7.99		51.09	0.85		6.26

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 very severe limitations that reduce the choice of crops or that require very careful management.

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

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

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

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

The land capability subclasses are 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 20 soil map units identified in the Chukkanakallu-2 microwatershed are grouped under 2 land capability classes and 5 land capability subclasses (Fig. 5.1).

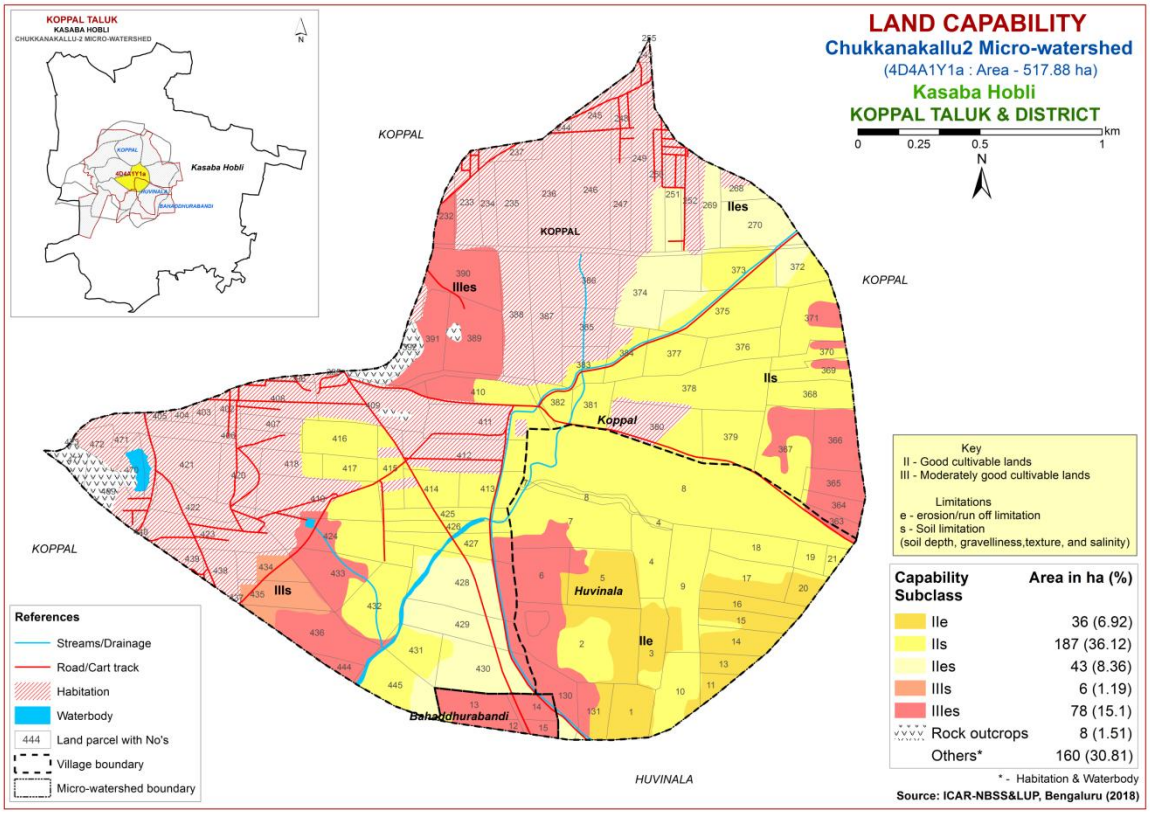


Fig. 5.1 Land Capability classification map of Chukkanakallu-2 Microwatershed

Entire cultivated area in the microwatershed is suitable for agriculture. Good lands (Class II) cover a maximum area of about 266 ha (51%) and are distributed in all parts of the microwatershed with minor problems of soil and erosion. Moderately good (Class III) lands cover an area of about 84 ha (16%) and are distributed in the western, eastern and southern part of the microwatershed with major problems of soil and erosion. An area of about 8 ha (2%) is covered by rockout crops and 160 ha (31%) by others (habitation and water body).

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.

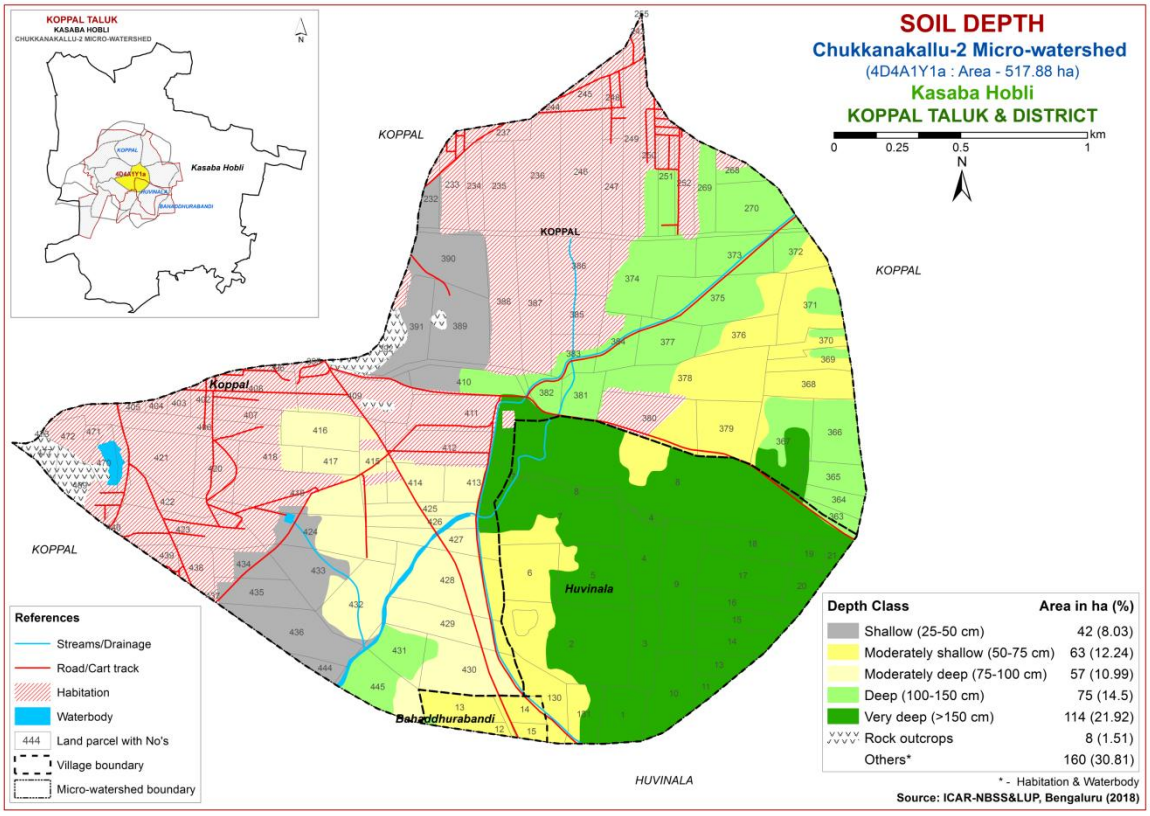


Fig. 5.2 Soil Depth map of Chukkanakallu-2 Microwatershed

Shallow (25-50 cm) soils cover an area of about 42 ha (8%) and are distributed in the western and southern part of the microwatershed. An area of about 63 ha (12%) is

moderately shallow (50-75 cm) and distributed in the western, eastern and southern part of the microwatershed. Moderately deep soils (75-100 cm) cover an area of 57 ha (11%) and are distributed in the western and southern part of the microwatershed. Deep to very deep (100 to >150 cm) soils occupy a maximum area of about 189 ha (37%) and are distributed in all parts of the microwatershed.

The most productive lands cover about 189 ha (37%) where all climatically adopted long duration crops can be grown. Problem soils cover about 42 ha (8%) where only short duration crops can be grown.

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.

An area of about 72 ha (14%) is loamy at the surface and are distributed in the eastern and southern part of the microwatershed. Maximum area of about 279 ha (54%) is clayey at the surface and are distributed in all parts of the microwatershed.

The most productive lands with respect to surface soil texture are clayey soils that (54%) 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 (14%) soils which also have high potential for soil- water retention and nutrient availability but have no drainage or other physical problems.

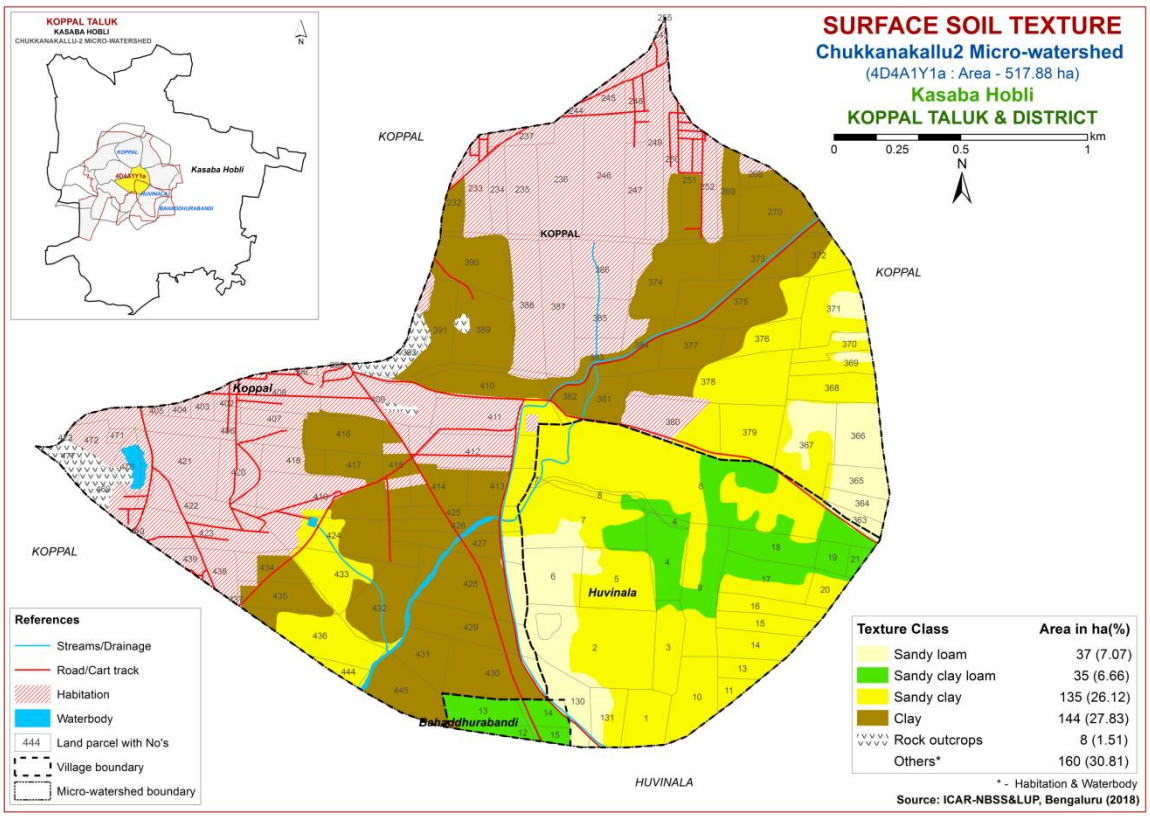


Fig. 5.3 Surface Soil Texture map of Chukkanakallu-2 Microwatershed

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 a maximum area of about 231 ha (45%) and distributed in all parts of the microwatershed. An area of about 100 ha (19%) is covered by gravelly (15-35% gravel) soils and are distributed in the eastern, central, western and southern part of the microwatershed (Fig. 5.4). Very gravelly (35-60%) soils cover an area of 20 ha (4%) and distributed in the southern part of the microwatershed.

The most productive lands with respect to gravelliness are found to be 45 per cent that 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 gravelly (15-35%) and very gravelly (35-60%) cover an area of about 23 per cent where only short duration crops can be grown.

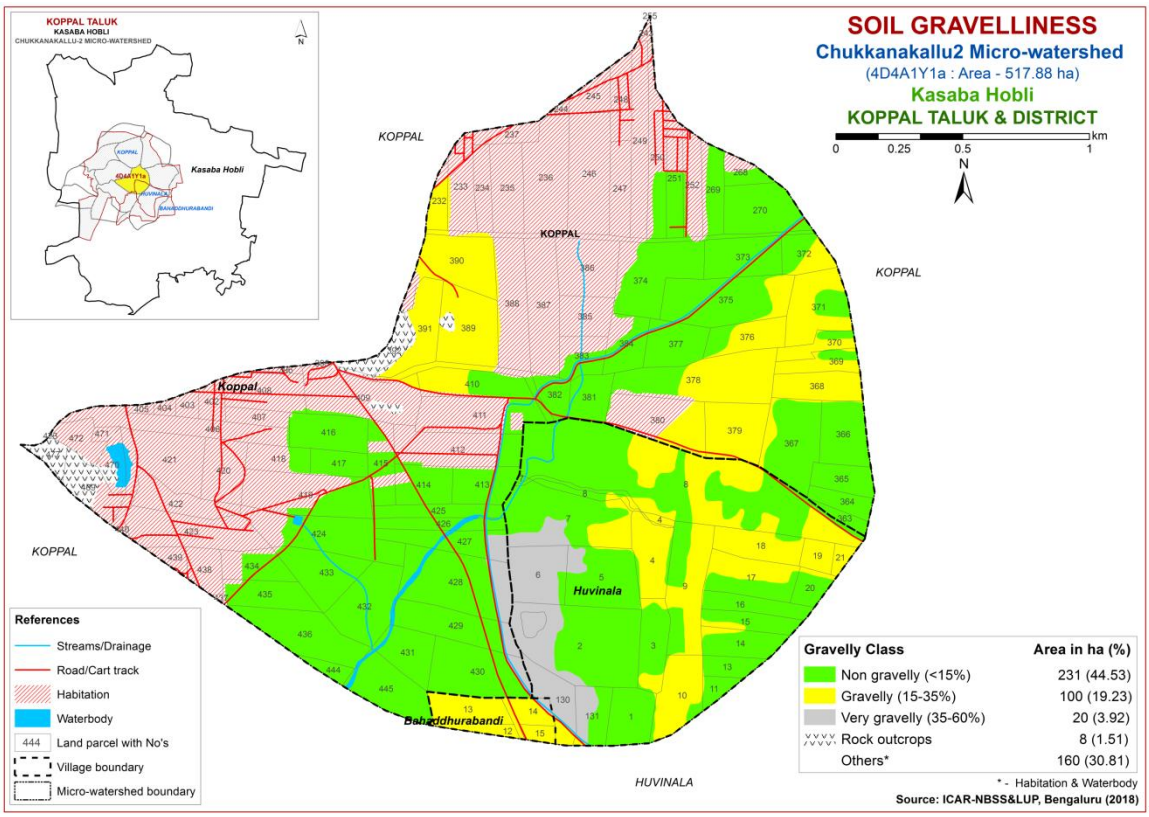


Fig. 5.4 Soil Gravelliness map of Chukkanakallu-2 Microwatershed

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.

An area of about 28 ha (5%) in the microwatershed has soils that are very low (<50 mm/m) in available water capacity and are distributed in the southern part of the microwatershed. Maximum area of about 186 ha (36%) has soils that are low (51 to 100 mm/m) in available water capacity and are distributed in all parts of the microwatershed. An area of about 57 ha (11%) has soils that are medium (101-150 mm/m) in available water capacity and are distributed in the southwestern and southern part of the microwatershed. High (151-200 mm/m) in an area of about 20 ha (4%) and distributed in the central part of the microwatershed. An area of about 59 ha (11%) is very high (>200 mm/m) in available water capacity and are distributed in the northern, central and southern part of the microwatershed.

An area of about 214 ha (41%) in the microwatershed has soils that are problematic with regard to available water capacity. Here, only short duration crops can be grown and the probability of crop failure is very high. These areas are best put to other alternative uses. An area of about 79 ha (15%) has soils that have high potential with regard to available water capacity where all climatically adapted long duration crops can be grown successfully.

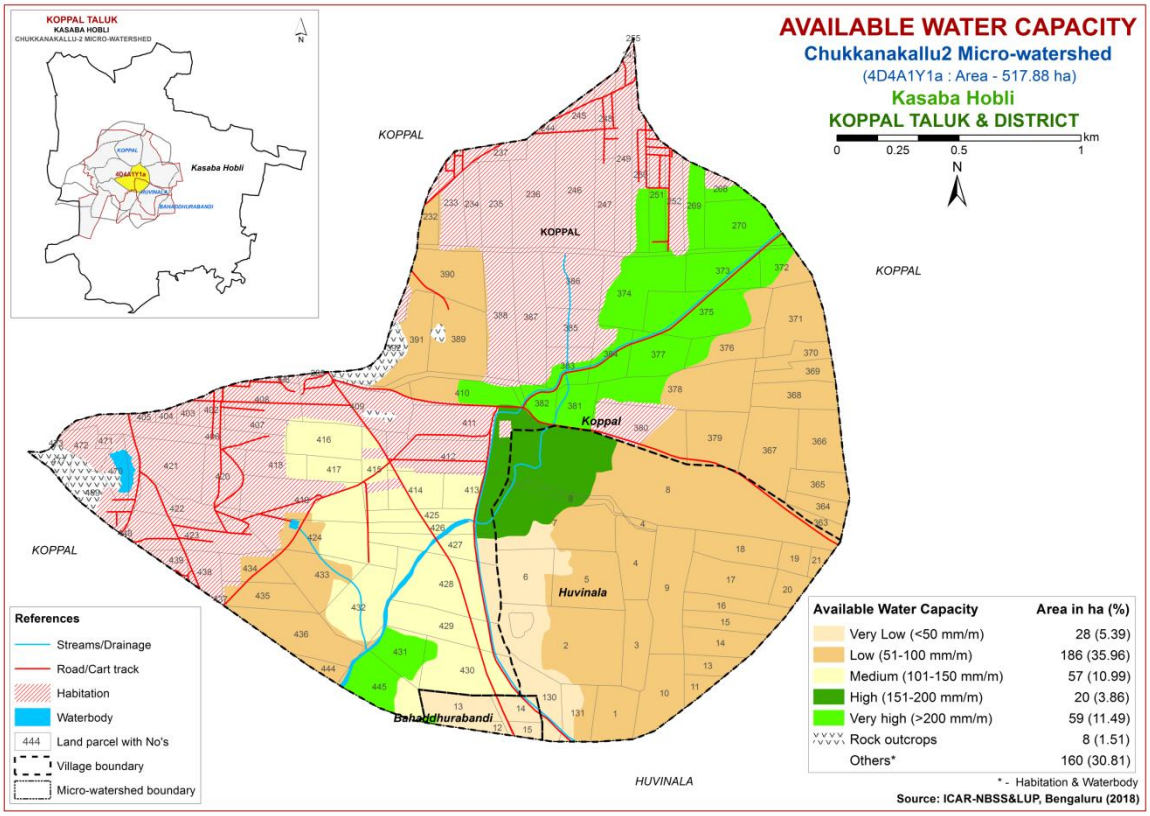


Fig. 5.5 Soil Available Water Capacity map of Chukkanakallu-2 Microwatershed

5.6 Soil Slope

Soil slope refers to the inclination of the surface of the land. It is defined by gradient, shape and length, and is an integral feature of any soil as a natural body. Slope is considered important in soil genesis, land use and land development. The length and gradient of slope influences the rate of runoff, infiltration, erosion and deposition. The soil map units were grouped into three slope classes and a slope map was generated showing the area extent and their geographic distribution of different slope classes in the microwatershed (Fig. 5.6).

An area of about 88 ha (17%) is nearly level (0-1%) lands and are distributed in the central, eastern, western and southern part of the microwatershed. Maximum area of 263 ha (51%) in the microwatershed has very gently sloping (1-3%) lands and are distributed in all parts of the microwatershed. In these areas, all climatically adapted annual and perennial crops can be grown without much soil and water conservation and other land development measures.

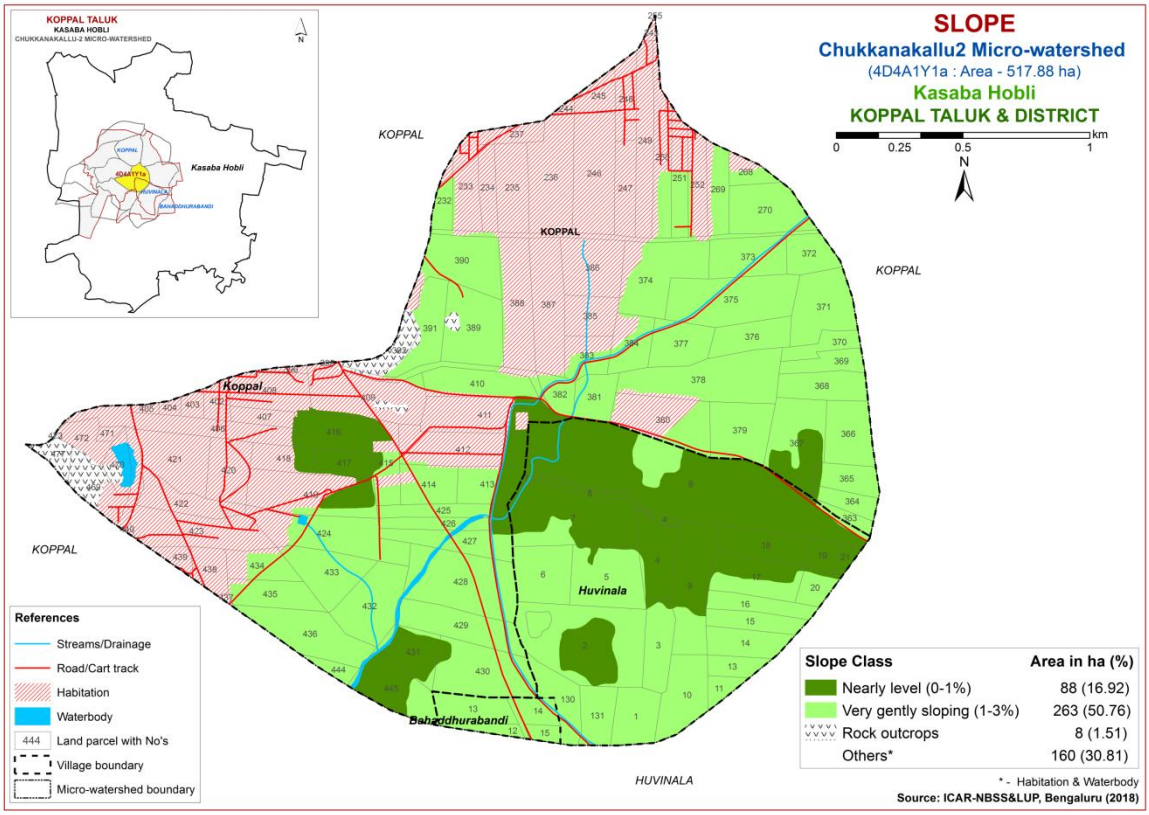


Fig. 5.6 Soil Slope map of Chukkanakallu-2 Microwatershed

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 (e1 class) lands cover a maximum area of about 193 ha (37%) and are distributed in all parts of the microwatershed. An area of about 157 ha (30%) is moderately eroded (e2 class) and distributed in the northern, eastern, western and southern part of the microwatershed. Moderately eroded lands are problematic and need appropriate soil and water conservation and other land development measures.

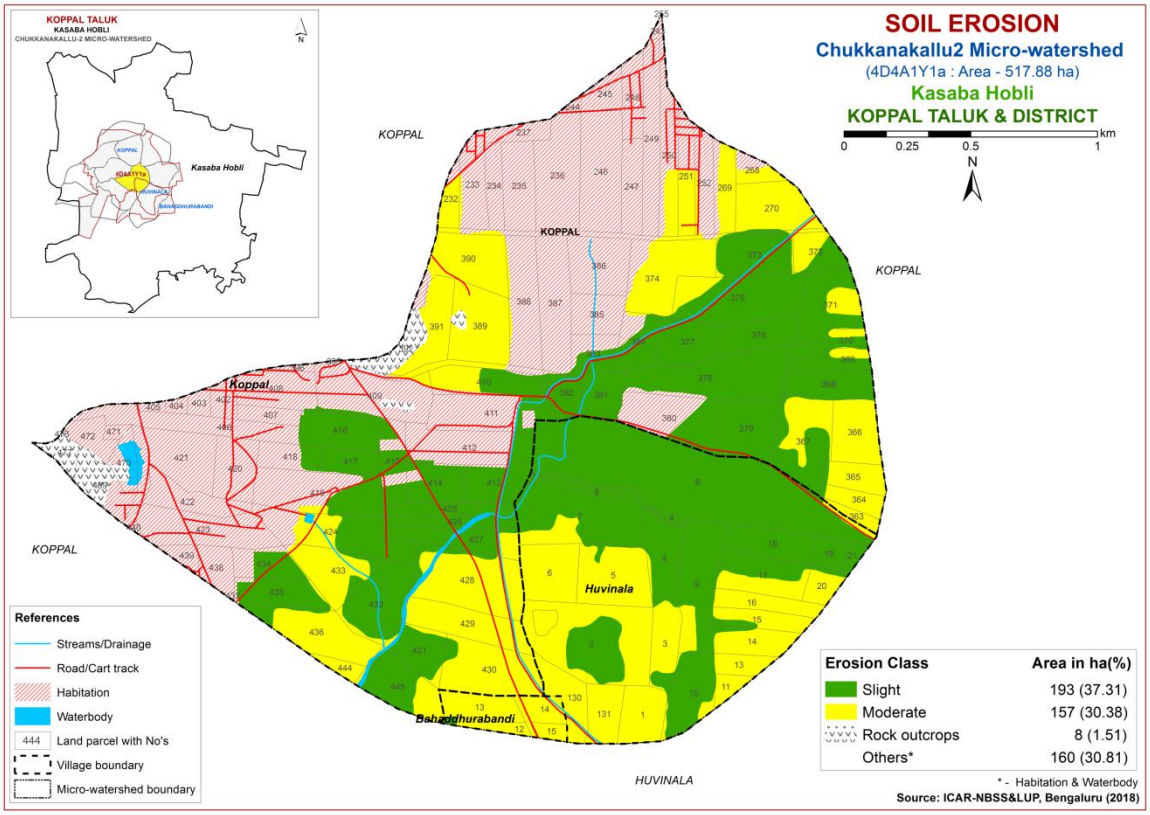


Fig. 5.7 Soil Erosion map of Chukkanakallu-2 Microwatershed

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 2018 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 Chukkanakallu-2 microwatershed for soil reaction (pH) showed that maximum area of about 202 ha (39%) is slightly alkaline (pH 7.3-7.8) and distributed in all parts of the microwatershed. An area of about 42 ha (8%) is moderately alkaline (pH 7.8-8.4) and are distributed in the eastern, central and southern part of the microwatershed. An area of about 45 ha (9%) is strongly alkaline (pH 8.4-9.0) and are distributed in the western, southern and eastern part of the microwatershed. An area of 61 ha (12%) is very strongly alkaline (pH >9.0) and distributed in the northern, western and southwestern part of the microwatershed. Thus, all the soils in the microwatershed are alkaline in reaction (Fig.6.1).

6.2 Electrical Conductivity (EC)

The Electrical Conductivity in the entire area of the microwatershed is <2 dS/m and as such soils are non-saline (Fig 6.2).

6.3 Organic Carbon

Maximum area of about 241 ha (47%) is medium (0.5-0.75%) in organic carbon content and distributed in all parts of the microwatershed (Fig.6.3). An area of about 109 ha (21%) is high (>0.75%) in organic carbon and distributed in the eastern part of the microwatershed.

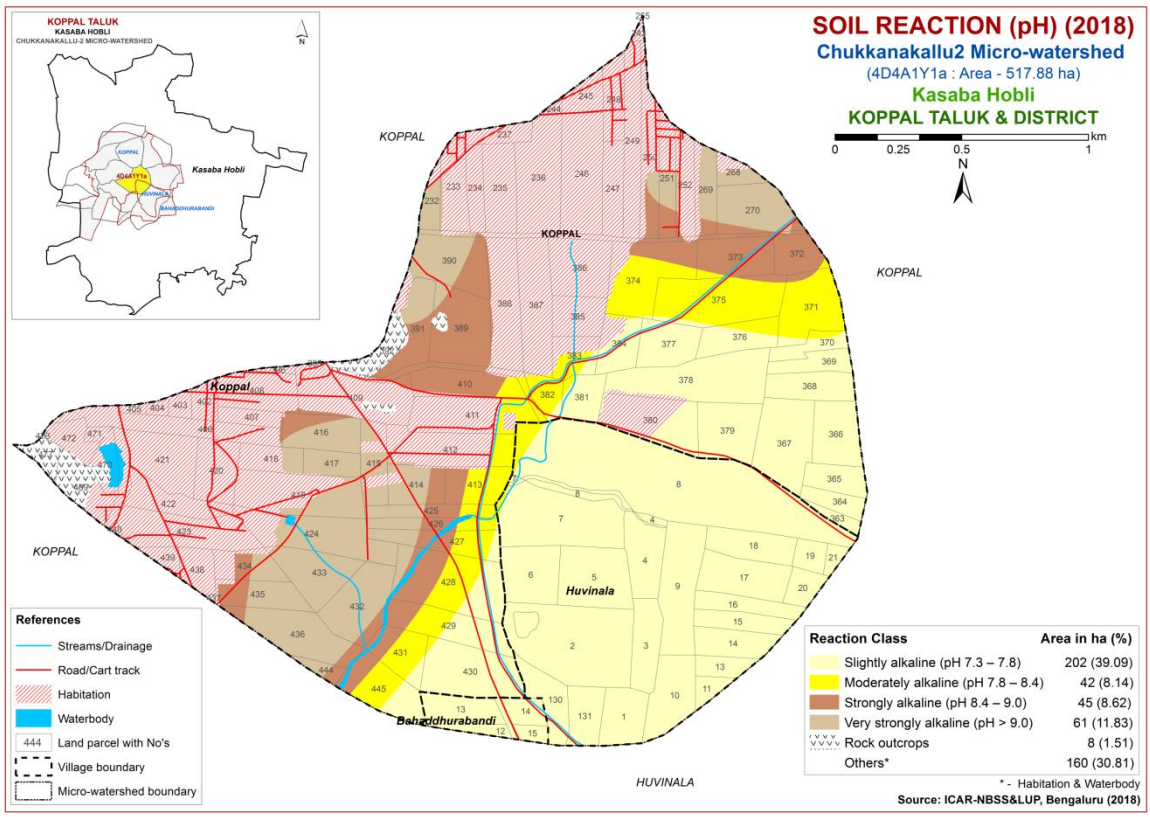


Fig.6.1 Soil Reaction (pH) map of Chukkanakallu-2 Microwatershed

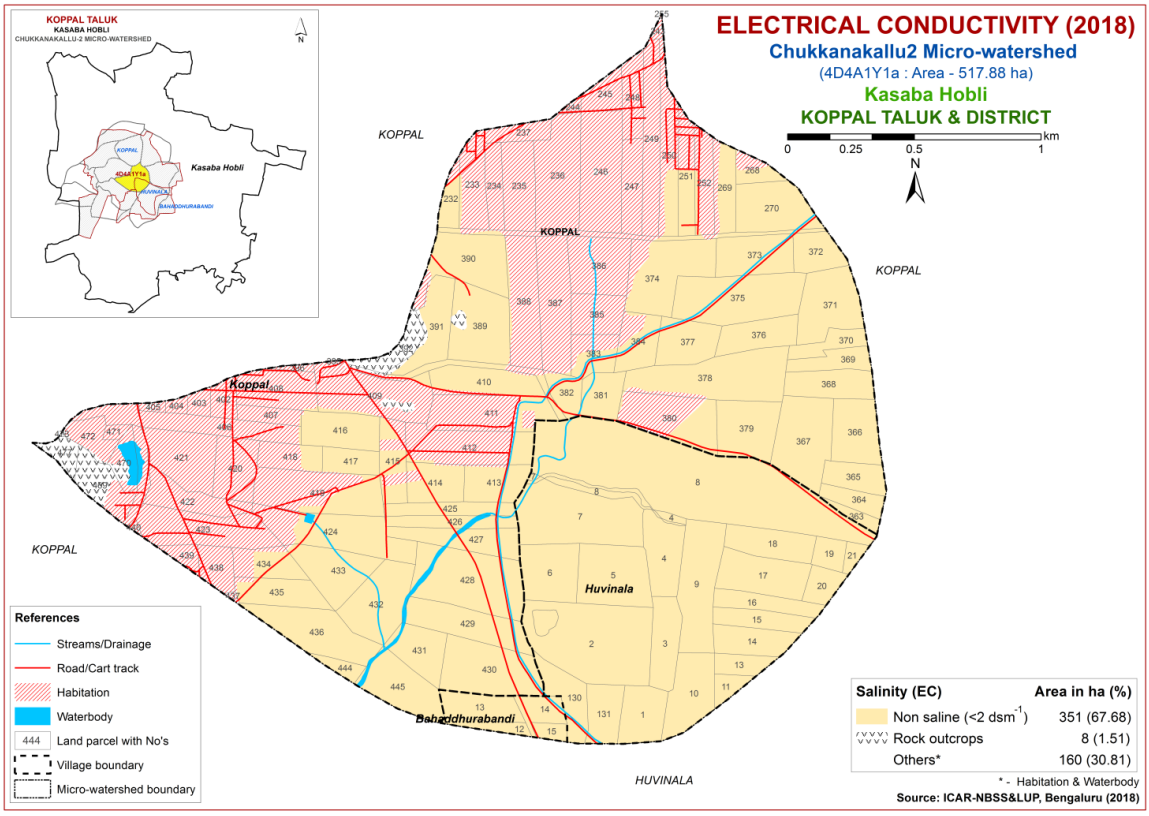


Fig.6.2 Electrical Conductivity (EC) map of Chukkanakallu-2 Microwatershed

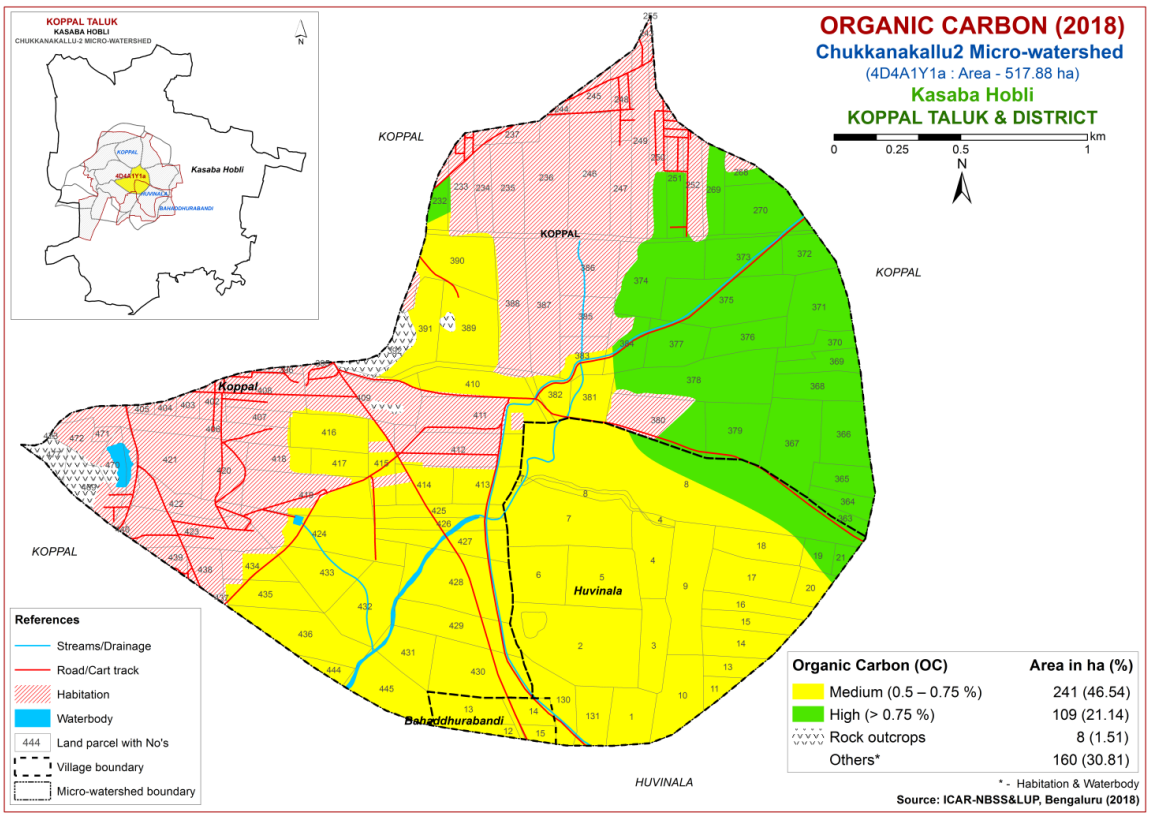


Fig.6.3 Soil Organic Carbon map of Chukkanakallu-2 Microwatershed

6.4 Available Phosphorus

Entire area in the microwatershed is medium (23-57 kg/ha) in available phosphorus. Apply additional 25% phosphorous in areas where it is low and medium in available phosphorous (Fig 6.4).

6.5 Available Potassium

Low (<145 kg/ha) in an area of about 130 ha (25%) and distributed in the eastern and southern part of the microwatershed. Medium (145-337 kg/ha) in a maximum area of about 213 ha (41%) and are distributed in all parts of the microwatershed. An area of about 8 ha (1%) is high (>337 kg/ha) in available potassium and are distributed in the northern part of the microwatershed (Fig. 6.5). Apply additional 25% potassium in areas where it is low and medium in available potassium.

6.6 Available Sulphur

Available sulphur content is low (<10 ppm) in a maximum area of about 349 ha (67%) and are distributed in all parts of the microwatershed. An area of about 1 ha (<1%) is medium (10-20 ppm) in available sulphur and are distributed in the western 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

Available boron content in Chukkanakallu-2 microwatershed is low (< 0.5ppm) in an area of about 12 ha (2%) and distributed in the western part of the microwatershed. Maximum area of about 339 ha (65%) is medium (0.5-1.0 ppm) and distributed in all parts of the microwatershed (Fig.6.7). High (>1.0 ppm) in an area of 24 ha (4%) and distributed in the southern part of the microwatershed.

6.8 Available Iron

Available iron content is deficient (<4.5 ppm) in a maximum area of about 290 ha (56%) and are distributed in all parts of the microwatershed. Sufficient (>4.5 ppm) in an area of about 60 ha (12%) and are distributed in the eastern part of the microwatershed (Fig 6.8).

6.9 Available Manganese

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

6.10 Available Copper

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

6.11 Available Zinc

Available zinc content is sufficient (>0.6 ppm) in the entire microwatershed area (Fig 6.11).

