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

MUNDRIGI (4D4A1Z1c) MICROWATERSHED

Koppal Hobli, 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

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

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PREFACE

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

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

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

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

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

ICAR-NBSS&LUP, Regional Centre, Bangalore has taken up a project sponsored by the Karnataka Watershed Development Project-II, (Sujala-III), Government of Karnataka funded by the World Bank under Component -1 Land Resource Inventry. This study was taken up to demonstrate the utility of such a database in reviewing, monitoring and evaluating all the land based watershed development programs on a scientific footing. To meet the requirements of various land use planners at grassroots level, the present study on "Land Resource Inventory and Socio-Economic Status of Farm Households for Watershed Planning and Development of for Mundrigi 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:15-11-2019

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PART-A

LAND RESOURCE INVENTORY

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EXECUTIVE SUMMARY

The land resource inventory of Mundrigi 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 about 411 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 89 per cent is covered by soils and 11 per cent is covered by others (Habitation and Settlements). The salient findings from the land resource inventory are summarized briefly below.

- *The soils belong to 8 soil series and 14 soil phases (management units) and 3 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.*
- *An area of about 89 per cent is suitable for agriculture.*
- *An area of about 3 per cent of the soils are moderately shallow (50-75 cm), 62 per cent of the soils are moderately deep to deep (75-150 cm) and 23 per cent soils are very deep (>150 cm).*
- *An area of about 48 per cent area in the microwatershed has loamy soils and 40 per cent clayey soils at the surface.*
- *An area of about 57 per cent area has non-gravelly (<15% gravel) soils and 31 per cent has gravelly to very gravelly (15-60% gravel) soils.*
- *An area of about 43 per cent area is very low to low (<50-100 mm/m), 23 per cent area is medium (101-150 mm/m) and 23 per cent area is high (151-200 mm/m) in available water capacity.*

- *An area of about 10 per cent area of the microwatershed has nearly level (0-1% slope) lands and 79 per cent area of the microwatershed has very gently sloping (1-3% slope) lands.*
- *An area of about 69 per cent area is moderately (e2) eroded and about 19 per cent area is slightly (e1) eroded.*
- *An area of about 2 per cent soils are slightly acid (pH 6.0-6.5), 74 per cent soils are neutral (pH 6.5-7.3) and 12 per cent soil are slightly alkaline (pH 7.3-7.8) in soil reaction.*
- *The Electrical Conductivity (EC) of the soils in the entire cultivated area of the microwatershed is <2 dsm^{-1} indicating that the soils are non-saline.*
- *Organic carbon is high (>0.75%) in 84 per cent area and medium (0.5-0.75%) in 4 per cent area of the microwatershed.*
- *Entire cultivated area of the microwatershed falls under high (>57 kg/ha) in the available phosphorus content.*
- *An area of about 12 per cent is low (<145 kg/ha), 76 per cent is medium (145-337 kg/ha) and <1 per cent is high (>337 kg/ha) in available potassium.*
- *Entire cultivated area of the microwatershed falls under low (<10 ppm) in the available sulphur content.*
- *An area of about 81 per cent is low (<0.5ppm) and 8 per cent is medium (0.5-1.0 ppm) in available boron content.*
- *An area of about 65 per cent is sufficient (>4.5 ppm) and 23 per cent is deficient (<4.5 ppm) in available iron content.*
- *Entire cultivated area of the microwatershed is sufficient (>1.0 ppm) in the available manganese content.*
- *Entire cultivated area of the microwatershed is sufficient (>0.2 ppm) in the available copper content.*
- *Entire cultivated area of the microwatershed is sufficient (>0.6 ppm) in the available zinc content.*
- *The land suitability for 31 major crops grown in the microwatershed was assessed and the areas that are highly suitable (S1) and moderately suitable (S2) are given below. It is however to be noted that a given soil may be suitable for various crops but what specific crop to be grown may be decided by the farmer looking to his capacity to invest on various inputs, marketing infrastructure, market price and finally the demand and supply position.*

Land suitability for various crops in the microwatershed

Crop	Suitability Area in ha (%)			Crop	Suitability Area in ha (%)	
	Highly suitable (S1)	Moderately suitable (S2)			Highly suitable (S1)	Moderately suitable (S2)
Sorghum	*172(42)*	*17(4)*		*Sapota*	*98(24)*	*114(28)*
Maize	*<1(<1)*	*189(46)*		*Pomegranate*	*98(24)*	*114(28)*
Bajra	*175(42)*	*51(12)*		*Guava*	*95(23)*	*117(28)*
Groundnut	*95(23)*	*219(53)*		*Jackfruit*	*98(24)*	*114(28)*
Sunflower	*95(23)*	*80(19)*		*Jamun*	*95(23)*	*116(28)*
Cotton	*95(23)*	*93(23)*		*Musambi*	*98(24)*	*114(28)*
Red gram	*95(23)*	*79(19)*		*Lime*	*98(24)*	*114(28)*
Bengalgram	-	*189(46)*		*Cashew*	*95(23)*	*167(40)*
Chilli	*172(42)*	*17(4)*		*Custard apple*	*175(42)*	*189(46)*
Tomato	*172(42)*	*17(4)*		*Amla*	*175(42)*	*189(46)*
Brinjal	*79(19)*	*234(57)*		*Tamarind*	*95(23)*	*21(5)*
Onion	*<1(<1)*	*314(76)*		*Marigold*	*95(23)*	*94(23)*
Bhendi	*<1(<1)*	*314(76)*		*Chrysanthemum*	*95(23)*	*93(23)*
Drumstick	*98(24)*	*166(40)*		*Jasmine*	*95(23)*	*93(23)*
Mulberry	*98(24)*	*252(61)*		*Crossandra*	*95(23)*	*93(23)*
Mango	*95(23)*	*3(1)*				

- *Apart from the individual crop suitability, a proposed crop plan has been prepared for the 3 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 for these problematic soils like saline/alkali, highly eroded, sandy soils etc.,*
- *Soil and water conservation treatment plan has been prepared that would help in identifying the sites to be treated and also the type of structures required.*
- *As part of the greening programme, several tree species have been suggested to be planted in marginal and submarginal lands, field bunds and also in the hillocks, mounds and ridges. That would help in supplementing the farm income, provide fodder and fuel, and generate lot of biomass which in turn would help in maintaining the ecological balance and contribute to mitigating the climate change.*

Chapter 1

INTRODUCTION

Soil is a finite natural resource that is central to sustainable agriculture and food security. Over the years, this precious resource is faced with the problems of erosion, salinity, alkalinity, degradation, depletion of nutrients and even decline in availability of land for agriculture. It is a known fact, that it takes thousands of years to form a few centimetres of soil, thus, soil is a precious gift of nature. The area available for agriculture is about 51 per cent of the total geographical area and more than 60 per cent of the people are still dependant on agriculture for their livelihood. However, the capacity of a soil to produce is limited and the limits to the production are set by its intrinsic characteristics, agro-climatic setting, and use and management. There is, therefore, tremendous pressure on land and water resources, which is causing decline in soil-health and stagnation in productivity. As much as 121 m ha of land is reportedly degraded which leads to impaired soil quality. It is imperative that steps are urgently taken to check and reverse land degradation without any further loss of time. The improvements in productivity will have to come from sustainable intensification measures that make the most effective use of land and water resources. 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.

Added to this, every year there is a significant diversion of farm lands and water resources for non-agricultural purposes. Thus, developing strategies to slow down the degradation process or reclaim the soils to normal condition and ensure sustainability of production system are the major issues today. This demands a systematic appraisal of our soil and land resources with respect to their extent, geographic distribution, characteristics, behaviour and uses potential, which is very important for developing an effective land use and cropping systems for augmenting agricultural production on a sustainable basis. The soil and land resource inventories made so far in Karnataka had limited utility because the surveys were of different types, scales and intensities carried out at different times with specific objectives. Hence, there is an urgent need to generate

detailed site-specific farm level database on various land resources for all the villages/watersheds in a time bound manner that would help to protect the valuable soil and land resources and also to stabilize the farm production.

Therefore, the land resource inventory required for farm level planning is the one which investigates all the parameters which are critical for productivity *viz.,* soils, site characteristics like slope, erosion, gravelliness and stoniness, climate, water, topography, geology, hydrology, vegetation, crops, land use pattern, animal population, socio-economic conditions, infrastructure, marketing facilities and various schemes and developmental works of the government etc. From the data collected at farm level, the specific problems and potentials of the area can be identified and highlighted, conservation measures required for the area can be planned on a scientific footing, suitability of the area for various uses can be worked out and finally viable and sustainable land use options suitable for each and every land holding can be prescribed.

The Land Resource Inventory is basically done for identifying potential and problem areas, developing sustainable land use plans, estimation of surface run off and water harvesting potential, preparation of soil and water conservation plans, land degradation/desertification etc. The Bureau is presently engaged in developing an LRI methodology using high 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 Mundrigi microwatershed in Koppal Taluk and 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 scales 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 Mundrigi Microwatershed is located in the central part of northern Karnataka in Koppal Taluk, Koppal District, Karnataka State (Fig.2.1). It comprises parts of Kunakeri, Lachanakeri & Mallikeri villages. It lies between $15^0$14' – $15^0$16' North latitudes and $76^0$11'– $76^0$12' East longitudes and covers an area of 411 ha. It is about 11 km from Koppal town and is surrounded by Lachanakeri village on the west, south and east, Mallikeri village on the northwest and Kunakeri village on the northern side of the microwatershed.

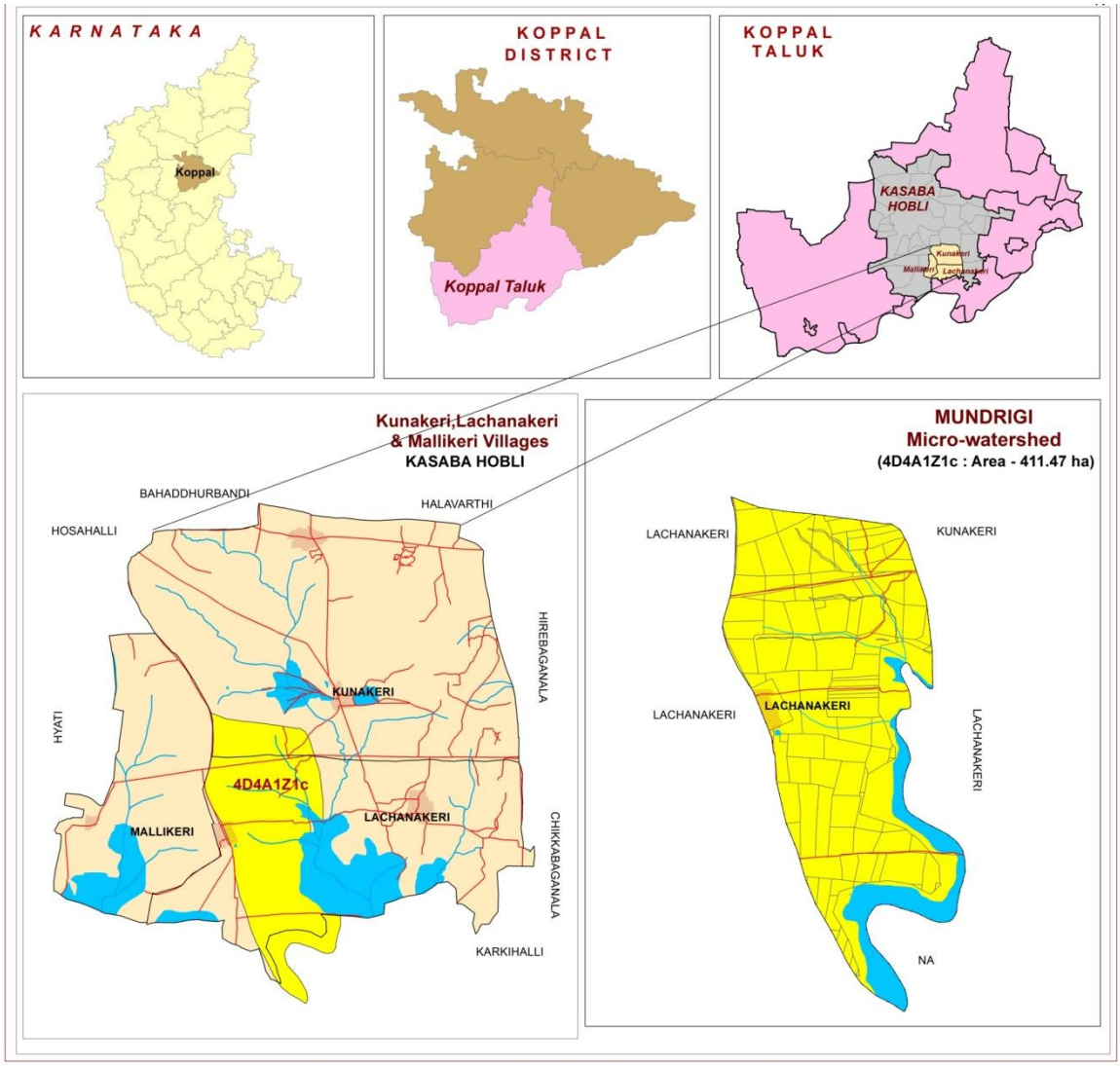

Fig.2.1 Location map of Mundrigi Microwatershed

2.2 Geology

Major rock formation observed in the microwatershed is granite gneiss (Figs.2.2). Granite gneisses are essentially pink to gray and are coarse to medium grained. They consist primarily of quartz, feldspar, biotite and hornblende. The gray granite gneisses are

highly weathered, fractured and fissured upto a depth of about 10 m. Dolerite dykes and quartz veins are common with variable width and found to occur in Bettageri village.

Fig.2.2 Granite and granite gneiss rocks

2.3 Physiography

Physiographically, the area has been identified as granite gneiss landscape based on geology. The microwatershed area has been further divided into mounds/ridges, summits, side slopes and very gently sloping uplands and nearly level plains based on slope and its relief features. The elevation ranges from 500-516 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 takes place 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 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 and 193 mm in the months 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**	

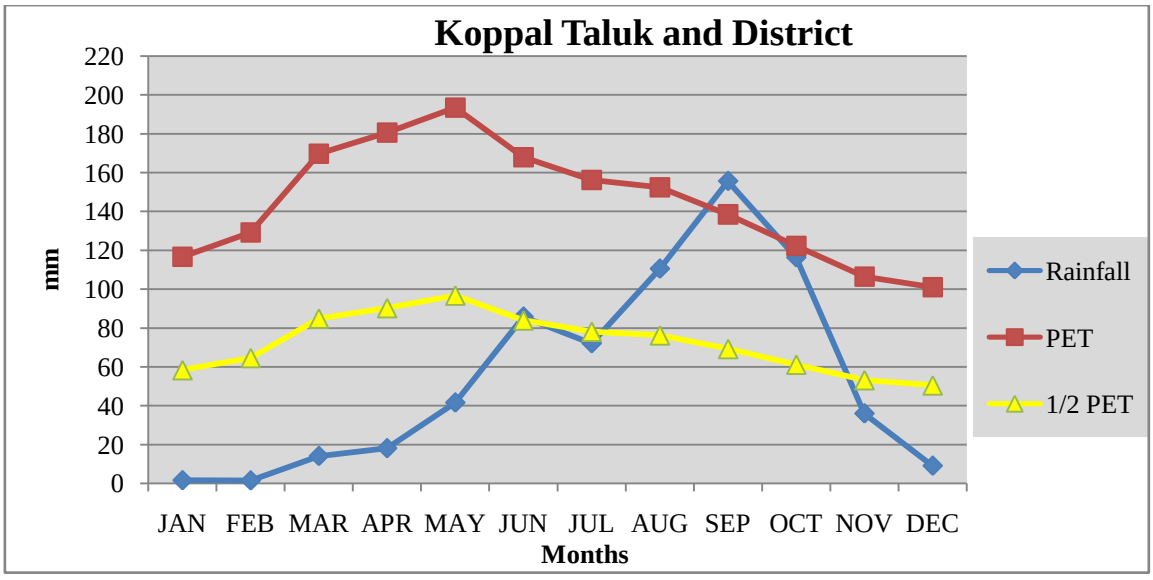

Fig. 2.3 Rainfall distribution in Koppal Taluk and District

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 Mundrigi 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 bouldery areas have very poor vegetative cover. 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 Mundrigi Microwatershed is presented in Fig.2.5. Major crops grown in the area are sorghum, maize, bajra, cotton, safflower, sunflower, red gram, horse gram, onion, mulberry, pomegranate, sugarcane, Bengalgram, marigold and groundnut (Fig 2.6). Simultaneously, enumeration of existing wells (bore wells and open wells) and other soil and water conservation structures in the microwatershed is made and their location in different survey numbers is marked on the cadastral map. Map showing the location of wells in Mundrigi Microwatershed is given 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

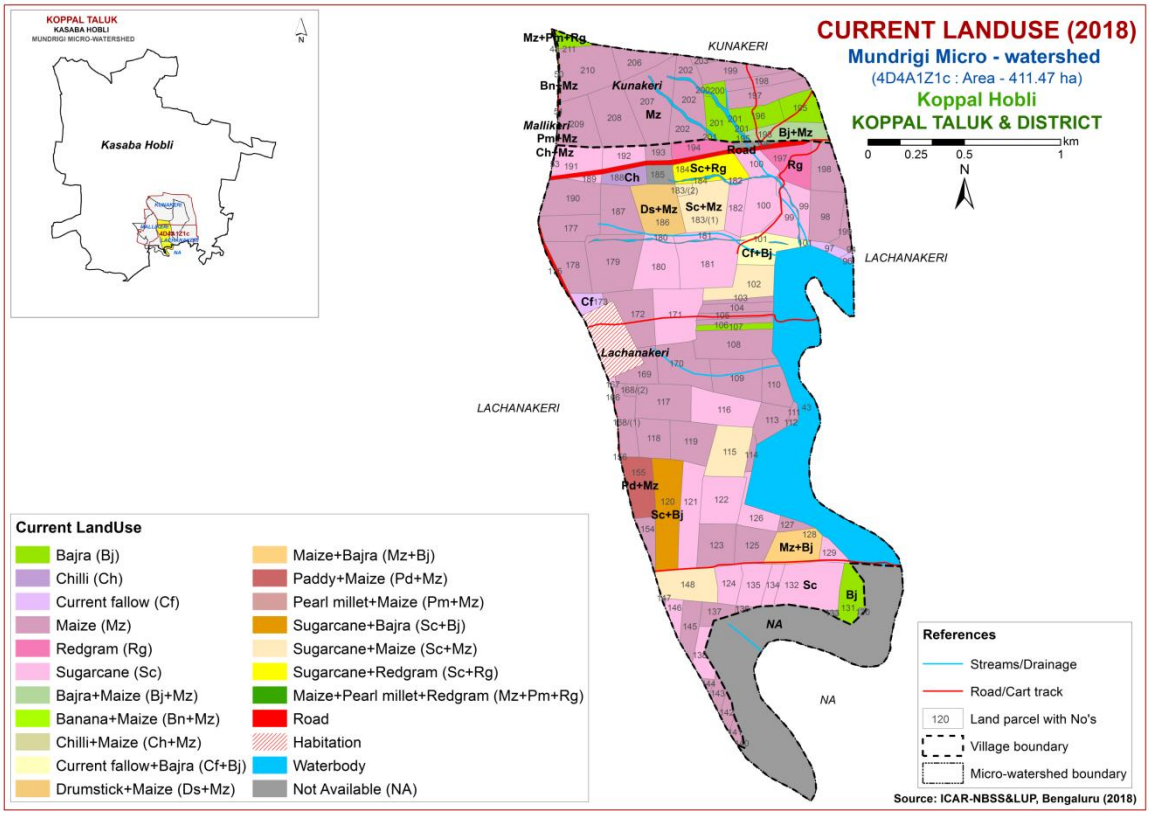

Fig.2.5 Current Land Use – Mundrigi Microwatershed

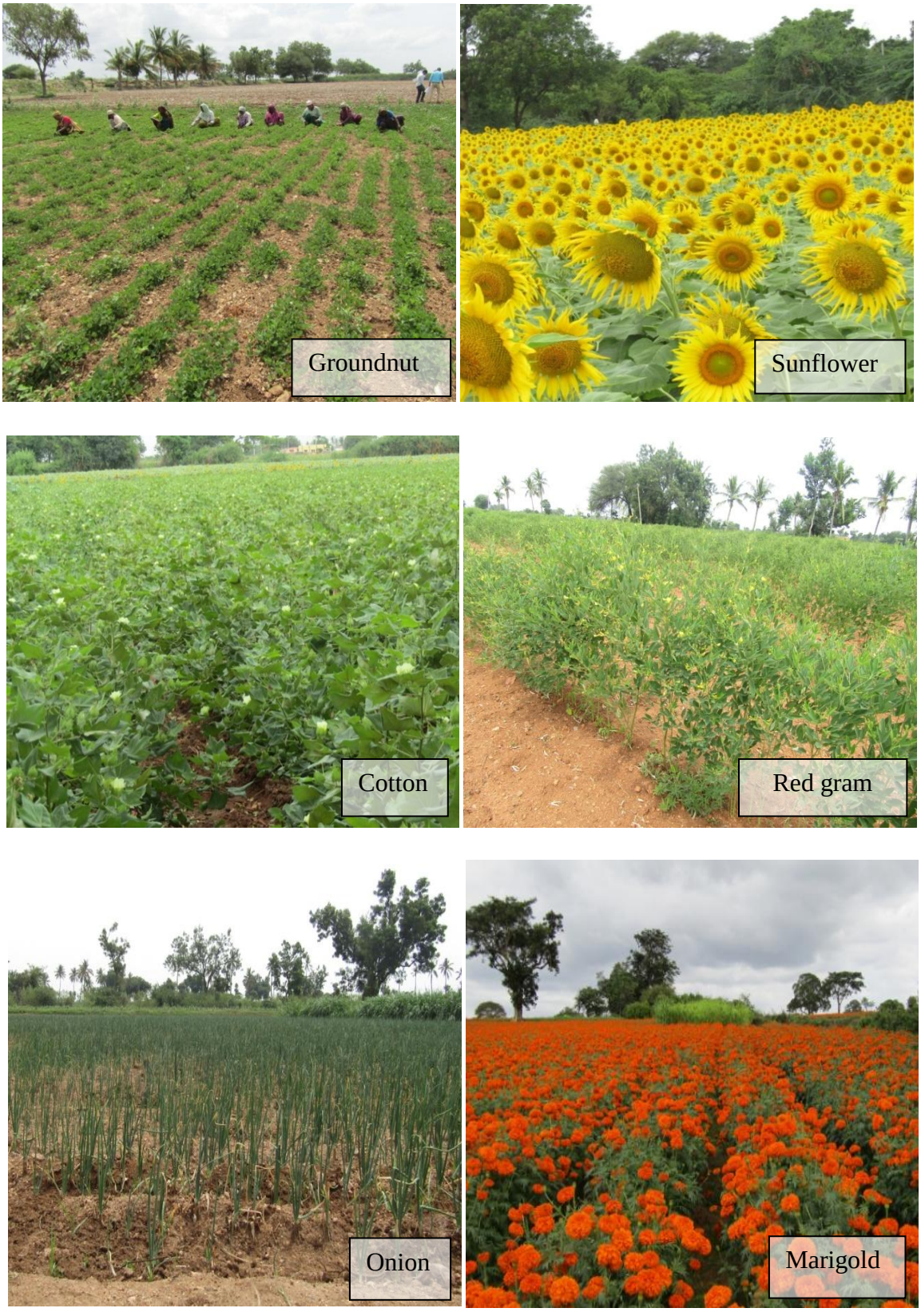

Fig.2.6 Different crops and cropping systems in Mundrigi Microwatershed

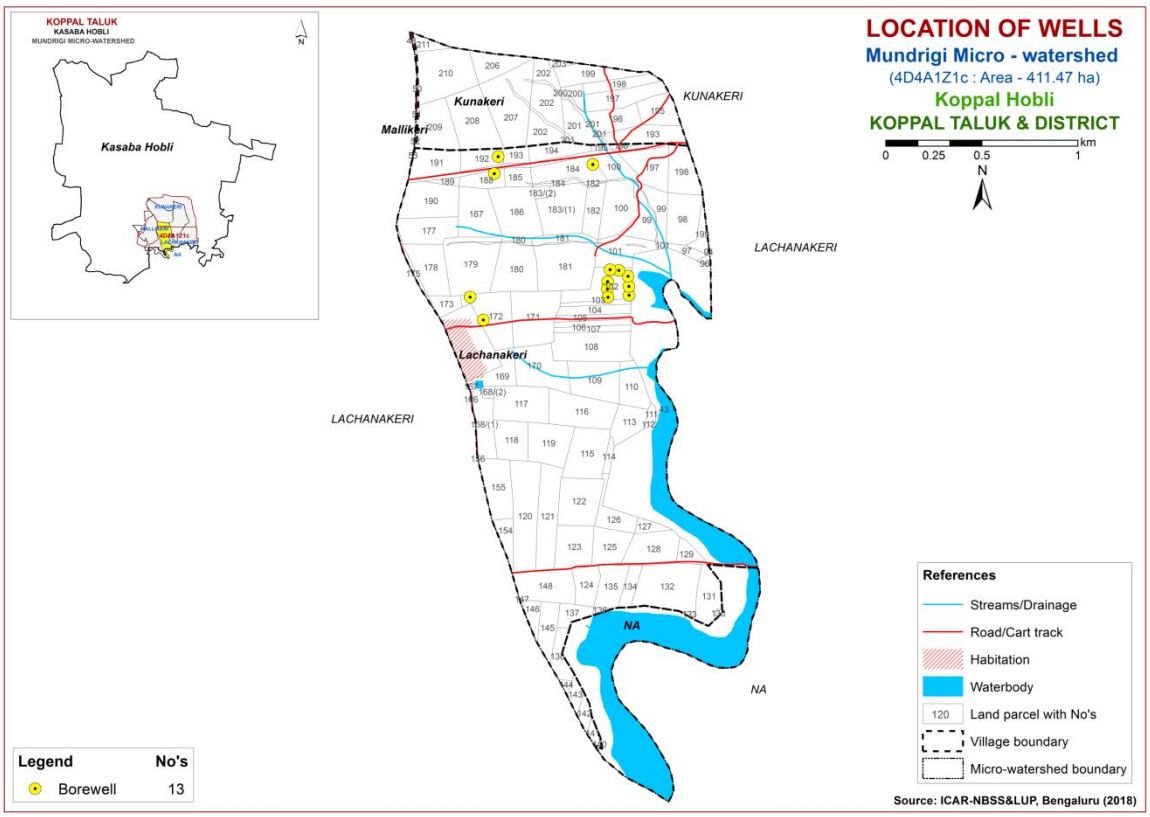

Fig.2.7 Location of wells - Mundrigi Microwatershed

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 Mundrigi 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 411 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 landscape and is divided into landforms such as uplands, summits and very gently sloping 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)

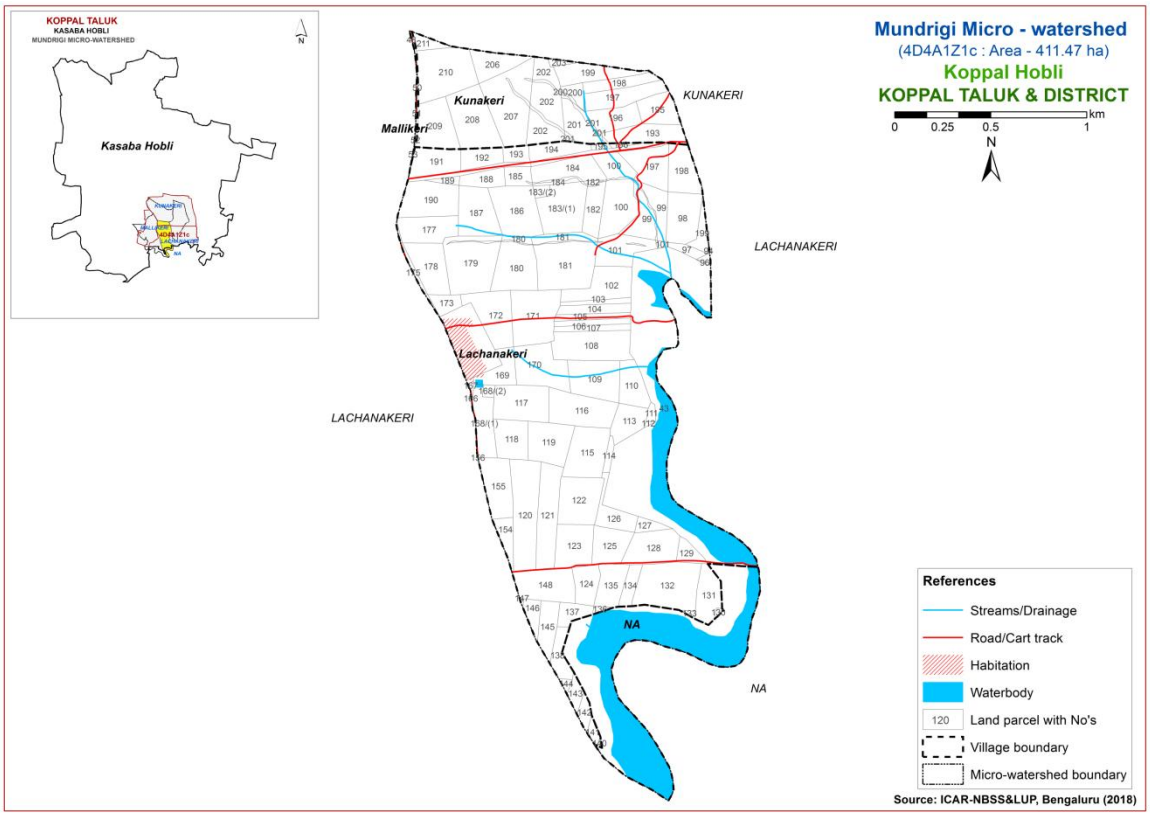

Fig 3.1 Scanned and Digitized Cadastral map of Mundrigi Microwatershed

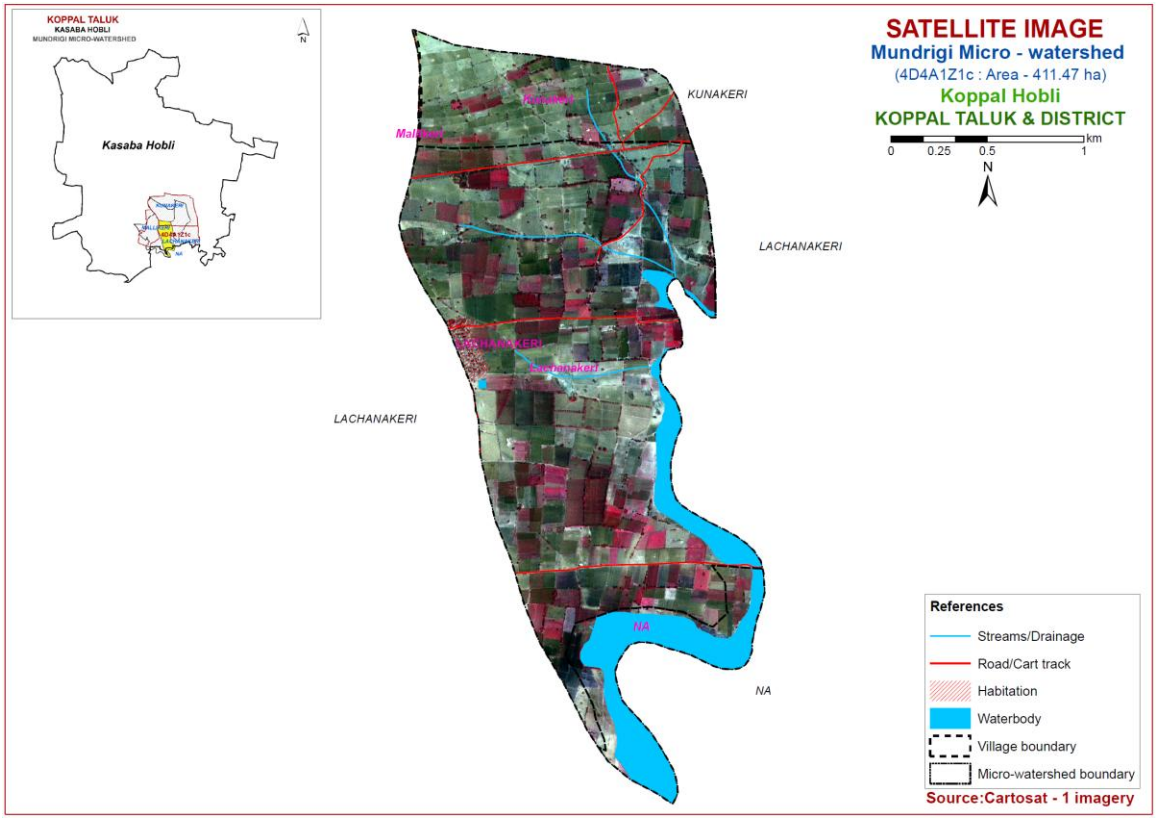

Fig.3.2 Satellite Image of Mundrigi Microwatershed

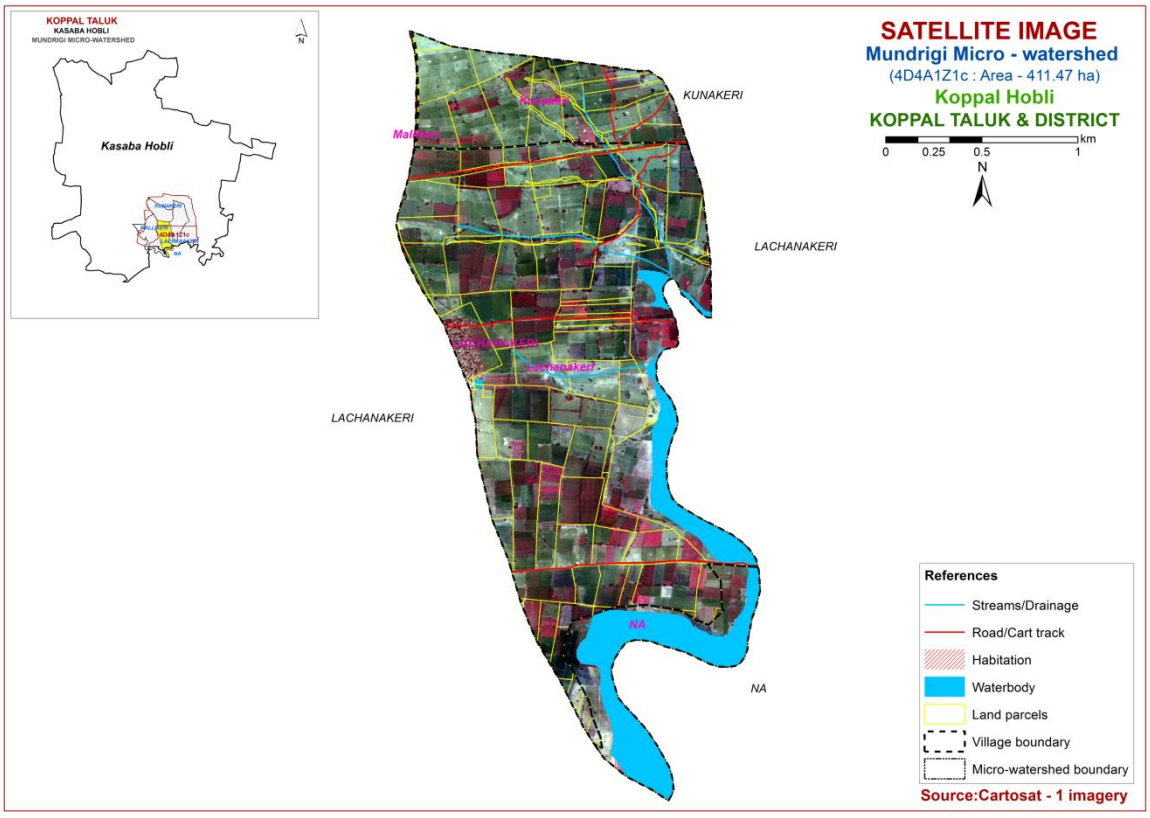

Fig.3.3 Cadastral map overlaid on IRS PAN+LISS IV merged imagery of Mundrigi Microwatershed

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 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).

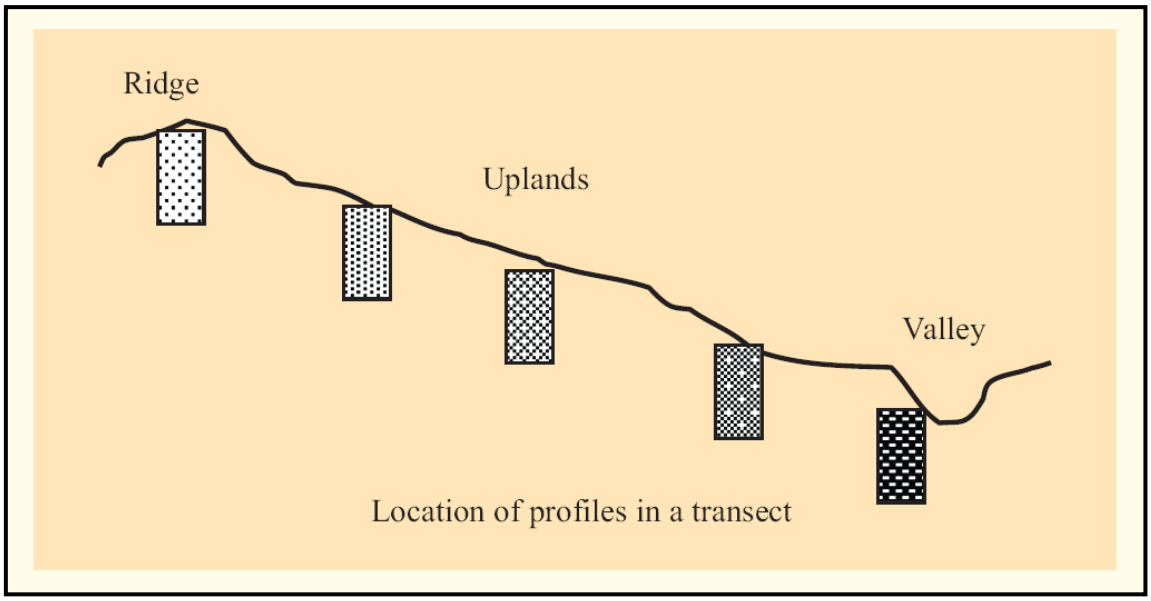

Fig: 3.4. Location of profiles in a transect

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 up to 200 cm or to the depth limited by rock or hard substratum and studied in detail for all their morphological and physical characteristics. The soil and site characteristics were recorded for all profile sites on a standard proforma as per the guidelines given in USDA Soil Survey Manual (Soil Survey Staff, 2012). Apart from the transect study, profiles were also studied at random, almost like in a grid pattern, outside the transect areas 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, 8 soil series were identified in Mundrigi Microwatershed.

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

Sl. No.	Soil Series	Depth (cm)	Colour (moist)	Texture	Gravel (%)	Horizon sequence	Calcareou-sness
SOILS OF GRANITE GNEISS LANDSCAPE							
1	Honnenahalli (HNH)	50-75	7.5YR3/3,4/3 10YR3/3	sc	<15	Ap-Bw-Cr	-
2	Hooradhahalli (HDH)	75-100	2.5YR2.5/4,3/4, 3/6	gsc-gc	>35	Ap-Bt-Cr	-
3	Chikkamegheri (CKM)	75-100	2.5YR2.5/3,3/4, 3/6	sc	<15	Ap-Bt-Cr	-
4	Bidanagere (BDG)	75-100	5YR3/3,3/4,4/3,5/4 2.5YR3/4	gc	35-60	Ap-Bt-Cr	-
5	Balapur (BPR)	100-150	2.5YR2.5/4,3/4	gsc-gc	>35	Ap-Bt-Cr	-
6	Jedigere (JDG)	100-150	5YR4/6,3/4, 7.5YR 3/4, 4/6	sc-c	<15	Ap-Bt-BC-Cr	-
7	Kumchahalli (KMH)	100-150	2.5YR3/4, 3/6	sc	<15	Bt-Cr	-
8	Ranatur (RTR)	>150	2.5YR2.5/3,2.5/4,3/3, 4/6	c	<15	Ap-Bt	-

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 minipits and a few auger bores representing different landforms occurring in the microwatershed were studied. In addition to the profile study, spot observations in the form of minipits, road cuts, terrace cuts etc., were studied to validate the soil boundaries on the soil map. The soil map shows the geographic distribution and area extent of 14 mapping units representing 8 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 14 phases mapped in the microwatershed. Each mapping unit (soil phase) delineated on the map has similar soil and site characteristics. In other words, all the farms or survey numbers included in one phase will have similar management needs and have to be treated accordingly.

3.5 Laboratory Characterization

Soil samples 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 Mundrigi farmer's fields 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.

3.6 Land Management Units (LMUs)

The 14 soil phases identified and mapped in the microwatershed were regrouped into 3 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 choosen for identification and delineation of LMUs. For Mundrigi Microwatershed, five soil and site characteristics, namely soil depth, soil texture, slope erosion and gravel content have been considered for defining LMUs. The land management units are expected to behave similarly for a given level of management.

Table 3.2 Soil map unit description of Mundrigi Microwatershed

Soil map unit No*	Soil Series	Soil Phase Symbol	Mapping Unit Description	Area in ha (%)
SOILS OF GRANITE GNEISS LANDSCAPE				
	HNH	Honnenahalli soils are moderately deep (50-75 cm), moderately well drained, have brown to dark brown, sandy clay soils occurring on nearly level to very gently sloping lowlands under cultivation		**14(3.47)**
471		HNHiB2	Sandy clay surface, slope 1-3%, moderate erosion	14(3.47)
	HDH	Hooradhahalli soils are moderately deep (75-100 cm), well drained, have dark red to dark reddish brown, red gravelly sandy clay to clay soils occurring on nearly level to moderately sloping uplands under cultivation		**37(9.01)**
111		HDHcB2g1	Sandy loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	30(7.41)
123		HDHhB2g1	Sandy clay loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	7(1.6)
	CKM	Chikkamegheri soils are moderately deep (75-100 cm), well drained, have dark brown to dark reddish brown, red sandy clay soils occurring on nearly level to very gently sloping uplands under cultivation		**76 (18.64)**
177		CKMiA1	Sandy clay surface, slope 0-1%, slight erosion	38(9.31)
178		CKMiB1	Sandy clay surface, slope 1-3%, slight erosion	38(9.33)

Soil map unit No*	Soil Series	Soil Phase Symbol	Mapping Unit Description	Area in ha (%)
	BDG	Bidanagere soils are moderately deep (75-100 cm), well drained, have dark reddish brown, red gravelly clay soils occurring on nearly level to gently sloping uplands under cultivation		**50 (12.03)**
187		BDGhB2	Sandy clay loam surface, slope 1-3%, moderate erosion	50 (12.03)
	BPR	Balapur soils are deep (100-150 cm), well drained, have dark reddish brown to dark red, gravelly sandy clay to clay soils occurring on nearly level to gently sloping uplands under cultivation		**89.06 (21.53)**
224		BPRcB2	Sandy loam surface, slope 1-3%, moderate erosion	0.06(0.01)
225		BPRcB2g1	Sandy loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	58 (14.02)
231		BPRhB2g1	Sandy clay loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	18 (4.45)
232		BPRhB2g2	Sandy clay loam surface, slope 1-3%, moderate erosion, very gravelly (35-60%)	13 (3.05)
	JDG	Jedigere soils are deep (100-150 cm), well drained, have dark brown to dark reddish brown, red sandy clay to clay soils occurring on nearly level to very gently sloping uplands under cultivation		**3(0.65)**
212		JDGiA1g1	Sandy clay surface, slope 0-1%, slight erosion, gravelly (15-35%)	3 (0.65)
	KMH	Kumchahalli soils are deep (100-150cm), well drained, have dark reddish brown to dark red, red sandy clay soils occurring on nearly level to very gently sloping uplands under cultivation		**0.02(0.01)**
201		KMHiB2	Sandy clay surface, slope 1-3%, moderate erosion	0.02(0.01)
	RTR	Ranatur soils are very deep (>150 cm), well drained, have dark reddish brown to dark red, clay soils occurring on nearly level to very gently sloping uplands under cultivation		**95 (23.17)**
285		RTRcB2	Sandy loam surface, slope 1-3%, moderate erosion	23(5.59)
288		RTRiB2	Sandy clay surface, slope 1-3%, moderate erosion	72(17.58)
1000		Others	Habitation and water body	**47(11.49)**

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

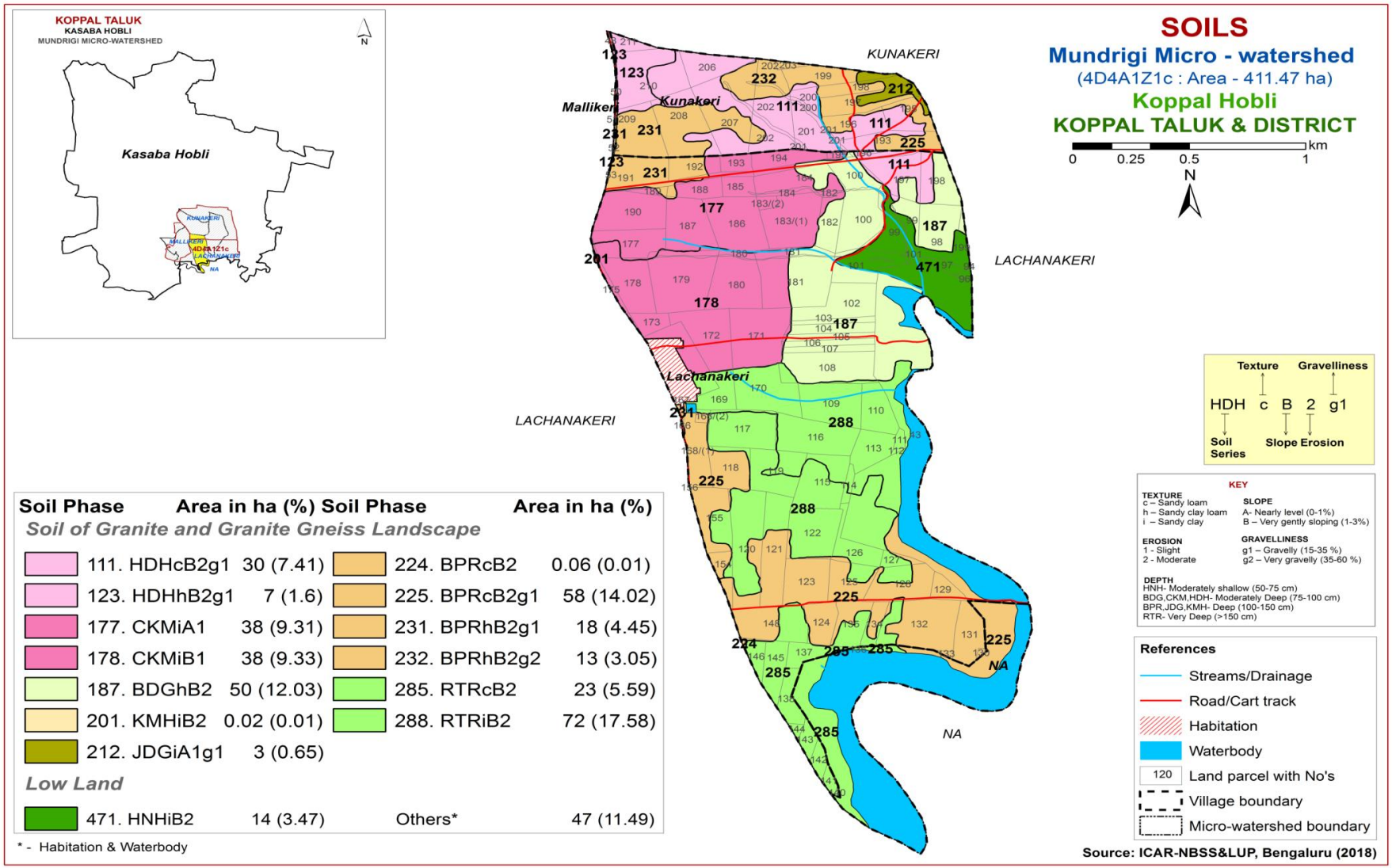

Fig 3.5 Soil Phase or Management Units- Mundrigi Microwatershed

Chapter 4

THE SOILS

Detailed information pertaining to the nature, extent and distribution of different kinds of soils occurring in Mundrigi Microwatershed is provided in this chapter. The microwatershed area has been identified as granite gneiss landscape based on geology. In all, 8 soil series are 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 8 soil series identified followed by 14 soil phases (management units) mapped (Fig. 3.5) are furnished below. The physical and chemical characteristics of soil series identified in Mundrigi microwatershed are given in Table 4.1 along with soil classification. The soils in any one map unit differ from place to place in their depth, texture, slope, gravelliness, erosion or any other site characteristic that affect management. The soil phase map can be used for identifying the suitability of areas for growing specific crops or for other alternative uses and also for deciding the type of conservation structures needed. The detailed information on soil and site-characteristics like soil depth, surface soil texture, slope, erosion, gravelliness, AWC, LCC etc, with respect to each of the soil phase identified is given village/survey number wise for the microwatershed in Appendix-I.

4.1 Soils of Granite gneiss landscape

In this landscape, 8 soil series are identified and mapped. Of these, Ranatur (RTR) series occupies major area of 95 ha (23%) followed by Balapur (BPR) 89 ha (22%), Chikkamegheri (CKM) 76 ha (19%), Bidanagere (BDG) 50 ha (12%), Hooradhahalli (HDH) 37 ha (9%), Honnenahalli (HNH) 14 ha (3%), Jedigere (JDG) 3 ha (1%) and Kumchahalli (KMH) <1 ha (<1%). The brief description of each soil series along with the soil phases identified and mapped is given below.

4.1.1 Honnenahalli (HNH) Series: Honnenahalli soils are moderately deep (50 to 75 cm), well drained, have brown to dark brown, sandy clay soils. They have developed from colluvio-alluvium and occur on nearly level to very gently sloping lowlands. The Honnenahalli series has been classified as a member of the fine-loamy, mixed, isohyperthermic family of Typic Haplustepts.

The thickness of the solum ranges from 52 to 74 cm. The thickness of A-horizon ranges from 12 to 21 cm. Its colour is in 7.5 YR and 10 YR hue with value 3 and chroma 3 to 4. The texture varies from sandy clay loam to sandy loam with 5 to 10 per cent gravel. The thickness of B horizon ranges from 45 to 62 cm. Its colour is in 7.5 YR and 10 YR hue with value 3 and chroma 3 to 4. Its texture is sandy clay. The available water capacity is medium (100-150 mm/m). Only one soil phase was identified and mapped.

Landscape and soil profile characteristics of Honnenahalli (HNH) Series

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

The thickness of the solum ranges from 76 to 100 cm. The thickness of A-horizon ranges from 11 to 19 cm. Its colour is in 5 YR and 2.5 YR hue with value 3 to 4 and chroma 3 to 6. The texture varies from loamy sand to sandy clay with 15 to 50 per cent gravel. The thickness of B horizon varies from 65 to 83 cm. Its colour is in 2.5 YR hue with value 2.5 to 3 and chroma 4 to 6. Texture is sandy clay to clay with 35 to 50 per cent gravel. The available water capacity is low (50-100mm/m). Two soil phases were identified and mapped.

Landscape and soil profile characteristics of Hooradhahalli (HDH) Series

4.1.3 Chikkamegheri (CKM) Series: Chikkamegheri soils are moderately deep (75-100 cm), well drained, have dark brown to dark reddish brown and red, sandy clay soils. They have developed from weathered granite gneiss and occur on nearly level to very gently sloping uplands. The Chikkamegheri series has been classified as a member of the fine, mixed, isohyperthermic family of Rhodic Paleustalfs.

The thickness of the solum ranges from 76 to 100 cm. The thickness of A-horizon ranges from 11 to 24 cm. Its colour is in 7.5 YR, 5YR and 2.5 YR hue with value 2 to 4 and chroma 3 to 6. The texture varies from sandy clay loam to sandy clay with 10 to 15 per cent gravel. The thickness of B horizon ranges from 65 to 86 cm. Its colour is in 2.5 YR hue with value 2.5 to 3 and chroma 3 to 6. Its texture is dominantly sandy clay to clay. The available water capacity is medium (100-150 mm/m). Two soil phases were identified and mapped.

Landscape and soil profile characteristics of Chikkamegheri (CKM) Series

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

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

Landscape Soil Profile Characteristics of Bidanagere (BDG) Series

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

The thickness of the solum ranges from 102 to 147 cm. The thickness of A-horizon ranges from 12 to 17cm. Its colour is in 5 YR and 2.5 YR hue with value and chroma 3 to 4. The texture ranges from loamy sand to sandy clay with 15 to 50 per cent gravel. The thickness of B horizon ranges from 90 to 132 cm. Its colour is in 2.5 YR hue with value 2.5 to 3 and chroma 4 to 6. Texture is sandy clay to clay with 35 to 50 per cent gravel. The available water capacity is medium (100-150 mm/m). Four soil phases were identified and mapped.

Landscape and soil profile characteristics of Balapur (BPR) Series

4.1.6 Jedigere (JDG) Series: Jedigere soils are deep (100-150 cm) well drained, have yellowish red to strong brown, sandy clay to clay soils. They have developed from weathered granite gneiss and occur on nearly level to very gently sloping uplands under cultivation. The Jedigere series has been classified as a member of the fine, mixed, isohyperthermic family of Typic Haplustalfs.

The thickness of the solum ranges from 117 to 145 cm. The thickness of A-horizon ranges from 13 to 21 cm. Its colour is in hue 5 YR and 7.5 YR with value 2 to 4 and chroma 2 to 6. Its texture is dominantly sandy clay and sand clay loam. The thickness of B horizon ranges from 104 to 124 cm. Its colour is in hue 5 YR and 7.5 YR with value 2 to 4 and chroma 3 to 6. Its texture is dominantly clay. The available water capacity is very high (>200mm/m). Only one soil phase was identified and mapped.

Landscape and Soil Profile Characteristics of Jedigere (JDG) Series

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

The thickness of the solum ranges from 102 to 150 cm. The thickness of A-horizon ranges from 11 to 23 cm. Its colour is in 5 YR and 2.5 YR hue with value 2.5 to 3 and chroma 3 to 6. The texture is dominantly sandy clay. The thickness of B horizon ranges from 95 to 132 cm. Its colour is in 2.5 YR hue with value 3 and chroma 4 to 6. Its texture is dominantly sandy clay loam to sandy clay. The available water capacity is high (150-200 mm/m). Only one soil phase was identified and mapped.

Landscape and soil profile characteristics of Kumchahalli (KMH) Series

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

The thickness of the solum is more than 150 cm. The thickness of A-horizon ranges from 8 to 14 cm. Its colour is in 5 YR and 2.5 YR hue with value 2.5 to 4 and chroma 3 to 6. The texture varies from sandy loam to sand clay. The thickness of B horizon is more than 150 cm. Its colour is in 2.5 YR hue with value 2.5 to 3 and chroma 3 to 6. Its texture is clay. The available water capacity is high (150-200 mm/m). Two soil phases were identified and mapped.

Landscape and soil profile characteristics of Ranatur (RTR) Series

Table: 4.1 Physical and Chemical Characteristics of Soil Series identified in Mundrigi Microwatershed

Series Name: Honnenahalli (HNH), **Pedon:** R-9
Location: $15^0$31'26"N, $76^0$15'55.0"E Hosura village, Koppal Taluk and District
Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Fine-loamy, mixed, isohyperthermic Typic Haplustepts

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-20	Ap	45.73	27.63	26.65	18.85	8.75	5.25	5.77	7.11	15	scl	16.95	8.71
20-35	Bw1	53.87	20.02	26.11	20.95	12.07	8.05	6.81	5.99	15	scl	15.94	8.39
35-50	Bw2	61.98	12.47	25.54	24.38	15.60	9.09	7.33	5.58	15	scl	15.27	9.04
50-70	Bw3	62.35	10.44	27.21	28.81	13.48	8.13	6.28	5.66	10	scl	17.44	9.25

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	7.94	-	-	0.99	1.24	-	14.78	2.59	0.10	0.38	17.85	18.00	0.68	99.15	2.13
20-35	7.68	-	-	0.09	0.81	-	15.03	3.02	0.10	0.32	18.46	18.40	0.70	100.34	1.72
35-50	7.63	-	-	0.06	0.48	-	14.28	2.91	0.10	0.28	17.56	17.50	0.69	100.37	1.61
50-70	7.67	-	-	0.06	0.48	-	13.78	2.29	0.13	0.36	16.56	18.20	0.67	90.99	1.96

Contd....

Soil Series: Hooradhahalli (HDH), **Pedon:** RM-69
Location: $13^0$24'31"N, $76^0$33'41"E, (4D3D8G2d), Hesarahalli village, Chikkanayakanahalli taluk, Tumukura district
Analysis at: NBSS&LUP, Regional Centre, Bengaluru **Classification:** Clayey-skeletal, mixed, isohyperthermic Rhodic Paleustalfs

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-18	Ap	72.56	15.17	12.27	4.57	8.33	17.38	23.88	18.39	35	sl	-	-
18-33	Bt1	56.29	10.75	32.96	7.88	10.24	13.41	14.43	10.34	55	scl	-	-
33-58	Bt2	46.66	10.79	42.55	10.79	9.87	8.43	9.04	8.53	55	sc	-	-
58-90	Bt3	43.09	13.63	43.27	9.90	8.25	7.32	8.76	8.87	45	c	-	-

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-18	6.54	-	-	0.07	0.60	0.00	2.68	1.38	0.44	0.42	4.91	5.84	0.48	84.07	7.11
18-33	5.90	-	-	0.07	0.52	0.00	3.99	1.27	0.09	0.37	5.71	8.61	0.26	66.32	4.29
33-58	6.16	-	-	0.07	0.44	0.00	4.92	1.67	0.08	0.55	7.22	10.00	0.24	72.23	5.50
58-90	6.39	-	-	0.06	0.40	0.00	4.30	2.02	0.08	0.46	6.87	9.21	0.21	74.61	5.05

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Series Name: Chikkamegheri (CKM), **Pedon:** RM-2
Location: $15^0$21'40"N, $76^0$16'43"E, Gudanahalli 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
0-10	Ap	66.80	5.51	27.69	10.14	10.04	20.29	14.75	11.58	-	scl	20.59	7.15
10-25	Bt1	39.52	7.17	53.32	8.75	9.59	7.27	8.43	5.48	-	c	26.96	13.99
25-38	Bt2	42.00	7.16	50.84	13.16	8.74	6.42	8.53	5.16	-	c	26.51	13.42
38-55	Bt3	41.77	10.31	47.92	15.19	8.54	6.33	7.38	4.32	10	c	25.28	14.10
55-70	Bt4	44.03	8.96	47.01	15.72	9.22	6.92	6.81	5.35	20	c	24.30	14.35
70-90	Bt5	56.02	8.46	35.52	11.41	17.07	12.36	10.26	4.92	25	sc	20.59	13.06

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}							%	%
0-10	7.99	-	-	0.326	0.83	4.44	9.35	4.76	0.28	0.54	14.93	12.50	0.45	119	1.73
10-25	7.36	-	-	0.345	0.99	2.40	10.37	4.84	0.10	1.18	16.48	17.60	0.33	94	2.67
25-38	6.69	-	-	0.477	0.79	0.00	10.25	4.20	0.09	1.61	16.15	16.10	0.32	100	4.00
38-55	6.45	-	-	0.548	0.63	0.00	9.43	2.86	0.10	1.52	13.91	14.80	0.31	94	4.11
55-70	6.35	-	-	0.532	0.71	0.00	9.59	2.79	0.11	1.66	14.16	14.60	0.31	97	4.56
70-90	6.44	-	-	0.613	0.27	0.00	9.58	3.10	0.19	1.87	14.74	14.70	0.41	100	5.08

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Series: Bidanagere (BDG), **Pedon**: RM-3
Location: $13^0$22'11"N, $76^0$38'03"E, (4D3D8G1a), Tharabenahalli village, Chikkanayakanahalli Taluk, Tumakuru District.
Analysis at: NBSS&LUP, Regional Centre, Bengaluru **Classification:** Clayey-skeletal, mixed, isohyperthermic Rhodic Paleustalfs

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-20	Ap	81.19	11.25	7.56	12.54	15.07	17.90	21.94	13.75	50	ls	-	-
20-35	Bt1	57.45	11.45	31.10	12.76	11.02	10.92	12.45	10.31	50	scl	-	-
35-92	Bt2	44.63	7.85	47.52	12.40	9.61	8.37	7.75	6.51	60	c	-	-

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-20	6.24	-	-	0.06	0.60	0.00	1.61	0.26	0.10	0.01	1.98	3.76	0.50	52.56	0.35
20-35	5.99	-	-	0.02	0.40	0.00	4.25	0.46	0.08	0.28	5.07	8.02	0.26	63.18	3.46
35-92	6.70	-	-	0.03	0.20	0.00	5.45	0.31	0.10	0.22	6.09	9.90	0.21	61.48	2.24

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Soil Series: Balapur (BPR), **Pedon**: RM-78
Location: $13^0$26'39"N, $76^0$35'03"E, (4D3D8G2c), Kasaba, Chikkanayakanahalli taluk, Tumakuru district
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
0-12	Ap	65.66	18.66	15.68	4.14	6.16	13.33	21.82	20.20	-	sl	-	-
12-34	Bt1	61.91	11.52	26.57	2.36	6.78	12.53	21.36	18.89	-	scl	-	-
34-60	Bt2	51.81	11.24	36.94	4.66	5.70	12.23	15.96	13.26	30	sc	-	-
60-84	Bt3	46.61	9.02	44.37	14.70	6.88	7.51	8.97	8.55	55	sc	-	-
84-112	Bt4	48.75	12.92	38.33	15.73	8.13	6.87	8.23	9.79	60	sc	-	-
112-127	Bc	50.98	24.74	24.28	5.25	4.63	5.15	10.92	25.03	50	scl	-	-

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-12	6.64	-	-	0.03	0.56	0.00	1.90	1.32	0.21	0.03	3.46	5.45	0.35	63.48	0.51
12-34	6.99	-	-	0.02	0.48	0.00	3.66	1.90	0.07	0.08	5.70	7.82	0.29	72.93	0.96
34-60	7.29	-	-	0.02	0.40	0.00	5.13	2.08	0.11	0.20	7.52	11.19	0.30	67.18	1.75
60-84	7.50	-	-	0.02	0.32	0.00	5.83	6.36	0.13	0.23	12.55	12.38	0.28	101.43	1.83
84-112	7.54	-	-	0.02	0.24	0.00	6.02	6.59	0.11	0.25	12.96	12.77	0.33	101.49	1.97
112-127	7.90	-	-	0.02	0.20	0.00	8.04	3.62	0.07	0.32	12.04	12.47	0.51	96.56	2.55

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Series Name: Jedigere (JDG) **Pedon:** R5
Location: $15^0$29'06"N, $76^0$10'38" E Chennahalu village, Yelburga Taluk and Koppal District
Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Fine, mixed, isohyperthermic Typic Haplustalfs

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-14	Ap	70.63	8.33	21.04	16.26	23.58	13.41	11.59	5.79	-	scl	13.46	6.17
14-39	Bt1	49.95	11.56	38.49	10.61	17.40	10.30	7.42	4.22	-	sc	23.07	13.70
39-62	Bt2	45.88	11.44	42.68	10.72	16.70	9.28	6.80	2.37	-	sc	25.24	15.20
62-94	Bt3	42.89	8.51	48.61	9.48	14.54	8.35	6.80	3.71	-	c	25.30	14.07
94-118	Bt4	45.24	11.90	42.86	10.66	15.53	8.59	6.63	3.83	-	sc	23.52	13.58

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-14	6.11			0.078	0.83		5.58	2.49	0.18	0.19	8.45	9.41	1.12	90	2.06
14-39	6.87			0.123	0.67		12.01	5.62	0.32	0.29	18.24	18.22	1.57	100	1.59
39-62	7.65			0.121	0.50				0.42	0.43		21.68	1.89	-	1.99
62-94	8.21			0.188	0.28				0.34	0.41		21.09	2.47	-	1.93
94-118	8.23			0.189	0.24				0.33	0.36		17.62	1.48	-	2.02

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S**eries Name:** Kumchahalli (KMH), **Pedon:** RM-9
Location: $15^0$20'05"N, $76^0$13'21"E, Basapura village, Koppal Taluk and District
Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Fine, 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
0-13	Ap	51.76	9.05	39.19	7.99	8.84	13.42	14.38	7.14	-	sc	20.08	13.69
13-27	A21	53.50	8.12	38.38	7.00	11.05	15.21	14.33	5.91	-	sc	17.05	12.32
27-43	A22	63.60	5.01	31.40	3.85	11.56	24.52	18.52	5.14	-	scl	11.76	9.09
43-64	Bt1	48.74	5.91	45.35	8.87	9.31	12.49	12.27	5.81	10	sc	16.68	13.35
64-84	Bt2	45.13	8.90	45.97	9.86	7.12	10.95	10.62	6.57	20	sc	17.45	13.42
84-114	BC	65.04	6.94	28.02	10.49	16.21	17.80	13.88	6.67	40	scl	13.20	9.75

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-13	7.2	-	-	0.193	0.81	3.00	9.69	3.93	1.41	0.08	15.10	15.07	0.38	100	0.54
13-27	7.13	-	-	0.161	0.7	3.00	8.69	3.57	1.29	0.16	13.70	13.75	0.36	100	1.14
27-43	7.31	-	-	0.096	0.89	2.64	5.19	2.36	1.07	0.24	8.86	9.46	0.30	94	2.51
43-64	7.65	-	-	0.089	1.16	2.52	8.25	2.88	0.72	0.35	12.20	12.65	0.28	96	2.79
64-84	7.98	-	-	0.1	0.38	3.12	10.49	2.88	0.26	0.41	14.04	14.63	0.32	96	2.78
84-114	8.23	-	-	0.121	0.58	2.88	8.02	1.87	0.09	0.43	10.41	10.67	0.38	98	4.02

Contd....

Soil Series: Ranatur (RTR), **Pedon:** TR7-3
Location: $15^0$07'58.3"N, $75^0$38'30.6"E, (4D4A3G2d), Devihal-4 microwatershed, Shirahatti taluk, Gadag district
Analysis at: NBSS&LUP, Regional Centre, Bengaluru **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
0-10	Ap	80.08	8.23	11.69	7.22	16.46	17.68	21.95	16.77	<5	sl	-	-
10-34	Bt1	44.96	12.64	42.39	3.84	11.42	10.07	11.32	8.31	<5	c	-	-
34-71	Bt2	43.35	13.02	43.63	5.20	10.40	9.77	9.77	8.21	<5	c	-	-
71-100	Bt3	47.00	10.23	42.77	10.43	12.71	9.09	7.54	7.23	<5	sc	-	-
100-138	Bt4	45.04	12.78	42.17	8.37	10.33	9.30	9.19	7.85	<5	sc	-	-
138-170	Bt5	44.63	13.79	41.58	9.19	8.99	8.26	9.40	8.78	<5	c	-	-

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-10	6.47	-	-	0.03	0.49	0.00	5.61	1.33	0.13	0.01	7.07	7.07	0.60	100.00	0.41
10-34	6.46	-	-	0.03	0.57	0.00	11.69	3.19	0.14	0.01	15.03	16.87	0.40	89.00	0.06
34-71	7.23	-	-	0.03	0.53	1.20	-	-	0.16	0.01	-	17.33	0.40	100.00	0.06
71-100	7.60	-	-	0.03	0.3	0.30	-	-	0.17	0.04	-	17.21	0.40	100.00	0.23
100-138	7.88	-	-	0.03	0.6	0.42	-	-	0.17	0.15	-	16.30	0.39	100.00	0.92
138-170	8.12	-	-	0.08	0.64	0.60	-	-	0.14	0.06	-	16.87	0.41	100.00	0.36

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

The land capability subclasses have been further subdivided into land capability units based on the kinds of limitations present in each subclass. Ten land capability units are identified 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 14 soil map units identified in the Mundrigi microwatershed are grouped under 2 Land capability classes and 5 land capability subclasses (Fig. 5.1). Entire cultivated area of about 363 ha (89%) is suitable for agriculture. An area of about 47 ha (11%) is under others (Habitation and Settlements).

Maximum area of about 225 ha (55%) are good lands (Class II) and distributed in the major part of the microwatershed with minor problems of soil, drainage and erosion. An area about 138 ha (34%) are moderately good lands (Class III) and distributed in the central, northern and southern part of the microwatershed with moderate limitations of soil and erosion.

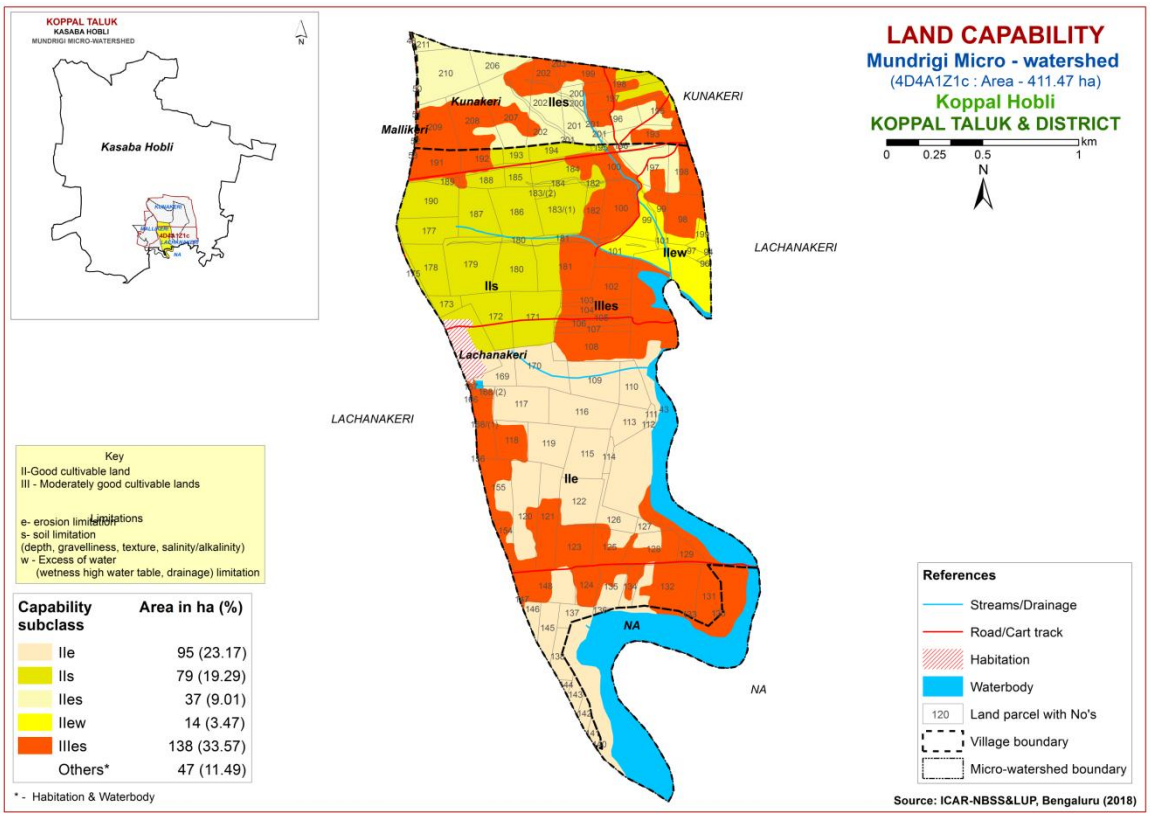


Fig. 5.1 Land Capability map of Mundrigi Microwatershed

5.2 Soil Depth

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

Moderately shallow (50-75 cm) soils cover an area of about 14 ha (3%) and occur in the northern part of the microwatershed. Moderately deep (75-100 cm) soils cover a major area of about 163 ha (40%) and distributed in the central and northern part of the microwatershed. An area of about 91 ha (22%) is under deep (100-150 cm) soils and occur in the central, northern and southern part of the microwatershed. Very deep (>150 cm) soils occupy an area of 95 ha (23%) and occur in the central and southern part of the microwatershed.

The most productive lands cover about 186 ha (45%) where all climatically adapted long duration crops can be grown.

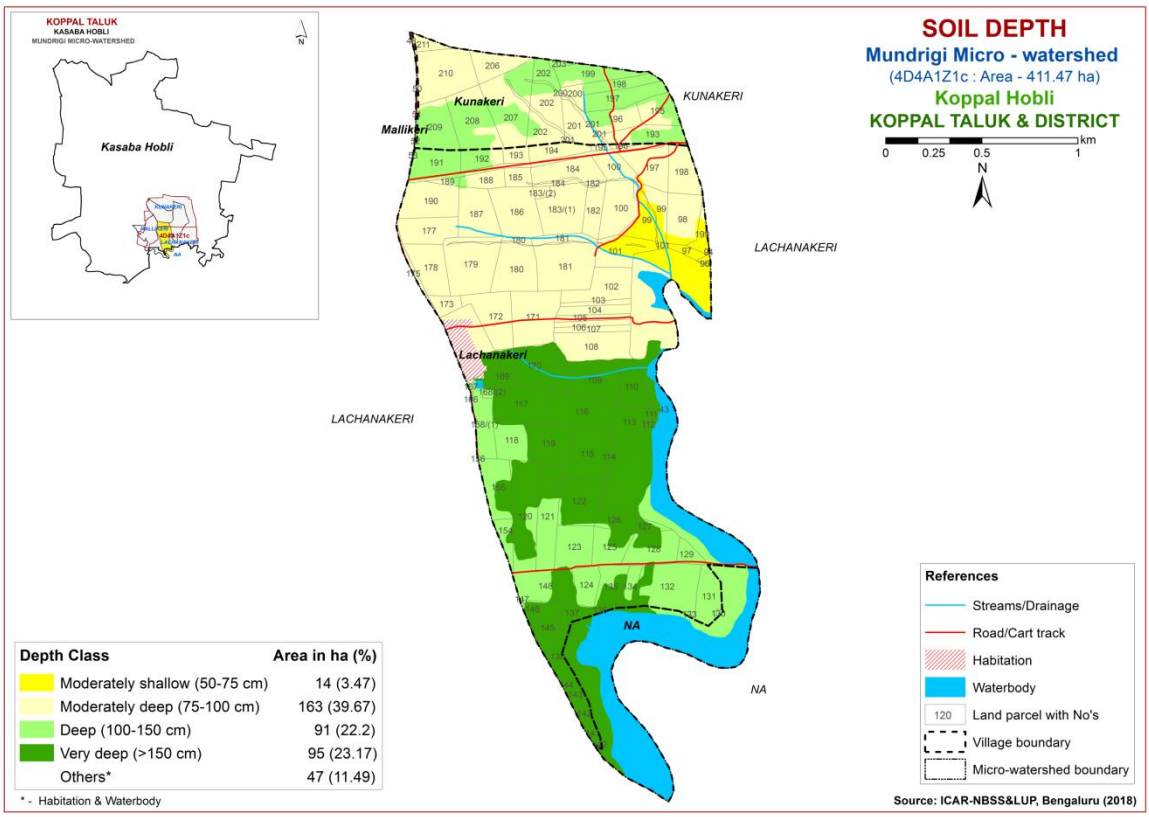


Fig. 5.2 Soil Depth map of Mundrigi Microwatershed

5.3 Surface Soil Texture

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

Maximum area of about 198 ha (48%) is loamy at the surface and distributed in the central, northern and southern part of the microwatershed. An area of 166 ha (40%) has soils that are clayey at the surface and occur in the central, northern and southern part of the microwatershed.

Entire area has most productive lands with respect to surface soil texture where 40 per cent area clayey soils. These soils 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 soils (48%) which also have high potential for soil-water retention and nutrient availability but have no drainage or other physical problems.

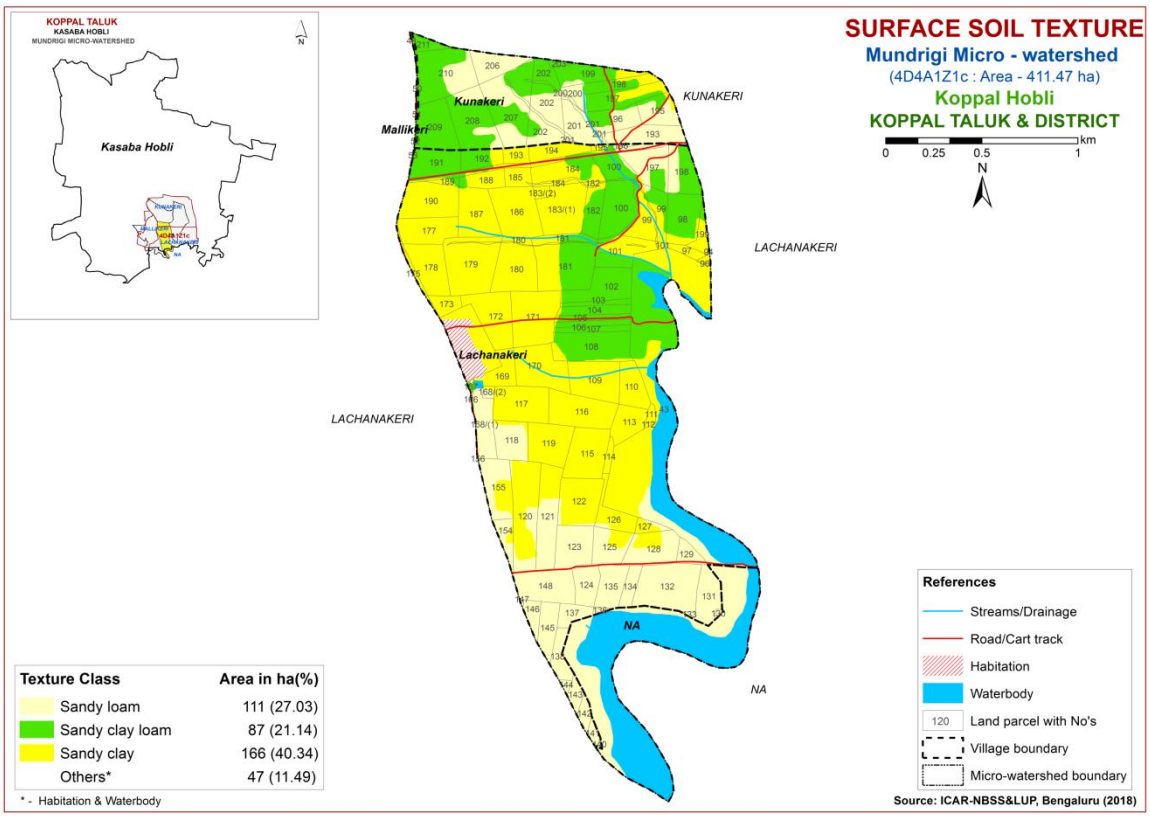


Fig. 5.3 Surface Soil Texture map of Mundrigi Microwatershed

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 spatial distribution in the microwatershed is shown in Fig.5.4.

Maximum area of about 236 ha (57%) has non gravelly (<15%) soils and occur in the major part of the microwatershed. An area of about 116 ha (28%) has gravelly (15-35%) soils and distributed in the central, northern and southern part of the microwatershed. An area of about 13 ha (3%) has very gravelly (35-60%) soils and occur in the northern part of the microwatershed.

An area of about 236 ha (57%) are most productive lands with respect to gravelliness. They are non-gravelly with less than 15 per cent gravel and have potential for growing both annual and perennial crops. The problem lands cover about 129 ha (31%) that are gravelly to very gravelly where only medium or short duration crops can be grown.

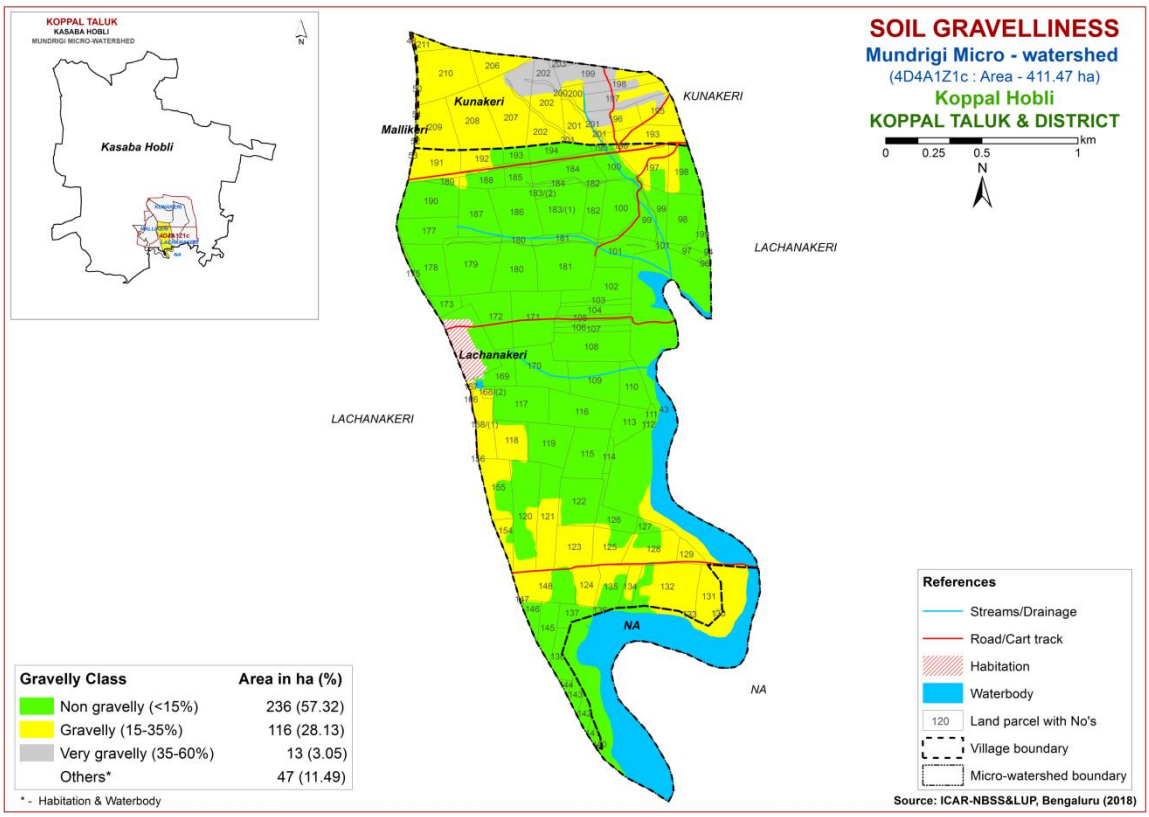


Fig. 5.4 Soil Gravelliness map of Mundrigi Microwatershed

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 (Fig. 5.5).