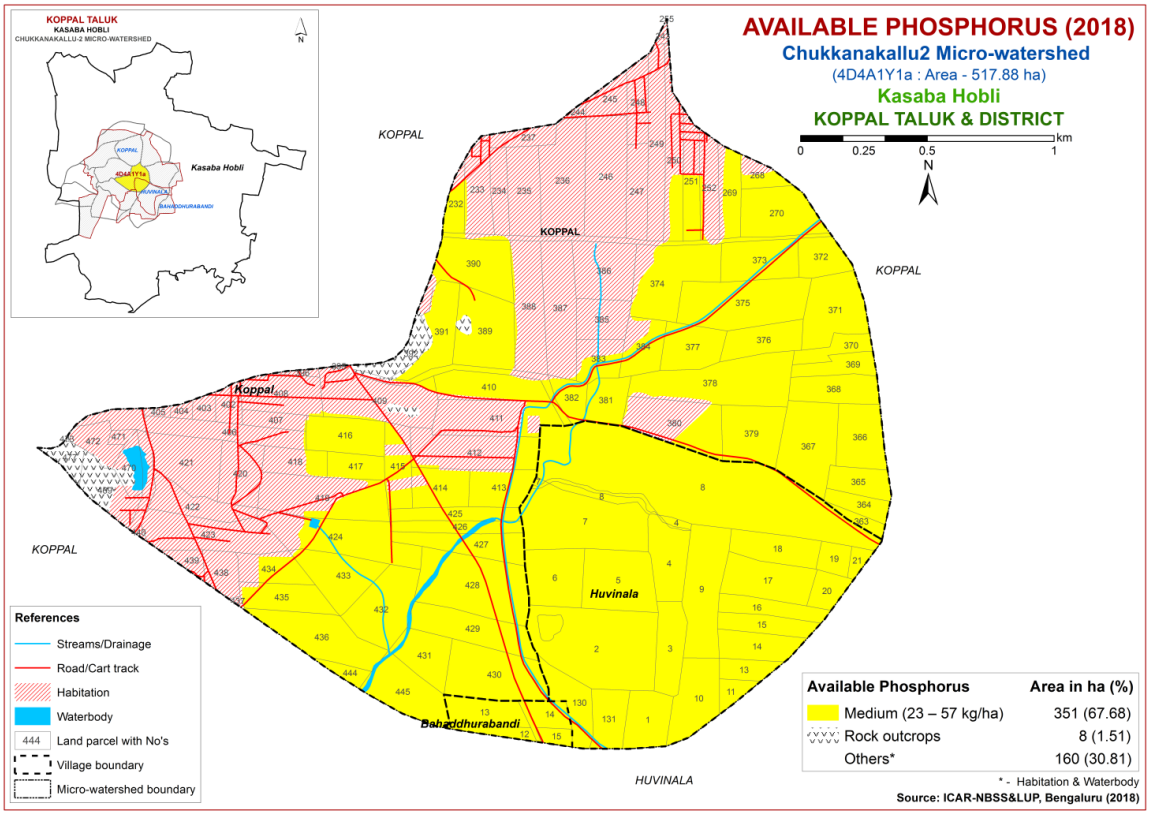


Fig.6.4 Soil Available Phosphorus map of Chukkanakallu-2 Microwatershed

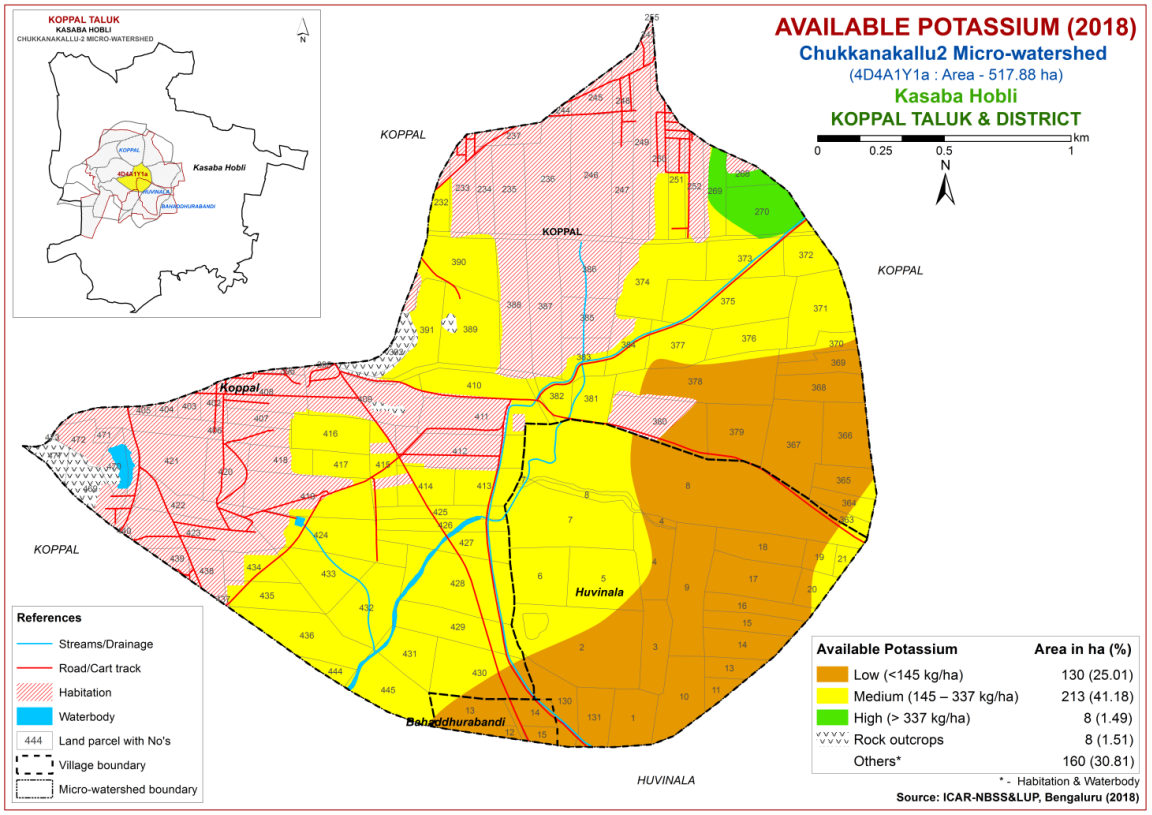


Fig.6.5 Soil Available Potassium map of Chukkanakallu-2 Microwatershed

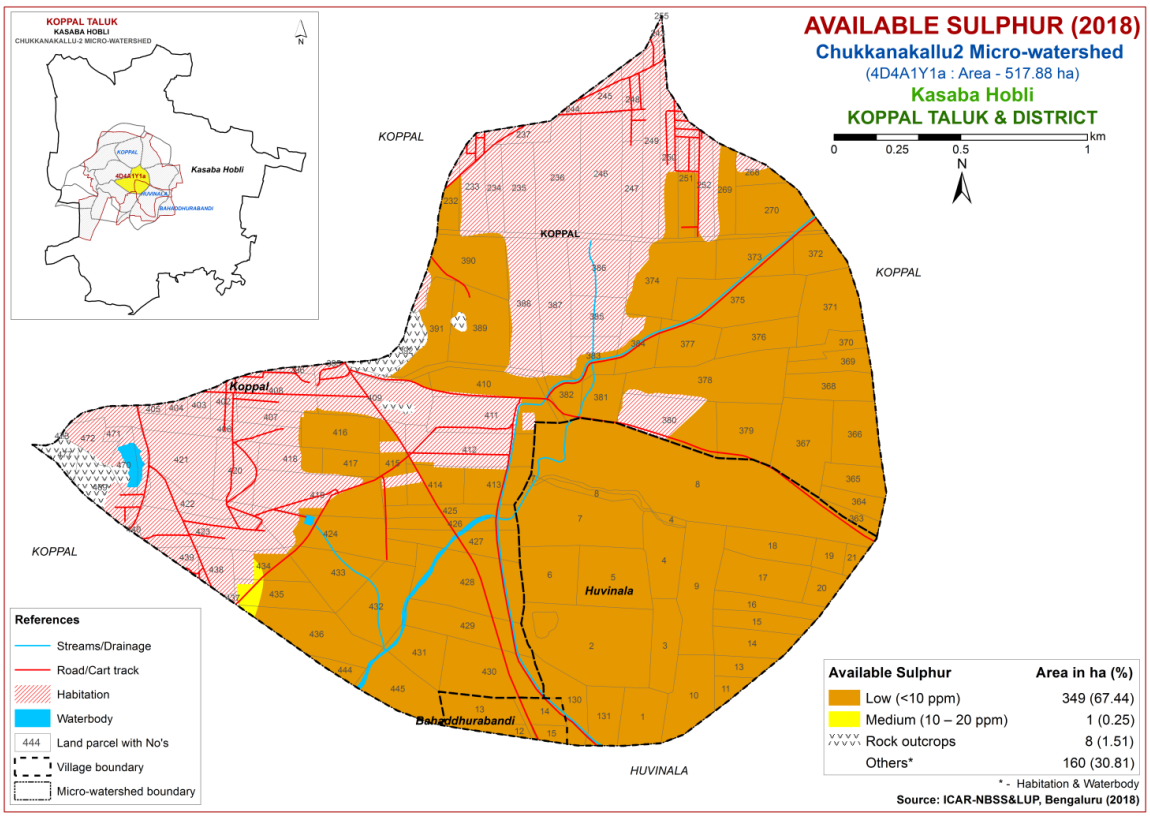


Fig.6.6 Soil Available Sulphur map of Chukkanakallu-2 Microwatershed

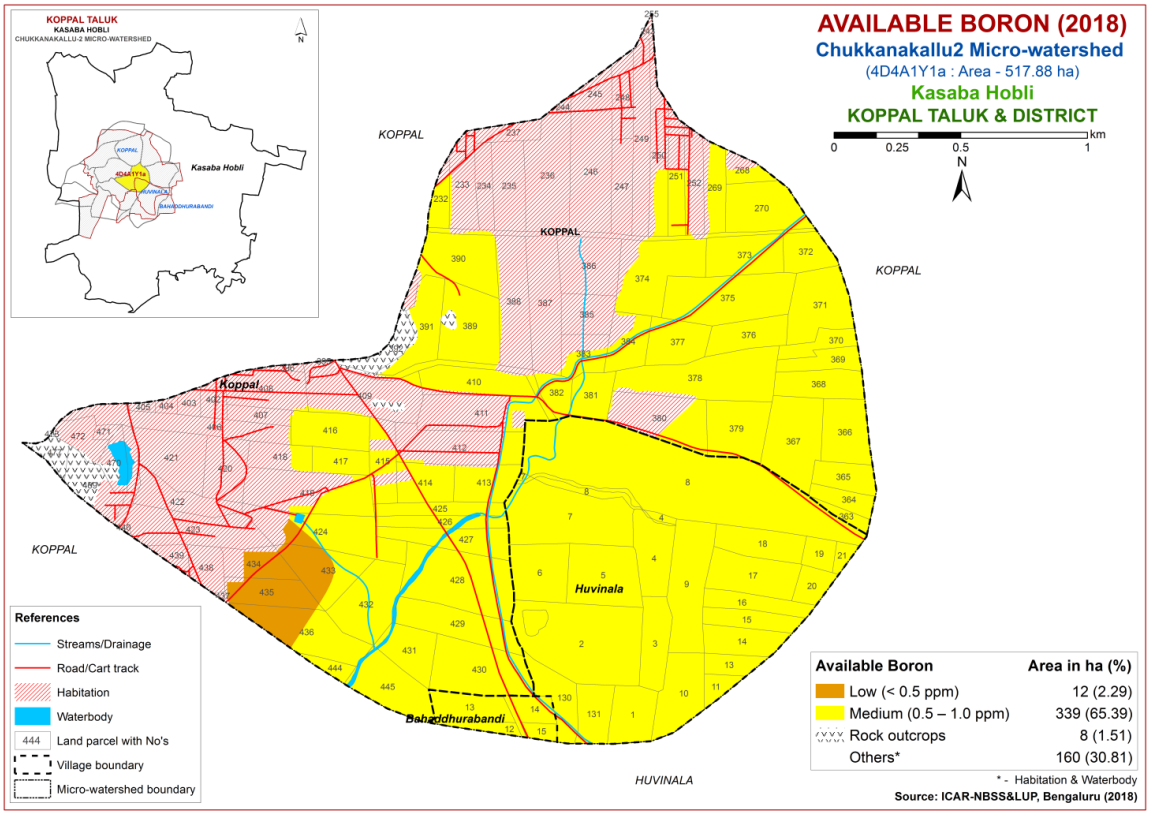


Fig.6.7 Soil Available Boron map of Chukkanakallu-2 Microwatershed

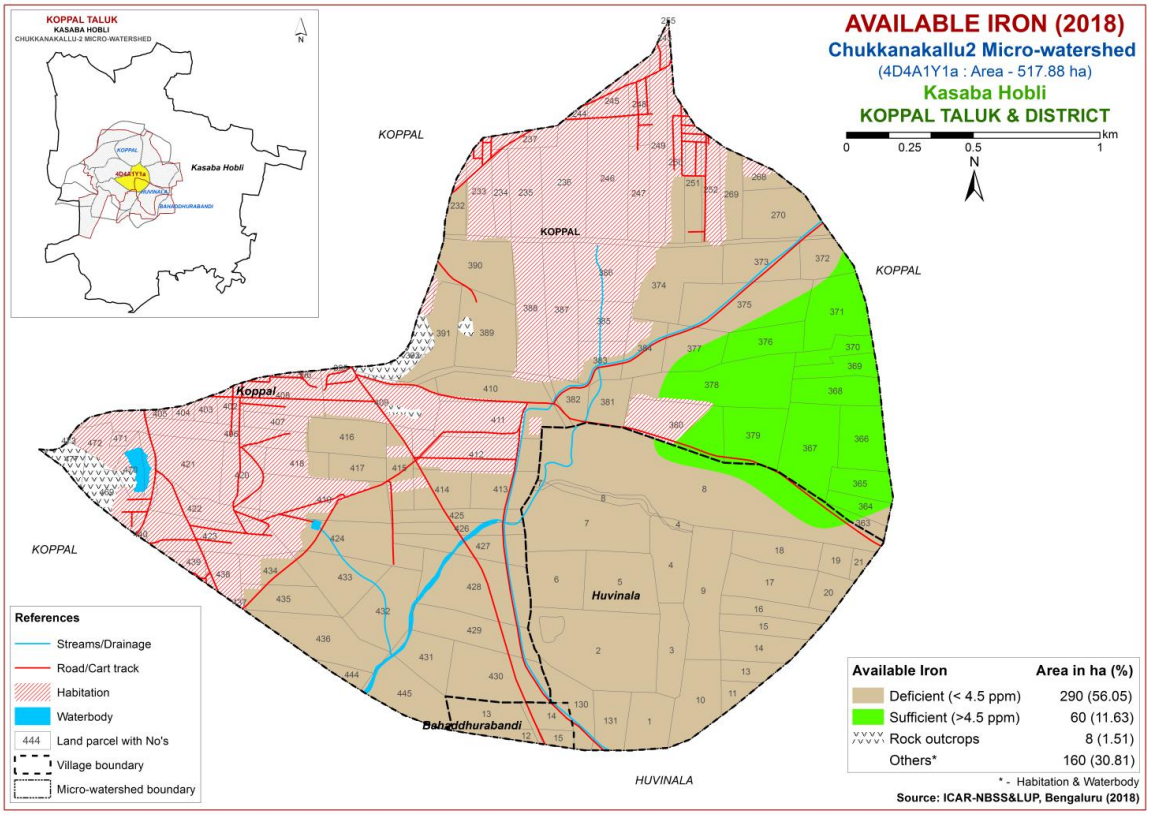


Fig.6.8 Soil Available Iron map of Chukkanakallu-2 Microwatershed

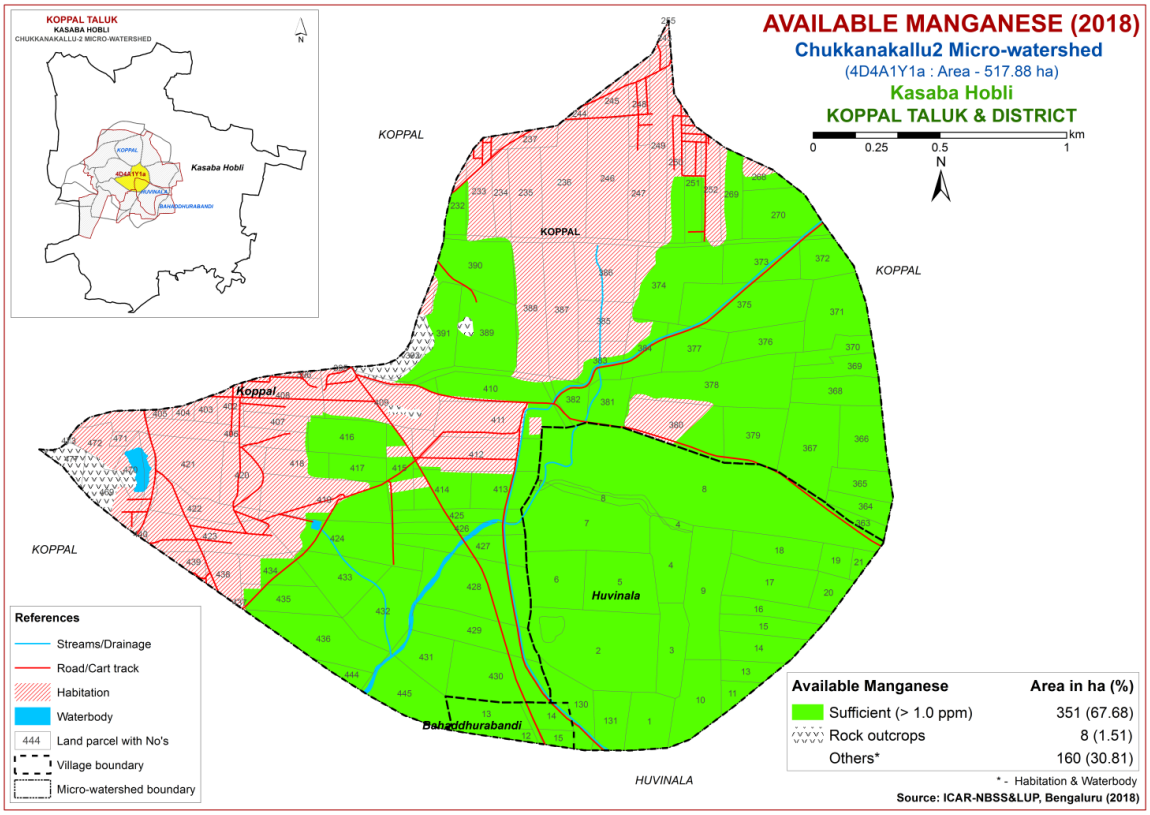


Fig.6.9 Soil Available Manganese map of Chukkanakallu-2 Microwatershed

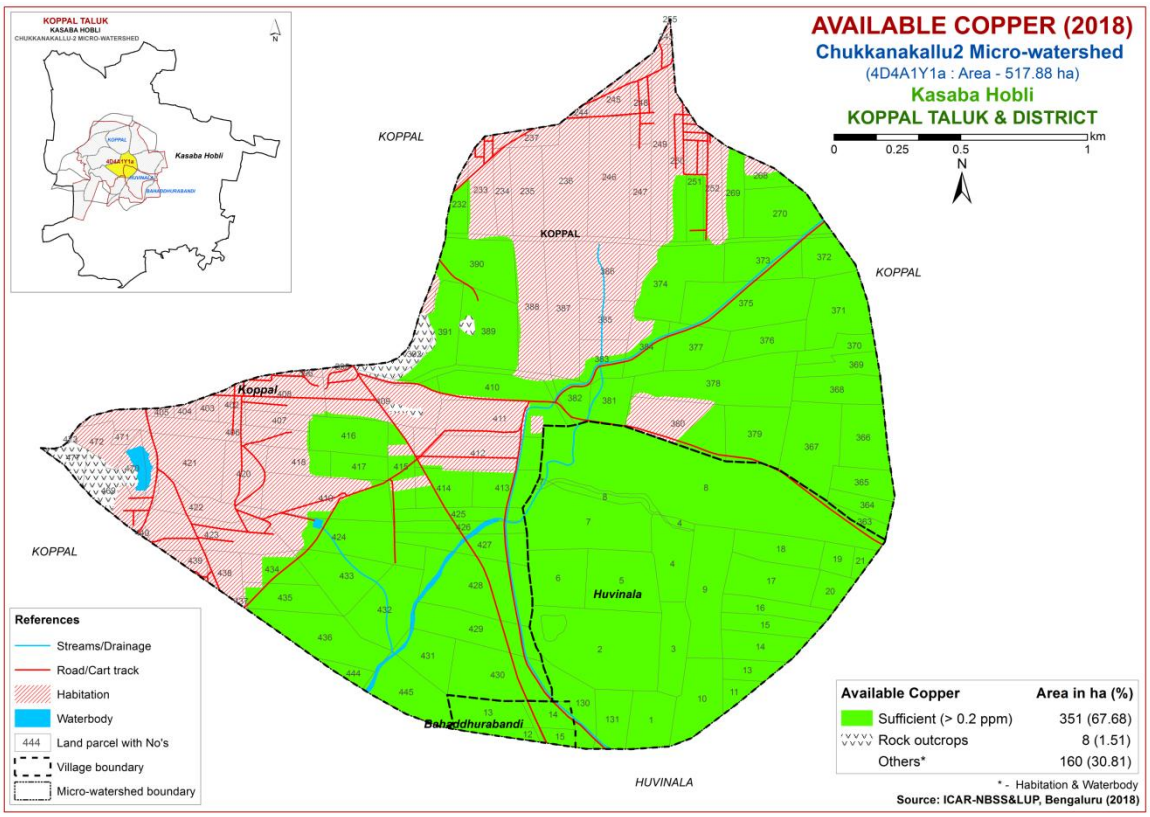


Fig.6.10 Soil Available Copper map of Chukkanakallu-2 Microwatershed

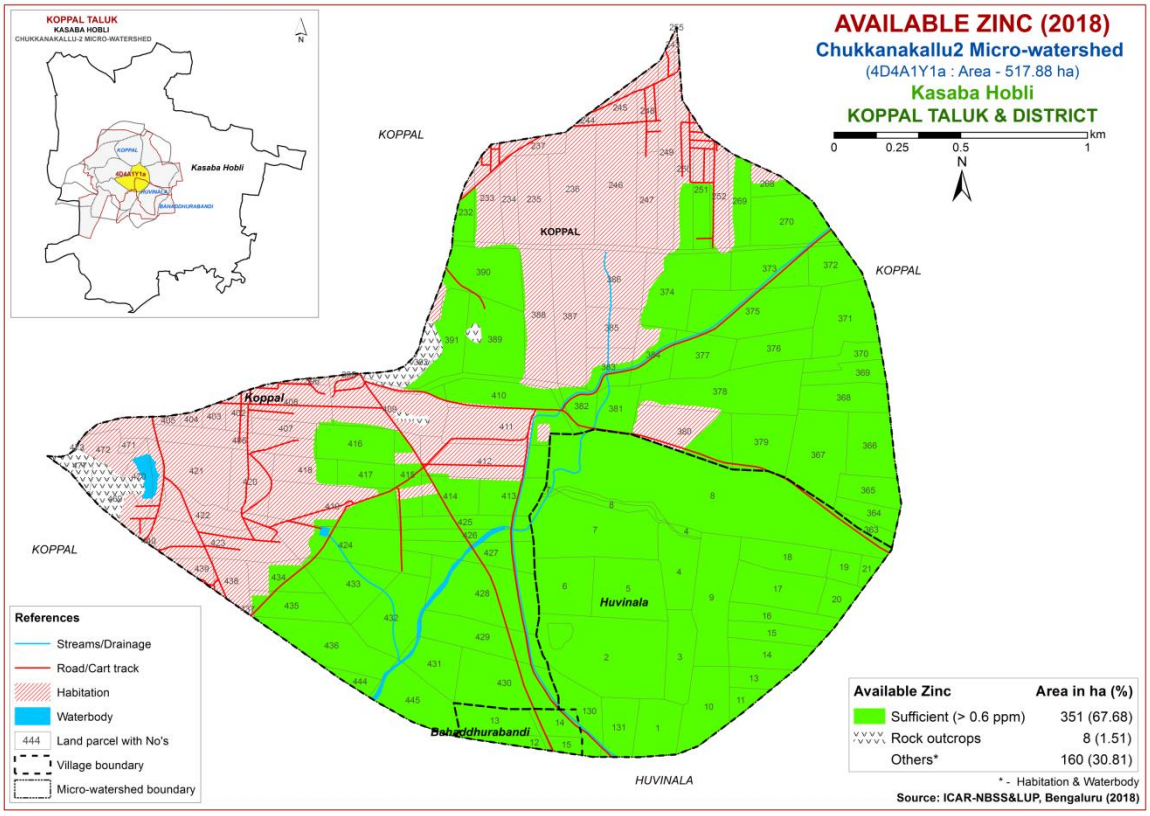


Fig.6.11 Soil Available Zinc map of Chukkanakallu-2 Microwatershed

Chapter 7

LAND SUITABILITY FOR MAJOR CROPS

The soil and land resource units (soil phases) of Chukkanakallu-2 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 soil and land characteristics were matched with the crop requirements to arrive at the crop suitability. The soil and land characteristics table (Table 7.1) were matched with the crop requirements (Tables 7.2-7.32) to arrive at the crop suitability and the criteria tables are given at the end of the chapter. 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 31 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 food crop 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.

Highly suitable (Class S1) lands occupy an area of about 65 ha (13%) for growing sorghum and occur in the northern, eastern, central and southern part of the

microwatershed. Maximum area of about 216 ha (42%) is moderately suitable (Class S2) for growing sorghum and distributed in all parts of the microwatershed with minor limitations of nutrient availability, calcareousness, rooting depth and gravelliness. An area of about 70 ha (13%) is marginally suitable (Class S3) for growing sorghum and distributed in the western and southern part of the microwatershed. They have moderate limitations of gravelliness, calcareousness and rooting depth.

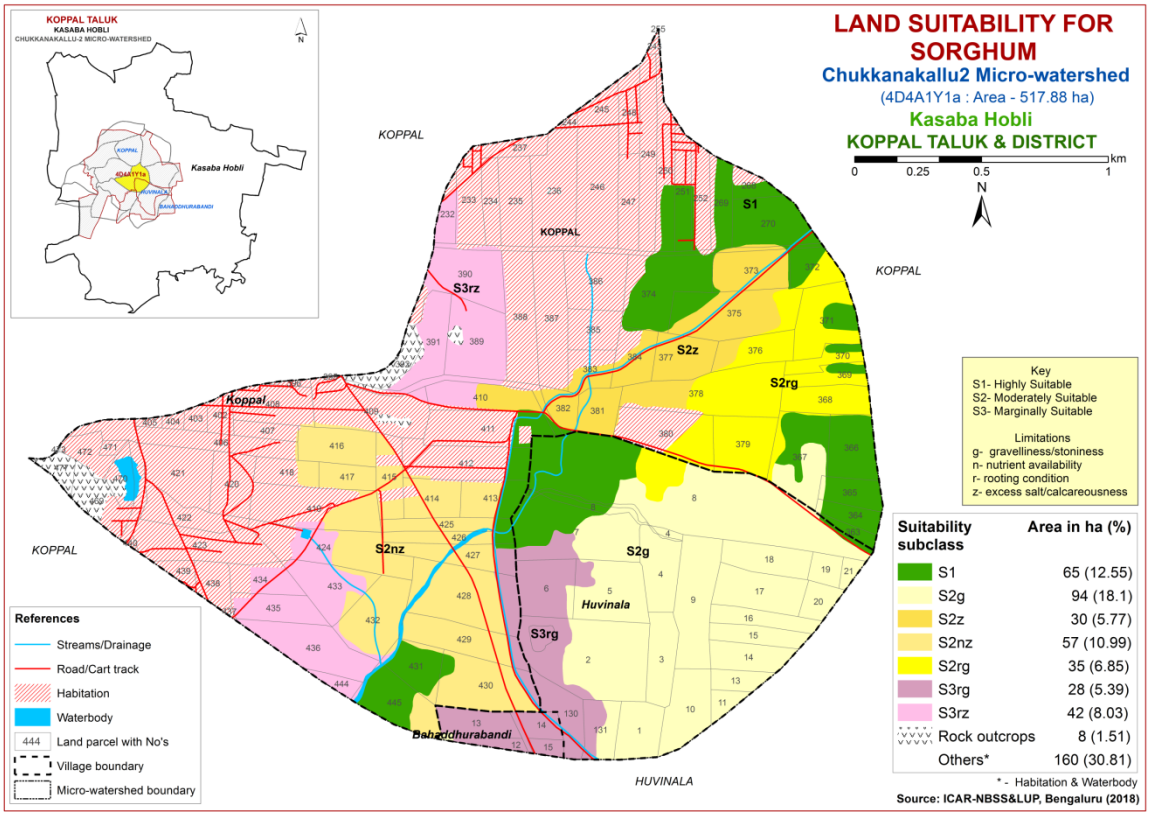


Fig. 7.1 Land Suitability map of Sorghum

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.

Highly suitable (Class S1) lands occupy an area of about 16 ha (3%) for growing Maize and occur in the eastern part of the microwatershed. Maximum area of about 266 ha (52%) is moderately suitable (Class S2) for growing Maize and distributed in all parts of the microwatershed with minor limitations gravelliness, calcareousness, rooting depth and texture. An area of about 70 ha (13%) is marginally suitable (Class S3) for growing Maize and distributed in the western and southern part of the microwatershed. They have moderate limitations of rooting depth, calcareousness, gravelliness and texture.

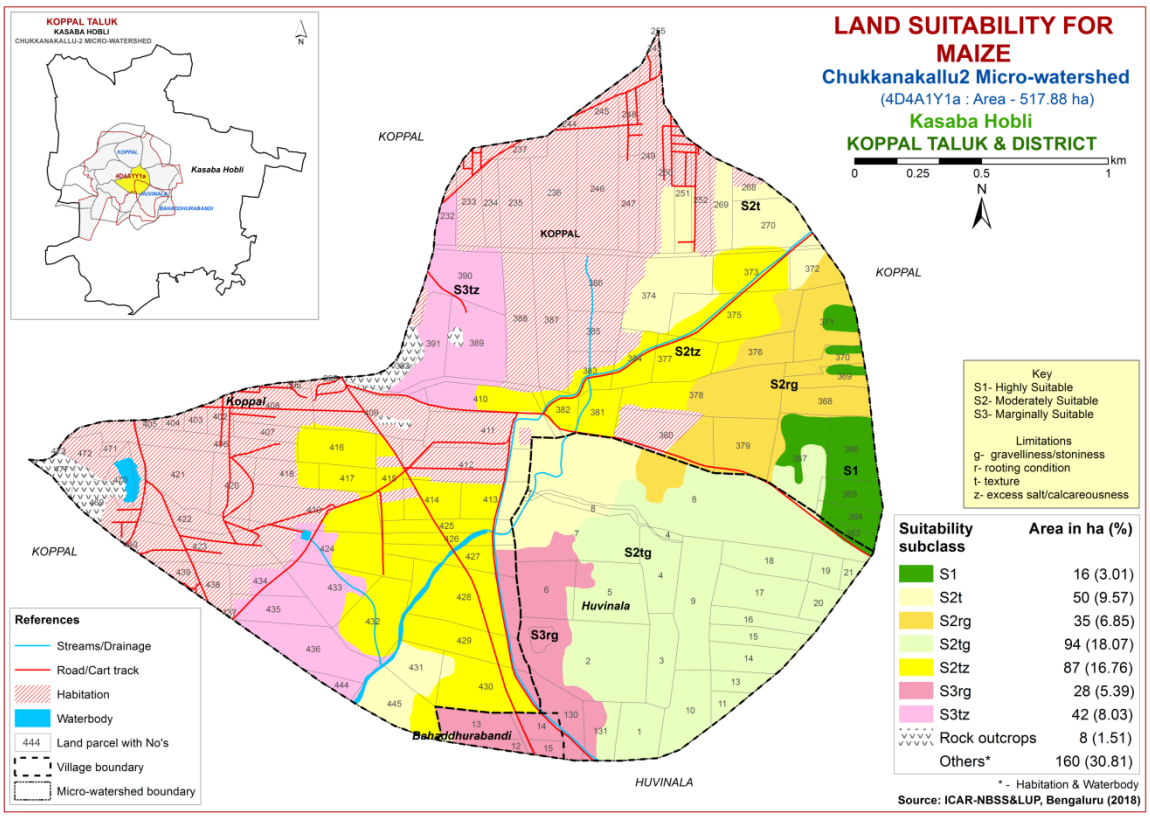


Fig. 7.2 Land Suitability map of Maize

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 Karnataka in the northern districts. 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.

An area of about 36 ha (7%) is highly suitable (Class S1) lands for growing Bajra and distributed in the southwestern and southern part of the microwatershed. Maximum area of about 274 ha (53%) is moderately suitable (Class S2) and distributed in all parts of the microwatershed with minor limitations of texture, gravelliness, rooting depth and calcareousness. Marginally suitable (Class S3) lands cover an area of about 42 ha (8%) and distributed in the western and southern part of the microwatershed. They have moderate limitations of calcareousness and rooting depth.

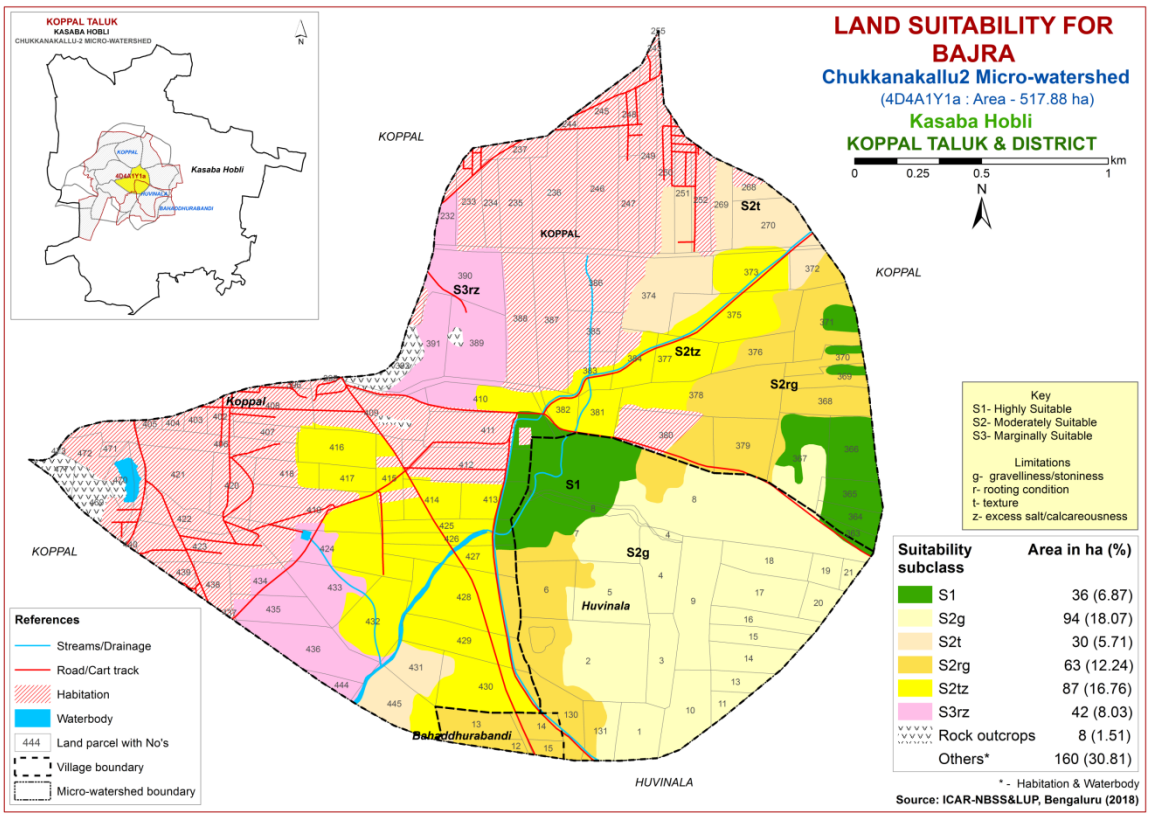


Fig. 7.3 Land Suitability map of Bajra

7.4 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 7.5) 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 7.4.

No highly suitable (Class S1) lands for growing Groundnut in the microwatershed. An area of about 58 ha (11%) is moderately suitable (Class S2) for growing Groundnut and distributed in the eastern and southern part of the microwatershed with minor limitations of rooting depth, gravelliness and texture. Marginally suitable (Class S3) lands cover a maximum area of about 293 ha (57%) and occur in all parts of the microwatershed with major limitations of gravelliness, rooting depth, texture and calcareousness.

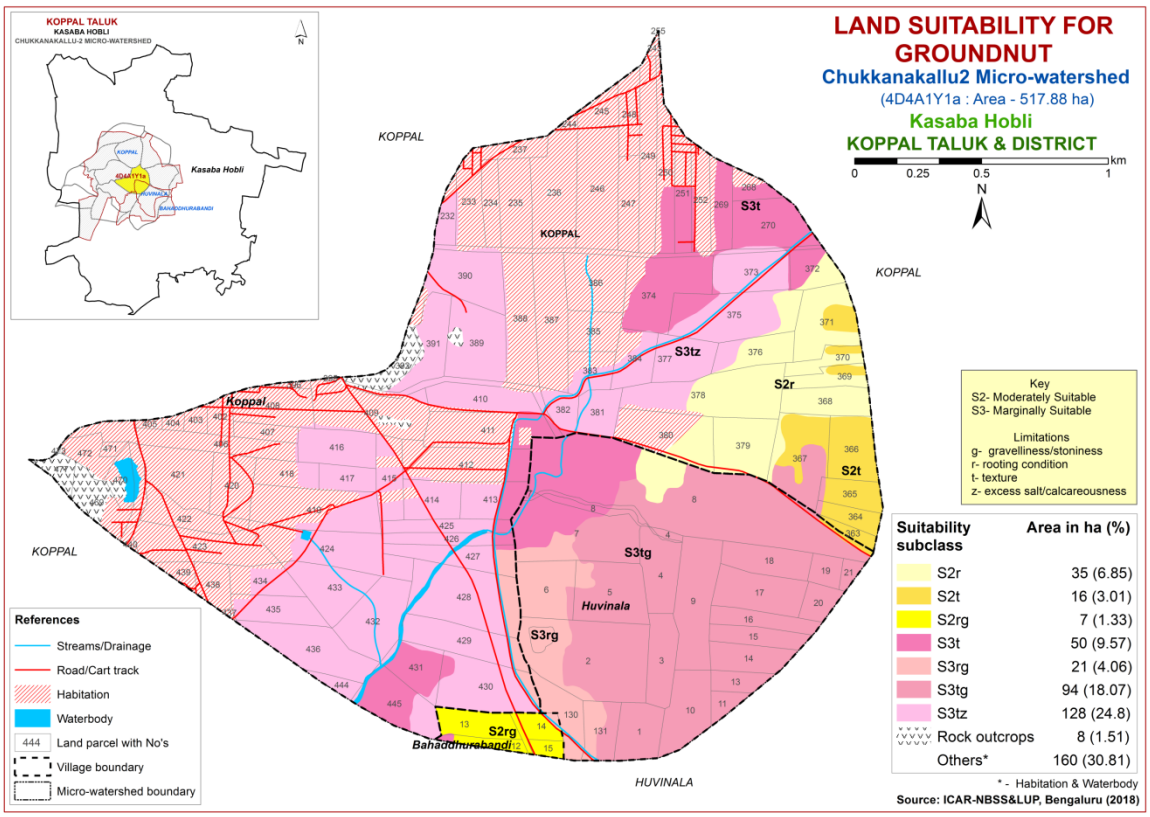


Fig. 7.4 Land Suitability map of Groundnut

7.5 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 7.6) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing sunflower was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.5.

An area of about 65 ha (13%) is highly suitable (Class S1) lands for growing Sunflower and distributed in the northern, eastern, southern and central part of the microwatershed. Maximum area of about 181 ha (35%) is moderately suitable (Class S2) and distributed in all parts of the microwatershed with minor limitations of calcareousness, rooting depth and gravelliness. Marginally suitable (Class S3) lands cover an area of about 63 ha (12%) and distributed in the eastern and southern part of the microwatershed. They have moderate limitations of gravelliness and rooting depth. An area of about 42 ha (8%) is currently not suitable (Class N1) for growing Sunflower and are distributed in the western and southern part of the microwatershed with severe limitations of rooting depth and calcareousness.

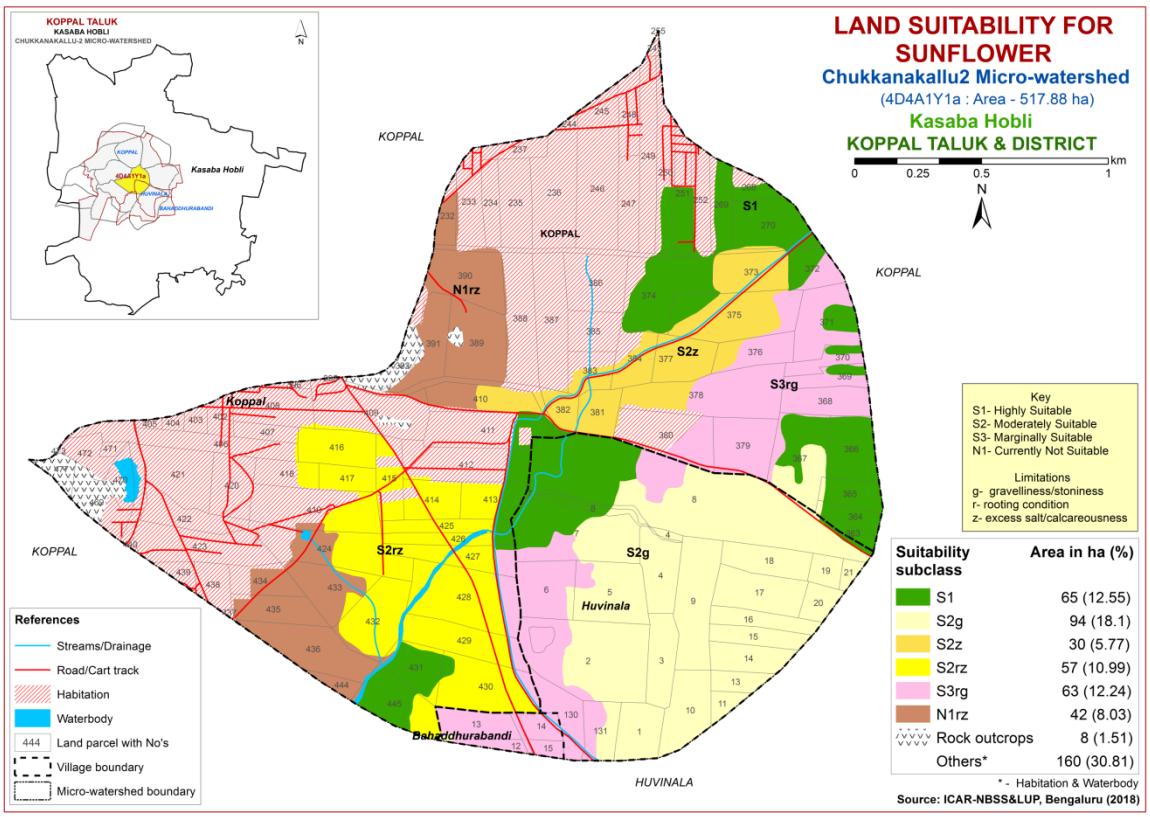


Fig. 7.5 Land Suitability map of Sunflower

7.6 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 7.7) 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 7.6.

An area of about 36 ha (7%) is highly suitable (Class S1) lands for growing Redgram and distributed in the eastern and central part of the microwatershed. Maximum area of about 163 ha (32%) is moderately suitable (Class S2) and distributed in all parts of the microwatershed with minor limitations of texture, calcareousness, rooting depth and gravelliness. Marginally suitable (Class S3) lands cover an area of about 110 ha (21%) and distributed in the northern, eastern, western and southern part of the microwatershed. They have moderate limitations of gravelliness, calcareousness and rooting depth. An area of about 42 ha (8%) is currently not suitable (Class N1) for growing Redgram and are distributed in the western and southern part of the microwatershed with severe limitations of rooting depth and calcareousness.

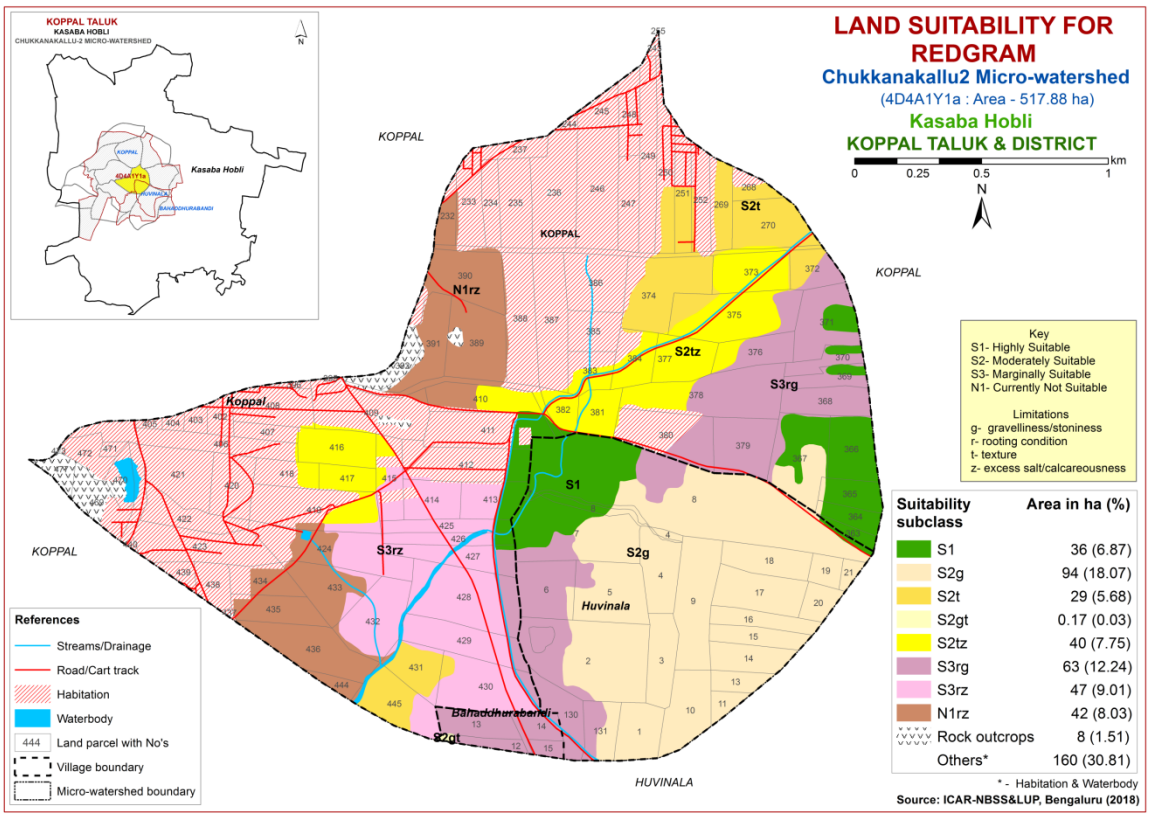


Fig. 7.6 Land Suitability map of Redgram

7.7 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 Bell ary districts. The crop requirements for growing Bengal gram (Table 7.8) 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 7.7.

Highly suitable (Class S1) lands occupy an area of about 29 ha (6%) for growing Bengal gram and occur in the northern and southern part of the microwatershed. Maximum area of about 280 ha (54%) is moderately suitable (Class S2) for growing Bengal gram and distributed in all parts of the microwatershed with minor limitations of rooting depth, calcareousness, texture and gravelliness. An area of about 42 ha (8%) is marginally suitable (Class S3) for growing Bengal gram and distributed in the western, eastern and southern part of the microwatershed. They have moderate limitations of calcareousness and rooting depth.

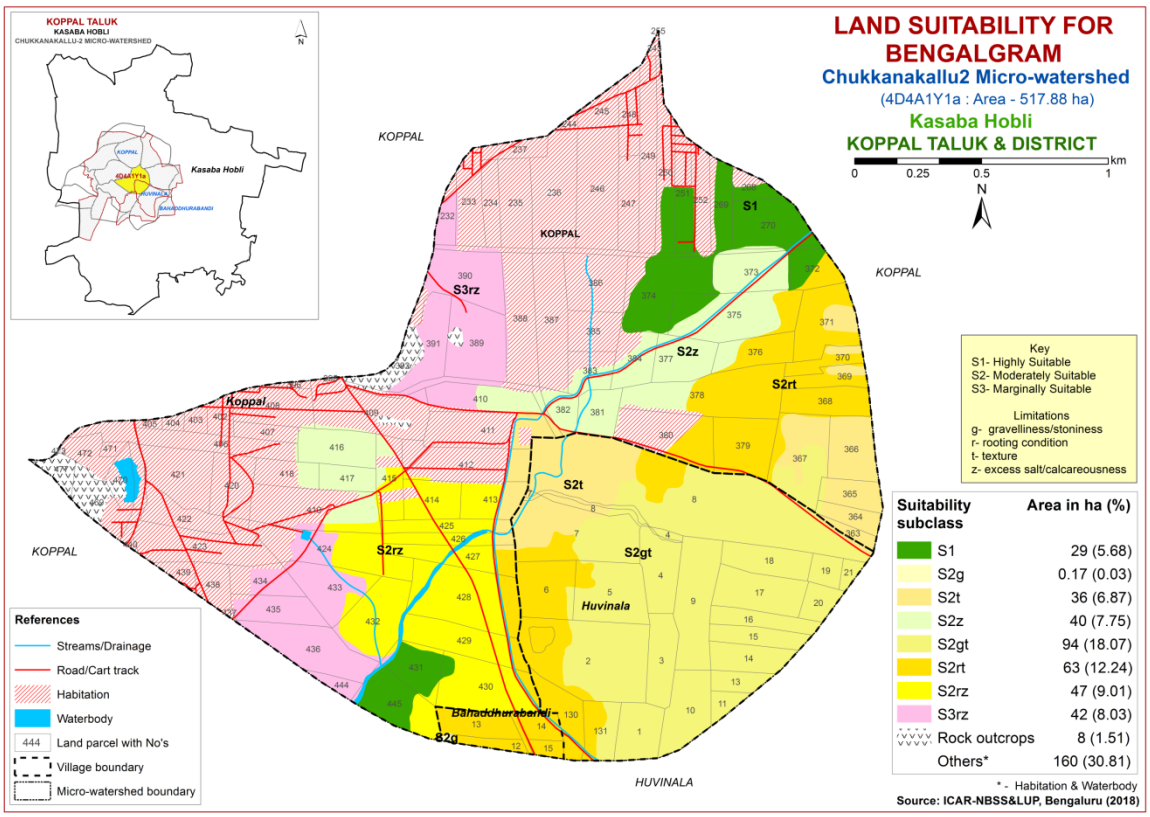


Fig. 7.7 Land Suitability map of Bengal gram

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.

An area of about 65 ha (13%) is highly suitable (Class S1) lands for growing Cotton and distributed in the northern, eastern, southern and central part of the microwatershed. Maximum area of about 216 ha (42%) is moderately suitable (Class S2) and distributed in all parts of the microwatershed with minor limitations of calcareousness, rooting depth and gravelliness. Marginally suitable (Class S3) lands cover an area of about 70 ha (13%) and distributed in the western and southern part of the microwatershed. They have moderate limitations of calcareousness, gravelliness and rooting depth.

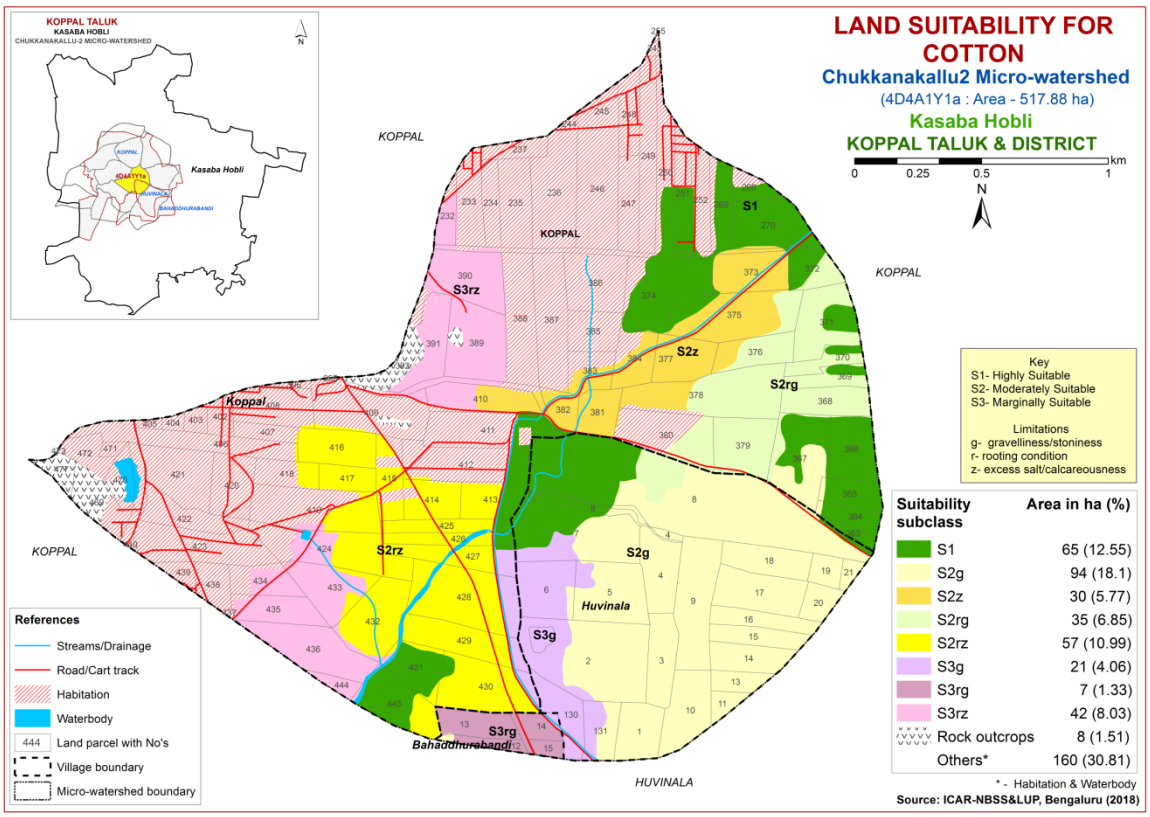


Fig. 7.8 Land Suitability map of Cotton

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

Chilli is one of the most important 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.

An area of about 16 ha (3%) is highly suitable (Class S1) for growing Chilli and distributed in the eastern part of the microwatershed. An area of about 149 ha (29%) is moderately suitable (Class S2) for growing Chilli and distributed in the eastern and southern part of the microwatershed with minor limitations of rooting depth, texture and gravelliness. Marginally suitable (Class S3) lands cover a maximum area of about 187 ha (36%) and occur in all parts of the microwatershed with major limitations of gravelliness, rooting depth, texture and calcareousness.

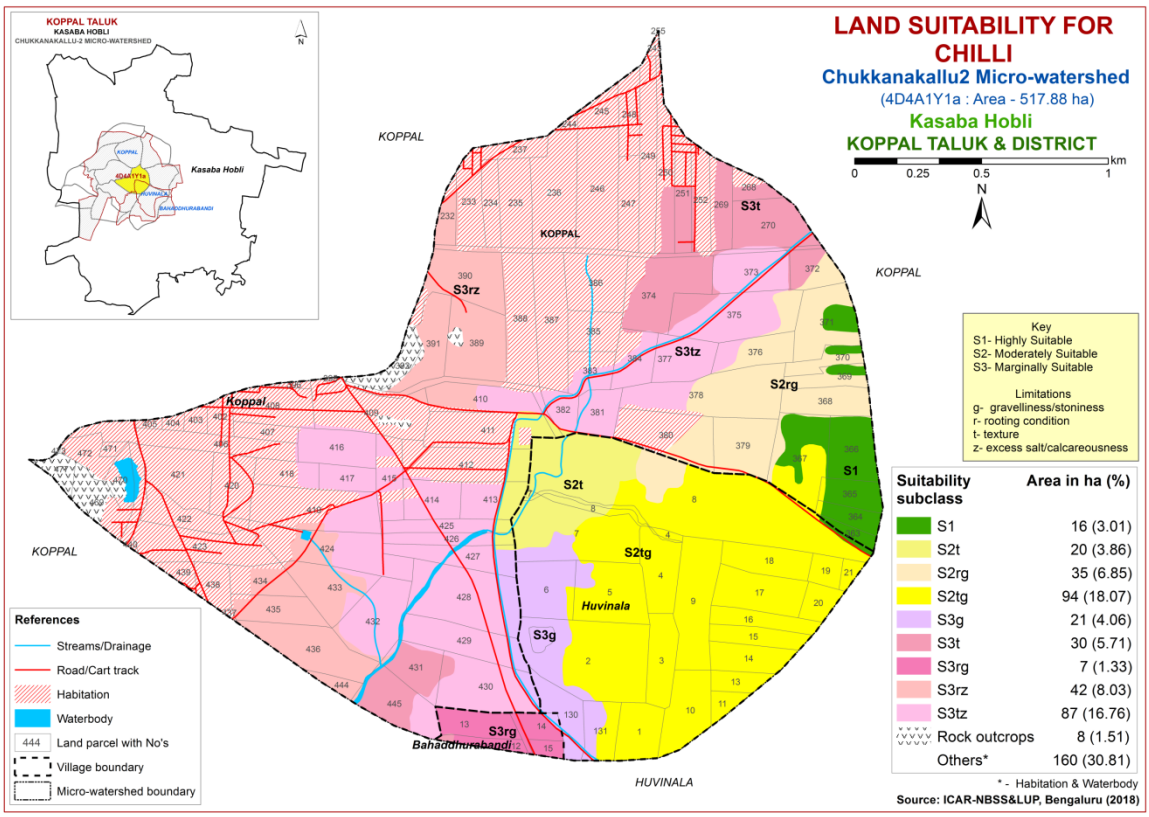


Fig. 7.9 Land Suitability map of Chilli

7.10 Land Suitability for Tomato (*Solanum lycopersicum*)

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

An area of about 16 ha (3%) is highly suitable (Class S1) for growing Tomato and distributed in the eastern part of the microwatershed. An area of about 149 ha (29%) is moderately suitable (Class S2) for growing Tomato and distributed in the eastern and southern part of the microwatershed with minor limitations of rooting depth, texture and gravelliness. Marginally suitable (Class S3) lands cover a maximum area of about 187 ha (36%) and occur in all parts of the microwatershed with major limitations of gravelliness, rooting depth, texture and calcareousness.

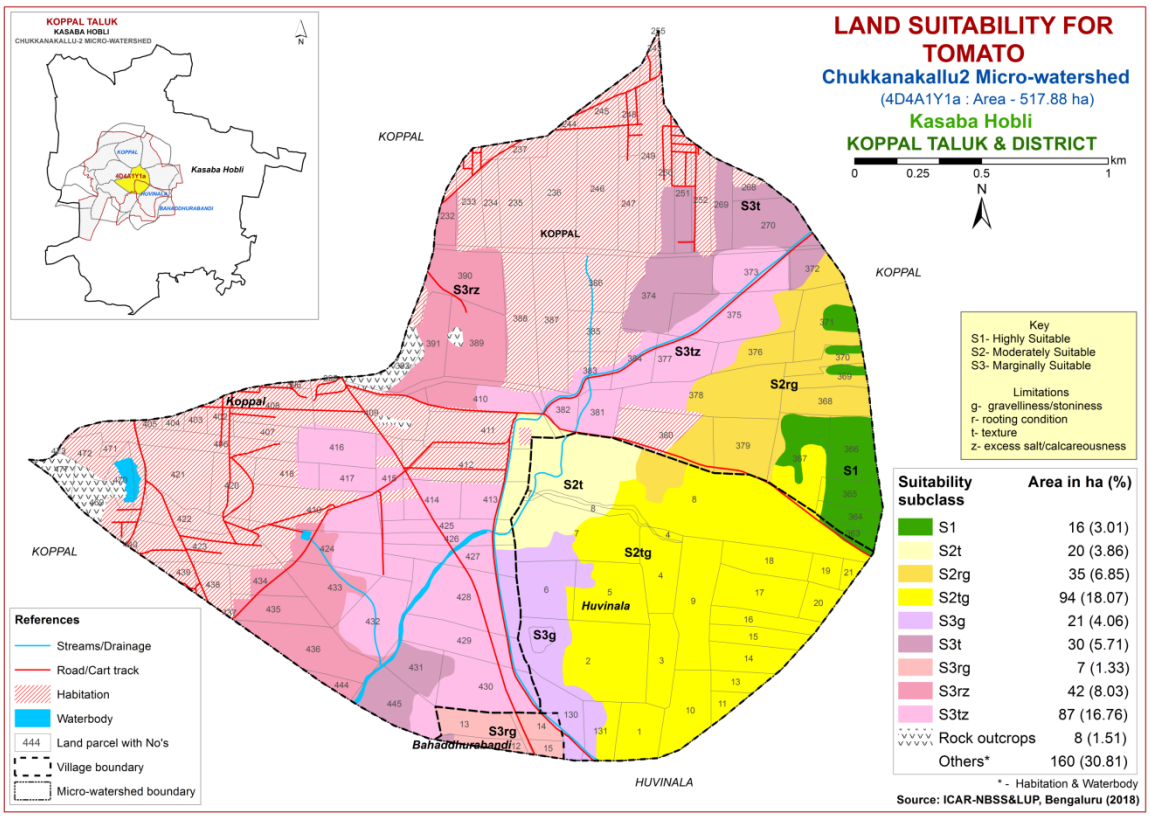


Fig. 7.10 Land Suitability map of Tomato

7.11 Land Suitability for Brinjal (*Solanum melongena*)

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

Highly suitable (Class S1) lands occur in an area of about 94 ha (18%) for growing Brinjal and distributed in the southern part of the microwatershed. Maximum area of about 188 ha (37%) is moderately suitable (Class S2) for growing Bhendi and distributed in all parts of the microwatershed with minor limitations of texture, rooting depth, gravelliness and calcareousness. Marginally suitable (Class S3) lands cover an area of about 70 ha (13%) and occur in the western and southern part of the microwatershed with major limitations of gravelliness and rooting depth.

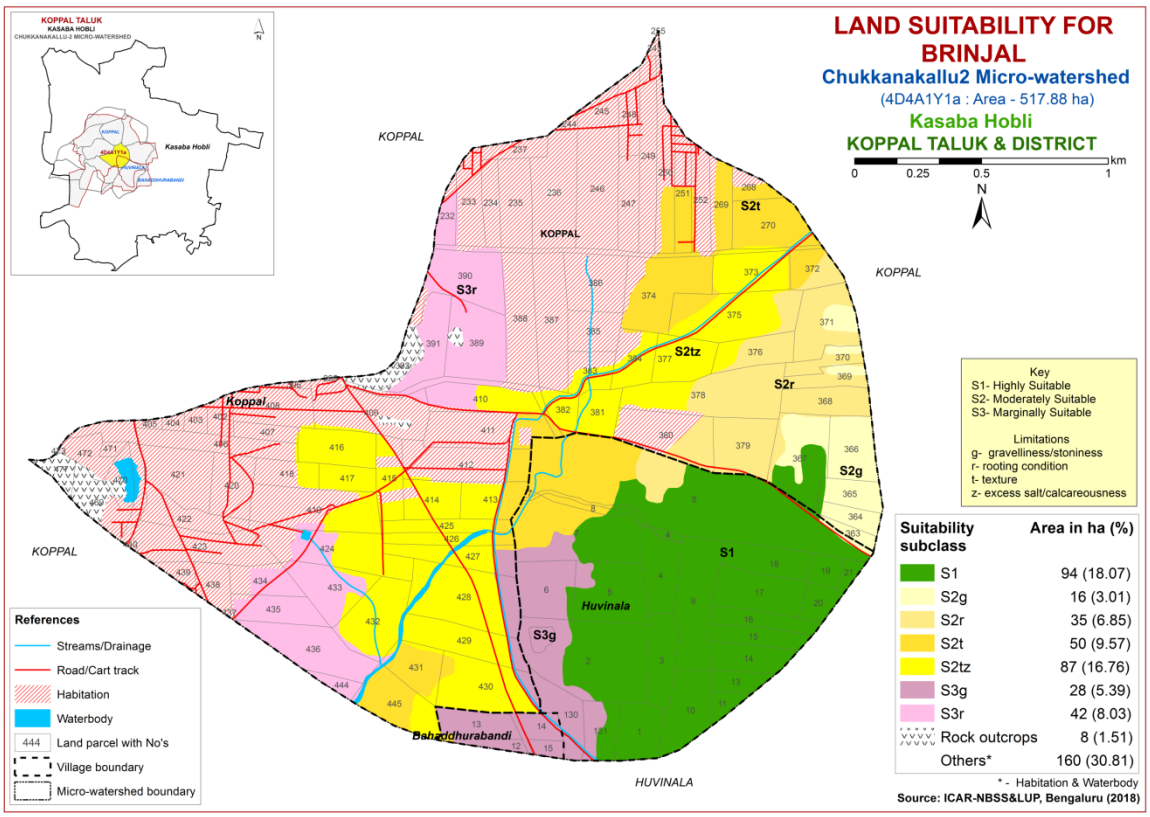


Fig 7.11 Land Suitability map of Brinjal

7.12 Land Suitability for Onion (*Allium cepa L.*,)

Onion is one of the most important vegetable crop grown in the state. The crop requirements for growing onion (Table 7.13) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing onion was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.12.

Highly suitable (Class S1) lands occur in an area of about 94 ha (18%) for growing Onion and distributed in the southern part of the microwatershed. An area of about 71 ha (14%) is moderately suitable (Class S2) for growing Onion and distributed in the eastern and central part of the microwatershed with minor limitations of texture, rooting depth and gravelliness. Marginally suitable (Class S3) lands cover a maximum area of about 187 ha (36%) and occur in all parts of the microwatershed with major limitations of gravelliness, texture, calcareousness and rooting depth.

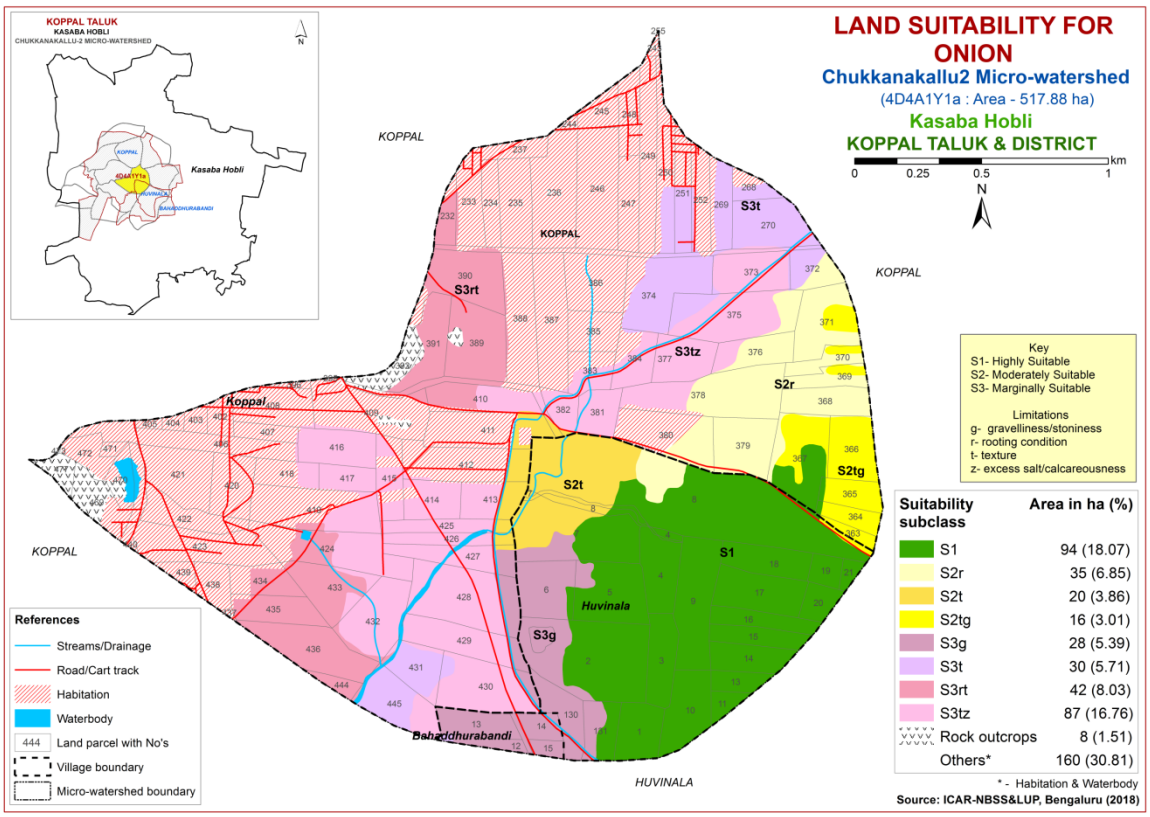


Fig 7.12 Land Suitability map of Onion

7.13 Land Suitability for Bhendi (*Abelmoschus esculentus*)

Bhendi is one of the most important vegetable crop grown in the state. The crop requirements for growing bhendi (Table 7.14) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing bhendi was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.13.

Highly suitable (Class S1) lands occur in an area of about 94 ha (18%) for growing Bhendi and distributed in the southern part of the microwatershed. Maximum area of about 188 ha (37%) is moderately suitable (Class S2) for growing Bhendi and distributed in all parts of the microwatershed with minor limitations of texture, rooting depth, gravelliness and calcareousness. Marginally suitable (Class S3) lands cover an area of about 70 ha (13%) and occur in the western and southern part of the microwatershed with major limitations of gravelliness and rooting depth.

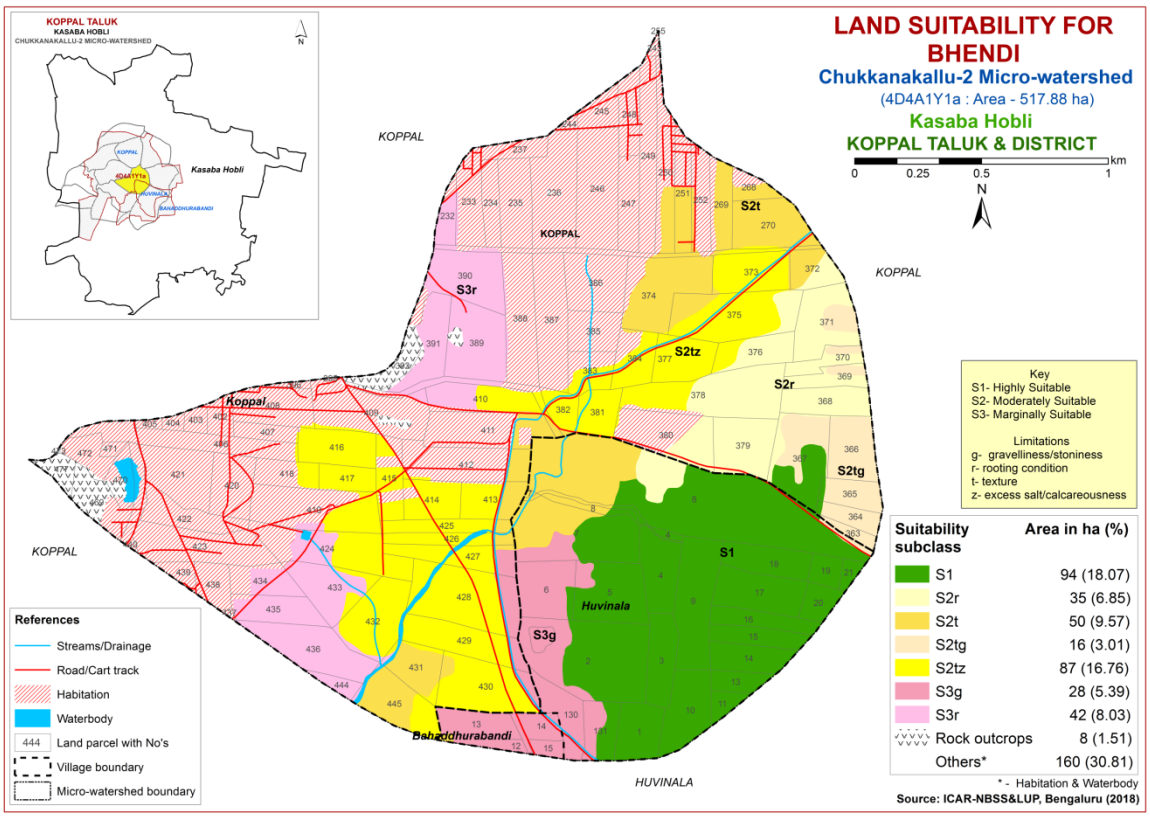


Fig 7.13 Land Suitability map of Bhendi

7.14 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 7.15) 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 7.14.

An area of about 36 ha (7%) is highly suitable (Class S1) lands for growing Drumstick and distributed in the eastern and central part of the microwatershed. Maximum area of about 210 ha (41%) is moderately suitable (Class S2) and distributed in all parts of the microwatershed with minor limitations of texture, calcareousness, rooting depth and gravelliness. Marginally suitable (Class S3) lands cover an area of about 63 ha (12%) and distributed in the northern, eastern, western and southern part of the microwatershed. They have moderate limitations of gravelliness and rooting depth. An area of about 42 ha (8%) is currently not suitable (Class N1) for growing Drumstick and are distributed in the western and southern part of the microwatershed with severe limitations of rooting depth and calcareousness.

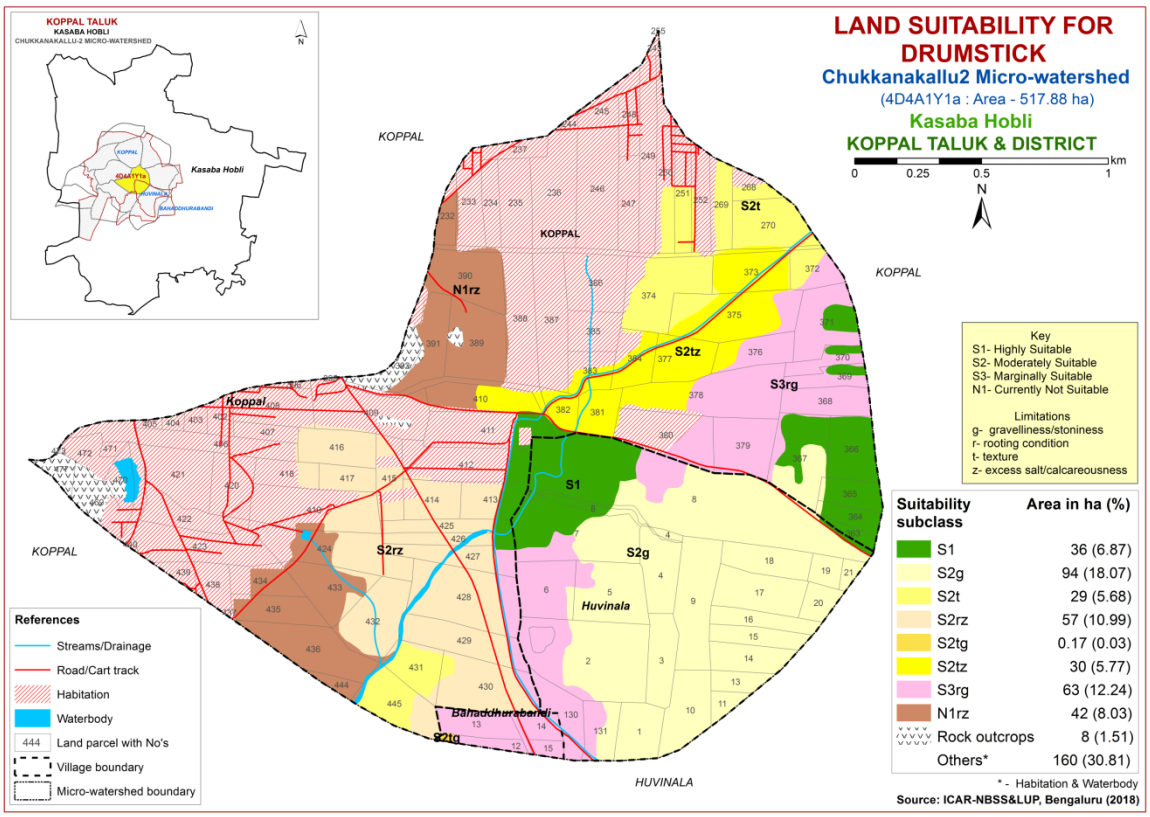


Fig. 7.14 Land Suitability map of Drumstick

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

Highly suitable (Class S1) lands for growing Mango in an area of about 36 ha (7%) and distributed in the eastern and southern part of the microwatershed. Maximum area of about 124 ha (24%) is moderately suitable (Class S2) and distributed in all parts of the microwatershed with minor limitations of rooting depth, gravelliness and calcareousness. Marginally suitable (Class S3) lands cover an area of about 87 ha (17%) and distributed in the northern, western and southern part of the microwatershed. They have moderate limitations of texture, rooting depth and calcareousness. An area of about 105 ha (20%) is currently not suitable (Class N1) for growing Mango and are distributed in the western, eastern and southern part of the microwatershed with severe limitations of rooting depth, texture and gravelliness.

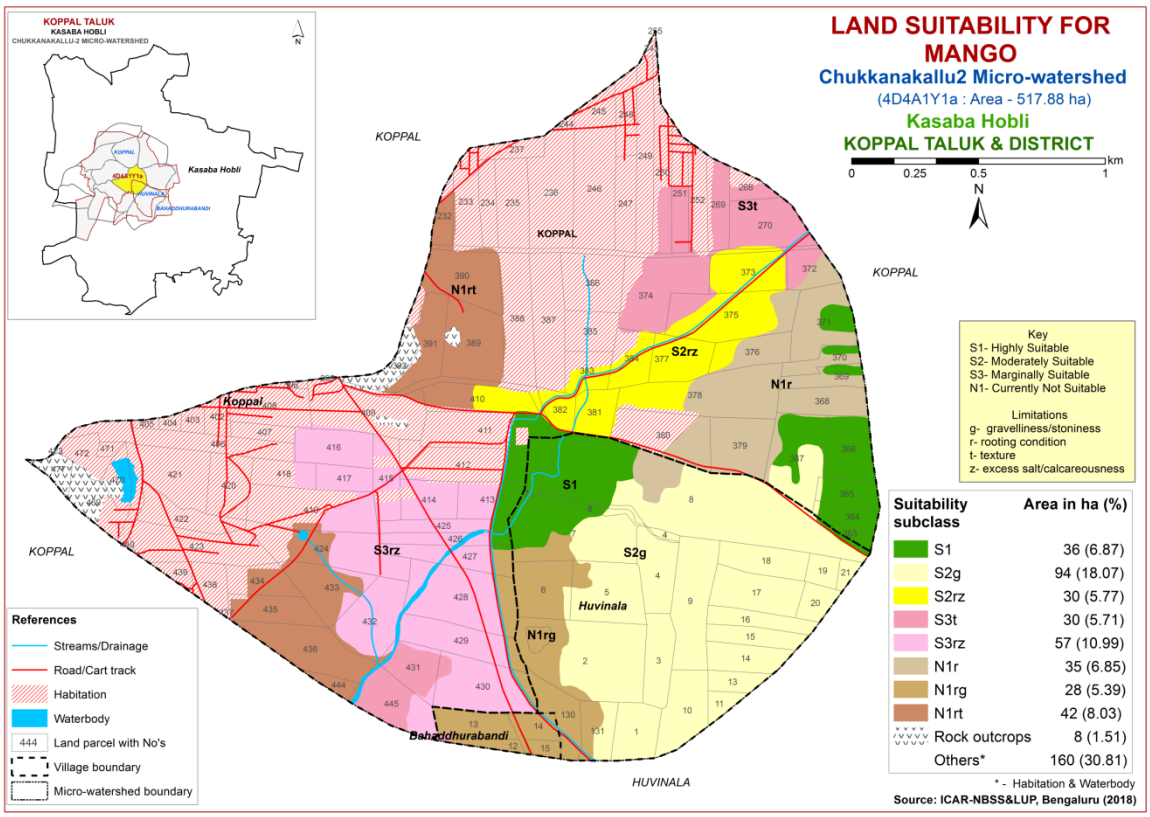


Fig. 7.15 Land Suitability map of Mango

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.

An area of about 20 ha (4%) is highly suitable (Class S1) lands for growing Guava and distributed in the central part of the microwatershed. An area of about 110 ha (21%) is moderately suitable (Class S2) and distributed in the eastern and southern part of the microwatershed with minor limitations of texture and gravelliness. Marginally suitable (Class S3) lands cover a maximum area of about 180 ha (35%) and distributed in all parts of the microwatershed. They have moderate limitations of rooting depth, gravelliness, calcareousness and texture. An area of about 42 ha (8%) is currently not suitable (Class N1) for growing Guava and are distributed in the western and southern part of the microwatershed with severe limitations of rooting depth and texture.