An area of about 87 ha (21%) has soils that are very low (<50 mm/m) in available water capacity and distributed in the central and northern part of the microwatershed. Low (51-100 mm/m) in available water capacity cover an area of about 89 ha (22%) and occur in the central, northern and southern part of the microwatershed. An area of about 94 ha (23%) is medium (101-150 mm/m) in available water capacity and occur in the central and northern part of the microwatershed. High (151-200 mm/m) in available water capacity cover a major area of about 95 ha (23%) and distributed in the central and southern part of the microwatershed.

An area of about 176 ha (43%) 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 95 ha (23%) has soils that have very high potential

(151-200 mm/m) with regard to available water capacity where all climatically adapted long duration crops can be grown successfully.

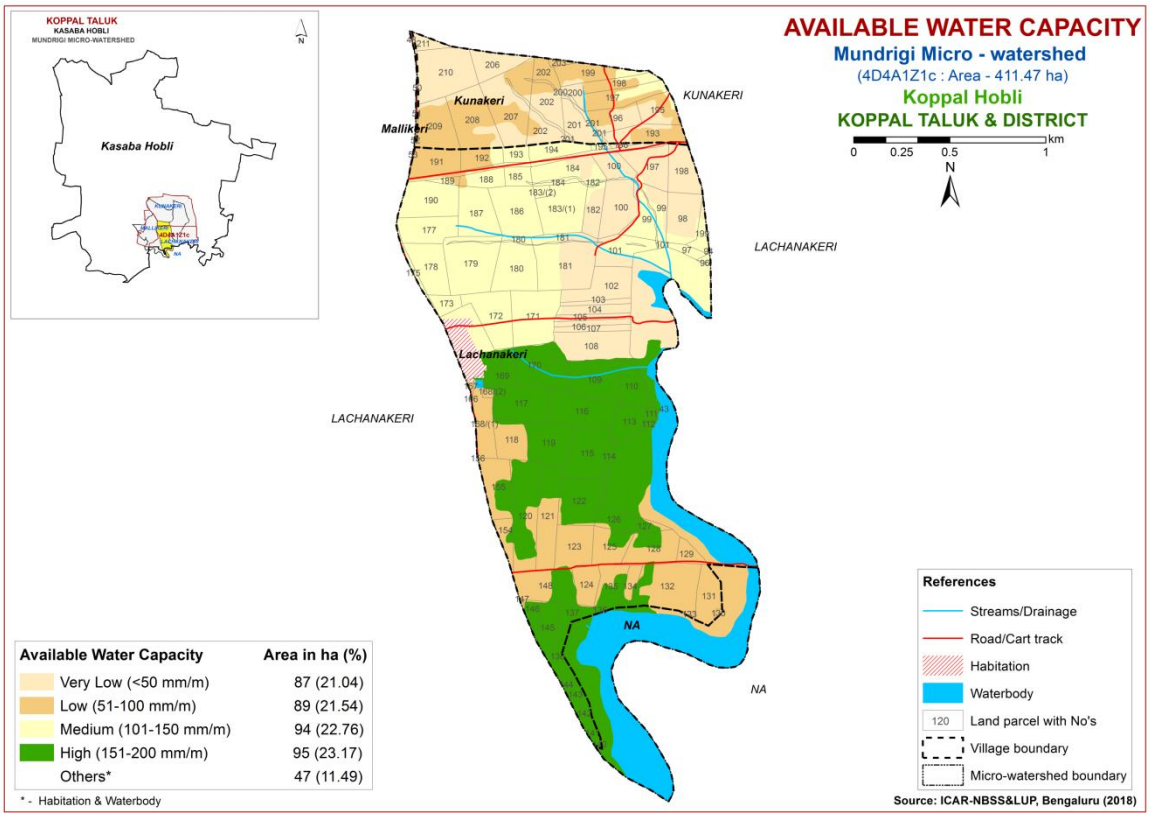


Fig. 5.5 Soil Available Water Capacity map of Mundrigi Microwatershed

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 different 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 41 ha (10%) falls under nearly level (0-1% slope) lands and distributed in the northern part of the microwatershed. Maximum area of about 323 ha (79%) falls under very gently sloping (1-3% slope) lands and distributed in the major part of the microwatershed.

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

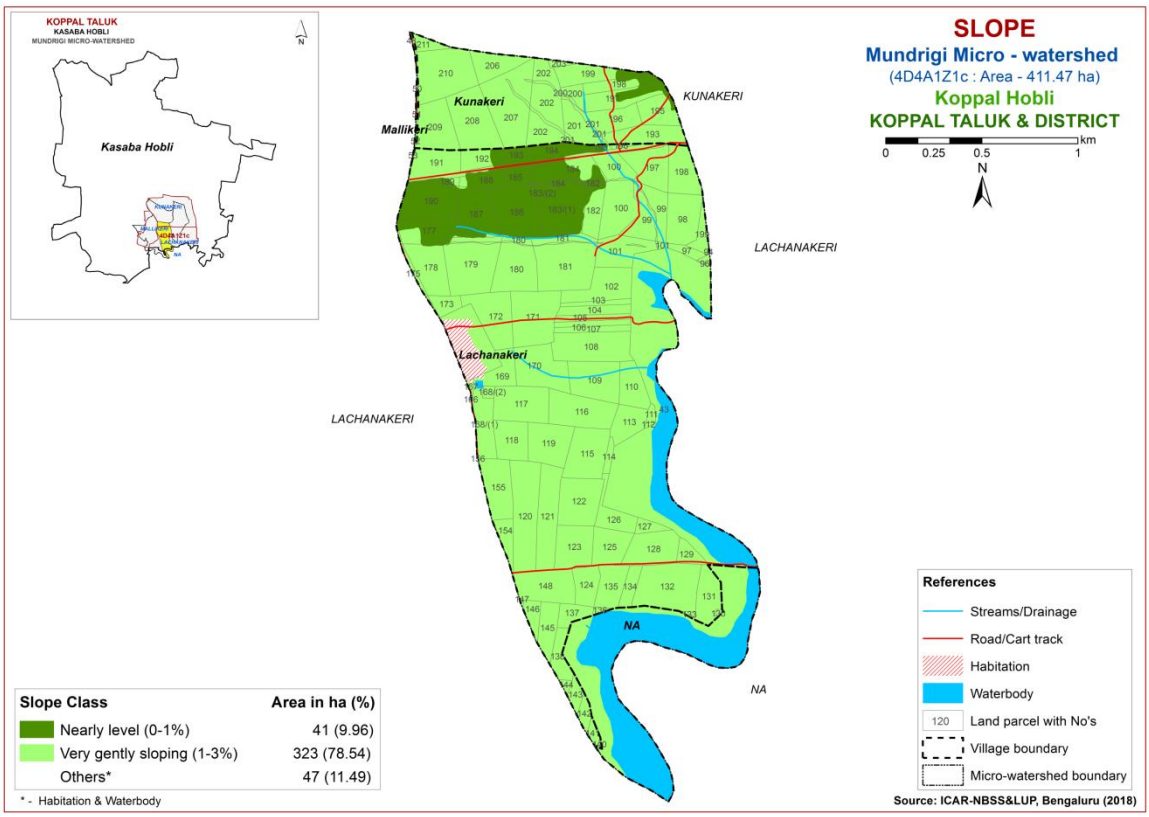


Fig. 5.6 Soil Slope map of Mundrigi Microwatershed

5.7 Soil Erosion

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

Soils that are slightly eroded (e1 class) cover an area of 79 ha (19%) and distributed in the northern part of the microwatershed. Soils that are moderately eroded (e2 class) cover a major area of 285 ha (69%) and distributed in the major part of the microwatershed.

Maximum area of about 285 ha (69%) in the microwatershed is problematic because of moderate erosion. For these areas, taking up soil and water conservation and other land development measures are needed.

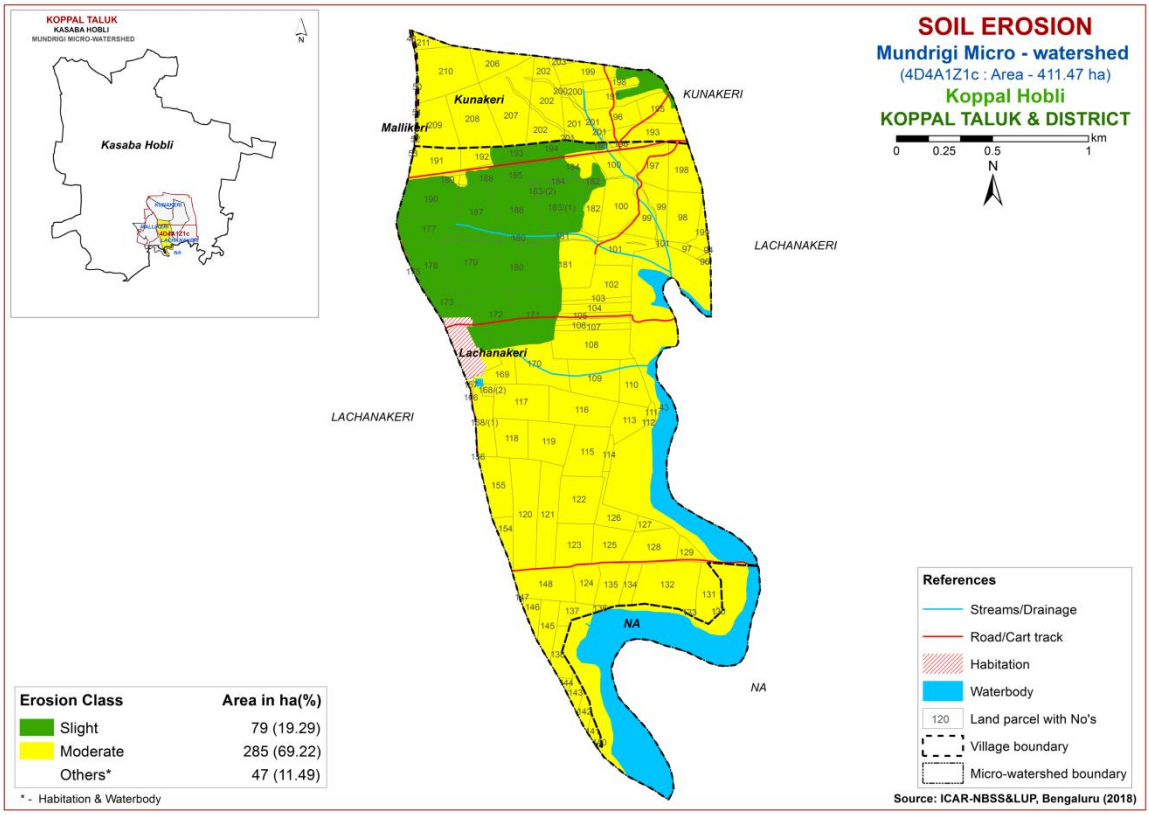


Fig. 5.7 Soil Erosion map of Mundrigi Microwatershed

Chapter 6

FERTILITY STATUS

Soil fertility plays an important role in increasing crop yield. The adoption of high yielding varieties that require high amounts of nutrients has resulted in deficiency symptoms in crops and plants due to imbalanced fertilization and poor inherent fertility status, as these areas are characterised by low rainfall and high temperatures. Hence, it is necessary to know the fertility (macro and micro nutrients) status of the soils of the watersheds for assessing the kind and amount of fertilizers required for each of the crop intended to be grown. For this purpose, the surface soil samples collected from the grid points (one soil sample at every 320 m grid interval) all over the microwatershed through land resource inventory in the year 2018 were analysed for pH, EC, organic carbon, available phosphorus and potassium, and for micronutrients like zinc, boron, copper, iron and manganese, and secondary nutrient sulphur.

Soil fertility data generated has been assessed and individual maps for all the nutrients for the microwatershed have been generated using 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 Mundrigi microwatershed for soil reaction (pH) showed that an area of about 9 ha (2%) is under slightly acid (pH 6.0-6.5) in soil reaction and distributed in the southern part of the microwatershed. Maximum area of about 305 ha (74%) is under neutral (pH 6.5-7.3) in soil reaction and distributed in the major part of the microwatershed. An area of about 50 ha (12%) is under slightly alkaline (pH 7.3-7.8) in soil reaction and occur in the northern and southern part of the microwatershed (Fig.6.1). Thus, major soils covering 305 ha (74%) area under neutral, 50 ha (12%) is under alkaline and 9 ha (2%) is under acidic condition.

6.2 Electrical Conductivity (EC)

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

6.3 Organic Carbon (OC)

The soil organic carbon content (an index of available Nitrogen) of the microwatershed is medium (0.5-0.75%) in an area of about 18 ha (4%) and occur in the northern part of the microwatershed. Maximum area of about 346 ha (84%) is high (>0.75%) in organic carbon and distributed in the major part of the microwatershed (Fig.6.3).

6.4 Available Phosphorus

Entire cultivated area of the microwatershed falls under high (>57 kg/ha) in available phosphorus content (Fig 6.4).

6.5 Available Potassium

An area of about 50 ha (12%) is low (<145 kg/ha) in available potassium and distributed in the southern part of the microwatershed. Maximum area of about 313 ha (76%) is medium (145-337 kg/ha) in available potassium and distributed in the major part of the microwatershed. An area of about 1 ha (<1%) is high (>337 kg/ha) in available potassium and distributed in the northern part of the microwatershed (Fig.6.5).

6.6 Available Sulphur

Entire cultivated area of the microwatershed falls under low (<10 ppm) in available sulpur content (Fig.6.6).

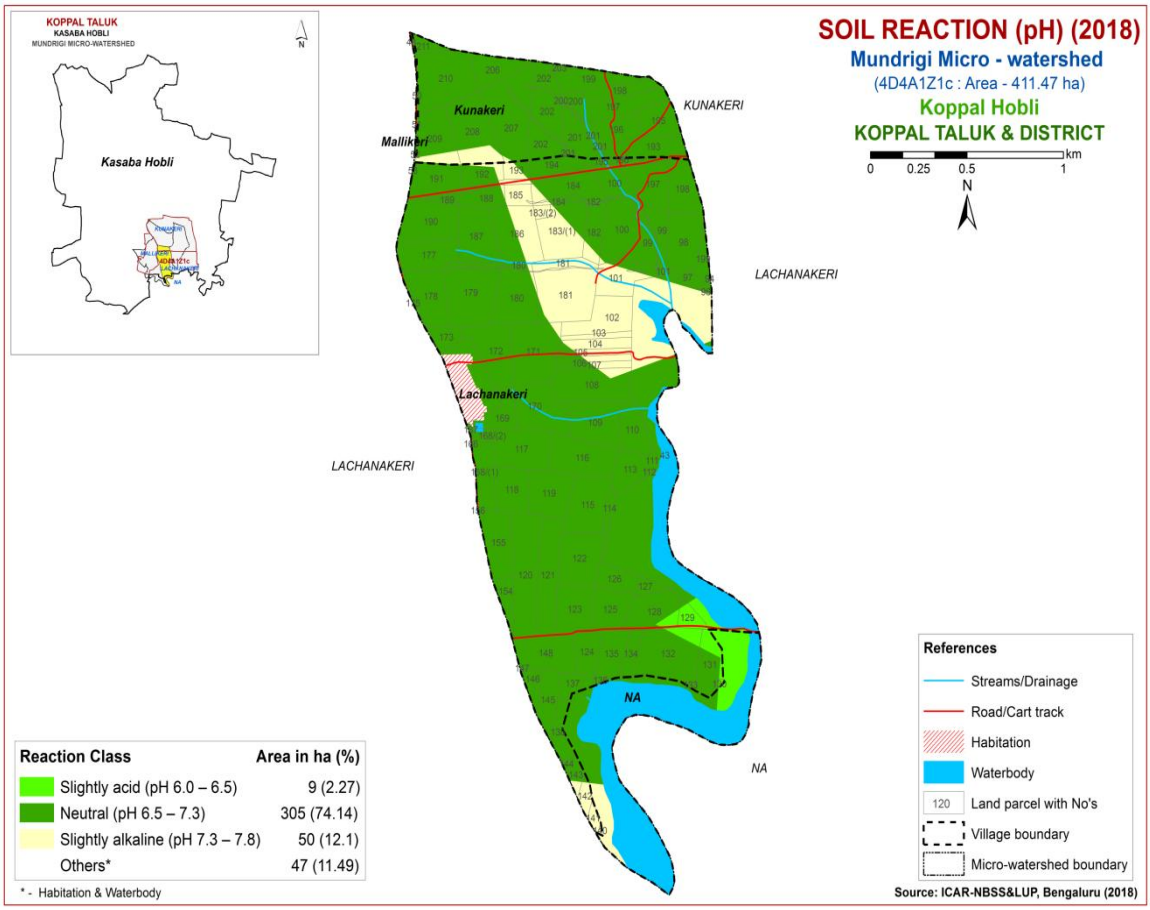


Fig.6.1 Soil Reaction (pH) map of Mundrigi Microwatershed

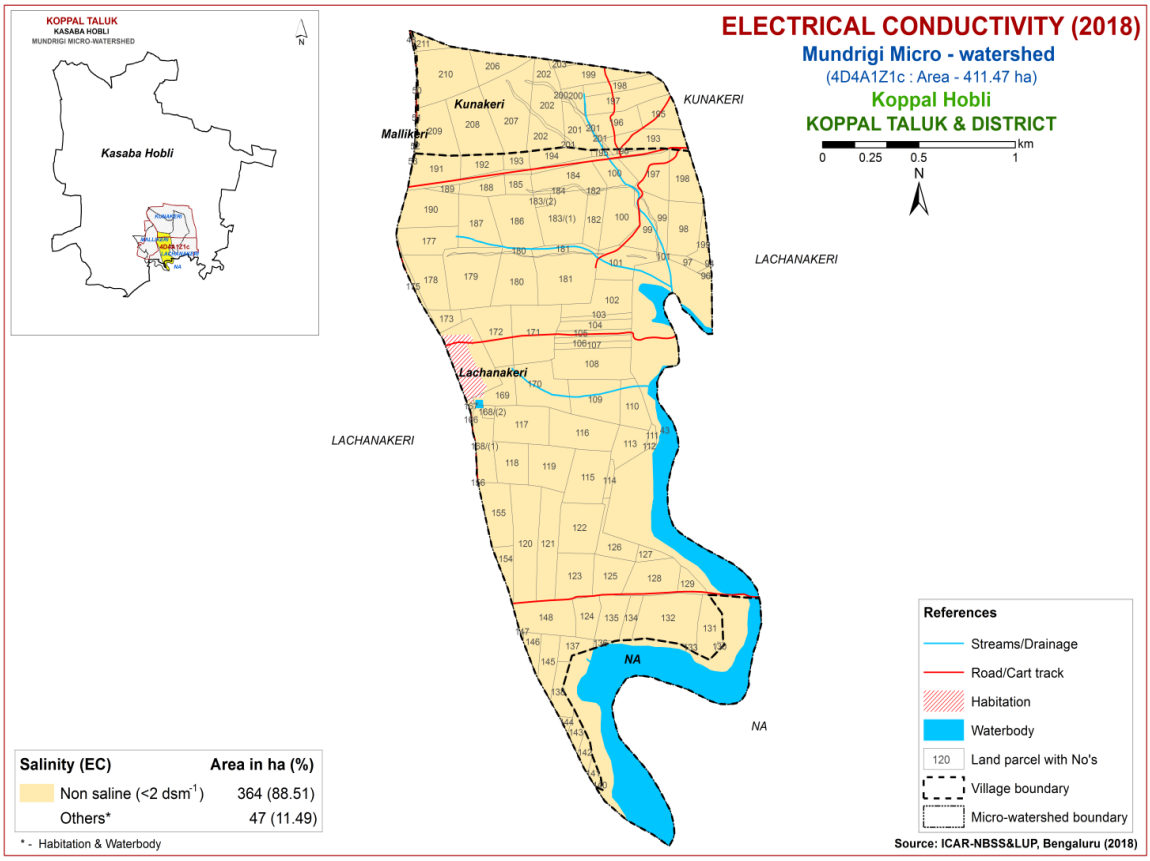


Fig.6.2 Electrical Conductivity (EC) map of Mundrigi Microwatershed

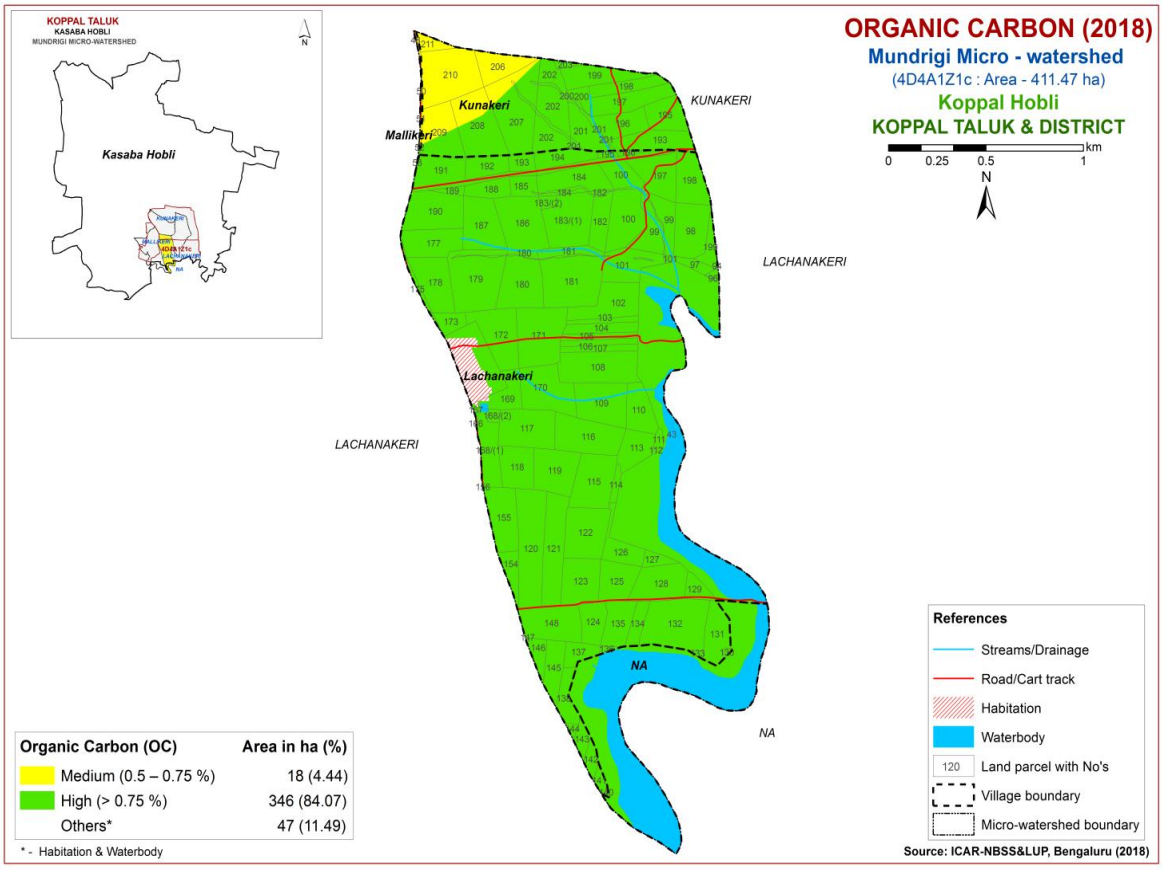


Fig.6.3 Soil Organic Carbon (OC) map of Mundrigi Microwatershed

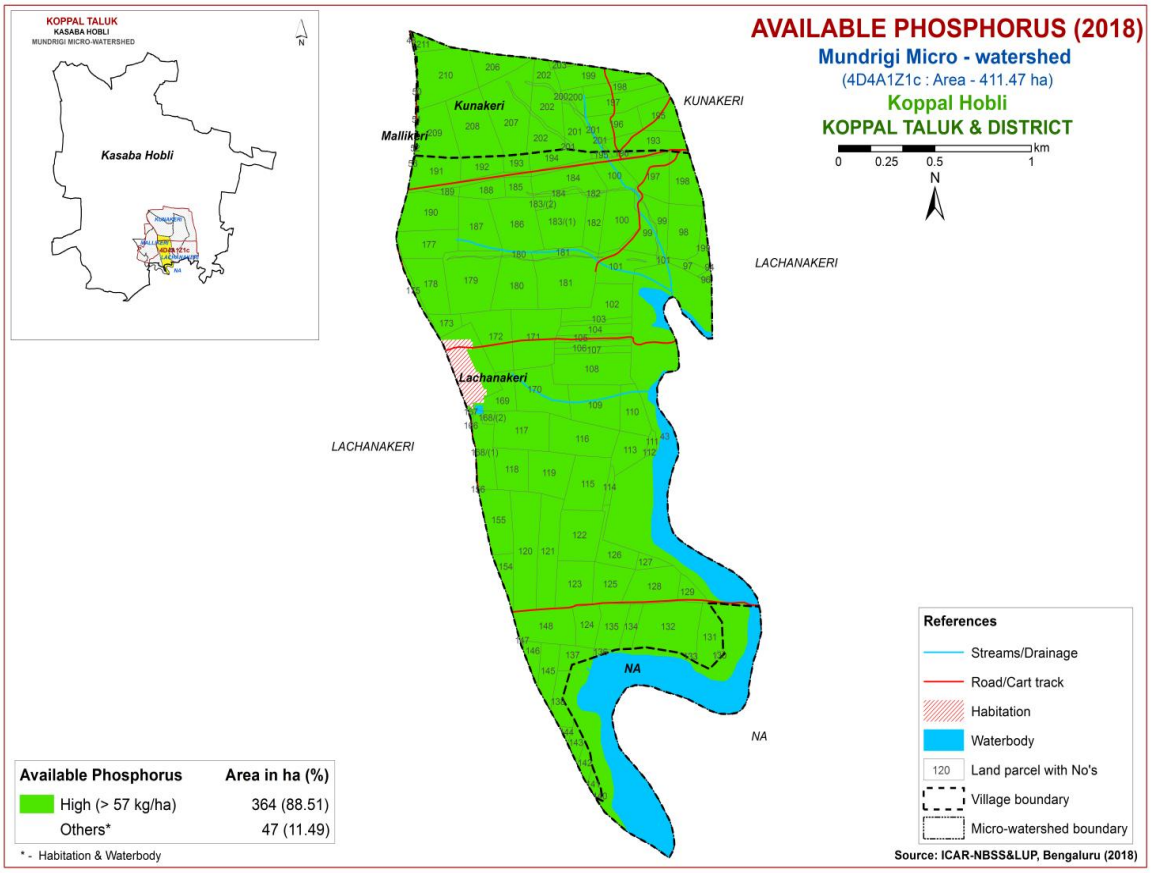


Fig.6.4 Soil Available Phosphorus map of Mundrigi Microwatershed

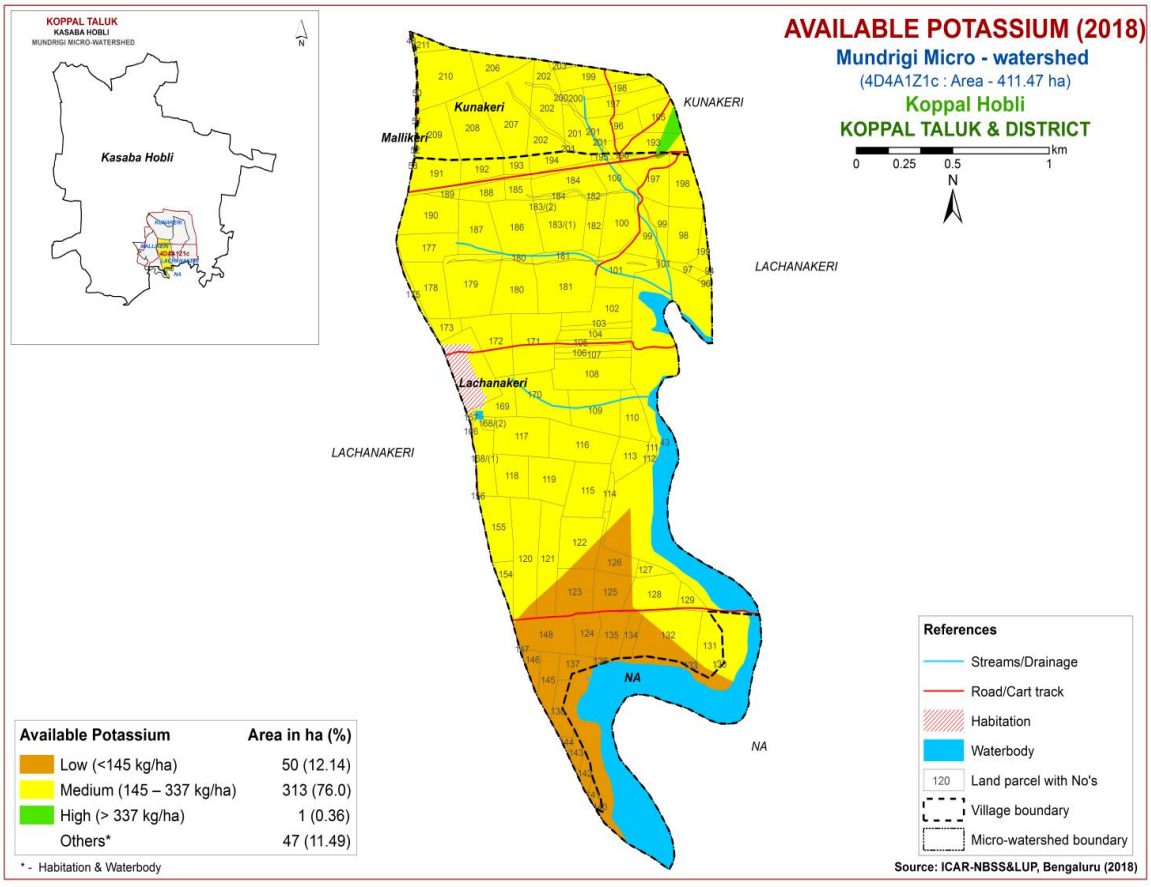


Fig.6.5 Soil Available Potassium map of Mundrigi Microwatershed

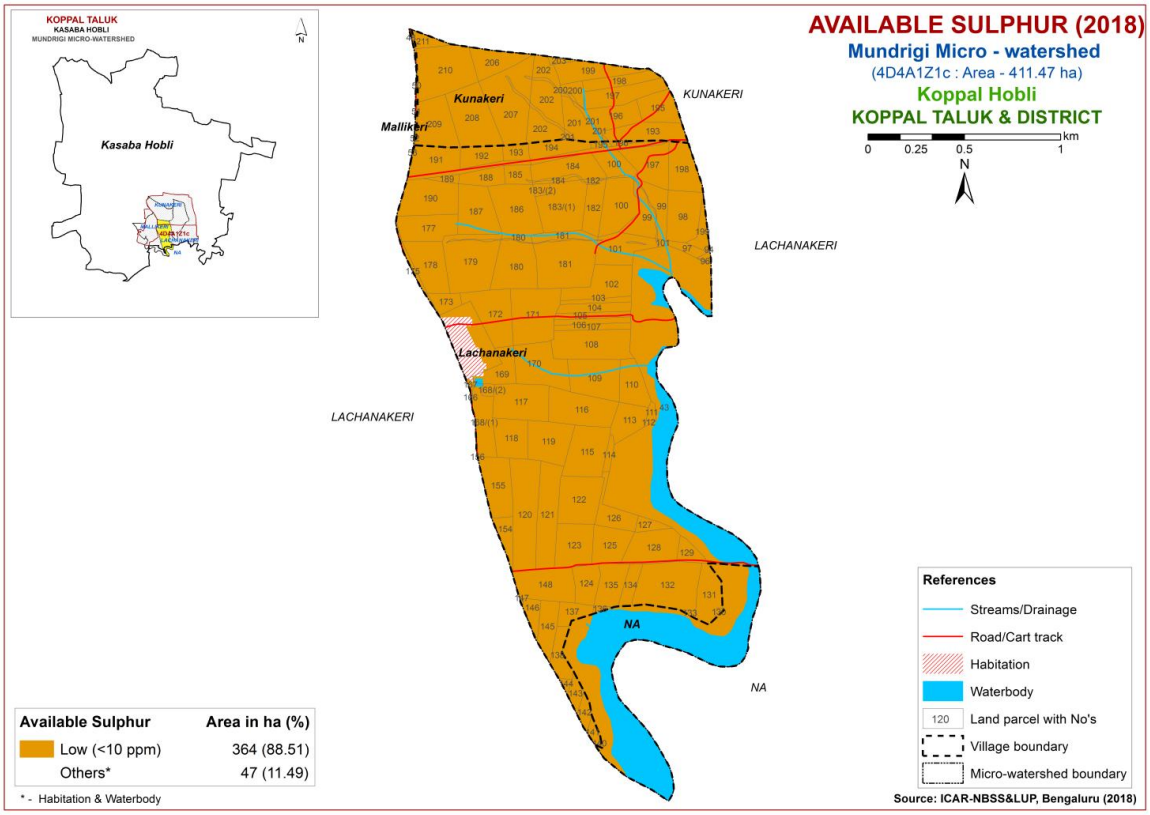


Fig.6.6 Soil Available Sulphur map of Mundrigi Microwatershed

6.7 Available Boron

Available boron is low (<0.5 ppm) in a major area of about 332 ha (81%) and distributed in the major part of the microwatershed. An area of about 32 ha (8%) is medium (0.5-1.0 ppm) in available boron and occur in the central, northern and southern part of the microwatershed (Fig.6.7).

6.8 Available Iron

Available iron content is sufficient (>4.5 ppm) in a major area of about 269 ha (65%) and distributed in the major part of the microwatershed. An area of about 95 ha (23%) is deficient (<4.5 ppm) in available iron and distributed in the northern part of the microwatershed (Fig 6.8).

6.9 Available Manganese

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

6.10 Available Copper

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

6.11 Available Zinc

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

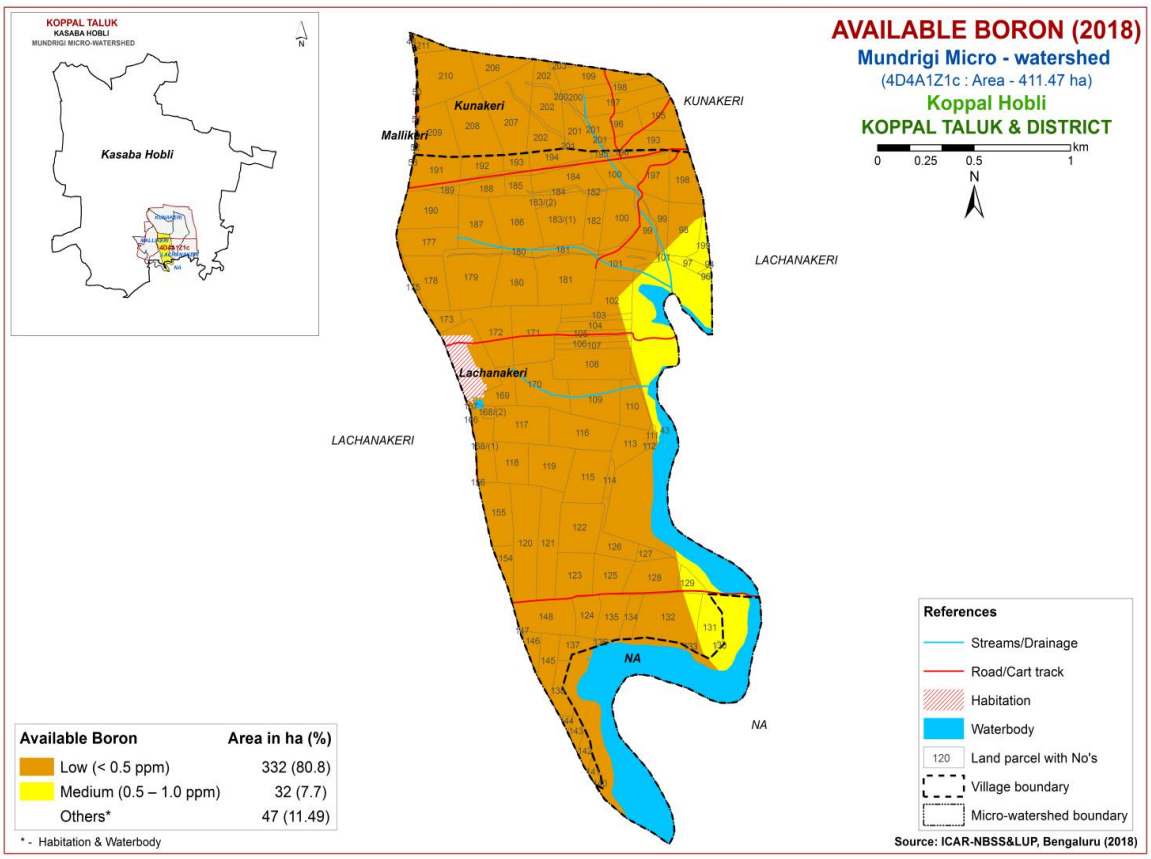


Fig.6.7 Soil Available Boron map of Mundrigi Microwatershed

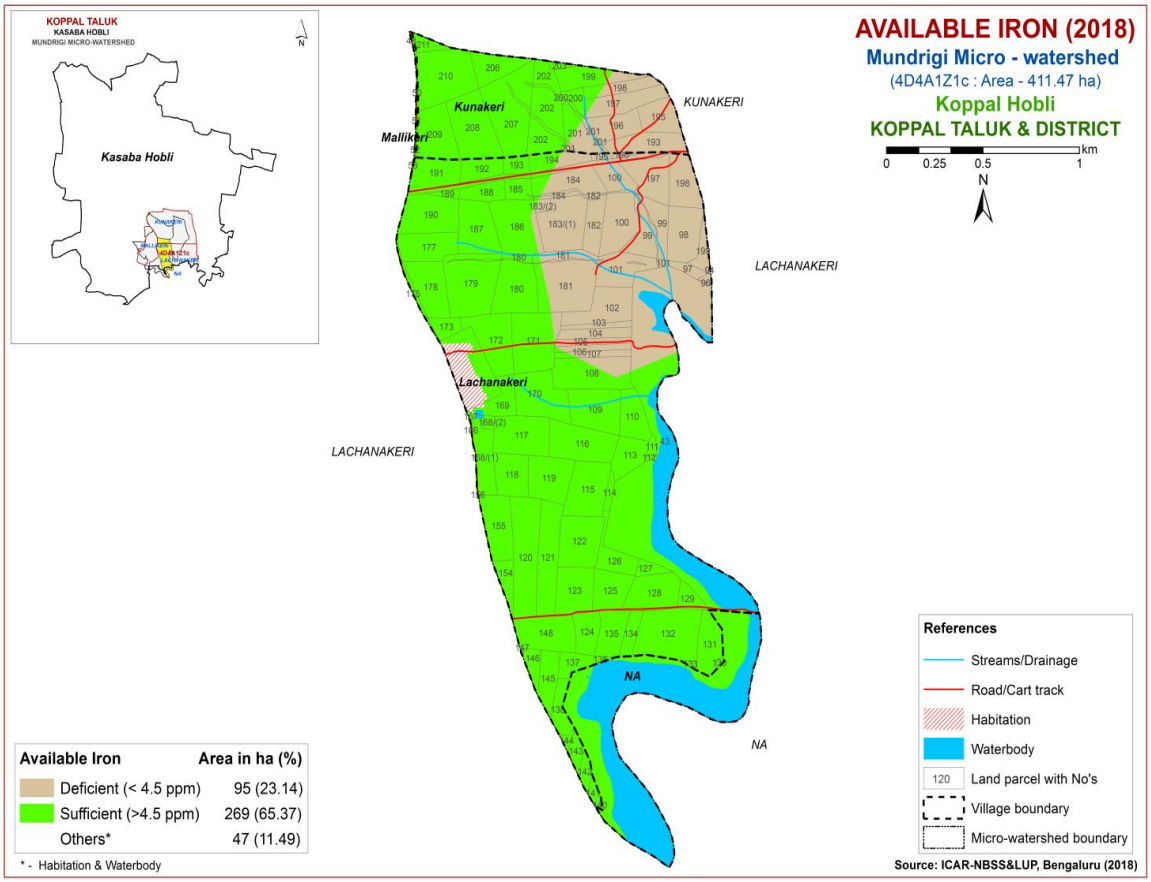


Fig.6.8 Soil Available Iron map of Mundrigi Microwatershed

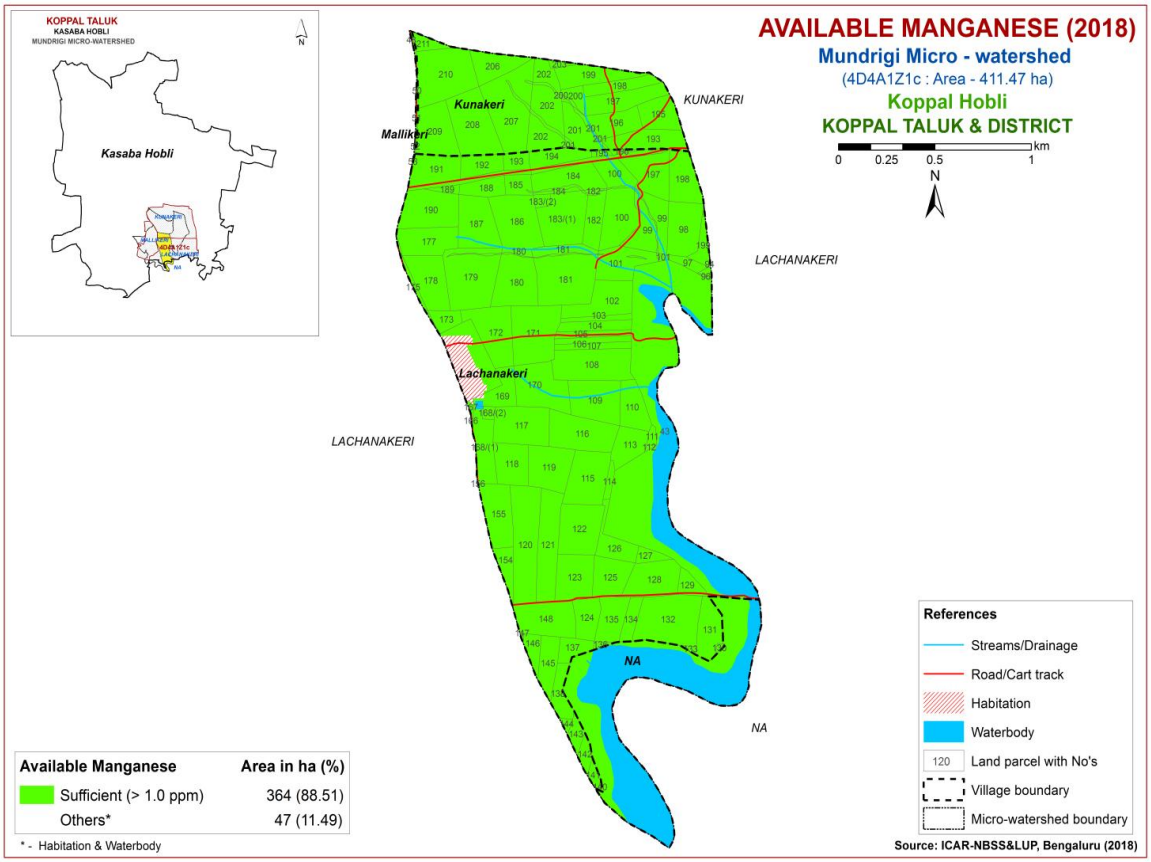


Fig.6.9 Soil Available Manganese map of Mundrigi Microwatershed

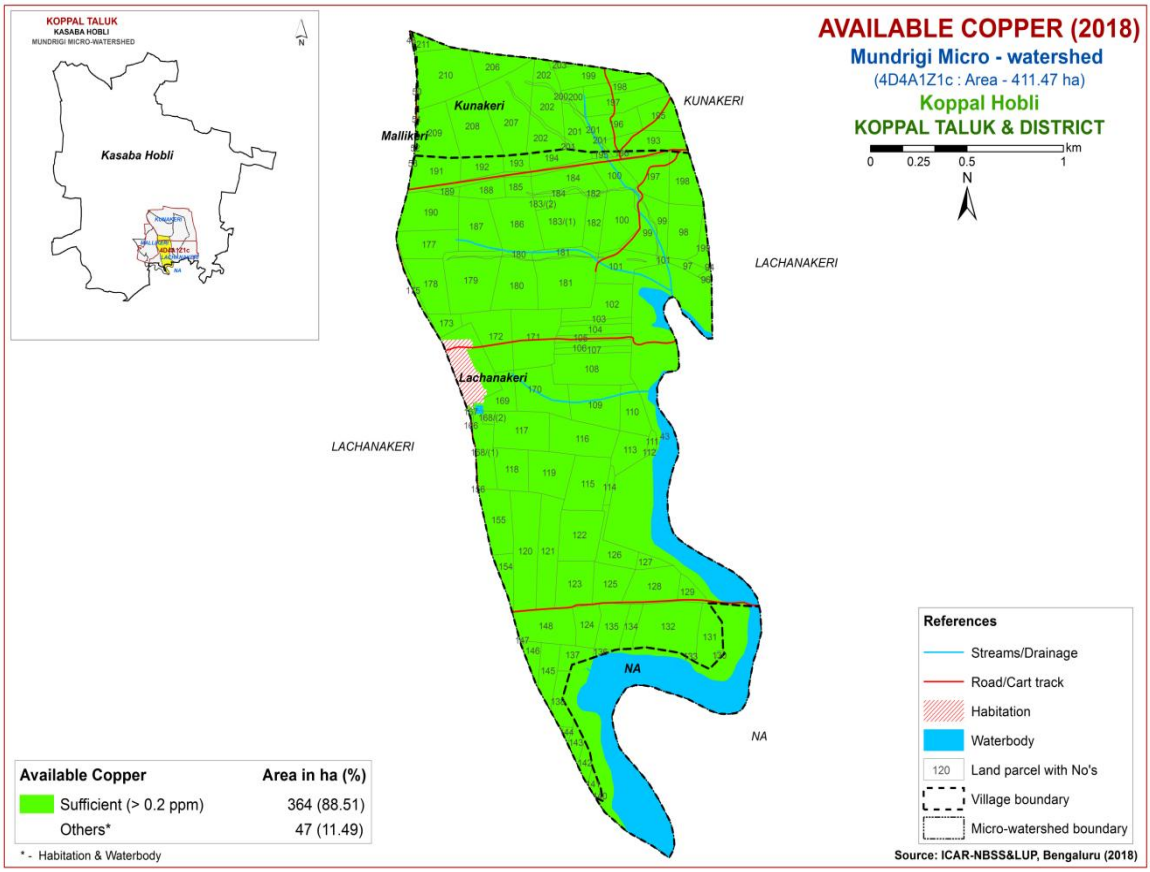


Fig.6.10 Soil Available Copper map of Mundrigi Microwatershed

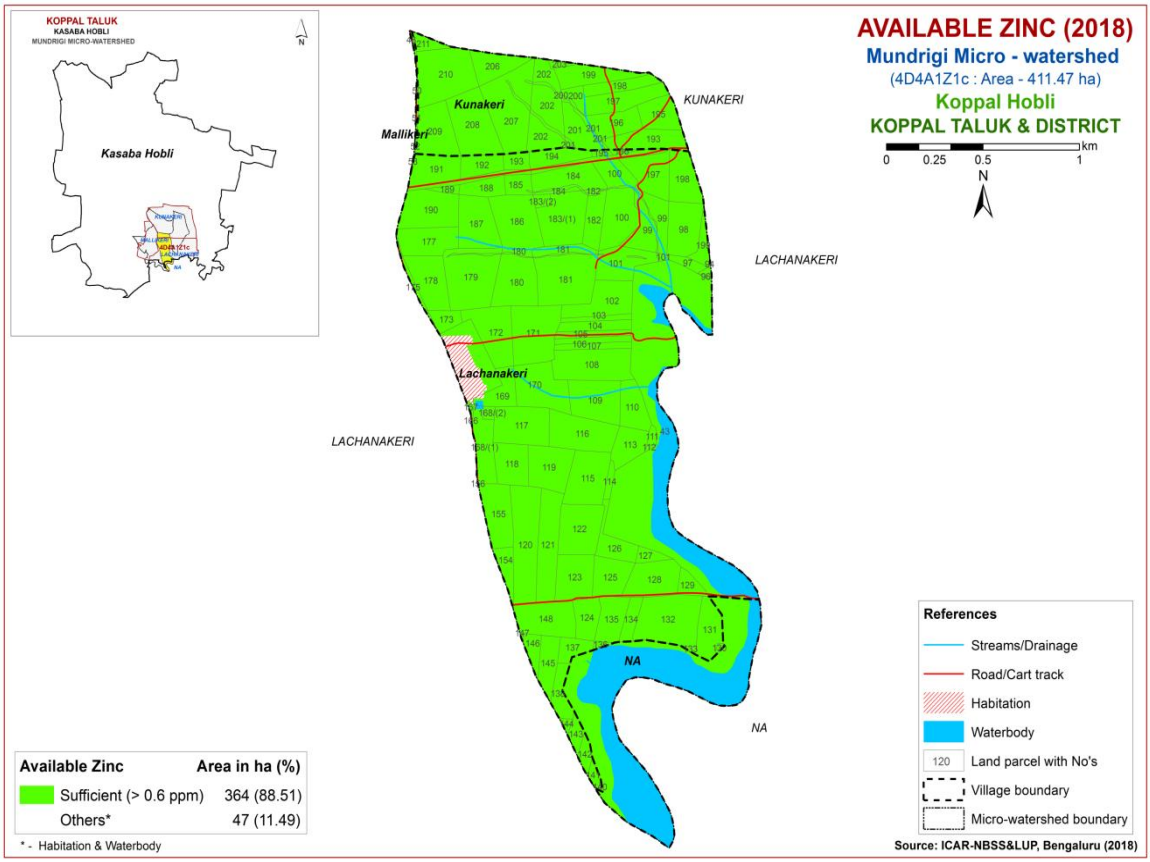


Fig.6.11 Soil Available Zinc map of Mundrigi Microwatershed

Chapter 7

LAND SUITABILITY FOR MAJOR CROPS

The soil and land resource units (soil phases) of Mundrigi 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 (Table 7.1) were matched with the crop requirements (Tables 7.2 to 7.32) to arrive at the crop suitability. The soil and land characteristics table and crop requirements 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, N1 and N2 are divided into subclasses based on the kinds of limitations encountered. The limitations that affect crop production are 'c' for erratic rainfall and its distribution and length of growing period (LGP), 'e' for erosion hazard, 'r' for rooting condition, 't' for lighter or heavy texture, 'g' for gravelliness or stoniness, 'n' for nutrient availability, 'l' for topography, 'm' for moisture availability, '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 land a suitability map for growing sorghum was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure. 7.1.

An area of about 172 ha (42%) is highly suitable (Class S1) for growing sorghum and occur in the central, northern and southern part of the microwatershed. An area of about 17 ha (4%) is moderately suitable (Class S2) for growing sorghum and distributed

in the northern part of the microwatershed. They have minor limitations of rooting depth, gravelliness, drainage and texture. Major area of about 175 ha (43%) is marginally suitable (Class S3) for growing sorghum and occur in the central, northern and southern part of the microwatershed with moderate limitation of gravelliness.

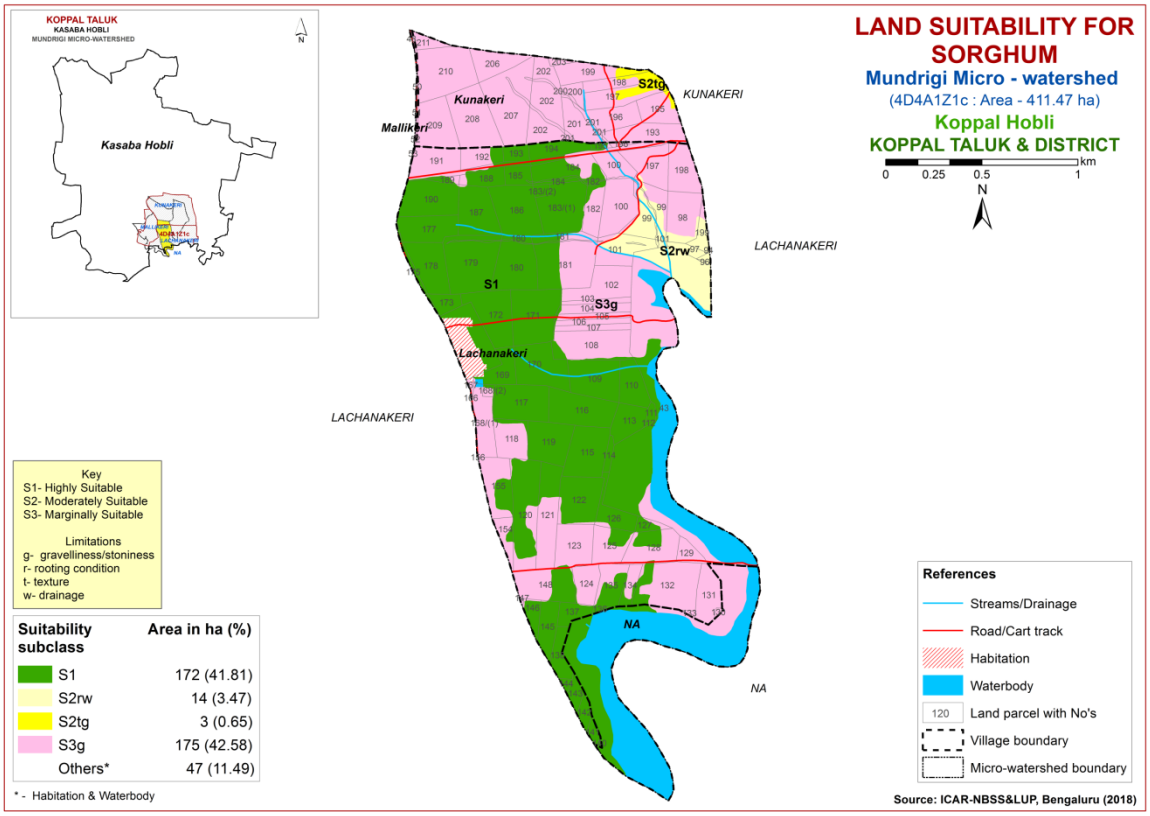


Fig. 7.1 Land Suitability map of Sorghum

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 is given in Figure 7.2.

An area of about <1 ha (<1%) is highly suitable (Class S1) for growing maize and occur in the northern part of the microwatershed. Maximum area of about 189 ha (46%) is moderately suitable (Class S2) for growing maize and distributed in the central, northern and southern part of the microwatershed with minor limitations of texture, rooting depth, drainage and gravelliness. An area of about 175 ha (43%) is marginally suitable (Class S3) for growing maize and occur in the central, northern and southern part of the microwatershed with moderate limitation of gravelliness.

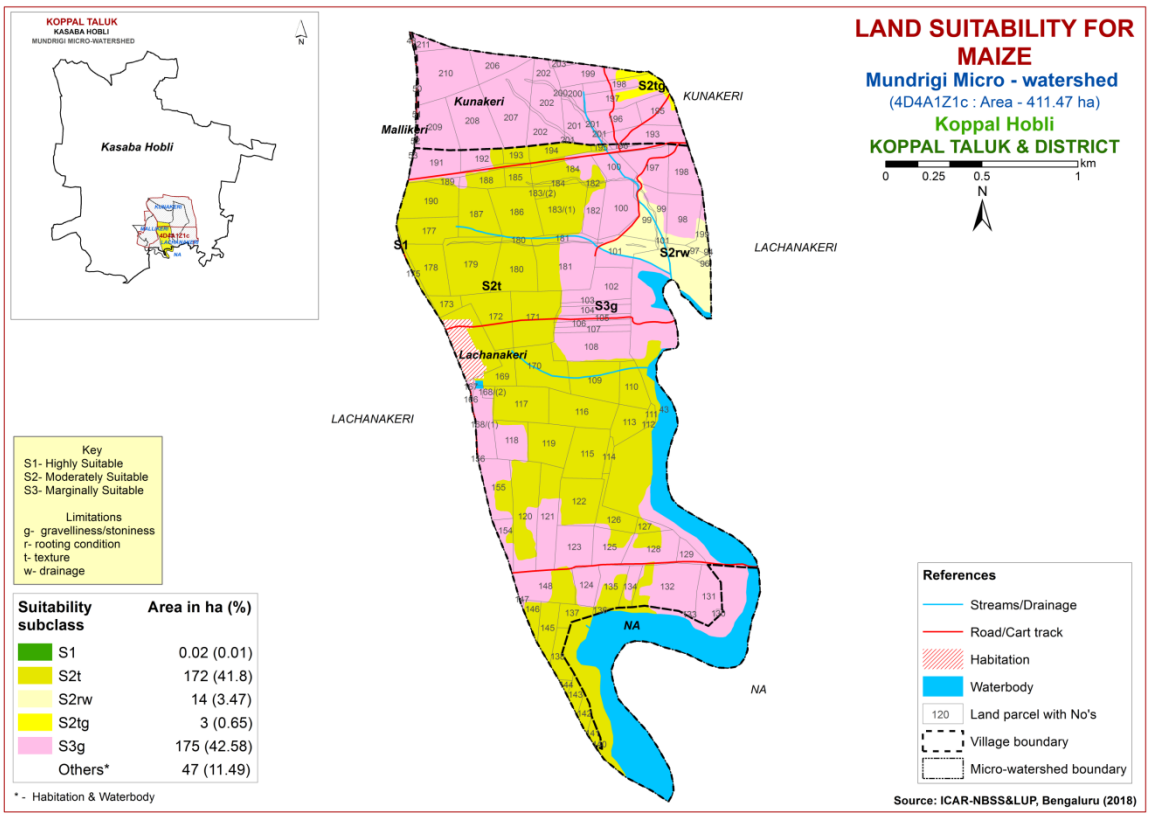


Fig. 7.2 Land Suitability map of Maize

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 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.

Maximum area of about 175 ha (42%) is highly suitable (Class S1) for growing bajra and distributed in the central, northern and southern part of the microwatershed. An area of about 51 ha (12%) is moderately suitable (Class S2) for growing bajra and distributed in the northern part of the microwatershed with minor limitations of rooting depth, drainage and gravelliness. An area of about 138 ha (34%) is marginally suitable (Class S3) for growing bajra and distributed in the central, northern and southern part of the microwatershed with moderate limitation of gravelliness.

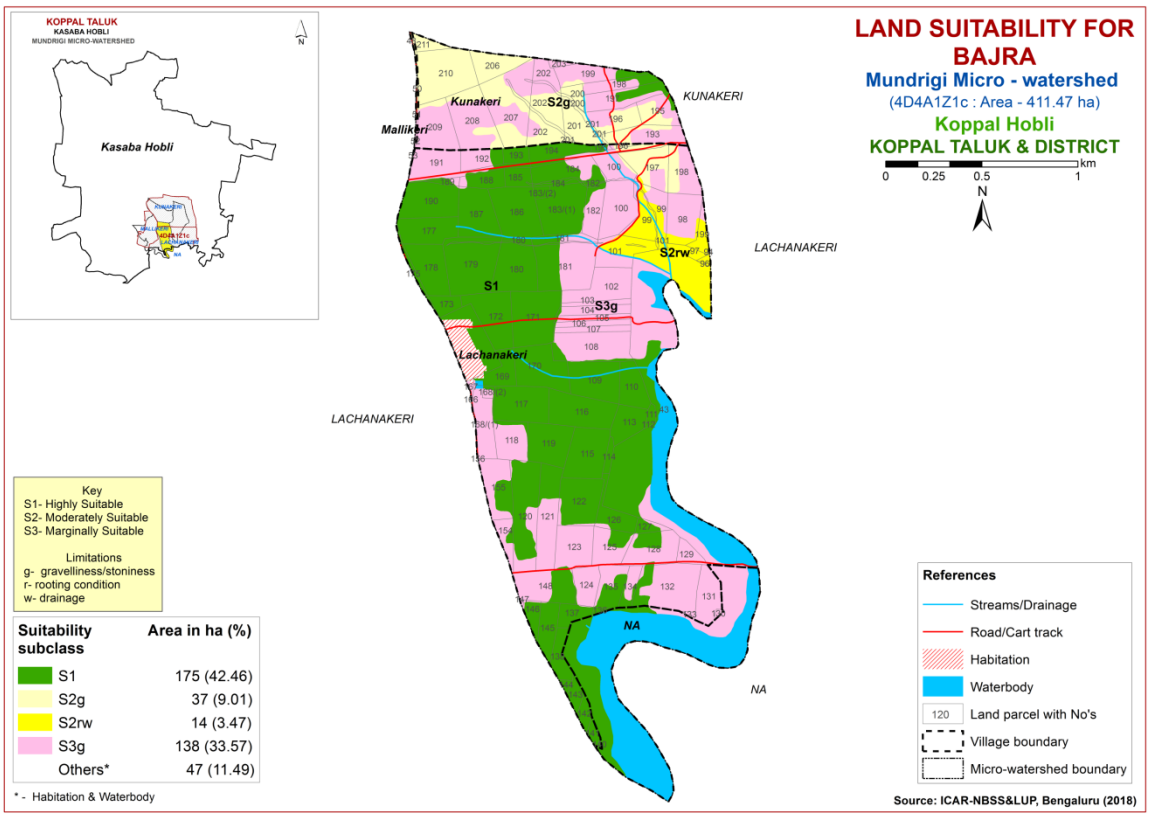


Fig. 7.3 Land Suitability map of Bajra

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.

An area of about 95 ha (23%) is highly suitable (Class S1) for growing groundnut and distributed in the central and southern part of the microwatershed. Maximum area of about 219 ha (53%) is moderately suitable (Class S2) for growing groundnut and distributed in the major part of the microwatershed. They have minor limitations of texture, rooting depth, drainage and gravelliness. An area of about 50 ha (12%) is marginally suitable (Class S3) for growing groundnut and distributed in the central and northern part of the microwatershed with moderate limitation of gravelliness.

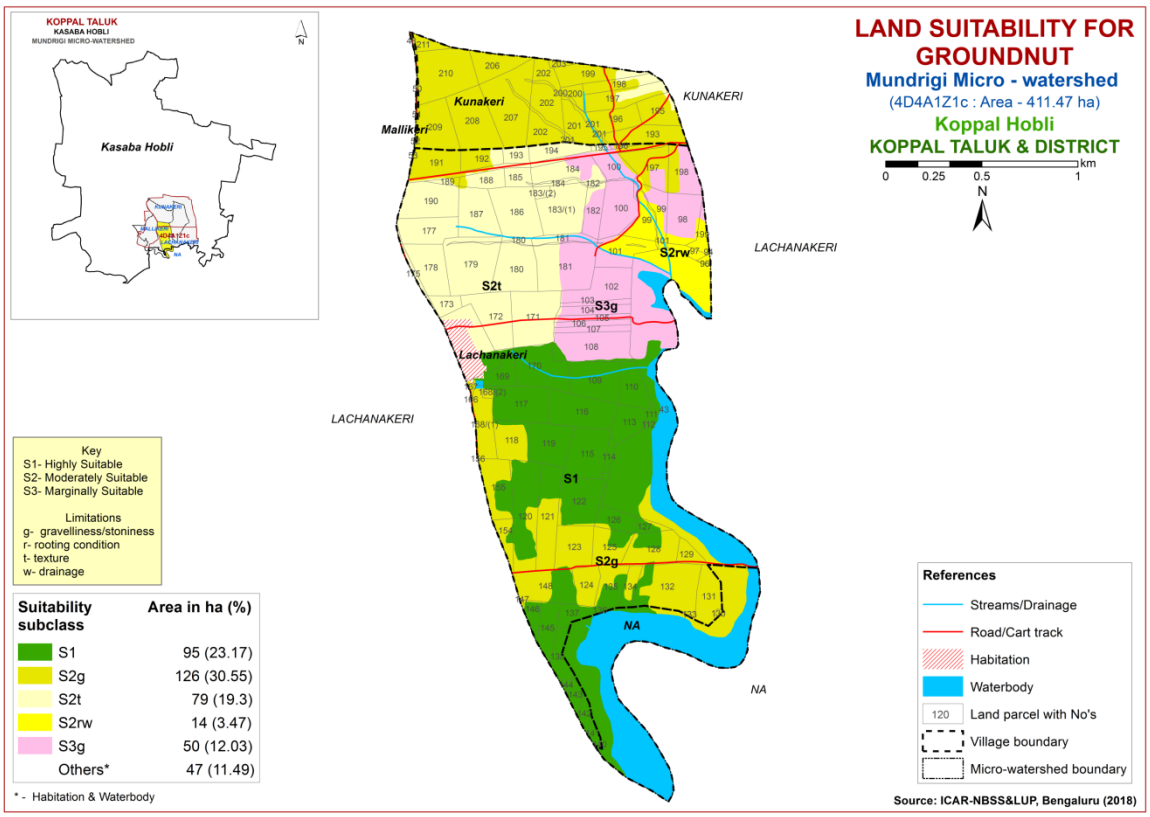


Fig. 7.4 Land Suitability map of Groundnut

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 95 ha (23%) is highly suitable (Class S1) for growing sunflower and distributed in the central and southern part of the microwatershed. An area of about 80 ha (19%) is moderately suitable (Class S2) for growing sunflower and distributed in the northern part of the microwatershed with minor limitations of gravelliness and rooting depth. Maximum area of about 189 ha (46%) is marginally suitable (Class S3) for growing sunflower and occur in the central, northern and southern part of the microwatershed with moderate limitations of gravelliness and rooting depth.

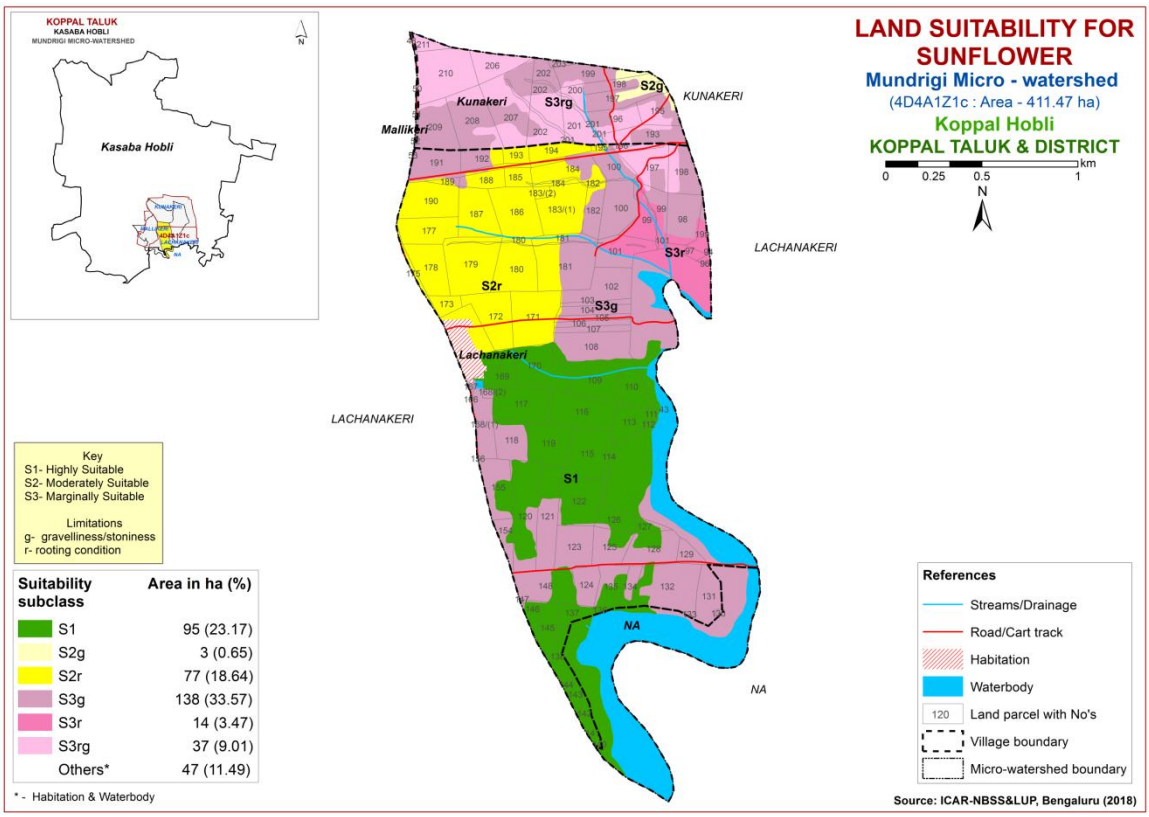


Fig. 7.5 Land Suitability map of Sunflower

7.6 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, Kalaburagi, Bijapur, Bidar, Bellary, Chitradurga and Chamarajnagar districts. The crop requirements for growing cotton (Table 7.7) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing cotton was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.6.

An area of about 95 ha (23%) is highly suitable (Class S1) for growing cotton and occur in the central and southern part of the microwatershed. An area of about 93 ha (23%) is moderately suitable (Class S2) for growing cotton and distributed in the northern part of the microwatershed with minor limitations of gravelliness, texture, drainage and rooting depth. Major area of about 175 ha (43%) is marginally suitable (Class S3) for growing cotton and occur in the central, northern and southern part of the microwatershed with moderate limitations of rooting depth and gravelliness.

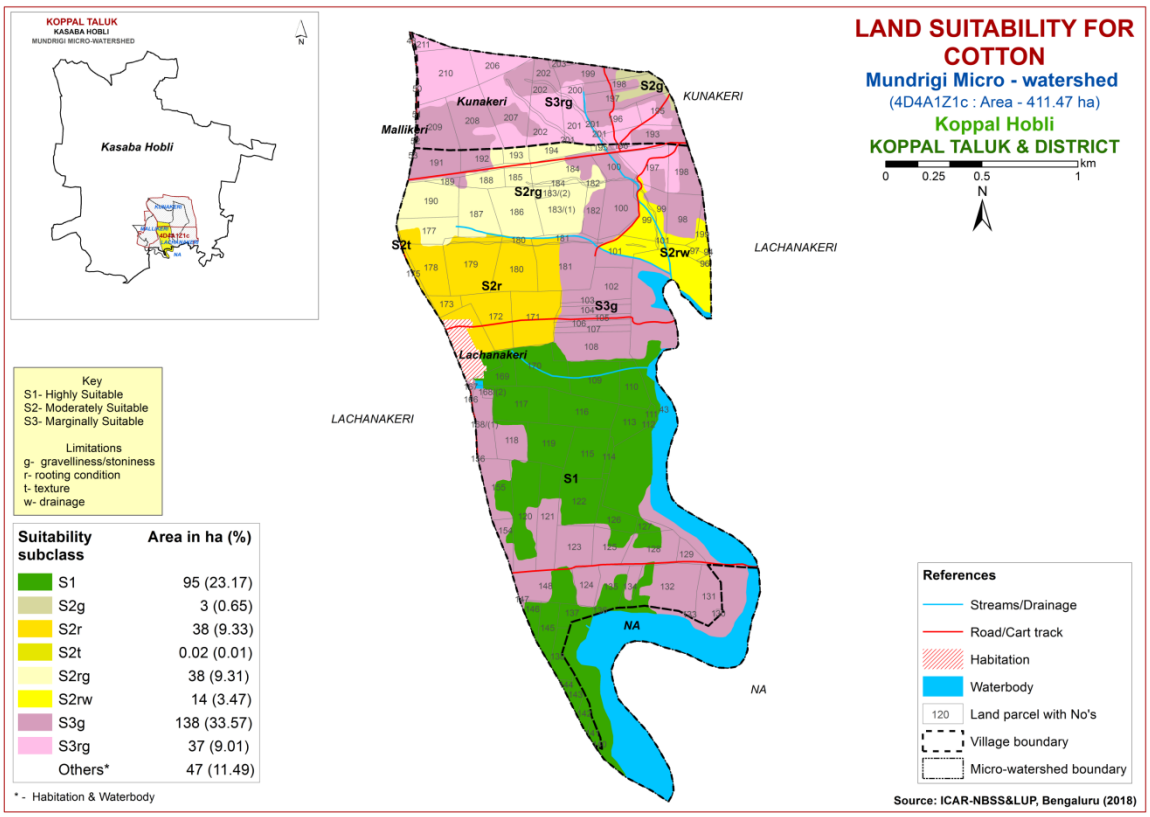


Fig. 7.6 Land Suitability map of Cotton

7.7 Land Suitability for Red gram (*Cajanus cajana*)

Red gram is one of the major pulse crop grown in an area of 7.28 lakh ha mainly in northern Karnataka in Bijapur, Kalaburagi, Raichur, Bidar, Belgaum, Dharwad and Bellary districts. The crop requirements for growing red 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 red gram was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed is given in Figure 7.7.

An area of about 95 ha (23%) is highly suitable (Class S1) for growing red gram and occur in the central and southern part of the microwatershed. An area of about 79 ha (19%) is moderately suitable (Class S2) for growing red gram and occur in the northern part of the microwatershed. They have minor limitations of rooting depth and gravelliness. Major area of about 189 ha (46%) is marginally suitable (Class S3) for growing red gram and distributed in the central, northern and southern part of the microwatershed with moderate limitations of rooting depth, drainage and gravelliness.

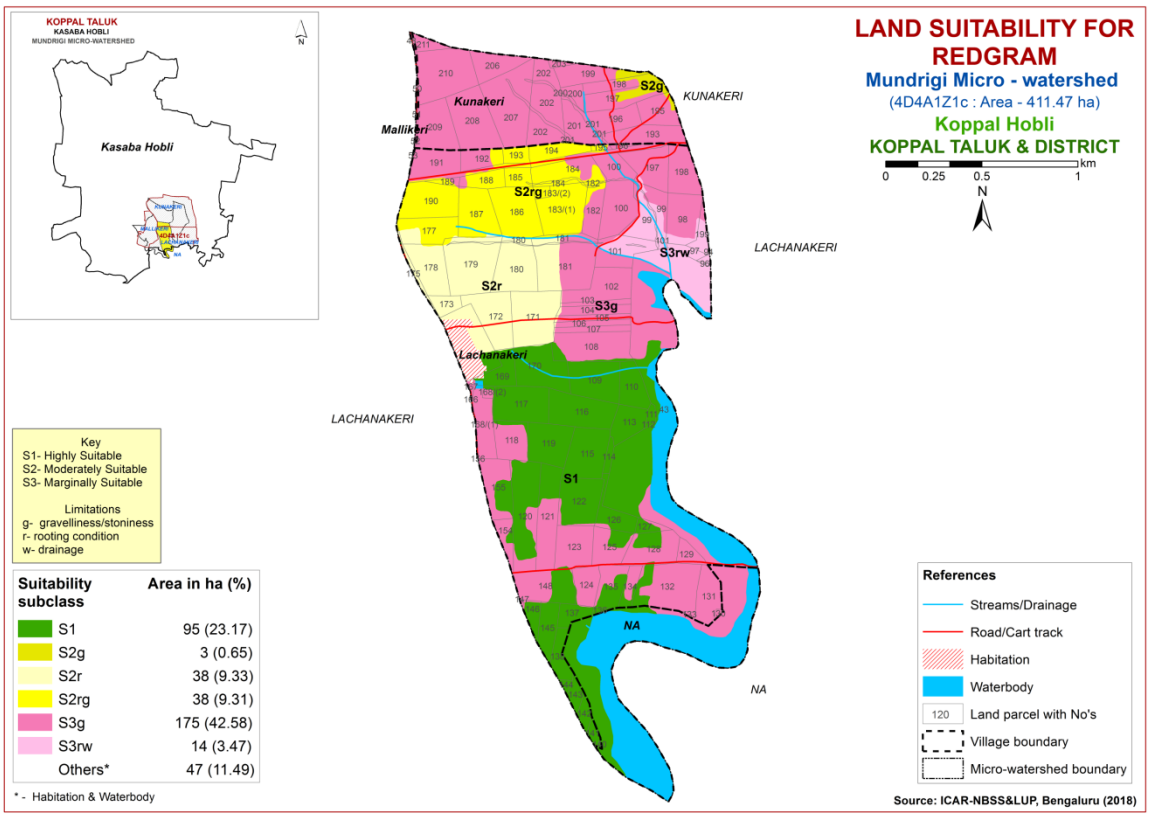


Fig. 7.7 Land Suitability map of Red gram

7.8 Land Suitability for Bengal gram (*Cicer aerativum*)

Bengal gram is one of the most important pulse crop grown in about 9.39 lakh ha area in Bijapur, Raichur, Kalaburagi, Dharwad, Belgaum and Bellary districts. The crop requirements for growing Bengal gram (Table 7.9) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing bengal gram was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.8.

Highly suitable (Class S1) lands for growing bengal gram are not available in this microwatershed. Maximum area of about 189 ha (46%) is moderately suitable (Class S2) for growing bengal gram and distributed in the central, northern and southern part of the microwatershed. They have minor limitations of rooting depth, gravelliness, drainage and texture. An area of about 175 ha (43%) is marginally suitable (Class S3) for growing Bengal gram and occur in the central, northern and southern part of the microwatershed with moderate limitation of gravelliness.

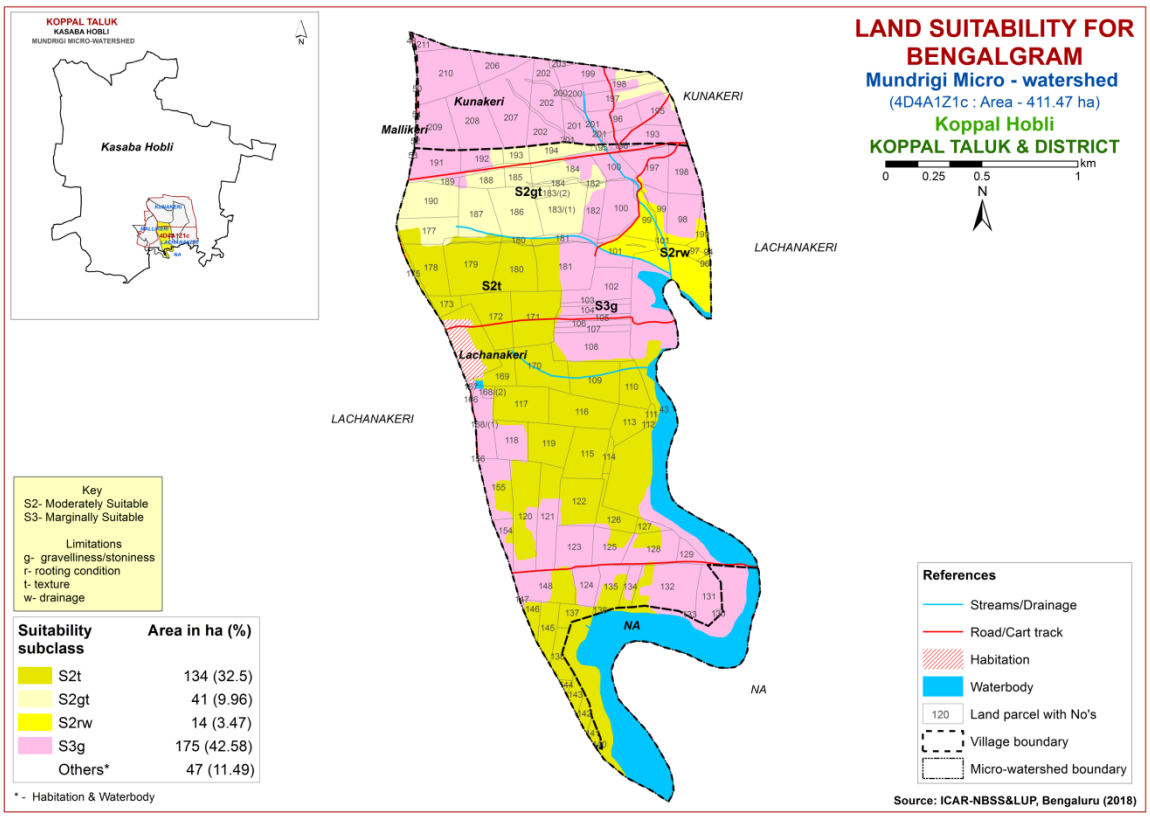


Fig. 7.8 Land Suitability map of Bengal gram

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

Chilli is one of the major 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 172 ha (42%) is highly suitable (Class S1) for growing chilli and distributed in the central, northern and southern part of the microwatershed. An area of about 17 ha (4%) is moderately suitable (Class S2) for growing chilli and distributed in the northern part of the microwatershed with minor limitations of gravelliness, drainage and rooting depth. Major area of about 175 ha (43%) is marginally suitable (Class S3) for growing chilli and occur in the central, northern and southern part of the microwatershed with moderate limitation of gravelliness.