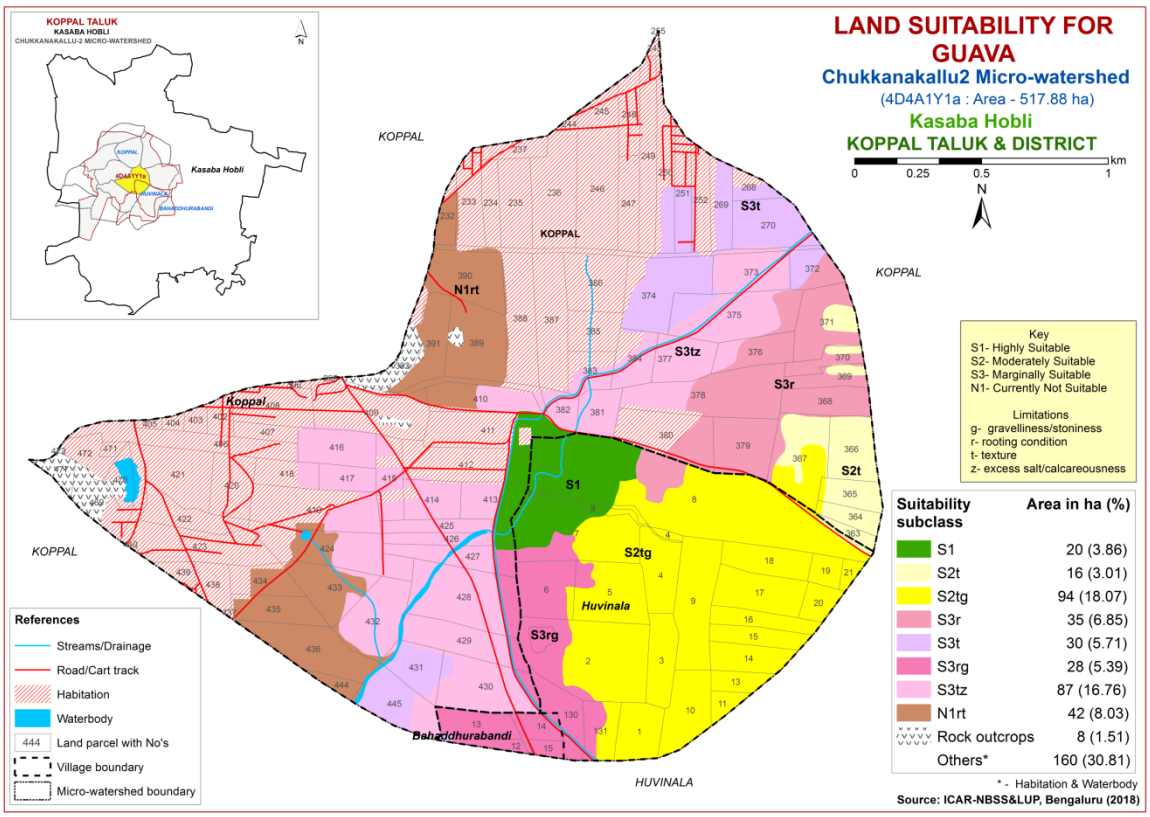


Fig. 7.16 Land Suitability map of Guava

7.17 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 7.18) for growing sapota were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing sapota was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.17.

An area of about 36 ha (7%) is highly suitable (Class S1) lands for growing Sapota and distributed in the eastern and central part of the microwatershed. An area of about 94 ha (18%) is moderately suitable (Class S2) and distributed in the southern part of the microwatershed with minor limitation of gravelliness. Marginally suitable (Class S3) lands cover a maximum area of about 180 ha (35%) and distributed in all parts of the microwatershed. They have moderate limitations of rooting depth, gravelliness, calcareousness and texture. An area of about 42 ha (8%) is currently not suitable (Class N1) for growing Sapota and are distributed in the western and southern part of the microwatershed with severe limitations of rooting depth and calcareousness.

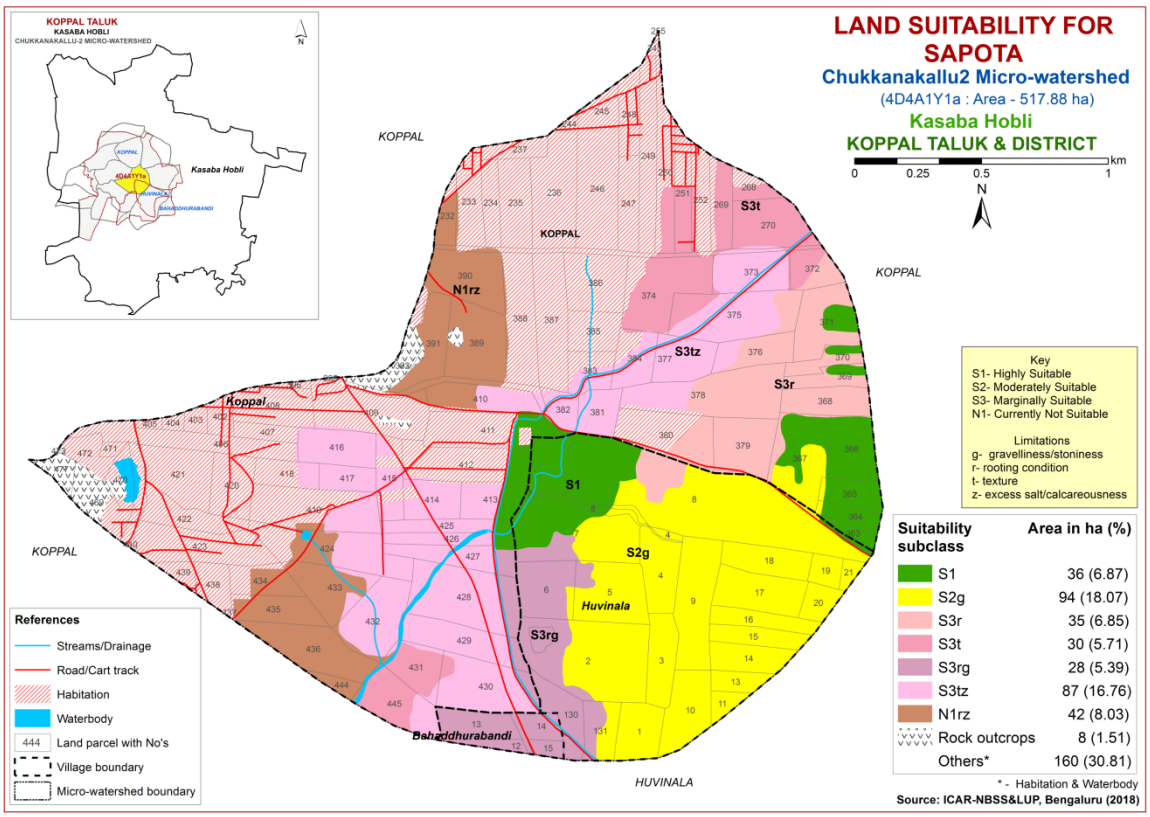


Fig. 7.17 Land Suitability map of Sapota

7.18 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 7.19) were matched with the soil-site characteristics (Table 7.1) of the soils of the microwatershed and a land suitability map for growing pomegranate was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.18.

An area of about 36 ha (7%) is highly suitable (Class S1) lands for growing Pomegranate and distributed in the eastern and central part of the microwatershed. Maximum area of about 210 ha (41%) is moderately suitable (Class S2) and distributed in all parts of the microwatershed with minor limitations of texture, calcareousness, rooting depth and gravelliness. Marginally suitable (Class S3) lands cover an area of about 63 ha (12%) and distributed in the eastern and southern part of the microwatershed. They have moderate limitations of gravelliness and rooting depth. An area of about 42 ha (8%) is currently not suitable (Class N1) for growing Pomegranate and are distributed in the western and southern part of the microwatershed with severe limitations of rooting depth and calcareousness.

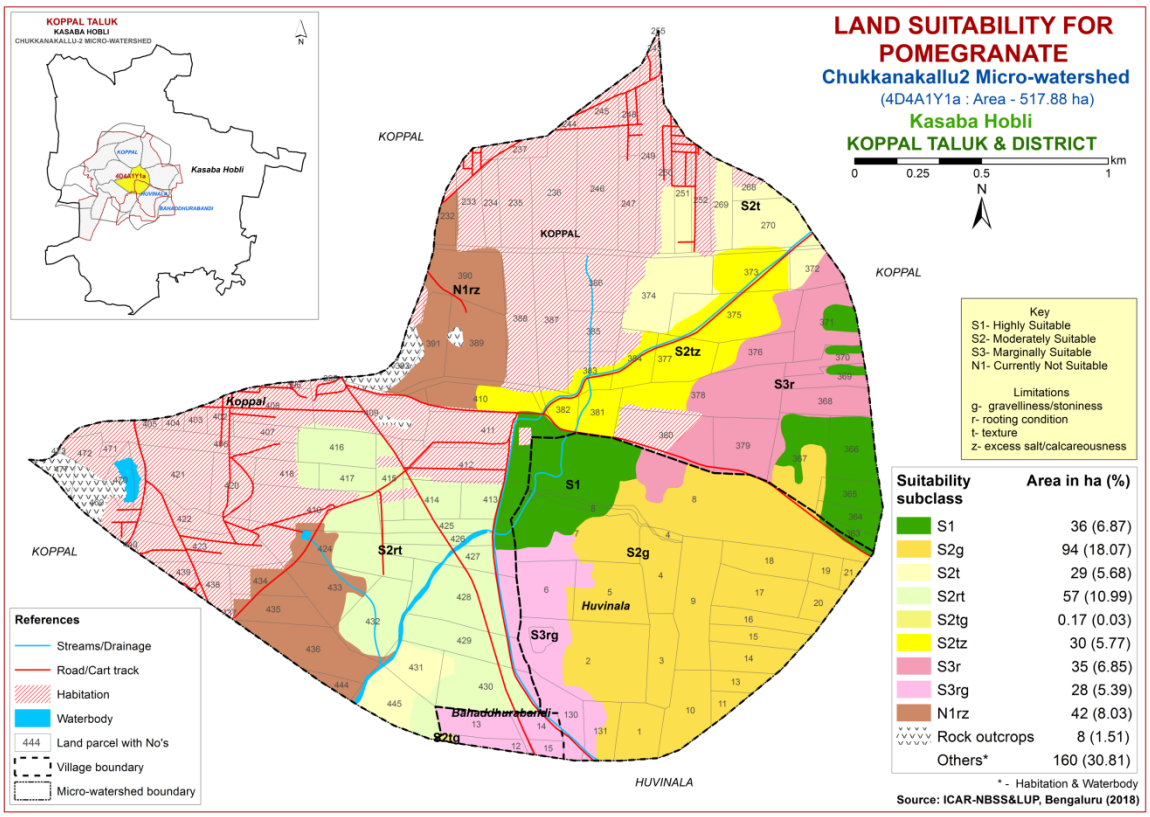


Fig. 7.18 Land Suitability map of Pomegranate

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.

An area of about 65 ha (13%) is highly suitable (Class S1) lands for growing Musambi and distributed in the western and southern part of the microwatershed. Maximum area of about 181 ha (35%) is moderately suitable (Class S2) and distributed in all parts of the microwatershed with minor limitations of rooting depth, calcareousness and gravelliness. Marginally suitable (Class S3) lands cover an area of about 63 ha (12%) and distributed in the eastern and southern part of the microwatershed. They have moderate limitations of rooting depth and gravelliness. An area of about 42 ha (8%) is currently not suitable (Class N1) for growing Musambi and are distributed in the western and southern part of the microwatershed with severe limitations of rooting depth and calcareousness.

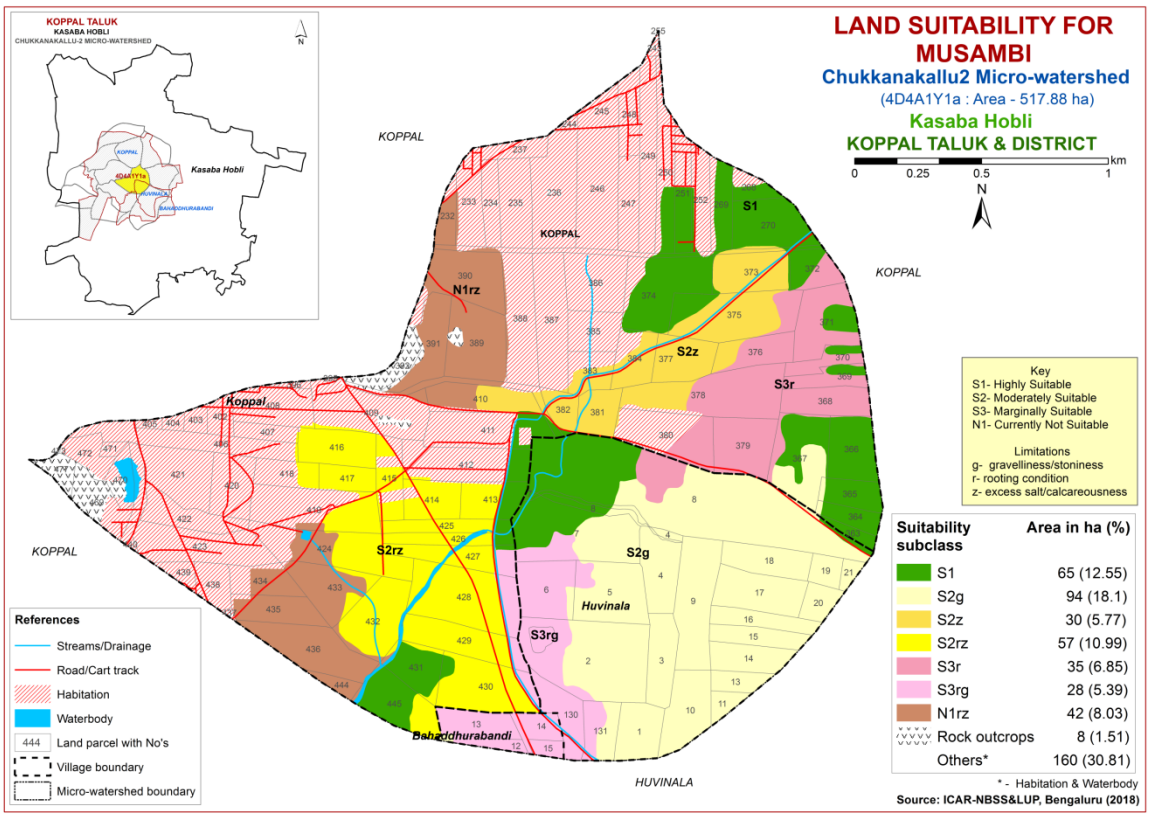


Fig. 7.19 Land Suitability map of Musambi

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.

An area of about 65 ha (13%) is highly suitable (Class S1) lands for growing Lime and distributed in the eastern, central and southern part of the microwatershed. Maximum area of about 181 ha (35%) is moderately suitable (Class S2) and distributed in all parts of the microwatershed with minor limitations of rooting depth, calcareousness and gravelliness. Marginally suitable (Class S3) lands cover an area of about 63 ha (12%) and distributed in the eastern and southern part of the microwatershed. They have moderate limitations of rooting depth and gravelliness. An area of about 42 ha (8%) is currently not suitable (Class N1) for growing Lime and are distributed in the western and southern part of the microwatershed with severe limitations of rooting depth and calcareousness.

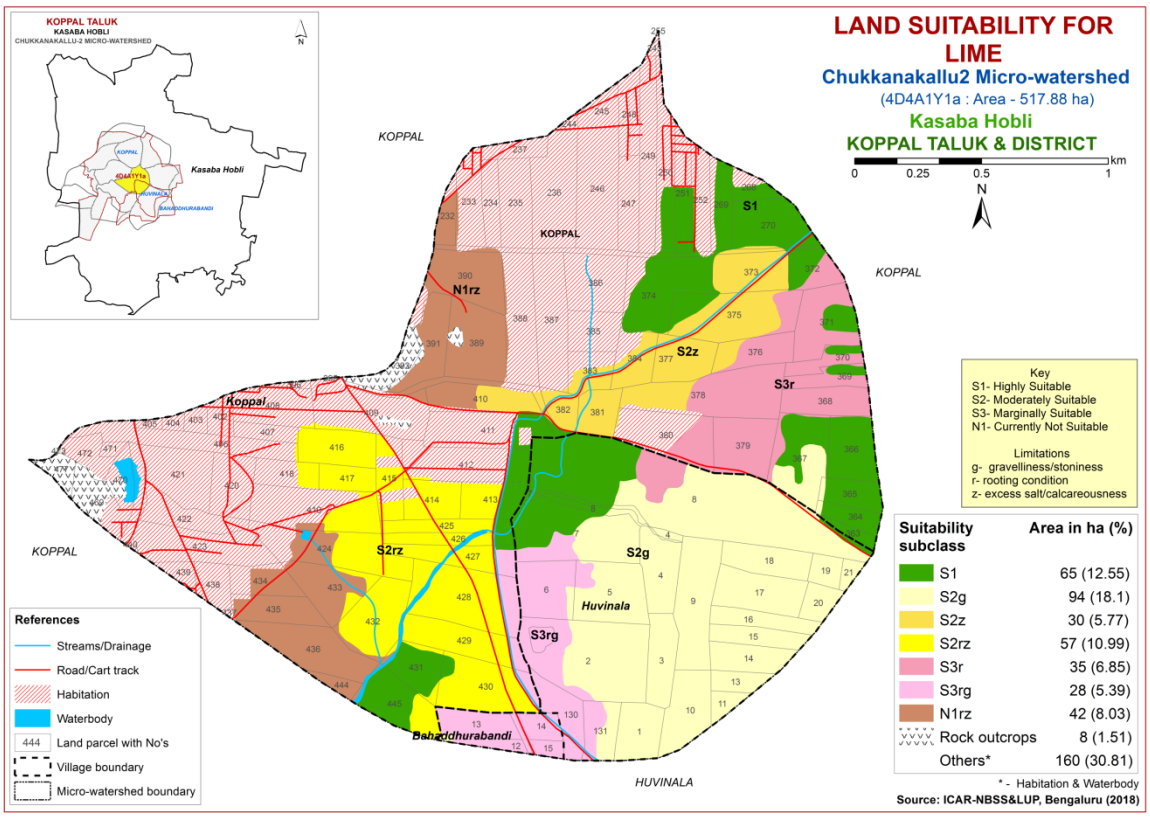


Fig. 7.20 Land Suitability map of Lime

7.21 Land Suitability for Amla (*Phyllanthus emblica*)

Amla is one of the most important medicinal crop grown in an area of 151 ha and distributed in almost all the districts of the state. The crop requirements (Table 7.22) 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 7.21.

An area of about 36 ha (7%) is highly suitable (Class S1) for growing Amla and are distributed in the eastern and central part of the microwatershed. Maximum area of about 273 ha (53%) is moderately suitable (Class S2) and are distributed in all parts of the microwatershed. They have minor limitations of rooting depth, texture, gravelliness and calcareousness. Marginally suitable (Class S3) lands occupy an area of about 42 ha (8%) and are distributed in the western and southern part of the microwatershed with moderate limitations of texture and calcareousness.

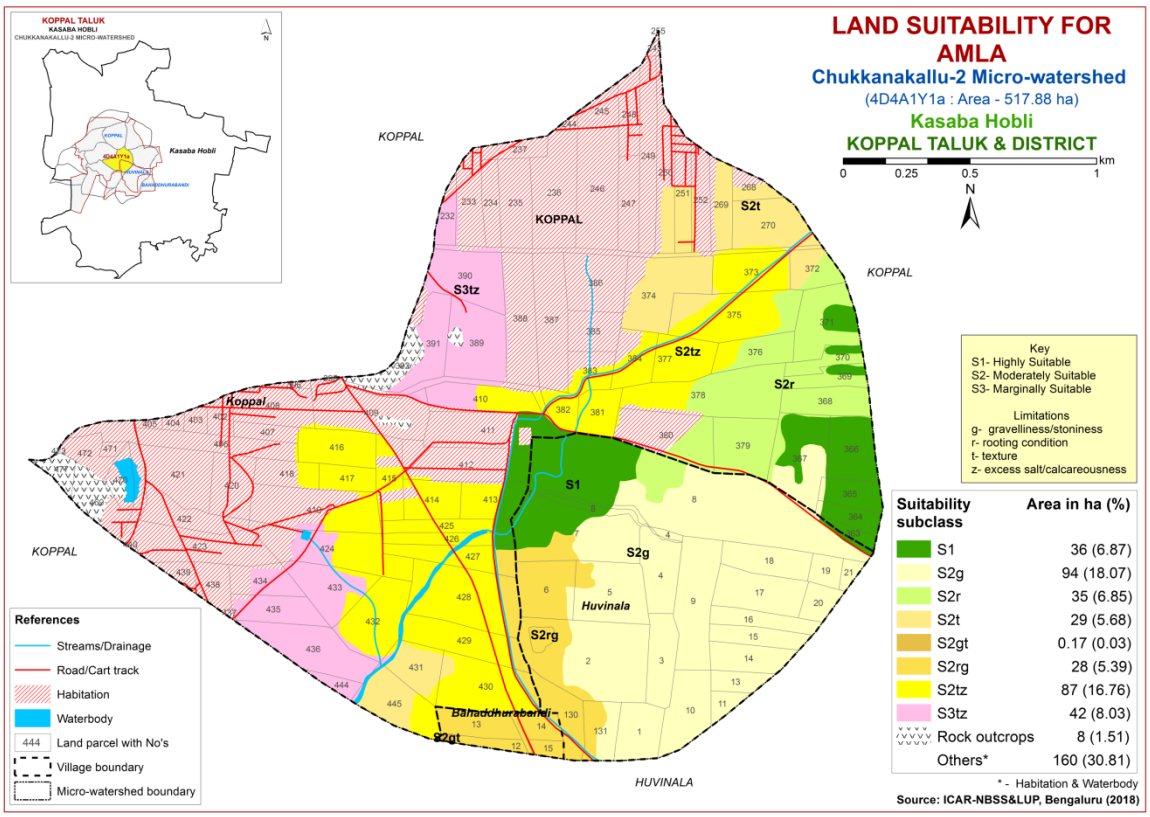


Fig. 7.21 Land Suitability map of Amla

7.22 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 7.23) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing cashew was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.22.

No highly suitable (Class S1) lands for growing Cashew in the microwatershed. An area of about 130 ha (25%) is moderately suitable (Class S2) and distributed in the eastern, central and southern part of the microwatershed with minor limitations of texture and gravelliness. Marginally suitable (Class S3) lands occupy an area of about 63 ha (12%) and are distributed in the eastern and southern part of the microwatershed with moderate limitations of rooting depth and gravelliness. Maximum area of about 159 ha (31%) is currently not suitable (Class N1) for growing Cashew and are distributed in all parts of the microwatershed with severe limitations of rooting depth, texture and calcareousness.

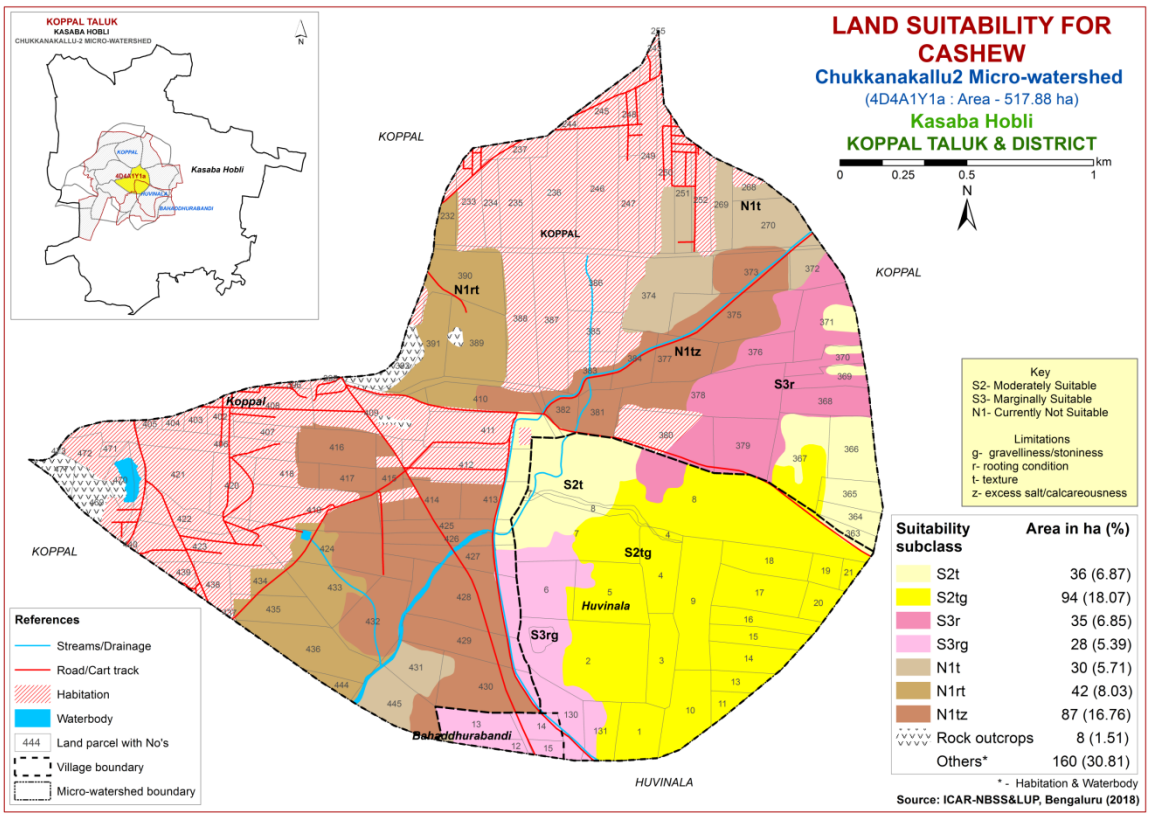


Fig. 7.22 Land Suitability map of Cashew

7.23 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.7.24) 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 7.23.

An area of about 36 ha (7%) is highly suitable (Class S1) lands for growing Jackfruit and distributed in the eastern and central part of the microwatershed. An area of about 94 ha (18%) is moderately suitable (Class S2) and distributed in the southern part of the microwatershed with minor limitation of gravelliness. Marginally suitable (Class S3) lands cover a maximum area of about 180 ha (35%) and distributed in all parts of the microwatershed. They have moderate limitations of rooting depth, gravelliness, calcareousness and texture. An area of about 42 ha (8%) is currently not suitable (Class N1) for growing Jackfruit and are distributed in the western and southern part of the microwatershed with severe limitations of rooting depth and texture.

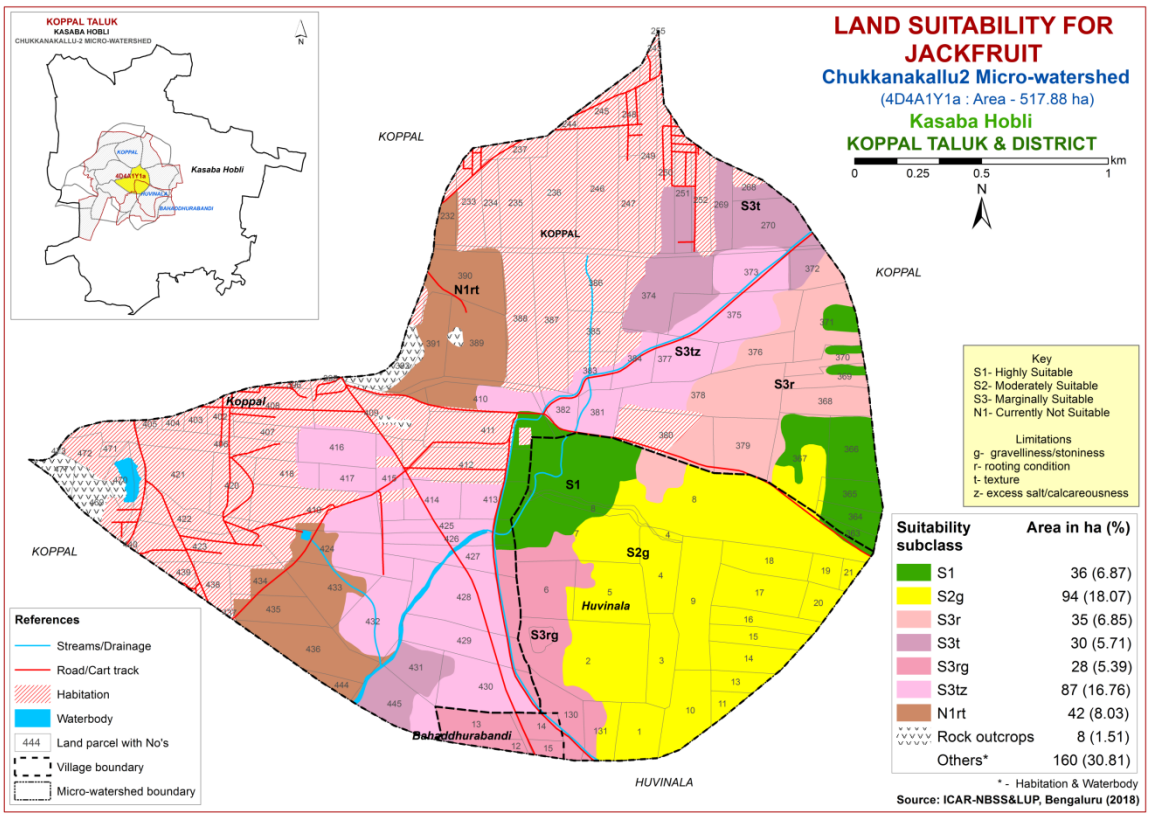


Fig. 7.23 Land Suitability map of Jackfruit

7.24 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 7.25) for growing Jamun were matched with the soil-site characteristics (Table 7.1) 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 7.24.

An area of about 36 ha (7%) is highly suitable (Class S1) lands for growing Jamun and distributed in the eastern and central part of the microwatershed. Maximum area of about 154 ha (30%) is moderately suitable (Class S2) and distributed in the northern, central and southern part of the microwatershed with minor limitations of gravelliness, rooting depth, texture and calcareousness. Marginally suitable (Class S3) lands cover an area of about 120 ha (23%) and distributed in the eastern, western and southern part of the microwatershed. They have moderate limitations of rooting depth, gravelliness, and calcareousness. An area of about 42 ha (8%) is currently not suitable (Class N1) for growing Jamun and are distributed in the western and southern part of the microwatershed with severe limitations of rooting depth and texture.

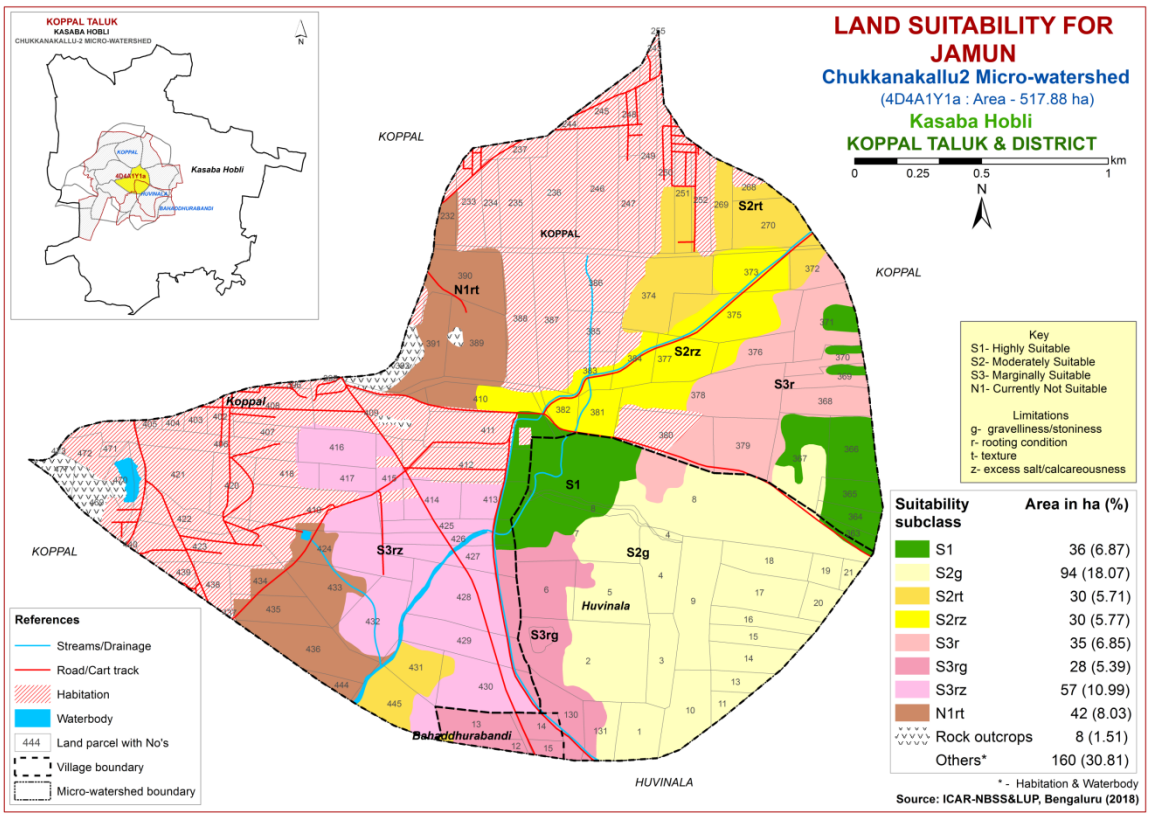


Fig. 7.24 Land Suitability map of Jamun

7.25 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 7.26) 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 7.25.

An area of about 65 ha (13%) is highly suitable (Class S1) for growing Custard Apple and are distributed in the northern, eastern, central and southern part of the microwatershed. Maximum area of about 244 ha (47%) is moderately suitable (Class S2) and are distributed in all parts of the microwatershed. They have minor limitations of rooting depth, gravelliness and calcareousness. Marginally suitable (Class S3) lands occupy an area of about 42 ha (8%) and are distributed in western and southern part of the microwatershed with moderate limitations of gravelliness and calcareousness.

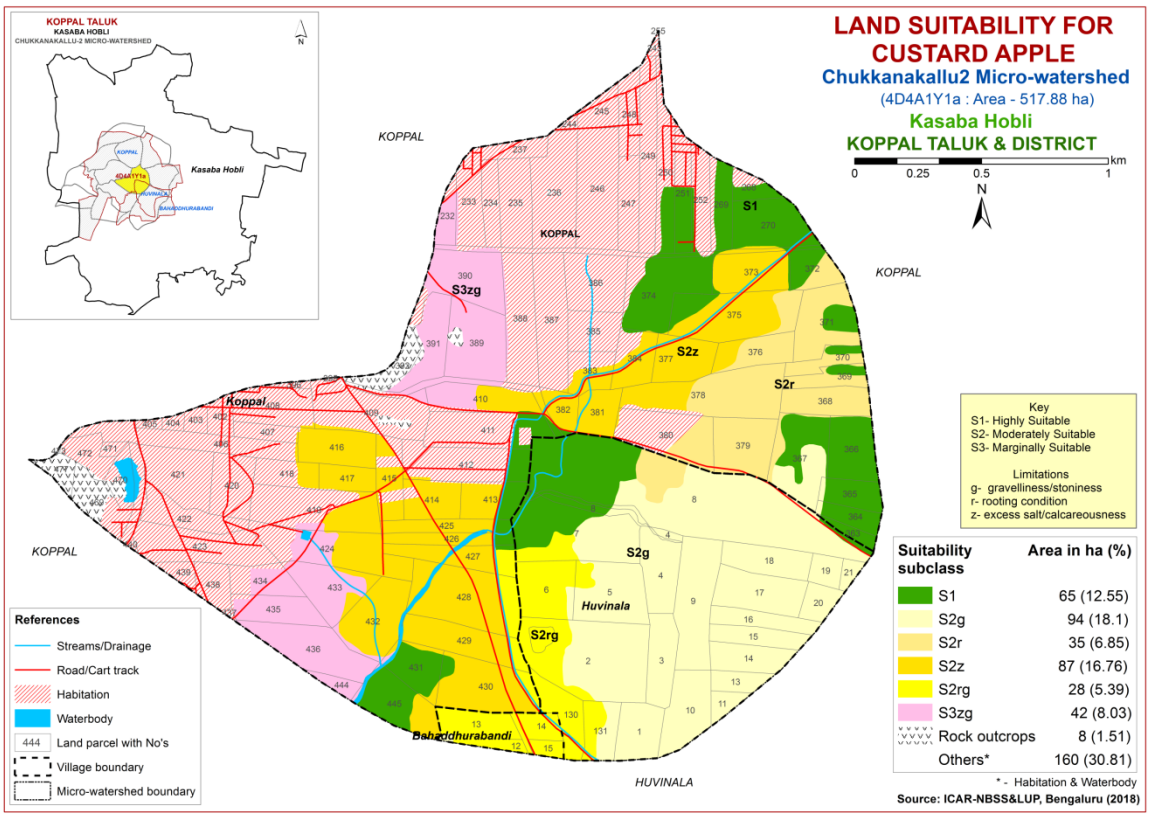


Fig. 7.25 Land Suitability map of Custard Apple

7.26 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 7.27) 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 7.26.

Highly suitable (Class S1) lands cover an area of 36 ha (7%) for growing Tamarind and distributed in the eastern and central part of the microwatershed. Maximum area of about 153 ha (30%) is moderately suitable (Class S2) and distributed in all parts of the microwatershed with minor limitations of rooting depth, calcareousness and gravelliness. Marginally suitable (Class S3) lands cover an area of about 57 ha (11%) and distributed in the southwestern and southern part of the microwatershed. They have moderate limitations of rooting depth and calcareousness. An area of about 105 ha (20%) is currently not suitable (Class N1) for growing Tamarind and are distributed in the western and southern part of the microwatershed with severe limitations of rooting depth, gravelliness and calcareousness.

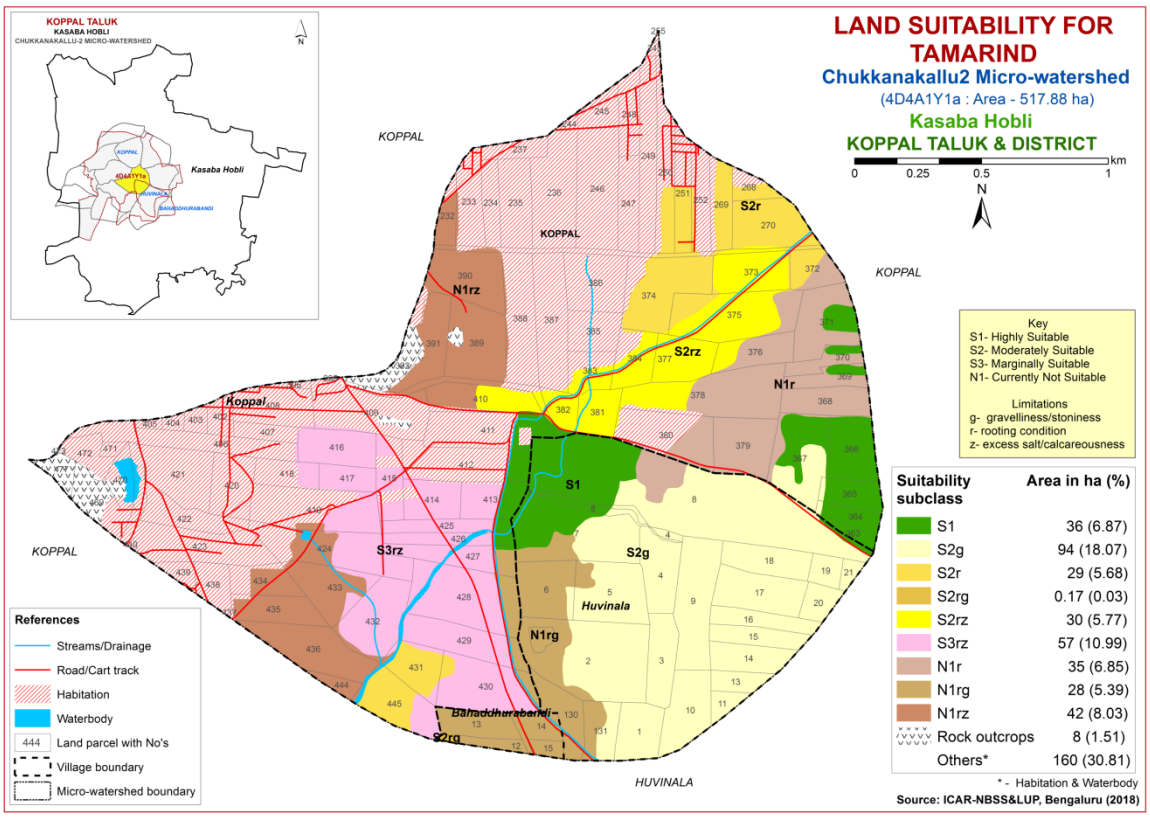


Fig. 7.26 Land Suitability map of Tamarind

7.27 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 7.28) 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 7.27.

An area of about 16 ha (3%) is highly suitable (Class S1) lands for growing Mulberry and distributed in the eastern part of the microwatershed. Maximum area of about 230 ha (45%) is moderately suitable (Class S2) and distributed in all parts of the microwatershed with minor limitations of texture, calcareousness and gravelliness. Marginally suitable (Class S3) lands cover an area of about 63 ha (12%) and distributed in the eastern and southern part of the microwatershed. They have moderate limitations of rooting depth and gravelliness. An area of about 42 ha (8%) is currently not suitable (Class N1) for growing Mulberry and are distributed in the western and southern part of the microwatershed with severe limitations of rooting depth and calcareousness.