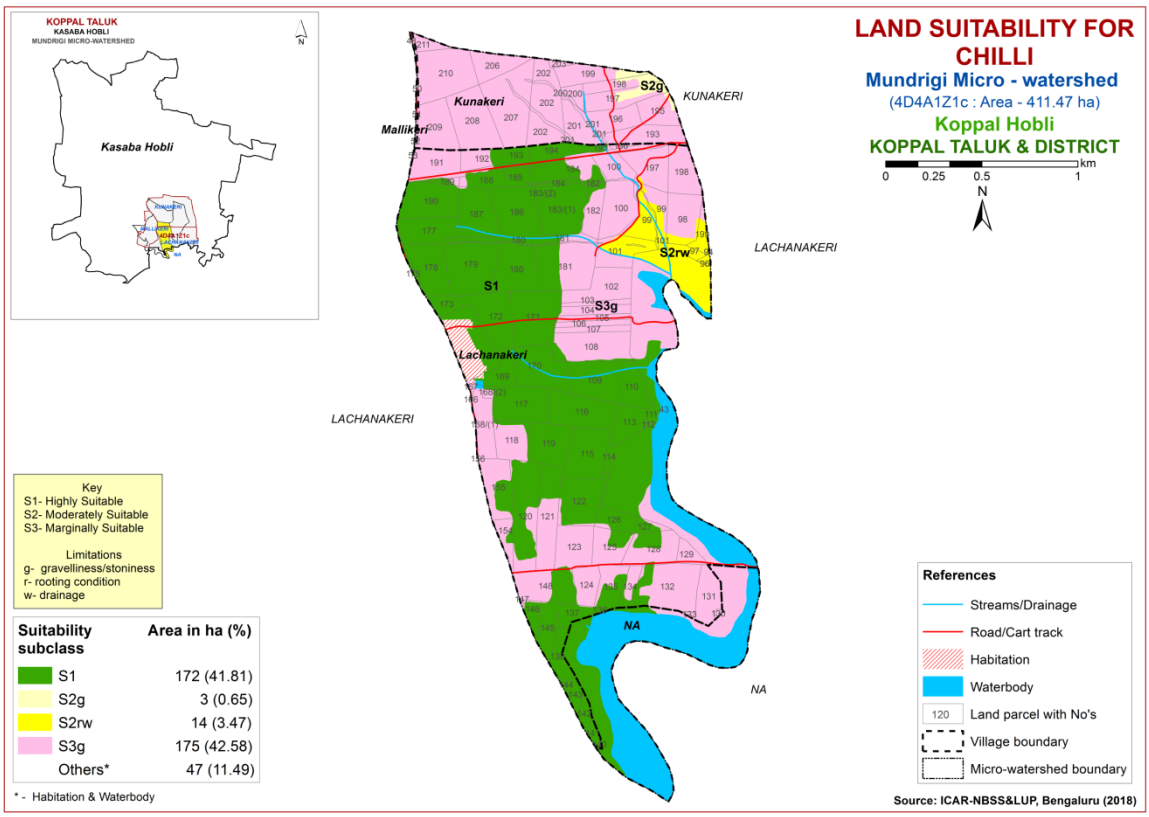


Fig. 7.9 Land Suitability map of Chilli

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 172 ha (42%) is highly suitable (Class S1) for growing tomato and distributed in the central, northern and southern part of the microwatershed. An area of about 17 ha (4%) is moderately suitable (Class S2) for growing tomato and distributed in the northern part of the microwatershed with minor limitations of gravelliness, drainage and rooting depth. Major area of about 175 ha (43%) is marginally suitable (Class S3) for growing tomato and occur in the central, northern and southern part of the microwatershed with moderate limitation of gravelliness.

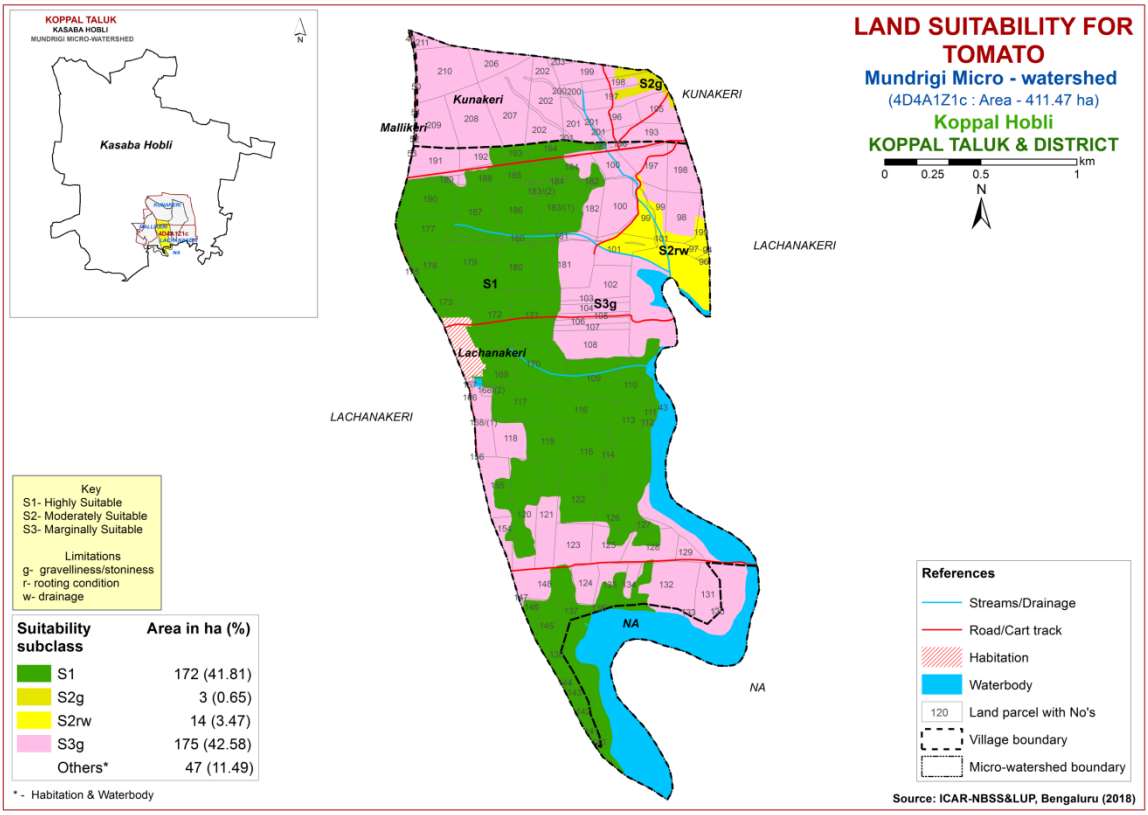


Fig. 7.10 Land Suitability map of Tomato

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 for growing brinjal occur in an area of 79 ha (19%) and distributed in the northern part of the microwatershed. Maximum area of about 234 ha (57%) is moderately suitable (Class S2) for brinjal and distributed in the major part of the microwatershed. They have minor limitations of gravelliness and texture. An area about of 51 ha (12%) is marginally suitable (Class S3) and distributed in the northern part of the microwatershed with moderate limitations of rooting depth and gravelliness.

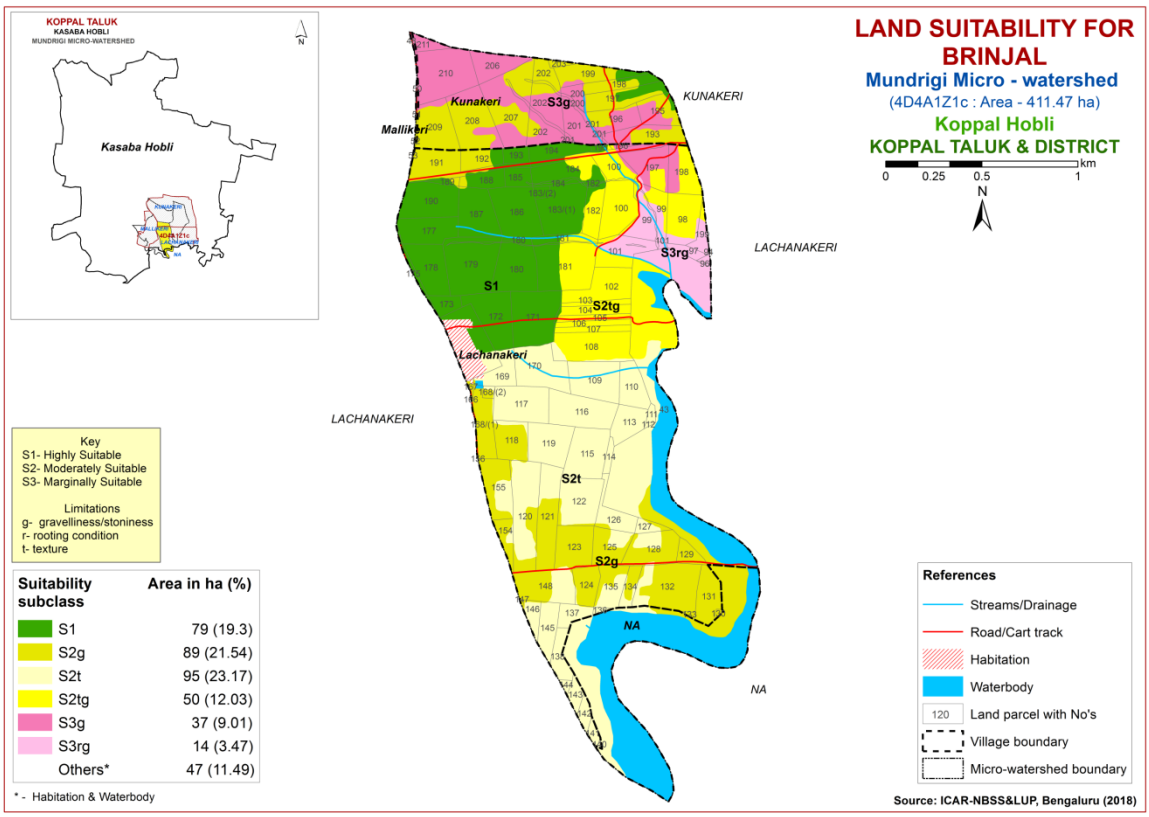


Fig 7.11 Land Suitability map of Brinjal

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 for growing onion occur in an area of about <1 ha (<1%) and distributed in the northern part of the microwatershed. Maximum area of about 314 ha (76%) is moderately suitable (Class S2) for onion and distributed in the major part of the microwatershed. They have minor limitations of texture and gravelliness. An area of about 51 ha (12%) is marginally suitable (Class S3) and distributed in the northern part of the microwatershed with moderate limitations of rooting depth and gravelliness.

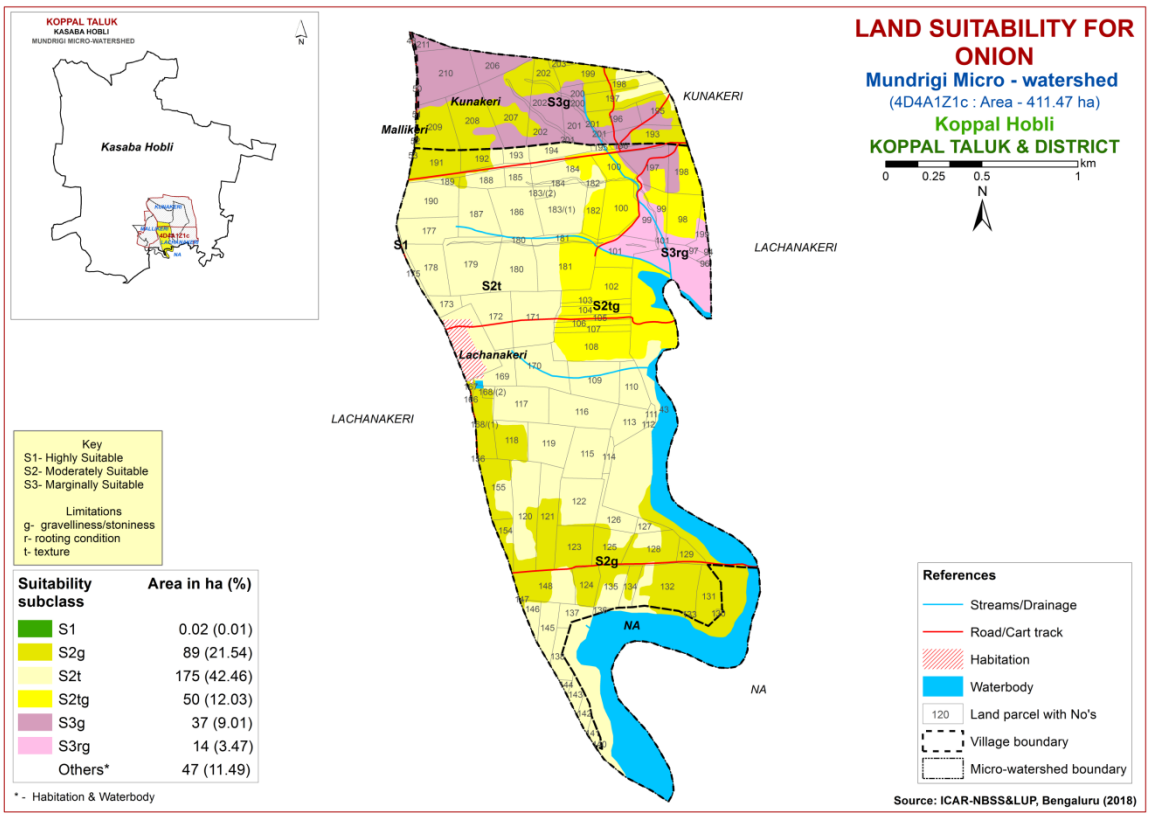


Fig 7.12 Land Suitability map of Onion

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 for growing bhendi occur in an area of about <1 ha (<1%) and distributed in the northern part of the microwatershed. Maximum area of about 314 ha (76%) is moderately suitable (Class S2) for bhendi and distributed in the major part of the microwatershed. They have minor limitations of gravelliness and texture. An area about of 51 ha (12%) is marginally suitable (Class S3) and distributed in the northern part of the microwatershed with moderate limitations of rooting depth and gravelliness.

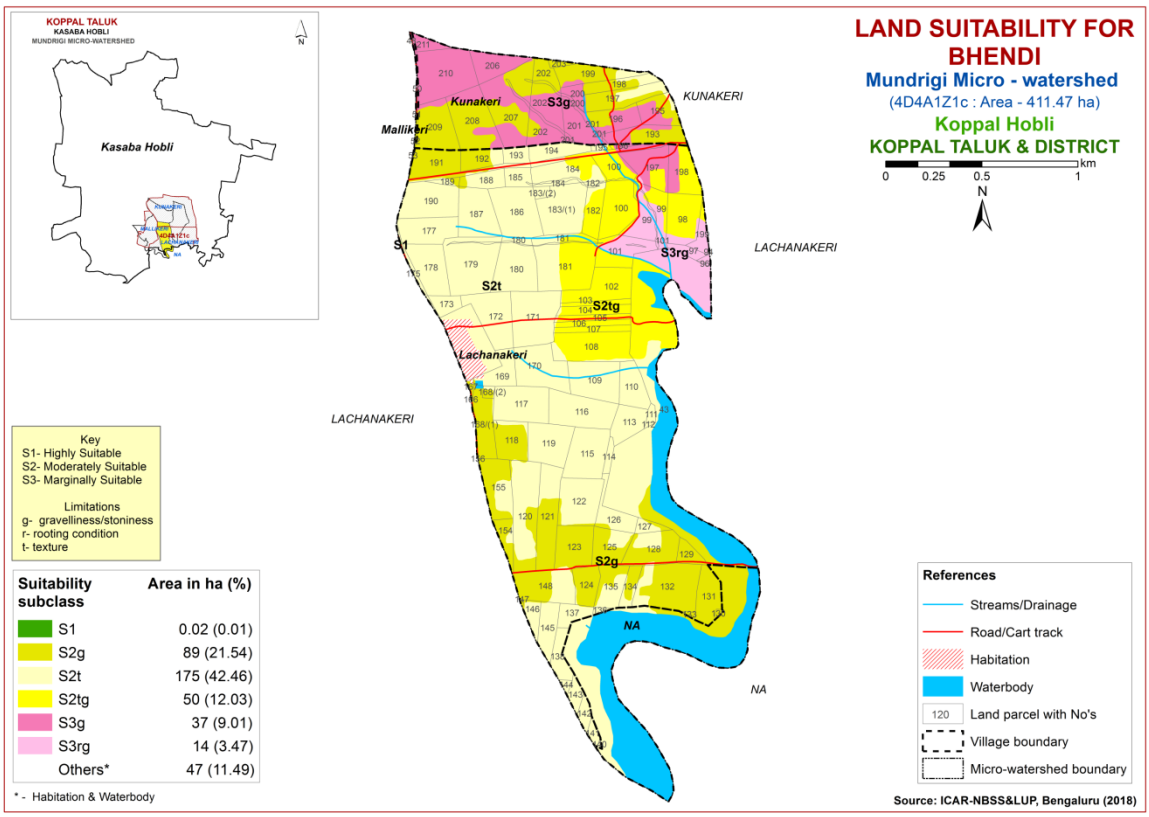


Fig 7.13 Land Suitability map of Bhendi

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 is given in Figure 7.14.

An area of about 98 ha (24%) is highly suitable (Class S1) for growing drumstick and distributed in the central, northern and southern part of the microwatershed. Maximum area of 166 ha (40%) is moderately suitable (Class S2) for growing drumstick and distributed in the central, northern and southern part of the microwatershed with minor limitations of rooting depth and gravelliness. An area of about 101 ha (25%) is marginally suitable (Class S3) for growing drumstick and occur in the central and northern part of the microwatershed with moderate limitations of rooting depth, drainage and gravelliness.

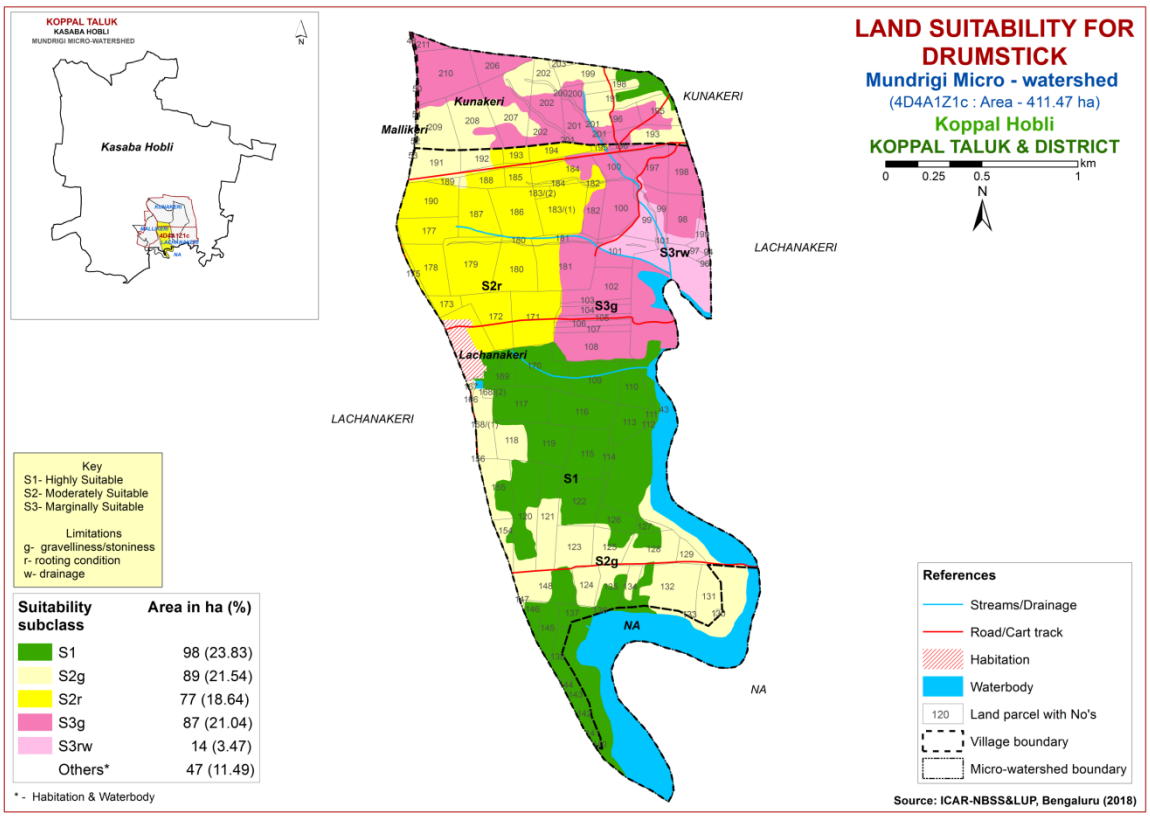


Fig. 7.14 Land Suitability map of Drumstick

7.15 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 7.16) 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 7.15.

Highly suitable (Class S1) lands for growing mulberry occur in an area of 98 ha (24%) and distributed in the central, northern and southern part of the microwatershed. Moderately suitable (Class S2) lands occupy a major area of about 252 ha (61%) and occur in the major part of the microwatershed. They have minor limitations of rooting depth and gravelliness. Marginally suitable (Class S3) lands cover an area of about 14 ha (3%) and occur in the northern part of the microwatershed. They have moderate limitations of rooting depth and drainage.

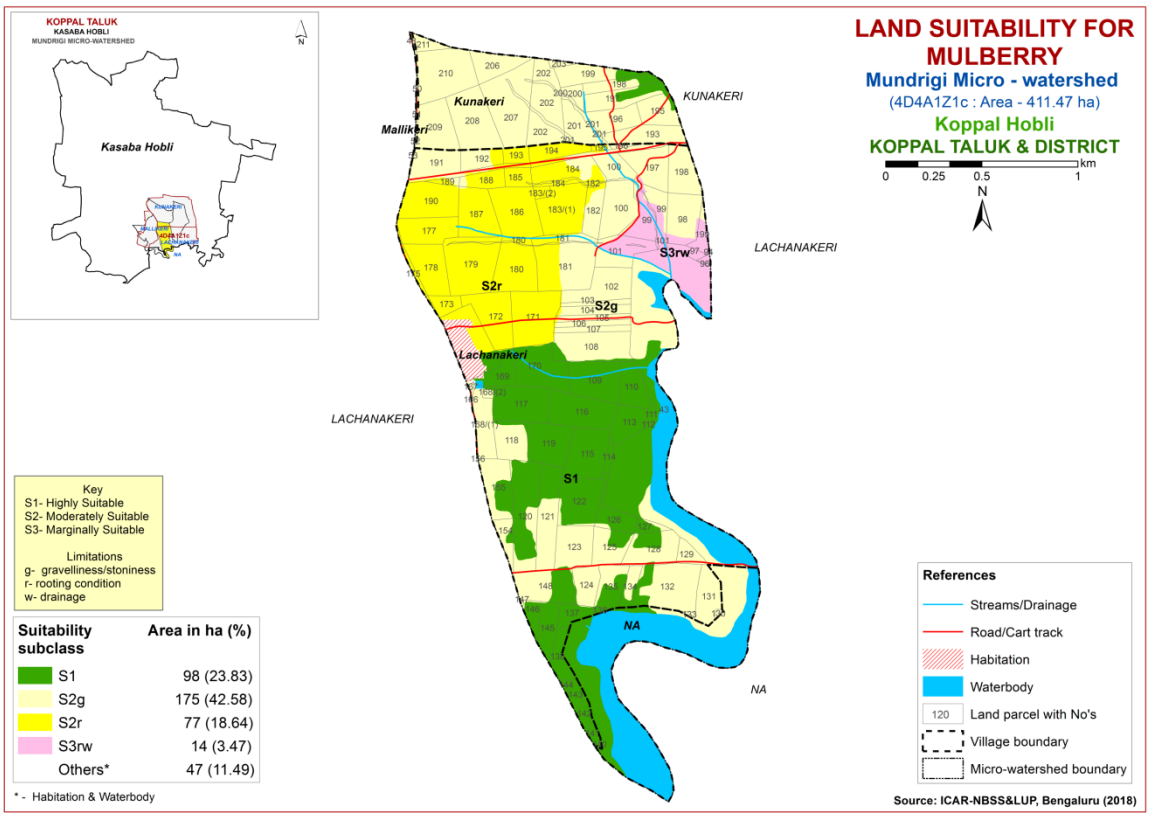


Fig. 7.15 Land Suitability map of Mulberry

7.16 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 7.17) for growing mango were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing mango was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.16.

An area of about 95 ha (23%) is highly suitable (Class S1) for growing mango and distributed in the central and southern part of the microwatershed. Moderately suitable (Class S2) lands occupy an area of about 3 ha (1%) and occur in the northern part of the microwatershed. They have minor limitation of rooting depth. Marginally suitable (Class S3) lands cover a major area of about 253 ha (61%) and occur in the major part of the microwatershed. They have moderate limitations of rooting depth and gravelliness. An area of about 14 ha (3%) is currently not suitable (Class N1) for growing mango and occur in the northern part of the microwatershed with severe limitation of rooting depth.

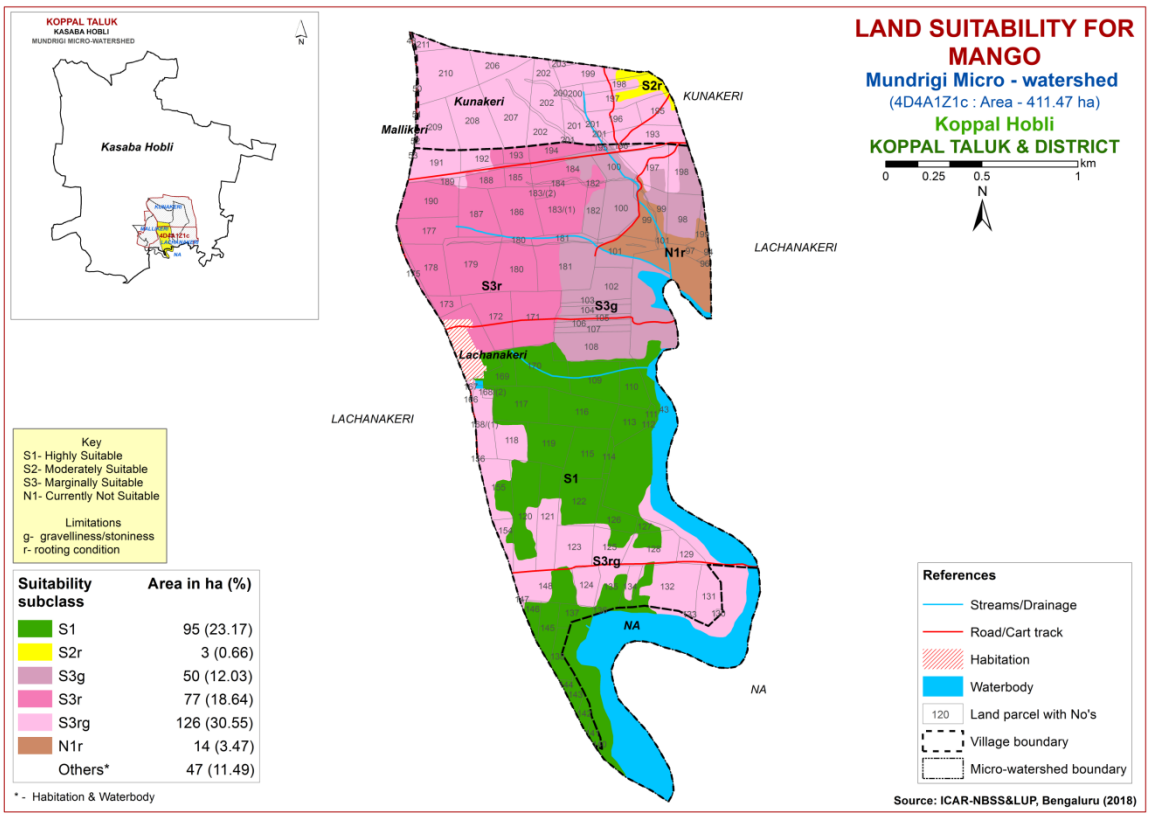


Fig. 7.16 Land Suitability map of Mango

7.17 Land Suitability for Sapota (*Manilkara zapota*)

Sapota is one of the most important fruit crop grown in an area of 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 98 ha (24%) is highly suitable (Class S1) for growing sapota and distributed in the central, northern and southern part of the microwatershed. An area of about 114 ha (28%) is moderately suitable (Class S2) for growing sapota and distributed in the northern part of the microwatershed with minor limitations of gravelliness and rooting depth. Major area of about 152 ha (37%) is marginally (Class S3) suitable for growing sapota and occur in the central, northern and southern part of the microwatershed with moderate limitations of rooting depth and gravelliness.

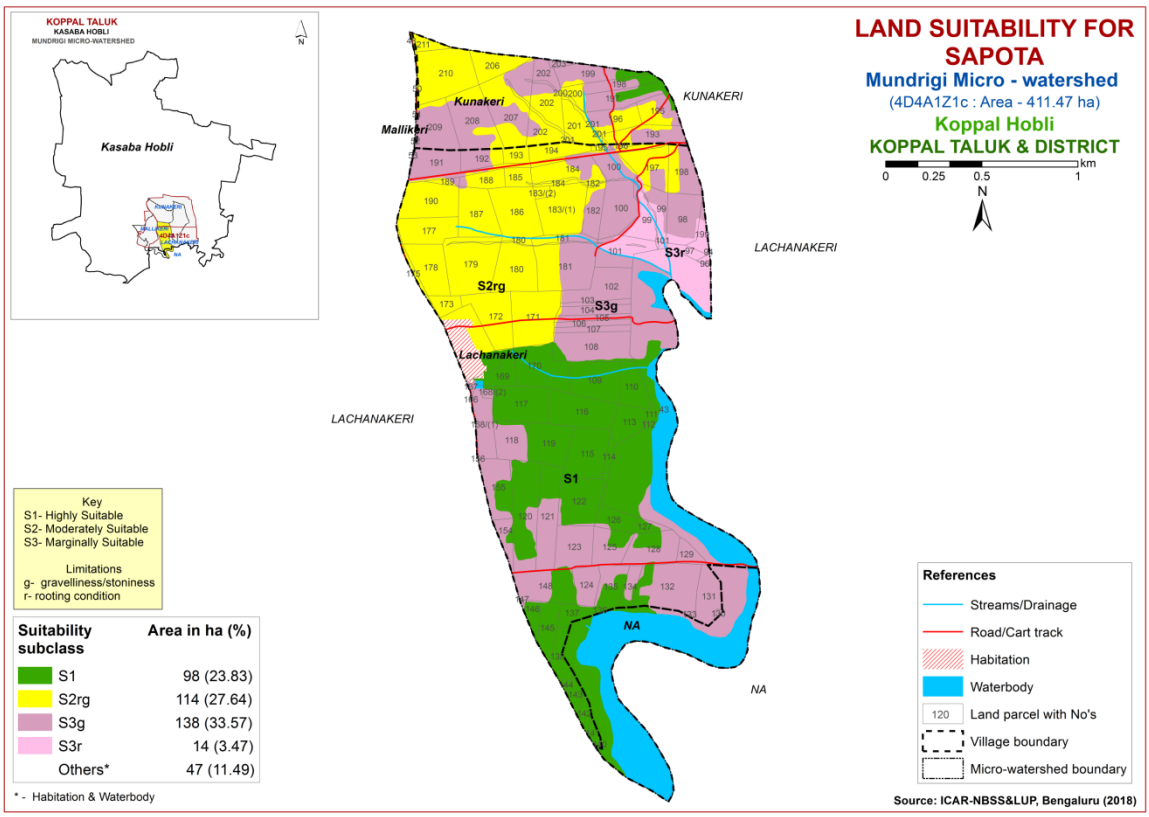


Fig. 7.17 Land Suitability map of Sapota

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.

Highly suitable (Class S1) lands for growing pomegranate occur in an area of about 98 ha (24%) and distributed in the central, northern and southern part of the microwatershed. An area of about 114 ha (28%) is moderately suitable (Class S2) for growing pomegranate and occur in the northern part of the microwatershed with minor limitations of texture, rooting depth and gravelliness. Marginally suitable (Class S3) lands cover a major area of about 152 ha (37%) and occur in the central, northern and southern part of the microwatershed. They have moderate limitations of rooting depth and gravelliness.

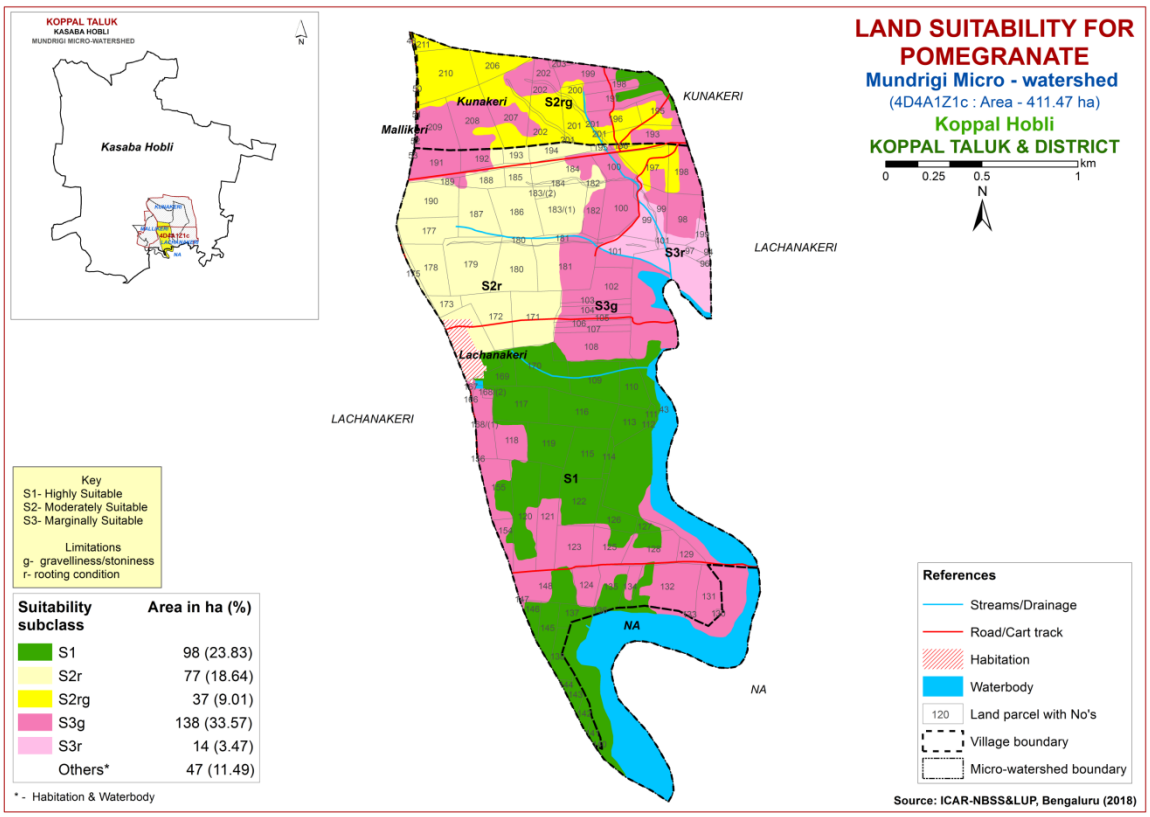


Fig. 7.18 Land Suitability map of Pomegranate

7.19 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 7.20) 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 7.19.

An area of about 95 ha (23%) is highly suitable (Class S1) for growing guava and distributed in the central and southern part of the microwatershed. An area of about 117 ha (28%) is moderately suitable (Class S2) for growing guava and distributed in the northern part of the microwatershed with minor limitations of rooting depth, texture and gravelliness. Maximum area of 152 ha (37%) is marginally (Class S3) suitable for growing guava and occur in the central, northern and southern part of the microwatershed with moderate limitations of rooting depth and gravelliness.

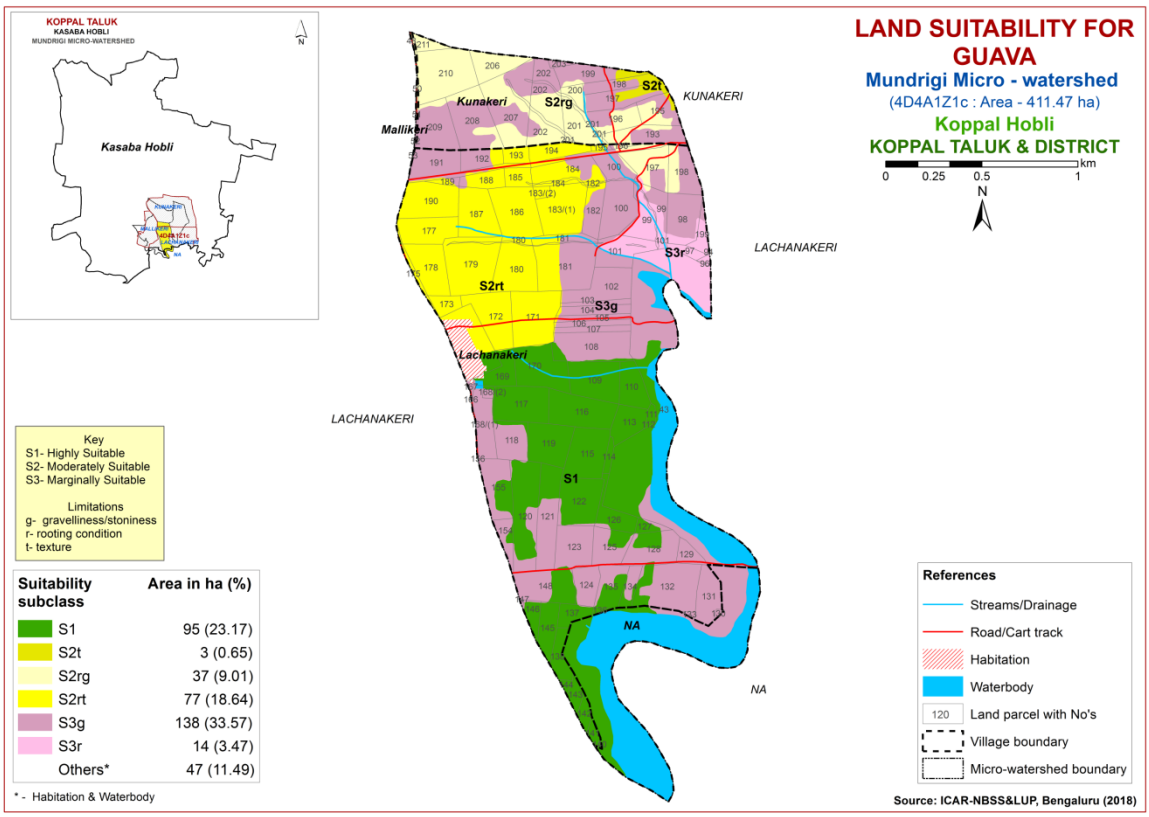


Fig. 7.19 Land Suitability map of Guava

7.20 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 7.21) 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 7.20.

Highly suitable (Class S1) lands for growing jackfruit occur in an area of about 98 ha (24%) and distributed in the central, northern and southern part of the microwatershed. An area of about 114 ha (28%) is moderately suitable (Class S2) for growing jackfruit and distributed in the northern part of the microwatershed with minor limitations of gravelliness and rooting depth. Major area of about 152 ha (37%) is marginally (Class S3) suitable for growing jackfruit and occur in the central, northern and southern part of the microwatershed with moderate limitations of rooting depth and gravelliness.