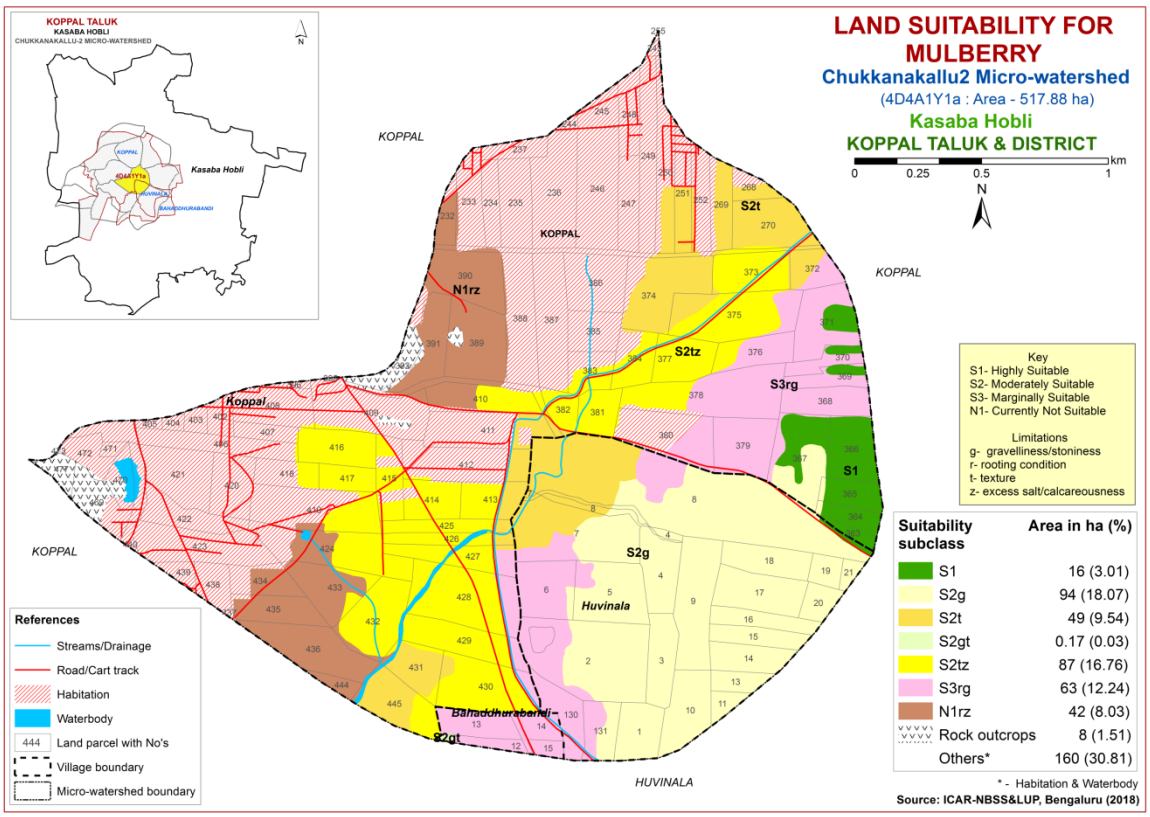


Fig. 7.27 Land Suitability map of Mulberry

7.28 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 7.29) 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 7.28.

An area of about 16 ha (3%) is highly suitable (Class S1) for growing Marigold and distributed in the eastern part of the microwatershed. Maximum area of about 265 ha (52%) is moderately suitable (Class S2) and are distributed in all parts of the microwatershed. They have minor limitations of rooting depth, gravelliness, texture and calcareousness. Marginally suitable (Class S3) lands occupy an area of about 70 ha (13%) and are distributed in the western and southern part of the microwatershed with moderate limitations of rooting depth, gravelliness and calcareousness.

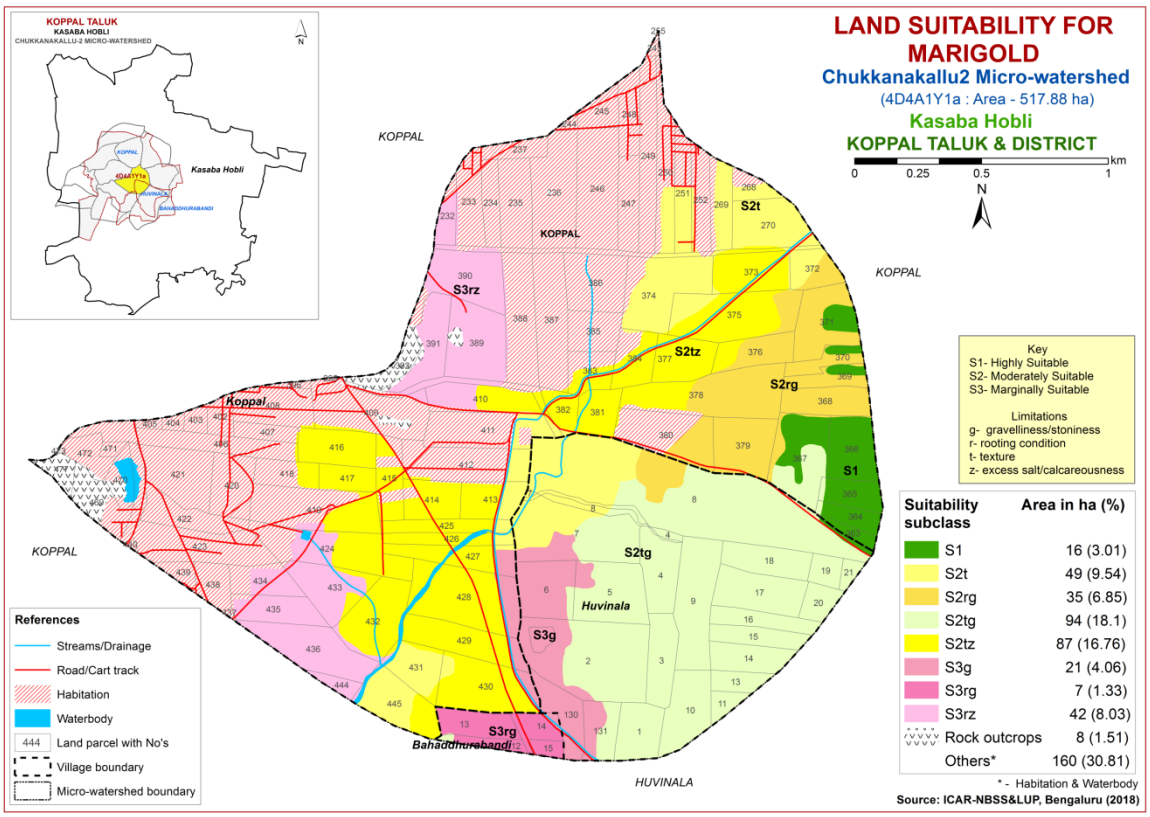


Fig. 7.28 Land Suitability map of Marigold

7.29 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 7.30) for growing chrysanthemum were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing chrysanthemum was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed is given in Figure 7.29.

An area of about 16 ha (3%) is highly suitable (Class S1) for growing Lime and distributed in the eastern part of the microwatershed. Maximum area of about 265 ha (52%) is moderately suitable (Class S2) and are distributed in all parts of the microwatershed. They have minor limitations of rooting depth, gravelliness, texture and calcareousness. Marginally suitable (Class S3) lands occupy an area of about 70 ha (13%) and are distributed in the western and southern part of the microwatershed with moderate limitations of rooting depth, gravelliness and calcareousness.

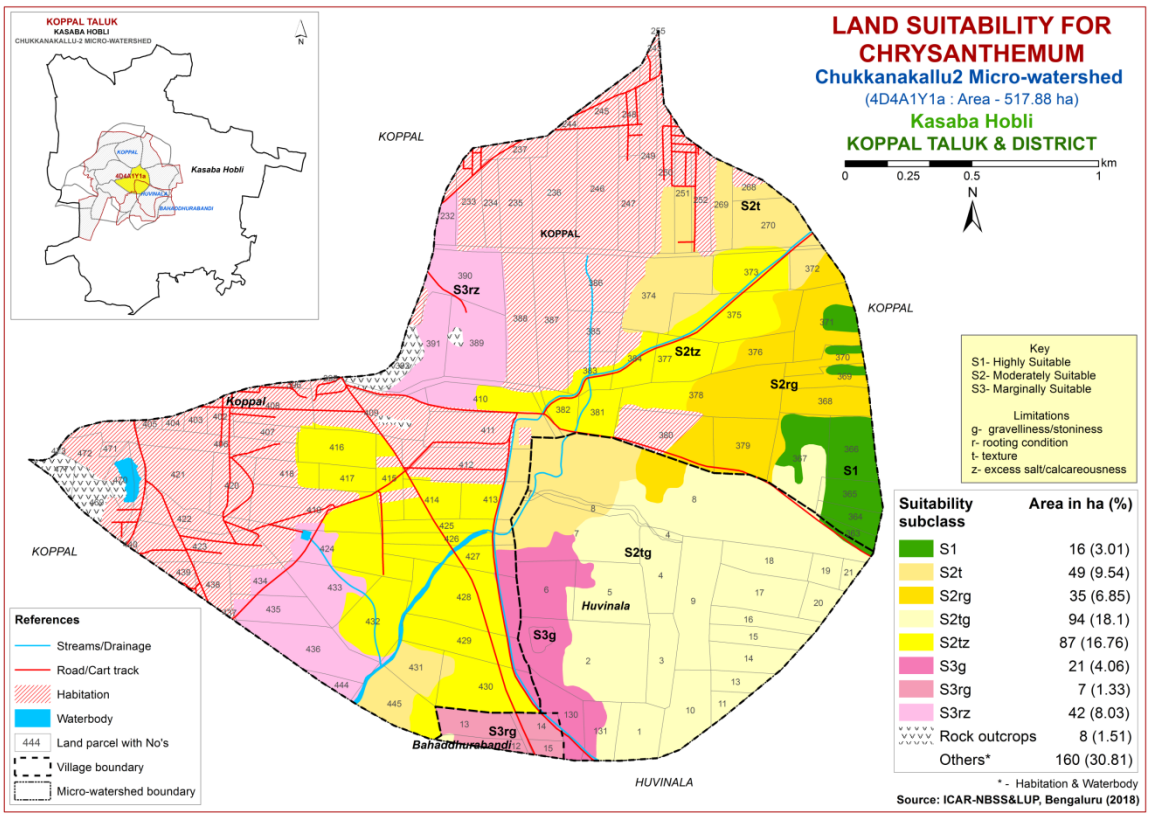


Fig. 7.29 Land Suitability map of Chrysanthemum

7. 30 Land Suitability for Jasmine *(Jasminum sp.)*

Jasmine is one of the most important flower crop grown in an area of 803 ha in almost all the districts of the State. The crop requirements (Table 7.31) for growing jasmine were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing jasmine was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.30.

An area of about 16 ha (3%) is highly suitable (Class S1) lands for growing Jasmine and distributed in the eastern part of the microwatershed. Moderately suitable (Class S2) lands occupy in an area of 149 ha (29%) and distributed in the central, eastern and southern part of the microwatershed with minor limitations of graveliness, rooting depth and texture. Marginally suitable (Class S3) lands occupy a maximum area of about 187 ha (36%) and are distributed in all parts of the microwatershed with moderate limitations of rooting depth, texture, gravelliness and calcareousness.

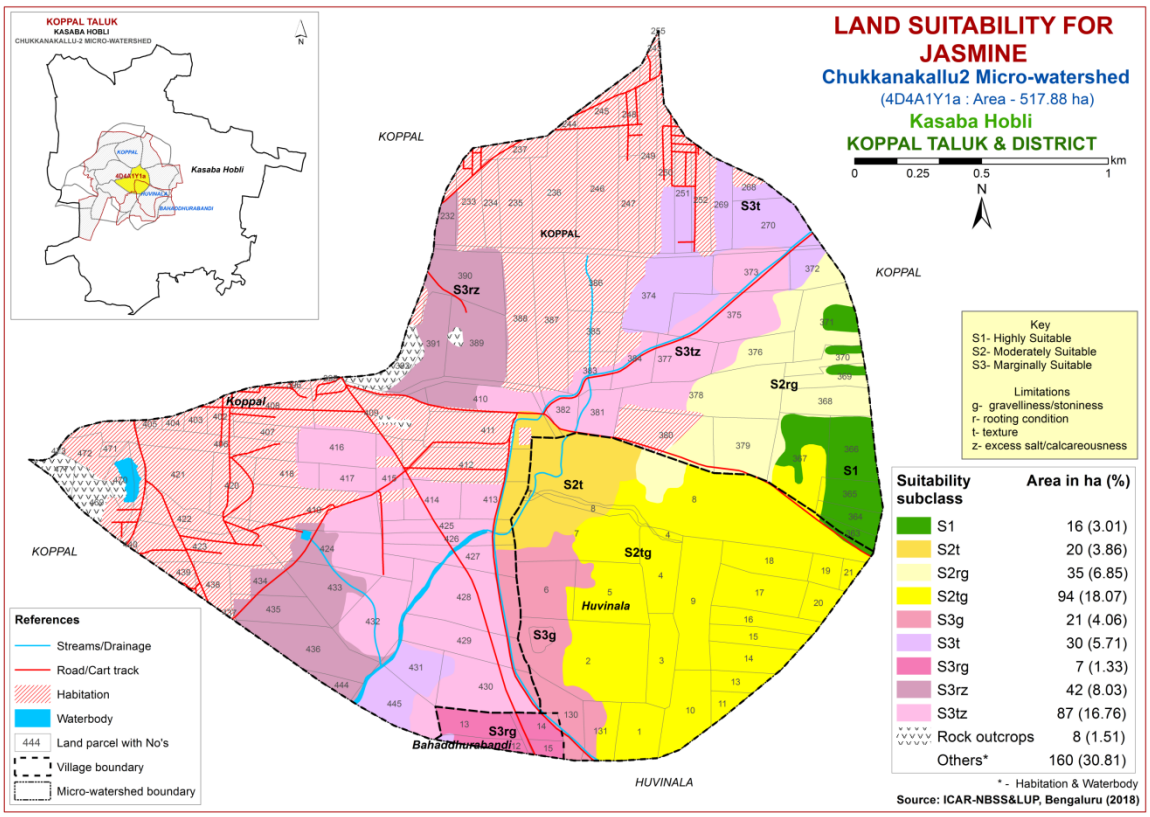


Fig. 7.30 Land Suitability map of Jasmine

7. 31 Land Suitability for Crossandra *(Crossandra infundibuliformis)*

Crossandra is one of the most important flower crop grown in almost all the districts of the State (Table 7.32). Land suitability map for growing crossandra was generated (Table 7.1). The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.31.

An area of about 36 ha (7%) is highly suitable (Class S1) lands for growing Crossandra and distributed in the eastern and central part of the microwatershed. Moderately suitable (Class S2) lands occupy in a maximum area of 176 ha (34%) and distributed in all parts of the microwatershed with minor limitations of graveliness, rooting depth and calcareousness. Marginally suitable (Class S3) lands occupy an area of about 139 ha (27%) and are distributed in the northern, eastern, western and southern part of the microwatershed with moderate limitations of rooting depth, texture, gravelliness and calcareousness.

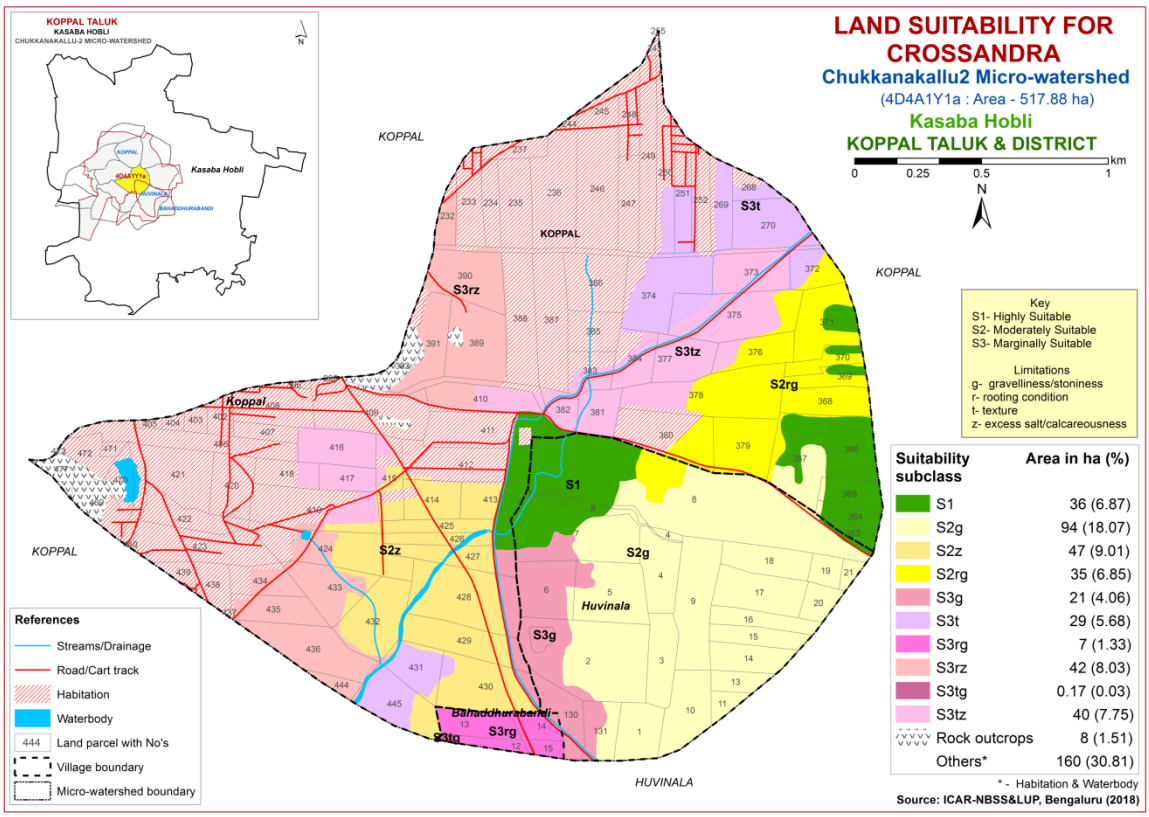


Fig. 7.31 Land Suitability map of Crossandra

Table 7.1 Soil-Site Characteristics of Chukkanakallu-2 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								
LKRcB2g1	662	<90	WD	50-75	sl	gsc	15-35	35-60	<50	1-3	moderate	8.18	0.30	4.51	12.19	100
LKRcB2g2	662	<90	WD	50-75	sc	gsc	15-35	35-60	<50	1-3	moderate	8.18	0.30	4.51	12.19	100
LKRhB2g1	662	<90	WD	50-75	sl	gsc	15-35	35-60	<50	1-3	moderate	8.18	0.30	4.51	12.19	100
KTPiB1g1	662	<90	WD	50-75	sc	gsc	15-35	15-35	51-100	1-3	slight	6.42	0.07	0.05	4.41	100
GDPcB2	662	<90	WD	100-150	sc	gsc-gc	<15	>35	51-100	1-3	moderate	7.88	0.10	2.87	7.80	97.00
HLKiA1	662	<90	WD	>150	scl	c	<15	<15	151-200	1-3	moderate	-	-	-	-	-
NDLhA1g1	662	<90	WD	>150	sc	gsc	<15	>35	51-100	1-3	slight	7.46	0.08	0.32	11.45	92
NDLiA1	662	<90	WD	>150	sc	gsc	<15	>35	51-100	1-3	slight	7.46	0.08	0.32	11.45	92
NDLiB1g1	662	<90	WD	>150	sc	gsc	<15	>35	51-100	1-3	slight	7.46	0.08	0.32	11.45	92
NDLiB2	662	<90	WD	>150	sc	gsc	<15	>35	51-100	1-3	slight	7.46	0.08	0.32	11.45	92
MTLiB2	662	<90	WD	25-50	sc	gc	15-35	15-35	51-100	1-3	slight	8.27	0.20	0.69	37.00	-
MTLmB1	662	<90	WD	25-50	sc	gc	<15	15-35	51-100	1-3	moderate	8.27	0.20	0.69	37.00	-
MTLmB2g1	662	<90	WD	25-50	c	gc	<15	15-35	51-100	1-3	slight	8.27	0.20	0.69	37.00	-
DRLmA1	662	<90	MWD	75-100	c	c	<15	<15	151-200	1-3	moderate	8.78	0.42	5.62	49.70	100
DRLmB1	662	<90	MWD	75-100	c	c	<15	<15	151-200	1-3	moderate	8.78	0.42	5.62	49.70	100
DRLmB2	662	<90	MWD	75-100	c	c	<15	<15	151-200	1-3	moderate	8.78	0.42	5.62	49.70	100
GRHmA1	662	<90	MWD	100-150	c	c	<15	<15	>200	0-1	slight	9.08	0.23	7.11	63.21	100
GRHmB1g1	662	<90	MWD	100-150	c	c	<15	<15	>200	1-3	moderate	9.08	0.23	7.11	63.21	100
GRHmB2	662	<90	MWD	100-150	c	c	<15	<15	>200	0-1	slight	9.08	0.23	7.11	63.21	100
KVRmB1	662	<90	MWD	100-150	c	c	<15	<15	>200	1-3	slight	8.40	0.26	0.60	43.25	-

Table 7.2 Land suitability criteria for Sorghum

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C	26–30	30–34; 24–26	34–40; 20–24	>40; <20
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Moderately well drained	Poorly drained	V.poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	sc, c (red), c (black)	scl, cl	ls, sl	-
	pH	1:2.5	5.5-7.8	5.0-5.5 7.8-9.0	>9.0	-
	CEC	C mol (p+)/Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	10-15
	OC	%				
Rooting conditions	Effective soil depth	cm	>75	50-75	25-50	<25
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	ds/m	<2	2-4	4-8	>8
	Sodicity (ESP)	%	5-10	10-15	>15	
Erosion hazard	Slope	%	0-3	3-5	5-10	>10

Table 7.3 Land suitability criteria for Maize

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C	30-34	35-38 26-30	38-40 26-20	
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Moderately well drained	Poorly drained	Very poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	scl, cl, sc	c (red), c (black)	ls, sl	-
	pH	1:2.5	5.5-7.8	5.0-5.5 7.8-9.0	>9.0	-
	CEC	C mol (p+)/Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>75	50-75	25-50	<25
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	ds/m	<2	2-4	4-8	>8
	Sodicity (ESP)	%	5-10	10-15	>15	-
Erosion hazard	Slope	%	0-3	3-5	5-10	>10

Table 7.4 Land suitability criteria for Bajra

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C	28-32	33-38 24-27	39-40 20-23	<20
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm	500-750	400-500	200-400	<200
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Moderately well drained	Poorly drained	Very poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	sl, scl, cl,sc,c (red)	c (black)	ls	-
	pH	1:2.5	6.0-7.8	5.0-5.5 7.8-9.0	5.5-6.0 >9.0	
	CEC	C mol (p+)/ Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>75	50-75	25-50	<25
	Stoniness	%				
	Coarse fragments	Vol %	15-35	35-60	>60	
Soil toxicity	Salinity (EC saturation extract)	ds/m	<2	2-4	4-8	>8
	Sodicity (ESP)	%	5-10	10-15	>15	
Erosion hazard	Slope	%	1-3	3-5	5-10	>10

Table 7.5 Land suitability criteria for Groundnut

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C	24–33	22–24; 33–35	20–22; 35–40	<20; >40
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Mod. Well drained	Poorly drained	Very Poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	scl	sl,cl, sc	c (red), c (black), ls	-
	pH	1:2.5	6.0-7.8	5.5-6.0 7.8-8.4	5.0-5.5 8.4-9.0	>9.0
	CEC	C mol (p+)/ Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>75	50-75	25-50	<25
	Stoniness	%				
	Coarse fragments	Vol %	<35	35-60	>60	
Soil toxicity	Salinity (EC saturation extract)	ds/m	<2	2-4	4-8	>8
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	<3	3-5	5-10	>10

Table 7.6 Land suitability criteria for Sunflower

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C	24–30	30–34; 20–24	34–38; 16–20	>38; <16
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	mod. Well drained	-	Poorly to very drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	cl, sc,c (red), c (black)	scl	ls, sl	-
	pH	1:2.5	6.5-7.8	7.8-8.4 5.5-6.5	8.4-9.0; 5.0-5.5	>9.0
	CEC	C mol (p+)/Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>100	75-100	50-75	<50
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	ds/m	<2	2-4	4-8	>8
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	<3	3-5	5-10	>10

Table 7.7 Land suitability criteria for Redgram

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C	30-35(G) 20-25(AV) 15-18 (F&PS) 35-40(M)	25-30(G) 20-25 (AV) 12-15 (F&PS) 30-35(M)	20-25(G) 15-20(AV) 10-12 (F&PS) 25-30(M)	< 20 <15 <10 <25
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Mod. Well drained	Poorly drained	Very Poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	sc, c (red)	c (black),sl, scl, cl	ls	-
	pH	1:2.5	6.0-7.8	5.5-6.0 7.8-9.0	5.0-5.5 >9.0	-
	CEC	C mol (p+)/ Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>100	75-100	50-75	<50
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-50	60-80
Soil toxicity	Salinity (EC saturation extract)	ds/m	<1.0	1.0-2.0	>2.0	
	Sodicity (ESP)	%	5-10	10-15	>15	
Erosion hazard	Slope	%	<3	3-5	5-10	>10

Table 7.8 Land suitability criteria for Bengal gram

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C	20–25	25–30; 15–20	30–35; 10–15	>35; <10
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Mod. Well drained	Poorly drained	Very Poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	c(black)	-	c (red), scl, cl, sc	ls, sl
	pH	1:2.5	6.0-7.8	5.0-6.0 7.8-9.0	>9.0	-
	CEC	C mol (p+)/Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>75	50-75	25-50	<25
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	ds/m	<2	2-4	4-8	>8
	Sodicity (ESP)	%	5-10	10-15	>15	-
Erosion hazard	Slope	%	<3	3-5	5-10	>10

Table 7.9 Land suitability criteria for Cotton

Land use requirement			**Rating**			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C	22-32	>32	<19	-
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well to moderately well	Poorly drained/Some what excessively drained	-	very poorly/excessively drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	sc, c (red,black)	cl	scl	ls, sl
	pH	1:2.5	6.5-7.8	7.8-8.4	5.5-6.5 8.4->9.0	<5.5
	CEC	C mol (p+)Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>100	50-100	25-50	<25
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	ds/m	<2	2-4	4-8	>8
	Sodicity (ESP)	%	5-10	10-15	>15	
Erosion hazard	Slope	%	<3	3-5	-	>5

Table 7.10 Land suitability criteria for Chilli

Land use requirement			Rating			
Soil –site characteristics		Unit	Highly suitable (S1)	Moderately suitable (S2)	Marginally suitable (S3)	Not suitable (N1)
Climatic regime	Mean temperature in growing season	°C	25-32	33-35 20-25	35-38 <20	>38
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Moderately well drained	Poorly drained	Very poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	scl, cl, sc	c (black), sl	ls	-
	pH	1:2.5	6.0-7.3	5.0-6.0 7.3-8.4	8.4-9.0	>9.0
	CEC	C mol (p+)/ Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>75	50-75	25-50	<25
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	ds/m	<2	2-4	4-8	>8
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	<3	3-5	5-10	>10

Table 7.11 Land suitability criteria for Tomato

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C	25-28	29-32 20-24	15-19 33-36	<15 >36
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Moderately well drained	Poorly drained	V.poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	sl, scl, cl, sc, c (red)	-	ls, c(black)	-
	pH	1:2.5	6.0-7.3	5.0-6.0 7.3-8.4	8.4-9.0	>9.0
	CEC	C mol (p+)/Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>75	50-75	25-50	<25
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	ds/m	<2.0	2-4	4-8	>8.0
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	<3	3-5	5-10	>10

Table 7.12 Land suitability criteria for Brinjal

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C	Well drained	Moderately well drained	Poorly drained	V. Poorly drained
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class				
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	sl, scl, cl, sc c (red)	-	ls, c (black)	-
	pH	1:2.5	6.0-7.3	7.3-8.4 5.0-6.0	8.4-9.0	>9.0
	CEC	C mol (p+)/Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>75	50-75	25-50	<25
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	>60
Soil toxicity	Salinity (EC saturation extract)	ds/m	<2.0	2-4	4-8	>8.0
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	<3	3-5	5-10	>10

Table 7.13 Land suitability criteria for Onion

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C	20-30	30-35	35-40	>40
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Moderately /imperfectly	-	Poorly to V poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	sl,scl,cl,sc,c (red)	-	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
	CEC	C mol (p+)/ Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>75	50-75	25-50	<25
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	ds/m	<1.0	1.0-2.0	2.0-4.0	<4
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	<3	3-5	5-10	>10

Table 7.14 Land suitability criteria for Bhendi

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C	25-28	29-32 20-24	15-19 33-36	<15 >36
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Moderately well drained	Imperfectly drained	Poorly to very poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	scl, cl,sc, c (red)	c (black)	ls	-
	pH	1:2.5	6.0-7.3	5.0-6.0 7.3-8.4	8.4-9.0	>9.0
	CEC	C mol (p+)/Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>75	50-75	25-50	<25
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	ds/m	<2.0	2-4	4-8	>8.0
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	<3	3-5	5-10	>10

Table 7.15 Land suitability criteria for Drumstick

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C				
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Moderately well drained	Poorly drained	V.Poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	sc, scl, cl, c (red)	sl, c (black)	ls	s
	pH	1:2.5	6.0-7.3	5.0-5.5 7.3-7.8	5.5-6.0 7.8-8.4	>8.4
	CEC	C mol (p+)/Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>100	75-100	50-75	<50
	Stoniness	%				
	Coarse fragments	Vol %	<35	35-60	60-80	>80
Soil toxicity	Salinity (EC saturation extract)	ds/m				
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	<3	3-10	-	>10

Table 7.16 Land suitability criteria for Mango

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C	28-32	24-27 33-35	36-40	20-24
	Min temp. before flowering	^{0}C	10-15	15-22	>22	-
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration	Days				
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Moderately well drained	Poorly drained	V. Poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	scl, cl, sc, c (red)	-	ls, sl, c (black)	-
	pH	1:2.5	5.5-7.3	5.0-5.5 7.3-8.4	8.4-9.0	>9.0
	CEC	C mol (p+)/Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>150	100-150	75-100	<75
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	ds/m	<2.0	2-4	4-8	>8.0
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	<3	3-5	5-10	>10

Table 7.17 Land suitability criteria for Guava

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C	28-32	33-36 24-27	37-42 20-23	
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Moderately well drained	Poorly drained	V.Poorly drained
	Water logging in growing season	Days				
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
	CEC	C mol (p+)/ Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>100	75-100	50-75	<50
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	ds/m	<2.0	2-4	4-8	>8.0
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	<3	3-5	5-10	>10

Table 7.18 Land suitability criteria for Sapota

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C	28-32	33-36 24-27	37-42 20-23	>42 <18
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Moderately well drained	-	Poorly to very drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	scl, cl, sc, c (red)	sl	ls, c (black)	-
	pH	1:2.5	6.0-7.3	5.0-6.0 7.3-8.4	8.4-9.0	>9.0
	CEC	C mol (p+)/ Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>100	75-100	50-75	<50
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	ds/m	<2.0	2-4	4-8	>8.0
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	<3	3-5	5-10	>10

Table 7.19 Land suitability criteria for Pomegranate

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C	30-34	35-38 25-29	39-40 15-24	
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Moderately well drained	Poorly drained	V.Poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	scl,cl, sc, c (red)	c (black),sl	ls	-
	pH	1:2.5	5.5-7.8	7.8-8.4	5.0-5.5 8.4-9.0	>9.0
	CEC	C mol (p+)/ Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>100	75-100	50-75	<50
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	ds/m	<2.0	2-4	4-8	>8.0
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	<3	3-5	5-10	>10

Table 7.20 Land suitability criteria for Musambi

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C	28-30	31-35 24-27	36-40 20-23	>40 <20
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Moderately drained	poorly	Very poorly
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	scl, cl, sc, c	sl	ls	-
	pH	1:2.5	6.0-7.8	5.5-6.0 7.8-8.4	5.0-5.5 8.4-9.0	>9.0
	CEC	C mol (p+)/ Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>100	75-100	50-75	<50
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	ds/m	<2.0	2-4	4-8	>8.0
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	<3	3-5	5-10	>10

Table 7.21 Land suitability criteria for Lime

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C	28-30	31-35 24-27	36-40 20-23	>40 <20
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Moderately drained	poorly	Very poorly
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	scl, cl, sc, c	sl	ls	-
	pH	1:2.5	6.0-7.8	5.5-6.0 7.8-8.4	5.0-5.5 8.4-9.0	>9.0
	CEC	C mol (p+)/ Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>100	75-100	50-75	<50
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	ds/m	<2.0	2-4	4-8	>8.0
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	<3	3-5	5-10	>10

Table 7.22 Land suitability criteria for Amla

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C				
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Mod. well drained	Poorly drained	V. Poorly drained
	Water logging in growing season	Days				
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 7.3-7.8	7.8-8.4	>8.4
	CEC	C mol (p+)/Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>75	50-75	25-50	<25
	Stoniness	%				
	Coarse fragments	Vol %	<15-35	35-60	60-80	-
Soil toxicity	Salinity (EC saturation extract)	ds/m	<2.0	2-4	4-8	>8.0
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	0-3	3-5	5-10	>10

Table 7.23 Land suitability criteria for Cashew

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C	32 to 34	28 to 32; 34 to 38	24 to 28; 38 to 40	<20; >40
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	moderately well drained	Poorly drained	Very poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	scl, cl, sc, c (red)	-	sl, ls	c (black)
	pH	1:2.5	5.5-6.5	5.0-5.5 6.5-7.3	7.3-7.8	>7.8
	CEC	C mol (p+)/ Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>100	75-100	50-75	<50
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	ds/m	<2	2-4	4-8	>8
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	<3	3-10	>10	-

Table 7.24 Land suitability criteria for Jackfruit

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C				
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Mod. well	Poorly	V. Poorly
	Water logging in growing season	Days				
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
	CEC	C mol (p+)/ Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>100	75-100	50-75	<50
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	>60
Soil toxicity	Salinity (EC saturation extract)	ds/m	<2.0	2-4	4-8	>8.0
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	0-3	3-5	5-10	>10-

Table 7.25 Land suitability criteria for Jamun

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C				
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well	Mod. well	Poorly	V.Poorly
	Water logging in growing season	Days				
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
	CEC	C mol (p+)/ Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>150	100-150	50-100	<50
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	>60
Soil toxicity	Salinity (EC saturation extract)	ds/m	<2.0	2-4	4-8	>8.0
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	0-3	3-5	5-10	>10

Table 7.26 Land suitability criteria for Custard apple

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C				
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Mod. well drained	Poorly drained	V.Poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	Scl, cl, sc, c (red), c (black)	-	Sl, ls	-
	pH	1:2.5	6.0-7.3	5.5-6.0 7.3-8.4	5.0-5.5 8.4-9.0	>9.0
	CEC	C mol (p+)/Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>75	50-75	25-50	<25
	Stoniness	%				
	Coarse fragments	Vol %	<15-35	35-60	60-80	-
Soil toxicity	Salinity (EC saturation extract)	ds/m	<2.0	2-4	4-8	>8.0
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	0-3	3-5	>5	-

Table 7.27 Land suitability criteria for Tamarind

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C				
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Mod.well drained	Poorly drained	V.Poorly drained
	Water logging in growing season	Days				
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
	CEC	C mol (p+)/ Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>150	100-150	75-100	<75
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	ds/m	<2	2-4	4-8	>8
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	0-3	3-5	5-10	>10

Table 7.28 Land suitability criteria for Mulberry

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C	24–28	22–24; 28–32	32–38; 22–18	>38; <18
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Moderately well drained	Poorly drained	V. Poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	sc, cl, scl	c (red)	c (black), sl, ls	-
	pH	1:2.5	5.5-7.3	5.0-5.5 7.8-8.4	7.3-8.4	>8.4
	CEC	C mol (p+)/Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>100	75-100	50-75	<50
	Stoniness	%				
	Coarse fragments	Vol %	0-35	35-60	60-80	>80
Soil toxicity	Salinity (EC saturation extract)	ds/m	<2	2-4	4-8	>8
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	0-3	3-5	5-10	>10

Table 7.29 Land suitability criteria for Marigold

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C	18-23	17-15 24-35	35-40 10-14	>40 <10
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Moderately well drained	Poorly drained	V.Poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	sl,scl, cl, sc, c (red)	c (black)	ls	-
	pH	1:2.5	6.0-7.3	5.0-6.0 7.3-8.4	8.4-9.0	>9.0
	CEC	C mol (p+)/Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>75	50-75	25-50	<25
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	ds/m	<2.0	2-4	4-8	>8.0
	Sodicity (ESP)	%				
Erosion hazard	Slope	%	<3	3-5	5-10	>10

Table 7.30 Land suitability criteria for Chrysanthemum

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C	18-23	17-15 24-35	35-40 10-14	>40 <10
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Moderately well drained	Poorly drained	V.Poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	sl,scl, cl, sc, c (red)	c (black)	ls	-
	pH	1:2.5	6.0-7.3	5.0-6.0 7.3-8.4	8.4-9.0	>9.0
	CEC	C mol (p+)/Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>75	50-75	25-50	<25
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	ds/m	<2.0	2-4	4-8	>8.0
	Sodicity (ESP)	%				
Erosion hazard	Slope	%	<3	3-5	5-10	>10

Table 7.31 Land suitability criteria for Jasmine (irrigated)

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C	18-23	17-15 24-35	35-40 10-14	-
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Moderately well drained	Poorly drained	V.Poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	scl, cl, sc, c (red)	sl	ls, c (black)	-
	pH	1:2.5	6.0-7.3	5.0-6.0 7.3-8.4	8.4-9.0	>9.0
	CEC	C mol (p+)/Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>75	50-75	25-50	<25
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	dS/m	<2.0	2-4	4-8	>8.0
	Sodicity (ESP)	%				
Erosion hazard	Slope	%	<3	3-5	5-10	>10

7.32 Land suitability criteria for Crossandra

Land use requirement			Rating			
Soil –site characteristics		Unit	Highly suitable (S1)	Moderately suitable (S2)	Marginally suitable (S3)	Not suitable (N1)
Climatic regime	Mean temperature in growing season	°C				
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Moderately well drained	-	Poorly to very poorly drained
	Water logging in growing season	Days				
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 7.3-8.4	8.4-9.0	>9.0
	CEC	C mol (p+)/Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>75	50-75	25-50	<25
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	dS/m	<2.0	2-4	4-8	>8.0
	Sodicity (ESP)	%				
Erosion hazard	Slope	%	<3	3-5	5-10	>10

7.32 Land Management Units (LMUs)

The 20 soil map units identified in Chukkanakallu-2 microwatershed have been grouped into 6 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 Units map (Fig.7.31) 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 6 Land Management Units along with brief description of soil and site characteristics are given below.

LMU	Mapping unit	Soil and site characteristics
1	272.HLKiA1	Very deep (>150 cm), red clay soils, slope (0-1%), slight erosion
2	293.NDLhA1g1 297.NDLiA1 299.NDLiB1g1 300.NDLiB2 267.GDPcB2	Deep to very deep (100 to >150 cm), red gravelly sandy clay loam to sandy clay soils, slope (0-3%), slight to moderate erosion, gravelly (15-35%)
3	370.GRHmA1 372.GRHmB1g1 373.GRHmB2 388.KVRmB1 344.DRLmA1 348.DRLmB1 350.DRLmB2	Moderately deep to deep (75-150 cm), black calcareous clay soils, slope (0-3%), slight to moderate erosion, gravelly (15-35%)
4	43.LKRcB2g1 44.LKRcB2g2 452.LKRhB2g1	Moderately shallow (50-75 cm), red gravelly loam soils, slope (1-3%), moderate erosion, gravelly (15-60%)
5	74.KTPiB1g1	Moderately shallow (50-75 cm), red clay soils, slope (1-3%), slight erosion, gravelly (15-35%)
6	304.MTLiB2 307.MTLmB1 311.MTLmB2g1	Shallow (25-50 cm), black calcareous clay soils, slope (1-3%), slight to moderate erosion, gravelly (15-35%)

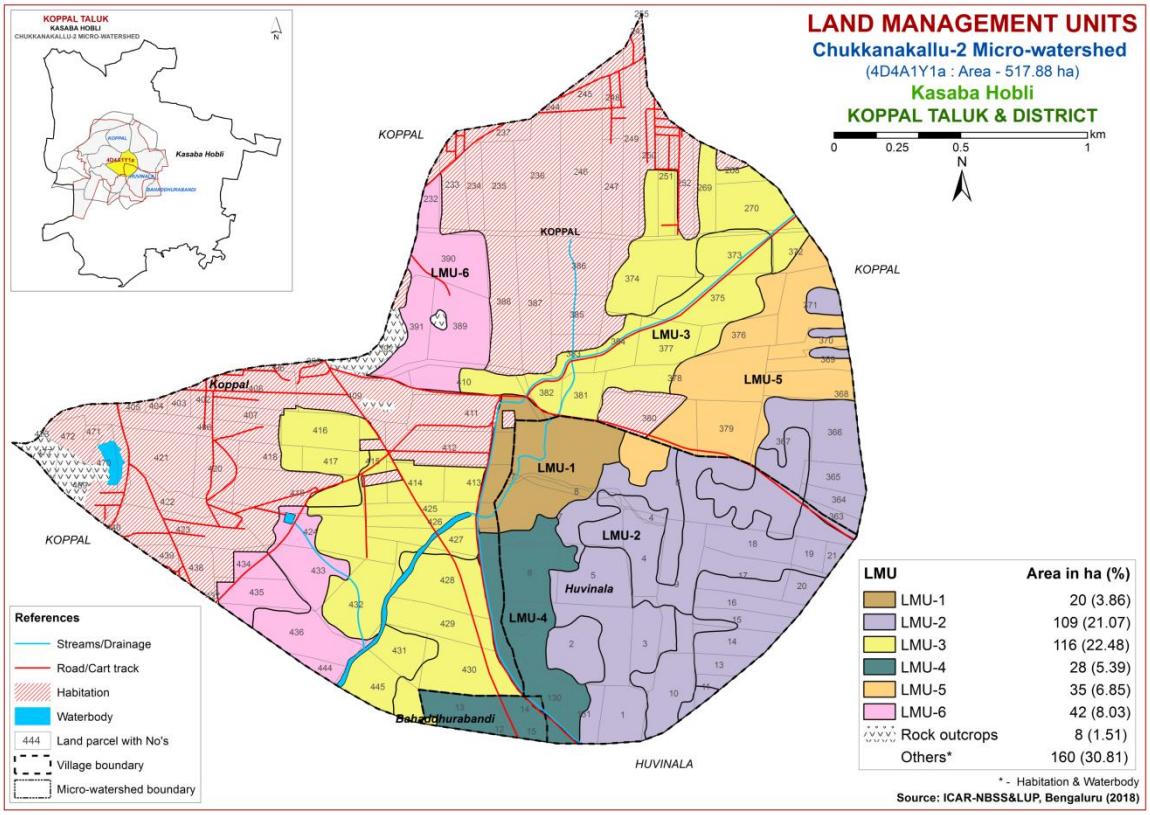


Fig 7.32 Land Management Units map of Chukkanakallu-2 microwatershed

7.33 Proposed Crop Plan for Chukkanakallu-2 Microwatershed

After assessing the land suitability for the 31 crops, the proposed crop plan has been prepared for the 6 identified LMUs by considering only the highly (Class S1) and moderately (Class S2) suitable lands for each of the 31 crops. The resultant proposed crop plan is presented in Table 7.33.

Table 7.33 Proposed Crop Plan for Chukkanakallu-2 Microwatershed

LMU	Soil Map Units	Survey Number	Field Crops	Horticulture Crops	Suitable Interventions
1	272.HLKiA1	**Huvinala** :7,8	Maize, Sorghum, Sunflower, Bajra, Finger millet, Groundnut, Red gram, Cowpea, Field bean, Castor, Mulberry	**Fruit crops**: Mango, Pomegranate, Guava, Sapota, Jackfruit, Jamun, Tamarind, Lime, Musambi, Amla, Custard apple, Cashew **Vegetable crops**: Drumstick, Tomato, Bhendi, Chilli, Brinjal, Onion, Curry leaves **Flower crops**: Marigold, Chrysanthemum, Jasmine, Crossandra	Drip irrigation, mulching, suitable soil and water conservation practices (Crescent Bunding with Catch Pit etc)
2	293.NDLhA1g1 297.NDLiA1 299.NDLiB1g1 300.NDLiB2 267.GDPcB2	**Huvinala** :1,2,3,4,5,9,10,11,13, 131 **Koppal** :363,364,365,366, 367	Groundnut, Bajra, Horse gram, Castor, Mulberry	**Fruit crops**: Musambi, Lime, Jamun, Jackfruit Amla, Custard apple, Tamarind **Vegetable crops**: Drumstick, Curry leaves	Drip irrigation, mulching, suitable soil and water conservation practices (Crescent Bunding with Catch Pit etc)
3	370.GRHmA1 372.GRHmB1g1 373.GRHmB2 388.KVRmB1 344.DRLmA1 348.DRLmB1 350.DRLmB2	**Koppal**:251,268,269,270,372,373,374,375,377,381,382,383,384,410,413,414,415,416,417,424, 425,426,427,428,429,430,431, 432, 445	Maize, Sorghum, Sunflower, Cotton, Bengal gram, Safflower, Linseed, Bajra, Soybean	**Fruit crops**: Sapota, Pomegranate, Jamun, Lime, Musambi, Tamarind, Amla, Custard apple **Vegetables**: Drumstick, Chilli, Coriander, Tomato,	Application of FYM, Biofertilizers and micronutrients, drip irrigation, mulching, suitable soil and water conservation practices

LMU	Soil Map Units	Survey Number	Field Crops	Horticulture Crops	Suitable Interventions
				Bhendi **Flower crops**: Marigold, Chrysanthemum, Crossandra, Jasmine	
4	43.LKRcB2g1 44.LKRcB2g2 452.LKRhB2g1	**Bahddhurabandi** :12,13,14,15 **Huvinala** :6,130	Sorghum, Groundnut, Bajra, Castor	**Fruit crops**: Lime, Musambi, Amla, Cashew, Custard apple,	Drip irrigation, mulching, suitable soil and water conservation practices (Crescent Bunding with Catch Pit etc)
5	74.KTPiB1g1	**Koppal**:368,369,370,371,376,378,379	Sorghum, Groundnut, Bajra, Green gram, Black gram, Cowpea, Horse gram, Castor,	**Fruit crops**: Lime, Musambi, Amla, Custard apple, Cashew **Flower crops**: Marigold, Chrysanthemum, Crossandra, Jasmine	Drip irrigation, mulching, suitable soil and water conservation practices (Crescent Bunding with Catch Pit etc)
6	304.MTLiB2 307.MTLmB1 311.MTLmB2g1	**Koppal**:232,389,390,391,433,434,435,436,444	Bengal gram	**Agri-Silvi-Pasture**: Hybrid Napier, *Styloxanthes hamata, Styloxanthes scabra*	Use of short duration varieties, sowing across the slope

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 Chukkanakallu-2 Microwatershed

- The soil phases with sizeable area identified in the microwatershed belonged to the soil series of NDL 94 ha (18%), DRL 57 ha (11%), MTL 42 ha (8%), KTP 35 ha (7%), GRH 30 ha (6%), KVR 30 ha (6%), LKR 28 ha (5%), HLK 20 ha (4%) and GDP 16 ha (3%).
- As per land capability classification, entire area in the microwatershed falls under arable land category (Class II and III). The major limitations identified in the arable lands were soil and erosion.

- On the basis of soil reaction, an area of about 202 ha (39%) is slightly alkaline (pH 7.3-7.8), 42 ha (8%) is moderately alkaline (pH 7.8-8.4), 45 ha (9%) is strongly alkaline (pH 8.4-9.0) and 61 ha (12%) is very strongly alkaline (pH >9.0).

Soil Health Management

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

Alkaline soils

About 350 ha (68%) is under alkaline soils (slightly to very strongly alkaline soils).

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

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 193 ha (37%) is under slight erosion and 157 ha (30%) 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 Chukkanakallu-2 Microwatershed.
- **Organic Carbon:** An area of about 241 ha (47%) is medium (0.5-0.75%) and 109 ha (21%) 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 241 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 medium (23-57 kg/ha) in 351 ha (68%) area of the microwatershed. The areas with low and medium phosphorus content, additional 25% phosphorus from the RDF to be applied.
- **Available Potassium:** Available potassium is low (<145 kg/ha) in 130 ha (25%), medium (145-337 kg/ha) in 213 ha (41%) and high (>337 kg/ha) in 8 ha (1%) 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.

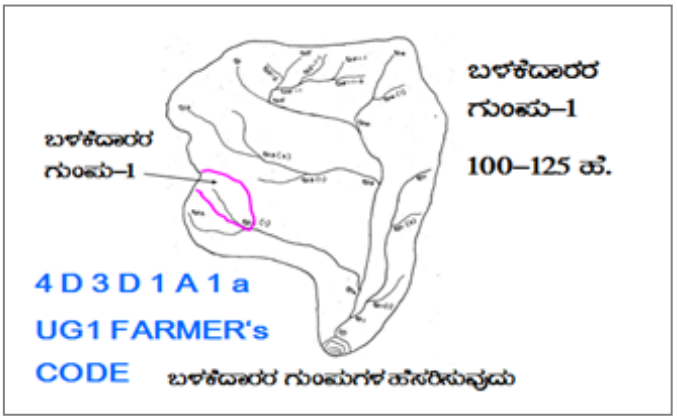
- **Available Sulphur:** Available sulphur is low (<10 ppm) in 349 ha (67%) and medium (10-20 ppm) in 1 ha (<%) area of the microwatershed. Areas with low and medium in available sulphur need to be applied with magnesium sulphate or gypsum or Factamphos (p) fertitilizer (13% sulphur) for 2-3 years for the deficiency to be corrected.
- **Available Iron:** Available iron is deficient (<4.5 ppm) in 290 ha (56%) and sufficient (>4.5 ppm) in 60 ha (12%) area of the microwatershed. Application of iron sulphate @ 25 kg/ha for 2-3 years to correct the deficiency.
- **Available Zinc:** Available zinc is sufficient (>0.6 ppm) in in the entire area of the microwatershed. Application of zinc sulphate @ 25 kg/ha is to be followed in areas that are deficient in available zinc.
- **Available Boron:** Available boron is low in (<0.5ppm) 12 ha (2%) and medium (0.5-1.0 ppm) in 339 ha (65%) area in the microwatershed. The areas with low and medium in boron content need to be applied with sodium borate @ 10 kg/ha as soil application or 0.2% borax as foliar spray to correct the deficiency.
- **Available Manganese**: It is sufficient (>1.0 ppm) in the entire area of the microwatershed.
- **Available Copper:** Available copper is sufficient (>0.2 ppm) in the entire area of the microwatershed.
- **Soil Alkalinity:** An area of 350 ha in the microwatershed has soils that are slightly to very strongly 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 and not 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 Chukkanakallu-2 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.

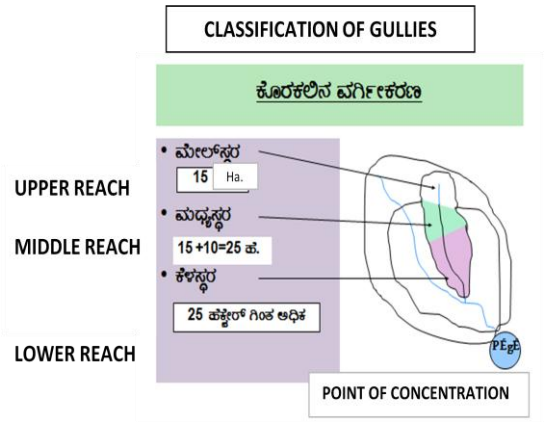
- Naming of user groups and farmers
- Identification of arable and non arable lands
- Identification of drainage lines and gullies
- Identification of non treatable areas
- Identification of priority areas in the arable lands
- Treatment plan for arable lands
- Location of water harvesting and recharge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

9.1 Treatment Plan

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

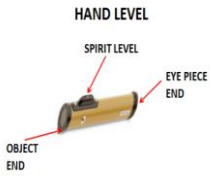
9.1.1 Arable Land Treatment

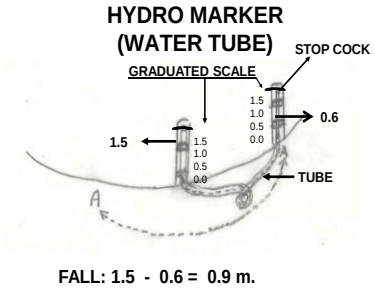
A. BUNDING

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.





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.

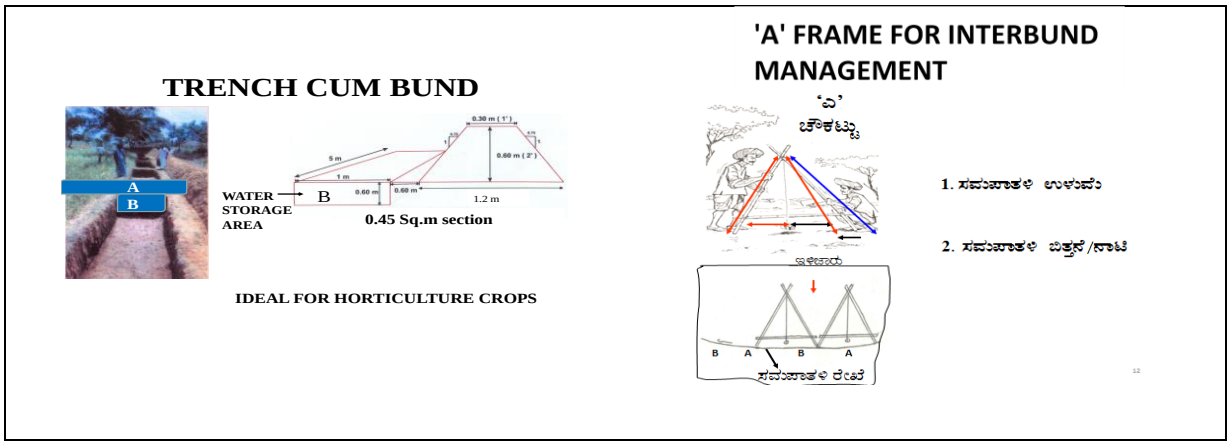
Recommended Bund Section

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 Levelling Survey using Dumpy Level / Total Station has to be carried out to arrive at the site-specific designs as shown in the Manual.
f) The location of ground water recharge structures are decided by examining the lineaments and fracture zones from geological maps.
g) Rainfall intensity data of the nearest Rain Gauge Station is considered for Hydrologic Designs.
h) Silt load to the Storage/Recharge Structures is reduced by providing vegetative, boulder and earthern checks in the natural water course. Location and design details are given in the Manual.

9.2 Recommended Soil and Water Conservation Measures

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

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

A map (Fig. 9.1) showing soil and water conservation plan with different kinds of structures recommended has been prepared which shows the spatial distribution and extent of area. An area of about 122 ha (24%) needs trench cum bunding. Maximum area of about 141 ha (27%) needs graded bunding. Strengthening of existing bunds/bunding occur in an area of about 88 ha (17%).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.

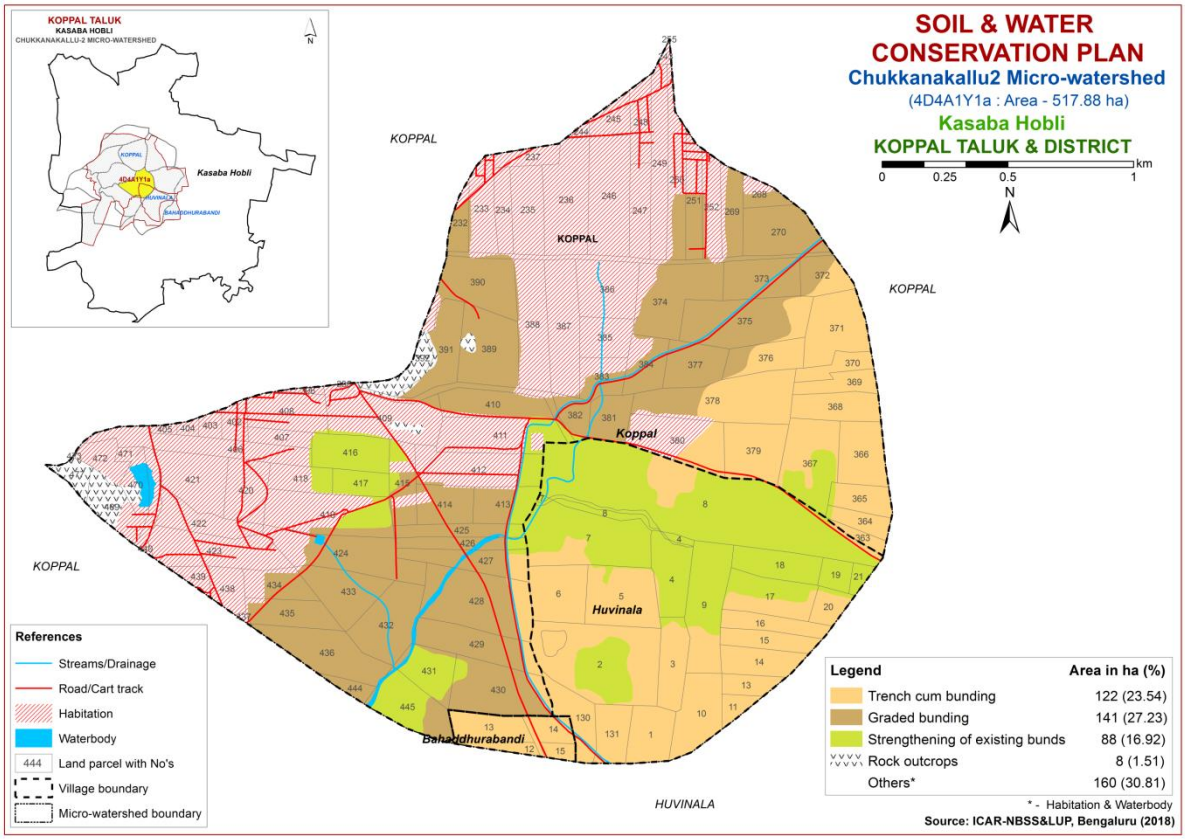


Fig. 9.1 Soil and Water Conservation Plan map of Chukkanakallu-2 Microwatershed

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

Chukkanakallu2 _1Y1a Microwatershed

Soil Phase Information

Village	Survey Number	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
Bahaddhu rabandi	12	1.31	LKRhB2g1	LMU-4	Moderately shallow (50-75 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
Bahaddhu rabandi	13	3.17	LKRhB2g1	LMU-4	Moderately shallow (50-75 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
Bahaddhu rabandi	14	1.65	LKRhB2g1	LMU-4	Moderately shallow (50-75 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
Bahaddhu rabandi	15	0.85	LKRhB2g1	LMU-4	Moderately shallow (50-75 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
Huvinala	1	3.81	NDLiB2	LMU-2	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Current fallow (Mz+Cf)	Not Available	IIe	Trench cum bunding
Huvinala	2	13.33	NDLiB2	LMU-2	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow+Bajra (Cf+Bj)	Not Available	IIe	Trench cum bunding
Huvinala	3	3.89	NDLiB2	LMU-2	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Sunflower (Mz+Sf)	Not Available	IIe	Trench cum bunding
Huvinala	4	4.58	NDLhA1g1	LMU-2	Very deep (>150 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Nearly level (0-1%)	Slight	Current fallow (Cf)	Not Available	IIs	Graded bunding
Huvinala	5	6.66	NDLiB2	LMU-2	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIe	Trench cum bunding
Huvinala	6	5.04	LKRcB2g2	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow (Cf)	Not Available	IIIes	Trench cum bunding
Huvinala	7	10.52	HLKiA1	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	High (151-200 mm/m)	Nearly level (0-1%)	Slight	Bajra (Bj)	Not Available	IIs	Graded bunding
Huvinala	8	31.59	HLKiA1	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	High (151-200 mm/m)	Nearly level (0-1%)	Slight	Current fallow+Bajra (Cf+Bj)	1 Borewell	IIs	Graded bunding
Huvinala	9	7.5	NDLhA1g1	LMU-2	Very deep (>150 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Nearly level (0-1%)	Slight	Maize (Mz)	Not Available	IIs	Graded bunding
Huvinala	10	5.09	NDLiB1g1	LMU-2	Very deep (>150 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIs	Trench cum bunding
Huvinala	11	1.17	NDLiB2	LMU-2	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIe	Trench cum bunding
Huvinala	13	1.72	NDLiB2	LMU-2	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIe	Trench cum bunding
Huvinala	14	3.33	NDLiB2	LMU-2	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIe	Trench cum bunding
Huvinala	15	2.69	NDLiB2	LMU-2	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIe	Trench cum bunding
Huvinala	16	2.72	NDLiB2	LMU-2	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIe	Trench cum bunding
Huvinala	17	5.28	NDLhA1g1	LMU-2	Very deep (>150 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Nearly level (0-1%)	Slight	Bajra (Bj)	Not Available	IIs	Graded bunding
Huvinala	18	3.85	NDLhA1g1	LMU-2	Very deep (>150 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Nearly level (0-1%)	Slight	Bajra (Bj)	Not Available	IIs	Graded bunding
Huvinala	19	1.48	NDLhA1g1	LMU-2	Very deep (>150 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Nearly level (0-1%)	Slight	Bajra (Bj)	Not Available	IIs	Graded bunding

Village	Survey Number	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
Huvinala	20	1.79	NDLiB2	LMU-2	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIe	Trench cum bunding
Huvinala	21	0.75	NDLhA1g1	LMU-2	Very deep (>150 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Nearly level (0-1%)	Slight	Bajra (Bj)	Not Available	IIs	Graded bunding
Huvinala	130	3.51	LKRcB2g2	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIIes	Trench cum bunding
Huvinala	131	3.12	NDLiB2	LMU-2	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow (Cf)	Not Available	IIe	Trench cum bunding
Koppal	232	1.65	MTLmB2g1	LMU-6	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIIes	Graded bunding
Koppal	233	3.79	Habitation	Others	Others	Others	Others	Others	Others	Others	Not Available (NA)	Not Available	Others	Others
Koppal	234	2.25	Habitation	Others	Others	Others	Others	Others	Others	Others	Habitation	Not Available	Others	Others
Koppal	235	4.49	Habitation	Others	Others	Others	Others	Others	Others	Others	Habitation+Pearl millet (Hb+Pm)	Not Available	Others	Others
Koppal	236	7.59	Habitation	Others	Others	Others	Others	Others	Others	Others	Habitation	Not Available	Others	Others
Koppal	237	1.77	Habitation	Others	Others	Others	Others	Others	Others	Others	Not Available (NA)	Not Available	Others	Others
Koppal	243	0.28	Habitation	Others	Others	Others	Others	Others	Others	Others	Habitation	Not Available	Others	Others
Koppal	244	0.34	Habitation	Others	Others	Others	Others	Others	Others	Others	Habitation	Not Available	Others	Others
Koppal	245	2.01	Habitation	Others	Others	Others	Others	Others	Others	Others	Habitation	Not Available	Others	Others
Koppal	246	7.82	Habitation	Others	Others	Others	Others	Others	Others	Others	Habitation	Not Available	Others	Others
Koppal	247	3.13	Habitation	Others	Others	Others	Others	Others	Others	Others	Habitation	Not Available	Others	Others
Koppal	248	2.72	Habitation	Others	Others	Others	Others	Others	Others	Others	Habitation	Not Available	Others	Others
Koppal	249	5.14	Habitation	Others	Others	Others	Others	Others	Others	Others	Habitation	Not Available	Others	Others
Koppal	250	4.57	Habitation	Others	Others	Others	Others	Others	Others	Others	Habitation	Not Available	Others	Others
Koppal	251	3.1	GRHmB2	LMU-3	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Habitation	Not Available	IIes	Graded bunding
Koppal	252	3.06	Habitation	Others	Others	Others	Others	Others	Others	Others	Habitation	Not Available	Others	Others
Koppal	255	0.001	Habitation	Others	Others	Others	Others	Others	Others	Others	Not Available (NA)	Not Available	Others	Others
Koppal	268	1.61	GRHmB2	LMU-3	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	Graded bunding
Koppal	269	3.07	GRHmB2	LMU-3	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Habitation	Not Available	IIes	Graded bunding
Koppal	270	5.57	GRHmB2	LMU-3	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	Graded bunding

Village	Survey Number	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
Koppal	363	0.91	GDPcB2	LMU-2	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Pearl millet (Pm)	Not Available	IIIes	Trench cum bunding
Koppal	364	1.84	GDPcB2	LMU-2	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Pearl millet (Pm)	Not Available	IIIes	Trench cum bunding
Koppal	365	2.62	GDPcB2	LMU-2	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	Trench cum bunding
Koppal	366	4.59	GDPcB2	LMU-2	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Habitation	Not Available	IIIes	Trench cum bunding
Koppal	367	7.11	NDLiA1	LMU-2	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Nearly level (0-1%)	Slight	Maize+Pearl millet (Mz+Pm)	Not Available	IIs	Graded bunding
Koppal	368	3.8	KTPiB1g1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Drumstick+Habitation (Ds+Hb)	Not Available	IIs	Trench cum bunding
Koppal	369	2.32	KTPiB1g1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Pearl millet+Drumstick (Pm+Ds)	Not Available	IIs	Trench cum bunding
Koppal	370	2	KTPiB1g1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIs	Trench cum bunding
Koppal	371	5.98	KTPiB1g1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIs	Trench cum bunding
Koppal	372	2.78	GRHmB2	LMU-3	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	Graded bunding
Koppal	373	4.72	KVRmB1	LMU-3	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Fallow land (Fl)	Not Available	IIs	Graded bunding
Koppal	374	7.75	GRHmB2	LMU-3	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow (Cf)	Not Available	IIes	Graded bunding
Koppal	375	9.04	KVRmB1	LMU-3	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIs	Graded bunding
Koppal	376	3.59	KTPiB1g1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIs	Trench cum bunding
Koppal	377	3.98	KVRmB1	LMU-3	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Pearl millet (Pm)	Not Available	IIs	Graded bunding
Koppal	378	9.84	KTPiB1g1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIs	Trench cum bunding
Koppal	379	5.33	KTPiB1g1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Drumstick+Maize (Ds+Mz)	Not Available	IIs	Trench cum bunding
Koppal	380	6.62	Habitation	Others	Others	Others	Others	Others	Others	Others	Drumstick (Ds)	Not Available	Others	Others
Koppal	381	2.83	KVRmB1	LMU-3	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Habitation	Not Available	IIs	Graded bunding
Koppal	382	1.91	KVRmB1	LMU-3	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Habitation	Not Available	IIs	Graded bunding
Koppal	383	2.85	KVRmB1	LMU-3	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Habitation	Not Available	IIs	Graded bunding
Koppal	384	3.42	KVRmB1	LMU-3	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIs	Graded bunding
Koppal	385	3.24	Habitation	Others	Others	Others	Others	Others	Others	Others	Current fallow (Cf)	Not Available	Others	Others
Koppal	386	5.38	Habitation	Others	Others	Others	Others	Others	Others	Others	Current fallow (Cf)	Not Available	Others	Others

Village	Survey Number	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
Koppal	387	6.64	Habitation	Others	Others	Others	Others	Others	Others	Others	Maize (Mz)	Not Available	Others	Others
Koppal	388	6.29	Habitation	Others	Others	Others	Others	Others	Others	Others	Pearl millet (Pm)	Not Available	Others	Others
Koppal	389	6.75	MTLmB2g1	LMU-6	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow (Cf)	Not Available	IIIes	Graded bunding
Koppal	390	6.47	MTLmB2g1	LMU-6	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow (Cf)	Not Available	IIIes	Graded bunding
Koppal	391	4.48	MTLmB2g1	LMU-6	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow (Cf)	Not Available	IIIes	Graded bunding
Koppal	392	2.19	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Not Available (NA)	Not Available	Ro	Ro
Koppal	395	0.04	Habitation	Others	Others	Others	Others	Others	Others	Others	Not Available (NA)	Not Available	Others	Others
Koppal	396	0.34	Habitation	Others	Others	Others	Others	Others	Others	Others	Habitation	Not Available	Others	Others
Koppal	402	1.51	Habitation	Others	Others	Others	Others	Others	Others	Others	Not Available (NA)	Not Available	Others	Others
Koppal	403	0.88	Habitation	Others	Others	Others	Others	Others	Others	Others	Habitation	Not Available	Others	Others
Koppal	404	0.51	Habitation	Others	Others	Others	Others	Others	Others	Others	Habitation	Not Available	Others	Others
Koppal	405	0.38	Habitation	Others	Others	Others	Others	Others	Others	Others	Habitation	Not Available	Others	Others
Koppal	406	4.49	Habitation	Others	Others	Others	Others	Others	Others	Others	Not Available (NA)	Not Available	Others	Others
Koppal	407	1.58	Habitation	Others	Others	Others	Others	Others	Others	Others	Habitation	Not Available	Others	Others
Koppal	408	4.64	Habitation	Others	Others	Others	Others	Others	Others	Others	Habitation	Not Available	Others	Others
Koppal	409	8	Habitation	Others	Others	Others	Others	Others	Others	Others	Not Available (NA)	Not Available	Others	Others
Koppal	410	4.48	KVRmB1	LMU-3	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Not Available (NA)	Not Available	IIs	Graded bunding
Koppal	411	6.53	Habitation	Others	Others	Others	Others	Others	Others	Others	Not Available (NA)	Not Available	Others	Others
Koppal	412	6.87	Habitation	Others	Others	Others	Others	Others	Others	Others	Habitation	Not Available	Others	Others
Koppal	413	3.56	DRLmB1	LMU-3	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Not Available (NA)	Not Available	IIs	Graded bunding
Koppal	414	3.47	DRLmB1	LMU-3	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Not Available (NA)	Not Available	IIs	Graded bunding
Koppal	415	3.43	DRLmB1	LMU-3	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Not Available (NA)	Not Available	IIs	Graded bunding
Koppal	416	4.26	DRLmA1	LMU-3	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Not Available (NA)	Not Available	IIs	Graded bunding
Koppal	417	2.22	DRLmA1	LMU-3	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Not Available (NA)	Not Available	IIs	Graded bunding

Village	Survey Number	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
Koppal	418	2.61	Habitation	Others	Others	Others	Others	Others	Others	Others	Not Available (NA)	Not Available	Others	Others
Koppal	419	8.05	Habitation	Others	Others	Others	Others	Others	Others	Others	Not Available (NA)	Not Available	Others	Others
Koppal	420	4.03	Habitation	Others	Others	Others	Others	Others	Others	Others	Not Available (NA)	Not Available	Others	Others
Koppal	421	5.55	Habitation	Others	Others	Others	Others	Others	Others	Others	Not Available (NA)	Not Available	Others	Others
Koppal	422	3.63	Habitation	Others	Others	Others	Others	Others	Others	Others	Habitation	Not Available	Others	Others
Koppal	423	6.92	Habitation	Others	Others	Others	Others	Others	Others	Others	Habitation	Not Available	Others	Others
Koppal	424	7.93	DRLmB1	LMU-3	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Not Available (NA)	1 Borewell	IIs	Graded bunding
Koppal	425	2.71	DRLmB1	LMU-3	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Not Available (NA)	Not Available	IIs	Graded bunding
Koppal	426	2.51	DRLmB1	LMU-3	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Not Available (NA)	Not Available	IIs	Graded bunding
Koppal	427	4.2	DRLmB1	LMU-3	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIs	Graded bunding
Koppal	428	9.81	DRLmB2	LMU-3	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Current fallow (Mz+Cf)	Not Available	IIes	Graded bunding
Koppal	429	5.67	DRLmB2	LMU-3	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	Graded bunding
Koppal	430	7.44	DRLmB2	LMU-3	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	Graded bunding
Koppal	431	3.73	GRHmA1	LMU-3	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Maize (Mz)	Not Available	IIs	Graded bunding
Koppal	432	6.22	DRLmB1	LMU-3	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Fallow land (Fl)	Not Available	IIs	Graded bunding
Koppal	433	5.1	MTLiB2	LMU-6	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Fallow land (Fl)	Not Available	IIIes	Graded bunding
Koppal	434	3.04	MTLmB1	LMU-6	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Not Available (NA)	Not Available	IIIs	Graded bunding
Koppal	435	3.66	MTLmB1	LMU-6	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Redgram (Rg)	1 Borewell	IIIs	Graded bunding
Koppal	436	6.54	MTLiB2	LMU-6	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Fallow land+Redgram (Fl+Rg)	Not Available	IIIes	Graded bunding
Koppal	437	0.14	Habitation	Others	Others	Others	Others	Others	Others	Others	Not Available (NA)	Not Available	Others	Others
Koppal	438	2.23	Habitation	Others	Others	Others	Others	Others	Others	Others	Habitation	Not Available	Others	Others
Koppal	439	1.07	Habitation	Others	Others	Others	Others	Others	Others	Others	Habitation	Not Available	Others	Others
Koppal	440	0.15	Habitation	Others	Others	Others	Others	Others	Others	Others	Not Available (NA)	Not Available	Others	Others
Koppal	444	1	MTLiB2	LMU-6	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Pearlmillet+Current fallow (Pm+Cf)	Not Available	IIIes	Graded bunding

Village	Survey Number	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
Koppal	445	5.35	GRHmA1	LMU-3	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Maize (Mz)	Not Available	IIs	Graded bunding
Koppal	469	3.5	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Dyke (Dy)	Not Available	Ro	Ro
Koppal	470	1.91	Waterbody	Others	Others	Others	Others	Others	Others	Others	Waterbody	Not Available	Others	Others
Koppal	471	0.48	Habitation	Others	Others	Others	Others	Others	Others	Others	Not Available (NA)	Not Available	Others	Others
Koppal	472	2.22	Habitation	Others	Others	Others	Others	Others	Others	Others	Not Available (NA)	Not Available	Others	Others
Koppal	473	0.03	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Not Available (NA)	Not Available	Ro	Ro
Koppal	477	1.42	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Not Available (NA)	Not Available	Ro	Ro

Appendix II

Chukkanakallu2 _1Y1a Microwatershed

Soil Fertility Information

Village	Survey Number	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Bahaddhu rabandi	12	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)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Bahaddhu rabandi	13	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)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Bahaddhu rabandi	14	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)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Bahaddhu rabandi	15	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)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Huvinala	1	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)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Huvinala	2	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)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Huvinala	3	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)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Huvinala	4	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)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Huvinala	5	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Huvinala	6	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Huvinala	7	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Huvinala	8	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)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Huvinala	9	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)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Huvinala	10	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)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Huvinala	11	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)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Huvinala	13	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)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Huvinala	14	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)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Huvinala	15	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)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Huvinala	16	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)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Huvinala	17	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)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Huvinala	18	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)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Huvinala	19	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)

Village	Survey Number	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Huvinala	20	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Huvinala	21	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 (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Huvinala	130	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)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Huvinala	131	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)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	232	Very strongly alkaline (pH > 9.0)	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 (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	233	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	234	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	235	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	236	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	237	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	243	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	244	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	245	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	246	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	247	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	248	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	249	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	250	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	251	Very strongly alkaline (pH > 9.0)	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 (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	252	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	255	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	268	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	269	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	270	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	363	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 (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	364	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	365	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	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
Koppal	366	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	367	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	368	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	369	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	370	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	371	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	372	Strongly alkaline (pH 8.4 – 9.0)	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 (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	373	Strongly alkaline (pH 8.4 – 9.0)	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 (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	374	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 (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	375	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 (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	376	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	377	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 (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	378	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	379	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	380	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	381	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	382	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 (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	383	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 (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	384	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 (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	385	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	386	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	387	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	388	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	389	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)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	390	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)

Village	Survey Number	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Koppal	391	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)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	392	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro
Koppal	395	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	396	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	402	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	403	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	404	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	405	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	406	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	407	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	408	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	409	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	410	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)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	411	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	412	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	413	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 (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	414	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	415	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	416	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	417	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	418	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	419	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	420	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	421	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	422	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	423	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	424	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	425	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)

Village	Survey Number	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Koppal	426	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	427	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 (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	428	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 (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	429	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	430	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	431	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 (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	432	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	433	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	434	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	435	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	436	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	437	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	438	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	439	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	440	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	444	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	445	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 (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Koppal	469	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro
Koppal	470	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	471	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	472	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	473	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro
Koppal	477	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro

Appendix III

Chukkanakallu2 _1Y1a Microwatershed

Soil Suitability Information

Village	Survey Number	Mango	Maize	Sapota	Sorghum	Guava	Cotton	Tamarind	Lime	Bengal gram	Sunflower	Red gram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Jasmine	Bhendi	Brinjal	Crossandra	Drumstick	Mulberry	Onion
Bahaddhurabandi	12	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3g	S3g	S3rg	S3rg	S3rg	S3g
Bahaddhurabandi	13	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3g	S3g	S3rg	S3rg	S3rg	S3g
Bahaddhurabandi	14	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3g	S3g	S3rg	S3rg	S3rg	S3g
Bahaddhurabandi	15	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3g	S3g	S3rg	S3rg	S3rg	S3g
Huvinala	1	S2g	S2tg	S2g	S2g	S2tg	S2g	S2g	S2g	S2gt	S2g	S2g	S2g	S2g	S2g	S2tg	S2g	S2g	S3tg	S2tg	S2tg	S2tg	S2tg	S2g	S2g	S2tg	S1	S1	S2g	S2g	S2g	S1
Huvinala	2	S2g	S2tg	S2g	S2g	S2tg	S2g	S2g	S2g	S2gt	S2g	S2g	S2g	S2g	S2g	S2tg	S2g	S2g	S3tg	S2tg	S2tg	S2tg	S2tg	S2g	S2g	S2tg	S1	S1	S2g	S2g	S2g	S1
Huvinala	3	S2g	S2tg	S2g	S2g	S2tg	S2g	S2g	S2g	S2gt	S2g	S2g	S2g	S2g	S2g	S2tg	S2g	S2g	S3tg	S2tg	S2tg	S2tg	S2tg	S2g	S2g	S2tg	S1	S1	S2g	S2g	S2g	S1
Huvinala	4	S2g	S2tg	S2g	S2g	S2tg	S2g	S2g	S2g	S2gt	S2g	S2g	S2g	S2g	S2g	S2tg	S2g	S2g	S3tg	S2tg	S2tg	S2tg	S2tg	S2g	S2g	S2tg	S1	S1	S2g	S2g	S2g	S1
Huvinala	5	S2g	S2tg	S2g	S2g	S2tg	S2g	S2g	S2g	S2gt	S2g	S2g	S2g	S2g	S2g	S2tg	S2g	S2g	S3tg	S2tg	S2tg	S2tg	S2tg	S2g	S2g	S2tg	S1	S1	S2g	S2g	S2g	S1
Huvinala	6	N1rg	S3rg	S3rg	S3rg	S3rg	S3g	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S2rg	S3g	S3g	S3g	S3g	S3rg	S3rg	S3g
Huvinala	7	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S2t	S1	S1	S3t	S2t	S2t	S2t	S2t	S1	S1	S2t	S2t	S2t	S1	S1	S2t	S2t
Huvinala	8	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S2t	S1	S1	S3t	S2t	S2t	S2t	S2t	S1	S1	S2t	S2t	S2t	S1	S1	S2t	S2t
Huvinala	9	S2g	S2tg	S2g	S2g	S2tg	S2g	S2g	S2g	S2gt	S2g	S2g	S2g	S2g	S2g	S2tg	S2g	S2g	S3tg	S2tg	S2tg	S2tg	S2tg	S2g	S2g	S2tg	S1	S1	S2g	S2g	S2g	S1
Huvinala	10	S2g	S2tg	S2g	S2g	S2tg	S2g	S2g	S2g	S2gt	S2g	S2g	S2g	S2g	S2g	S2tg	S2g	S2g	S3tg	S2tg	S2tg	S2tg	S2tg	S2g	S2g	S2tg	S1	S1	S2g	S2g	S2g	S1
Huvinala	11	S2g	S2tg	S2g	S2g	S2tg	S2g	S2g	S2g	S2gt	S2g	S2g	S2g	S2g	S2g	S2tg	S2g	S2g	S3tg	S2tg	S2tg	S2tg	S2tg	S2g	S2g	S2tg	S1	S1	S2g	S2g	S2g	S1
Huvinala	13	S2g	S2tg	S2g	S2g	S2tg	S2g	S2g	S2g	S2gt	S2g	S2g	S2g	S2g	S2g	S2tg	S2g	S2g	S3tg	S2tg	S2tg	S2tg	S2tg	S2g	S2g	S2tg	S1	S1	S2g	S2g	S2g	S1
Huvinala	14	S2g	S2tg	S2g	S2g	S2tg	S2g	S2g	S2g	S2gt	S2g	S2g	S2g	S2g	S2g	S2tg	S2g	S2g	S3tg	S2tg	S2tg	S2tg	S2tg	S2g	S2g	S2tg	S1	S1	S2g	S2g	S2g	S1
Huvinala	15	S2g	S2tg	S2g	S2g	S2tg	S2g	S2g	S2g	S2gt	S2g	S2g	S2g	S2g	S2g	S2tg	S2g	S2g	S3tg	S2tg	S2tg	S2tg	S2tg	S2g	S2g	S2tg	S1	S1	S2g	S2g	S2g	S1
Huvinala	16	S2g	S2tg	S2g	S2g	S2tg	S2g	S2g	S2g	S2gt	S2g	S2g	S2g	S2g	S2g	S2tg	S2g	S2g	S3tg	S2tg	S2tg	S2tg	S2tg	S2g	S2g	S2tg	S1	S1	S2g	S2g	S2g	S1
Huvinala	17	S2g	S2tg	S2g	S2g	S2tg	S2g	S2g	S2g	S2gt	S2g	S2g	S2g	S2g	S2g	S2tg	S2g	S2g	S3tg	S2tg	S2tg	S2tg	S2tg	S2g	S2g	S2tg	S1	S1	S2g	S2g	S2g	S1
Huvinala	18	S2g	S2tg	S2g	S2g	S2tg	S2g	S2g	S2g	S2gt	S2g	S2g	S2g	S2g	S2g	S2tg	S2g	S2g	S3tg	S2tg	S2tg	S2tg	S2tg	S2g	S2g	S2tg	S1	S1	S2g	S2g	S2g	S1
Huvinala	19	S2g	S2tg	S2g	S2g	S2tg	S2g	S2g	S2g	S2gt	S2g	S2g	S2g	S2g	S2g	S2tg	S2g	S2g	S3tg	S2tg	S2tg	S2tg	S2tg	S2g	S2g	S2tg	S1	S1	S2g	S2g	S2g	S1
Huvinala	20	S2g	S2tg	S2g	S2g	S2tg	S2g	S2g	S2g	S2gt	S2g	S2g	S2g	S2g	S2g	S2tg	S2g	S2g	S3tg	S2tg	S2tg	S2tg	S2tg	S2g	S2g	S2tg	S1	S1	S2g	S2g	S2g	S1