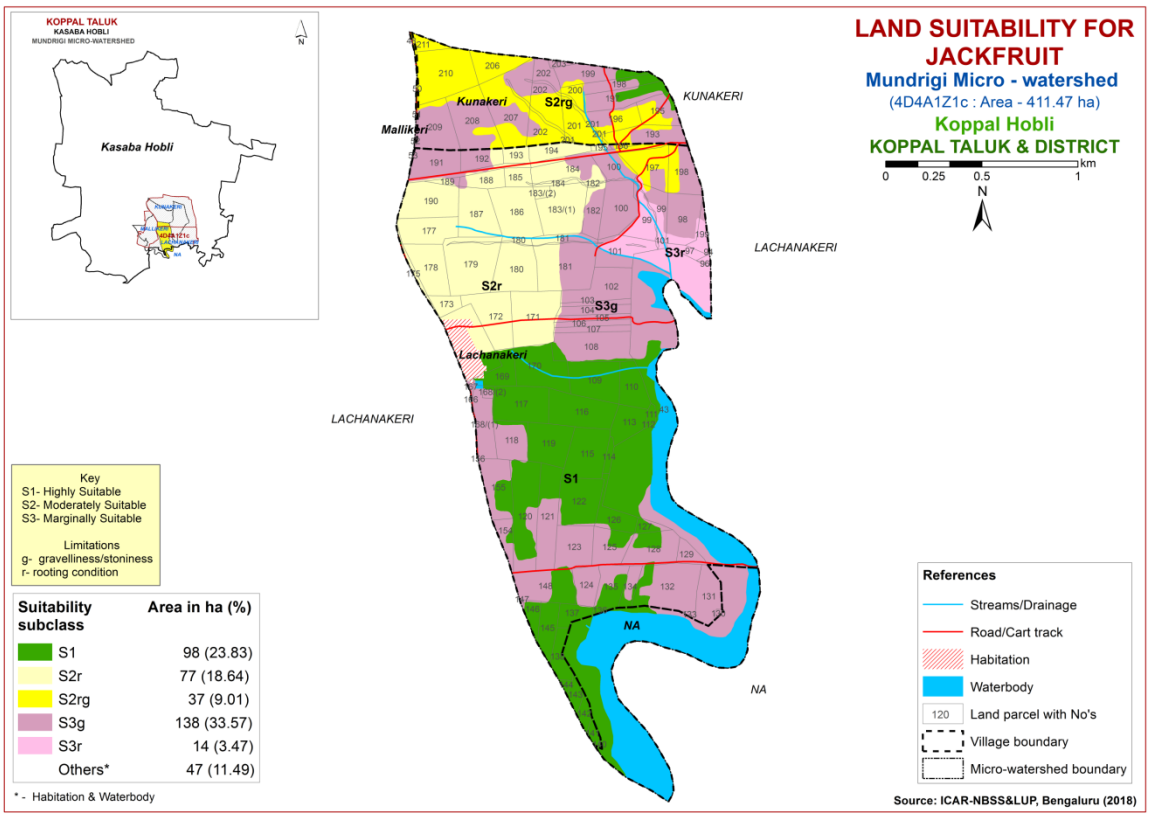


Fig. 7.20 Land Suitability map of Jackfruit

7.21 Land Suitability for Jamun (*Syzygium cumini*)

Jamun is one of the important fruit crop grown in almost all the districts of the state. The crop requirements (Table 7.22) 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 7.21.

An area of about 95 ha (23%) is highly suitable (Class S1) for growing jamun and distributed in the central and southern part of the microwatershed. An area of 116 ha (28%) is moderately suitable (Class S2) for growing jamun and occur in the northern part of the microwatershed with minor limitations of rooting depth and gravelliness. Marginally suitable (Class S3) lands cover a major area of about 152 ha (37%) and occur in the central, northern and southern part of the microwatershed. They have moderate limitations of rooting depth and gravelliness.

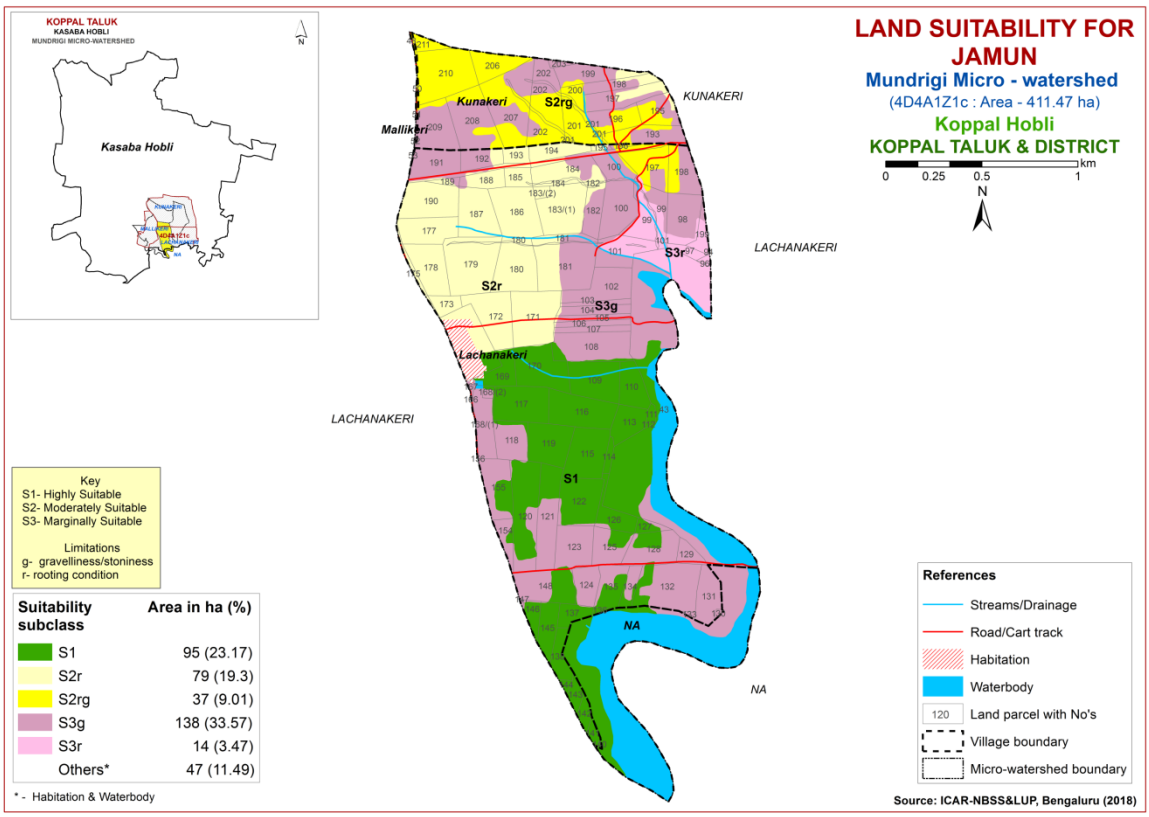


Fig. 7.21 Land Suitability map of Jamun

7.22 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 7.23) 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 7.22.

Highly suitable (Class S1) lands for growing musambi cover an area of about 98 ha (24%) and occur in the central, northern and southern part of the microwatershed. An area of about 114 ha (28%) is moderately suitable (Class S2) for growing musambi and occur in the northern part of the microwatershed with minor limitations of rooting depth and gravelliness. Marginally suitable (Class S3) lands cover a major area of about 152 ha (37%) and occur in the central, northern and southern part of the microwatershed. They have moderate limitations of rooting depth and gravelliness.

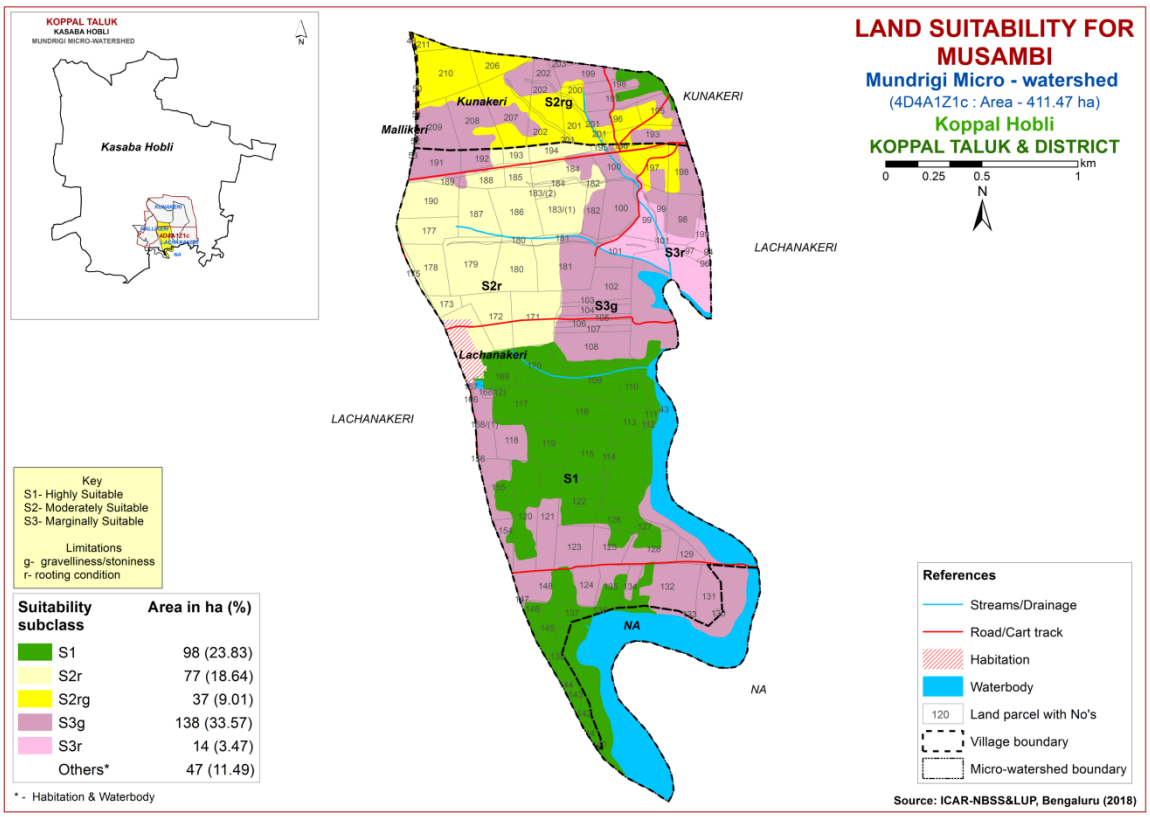


Fig. 7.22 Land Suitability map of Musambi

7.23 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 (Table 7.24) for growing lime (Table 7.15) 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 7.23.

An area of about 98 ha (24%) is highly suitable (Class S1) for growing lime and occur in the central, northern and southern part of the microwatershed. An area of about 114 ha (28%) is moderately suitable (Class S2) for growing lime and occur in the northern part of the microwatershed with minor limitations of rooting depth and gravelliness. Marginally suitable (Class S3) lands cover a major area of about 152 ha (37%) and occur in the central, northern and southern part of the microwatershed. They have moderate limitations of rooting depth and gravelliness.

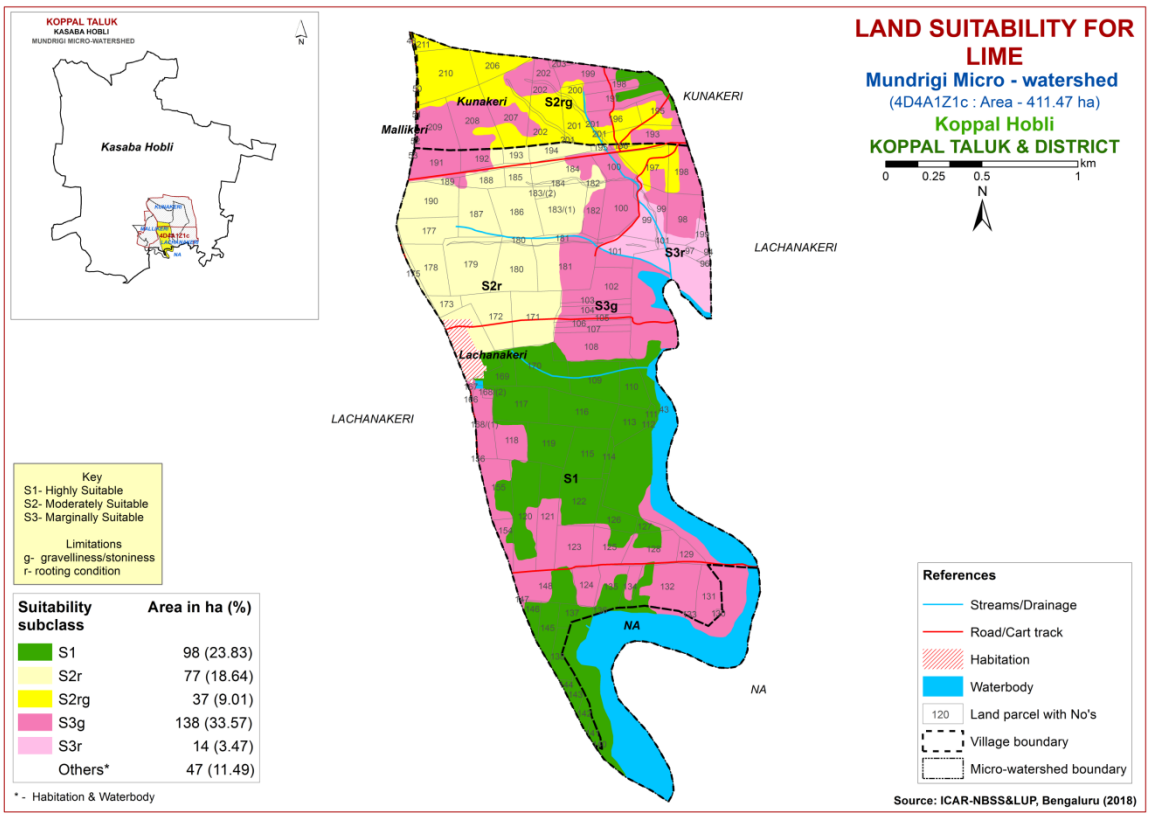


Fig. 7.23 Land Suitability map of Lime

7.24 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 (Table 7.25) for growing cashew 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 7.24.

Highly suitable (Class S1) lands for growing cashew cover an area of about 95 ha (23%) and occur in the central and southern part of the microwatershed. Maximum area of about 167 ha (40%) is moderately suitable (Class S2) for growing cashew and distributed in the central and northern part of the microwatershed with minor limitations of rooting depth, texture and gravelliness. An area of about 89 ha (22%) is marginally suitable (Class S3) for growing cashew and distributed in the central, northern and southern part of the microwatershed with moderate limitation of gravelliness. Currently not suitable (Class N1) lands cover an area of about 14 ha (3%) and distributed in the northern part of the microwatershed with severe limitations of texture and drainage.

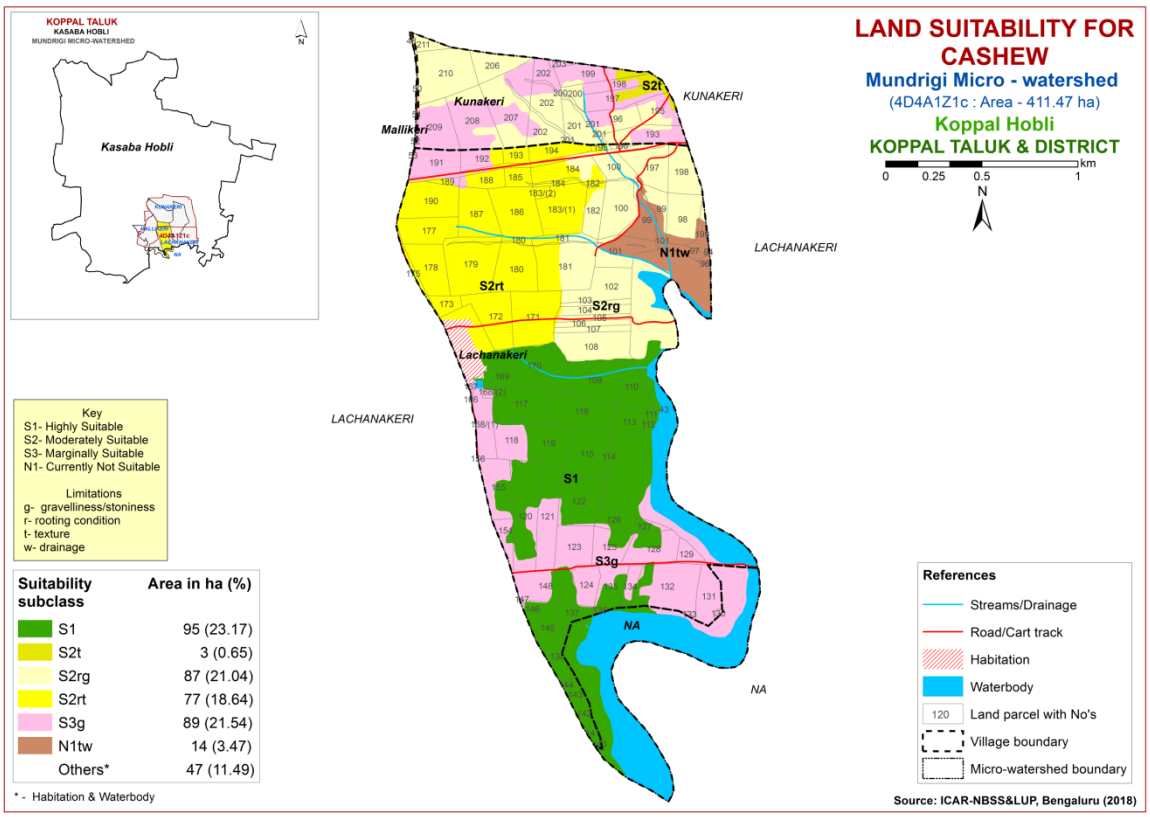


Fig. 7.24 Land Suitability map of Cashew

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 175 ha (42%) is highly suitable (Class S1) for growing custard apple and occur in the central, northern and southern part of the microwatershed. Major area of about 189 ha (46%) is moderately suitable (Class S2) for growing custard apple and occur in the central, northern and southern part of the microwatershed with minor limitations of rooting depth, drainage and gravelliness.

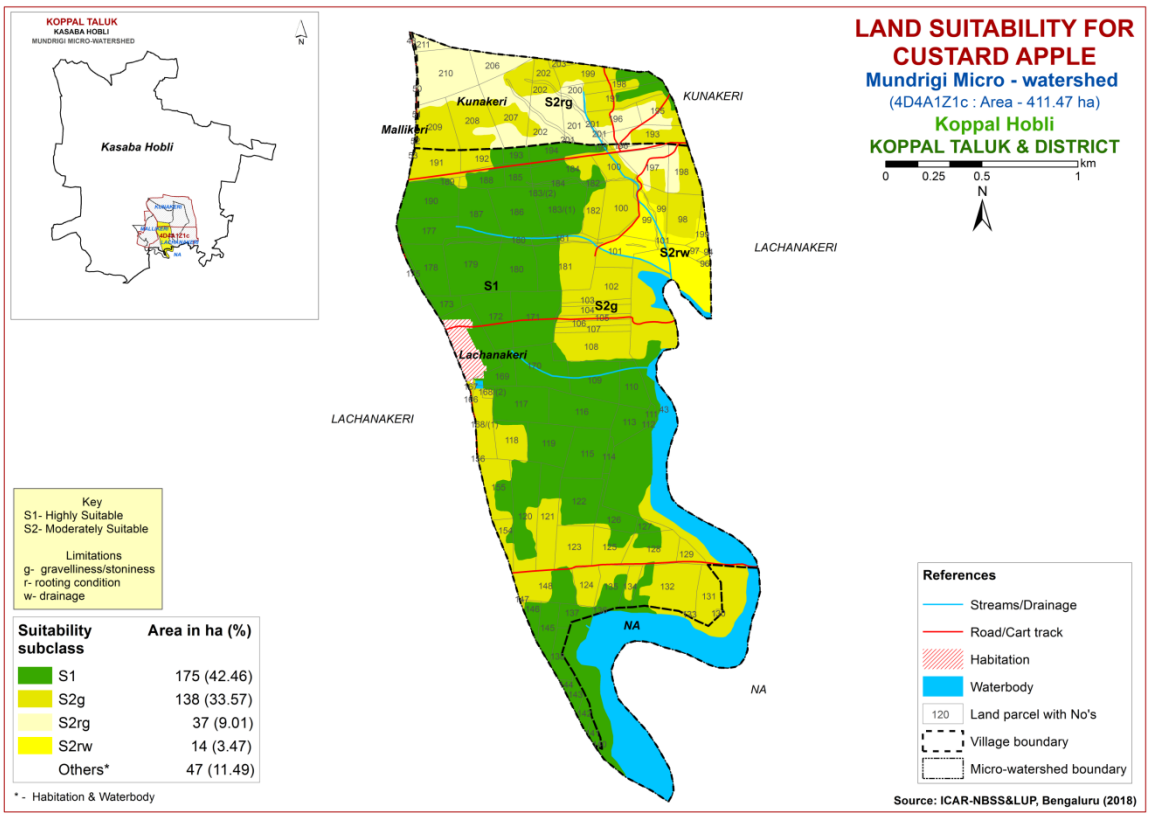


Fig. 7.25 Land Suitability map of Custard Apple

7.26 Land Suitability for Amla (*Phyllanthus emblica*)

Amla is one of the most important fruit and medicinal crop grown in an area of 151 ha and distributed in almost all the districts of the state. The crop requirements for (Table 7.27) 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 7.26.

Highly suitable (Class S1) lands for growing amla cover an area of about 175 ha (42%) and occur in the central, northern and southern part of the microwatershed. Major area of about 189 ha (46%) is moderately suitable (Class S2) for growing amla and occur in the central, northern and southern part of the microwatershed with minor limitations of rooting depth, drainage and gravelliness.

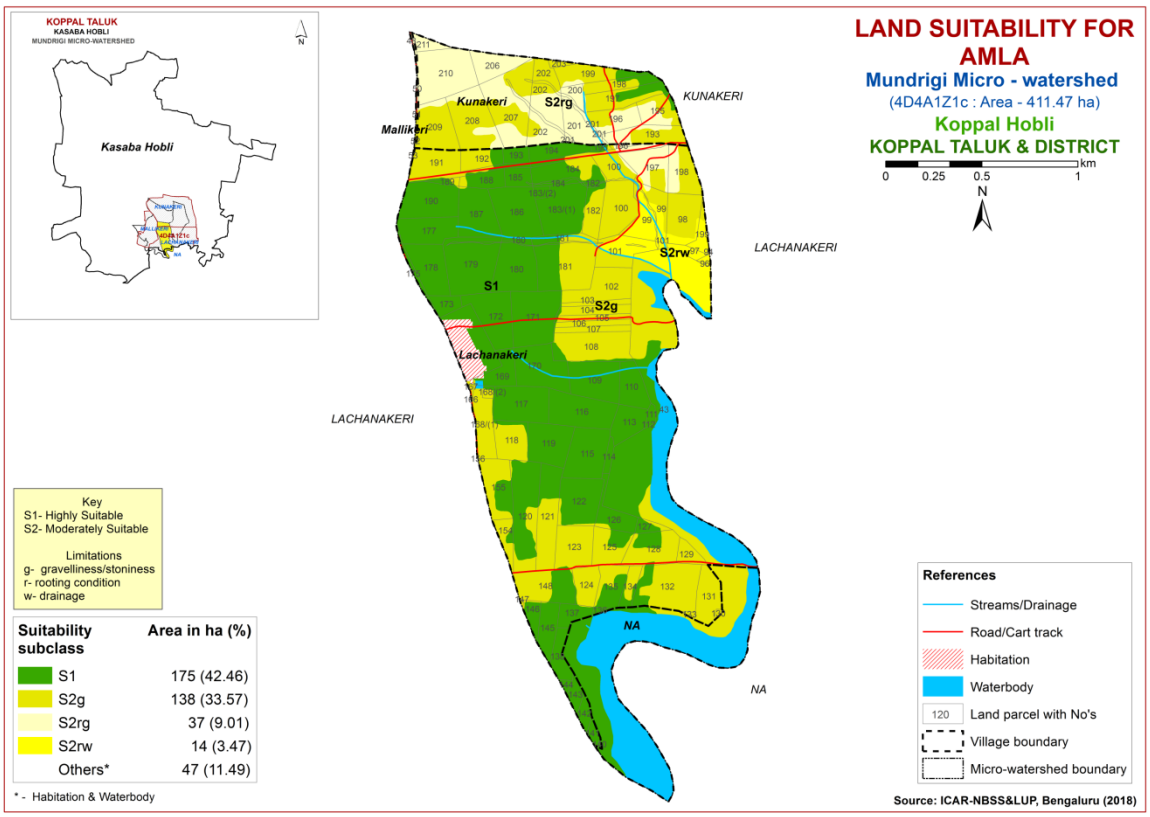


Fig. 7.26 Land Suitability map of Amla

7.27 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 7.28) 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 is given in Figure 7.27.

An area of about 95 ha (23%) is highly suitable (Class S1) for growing tamarind and occur in the central and southern part of the microwatershed. An area of about 21 ha (5%) is moderately suitable (Class S2) for growing tamarind and occur in the northern part of the microwatershed with minor limitations of rooting depth and gravelliness. Marginally suitable (Class S3) lands cover a major area of 234 ha (58%) for growing tamarind and occur in the major part of the microwatershed. They have moderate limitations of rooting depth and gravelliness. An area of about 14 ha (3%) is currently not suitable (Class N1) for growing tamarind and distributed in the northern part of the microwatershed. They have severe limitation of rooting depth.

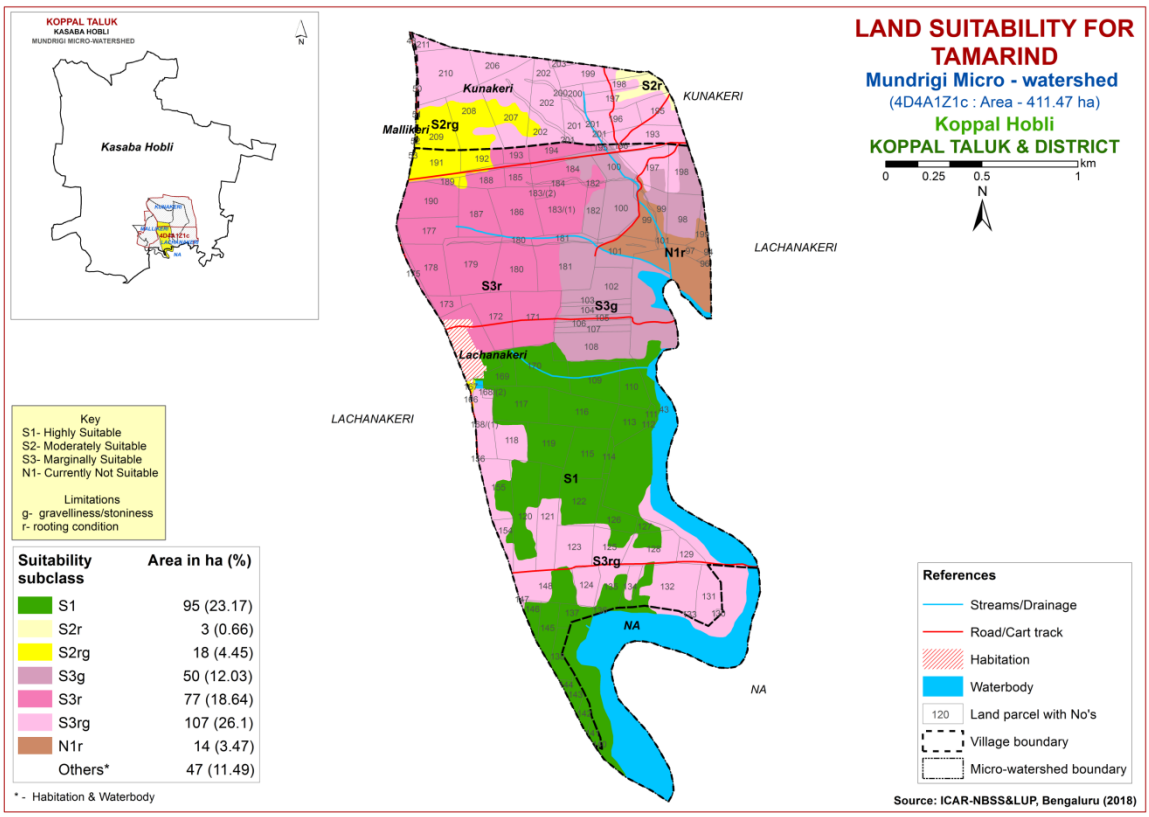


Fig. 7.27 Land Suitability map of Tamarind

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 (Table 7.1) and a land suitability map for growing marigold was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.28.

Highly suitable (Class S1) lands for growing marigold cover an area of about 95 ha (23%) and occur in the central and southern part of the microwatershed. An area of about 94 ha (23%) is moderately suitable (Class S2) for growing marigold and distributed in the northern part of the microwatershed with minor limitations of texture, rooting depth, drainage and gravelliness. Maximum area of about 175 ha (43%) is marginally suitable (Class S3) for growing marigold and occur in the central, northern and southern part of the microwatershed with moderate limitation of gravelliness.

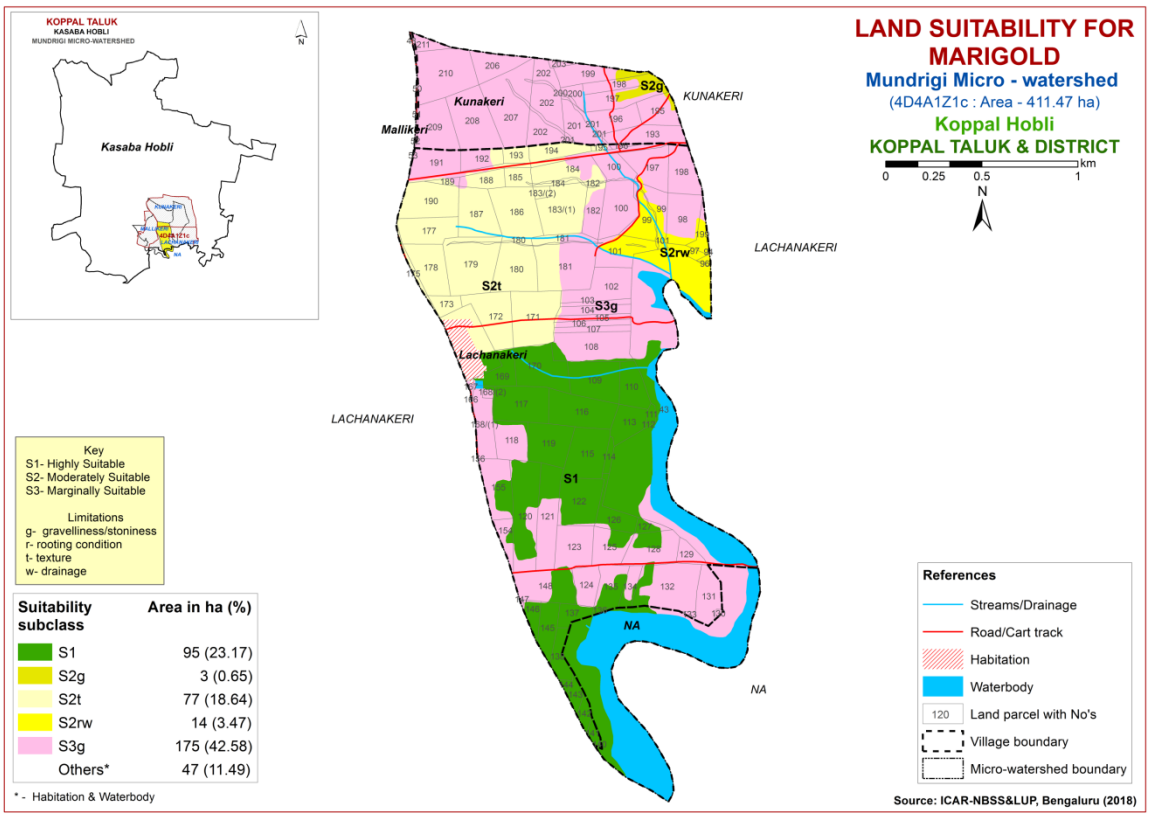


Fig. 7.28 Land Suitability map of Marigold

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 95 ha (23%) is highly suitable (Class S1) for growing chrysanthemum and occur in the central and southern part of the microwatershed. An area of about 93 ha (23%) is moderately suitable (Class S2) for growing chrysanthemum and distributed in the northern part of the microwatershed with minor limitations of texture, rooting depth, drainage and gravelliness. Maximum area of about 175 ha (43%) is marginally suitable (Class S3) for growing chrysanthemum and occur in the central, northern and southern part of the microwatershed with moderate limitation of gravelliness.

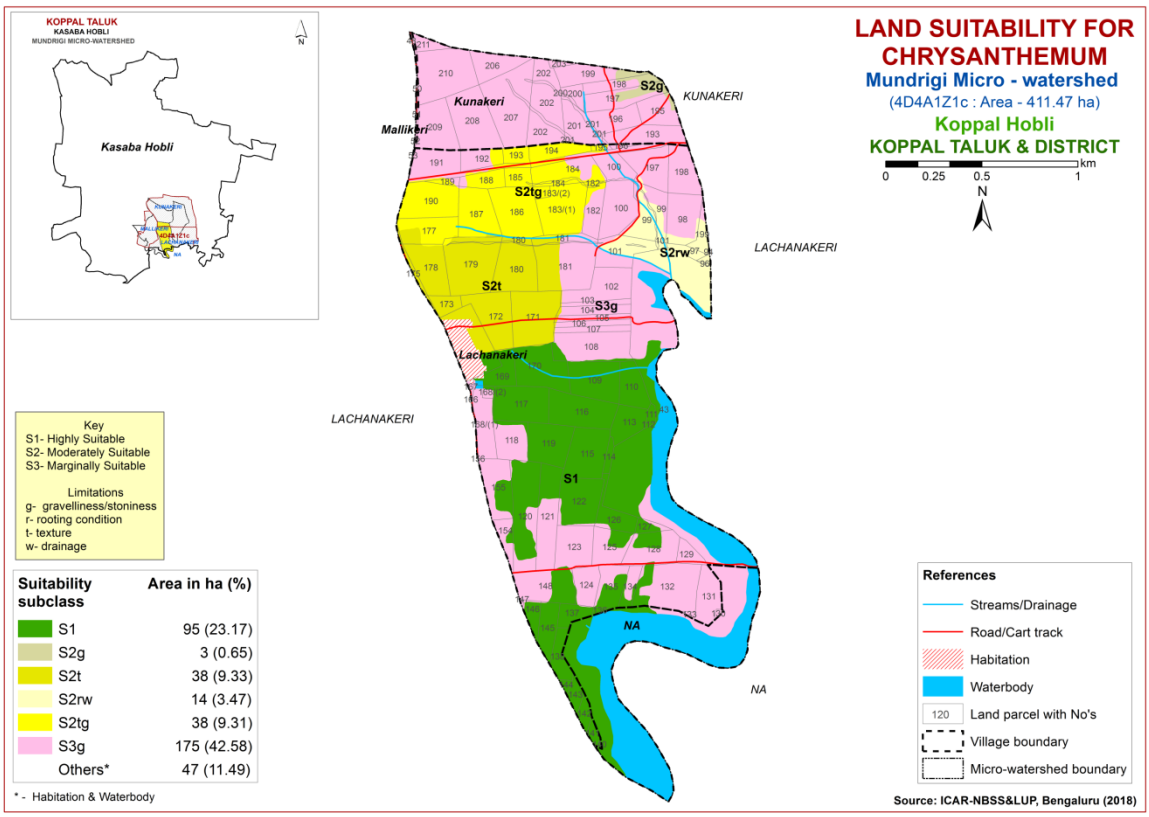


Fig. 7.29 Land Suitability map of Chrysanthemum

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.

Highly suitable (Class S1) lands for growing jasmine cover an area of about 95 ha (23%) and occur in the central and southern part of the microwatershed. An area of about 93 ha (23%) is moderately suitable (Class S2) for growing jasmine and occur in the northern part of the microwatershed. They have minor limitations of gravelliness, texture, drainage and rooting depth. Major area of about 175 ha (43%) is marginally suitable (Class S3) for growing jasmine and occur in the central, northern and southern part of the microwatershed. They have moderate limitation of gravelliness.

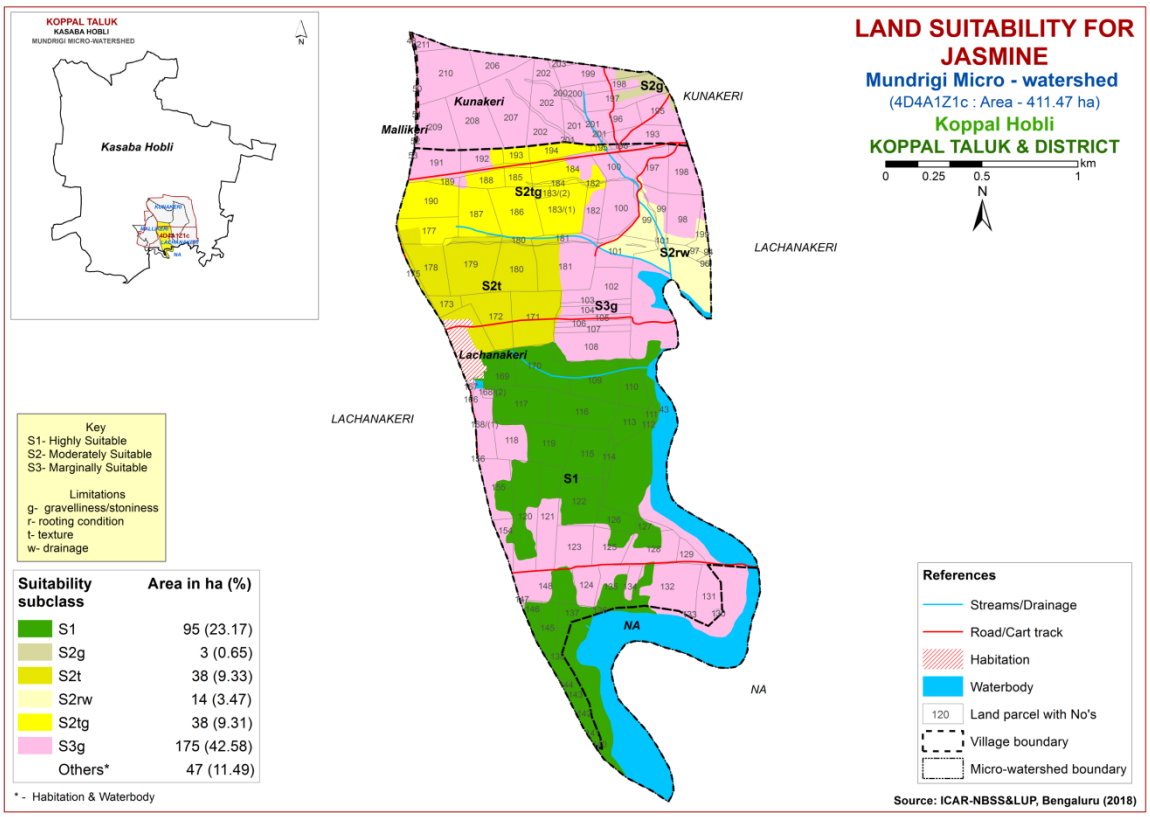


Fig. 7.30 Land Suitability map of Jasmine

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

Crossandra is one of the most important flower crop grown in all the districts of the state. The crop requirements (Table 7.32) for growing crossandra were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing crossandra was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.31.

An area of about 95 ha (23%) is highly suitable (Class S1) for growing crossandra and occur in the central and southern part of the microwatershed. An area of about 93 ha (23%) is moderately suitable (Class S2) for growing crossandra and occur in the northern part of the microwatershed. They have minor limitations of gravelliness, texture, drainage and rooting depth. Major area of about 175 ha (43%) is marginally suitable (Class S3) for growing crossandra and occur in the central, northern and southern part of the microwatershed. They have moderate limitation of gravelliness.