Village	Survey Number	Mango	Maize	Sapota	Sorghum	Guava	Cotton	Tamarind	Lime	Bengal gram	Sunflower	Red gram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Jasmine	Bhendi	Brinjal	Crossandra	Drumstick	Mulberry	Onion
Huvinala	21	S2g	S2tg	S2g	S2g	S2tg	S2g	S2g	S2g	S2gt	S2g	S2g	S2g	S2g	S2g	S2tg	S2g	S2g	S3tg	S2tg	S2tg	S2tg	S2tg	S2g	S2g	S2tg	S1	S1	S2g	S2g	S2g	S1
Huvinala	130	N1rg	S3rg	S3rg	S3rg	S3rg	S3g	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S2rg	S3g	S3g	S3g	S3g	S3rg	S3rg	S3g
Huvinala	131	S2g	S2tg	S2g	S2g	S2tg	S2g	S2g	S2g	S2gt	S2g	S2g	S2g	S2g	S2g	S2tg	S2g	S2g	S3tg	S2tg	S2tg	S2tg	S2tg	S2g	S2g	S2tg	S1	S1	S2g	S2g	S2g	S1
Koppal	232	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3r	S3r	S3rz	N1rz	N1rz	S3rt
Koppal	233	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	234	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	235	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	236	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	237	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	243	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	244	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	245	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	246	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	247	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	248	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	249	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	250	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	251	S3t	S2t	S3t	S1	S3t	S1	S2r	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S3t	S2t	S2t	S3t
Koppal	252	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	255	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	268	S3t	S2t	S3t	S1	S3t	S1	S2r	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S3t	S2t	S2t	S3t
Koppal	269	S3t	S2t	S3t	S1	S3t	S1	S2r	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S3t	S2t	S2t	S3t
Koppal	270	S3t	S2t	S3t	S1	S3t	S1	S2r	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S3t	S2t	S2t	S3t

Village	Survey Number	Mango	Maize	Sapota	Sorghum	Guava	Cotton	Tamarind	Lime	Bengal gram	Sunflower	Red gram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Jasmine	Bhendi	Brinjal	Crossandra	Drumstick	Mulberry	Onion
Koppal	363	S1	S1	S1	S1	S2t	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S2t	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S2tg	S2g	S1	S1	S1	S2tg
Koppal	364	S1	S1	S1	S1	S2t	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S2t	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S2tg	S2g	S1	S1	S1	S2tg
Koppal	365	S1	S1	S1	S1	S2t	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S2t	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S2tg	S2g	S1	S1	S1	S2tg
Koppal	366	S1	S1	S1	S1	S2t	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S2t	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S2tg	S2g	S1	S1	S1	S2tg
Koppal	367	S2g	S2tg	S2g	S2g	S2tg	S2g	S2g	S2g	S2gt	S2g	S2g	S2g	S2g	S2g	S2tg	S2g	S2g	S3tg	S2tg	S2tg	S2tg	S2tg	S2g	S2g	S2tg	S1	S1	S2g	S2g	S2g	S1
Koppal	368	N1r	S2rg	S3r	S2rg	S3r	S2rg	N1r	S3r	S2rt	S3rg	S3rg	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2rg	S2rg	S2rg	S2rg	S3r	S2rg	S2rg	S2r	S2r	S2rg	S3rg	S3rg	S2r
Koppal	369	N1r	S2rg	S3r	S2rg	S3r	S2rg	N1r	S3r	S2rt	S3rg	S3rg	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2rg	S2rg	S2rg	S2rg	S3r	S2rg	S2rg	S2r	S2r	S2rg	S3rg	S3rg	S2r
Koppal	370	N1r	S2rg	S3r	S2rg	S3r	S2rg	N1r	S3r	S2rt	S3rg	S3rg	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2rg	S2rg	S2rg	S2rg	S3r	S2rg	S2rg	S2r	S2r	S2rg	S3rg	S3rg	S2r
Koppal	371	N1r	S2rg	S3r	S2rg	S3r	S2rg	N1r	S3r	S2rt	S3rg	S3rg	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2rg	S2rg	S2rg	S2rg	S3r	S2rg	S2rg	S2r	S2r	S2rg	S3rg	S3rg	S2r
Koppal	372	S3t	S2t	S3t	S1	S3t	S1	S2r	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S3t	S2t	S2t	S3t
Koppal	373	S2rz	S2tz	S3tz	S2z	S3tz	S2z	S2rz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2rz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S2tz	S2tz	S3tz	S2tz	S2tz	S3tz
Koppal	374	S3t	S2t	S3t	S1	S3t	S1	S2r	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S3t	S2t	S2t	S3t
Koppal	375	S2rz	S2tz	S3tz	S2z	S3tz	S2z	S2rz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2rz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S2tz	S2tz	S3tz	S2tz	S2tz	S3tz
Koppal	376	N1r	S2rg	S3r	S2rg	S3r	S2rg	N1r	S3r	S2rt	S3rg	S3rg	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2rg	S2rg	S2rg	S2rg	S3r	S2rg	S2rg	S2r	S2r	S2rg	S3rg	S3rg	S2r
Koppal	377	S2rz	S2tz	S3tz	S2z	S3tz	S2z	S2rz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2rz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S2tz	S2tz	S3tz	S2tz	S2tz	S3tz
Koppal	378	N1r	S2rg	S3r	S2rg	S3r	S2rg	N1r	S3r	S2rt	S3rg	S3rg	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2rg	S2rg	S2rg	S2rg	S3r	S2rg	S2rg	S2r	S2r	S2rg	S3rg	S3rg	S2r
Koppal	379	N1r	S2rg	S3r	S2rg	S3r	S2rg	N1r	S3r	S2rt	S3rg	S3rg	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2rg	S2rg	S2rg	S2rg	S3r	S2rg	S2rg	S2r	S2r	S2rg	S3rg	S3rg	S2r
Koppal	380	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	381	S2rz	S2tz	S3tz	S2z	S3tz	S2z	S2rz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2rz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S2tz	S2tz	S3tz	S2tz	S2tz	S3tz
Koppal	382	S2rz	S2tz	S3tz	S2z	S3tz	S2z	S2rz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2rz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S2tz	S2tz	S3tz	S2tz	S2tz	S3tz
Koppal	383	S2rz	S2tz	S3tz	S2z	S3tz	S2z	S2rz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2rz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S2tz	S2tz	S3tz	S2tz	S2tz	S3tz
Koppal	384	S2rz	S2tz	S3tz	S2z	S3tz	S2z	S2rz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2rz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S2tz	S2tz	S3tz	S2tz	S2tz	S3tz
Koppal	385	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	386	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	387	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	388	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe

Village	Survey Number	Mango	Maize	Sapota	Sorghum	Guava	Cotton	Tamarind	Lime	Bengal gram	Sunflower	Red gram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Jasmine	Bhendi	Brinjal	Crossandra	Drumstick	Mulberry	Onion
		rs	rs	rs	rs	rs	rs	rs	rs	rs	rs	rs	rs	rs	rs	rs	rs	rs	rs	rs	rs	rs	rs	rs	rs	rs	rs	rs	rs	rs	rs	rs
Koppal	389	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3r	S3r	S3rz	N1rz	N1rz	S3rt
Koppal	390	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3r	S3r	S3rz	N1rz	N1rz	S3rt
Koppal	391	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3r	S3r	S3rz	N1rz	N1rz	S3rt
Koppal	392	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro
Koppal	395	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	396	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	402	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	403	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	404	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	405	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	406	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	407	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	408	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	409	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	410	S2rz	S2tz	S3tz	S2z	S3tz	S2z	S2rz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2rz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S2tz	S2tz	S3tz	S2tz	S2tz	S3tz
Koppal	411	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	412	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	413	S3rz	S2tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S2tz	S3tz	S2tz	S2tz	S2z	S2rz	S2tz	S3tz
Koppal	414	S3rz	S2tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S2tz	S3tz	S2tz	S2tz	S2z	S2rz	S2tz	S3tz
Koppal	415	S3rz	S2tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S2tz	S3tz	S2tz	S2tz	S2z	S2rz	S2tz	S3tz
Koppal	416	S3rz	S2tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2z	S2rz	S2tz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S2tz	S3tz	S2tz	S2tz	S3tz	S2rz	S2tz	S3tz
Koppal	417	S3rz	S2tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2z	S2rz	S2tz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S2tz	S3tz	S2tz	S2tz	S3tz	S2rz	S2tz	S3tz
Koppal	418	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe	Othe

Village	Survey Number	Mango	Maize	Sapota	Sorghum	Guava	Cotton	Tamarind	Lime	Bengal gram	Sunflower	Red gram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Jasmine	Bhendi	Brinjal	Crossandra	Drumstick	Mulberry	Onion
		rs	rs	rs	rs	rs	rs	rs	rs	rs	rs	rs	rs	rs	rs	rs	rs	rs	rs	rs	rs	rs	rs	rs	rs	rs	rs	rs	rs	rs	rs	rs
Koppal	419	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	420	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	421	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	422	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	423	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	424	S3rz	S2tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S2tz	S3tz	S2tz	S2tz	S2z	S2rz	S2tz	S3tz
Koppal	425	S3rz	S2tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S2tz	S3tz	S2tz	S2tz	S2z	S2rz	S2tz	S3tz
Koppal	426	S3rz	S2tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S2tz	S3tz	S2tz	S2tz	S2z	S2rz	S2tz	S3tz
Koppal	427	S3rz	S2tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S2tz	S3tz	S2tz	S2tz	S2z	S2rz	S2tz	S3tz
Koppal	428	S3rz	S2tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S2tz	S3tz	S2tz	S2tz	S2z	S2rz	S2tz	S3tz
Koppal	429	S3rz	S2tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S2tz	S3tz	S2tz	S2tz	S2z	S2rz	S2tz	S3tz
Koppal	430	S3rz	S2tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S2tz	S3tz	S2tz	S2tz	S2z	S2rz	S2tz	S3tz
Koppal	431	S3t	S2t	S3t	S1	S3t	S1	S2r	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S3t	S2t	S2t	S3t
Koppal	432	S3rz	S2tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S2tz	S3tz	S2tz	S2tz	S2z	S2rz	S2tz	S3tz
Koppal	433	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3r	S3r	S3rz	N1rz	N1rz	S3rt
Koppal	434	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3r	S3r	S3rz	N1rz	N1rz	S3rt
Koppal	435	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3r	S3r	S3rz	N1rz	N1rz	S3rt
Koppal	436	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3r	S3r	S3rz	N1rz	N1rz	S3rt
Koppal	437	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	438	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	439	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	440	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	444	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3r	S3r	S3rz	N1rz	N1rz	S3rt

Village	Survey Number	Mango	Maize	Sapota	Sorghum	Guava	Cotton	Tamarind	Lime	Bengal gram	Sunflower	Red gram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Jasmine	Bhendi	Brinjal	Crossandra	Drumstick	Mulberry	Onion
Koppal	445	S3t	S2t	S3t	S1	S3t	S1	S2r	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S3t	S2t	S2t	S3t
Koppal	469	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro
Koppal	470	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	471	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	472	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Koppal	473	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro
Koppal	477	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro

Ro-Rock outcrops

PART-B

SOCIO-ECONOMIC STATUS OF FARM HOUSEHOLDS

CONTENTS

LIST OF TABLES

Chapter 1

SALIENT FINDINGS OF THE SURVEY

- *The data indicated that there were 78 (57.35 %) men and 58 (42.65 %) were women among the sampled households.*
- *The average family size of landless' was 2.8, marginal farmers' was 4.2, small farmers' was 4.3, semi medium farmers' was 4 and medium farmers' was 4.5.*
- *The data indicated that, 15 (11.03 %) people were in 0-15 years of age, 51 (37.5 %) were in 16-35 years of age, 57 (41.91 %) were in 36-60 years of age and 13 (9.56 %) were above 61 years of age.*
- *The results indicated that Chukkanakallu-2 had 37.50 per cent illiterates, 34.56 per cent of them had primary school education, 7.35 per cent of them had middle school education, 10.29 per cent of them had high school education, 2.94 per cent of them had PUC education, 1.47 per cent of them had Diploma and degree education and 2.21 per cent of them had masters education.*
- *The results indicate that, 91.18 per cent of household heads were practicing agriculture and 5.88 per cent of the household heads were agricultural laborers. The results indicate that agriculture was the major occupation for 23.53 per cent of the household members, 67.65 per cent were agricultural laborers, 1.47 per cent were in government service, 6.62 per cent were students and 0.74 per cent were children.*
- *The results show that, 100 per cent of the population in the micro watershed has not participated in any of the institution.*
- *The results indicate that 82.35 per cent of the households possess katcha house and 17.65 per cent of them possess pucca/RCC house.*
- *The results show that 55.88 per cent of the households possess TV, 70.59 per cent of them possess mixer/grinder, 5.88 per cent of them possess bicycle, 32.35 per cent of the households possess motor cycle, 2.94 per cent of the households possess auto and 67.65 per cent of the households possess mobile phones.*
- *The results show that the average value of television was Rs 5,515, mixer/grinder was Rs 1,875, bicycle was Rs 2,000, motor cycle was Rs. 49,272, auto was Rs. 200,000 and mobile phone was Rs. 2,336.*
- *About 5.88 per cent of the households possess bullock cart and thresher, 52.94 per cent of them possess plough, 8.82 per cent of them possess sprayer, 52.94 per cent of them possess weeder and 2.94 per cent of them possess Cultivator.*
- *The results show that the average value of bullock cart was Rs. 10,000, plough was Rs. 1,877, sprayer was Rs. 1,550, average value of weeder was Rs. 123, average value of thresher was 190 and the average value of Cultivator was Rs. 32.*
- *The results indicate that, 17.65 per cent of the households possess bullocks, 14.71 per cent of the households possess local cow and 2.94 per cent of the households possess Buffalo.*

- *The results indicate that, average own labour men available in the micro watershed was 1.93, average own labour (women) available was 1.10, average hired labour (men) available and average hired labour (women) available was 15.86. The results indicate that, 85.29 per cent of the households opined that the hired labour was inadequate.*
- *The results indicate that, households of the Chukkanakallu-2 micro-watershed possess 26.24 ha (72.73%) of dry land, 7.36 ha (20.39 %) of irrigated land and 2.48 ha (6.88%) of permanent fallow land. Marginal farmers possess 5.92 ha (100%) of dry land. Small farmers possess 12.27 ha (78.85 %) of dry land, 0.81 ha (5.20 %) of irrigated land and 2.48 ha (15.95%). Semi medium farmers possess 8.05 ha (86.22 %) of dry land and 1.29 ha (13.78%) of irrigated land. Medium farmers possess 5.26 ha (100 %) of irrigated land.*
- *The results indicate that, the average value of dry land was Rs. 350,462.68, the average value of irrigated land was Rs.230,968.10 and the average value of permanent fallow land Rs. 201,468.19. In case of marginal famers, the average land value was Rs. 675,324.68 for dry land. In case of small famers, the average land value was Rs. 325,965.03 for dry land, Rs. 247,000 for irrigated land and Rs. 201,468.19 for permanent fallow land. In case of semi medium famers, the average land value was Rs. 148,944.72 for dry land and Rs. 388,364.77 for irrigated land. In case of medium farmers, Rs.190,000 for irrigated land.*
- *The results indicate that, there were 4 functioning and de-functioning bore wells in the micro watershed. The results indicate that, bore well was the major irrigation source in the micro water shed for 11.76 per cent of the farmers.*
- *The results indicate that, the depth of bore well was found to be 3.59 meters.*
- *The results indicate that semi medium and medium farmers had an irrigated area of 1.29 ha and 2.83 ha respectively.*
- *The results indicate that, farmers have grown maize (22.36 ha), Bajra (7.36 ha), Sunflower (2.83 ha) and Wheat (3.34 ha). Marginal farmers have grown maize, bajra and sunflower. Small farmers have grown maize, bajra and cowpea. Semi medium farmers have grown maize and bajra. Medium farmers have grown maize and sunflower.*
- *The results indicate that, the cropping intensity in Chukkanakallu-2 micro-watershed was found to be 100 per cent.*
- *The results indicate that, 79.14 per cent of the households have bank account and savings.*
- *The results indicate that, 79.41 per cent of the households have availed credit from different sources.*
- *The results indicate that, 7.41 per cent of the households have borrowed from commercial bank.*

- *The results indicate that, the average credit amount borrowed by households in micro-watershed was Rs, 5,000.*
- *The results indicate that, 100 per cent of the households borrowed from institutional sources for the purpose of agricultural production.*
- *The results indicated that 100 per cent of the households did not repay their loan borrowed from institutional sources.*
- *The results indicate that, around 100 per cent opined that helped to perform timely agricultural operation.*
- *The results indicate that, the total cost of cultivation for bajra was Rs. 15704.22. The gross income realized by the farmers was Rs. 24107.32. The net income from bajra cultivation was Rs. 8403.10. Thus the benefit cost ratio was found to be 1: 1:1.54.*
- *The total cost of cultivation for Sunflower was Rs. 25491.42. The gross income realized by the farmers was Rs. 40617.78. The net income from Sunflower cultivation was Rs. 15126.36. Thus the benefit cost ratio was found to be 1:1.59.*
- *The total cost of cultivation for maize was Rs. 44628.49. The gross income realized by the farmers was Rs. 40066.01. The net income from maize cultivation was Rs. -4562.48. Thus the benefit cost ratio was found to be 1:0.9.*
- *The total cost of cultivation for cowpea was Rs. 11809.29. The gross income realized by the farmers was Rs. 37050. The net income from cowpea cultivation was Rs. 25240.71. Thus the benefit cost ratio was found to be 1:3.14.*
- *The results indicate that, 2.94 per cent of the households opined that dry fodder was inadequate and green fodder was adequate.*
- *The results indicate that the annual gross income was Rs. 43,833.33 for landless households, for marginal farmers it was Rs. 32,400, for small farmers it was Rs. 68,916.67, for semi medium farmers it was Rs. 77,500 and for medium farmers it was Rs. 115,000.*
- *The results indicate that the average annual expenditure is Rs. 4,806.06. For landless households it was Rs. 7,666.67, for marginal farmers it was Rs. 2,346.67, for small farmers it was Rs. 2,751.89, for semi medium farmers it was Rs. 7,104.17 and for medium farmers it was Rs. 16,250.*
- *The results indicate that, sampled households have grown 1 coconut, 2 guava and 4 mango trees in their field and1 in backyard.*
- *The results indicate that, households have planted 22 teak, 50 neem and 1 tamarind trees in their field and also 1 neem trees in their backyard.*
- *The results indicated that, Bajra were sold to the extent of 79.17 per cent, cowpea were sold to the extent of 60 per cent, maize were sold to the extent of 98.33 per cent and sunflower were sold to the extent of 92.86 per cent.*
- *The results indicated that, about 73.53 per cent of the farmers sold their produce to regulated market. The results indicated that 79.41 per cent of the households used tractor as a mode of transportation for their agricultural produce.*

- *The results indicated that, 20.59 per cent of the households have experienced soil and water erosion problems in the farm.*
- *The results indicated that, 76.47 per cent have shown interest in soil test.*
- *The results indicated that, 100 per cent of the households used firewood, 2.86 per cent of the households used LPG as a source of fuel and 2.86 per cent of the households used Kerosene.*
- *The results indicated that, piped supply was the source of drinking water for 2.94 per cent of the households and bore well was the major source of drinking water for 97.06 per cent of the households in micro watershed.*
- *Electricity was the major source of light for 100 per cent of the households in micro watershed.*
- *The results indicated that, 100 per cent of the households possess sanitary toilet facility.*
- *The results indicated that, 100 per cent of the sampled households possessed BPL card.*
- *The results indicated that, 23.53 per cent of the households participated in NREGA programme.*
- *The results indicated that, cereals were adequate for 76.47 per cent of the households, pulses were adequate for 70.59 per cent, oilseeds were adequate for 20.59 per cent, vegetables and egg were adequate for 14.71 per cent, fruits were adequate for 44.12 per cent, milk was adequate for 17.65 per cent and meat was adequate for 8.82 per cent.*
- *The results indicated that, Cereals were inadequate for 11.76 per cent of the households, pulses were inadequate for 17.65 per cent of the households, oilseeds were inadequate for 67.65 per cent, vegetables were inadequate for 70.59 per cent, fruits was inadequate for 41.18 per cent, milk were inadequate for 44.12 per cent and egg and meat was inadequate for 70.59 per cent of the households.*
- *The results indicated that, cereals, pulses, oilseeds, vegetables, milk and egg were market surplus for 11.76 per cent and fruits and meat were market surplus for 14.71 per cent of the households.*
- *The results indicated that, lower fertility status of the soil was the constraint experienced by 76.41 per cent of the households, wild animal menace on farm field (79.41%), frequent incidence of pest and diseases (20.59%), inadequacy of irrigation water and inadequate extension services (5.88%), high cost of fertilizers and plant protection chemicals (20.59%), high rate of interest on credit and low price for the agricultural commodities (8.82%), lack of transport for safe transport of the agricultural produce to the market (23.53%), less rainfall (26.47%) and source of agri-technology information (14.71%).*

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

Chukkanakallu-2 micro-watershed in Chukkanakallu sub-watershed (Koppal taluk and district) is located in between $15^0$20’54.622’’ to 15^0 19’23.016’’North latitudes and 76^0 10’52.162’’ to $76^0$8’59.717’’ East longitudes, covering an area of about 518.08 ha, bounded by Chukanakal, Huvinala and Koppala 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 34 households located in the micro-watershed were interviewed for the survey.

Chapter 4

SALIENT FEATURES OF THE SURVEY

Households sampled for socio-economic survey: The data on households sampled for socio economic survey in Chukkanakallu-2 micro-watershed is presented in Table 1 and it indicated that 34 farmers were sampled in Chukkanakallu-2 micro-watershed among them 6 (17.65 %) were landless farmers, 10 (29.41 %) were marginal farmers, 12 (35.29 %) were small farmers, 4 (11.76 %) were semi medium farmer and 2 (5.88%) were medium farmers.

Table 1: Households sampled for socio economic survey in Chukkanakallu-2 micro-watershed

Sl.No.	Particulars	LL (6)		MF (10)		SF (12)		SMF (4)		MDF (2)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Farmers	6	17.65	10	29.41	12	35.29	4	11.76	2	5.88	34	100

Population characteristics: The population characteristics of households sampled for socio-economic survey in Chukkanakallu-2 micro-watershed is presented in Table 2. The data indicated that there were 78 (57.35 %) men and 58 (42.65 %) were women among the sampled households. The average family size of landless' was 2.8, marginal farmers' was 4.2, small farmers' was 4.3, semi medium farmers' was 4 and medium farmers' was 4.5.

Table 2: Population characteristics of Chukkanakallu-2 micro-watershed

Sl.No.	Particulars	LL (17)		MF (42)		SF (52)		SMF (16)		MDF (9)		All (136)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Men	8	47.06	24	57.14	29	55.77	10	62.50	7	77.78	78	57.35
2	Women	9	52.94	18	42.86	23	44.23	6	37.50	2	22.22	58	42.65
Total		17	100	42	100	52	100	16	100	9	100	136	100
Average		2.8		4.2		4.3		4		4.5		4	

Age wise classification of population: The age wise classification of household members in Chukkanakallu-2 micro-watershed is presented in Table 3. The data indicated that, 15 (11.03 %) people were in 0-15 years of age, 51 (37.5 %) were in 16-35 years of age, 57 (41.91 %) were in 36-60 years of age and 13 (9.56 %) were above 61 years of age.

Table 3: Age wise classification of household members in Chukkanakallu-2 micro-watershed

Sl.No.	Particulars	LL (17)		MF (42)		SF (52)		SMF (16)		MDF (9)		All (136)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	0-15 years of age	2	11.76	8	19.05	5	9.62	0	0	0	0	15	11.03
2	16-35 years of age	5	29.41	17	40.48	21	40.38	6	37.50	2	22.22	51	37.50
3	36-60 years of age	8	47.06	17	40.48	21	40.38	6	37.50	5	55.56	57	41.91
4	> 61 years	2	11.76	0	0	5	9.62	4	25	2	22.22	13	9.56
Total		17	100	42	100	52	100	16	100	9	100	136	100

Education level of household members: Education level of household members in Chukkanakallu-2 micro-watershed is presented in Table 4. The results indicated that

Chukkanakallu-2 had 37.50 per cent illiterates, 34.56 per cent of them had primary school education, 7.35 per cent of them had middle school education, 10.29 per cent of them had high school education, 2.94 per cent of them had PUC education, 1.47 per cent of them had Diploma and degree education and 2.21 per cent of them had masters education.

Table 4. Education level of household members in Chukkanakallu-2 micro-watershed

Sl.No.	Particulars	LL (17)		MF (42)		SF (52)		SMF(16)		MDF (9)		All (136)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Illiterate	10	58.82	15	35.71	18	34.62	6	37.50	2	22.22	51	37.50
2	Primary School	3	17.65	14	33.33	19	36.54	4	25	7	77.78	47	34.56
3	Middle School	3	17.65	2	4.76	4	7.69	1	6.25	0	0	10	7.35
4	High School	1	5.88	3	7.14	7	13.46	3	18.75	0	0	14	10.29
5	PUC	0	0	4	9.52	0	0	0	0	0	0	4	2.94
6	Diploma	0	0	1	2.38	1	1.92	0	0	0	0	2	1.47
7	Degree	0	0	1	2.38	1	1.92	0	0	0	0	2	1.47
8	Masters	0	0	1	2.38	2	3.85	0	0	0	0	3	2.21
9	Others	0	0	1	2.38	0	0	2	12.50	0	0	3	2.21
Total		17	100	42	100	52	100	16	100	9	100	136	100

Occupation of household heads: The data regarding the occupation of the household heads in Chukkanakallu-2 micro-watershed is presented in Table 5. The results indicate that, 91.18 per cent of household heads were practicing agriculture and 5.88 per cent of the household heads were agricultural laborers.

Table 5: Occupation of household heads in Chukkanakallu-2 micro-watershed

Sl.No.	Particulars	LL (6)		MF (10)		SF (12)		SMF (4)		MDF (2)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Agriculture	6	100	10	100	10	83.33	3	75	2	100	31	91.18
2	Agricultural Labour	0	0	0	0	1	8.33	1	25	0	0	2	5.88
Total		6	100	10	100	11	100	4	100	2	100	33	100

Occupation of the household members: The data regarding the occupation of the household members in Chukkanakallu-2 micro-watershed is presented in Table 6. The results indicate that agriculture was the major occupation for 23.53 per cent of the household members, 67.65 per cent were agricultural laborers, 1.47 per cent were in government service, 6.62 per cent were students and 0.74 per cent were children.

Table 6: Occupation of family members in Chukkanakallu-2 micro-watershed

Sl.No.	Particulars	LL (17)		MF (42)		SF (52)		SMF (16)		MDF (9)		All (136)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Agriculture	6	35.29	10	23.81	11	21.15	3	18.75	2	22.22	32	23.53
2	Agricultural Labour	10	58.82	27	64.29	35	67.31	13	81.25	7	77.78	92	67.65
3	Government Service	0	0	0	0	2	3.85	0	0	0	0	2	1.47
4	Student	1	5.88	4	9.52	4	7.69	0	0	0	0	9	6.62
5	Children	0	0	1	2.38	0	0	0	0	0	0	1	0.74
Total		17	100	42	100	52	100	16	100	9	100	136	100

Institutional participation of the household members: The data regarding the institutional participation of the household members in Chukkanakallu-2 micro-watershed is presented in Table 7. The results show that, 100 per cent of the population in the micro watershed has not participated in any of the institution.

Table7. Institutional Participation of household members in Chukkanakallu-2 micro-watershed

Sl.No.	Particulars	LL (17)		MF (42)		SF (52)		SMF (16)		MDF (9)		All (136)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	No Participation	17	100	42	100	52	100	16	100	9	100	136	100
Total		17	100	42	100	52	100	16	100	9	100	136	100

Type of house owned: The data regarding the type of house owned by the households in Chukkanakallu-2 micro-watershed is presented in Table 8. The results indicate that 82.35 per cent of the households possess katcha house and 17.65 per cent of them possess pucca/RCC house.

Table 8. Type of house owned by households in Chukkanakallu-2 micro-watershed

Sl.No.	Particulars	LL (6)		MF (10)		SF (12)		SMF (4)		MDF (2)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Katcha	5	83.33	9	90	9	75	3	75	2	100	28	82.35
2	Pucca/RCC	1	16.67	1	10	3	25	1	25	0	0	6	17.65
Total		6	100	10	100	12	100	4	100	2	100	34	100

Durable Assets owned by the households: The data regarding the Durable Assets owned by the households in Chukkanakallu-2 micro-watershed is presented in Table 9. The results show that 55.88 per cent of the households possess TV, 70.59 per cent of them possess mixer/grinder, 5.88 per cent of them possess bicycle, 32.35 per cent of the households possess motor cycle, 2.94 per cent of the households possess auto and 67.65 per cent of the households possess mobile phones.

Table 9. Durable Assets owned by households in Chukkanakallu-2 micro-watershed

Sl.No.	Particulars	LL (6)		MF (10)		SF (12)		SMF (4)		MDF (2)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Television	1	16.67	6	60	8	66.67	3	75	1	50	19	55.88
2	Mixer/Grinder	1	16.67	7	70	11	91.67	3	75	2	100	24	70.59
3	Bicycle	0	0	2	20	0	0	0	0	0	0	2	5.88
4	Motor Cycle	0	0	4	40	5	41.67	1	25	1	50	11	32.35
5	Auto	0	0	1	10	0	0	0	0	0	0	1	2.94
6	Mobile Phone	1	16.67	6	60	11	91.67	3	75	2	100	23	67.65
7	Blank	5	83.33	1	10	1	8.33	0	0	0	0	7	20.59

Average value of durable assets: The data regarding the average value of durable assets owned by the households in Chukkanakallu-2 micro-watershed is presented in Table 10. The results show that the average value of television was Rs 5,515, mixer/grinder was Rs 1,875, bicycle was Rs 2,000, motor cycle was Rs. 49,272, auto was Rs. 200,000 and mobile phone was Rs. 2,336.

Table 10. Average value of durable assets owned by households in Chukkanakallu-2 micro-watershed **Average value (Rs.)**

Sl.No.	Particulars	LL (6)	MF (10)	SF (12)	SMF (4)	MDF (2)	All (34)
1	Television	2,000	4,966	6,500	5,000	6,000	5,515
2	Mixer/Grinder	2,000	1,714	1,945	1,866	2,000	1,875
3	Bicycle	0	2,000	0	0	0	2,000
4	Motor Cycle	0	50,000	44,400	60,000	60,000	49,272
5	Auto	0	200,000	0	0	0	200,000
6	Mobile Phone	2,000	1,909	2,736	2,300	1,750	2,336

Farm Implements owned: The data regarding the farm implements owned by the households in Chukkanakallu-2 micro-watershed is presented in Table 11. About 5.88 per cent of the households possess bullock cart and thresher, 52.94 per cent of them possess plough, 8.82 per cent of them possess sprayer, 52.94 per cent of them possess weeder and 2.94 per cent of them possess Cultivator.

Table 11. Farm Implements owned by households in Chukkanakallu-2 micro-watershed

Sl.No.	Particulars	LL (6)		MF (10)		SF (12)		SMF (4)		MDF (2)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Bullock Cart	0	0	0	0	1	8.33	1	25	0	0	2	5.88
2	Plough	0	0	5	50	8	66.67	3	75	2	100	18	52.94
3	Sprayer	0	0	2	20	0	0	0	0	1	50	3	8.82
4	Weeder	0	0	3	30	10	83.33	3	75	2	100	18	52.94
5	Thresher	0	0	1	10	0	0	0	0	1	50	2	5.88
6	Cultivator	0	0	0	0	0	0	1	25	0	0	1	2.94
7	Blank	6	100	5	50	2	16.67	0	0	0	0	13	38.24

Average value of farm implements: The data regarding the average value of farm Implements owned by the households in Chukkanakallu-2 micro-watershed is presented in Table 12. The results show that the average value of bullock cart was Rs. 10,000, plough was Rs. 1,877, sprayer was Rs. 1,550, average value of weeder was Rs. 123, average value of thresher was 190 and the average value of Cultivator was Rs. 32.

Table 12. Average value of farm implements owned by households in Chukkanakallu-2 micro-watershed **Average Value (Rs.)**

Sl.No.	Particulars	LL (6)	MF (10)	SF (12)	SMF (4)	MDF (2)	All (34)
1	Bullock Cart	0	0	10,000	10,000	0	10,000
2	Plough	0	1,760	1,900	2,000	1,900	1,877
3	Sprayer	0	1,600	0	0	1,500	1,550
4	Weeder	0	32	48	521	91	123
5	Thresher	0	180	0	0	200	190
6	Cultivator	0	0	0	32	0	32

Livestock possession by the households: The data regarding the Livestock possession by the households in Chukkanakallu-2 micro-watershed is presented in Table 13. The results indicate that, 17.65 per cent of the households possess bullocks, 14.71 per cent of the households possess local cow and 2.94 per cent of the households possess Buffalo.

Table 13. Livestock possession by households in Chukkanakallu-2 micro-watershed

Sl.No.	Particulars	LL (6)		MF (10)		SF (12)		SMF (4)		MDF (2)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Bullock	0	0	1	10	4	33.33	1	25	0	0	6	17.65
2	Local cow	0	0	3	30	1	8.33	1	25	0	0	5	14.71
3	Buffalo	0	0	0	0	1	8.33	0	0	0	0	1	2.94
4	blank	6	100	7	70	8	66.67	3	75	2	100	26	76.47

Average Labour availability: The data regarding the average labour availability in Chukkanakallu-2 micro-watershed is presented in Table 14. The results indicate that, average own labour men available in the micro watershed was 1.93, average own labour (women) available was 1.10, average hired labour (men) available and average hired labour (women) available was 15.86.

In case of marginal farmers, average own labour men available was 1.7, average own labour (women) was 110, average hired labour (men) and average hired labour (women) available was 16.40. In case of Small farmers, average own labour men available was 2, average own labour (women) was 1.08, average hired labour (men) and average hired labour (women) available was 15.33. In case of semi medium farmers, average own labour men available was 2.25, average own labour (women) was 1, average hired labour (men) and average hired labour (women) available was 16.25. In case of medium farmers, average own labour men available was 2.5, average own labour (women) was 1.50, average hired labour men and average hired labour (women) available was 22.50

Table 14. Average Labour availability in Chukkanakallu-2 micro-watershed

Sl.No.	Particulars	LL (6)	MF (10)	SF (12)	SMF (4)	MDF (2)	All (34)
1	Hired labour Female	2	16.40	15.33	16.25	22.50	15.86
2	Own Labour Female	1	1.10	1.08	1	1.50	1.10
3	Own labour Male	1	1.70	2	2.25	2.50	1.93
4	Hired labour Male	2	16.40	15.33	16.25	22.50	15.86

Adequacy of Hired Labour: The data regarding the adequacy of hired labour in Chukkanakallu-2 micro-watershed is presented in Table 15. The results indicate that, 85.29 per cent of the households opined that the hired labour was inadequate.

Table 15. Adequacy of Hired Labour in Chukkanakallu-2 micro-watershed

Sl.No.	Particulars	LL (6)		MF (10)		SF (12)		SMF (4)		MDF (2)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Inadequate	1	16.67	10	100	12	100	4	100	2	100	29	85.29

Distribution of land (ha): The data regarding the distribution of land (ha) in Chukkanakallu-2 micro-watershed is presented in Table 16. The results indicate that, households of the Chukkanakallu-2 micro-watershed possess 26.24 ha (72.73%) of dry land, 7.36 ha (20.39 %) of irrigated land and 2.48 ha (6.88%) of permanent fallow land. Marginal farmers possess 5.92 ha (100%) of dry land. Small farmers possess 12.27 ha (78.85 %) of dry land, 0.81 ha (5.20 %) of irrigated land and 2.48 ha (15.95%). Semi

medium farmers possess 8.05 ha (86.22 %) of dry land and 1.29 ha (13.78%) of irrigated land. Medium farmers possess 5.26 ha (100 %) of irrigated land.

Table 16. Distribution of land (Ha) in Chukkanakallu-2 micro-watershed

Sl.No.	Particulars	MF (10)		SF (12)		SMF (4)		MDF (2)		All (34)	
		ha	%	ha	%	ha	%	ha	%	ha	%
1	Dry	5.92	100	12.27	78.85	8.05	86.22	0	0	26.24	72.73
2	Irrigated	0	0	0.81	5.20	1.29	13.78	5.26	100	7.36	20.39
3	Permanent Fallow	0	0	2.48	15.95	0	0	0	0	2.48	6.88
Total		5.92	100	15.56	100	9.34	100	5.26	100	36.08	100

Average land value (Rs./ha): The data regarding the average land value (Rs./ha) in Chukkanakallu-2 micro-watershed is presented in Table 17. The results indicate that, the average value of dry land was Rs. 350,462.68; the average value of irrigated land was Rs. 230,968.10 and the average value of permanent fallow land Rs. 201,468.19. In case of marginal famers, the average land value was Rs. 675,324.68 for dry land. In case of small famers, the average land value was Rs. 325,965.03 for dry land, Rs. 247,000 for irrigated land and Rs. 201,468.19 for permanent fallow land. In case of semi medium famers, the average land value was Rs. 148,944.72 for dry land and Rs. 388,364.77 for irrigated land. In case of medium farmers, Rs.190,000 for irrigated land.

Table 17. Average land value (Rs./ha) in Chukkanakallu-2 micro-watershed

Sl.No.	Particulars	LL (6)	MF (10)	SF (12)	SMF (4)	MDF (2)	All (34)
1	Dry	0	675,324.68	325,965.03	148,944.72	0	350,462.68
2	Irrigated	0	0	247,000	388,364.77	190,000	230,968.10
3	Permanent Fallow	0	0	201,468.19	0	0	201,468.19

Status of bore wells: The data regarding the status of bore wells in Chukkanakallu-2 micro-watershed is presented in Table 18. The results indicate that, there were 4 functioning and de-functioning bore wells in the micro watershed.

Table 18. Status of bore wells in Chukkanakallu-2 micro-watershed

Sl.No.	Particulars	LL (6)	MF (10)	SF (12)	SMF (4)	MDF (2)	All (34)
1	De-functioning	0	0	0	1	3	4
2	Functioning	0	0	0	1	3	4

Source of irrigation: The data regarding the source of irrigation in Chukkanakallu-2 micro-watershed is presented in Table 19. The results indicate that, bore well was the major irrigation source in the micro water shed for 11.76 per cent of the farmers.

Table 19. Source of irrigation in Chukkanakallu-2 micro-watershed

Sl.No.	Particulars	LL (6)		MF (10)		SF (12)		SMF (4)		MDF (2)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Bore Well	0	0	0	0	0	0	1	25	3	150	4	11.76

Depth of water (Avg in meters): The data regarding the depth of water in Chukkanakallu-2 micro-watershed is presented in Table 20. The results indicate that, the depth of bore well was found to be 3.59 meters.

Table 20. Depth of water (Avg in meters) in Chukkanakallu-2 micro-watershed

Sl.No.	Particulars	LL (6)	MF (10)	SF (12)	SMF (4)	MDF (2)	All (34)
1	Bore Well	0	0	0	19.05	22.86	3.59

Irrigated Area (ha): The data regarding the irrigated area (ha) in Chukkanakallu-2 micro-watershed is presented in Table 21. The results indicate that semi medium and medium farmers had an irrigated area of 1.29 ha and 2.83 ha respectively.

Table 21. Irrigated Area (ha) in Chukkanakallu-2 micro-watershed

Sl.No.	Particulars	LL (6)	MF (10)	SF (12)	SMF (4)	MDF (2)	All (34)
1	Kharif	0	0	0	1.29	2.83	4.12

Cropping pattern: The data regarding the cropping pattern in Chukkanakallu-2 micro-watershed is presented in Table 22. The results indicate that, farmers have grown maize (22.36 ha), Bajra (7.36 ha), Sunflower (2.83 ha) and Wheat (3.34 ha). Marginal farmers have grown maize, bajra and sunflower. Small farmers have grown maize, bajra and cowpea. Semi medium farmers have grown maize and bajra. Medium farmers have grown maize and sunflower.

Table 22. Cropping pattern in Chukkanakallu-2 micro-watershed (Area in ha)

Sl.No.	Particulars	LL (6)	MF (10)	SF (12)	SMF (4)	MDF (2)	All (34)
1	Kharif - Maize	0	3.36	10.42	4.53	4.05	22.36
2	Kharif - Bajra	0	1.21	1.33	4.82	0	7.36
3	Kharif - Sunflower	0	1.62	0	0	1.21	2.83
4	Kharif - Cowpea	0	0	1.21	0	0	1.21
Total		0	6.19	12.97	9.34	5.26	33.77

Cropping intensity: The data regarding the cropping intensity in Chukkanakallu-2 micro-watershed is presented in Table 23. The results indicate that, the cropping intensity in Chukkanakallu-2 micro-watershed was found to be 100 per cent.

Table 23. Cropping intensity (%) in Chukkanakallu-2 micro-watershed

Sl.No.	Particulars	LL (6)	MF (10)	SF (12)	SMF (4)	MDF (2)	All (34)
1	Cropping Intensity	0	100	100	100	100	100

Possession of Bank account and savings: The data regarding the possession of bank account and saving in Chukkanakallu-2 micro-watershed is presented in Table 24. The results indicate that, 79.14 per cent of the households have bank account and savings.

Table 24. Possession of Bank account and savings in Chukkanakallu-2 micro-watershed

Sl.No.	Particulars	LL (6)		MF (10)		SF (12)		SMF (4)		MDF (2)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Account	1	16.67	10	100	10	83.33	4	100	2	100	27	79.41
2	Savings	1	16.67	10	100	10	83.33	4	100	2	100	27	79.41

Borrowing status: The data regarding the borrowing status in Chukkanakallu-2 micro-watershed is presented in Table 25. The results indicate that, 79.41 per cent of the households have availed credit from different sources.

Table 25. Borrowing status in Chukkanakallu-2 micro-watershed

Sl.No.	Particulars	LL (6)		MF (10)		SF (12)		SMF (4)		MDF (2)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Credit Availed	1	16.67	10	100	10	83.33	4	100	2	100	27	79.41

Source of credit availed by households: The data regarding the borrowing status in Chukkanakallu-2 micro-watershed is presented in Table 26. The results indicate that, 7.41 per cent of the households have borrowed from commercial bank.

Table 26. Source of credit availed by households in Chukkanakallu-2 micro-watershed

Sl.No.	Particulars	LL (1)		MF (10)		SF (10)		SMF (4)		MDF (2)		All (27)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Commercial Bank	0	0	0	0	1	10	0	0	1	50	2	7.41

Avg. Credit amount: The data regarding the avg. Credit amount in Chukkanakallu-2 micro-watershed is presented in Table 27. The results indicate that, the average credit amount borrowed by households in micro-watershed was Rs, 5,000.

Table 27. Avg. credit amount by household in Chukkanakallu-2 micro-watershed

Sl.No.	Particulars	LL (1)	MF (10)	SF (10)	SMF (4)	MDF (2)	All (27)
1	Average Credit	0	0	5,000	0	42,500	5,000

Purpose of credit borrowed - Institutional Credit: The data regarding the purpose of credit borrowed - Institutional Credit in Chukkanakallu-2 micro-watershed is presented in Table 28. The results indicate that, 100 per cent of the households borrowed from institutional sources for the purpose of agricultural production.

Table 28. Purpose of credit borrowed - Institutional Credit by household in Chukkanakallu-2 micro-watershed

Sl.No.	Particulars	SF (1)		MDF (1)		All (2)	
		N	%	N	%	N	%
1	Agriculture production	1	100	1	100	2	100

Repayment status of households – Institutional: The data regarding the repayment status of credit borrowed from institutional sources by households in Chukkanakallu-2 micro watershed is presented in Table 29. The results indicated that 100 per cent of the households did not repay their loan borrowed from institutional sources.

Table 29. Repayment status of households – Institutional Credit in Chukkanakallu-2 micro-watershed

Sl.No.	Particulars	SF (1)		MDF (1)		All (2)	
		N	%	N	%	N	%
1	Un paid	1	100	1	100	2	100

Opinion on institutional sources of credit: The data regarding the opinion on institutional sources of credit in Chukkanakallu-2 micro watershed is presented in Table 30. The results indicate that, around 100 per cent opined that helped to perform timely agricultural operation.

Table 30. Opinion on institutional sources of credit in Chukkanakallu-2 micro watershed

Sl.No.	Particulars	SF (1)		MDF (1)		All (2)	
		N	%	N	%	N	%
1	Helped to perform timely agricultural operations	1	100	1	100	2	100

Cost of cultivation of Bajra: The data regarding the cost of cultivation of Bajra in Chukkanakallu-2 micro-watershed is presented in Table 31. The results indicate that, the total cost of cultivation for bajra was Rs. 15704.22. The gross income realized by the farmers was Rs. 24107.32. The net income from bajra cultivation was Rs. 8403.10. Thus the benefit cost ratio was found to be 1: 1:1.54.

Table 31. Cost of Cultivation of bajra in Chukkanakallu-2 micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	12.29	2694.48	17.16
2	Bullock		Pairs/day	1.32	728.11	4.64
3	Tractor		Hours	2.40	1798.07	11.45
4	Machinery		Hours	0	0	0
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	14.11	1501.10	9.56
7	FYM		Quintal	0	0	0
8	Fertilizer + micronutrients		Quintal	2.10	1993.85	12.70
9	Pesticides (PPC)		Kgs /liters	1.32	1593.45	10.15
12	Msc. Charges (Marketing costs etc)			0	0	0
13	Depreciation charges			0	34.39	0.22
14	Land revenue and Taxes			0	0	0
II	**Cost B1**					
16	Interest on working capital				611.81	3.90
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				10955.26	69.76
III	**Cost B2**					
18	Rental Value of Land				277.78	1.77
19	**Cost B2 = (Cost B1 + Rental value)**				11233.04	71.53
IV	**Cost C1**					
20	Family Human Labour			11.39	3033.53	19.32
21	**Cost C1 = (Cost B2 + Family Labour)**				14266.57	90.85
V	**Cost C2**					
22	Risk Premium				10	0.06
23	**Cost C2 = (Cost C1 + Risk Premium)**				14276.57	90.91
VI	**Cost C3**					
24	Managerial Cost				1427.66	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				15704.22	100
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		17.68	23570.52	
		b) Main Crop Sales Price (Rs.)			1333.33	
	By Product	e) Main Product (q)		5.37	536.79	
		f) Main Crop Sales Price (Rs.)			100	
b.	Gross Income (Rs.)				24107.32	
c.	Net Income (Rs.)				8403.10	
d.	Cost per Quintal (Rs./q.)				888.35	
e.	Benefit Cost Ratio (BC Ratio)				1:1.54	

Cost of Cultivation of Sunflower: The data regarding the cost of cultivation of Sunflower in Chukkanakallu-2 micro-watershed is presented in Table 32. The results indicate that, the total cost of cultivation for Sunflower was Rs. 25491.42. The gross income realized by the farmers was Rs. 40617.78. The net income from Sunflower cultivation was Rs. 15126.36. Thus the benefit cost ratio was found to be 1:1.59.

Table 32. Cost of Cultivation of Sunflower in Chukkanakallu-2 micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	17.43	3787.33	14.86
2	Bullock		Pairs/day	1.37	754.72	2.96
3	Tractor		Hours	2.47	1852.50	7.27
4	Machinery		Hours	0	0	0
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	9.06	1679.60	6.59
6	Seed Inter Crop		Kgs.	0	0	0
7	FYM		Quintal	0	0	0
8	Fertilizer + micronutrients		Quintal	5.21	4789.06	18.79
9	Pesticides (PPC)		Kgs / liters	2.20	2909.11	11.41
10	Irrigation		Number	0	0	0
11	Repairs			0	0	0
12	Msc. Charges (Marketing costs etc)			0	0	0
13	Depreciation charges			0	60.72	0.24
14	Land revenue and Taxes			0	0	0
II	**Cost B1**					
16	Interest on working capital				1126.53	4.42
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				16959.58	66.53
III	**Cost B2**					
18	Rental Value of Land				166.67	0.65
19	**Cost B2 = (Cost B1 + Rental value)**				17126.24	67.18
IV	**Cost C1**					
20	Family Human Labour			22.64	6037.78	23.69
21	**Cost C1 = (Cost B2 + Family Labour)**				23164.02	90.87
V	**Cost C2**					
22	Risk Premium				10	0.04
23	**Cost C2 = (Cost C1 + Risk Premium)**				23174.02	90.91
VI	**Cost C3**					
24	Managerial Cost				2317.40	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				25491.42	100
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		10.15	40617.78	
		b) Main Crop Sales Price (Rs.)			4000	
b.	Gross Income (Rs.)				40617.78	
c.	Net Income (Rs.)				15126.36	
d.	Cost per Quintal (Rs./q.)				2510.37	
e.	Benefit Cost Ratio (BC Ratio)				1:1.59	

Cost of cultivation of Maize: The data regarding the cost of cultivation of maize in Chukkanakallu-2 micro-watershed is presented in Table 33. The results indicate that, the total cost of cultivation for maize was Rs. 44628.49. The gross income realized by the farmers was Rs. 40066.01. The net income from maize cultivation was Rs. -4562.48. Thus the benefit cost ratio was found to be 1:0.9.

Table 33. Cost of Cultivation of Maize in Chukkanakallu-2 micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	31.87	8222.33	18.42
2	Bullock		Pairs/day	4.25	2339.41	5.24
3	Tractor		Hours	3.61	2707.69	6.07
4	Machinery		Hours	0.44	266.28	0.60
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	22.99	2758.74	6.18
6	Seed Inter Crop		Kgs.	0	0	0
7	FYM		Quintal	34.31	6861.11	15.37
8	Fertilizer + micronutrients		Quintal	6.22	5714.76	12.81
9	Pesticides (PPC)		Kgs / liters	2.01	2209.22	4.95
10	Irrigation		Number	0	0	0
11	Repairs			0	0	0
12	Msc. Charges (Marketing costs etc)			0	0	0
13	Depreciation charges			0	45.34	0.10
14	Land revenue and Taxes			0	0	0
II	**Cost B1**					
16	Interest on working capital				2106.41	4.72
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				33231.29	74.46
III	**Cost B2**					
18	Rental Value of Land				166.67	0.37
19	**Cost B2 = (Cost B1 + Rental value)**				33397.96	74.84
IV	**Cost C1**					
20	Family Human Labour			27.53	7163.85	16.05
21	**Cost C1 = (Cost B2 + Family Labour)**				40561.80	90.89
V	**Cost C2**					
22	Risk Premium				9.55	0.02
23	**Cost C2 = (Cost C1 + Risk Premium)**				40571.35	90.91
VI	**Cost C3**					
24	Managerial Cost				4057.14	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				44628.49	100
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		29.92	36351.82	
		b) Main Crop Sales Price (Rs.)			1215	
	By Product	e) Main Product (q)		38.69	3714.20	
		f) Main Crop Sales Price (Rs.)			96	
b.	Gross Income (Rs.)				40066.01	
c.	Net Income (Rs.)				-4562.48	
d.	Cost per Quintal (Rs./q.)				1491.63	
e.	Benefit Cost Ratio (BC Ratio)				1:0.9	

Cost of cultivation of Cowpea: The data regarding the cost of cultivation of cowpea in Chukkanakallu-2 micro-watershed is presented in Table 34. The results indicate that, the total cost of cultivation for cowpea was Rs. 11809.29. The gross income realized by the farmers was Rs. 37050. The net income from cowpea cultivation was Rs. 25240.71. Thus the benefit cost ratio was found to be 1:3.14.

Table 34. Cost of Cultivation of cowpea in Chukkanakallu-2 micro-watershed

Sl.No	Particulars	Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**				
1	Hired Human Labour	Man days	13.17	2717	23.01
2	Bullock	Pairs/day	1.65	905.67	7.67
3	Tractor	Hours	2.47	1852.50	15.69
4	Machinery	Hours	0	0	0
5	Seed Main Crop (Establishment and Maintenance)	Kgs (Rs.)	7.41	741	6.27
6	Seed Inter Crop	Kgs.	0	0	0
7	FYM	Quintal	0	0	0
8	Fertilizer + micronutrients	Quintal	1.65	1564.33	13.25
9	Pesticides (PPC)	Kgs / liters	0	0	0
10	Irrigation	Number	0	0	0
11	Repairs		0	0	0
12	Msc. Charges (Marketing costs etc)		0	0	0
13	Depreciation charges		0	30.71	0.26
14	Land revenue and Taxes		0	0	0
II	**Cost B1**				
16	Interest on working capital			277.84	2.35
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**			8089.05	68.50
III	**Cost B2**				
18	Rental Value of Land			166.67	1.41
19	**Cost B2 = (Cost B1 + Rental value)**			8255.72	69.91
IV	**Cost C1**				
20	Family Human Labour		9.88	2470	20.92
21	**Cost C1 = (Cost B2 + Family Labour)**			10725.72	90.82
V	**Cost C2**				
22	Risk Premium			10	0.08
23	**Cost C2 = (Cost C1 + Risk Premium)**			10735.72	90.91
VI	**Cost C3**				
24	Managerial Cost			1073.57	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**			11809.29	100
VII	**Economics of the Crop**				
a.	Main Product	a) Main Product (q)	4.12	37050	
		b) Main Crop Sales Price (Rs.)		9000	
b.	Gross Income (Rs.)			37050	
c.	Net Income (Rs.)			25240.71	
d.	Cost per Quintal (Rs./q.)			2868.65	
e.	Benefit Cost Ratio (BC Ratio)			1:3.14	

Adequacy of fodder: The data regarding the adequacy of fodder in Chukkanakallu-2 micro-watershed is presented in Table 35. The results indicate that, 2.94 per cent of the households opined that dry fodder was inadequate and green fodder was adequate.

Table 35. Adequacy of fodder in Chukkanakallu-2 micro-watershed

Sl.No.	Particulars	LL (6)		MF (10)		SF (12)		SMF (4)		MDF (2)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Inadequate-Dry Fodder	0	0	1	10	0	0	0	0	0	0	1	2.94
2	Adequate-Green Fodder	0	0	1	10	0	0	0	0	0	0	1	2.94

Annual gross income: The data regarding the annual gross income in Chukkanakallu-2 micro-watershed is presented in Table 36. The results indicate that the annual gross income was Rs. 43,833.33 for landless households, for marginal farmers it was Rs. 32,400, for small farmers it was Rs. 68,916.67, for semi medium farmers it was Rs. 77,500 and for medium farmers it was Rs. 115,000.

Table 36. Annual gross income in Chukkanakallu-2 micro-watershed

(Avg value in Rs.)

Sl.No.	Particulars	LL (6)	MF (10)	SF (12)	SMF (4)	MDF (2)	All (34)
1	Business	0	2,000	4,166.67	0	0	2,058.82
2	Wage	27,000	7,500	19,166.67	17,500	30,000	17,558.82
3	Agriculture	16,833.33	22,900	45,583.33	60,000	85,000	37,852.94
Income(Rs.)		43,833.33	32,400	68,916.67	77,500	115,000	57,470.59

Average annual expenditure: The data regarding the average annual expenditure in Chukkanakallu-2 micro-watershed is presented in Table 37. The results indicate that the average annual expenditure is Rs. 4,806.06. For landless households it was Rs. 7,666.67, for marginal farmers it was Rs. 2,346.67, for small farmers it was Rs. 2,751.89, for semi medium farmers it was Rs. 7,104.17 and for medium farmers it was Rs. 16,250.

Table 37. Average annual expenditure in Chukkanakallu-2 micro-watershed

(Avg value in Rs.)

Sl.No.	Particulars	LL (6)	MF (10)	SF (12)	SMF (4)	MDF (2)	All (34)
1	Business	0	10,000	11,000	0	0	941.18
2	Wage	26,666.67	4,666.67	4,750	4,666.67	7,500	4,735.29
3	Agriculture	19,333.33	8,800	17,272.73	23,750	25,000	14,147.06
Total		46,000	23,466.67	33,022.73	28,416.67	32,500	163,406.06
Average		7,666.67	2,346.67	2,751.89	7,104.17	16,250	4,806.06

Table 38. Horticulture species grown in Chukkanakallu-2 micro-watershed

Sl.No.	Particulars	LL (6)		MF (10)		SF (12)		SMF (4)		MDF (2)		All (34)	
		F	B	F	B	F	B	F	B	F	B	F	B
1	Coconut	0	0	0	0	1	0	0	0	0	0	1	0
2	Guava	0	0	0	0	2	0	0	0	0	0	2	0
3	Mango	0	0	2	0	0	0	2	0	0	0	4	0

***F= Field B=Back Yard**

Horticulture species grown: The data regarding horticulture species grown in Chukkanakallu-2 micro-watershed is presented in Table 38. The results indicate that,

sampled households have grown 1 coconut, 2 guava and 4 mango trees in their field and1 in backyard.

Forest species grown: The data regarding forest species grown in Chukkanakallu-2 micro-watershed is presented in Table 39. The results indicate that, households have planted 22 teak, 50 neem and 1 tamarind trees in their field and also 1 neem trees in their backyard.

Table 39: Forest species grown in Chukkanakallu-2 micro-watershed

Sl.No.	Particulars	LL (6)		MF (10)		SF (12)		SMF (4)		MDF (2)		All (34)	
		F	B	F	B	F	B	F	B	F	B	F	B
1	Teak	0	0	0	0	22	0	0	0	0	0	22	0
2	Neem	0	0	12	0	14	0	22	0	2	1	50	1
3	Tamarind	0	0	0	0	1	0	0	0	0	0	1	0

***F= Field B=Back Yard**

Marketing of the agricultural produce: The data regarding marketing of the agricultural produce in Chukkanakallu-2 micro-watershed is presented in Table 40. The results indicated that, Bajra were sold to the extent of 79.17 per cent, cowpea were sold to the extent of 60 per cent, maize were sold to the extent of 98.33 per cent and sunflower were sold to the extent of 92.86 per cent.

Table 40. Marketing of the agricultural produce in Chukkanakallu-2 micro-watershed

Sl. No	Crops	Output obtained (q)	Output retained (q)	Output sold (q)	Output sold (%)	Avg. Price obtained (Rs/q)
1	Bajra	96	20	76	79.17	1333.33
2	Cow Pea	5	2	3	60	9000.0
3	Maize	599	10	589	98.33	1215.0
4	Sunflower	28	2	26	92.86	4000.0

Marketing Channels used for sale of agricultural produce: The data regarding marketing channels used for sale of agricultural produce in Chukkanakallu-2 micro-watershed is presented in Table 41. The results indicated that, about 73.53 per cent of the farmers sold their produce to regulated market.

Table 41. Marketing Channels used for sale of agricultural produce in Chukkanakallu-2 micro-watershed

Sl.No.	Particulars	LL (6)		MF (10)		SF (12)		SMF (4)		MDF (2)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Regulated Market	0	0	9	90	9	75	4	100	3	150	25	73.53

Table 42. Mode of transport of agricultural produce in Chukkanakallu-2 micro-watershed

Sl.No.	Particulars	LL (6)		MF (10)		SF (12)		SMF (4)		MDF (2)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Tractor	0	0	10	100	10	83.33	4	100	3	150	27	79.41

Mode of transport of agricultural produce: The data regarding mode of transport of agricultural produce in Chukkanakallu-2 micro-watershed is presented in Table 42. The results indicated that 79.41 per cent of the households used tractor as a mode of transportation for their agricultural produce.

Incidence of soil and water erosion problems: The data regarding incidence of soil and water erosion problems in Chukkanakallu-2 micro-watershed is presented in Table 43. The results indicated that, 20.59 per cent of the households have experienced soil and water erosion problems in the farm.

Table 43. Incidence of soil and water erosion problems in Chukkanakallu-2 micro-watershed

Sl.No.	Particulars	LL (6)		MF (10)		SF (12)		SMF (4)		MDF (2)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Soil and water erosion problems in the farm	0	0	3	30	3	25	1	25	0	0	7	20.59

Interest shown towards soil testing: The data regarding Interest shown towards soil testing in Chukkanakallu-2 micro-watershed is presented in Table 44. The results indicated that, 76.47 per cent have shown interest in soil test.

Table 44. Interest shown towards soil testing in Chukkanakallu-2 micro-watershed

Sl.No.	Particulars	LL (6)		MF (10)		SF (12)		SMF (4)		MDF (2)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Interest in soil test	0	0	10	100	10	83.33	4	100	2	100	26	76.47

Usage pattern of fuel for domestic use: The data regarding usage pattern of fuel for domestic use in Chukkanakallu-2 micro-watershed is presented in Table 45. The results indicated that, 100 per cent of the households used firewood, 2.86 per cent of the households used LPG as a source of fuel and 2.86 per cent of the households used Kerosene.

Table 45. Usage pattern of fuel for domestic use in Chukkanakallu-2 micro-watershed

Sl.No.	Particulars	LL (6)		MF (10)		SF (12)		SMF (4)		MDF (2)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Fire Wood	6	100	10	100	12	100	4	100	2	100	34	100

Source of drinking water: The data regarding source of drinking water in Chukkanakallu-2 micro-watershed is presented in Table 46. The results indicated that, piped supply was the source of drinking water for 2.94 per cent of the households and bore well was the major source of drinking water for 97.06 per cent of the households in micro watershed.

Table 46. Source of drinking water in Chukkanakallu-2 micro-watershed

Sl.No.	Particulars	LL (6)		MF (10)		SF (12)		SMF (4)		MDF (2)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Piped supply	0	0	0	0	0	0	1	25	0	0	1	2.94
2	Bore Well	6	100	10	100	12	100	3	75	2	100	33	97.06

Source of light: The data regarding source of light in Chukkanakallu-2 micro-watershed is presented in Table 47. The results indicated that, Electricity was the major source of light for 100 per cent of the households in micro watershed.

Table 47. Source of light in Chukkanakallu-2 micro-watershed

Sl.No.	Particulars	LL (6)		MF (10)		SF (12)		SMF (4)		MDF (2)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Electricity	6	100	10	100	12	100	4	100	2	100	34	100

Existence of Sanitary toilet facility: The data regarding existence of sanitary toilet facility in Chukkanakallu-2 micro-watershed is presented in Table 48. The results indicated that, 100 per cent of the households possess sanitary toilet facility.

Table 48. Existence of Sanitary toilet facility in Chukkanakallu-2 micro-watershed

Sl.No.	Particulars	LL (6)		MF (10)		SF (12)		SMF (4)		MDF (2)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Sanitary toilet facility	6	100	10	100	12	100	4	100	2	100	34	100

Possession of PDS card: The data regarding possession of PDS card in Chukkanakallu-2 micro-watershed is presented in Table 49. The results indicated that, 100 per cent of the sampled households possessed BPL card.

Table 49. Possession of PDS card in Chukkanakallu-2 micro-watershed

Sl.No.	Particulars	LL (6)		MF (10)		SF (12)		SMF (4)		MDF (2)		LF (0)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	BPL	6	100	10	100	12	100	4	100	2	100	0	0	34	100

Participation in NREGA program: The data regarding participation in NREGA programme in Chukkanakallu-2 micro-watershed is presented in Table 50. The results indicated that, 23.53 per cent of the households participated in NREGA programme.

Table 50. Participation in NREGA programme in Chukkanakallu-2 micro-watershed

Sl.No.	Particulars	LL (6)		MF (10)		SF (12)		SMF (4)		MDF (2)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Participation in NREGA programme	1	16.67	3	30	1	8.33	1	25	2	100	8	23.53

Table 51. Adequacy of food items in Chukkanakallu-2 micro-watershed

Sl.No.	Particulars	LL (6)		MF (10)		SF (12)		SMF (4)		MDF (2)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Cereals	2	33.33	9	90	9	75	4	100	2	100	26	76.47
2	Pulses	2	33.33	7	70	10	83.33	4	100	1	50	24	70.59
3	Oilseed	2	33.33	3	30	1	8.33	0	0	1	50	7	20.59
4	Vegetables	0	0	2	20	2	16.67	1	25	0	0	5	14.71
5	Fruits	2	33.33	4	40	7	58.33	1	25	1	50	15	44.12
6	Milk	0	0	1	10	4	33.33	1	25	0	0	6	17.65
7	Egg	0	0	1	10	2	16.67	2	50	0	0	5	14.71
8	Meat	0	0	2	20	1	8.33	0	0	0	0	3	8.82

Adequacy of food items: The data regarding adequacy of food items in Chukkanakallu-2 micro-watershed is presented in Table 51. The results indicated that, cereals were adequate for 76.47 per cent of the households, pulses were adequate for 70.59 per cent, oilseeds were adequate for 20.59 per cent, vegetables and egg were adequate for 14.71 per cent, fruits were adequate for 44.12 per cent, milk was adequate for 17.65 per cent and meat was adequate for 8.82 per cent.

Response on Inadequacy of food items: The data regarding inadequacy of food items in Chukkanakallu-2 micro-watershed is presented in Table 52. The results indicated that, Cereals were inadequate for 11.76 per cent of the households, pulses were inadequate for 17.65 per cent of the households, oilseeds were inadequate for 67.65 per cent, vegetables were inadequate for 70.59 per cent, fruits was inadequate for 41.18 per cent, milk were inadequate for 44.12 per cent and egg and meat was inadequate for 70.59 per cent of the households.

Table 52. Response on Inadequacy of food items in Chukkanakallu-2 micro-watershed

Sl.No.	Particulars	LL (6)		MF (10)		SF (12)		SMF (4)		MDF (2)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Cereals	1	16.67	0	0	3	25	0	0	0	0	4	11.76
2	Pulses	1	16.67	2	20	2	16.67	0	0	1	50	6	17.65
3	Oilseed	1	16.67	6	60	11	91.67	4	100	1	50	23	67.65
4	Vegetables	3	50	7	70	9	75	3	75	2	100	24	70.59
5	Fruits	1	16.67	5	50	5	41.67	2	50	1	50	14	41.18
6	Milk	1	16.67	4	40	8	66.67	0	0	2	100	15	44.12
7	Egg	3	50	7	70	9	75	3	75	2	100	24	70.59
8	Meat	3	50	5	50	11	91.67	3	75	2	100	24	70.59

Response on Market Surplus of food items: The data regarding market surplus of food items in Chukkanakallu-2 micro watershed is presented in Table 53. The results indicated that, cereals, pulses, oilseeds, vegetables, milk and egg were market surplus for 11.76 per cent and fruits and meat were market surplus for 14.71 per cent of the households.

Table 53. Response on Market surplus of food items in Chukkanakallu-2 micro watershed

Sl.No.	Particulars	LL (6)		MF (10)		SF (12)		SMF (4)		MDF (2)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Cereals	3	50	1	10	0	0	0	0	0	0	4	11.76
2	Pulses	3	50	1	10	0	0	0	0	0	0	4	11.76
3	Oilseed	3	50	1	10	0	0	0	0	0	0	4	11.76
4	Vegetables	3	50	1	10	0	0	0	0	0	0	4	11.76
5	Fruits	3	50	1	10	0	0	1	25	0	0	5	14.71
6	Milk	3	50	1	10	0	0	0	0	0	0	4	11.76
7	Egg	3	50	1	10	0	0	0	0	0	0	4	11.76
8	Meat	3	50	2	20	0	0	0	0	0	0	5	14.71

Farming constraints: The data regarding farming constraints experienced by households in Chukkanakallu-2 micro-watershed is presented in Table 54. The results indicated that,

lower fertility status of the soil was the constraint experienced by 76.41 per cent of the households, wild animal menace on farm field (79.41%), frequent incidence of pest and diseases (20.59%), inadequacy of irrigation water and inadequate extension services (5.88%), high cost of fertilizers and plant protection chemicals (20.59%), high rate of interest on credit and low price for the agricultural commodities (8.82%), lack of transport for safe transport of the agricultural produce to the market (23.53%), less rainfall (26.47%) and source of agri-technology information (14.71%).

Table 54. Farming constraints Experienced in Chukkanakallu-2 micro-watershed

Sl. No.	Particulars	MF(10)		SF (12)		SMF(4)		MDF(2)		All (34)	
		N	%	N	%	N	%	N	%	N	%
1	Lower fertility status of the soil	8	80	10	83.33	5	125	2	100	26	76.47
2	Wild animal menace on farm field	11	110	10	83.33	3	75	2	100	27	79.41
3	Frequent incidence of pest and diseases	4	40	2	16.67	1	25	0	0	7	20.59
4	Inadequacy of irrigation water	0	0	2	16.67	0	0	0	0	2	5.88
5	High cost of Fertilizers and plant protection chemicals	3	30	3	25	1	25	0	0	7	20.59
6	High rate of interest on credit	2	20	1	8.33	0	0	0	0	3	8.82
7	Low price for the agricultural commodities	1	10	0	0	0	0	2	100	3	8.82
8	Lack of marketing facilities in the area	1	10	3	25	1	25	0	0	5	14.71
9	Inadequate extension services	0	0	1	8.33	1	25	0	0	2	5.88
10	Lack of transport for safe transport of the Agril produce to the market.	4	40	1	8.33	2	50	0	0	8	23.53
11	Less rainfall	4	40	3	25	1	25	1	50	9	26.47
12	Source of Agri-technology information	1	10	2	16.67	2	50	0	0	5	14.71

Chapter 5

SUMMARY

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 34 households located in the micro watershed were interviewed for the survey.

The data indicated that there were 78 (57.35 %) men and 58 (42.65 %) were women among the sampled households. The average family size of landless' was 2.8, marginal farmers' was 4.2, small farmers' was 4.3, semi medium farmers' was 4 and medium farmers' was 4.5. The data indicated that, 15 (11.03 %) people were in 0-15 years of age, 51 (37.5 %) were in 16-35 years of age, 57 (41.91 %) were in 36-60 years of age and 13 (9.56 %) were above 61 years of age.

The results indicated that Chukkanakallu-2 had 37.50 per cent illiterates, 34.56 per cent of them had primary school education, 7.35 per cent of them had middle school education, 10.29 per cent of them had high school education, 2.94 per cent of them had PUC education, 1.47 per cent of them had Diploma and degree education and 2.21 per cent of them had masters education.

The results indicate that, 91.18 per cent of household heads were practicing agriculture and 5.88 per cent of the household heads were agricultural laborers. The results indicate that agriculture was the major occupation for 23.53 per cent of the household members, 67.65 per cent were agricultural laborers, 1.47 per cent were in government service, 6.62 per cent were students and 0.74 per cent were children.

The results show that, 100 per cent of the population in the micro watershed has not participated in any of the institution. The results indicate that 82.35 per cent of the households possess katcha house and 17.65 per cent of them possess pucca/RCC house.

The results show that 55.88 per cent of the households possess TV, 70.59 per cent of them possess mixer/grinder, 5.88 per cent of them possess bicycle, 32.35 per cent of the households possess motor cycle, 2.94 per cent of the households possess auto and 67.65 per cent of the households possess mobile phones. The results show that the average value of television was Rs 5,515, mixer/grinder was Rs 1,875, bicycle was Rs 2,000, motor cycle was Rs. 49,272, auto was Rs. 200,000 and mobile phone was Rs. 2,336.

About 5.88 per cent of the households possess bullock cart and thresher, 52.94 per cent of them possess plough, 8.82 per cent of them possess sprayer, 52.94 per cent of

them possess weeder and 2.94 per cent of them possess Cultivator. The results show that the average value of bullock cart was Rs. 10,000, plough was Rs. 1,877, sprayer was Rs. 1,550, average value of weeder was Rs. 123, average value of thresher was 190 and the average value of Cultivator was Rs. 32.

The results indicate that, 17.65 per cent of the households possess bullocks, 14.71 per cent of the households possess local cow and 2.94 per cent of the households possess Buffalo.

The results indicate that, average own labour men available in the micro watershed was 1.93, average own labour (women) available was 1.10, average hired labour (men) available and average hired labour (women) available was 15.86. The results indicate that, 85.29 per cent of the households opined that the hired labour was inadequate.

The results indicate that, households of the Chukkanakallu-2 micro-watershed possess 26.24 ha (72.73%) of dry land, 7.36 ha (20.39 %) of irrigated land and 2.48 ha (6.88%) of permanent fallow land. Marginal farmers possess 5.92 ha (100%) of dry land. Small farmers possess 12.27 ha (78.85 %) of dry land, 0.81 ha (5.20 %) of irrigated land and 2.48 ha (15.95%). Semi medium farmers possess 8.05 ha (86.22 %) of dry land and 1.29 ha (13.78%) of irrigated land. Medium farmers possess 5.26 ha (100 %) of irrigated land.

The results indicate that, the average value of dry land was Rs. 350,462.68, the average value of irrigated land was Rs. 230,968.10 and the average value of permanent fallow land Rs. 201,468.19. In case of marginal famers, the average land value was Rs. 675,324.68 for dry land. In case of small famers, the average land value was Rs. 325,965.03 for dry land, Rs. 247,000 for irrigated land and Rs. 201,468.19 for permanent fallow land. In case of semi medium famers, the average land value was Rs. 148,944.72 for dry land and Rs. 388,364.77 for irrigated land. In case of medium farmers, Rs.190,000 for irrigated land.

The results indicate that, there were 4 functioning and de-functioning bore wells in the micro watershed. The results indicate that, bore well was the major irrigation source in the micro water shed for 11.76 per cent of the farmers. The results indicate that, the depth of bore well was found to be 3.59 meters.

The results indicate that semi medium and medium farmers had an irrigated area of 1.29 ha and 2.83 ha respectively. The results indicate that, farmers have grown maize (22.36 ha), Bajra (7.36 ha), Sunflower (2.83 ha) and Wheat (3.34 ha). Marginal farmers have grown maize, bajra and sunflower. Small farmers have grown maize, bajra and cowpea. Semi medium farmers have grown maize and bajra. Medium farmers have grown maize and sunflower. The results indicate that, the cropping intensity in Chukkanakallu-2 micro-watershed was found to be 100 per cent.

The results indicate that, 79.14 per cent of the households have bank account and savings. The results indicate that, 79.41 per cent of the households have availed credit from different sources. The results indicate that, 7.41 per cent of the households have borrowed from commercial bank. The results indicate that, the average credit amount borrowed by households in micro-watershed was Rs, 5,000. The results indicate that, 100 per cent of the households borrowed from institutional sources for the purpose of agricultural production. The results indicated that 100 per cent of the households did not repay their loan borrowed from institutional sources. The results indicate that, around 100 per cent opined that helped to perform timely agricultural operation.

The results indicate that, the total cost of cultivation for bajra was Rs. 15704.22. The gross income realized by the farmers was Rs. 24107.32. The net income from bajra cultivation was Rs. 8403.10. Thus the benefit cost ratio was found to be 1: 1:1.54. The total cost of cultivation for Sunflower was Rs. 25491.42. The gross income realized by the farmers was Rs. 40617.78. The net income from Sunflower cultivation was Rs. 15126.36. Thus the benefit cost ratio was found to be 1:1.59. The total cost of cultivation for maize was Rs. 44628.49. The gross income realized by the farmers was Rs. 40066.01. The net income from maize cultivation was Rs. -4562.48. Thus the benefit cost ratio was found to be 1:0.9. The total cost of cultivation for cowpea was Rs. 11809.29. The gross income realized by the farmers was Rs. 37050. The net income from cowpea cultivation was Rs. 25240.71. Thus the benefit cost ratio was found to be 1:3.14.

The results indicate that, 2.94 per cent of the households opined that dry fodder was inadequate and green fodder was adequate.

The results indicate that the annual gross income was Rs. 43,833.33 for landless households, for marginal farmers it was Rs. 32,400, for small farmers it was Rs. 68,916.67, for semi medium farmers it was Rs. 77,500 and for medium farmers it was Rs. 115,000. The results indicate that the average annual expenditure is Rs. 4,806.06. For landless households it was Rs. 7,666.67, for marginal farmers it was Rs. 2,346.67, for small farmers it was Rs. 2,751.89, for semi medium farmers it was Rs. 7,104.17 and for medium farmers it was Rs. 16,250.

The results indicate that, sampled households have grown 1 coconut, 2 guava and 4 mango trees in their field and1 in backyard. The results indicate that, households have planted 22 teak, 50 neem and 1 tamarind trees in their field and also 1 neem trees in their backyard.

The results indicated that, Bajra were sold to the extent of 79.17 per cent, cowpea were sold to the extent of 60 per cent, maize were sold to the extent of 98.33 per cent and sunflower were sold to the extent of 92.86 per cent.

The results indicated that, about 73.53 per cent of the farmers sold their produce to regulated market. The results indicated that 79.41 per cent of the households used tractor as a mode of transportation for their agricultural produce.

The results indicated that, 20.59 per cent of the households have experienced soil and water erosion problems in the farm. The results indicated that, 76.47 per cent have shown interest in soil test.

The results indicated that, 100 per cent of the households used firewood, 2.86 per cent of the households used LPG as a source of fuel and 2.86 per cent of the households used Kerosene. The results indicated that, piped supply was the source of drinking water for 2.94 per cent of the households and bore well was the major source of drinking water for 97.06 per cent of the households in micro watershed.

Electricity was the major source of light for 100 per cent of the households in micro watershed. The results indicated that, 100 per cent of the households possess sanitary toilet facility. The results indicated that, 100 per cent of the sampled households possessed BPL card. The results indicated that, 23.53 per cent of the households participated in NREGA programme.

The results indicated that, cereals were adequate for 76.47 per cent of the households, pulses were adequate for 70.59 per cent, oilseeds were adequate for 20.59 per cent, vegetables and egg were adequate for 14.71 per cent, fruits were adequate for 44.12 per cent, milk was adequate for 17.65 per cent and meat was adequate for 8.82 per cent.

The results indicated that, Cereals were inadequate for 11.76 per cent of the households, pulses were inadequate for 17.65 per cent of the households, oilseeds were inadequate for 67.65 per cent, vegetables were inadequate for 70.59 per cent, fruits was inadequate for 41.18 per cent, milk were inadequate for 44.12 per cent and egg and meat was inadequate for 70.59 per cent of the households.

The results indicated that, cereals, pulses, oilseeds, vegetables, milk and egg were market surplus for 11.76 per cent and fruits and meat were market surplus for 14.71 per cent of the households.

The results indicated that, lower fertility status of the soil was the constraint experienced by 76.41 per cent of the households, wild animal menace on farm field (79.41%), frequent incidence of pest and diseases (20.59%), inadequacy of irrigation water and inadequate extension services (5.88%), high cost of fertilizers and plant protection chemicals (20.59%), high rate of interest on credit and low price for the agricultural commodities (8.82%), lack of transport for safe transport of the agricultural produce to the market (23.53%), less rainfall (26.47%) and source of agri-technology information (14.71%).