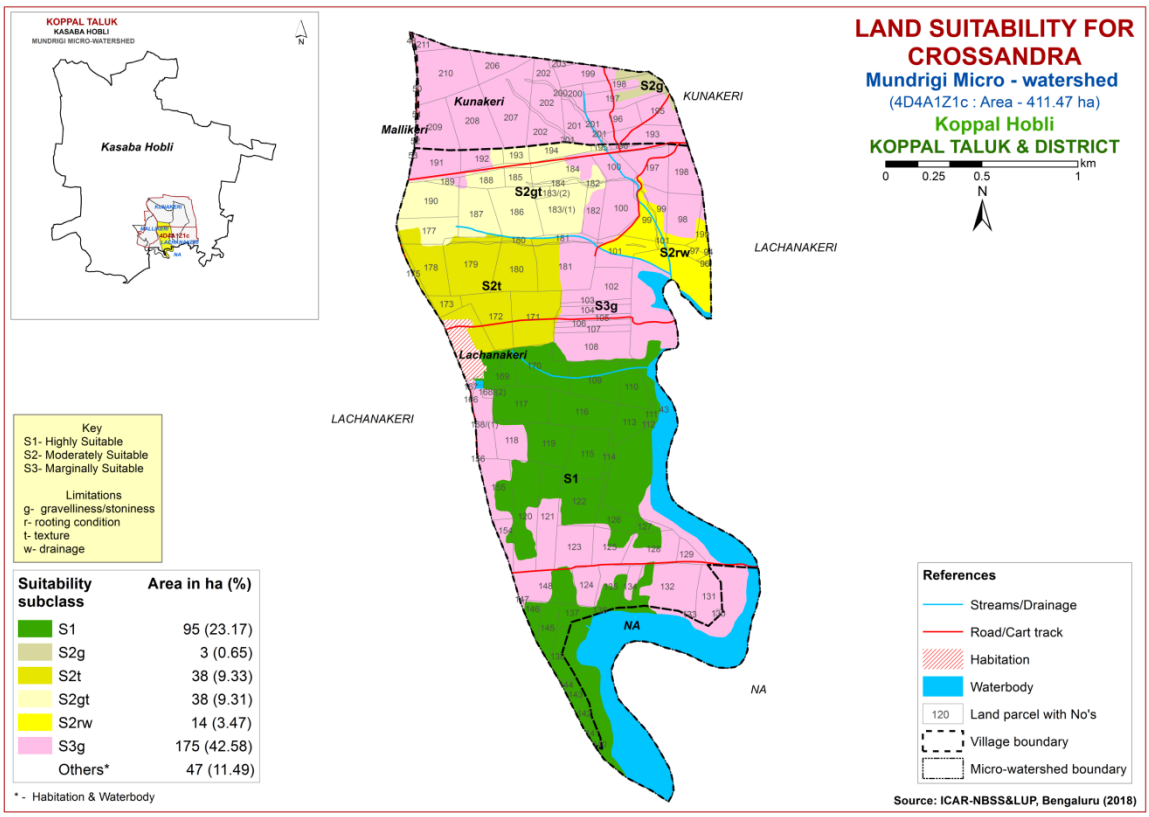


Fig. 7.31 Land Suitability map of Crossandra

Table 7.1 Soil-Site Characteristics of Mundrigi Microwatershed

Soil Map Units	Climate (P) (mm)	Growing period (Days)	Drainage Class	Soil depth (cm)	Soil texture		Gravelliness		AWC (mm/m	Slope (%)	Erosion	pH	EC	ESP	CEC [Cmol (p+)kg-1]	BS (%)
					Surf-ace	Sub-surface	Sur-face	Sub-surface								
HNHiB2	662	<90	MWD	50-75	sc	sc	<15	<15	101-150	1-3	Moderate	7.94	0.99	2.13	18.00	99.15
HDHcB2g1	662	<90	WD	75-100	sl	gsc-gc	15-35	>35	51-100	1-3	Moderate	6.54	0.07	7.11	5.84	84.07
HDHhB2g1	662	<90	WD	75-100	scl	gsc-gc	15-35	>35	51-100	1-3	Moderate	6.54	0.07	7.11	5.84	84.07
CKMiA1	662	<90	WD	75-100	sc	sc	<15	<15	101-150	0-1	Slight	7.99	0.326	1.73	12.50	119
CKMiB1	662	<90	WD	75-100	sc	sc	<15	<15	101-150	1-3	Slight	7.99	0.326	1.73	12.50	119
BDGhB2	662	<90	WD	75-100	scl	gc	<15	35-60	<50	1-3	Moderate	6.24	0.06	0.35	3.76	52.56
BPRcB2	662	<90	WD	100-150	sl	gsc-gc	<15	>35	101-150	1-3	Moderate	6.64	0.03	0.51	5.45	63.48
BPRcB2g1	662	<90	WD	100-150	sl	gsc-gc	15-35	>35	101-150	1-3	Moderate	6.64	0.03	0.51	5.45	63.48
BPRhB2g1	662	<90	WD	100-150	scl	gsc-gc	15-35	>35	101-150	1-3	Moderate	6.64	0.03	0.51	5.45	63.48
BPRhB2g2	662	<90	WD	100-150	scl	gsc-gc	35-60	>35	101-150	1-3	Moderate	6.64	0.03	0.51	5.45	63.48
JDGiA1g1	662	<90	WD	100-150	sc	sc-c	15-35	<15	>200	0-1	Slight	6.11	0.078	2.06	9.41	90
KMHiB2	662	<90	WD	100-150	sc	sc	<15	<15	151-200	1-3	Moderate	7.2	0.193	0.54	15.07	100
RTRcB2	662	<90	WD	>150	sl	c	<15	<15	151-200	1-3	Moderate	6.47	0.03	0.41	7.07	100
RTRiB2	662	<90	WD	>150	sc	c	<15	<15	151-200	1-3	Moderate	6.47	0.03	0.41	7.07	100

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

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 characteristics					
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 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/Somewhat 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 7.8 Land suitability criteria for Red 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	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 7.9 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 7.10 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 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

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

Table 7.17 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 7.18 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 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 7.21 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 7.22 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 7.23 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 7.24 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 7.25 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 7.26 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 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 7.28 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 7.29 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

Table 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 14 soil map units identified in Mundrigi microwatershed have been grouped into 3 Land Management Units (LMUs) for the purpose of preparing a Proposed Crop Plan. Land Management Units are grouped based on the similarities in respect of the type of soil, the depth of the soil, the surface soil texture, gravel content, AWC, slope, erosion etc. and a Land Management Unit map (Fig.7.32) 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 3 Land Management Units along with brief description of soil and site characteristics are given below.

LMUs	Mapping unit	Soil and site characteristics
1	177.CKMiA1 178.CKMiB1 212.JDGiA1g1 201.KMHiB2 285.RTRcB2 288.RTRiB2	Moderately deep to very deep, sandy clay to clay soils, 0-3% slope, slight to moderate erosion, non-gravelly to gravelly (<15-35%).
2	471.HNHiB2	Moderately shallow, lowland sandy clay soils, 1-3% slope, moderate erosion, non-gravelly (<15%).
3	187.BDGhB2 224.BPRcB2 225.BPRcB2g1 231.BPRhB2g1 232.BPRhB2g2 111.HDHcB2g1 123.HDHhB2g1	Moderately deep to deep, red gravelly clay soils, 1-3% slope, moderate erosion, non-gravelly to very gravelly (<15-60%).

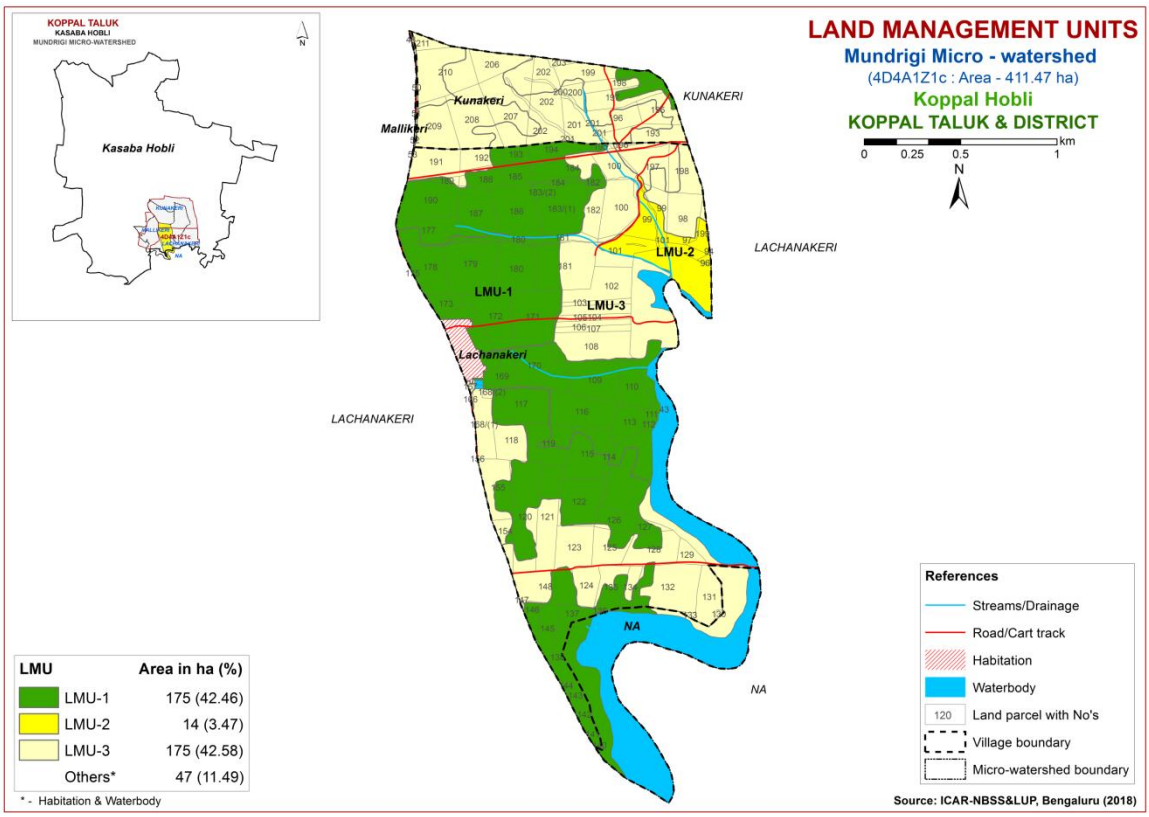


Fig 7.32 Land Management Units map of Mundrigi microwatershed

7.33 Proposed Crop Plan for Mundrigi Microwatershed

After assessing the land suitability for the 31 crops, the proposed crop plan has been prepared for the 3 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 Mundrigi Microwatershed

LMU	Soil Map Units	Survey Number	Soil and site characteristics	Field Crops	Horticulture Crops	Suitable Interventions
1	177.CKMiA1 178.CKMiB1 212.JDGiA1g1 201.KMHiB2 285.RTRcB2 288.RTRiB2	**Lachanakeri**:109,110,111,112,113,114,115,116,117,119,120,122,126,127,135,136,137,138,140,141,142,143,144,145,146,169,170,171,172,173,175,177,178,179,180,183/(1),183/(2),184,185,186,187,188,189,190,193,194,195	Moderately deep to very deep, sandy clay to clay soils, 0-3% slope, slight to moderate erosion, non-gravelly to gravelly (<15-35%).	Maize, Red gram, Finger millet, Bajra, Sorghum, Sunflower, Groundnut, 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, Jasmine, Chrysanthemum, Crossandra	Drip irrigation, mulching, suitable soil and water conservation practices (Crescent Bunding with Catch Pit etc)
2	471.HNHiB2	**Lachanakeri**:94,96,97,99,101,199	Moderately shallow, lowland sandy clay soils, 1-3% slope, moderate erosion, non-gravelly (<15%).	Maize, Bajra	**Fruit crops**: Custard Apple, Amla **Vegetable crops**: Brinjal, Tomato, Chillies, Coriander, Cabbage, Onion	Providing proper drainage, addition of organic manures, green leaf manuring, suitable conservation practices
3	187.BDGhB2 224.BPRcB2 225.BPRcB2g1 231.BPRhB2g1 232.BPRhB2g2 111.HDHcB2g1 123.HDHhB2g1	**Kunakeri**:193,195,196,197,198,199,200,201,202,203,206,207, 208,209,210,211 **Lachanakeri**:98,100,102,103,104,105,106,107,108,118,121,123,124,125,128,129,130,131,132,133,134,147,148,154,155,156,166,167,168/(1),168/(2),181,182,191,192,196,197,198 **Mallikeri**: 48,50,51,52,53	Moderately deep to deep, red gravelly clay soils, 1-3% slope, moderate erosion, non-gravelly to very gravelly (<15-60%).	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)

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 unfavorable conditions occur

Characteristics of Mundrigi Microwatershed

- The soil phases with sizeable area identified in the microwatershed belonged to the soil series of Ranatur (RTR) series occupies major area of 95 ha (23%) followed by Balapur (BPR) 89 ha (22%), Chikkamegheri (CKM) 76 ha (19%), Bidanagere (BDG) 50 ha (12%), Hooradhahalli (HDH) 37 ha (9%), Honnenahalli (HNH) 14 ha (3%), Jedigere (JDG) 3 ha (1%) and Kumchahalli (KMH) <1 ha (<1%).
- As per land capability classification, maximum area of about 225 ha (55%) in the microwatershed falls under good lands (Class II) with minor limitations of soil,

drainage and erosion. An area of about 138 ha (34%) is under moderately good lands (Class III) with severe limitations of soil and erosion.

- On the basis of soil reaction, an area of about 9 ha (2%) are slightly acid (pH 6.0-6.5), 305 ha (74%) are neutral (pH 6.5-7.3) and 50 ha (12%) are slightly alkaline (pH 7.3-7.8) in soil reaction.

Soil Health Management

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

Acid soils

Slightly acid soils occur in an area of about 9 ha (2%) in the microwatershed.

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

Liming materials:

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

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

Neutral soils

Neutral soils occur in an area of about 305 ha (74%) in the microwatershed.

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

Alkaline soils

Slightly alkaline soils cover an area of about 50 ha (12%) in the microwatershed.

1. Regular addition of organic manure, green manuring, green leaf manuring, crop residue incorporation and mulching needs to be taken up to improve the soil organic matter status.
2. Application of Biofertilizers (Azospirullum, Azotobacter, Rhizobium).
3. Application of 25% extra N and P (125 % RDN&P).
4. Application of ZnSO4 – 12.5 kg/ha (once in three years).
5. Application of Boron – 5 kg/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 285 ha (69%) is suffering from moderate erosion. These areas need immediate soil and water conservation and, other land development and land husbandry practices for restoring soil health.

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, radish, 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 Mundrigi Microwatershed.
- **Organic Carbon:** The OC content is medium (0.5-0.75%) in an area of about 18 ha (4%). These areas needs to be further improved by applying farmyard manure and rotating crops with cereals and legumes or mixed cropping and high (>0.75%) in 346 ha (84%) area of the microwatershed.
- **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 18 ha (4%) area where OC is low and medium (<0.5-0.75%). For example, for rainfed maize, recommended level is 50 kg N per ha and an additional 12 kg /ha needs to be applied for all the crops grown in these plots.
- **Available Phosphorus**: Entire cultivated area of the microwatershed fall under high (>57 kg/ha) in available phosphorus content. Hence all the plots, where available phosphorus is low and medium, for all the crops, 25% additional P-needs to be applied
- **Available Potassium:** Available potassium content is low (<145 kg/ha) in an area of about 50 ha (12%), medium (145-337 kg/ha) in 313 ha (76%) area and high (>337 kg/ha) in 1 ha (<1%) area of the microwatershed. All the plots, where available potassium is low and medium, for all the crops, additional 25% of potassium may be applied.
- **Available Sulphur:** Available sulphur is a very critical nutrient for oilseed crops. Available sulphur content is low (<10 ppm) in the entire cultivated area of the microwatershed. Low and medium areas need to be applied with magnesium sulphate or gypsum or Factamphos (p) fertilizer (13% of sulphur) for 2-3 years for the deficiency to be corrected.
- **Available Boron:** An area of about 332 ha (81%) is low (<0.5 ppm) and 32 ha (8%) is medium (0.5-1.0 ppm) in available boron content. Low and medium (<0.5-1.0 ppm) areas need to be applied with sodium borate @ 10kg/ha as soil application or 0.2% borax as foliar spray to correct the deficiency.

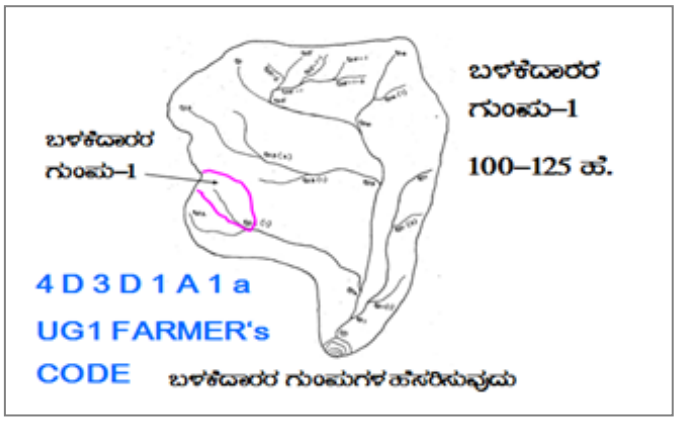
- **Available Iron:** Available iron content is deficient (<4.5 ppm) in an area of about 95 ha (23%) and sufficient (>4.5 ppm) in 269 ha (65%) area of the microwatershed. For deficient areas, iron sulphate @ 25 kg/ha needs to be applied for 2-3 years to correct the deficiency.
- **Available Manganese:** Entire cultivated area of the microwatershed is sufficient (>1.0 ppm) in the available manganese content.
- **Available Copper:** Entire cultivated area of the microwatershed is sufficient (>0.2 ppm) in the available copper content.
- **Available Zinc:** Available zinc content is sufficient (>0.6 ppm) in the entire cultivated area of the microwatershed. For deficient areas, application of zinc sulphate @ 25kg/ha is recommended.
- **Soil Alkalinity:** An area of about 50 ha (12%) in the microwatershed has soils that are slightly 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 Mundrigi 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 needs to be collected.

Steps for Survey and Preparation of Treatment Plan

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

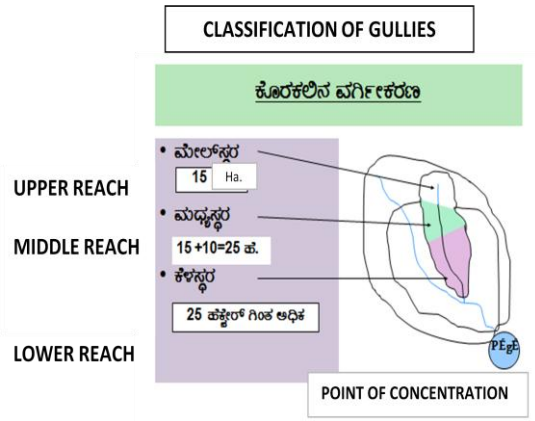
- Naming of user groups and farmers
- Identification of arable and non arable lands
- Identification of drainage lines and gullies
- Identification of non treatable areas
- Identification of priority areas in the arable lands
- Treatment plan for arable lands
- Location of water harvesting and recharge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

9.1 Treatment Plan

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

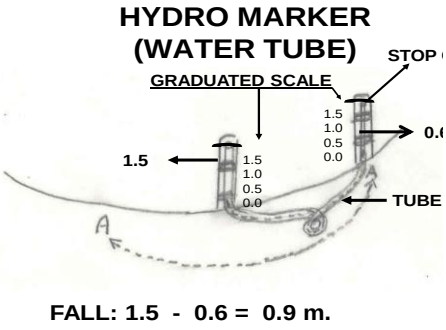
9.1.1 Arable Land Treatment

A. BUNDING

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

Measurement of Land Slope

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



FALL: 1.5 - 0.6 = 0.9 m.

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

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

Note: (i) The above intervals are maximum.

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

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

Section of the Bund

Bund section is decided considering the soil texture class and gravelliness class (bg0 .....b= loamy sand, g0 = <15% gravel). The recommended sections for different soils are given below.

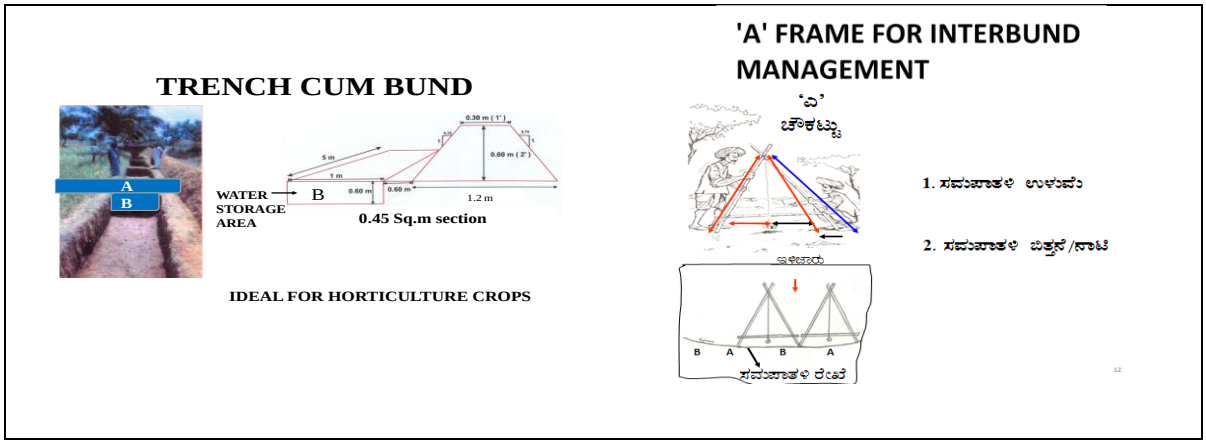
Recommended Bund Section

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

Formation of Trench cum Bund

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

Details of Borrow Pit dimensions are given below



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

Bund section	Bund length	Earth quantity	Pit				Berm (pit to pit)	Soil depth Class
m2	m	m3	L(m)	W(m)	D(m)	Quantity (m3)	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 drainage lines (gullies/ *nalas/ hallas*) and existing structures are marked to the scale and storage capacity of the existing water bodies are documented.
b) The drainage line will be demarcated into Upper Reach, Middle Reach and Lower Reach.
c) Considering the Catchment, *Nala* bed and bank conditions, suitable structures are decided.
d) Number of storage structures (Check dam/ *Nala* bund/ Percolation tank) will be decided considering the commitments and available runoff in water budgeting and quality of water in the wells and site suitability.
e) Detailed Leveling Survey using Dumpy Level / Total Station has to be carried out to arrive at the site-specific designs as shown in the Manual.
f) The location of ground water recharge structures are decided by examining the lineaments and fracture zones from geological maps.
g) Rainfall intensity data of the nearest Rain Gauge Station is considered for Hydrologic Designs.
h) Silt load to the Storage/Recharge Structures is reduced by providing vegetative, boulder and 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 309 ha (75%) needs Trench cum Bunding, 14 ha (3%) needs Graded Bunding and 41 ha (10%) needs strengthening of existing bunds.

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

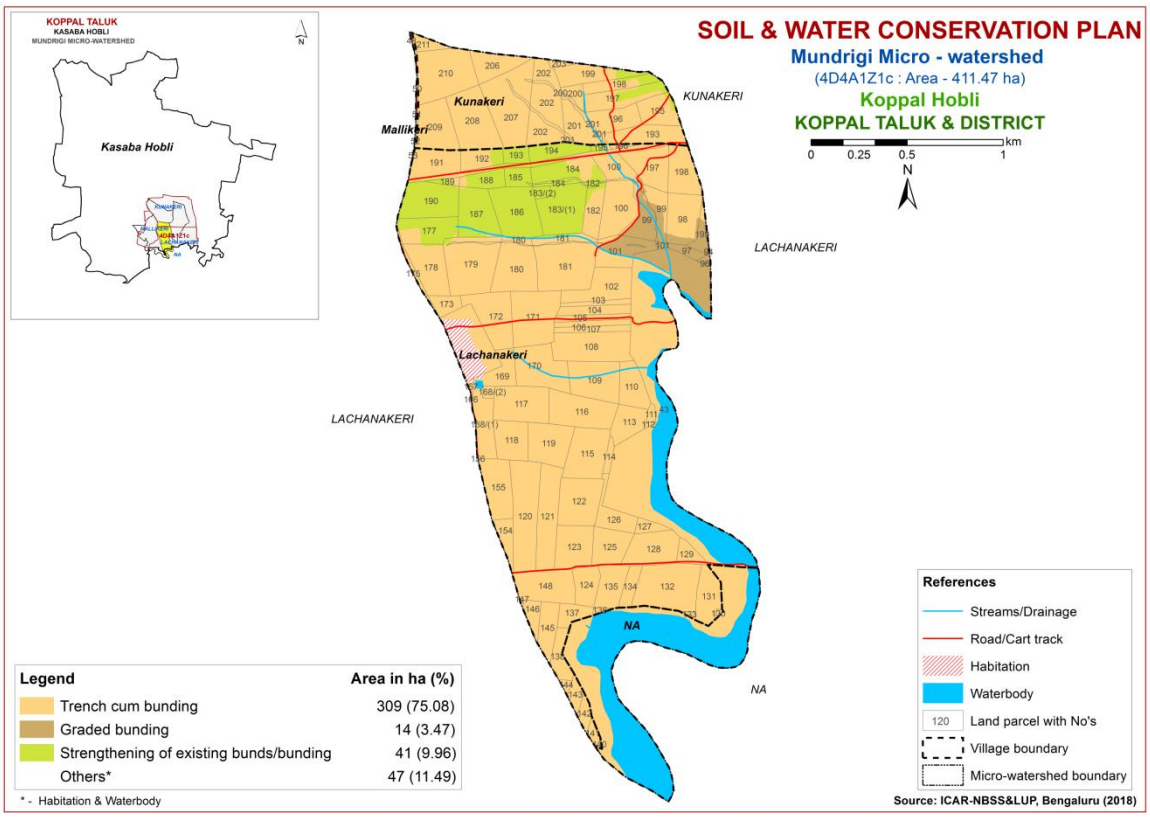


Fig. 9.1 Soil and Water Conservation Plan map of Mundrigi Microwatershed

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

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

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

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Appendix I

Mundrigi (1Z1c) 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
Lachanakeri	43	40.8	Waterbody	Others	Others	Others	Others	Others	Others	Others	Waterbody	Not Available	Others	Others
Lachanakeri	94	0.03	HNHiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIew	Graded bunding
Lachanakeri	96	0.07	HNHiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow (Cf)	Not Available	IIew	Graded bunding
Lachanakeri	97	0.82	HNHiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow (Cf)	Not Available	IIew	Graded bunding
Lachanakeri	98	4.37	BDGhB2	LMU-3	Moderately deep (75-100 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	Trench cum bunding
Lachanakeri	99	4.71	HNHiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Sugarcane (Sc)	Not Available	IIew	Graded bunding
Lachanakeri	100	6.74	BDGhB2	LMU-3	Moderately deep (75-100 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Sugarcane (Sc)	Not Available	IIIes	Trench cum bunding
Lachanakeri	101	3.94	HNHiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow+Bajra (Cf+Bj)	Not Available	IIew	Graded bunding
Lachanakeri	102	4.5	BDGhB2	LMU-3	Moderately deep (75-100 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Sugarcane+Maize (Sc+Mz)	8 Borewell	IIIes	Trench cum bunding
Lachanakeri	103	0.88	BDGhB2	LMU-3	Moderately deep (75-100 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	Trench cum bunding
Lachanakeri	104	1.8	BDGhB2	LMU-3	Moderately deep (75-100 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	Trench cum bunding
Lachanakeri	105	1.23	BDGhB2	LMU-3	Moderately deep (75-100 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	Trench cum bunding
Lachanakeri	106	1.14	BDGhB2	LMU-3	Moderately deep (75-100 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	Trench cum bunding
Lachanakeri	107	1.24	BDGhB2	LMU-3	Moderately deep (75-100 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIIes	Trench cum bunding
Lachanakeri	108	6.16	BDGhB2	LMU-3	Moderately deep (75-100 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	Trench cum bunding
Lachanakeri	109	5.15	RTRiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIe	Trench cum bunding
Lachanakeri	110	3.03	RTRiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIe	Trench cum bunding
Lachanakeri	111	0.37	RTRiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIe	Trench cum bunding
Lachanakeri	112	0.09	RTRiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIe	Trench cum bunding
Lachanakeri	113	2.74	RTRiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIe	Trench cum bunding
Lachanakeri	114	0.6	RTRiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIe	Trench cum bunding
Lachanakeri	115	5.23	RTRiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	Sugarcane+Maize (Sc+Mz)	Not Available	IIe	Trench cum 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
Lachan akeri	116	5.55	RTRiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	Sugarcane (Sc)	Not Available	IIe	Trench cum bunding
Lachan akeri	117	5.29	RTRiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIe	Trench cum bunding
Lachan akeri	118	3.48	BPRcB2g1	LMU-3	Deep (100-150 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	Trench cum bunding
Lachan akeri	119	4.6	RTRiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIe	Trench cum bunding
Lachan akeri	120	7.66	RTRiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	Sugarcane+Bajra (Sc+Bj)	Not Available	IIe	Trench cum bunding
Lachan akeri	121	5.73	BPRcB2g1	LMU-3	Deep (100-150 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Sugarcane (Sc)	Not Available	IIIes	Trench cum bunding
Lachan akeri	122	5.23	RTRiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	Sugarcane (Sc)	Not Available	IIe	Trench cum bunding
Lachan akeri	123	4.26	BPRcB2g1	LMU-3	Deep (100-150 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	Trench cum bunding
Lachan akeri	124	2.48	BPRcB2g1	LMU-3	Deep (100-150 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Sugarcane (Sc)	Not Available	IIIes	Trench cum bunding
Lachan akeri	125	3.39	BPRcB2g1	LMU-3	Deep (100-150 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	Trench cum bunding
Lachan akeri	126	2.46	RTRiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	Sugarcane (Sc)	Not Available	IIe	Trench cum bunding
Lachan akeri	127	0.9	RTRiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIe	Trench cum bunding
Lachan akeri	128	4.49	BPRcB2g1	LMU-3	Deep (100-150 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Bajra (Mz+Bj)	Not Available	IIIes	Trench cum bunding
Lachan akeri	129	1.28	BPRcB2g1	LMU-3	Deep (100-150 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Sugarcane (Sc)	Not Available	IIIes	Trench cum bunding
Lachan akeri	130	0.14	BPRcB2g1	LMU-3	Deep (100-150 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIIes	Trench cum bunding
Lachan akeri	131	3.23	BPRcB2g1	LMU-3	Deep (100-150 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIIes	Trench cum bunding
Lachan akeri	132	7.43	BPRcB2g1	LMU-3	Deep (100-150 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Sugarcane (Sc)	Not Available	IIIes	Trench cum bunding
Lachan akeri	133	0.17	BPRcB2g1	LMU-3	Deep (100-150 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIIes	Trench cum bunding
Lachan akeri	134	1.45	BPRcB2g1	LMU-3	Deep (100-150 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Sugarcane (Sc)	Not Available	IIIes	Trench cum bunding
Lachan akeri	135	3.03	RTRcB2	LMU-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	Sugarcane (Sc)	Not Available	IIe	Trench cum bunding
Lachan akeri	136	0.23	RTRcB2	LMU-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIe	Trench cum bunding
Lachan akeri	137	1.62	RTRcB2	LMU-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIe	Trench cum bunding
Lachan akeri	138	1.95	RTRcB2	LMU-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	Sugarcane (Sc)	Not Available	IIe	Trench cum bunding
Lachan akeri	140	0.07	RTRcB2	LMU-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIe	Trench cum 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
Lachan akeri	141	0.55	RTRcB2	LMU-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIe	Trench cum bunding
Lachan akeri	142	0.88	RTRcB2	LMU-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIe	Trench cum bunding
Lachan akeri	143	0.97	RTRcB2	LMU-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIe	Trench cum bunding
Lachan akeri	144	0.28	RTRcB2	LMU-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIe	Trench cum bunding
Lachan akeri	145	2.51	RTRcB2	LMU-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIe	Trench cum bunding
Lachan akeri	146	1.23	RTRcB2	LMU-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	Sugarcane (Sc)	Not Available	IIe	Trench cum bunding
Lachan akeri	147	0.05	BPRcB2	LMU-3	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
Lachan akeri	148	5	BPRcB2g1	LMU-3	Deep (100-150 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Sugarcane+Maize (Sc+Mz)	Not Available	IIIes	Trench cum bunding
Lachan akeri	154	1.6	BPRcB2g1	LMU-3	Deep (100-150 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	Trench cum bunding
Lachan akeri	155	4.41	BPRcB2g1	LMU-3	Deep (100-150 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy+Maize (Pd+Mz)	Not Available	IIIes	Trench cum bunding
Lachan akeri	156	0.001	BPRcB2g1	LMU-3	Deep (100-150 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Sugarcane+Maize (Sc+Mz)	Not Available	IIIes	Trench cum bunding
Lachan akeri	166	0.01	BPRhB2g1	LMU-3	Deep (100-150 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Sugarcane (Sc)	Not Available	IIIes	Trench cum bunding
Lachan akeri	167	0.22	BPRhB2g1	LMU-3	Deep (100-150 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Sugarcane (Sc)	Not Available	IIIes	Trench cum bunding
Lachan akeri	168/(1)	3.5	BPRcB2g1	LMU-3	Deep (100-150 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	Trench cum bunding
Lachan akeri	168/(2)	0.39	BPRcB2g1	LMU-3	Deep (100-150 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	Trench cum bunding
Lachan akeri	169	2.56	RTRiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIe	Trench cum bunding
Lachan akeri	170	5.53	RTRiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIe	Trench cum bunding
Lachan akeri	171	6.58	CKMiB1	LMU-1	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Sugarcane (Sc)	Not Available	IIs	Trench cum bunding
Lachan akeri	172	5.15	CKMiB1	LMU-1	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	2 Borewell	IIs	Trench cum bunding
Lachan akeri	173	1.34	CKMiB1	LMU-1	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow (Cf)	Not Available	IIs	Trench cum bunding
Lachan akeri	175	0.01	CKMiB1	LMU-1	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Redgram (Rg)	Not Available	IIs	Trench cum bunding
Lachan akeri	177	3.98	CKMiA1	LMU-1	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Maize (Mz)	Not Available	IIs	Graded bunding
Lachan akeri	178	4.42	CKMiB1	LMU-1	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIs	Trench cum bunding
Lachan akeri	179	7.56	CKMiB1	LMU-1	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIs	Trench cum 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
Lachanakeri	180	5.72	CKMiB1	LMU-1	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Sugarcane (Sc)	Not Available	IIs	Trench cum bunding
Lachanakeri	181	8.67	BDGhB2	LMU-3	Moderately deep (75-100 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Sugarcane (Sc)	Not Available	IIIes	Trench cum bunding
Lachanakeri	182	2.55	BDGhB2	LMU-3	Moderately deep (75-100 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Sugarcane (Sc)	Not Available	IIIes	Trench cum bunding
Lachanakeri	183/(1)	5.75	CKMiA1	LMU-1	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Sugarcane+Maize (Sc+Mz)	Not Available	IIs	Graded bunding
Lachanakeri	183/(2)	0.52	CKMiA1	LMU-1	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Sugarcane+Maize (Sc+Mz)	Not Available	IIs	Graded bunding
Lachanakeri	184	4.08	CKMiA1	LMU-1	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Sugarcane+Redgram (Sc+Rg)	1 Borewell	IIs	Graded bunding
Lachanakeri	185	1.36	CKMiA1	LMU-1	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Not Available (NA)	Not Available	IIs	Graded bunding
Lachanakeri	186	5.83	CKMiA1	LMU-1	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Drumstick+Maize (Ds+Mz)	Not Available	IIs	Graded bunding
Lachanakeri	187	4.89	CKMiA1	LMU-1	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Maize (Mz)	Not Available	IIs	Graded bunding
Lachanakeri	188	1.87	CKMiA1	LMU-1	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Chilli (Ch)	1 Borewell	IIs	Graded bunding
Lachanakeri	189	0.47	CKMiA1	LMU-1	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Sugarcane (Sc)	Not Available	IIs	Graded bunding
Lachanakeri	190	5.25	CKMiA1	LMU-1	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Maize (Mz)	Not Available	IIs	Graded bunding
Lachanakeri	191	3.55	BPRhB2g1	LMU-3	Deep (100-150 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Sugarcane (Sc)	Not Available	IIIes	Trench cum bunding
Lachanakeri	192	2.15	BPRhB2g1	LMU-3	Deep (100-150 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Sugarcane (Sc)	1 Borewell	IIIes	Trench cum bunding
Lachanakeri	193	1.13	CKMiA1	LMU-1	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Maize (Mz)	Not Available	IIs	Graded bunding
Lachanakeri	194	2.25	CKMiA1	LMU-1	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Redgram (Rg)	Not Available	IIs	Graded bunding
Lachanakeri	195	0.31	CKMiA1	LMU-1	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Not Available (NA)	Not Available	IIs	Graded bunding
Lachanakeri	196	0.26	HDHcB2g1	LMU-3	Moderately deep (75-100 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIes	Trench cum bunding
Lachanakeri	197	3.99	HDHcB2g1	LMU-3	Moderately deep (75-100 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Trench cum bunding
Lachanakeri	198	3.64	BDGhB2	LMU-3	Moderately deep (75-100 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	Trench cum bunding
Lachanakeri	199	1.24	HNHiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIew	Graded bunding
Mallikeri	48	0.11	HDHhB2g1	LMU-3	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Pearl millet+Redgram (Mz+Pm+Rg)	Not Available	IIes	Trench cum bunding
Mallikeri	50	0.16	HDHhB2g1	LMU-3	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Banana+Maize (Bn+Mz)	Not Available	IIes	Trench cum 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
Mallikeri	51	0.23	BPRhB2g1	LMU-3	Deep (100-150 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	Trench cum bunding
Mallikeri	52	0.05	BPRhB2g1	LMU-3	Deep (100-150 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Pearl millet+Maize (Pm+Mz)	Not Available	IIIes	Trench cum bunding
Mallikeri	53	0.02	HDHhB2g1	LMU-3	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Chilli+Maize (Ch+Mz)	Not Available	IIes	Trench cum bunding
NA	NA	41.92	Waterbody	Others	Others	Others	Others	Others	Others	Others	Not Available (NA)	Not Available	Others	Others
Kunakeri	193	3.7	BPRcB2g1	LMU-3	Deep (100-150 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Maize (Bj+Mz)	Not Available	IIIes	Trench cum bunding
Kunakeri	195	2.94	HDHcB2g1	LMU-3	Moderately deep (75-100 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIes	Trench cum bunding
Kunakeri	196	2.92	HDHcB2g1	LMU-3	Moderately deep (75-100 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIes	Trench cum bunding
Kunakeri	197	3.69	BPRhB2g2	LMU-3	Deep (100-150 cm)	Sandy clay loam	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	Trench cum bunding
Kunakeri	198	2.16	BPRhB2g2	LMU-3	Deep (100-150 cm)	Sandy clay loam	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	Trench cum bunding
Kunakeri	199	3.34	BPRhB2g2	LMU-3	Deep (100-150 cm)	Sandy clay loam	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	Trench cum bunding
Kunakeri	200	0.95	HDHcB2g1	LMU-3	Moderately deep (75-100 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIes	Trench cum bunding
Kunakeri	201	2.65	HDHcB2g1	LMU-3	Moderately deep (75-100 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIes	Trench cum bunding
Kunakeri	202	6.36	HDHcB2g1	LMU-3	Moderately deep (75-100 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	Trench cum bunding
Kunakeri	203	0.36	BPRhB2g2	LMU-3	Deep (100-150 cm)	Sandy clay loam	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	Trench cum bunding
Kunakeri	206	2.99	HDHcB2g1	LMU-3	Moderately deep (75-100 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	Trench cum bunding
Kunakeri	207	7.98	HDHcB2g1	LMU-3	Moderately deep (75-100 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	Trench cum bunding
Kunakeri	208	6.47	BPRhB2g1	LMU-3	Deep (100-150 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	Trench cum bunding
Kunakeri	209	4.74	BPRhB2g1	LMU-3	Deep (100-150 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	Trench cum bunding
Kunakeri	210	7.19	HDHhB2g1	LMU-3	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	Trench cum bunding
Kunakeri	211	0.98	HDHhB2g1	LMU-3	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIes	Trench cum bunding

Appendix II

Mundrigi (1Z1c) 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
Lachanakeri	43	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Lachanakeri	94	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	96	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	97	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	98	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 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)
Lachanakeri	99	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 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)
Lachanakeri	100	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 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)
Lachanakeri	101	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 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)
Lachanakeri	102	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 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)
Lachanakeri	103	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 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)
Lachanakeri	104	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 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)
Lachanakeri	105	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 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)
Lachanakeri	106	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 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)
Lachanakeri	107	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 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)
Lachanakeri	108	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	109	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	110	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	111	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	112	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	113	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	114	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	115	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 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
Lachanakeri	116	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	117	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	118	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	119	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	120	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	121	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	122	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	123	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	124	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	125	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	126	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	127	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	128	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	129	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	130	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	131	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	132	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	133	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	134	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	135	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	136	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	137	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	138	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	140	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 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
Lachanakeri	141	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	142	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	143	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	144	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	145	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	146	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	147	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	148	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	154	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	155	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	156	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	166	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	167	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	168/(1)	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	168/(2)	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	169	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	170	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	171	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	172	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	173	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	175	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	177	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	178	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	179	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 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
Lachanakeri	180	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	181	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 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)
Lachanakeri	182	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 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)
Lachanakeri	183/(1)	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 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)
Lachanakeri	183/(2)	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 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)
Lachanakeri	184	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 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)
Lachanakeri	185	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	186	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	187	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	188	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	189	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	190	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	191	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	192	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	193	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	194	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Lachanakeri	195	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 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)
Lachanakeri	196	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 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)
Lachanakeri	197	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 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)
Lachanakeri	198	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 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)
Lachanakeri	199	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Mallikeri	48	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Mallikeri	50	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Mallikeri	51	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 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
Mallikeri	52	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Mallikeri	53	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
NA	NA	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Kunakeri	193	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 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)
Kunakeri	195	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 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)
Kunakeri	196	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 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)
Kunakeri	197	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 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)
Kunakeri	198	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 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)
Kunakeri	199	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kunakeri	200	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kunakeri	201	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 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)
Kunakeri	202	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kunakeri	203	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kunakeri	206	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kunakeri	207	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kunakeri	208	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kunakeri	209	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kunakeri	210	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kunakeri	211	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)

Appendix III

Mundrigi (1Z1c) 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
Lachanakeri	43	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Lachanakeri	94	N1r	S2rw	S3r	S2rw	S3r	S2rw	N1r	S3r	S2rw	S3r	S3rw	S2rw	S3r	S2rw	N1tw	S3r	S3r	S2rw	S2rw	S2rw	S2rw	S2rw	S3r	S2rw	S2rw	S3rg	S3rg	S2rw	S3rw	S3rw	S3rg
Lachanakeri	96	N1r	S2rw	S3r	S2rw	S3r	S2rw	N1r	S3r	S2rw	S3r	S3rw	S2rw	S3r	S2rw	N1tw	S3r	S3r	S2rw	S2rw	S2rw	S2rw	S2rw	S3r	S2rw	S2rw	S3rg	S3rg	S2rw	S3rw	S3rw	S3rg
Lachanakeri	97	N1r	S2rw	S3r	S2rw	S3r	S2rw	N1r	S3r	S2rw	S3r	S3rw	S2rw	S3r	S2rw	N1tw	S3r	S3r	S2rw	S2rw	S2rw	S2rw	S2rw	S3r	S2rw	S2rw	S3rg	S3rg	S2rw	S3rw	S3rw	S3rg
Lachanakeri	98	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2tg	S2tg	S3g	S3g	S2g	S2tg
Lachanakeri	99	N1r	S2rw	S3r	S2rw	S3r	S2rw	N1r	S3r	S2rw	S3r	S3rw	S2rw	S3r	S2rw	N1tw	S3r	S3r	S2rw	S2rw	S2rw	S2rw	S2rw	S3r	S2rw	S2rw	S3rg	S3rg	S2rw	S3rw	S3rw	S3rg
Lachanakeri	100	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2tg	S2tg	S3g	S3g	S2g	S2tg
Lachanakeri	101	N1r	S2rw	S3r	S2rw	S3r	S2rw	N1r	S3r	S2rw	S3r	S3rw	S2rw	S3r	S2rw	N1tw	S3r	S3r	S2rw	S2rw	S2rw	S2rw	S2rw	S3r	S2rw	S2rw	S3rg	S3rg	S2rw	S3rw	S3rw	S3rg
Lachanakeri	102	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2tg	S2tg	S3g	S3g	S2g	S2tg
Lachanakeri	103	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2tg	S2tg	S3g	S3g	S2g	S2tg
Lachanakeri	104	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2tg	S2tg	S3g	S3g	S2g	S2tg
Lachanakeri	105	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2tg	S2tg	S3g	S3g	S2g	S2tg
Lachanakeri	106	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2tg	S2tg	S3g	S3g	S2g	S2tg
Lachanakeri	107	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2tg	S2tg	S3g	S3g	S2g	S2tg
Lachanakeri	108	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2tg	S2tg	S3g	S3g	S2g	S2tg
Lachanakeri	109	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S2t	S2t	S1	S1	S1	S2t
Lachanakeri	110	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S2t	S2t	S1	S1	S1	S2t
Lachanakeri	111	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S2t	S2t	S1	S1	S1	S2t
Lachanakeri	112	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S2t	S2t	S1	S1	S1	S2t
Lachanakeri	113	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S2t	S2t	S1	S1	S1	S2t
Lachanakeri	114	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S2t	S2t	S1	S1	S1	S2t
Lachanakeri	115	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S2t	S2t	S1	S1	S1	S2t
Lachanakeri	116	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S2t	S2t	S1	S1	S1	S2t
Lachanakeri	117	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S2t	S2t	S1	S1	S1	S2t

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
Lachanakeri	118	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g
Lachanakeri	119	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S2t	S2t	S1	S1	S1	S2t
Lachanakeri	120	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S2t	S2t	S1	S1	S1	S2t
Lachanakeri	121	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g
Lachanakeri	122	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S2t	S2t	S1	S1	S1	S2t
Lachanakeri	123	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g
Lachanakeri	124	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g
Lachanakeri	125	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g
Lachanakeri	126	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S2t	S2t	S1	S1	S1	S2t
Lachanakeri	127	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S2t	S2t	S1	S1	S1	S2t
Lachanakeri	128	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g
Lachanakeri	129	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g
Lachanakeri	130	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g
Lachanakeri	131	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g
Lachanakeri	132	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g
Lachanakeri	133	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g
Lachanakeri	134	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g
Lachanakeri	135	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S2t	S2t	S1	S1	S1	S2t
Lachanakeri	136	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S2t	S2t	S1	S1	S1	S2t
Lachanakeri	137	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S2t	S2t	S1	S1	S1	S2t
Lachanakeri	138	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S2t	S2t	S1	S1	S1	S2t
Lachanakeri	140	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S2t	S2t	S1	S1	S1	S2t
Lachanakeri	141	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S2t	S2t	S1	S1	S1	S2t
Lachanakeri	142	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S2t	S2t	S1	S1	S1	S2t
Lachanakeri	143	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S2t	S2t	S1	S1	S1	S2t
Lachanakeri	144	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S2t	S2t	S1	S1	S1	S2t

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
Lachanakeri	145	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S2t	S2t	S1	S1	S1	S2t
Lachanakeri	146	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S2t	S2t	S1	S1	S1	S2t
Lachanakeri	147	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g
Lachanakeri	148	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g
Lachanakeri	154	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g
Lachanakeri	155	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g
Lachanakeri	156	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g
Lachanakeri	166	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g
Lachanakeri	167	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g
Lachanakeri	168 /(1)	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g
Lachanakeri	168 /(2)	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g
Lachanakeri	169	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S2t	S2t	S1	S1	S1	S2t
Lachanakeri	170	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S2t	S2t	S1	S1	S1	S2t
Lachanakeri	171	S3r	S2t	S2rg	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S2rt	S2r	S2r	S2t	S1	S1	S2t	S2t	S2r	S1	S2t	S2t	S1	S2t	S2r	S2r	S2t
Lachanakeri	172	S3r	S2t	S2rg	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S2rt	S2r	S2r	S2t	S1	S1	S2t	S2t	S2r	S1	S2t	S2t	S1	S2t	S2r	S2r	S2t
Lachanakeri	173	S3r	S2t	S2rg	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S2rt	S2r	S2r	S2t	S1	S1	S2t	S2t	S2r	S1	S2t	S2t	S1	S2t	S2r	S2r	S2t
Lachanakeri	175	S3r	S2t	S2rg	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S2rt	S2r	S2r	S2t	S1	S1	S2t	S2t	S2r	S1	S2t	S2t	S1	S2t	S2r	S2r	S2t
Lachanakeri	177	S3r	S2t	S2rg	S1	S2rt	S2rg	S3r	S2r	S2gt	S2r	S2rg	S1	S2r	S1	S2rt	S2r	S2r	S2t	S1	S1	S2t	S2tg	S2r	S1	S2tg	S2t	S1	S2gt	S2r	S2r	S2t
Lachanakeri	178	S3r	S2t	S2rg	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S2rt	S2r	S2r	S2t	S1	S1	S2t	S2t	S2r	S1	S2t	S2t	S1	S2t	S2r	S2r	S2t
Lachanakeri	179	S3r	S2t	S2rg	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S2rt	S2r	S2r	S2t	S1	S1	S2t	S2t	S2r	S1	S2t	S2t	S1	S2t	S2r	S2r	S2t
Lachanakeri	180	S3r	S2t	S2rg	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S2rt	S2r	S2r	S2t	S1	S1	S2t	S2t	S2r	S1	S2t	S2t	S1	S2t	S2r	S2r	S2t
Lachanakeri	181	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2tg	S2tg	S3g	S3g	S2g	S2tg
Lachanakeri	182	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2tg	S2tg	S3g	S3g	S2g	S2tg
Lachanakeri	183 /(1)	S3r	S2t	S2rg	S1	S2rt	S2rg	S3r	S2r	S2gt	S2r	S2rg	S1	S2r	S1	S2rt	S2r	S2r	S2t	S1	S1	S2t	S2tg	S2r	S1	S2tg	S2t	S1	S2gt	S2r	S2r	S2t
Lachanakeri	183 /(2)	S3r	S2t	S2rg	S1	S2rt	S2rg	S3r	S2r	S2gt	S2r	S2rg	S1	S2r	S1	S2rt	S2r	S2r	S2t	S1	S1	S2t	S2tg	S2r	S1	S2tg	S2t	S1	S2gt	S2r	S2r	S2t
Lachanakeri	184	S3r	S2t	S2rg	S1	S2rt	S2rg	S3r	S2r	S2gt	S2r	S2rg	S1	S2r	S1	S2rt	S2r	S2r	S2t	S1	S1	S2t	S2tg	S2r	S1	S2tg	S2t	S1	S2gt	S2r	S2r	S2t

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
Lachanakeri	185	S3r	S2t	S2rg	S1	S2rt	S2rg	S3r	S2r	S2gt	S2r	S2rg	S1	S2r	S1	S2rt	S2r	S2r	S2t	S1	S1	S2t	S2tg	S2r	S1	S2tg	S2t	S1	S2gt	S2r	S2r	S2t
Lachanakeri	186	S3r	S2t	S2rg	S1	S2rt	S2rg	S3r	S2r	S2gt	S2r	S2rg	S1	S2r	S1	S2rt	S2r	S2r	S2t	S1	S1	S2t	S2tg	S2r	S1	S2tg	S2t	S1	S2gt	S2r	S2r	S2t
Lachanakeri	187	S3r	S2t	S2rg	S1	S2rt	S2rg	S3r	S2r	S2gt	S2r	S2rg	S1	S2r	S1	S2rt	S2r	S2r	S2t	S1	S1	S2t	S2tg	S2r	S1	S2tg	S2t	S1	S2gt	S2r	S2r	S2t
Lachanakeri	188	S3r	S2t	S2rg	S1	S2rt	S2rg	S3r	S2r	S2gt	S2r	S2rg	S1	S2r	S1	S2rt	S2r	S2r	S2t	S1	S1	S2t	S2tg	S2r	S1	S2tg	S2t	S1	S2gt	S2r	S2r	S2t
Lachanakeri	189	S3r	S2t	S2rg	S1	S2rt	S2rg	S3r	S2r	S2gt	S2r	S2rg	S1	S2r	S1	S2rt	S2r	S2r	S2t	S1	S1	S2t	S2tg	S2r	S1	S2tg	S2t	S1	S2gt	S2r	S2r	S2t
Lachanakeri	190	S3r	S2t	S2rg	S1	S2rt	S2rg	S3r	S2r	S2gt	S2r	S2rg	S1	S2r	S1	S2rt	S2r	S2r	S2t	S1	S1	S2t	S2tg	S2r	S1	S2tg	S2t	S1	S2gt	S2r	S2r	S2t
Lachanakeri	191	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g
Lachanakeri	192	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g
Lachanakeri	193	S3r	S2t	S2rg	S1	S2rt	S2rg	S3r	S2r	S2gt	S2r	S2rg	S1	S2r	S1	S2rt	S2r	S2r	S2t	S1	S1	S2t	S2tg	S2r	S1	S2tg	S2t	S1	S2gt	S2r	S2r	S2t
Lachanakeri	194	S3r	S2t	S2rg	S1	S2rt	S2rg	S3r	S2r	S2gt	S2r	S2rg	S1	S2r	S1	S2rt	S2r	S2r	S2t	S1	S1	S2t	S2tg	S2r	S1	S2tg	S2t	S1	S2gt	S2r	S2r	S2t
Lachanakeri	195	S3r	S2t	S2rg	S1	S2rt	S2rg	S3r	S2r	S2gt	S2r	S2rg	S1	S2r	S1	S2rt	S2r	S2r	S2t	S1	S1	S2t	S2tg	S2r	S1	S2tg	S2t	S1	S2gt	S2r	S2r	S2t
Lachanakeri	196	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S3g	S3g	S2g	S3g
Lachanakeri	197	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S3g	S3g	S2g	S3g
Lachanakeri	198	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2tg	S2tg	S3g	S3g	S2g	S2tg
Lachanakeri	199	N1r	S2rw	S3r	S2rw	S3r	S2rw	N1r	S3r	S2rw	S3r	S3rw	S2rw	S3r	S2rw	N1tw	S3r	S3r	S2rw	S2rw	S2rw	S2rw	S2rw	S3r	S2rw	S2rw	S3rg	S3rg	S2rw	S3rw	S3rw	S3rg
Mallikeri	48	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S3g	S3g	S2g	S3g
Mallikeri	50	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S3g	S3g	S2g	S3g
Mallikeri	51	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g
Mallikeri	52	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g
Mallikeri	53	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S3g	S3g	S2g	S3g
NA	NA	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Kunakeri	193	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g
Kunakeri	195	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S3g	S3g	S2g	S3g
Kunakeri	196	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S3g	S3g	S2g	S3g
Kunakeri	197	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g
Kunakeri	198	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g

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
Kunakeri	199	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g
Kunakeri	200	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S3g	S3g	S2g	S3g
Kunakeri	201	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S3g	S3g	S2g	S3g
Kunakeri	202	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S3g	S3g	S2g	S3g
Kunakeri	203	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g
Kunakeri	206	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S3g	S3g	S2g	S3g
Kunakeri	207	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S3g	S3g	S2g	S3g
Kunakeri	208	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g
Kunakeri	209	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g
Kunakeri	210	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S3g	S3g	S2g	S3g
Kunakeri	211	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S3g	S3g	S2g	S3g

PART-B

SOCIO-ECONOMIC STATUS OF FARM HOUSEHOLDS

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Chapter 1

FINDINGS OF THE SOCIO-ECONOMIC SURVEY

- *The survey was conducted in Mundrigi is located at North latitude 15^0 16' 58.624" and 15^0 14' 44.725" and East longitude 76^0 12' 48.228" and 75^0 11' 55.13" covering an area of about 411.61 ha coming under Mallikeri, Kunakeri and Lachananakeri Villages of Koppal taluk.*
- *Socio-economic analysis of Mundrigi micro watersheds of Karkihalli sub-watershed, Koppal taluk & District indicated that, out of the total sample of 34 total respondents, 16 were marginal, (47.06 %) were small 4 (11.76%), 5 (14.71 %) were Semi medium and 4 (11.76 %) were medium farmers.*
- *The population characteristics of households indicated that, there were 103 (58.19%) men and 74 (41.81 %) were women.*
- *Majority of the respondents (40.68%) were in the age group of 16-35 years.*
- *Education level of the sample households indicated that, there were 29.94 per cent illiterates, 32.20 per cent of them had primary school education, 11.86 per cent middle school education, and 9.60 per cent high school education, 5.65 per cent of them had PUC education, 0.56 per cent of them had Diploma, 1.69 per cent attained graduation.*
- *About, 82.35 per cent of household heads practicing agriculture and 17.65 per cent of the household heads were engaged as agricultural labourers.*
- *Agriculture was the major occupation for 31.64 per cent of the household members.*
- *In the study area, 82.35 per cent of the households possess katcha house.*
- *The durable assets owned by the households showed that, 70.59 per cent possess TV, 29.41 per cent possess mixer grinder, 85.29 per cent possess mobile phones and 38.24 per cent possess motor cycles.*
- *Farm implements owned by the households indicated that, 11.76 per cent of the households possess plough, 20.59 per cent possess bullock cart and 20.59 per cent possess sprayer.*
- *Regarding livestock possession by the households, 8.82 per cent possess local cow and 2.94 per cent possess buffalo.*
- *The average labour availability in the study area showed that, own men and women labour availability in the micro watershed was 15.45 each, while the hired labour (men) availability was 1.82.*
- *Further, 67.65 per cent of the households opined that hired labour was inadequate during the agricultural season.*
- *Out of the total land holding of the sample respondents 54.77 per cent (35.53 ha) of the area is under dry condition and the remaining 45.23 per cent area is irrigated land.*
- *There were 20.00 live bore wells and 20.00 dry bore wells among the sampled households.*

- *Bore/open well was the major source of irrigation for 58.82 per cent of the households.*
- *The major crops grown by sample farmers are Maize, Bajra, Groundnut, Cotton, Paddy, Pearl millet and Redgram and cropping intensity was recorded as 91.29 per cent.*
- *Out of the sample households 52.94 percent possessed bank account and 52.94 per cent of them have savings in the account.*
- *About 52.94 per cent of the respondents borrowed credit from various sources.*
- *Among the credit borrowed by households, 11.11 per cent have borrowed loan from co-operative/Grameena bank.*
- *Majority of the respondents (100.00%) have borrowed loan for agriculture purpose.*
- *Regarding the opinion on institutional sources of credit, 100.00 per cent of the households opined that credit helped to perform timely agricultural operations.*
- *The per hectare cost of cultivation for Maize, Bajra, Groundnut, Cotton and Redgram was Rs.51685.51, 24587.06, 47833.51, 33857.89 and 12779.58 with benefit cost ratio of 1:1.00, 1: 1.40, 1: 1.30, 1: 1.80 and 1:4.30 respectively.*
- *Further, 17.65 per cent of the households opined that dry fodder was adequate and 14.71 per cent of the households have opined that the green fodder was adequate.*
- *The average annual gross income of the farmers was Rs. 59020.59 in micro-watershed, of which Rs. 40667.65 comes from agriculture.*
- *Sampled households have grown 28 horticulture trees and 35 forestry trees together in the fields and back yards.*
- *Regarding marketing channels, 61.76 per cent of the households have sold agricultural produce to the local/village merchants, while, 23.53 per cent have sold in regulated markets.*
- *Further, 85.29 per cent of the households have used tractor for the transport of agriculture commodity.*
- *Majority of the farmers (52.94%) have experienced soil and water erosion problems in the watershed and 58.82 per cent of the households were interested towards soil testing.*
- *Fire was the major source of fuel for domestic use for 100.00 per cent of the households.*
- *Piped supply was the major source for drinking water for 79.41 per cent of the households.*
- *Electricity was the major source of light for 97.06 per cent of the households.*
- *In the study area, 50.00 per cent of the households possess toilet facility.*
- *Regarding possession of PDS card, 100.00 per cent of the households possessed BPL card.*

- *Households opined that, the requirement of cereals (58.82%), pulses (55.88%) and oilseeds (20.59%) are adequate for consumption.*
- *Farming constraints experienced by households in the micro watersheds were lower fertility status of the soil (52.94%) wild animal menace on farm field (70.59%), frequent incidence of pest and diseases (26.47%), inadequacy of irrigation water (11.76%), high cost of fertilizers and plant protection chemicals (35.29%), high rate of interest on credit (20.59%), low price for the agricultural commodities (11.76%), lack of marketing facilities in the area (29.41%), inadequate extension services (11.76%), lack of transport for safe transport of the agricultural produce to the market (29.41%), Less rainfall (52.94%) and Source of Agri-technology information (Newspaper/ TV/Mobile) (20.59%).*

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.

1. 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%.

2. Locale of the survey and description of the micro-watershed and

The study was conducted in Mundrigi micro-watershed (Karkihalli sub-watershed, Koppal taluk & District) is located at North latitude 15^0 16' 58.624" and 15^0 14' 44.725" and East longitude 76^0 12' 48.228" and 75^0 11' 55.13"covering an area of about 411.61 ha bounded by under Mallikeri, Kunakeri and Lachananakeri Villages.

3. Selection of the respondents for the study

The micro-watershed is marked with 320 square meters grids. One farmer from every alternate grid in the micro-watershed was selected for the study and interviewed for socio-economic data. Totally 34 households were interviewed for the survey.

4. The parameters considered for socio-economic survey of households

Two forms of data were collected from the micro-watershed which includes primary data from the farm households and secondary data about the villages under the micro-watershed jurisdiction.

The following parameters were considered for the primary data collection about the socio-economic data of the households, (1) Demographic information, (2) Farm and durable assets owned by households, (3) Livestock possession, (4) Labour availability, (5) Level of migration in the village, Land holding, (7) Cropping pattern, (8) Source of irrigation, (9) Borrowing status, (10) Cost of cultivation of major crops, (11) Economics of subsidiary activities, (12) Fodder availability, (13) Family annual income from different sources, (14) Horticulture and forestry species grown, (15) Additional investment capacity, (16) Marketing practices, (17) Status of soil and water conservation structure, (18) Access to basic needs and (19) Constraints and suggestion.

The following parameters were considered for the secondary data regarding the villages under the micro-watershed jurisdiction, (1) Number of villages in each micro-watershed jurisdiction, (2) Village wise number of households, (3) Geographical area of the villages, (4) Cultivable are a including rainfed and irrigated, (5) Number and type of house in each village, (6) Human and livestock population, (7) Facilities in the village such as roads, transport facility for conveyance, drinking water supply, street light and (8) Community based organizations in the villages.

5. Development of interview schedule and data collection

Taking into the consideration the objectives of the survey, an interview schedule was prepared after thorough consultation with the experts in the field of social sciences. A comprehensive interview schedule covering all the major parameters for measuring the socio-economic situation was developed.

6. Tools used to analyze the data

The statistical components such as frequency and percentage were used to analyze the data.

Abbreviations used in the report

LL=Landless
MF=Marginal Farmers
SF=Small farmers
SMF=Semi medium farmers
MDF=Medium farmers
LF=Large Farmers

Chapter 4

FINDINGS OF THE SURVEY

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

Households sampled for socio-economic survey: The data on households sampled for socio economic survey in Mundrigi Micro watershed is presented in Table 1 and it indicated that 34 farmers were sampled in Mundrigi micro-watershed among households surveyed 16 (47.06%) were marginal, 4 (11.76%) were small, 5 (14.71 %) were semi medium and 4 (11.76 %) were medium farmers. 5 landless farmers were also interviewed for the survey.

Table 1. Households sampled for socio economic survey in Mundrigi micro-watershed

Sl.No.	Particulars	LL (5)		MF (16)		SF (4)		SMF (5)		MDF (4)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Farmers	5	14.7	16	47.1	4	11.8	5	14.7	4	11.8	34	100

Population characteristics: The population characteristics of households sampled for socio-economic survey in Mundrigi Micro watershed is presented in Table 2. The data indicated that, there were 103 (58.19%) men and 74 (41.81%) were women. The average family size of the micro-watershed was 5.2.

Table 2. Population characteristics in Mundrigi micro-watershed

Sl.No.	Particulars	LL (23)		MF (80)		SF (26)		SMF (27)		MDF (21)		All (177)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Men	12	52.2	50	63	14	54	16	59.3	11	52.4	103	58.2
2	Women	11	47.8	30	38	12	46	11	40.7	10	47.6	74	41.8
Total		23	100	80	100	26	100	27	100	21	100	177	100
Average		4.6		5.0		6.5		5.4		5.3		5.2	

Age wise classification of population: The age wise classification of household members in Mundrigi Micro watershed is presented in Table 3. The indicated that, 49 (27.68%) of population were 0-15 years of age, 72 (40.68%) were 16-35 years of age, 44(24.86%) were 36-60 years of age and 12 (6.78 %) were above 61 years of age.

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

Sl.No.	Particulars	LL (23)		MF (80)		SF (26)		SMF (27)		MDF (21)		All (177)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	0-15 years of age	6	26.1	25	31.3	6	23.1	11	40.74	1	4.8	49	27.68
2	16-35 years of age	9	39.1	34	42.5	11	42.3	8	29.63	10	48	72	40.68
3	36-60 years of age	7	30.4	16	20	5	19.2	8	29.63	8	38	44	24.86
4	> 61 years	1	4.35	5	6.25	4	15.4	0	0	2	9.5	12	6.78
Total		23	100	80	100	26	100	27	100	21	100	177	100

Education level of household members: Education level of household members in Mundrigi Micro watershed is presented in Table 4. The results indicated that, there were

29.94 per cent of illiterates, 32.20 per cent of them had primary school education, 11.86 per cent middle school education, and 9.60 per cent high school education, 5.65 per cent of them had PUC education, 0.56 per cent of them had Diploma, 1.69 per cent attained graduation and 7.91 them had other education.

Table 4. Education level of members of the household in Mundrigi micro-watershed

Sl.No.	Particulars	LL (23)		MF (80)		SF (26)		SMF (27)		MDF (21)		All (177)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Illiterate	5	21.7	23	28.8	10	38.5	9	33.3	6	28.57	53	29.9
2	Primary School	10	43.5	23	28.8	5	19.2	11	40.7	8	38.1	57	32.2
3	Middle School	2	8.7	14	17.5	1	3.85	4	14.8	0	0	21	11.9
4	High School	1	4.35	9	11.3	3	11.5	0	0	4	19.05	17	9.6
5	PUC	1	4.35	5	6.25	2	7.69	1	3.7	1	4.76	10	5.65
6	Diploma	1	4.35	0	0	0	0	0	0	0	0	1	0.56
7	ITI	0	0	1	1.25	0	0	0	0	0	0	1	0.56
8	Degree	0	0	0	0	1	3.85	0	0	2	9.52	3	1.69
9	Others	3	13	5	6.25	4	15.4	2	7.41	0	0	14	7.91
Total		23	100	80	100	26	100	27	100	21	100	177	100

Occupation of head of households: The data regarding the occupation of the household heads in Mundrigi Micro watershed is presented in Table 5. The results indicate that, 82.35 per cent of households heads were practicing agriculture, 17.65 per cent of the household heads were agricultural Labour.

Table 5: Occupation of heads of households in Mundrigi micro-watershed

Sl.No.	Particulars	LL (5)		MF (16)		SF (4)		SMF (5)		MDF (4)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Agriculture	2	40	14	88	3	75	5	100	4	100	28	82.35
2	Agricultural Labour	3	60	2	13	1	25	0	0	0	0	6	17.65
Total		5	100	16	100	4	100	5	100	4	100	34	100

Occupation of the members of the household: The data regarding the occupation of the household members in Mundrigi Micro watershed is presented in Table 6. The results indicate that, agriculture was the major occupation for 31.64 per cent of the household members, 35.03 per cent were agricultural labour, 23.73 per cent were working in pursuing education, 1.69 per cent were involved as housewife, and 7.34 per cent were children's.

Table 6: Occupation of members of the household in Mundrigi micro-watershed

Sl. No	Particulars	LL (23)		MF (80)		SF (26)		SMF (27)		MDF (21)		All (177)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Agriculture	2	8.7	28	35	7	26.92	9	33.33	10	48	56	31.6
2	Agricultural Labour	15	65.2	20	25	11	42.31	6	22.22	10	48	62	35
3	Private Service	1	4.35	0	0	0	0	0	0	0	0	1	0.56
4	Student	1	4.35	25	31.3	5	19.23	10	37.04	1	4.8	42	23.7
5	Housewife	1	4.35	2	2.5	0	0	0	0	0	0	3	1.69
6	Children	3	13	5	6.25	3	11.54	2	7.41	0	0	13	7.34
Total		23	100	80	100	26	100	27	100	21	100	177	100

Institutional Participation of household members: The data regarding the institutional participation of the household members in Mundrigi Micro watershed is presented in Table 7. The results show that, out of the total family members in the households 1.13 per cent of them are participating in User group and rest were not participating in any of the institutions.

Table 7: Institutional Participation of household member in Mundrigi micro-watershed

Sl. No.	Particulars	LL (23)		MF (80)		SF (26)		SMF (27)		MDF (21)		All (177)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	User Group	0	0	1	1.25	0	0	0	0	1	4.76	2	1.13
2	No Participation	23	100	79	98.8	26	100	27	100	20	95.24	175	98.9
Total		23	100	80	100	26	100	27	100	21	100	177	100

Type of house owned: The data regarding the type of house owned by the households in Mundrigi Micro watershed is presented in Table 8. The results indicate that, 2.94 percent possess thatched house and 82.35 per cent of the households possess katcha house.

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

Sl.No.	Particulars	LL (5)		MF (16)		SF (4)		SMF (5)		MDF (4)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Thatched	1	20	0	0	0	0	0	0	0	0	1	2.94
2	Katcha	4	80	12	75	4	100	6	120	2	50	28	82.35
Total		5	100	12	100	4	100	6	100	2	100	29	100

Durable assets owned by the households: The data regarding the Durable Assets owned by the households in Mundrigi Micro watershed is presented in Table 9. The results shows that, 70.59 per cent possess TV, 29.41 per cent possess mixer grinder, 2.94 per cent possess Bicycle, 38.24 per cent possess motor cycle and 85.29 per cent possess mobile phones.

Table 9. Durable assets owned by households in Mundrigi micro-watershed

Sl.No.	Particulars	LL (5)		MF (16)		SF (4)		SMF (5)		MDF (4)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Television	5	100	9	56	2	50	4	80	4	100	24	70.59
2	DVD/VCD Player	0	0	0	0	1	25	0	0	0	0	1	2.94
3	Mixer/Grinder	0	0	6	38	0	0	1	20	3	75	10	29.41
4	Bicycle	0	0	1	6.3	0	0	0	0	0	0	1	2.94
5	Motor Cycle	2	40	5	31	1	25	2	40	3	75	13	38.24
6	Mobile Phone	4	80	15	94	3	75	5	100	2	50	29	85.29
7	Blank	0	0	1	6.3	0	0	0	0	0	0	1	2.94

Average value of durable assets: The data regarding the average value of durable assets owned by the households in Mundrigi Micro watershed is presented in Table 10. The result shows that, the average value of television was Rs.8666.00, mixer grinder was Rs.1850.00, bicycle was Rs.20000.00, motor cycle was Rs. 38692.00 and mobile phone was Rs.3022.00.

Table 10. Average value of durable assets owned in Mundrigi micro-watershed

Average Value (Rs.)

Sl.No.	Particulars	LL (5)	MF (16)	SF (4)	SMF (5)	MDF (4)	All (34)
1	Television	17400	6333	5500	7500	5750	8666
2	DVD/VCD Player	0	0	2000	0	0	2000
3	Mixer/Grinder	0	2083	0	2000	1333	1850
4	Bicycle	0	20000	0	0	0	20000
5	Motor Cycle	37500	32000	40000	54000	40000	38692
6	Mobile Phone	2325	2950	3833	4000	2000	3022

Farm implements owned: The data regarding the farm implements owned by the households in Mundrigi Micro watershed is presented in Table 11. About 20.59 per cent of the households possess Bullock Cart, 11.76 per cent possess plough, 20.59 per cent possess Sprayer and 35.29 per cent possess Weeder.

Table 11. Farm implements owned in Mundrigi micro-watershed

Sl.No.	Particulars	LL (5)		MF (16)		SF (4)		SMF (5)		MDF (4)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Bullock Cart	0	0	0	0	0	0	4	80	3	75	7	20.59
2	Plough	0	0	0	0	0	0	1	20	3	75	4	11.76
3	Sprayer	0	0	3	18.8	1	25	1	20	2	50	7	20.59
4	Weeder	1	20	4	25	1	25	2	40	4	100	12	35.29
5	Maize Huller	1	20	0	0	0	0	0	0	0	0	1	2.94
6	Blank	3	60	12	75	3	75	1	20	0	0	19	55.88

Average value of farm implements: The data regarding the average value of farm Implements owned by the households in Mundrigi Micro watershed is presented in Table 12. The results show that the average value of plough was Rs.2000.00, bullock Cart was Rs.17857.00, seed/fertilizer drill was Rs.4357.00, sprayer and weeder was Rs.109.00.

Table 12. Average value of farm implements in Mundrigi micro-watershed

Average Value (Rs.)

Sl.No.	Particulars	LL (5)	MF (16)	SF (4)	SMF (5)	MDF (4)	All (34)
1	Bullock Cart	0	0	0	14750	22000	17857
2	Plough	0	0	0	2000	2000	2000
3	Sprayer	0	5000	3000	2500	5000	4357
4	Weeder	50	160	83	100	84	109
5	Maize Huller	1200	0	0	0	0	1200

Table 13. Livestock possession by households in Mundrigi micro-watershed

Sl.No.	Particulars	LL (5)		MF (16)		SF (4)		SMF (5)		MDF (4)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Bullock	0	0	0	0	0	0	4	80	3	75	7	20.59
2	Local cow	0	0	2	13	0	0	0	0	1	25	3	8.82
3	Crossbred cow	0	0	2	13	0	0	0	0	0	0	2	5.88
4	Buffalo	0	0	0	0	1	25	0	0	0	0	1	2.94
5	blank	5	100	9	56	3	75	1	20	1	25	19	55.88

Livestock possession by the households: The data regarding the Livestock possession by the households in Mundrigi Micro watershed is presented in Table 13. The indicate

that, 20.59 per cent of the households possess bullocks, 8.82 per cent possess local cow, 2.94 per cent possess buffalo and 5.88 per cent possess crossbred cow.

Average Labour availability: The data regarding the average labour availability in Mundrigi Micro watershed is presented in Table 14. The indicated that, own labour men available in the micro watershed was 13.97, women available in the micro watershed was 1.48, hired labour (men) available was 1.82 and hired labour (women) available was 13.88.

Table 14. Average labour availability in Mundrigi micro-watershed

Sl.No.	Particulars	LL (5)	MF (16)	SF (4)	SMF (5)	MDF (4)	All (34)
		N	N	N	N	N	N
1	Hired labour Female	6.6	14.5	12.5	18.2	17.3	13.97
2	Own Labour Female	1	1.38	2	1.2	2.25	1.48
3	Own labour Male	1	1.75	3	1.8	2	1.82
4	Hired labour Male	6.4	14.3	12.5	18.2	17.8	13.88

Adequacy of hired labour: The data regarding the adequacy of hired labour in Mundrigi Micro watershed is presented in Table 15. The results indicate that, 29.41 per cent of the household opined that hired labour was adequate, 67.65 per cent of the household opined that hired labour was Inadequate.

Table 15. Adequacy of hired labour in Mundrigi micro-watershed

Sl.No.	Particulars	LL (5)		MF (16)		SF (4)		SMF (5)		MDF (4)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Adequate	0	0	6	37.5	1	25	2	40	1	25	10	29.4
2	Inadequate	5	100	10	62.5	3	75	3	60	2	50	23	67.7

Distribution of land (ha): The data regarding the distribution of land (ha) in Mundrigi Micro watershed is presented in Table 16. The results indicate that, 19.46 ha (54.77%) of dry land and 16.07 ha (45.23 %) of irrigated land.

Table 16. Distribution of land (ha) in Mundrigi micro-watershed

Sl.No.	Particulars	LL (5)		MF (16)		SF (4)		SMF (5)		MDF (4)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Dry	0	0	7.38	78.25	3.95	82.99	8.13	73.47	0	0	19.46	54.77
2	Irrigated	0	0	2.05	21.75	0.81	17.01	2.93	26.53	10.28	100	16.07	45.23
Total		0	100	9.43	100	4.76	100	11.06	100	10.28	100	35.53	100

Average value of land (ha): The data regarding the average land value (Rs./ha) in Mundrigi Micro watershed is presented in Table 17. The results show that the average value of dry land was Rs.390432.62, and the average value of irrigated land was Rs.444114.83.

Table 17. Average value of land (ha) in Mundrigi micro-watershed

Sl.No.	Particulars	LL (5)	MF (16)	SF (4)	SMF (5)	MDF (4)	All (34)
		N	N	N	N	N	N
1	Dry	0	636458.4	354303.3	184512	0	390432.6
2	Irrigated	0	1432308	741000	408827.6	233477.8	444114.8

Status of bore wells: The data regarding the status of bore wells in Mundrigi Micro watershed is presented in Table 18. The results indicate that, there were 20 De-functioning bore wells and 20 functioning bore wells among the sampled households in micro watershed.

Table 18. Status of bore wells in Mundrigi micro-watershed

Sl.No.	Particulars	LL (5)	MF (16)	SF (4)	SMF (5)	MDF (4)	All (34)
		N	N	N	N	N	N
1	De-functioning	0	7	0	4	9	20
2	Functioning	0	7	0	4	9	20

Source of irrigation: The data regarding the source of irrigation in Mundrigi Micro watershed is presented in Table 19. The results that Bore well were major source of irrigation for 58.82 per cent of the households.

Table 19. Source of irrigation in Mundrigi micro-watershed

Sl.No.	Particulars	LL (5)		MF (16)		SF (4)		SMF (5)		MDF (4)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Bore Well	0	0	7	43.8	0	0	4	80	9	225	20	58.82

Depth of water (Avg. In meters): The data regarding the depth of water in Mundrigi Micro watershed is presented in Table 20. The results revealed that, the depth of bore well was 25.28 meter.

Table 20. Depth of water (Avg. In meters) in Mundrigi micro-watershed

Sl.No.	Particulars	LL (5)	MF (16)	SF (4)	SMF (5)	MDF (4)	All (34)
		N	N	N	N	N	N
1	Bore Well	0	26.1	0	9.75	98.3	25.28

Irrigated Area (ha): The data regarding the irrigated area (ha) in Mundrigi Micro watershed is presented in Table 21. The results indicate that, the availability of irrigation water was used for kharif crops was 14.38 ha.

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

Sl.No.	Particulars	LL (5)	MF (16)	SF (4)	SMF (5)	MDF (4)	All (34)
1	Kharif	0	2.05	0	2.94	9.39	14.38

Table 22. Cropping pattern in Mundrigi micro-watershed

Sl.No.	Particulars	LL (5)	MF (16)	SF (4)	SMF (5)	MDF (4)	All (34)
1	Kharif - Maize	0	5.42	2.33	5.32	6.96	20.04
2	Kharif - Bajra	0	3.08	0	5.71	0	8.79
3	Kharif - Red gram (togari)	0	0	1.62	0	0	1.62
4	Kharif - Pearl millet (Sajje)	0	0.94	0	0	0	0.94
5	Kharif - Cotton	0	0	0.81	0	0	0.81
6	Kharif - Groundnut	0	0	0	0	0.81	0.81
7	Kharif - Paddy	0	0	0	0	0.81	0.81

Cropping pattern: The data regarding the cropping pattern in Mundrigi Micro watershed is presented in Table 22. The results indicate that, farmers have grown Maize

(20.04 ha), Bajra (8.79 ha), Red gram (1.62 ha), Pearl millet (0.94 ha), Cotton (0.81 ha), Groundnut (0.81 ha) and Paddy (0.81 ha).

Cropping intensity: The data regarding the cropping intensity in Mundrigi Micro watershed is presented in Table 23. The results indicate that, the cropping intensity was 91.29 per cent.

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

Sl.No.	Particulars	LL (5)	MF (16)	SF (4)	SMF (5)	MDF (4)	All (34)
1	Cropping Intensity	0	100	100	76.96	100	91.29

Possession of bank account and savings: The data regarding the possession of bank account and saving in Mundrigi micro-watershed is presented in Table 24. The results indicate that, 52.94 cent of the households posses bank account and 52.94 per cent of them have savings.

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

Sl.No.	Particulars	LL (5)		MF (16)		SF (4)		SMF (5)		MDF (4)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Account	0	0	10	62.5	3	75	3	60	2	50	18	52.94
2	Savings	0	0	10	62.5	3	75	3	60	2	50	18	52.94

Borrowing status: The data regarding the borrowing status in Mundrigi micro-watershed is presented in Table 25. The results indicate that, 52.94 percent of the sample farmers have borrowed credit from different sources.

Table 25. Borrowing status in Mundrigi micro-watershed

Sl.No.	Particulars	LL (5)		MF (16)		SF (4)		SMF (5)		MDF (4)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Credit Availed	0	0	10	62.5	3	75	3	60	2	50	18	52.94

Source of credit: The data regarding the source of credit availed by households in Mundrigi micro-watershed is presented in Table 26. The results show that, 11.11 per cent have borrowed loan from Grameena Bank.

Table 26. Source of credit borrowed by households in Mundrigi micro-watershed

Sl.No.	Particulars	MF (10)		SF (3)		SMF (3)		MDF (2)		All (18)	
		N	%	N	%	N	%	N	%	N	%
1	Grameena Bank	1	10	1	33.3	0	0	0	0	2	11.11

Avg. Credit amount: The data regarding the avg. Credit amount in Mundrigi micro-watershed is presented in Table 27. The results show that, farmers have borrowed Avg. Credit of Rs.3888.89 from different sources.

Table 27. Avg. Credit amount in Mundrigi micro-watershed

Sl.No.	Particulars	MF (10)	SF (3)	SMF (3)	MDF (2)	All (18)
		N	N	N	N	N
1	Average Credit	3000	13333.3	0	0	3888.89

Purpose of credit borrowed (institutional Source): The data regarding the purpose of credit borrowed - Institutional Credit in Mundrigi micro-watershed is presented in Table

28. The results indicate that, 100.00 per cent of the households have borrowed loan for agriculture.

Table 28. Purpose of credit borrowed (institutional Source) by households in Mundrigi micro-watershed

SN	Particulars	MF (1)		SF (1)		All (2)	
		N	%	N	%	N	%
1	Agriculture production	1	100	1	100	2	100

Repayment status of household (institutional Source): The data regarding the repayment status of credit borrowed from institutional Source by households in Mundrigi micro watershed is presented in Table 29. The results indicate that, 100.00 per cent have unpaid.

Table 29. Repayment status of household (institutional Source) in Mundrigi micro-watershed

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

Opinion regarding institutional sources of credit: The data regarding the opinion on institutional sources of credit in Mundrigi micro watershed is presented in Table 30. The results indicate that, 100.00 per cent of the households opined that credit helped to perform timely agricultural operations.

Table 30. Opinion regarding institutional sources of credit in Mundrigi micro-watershed

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

Cost of Cultivation of Maize: The data regarding the cost of cultivation (Rs/ha) of Maize in Mundrigi micro watershed is presented in Table 31.a. The results indicate that, the total cost of cultivation (Rs/ha) for Maize was Rs. 51685.51. The gross income realized by the farmers was Rs. 49179.55. The net income from Maize cultivation was Rs.-2505.95, thus the benefit cost ratio was found to be 1:1.00.

Table 3318(a). Cost of Cultivation of Maize in Mundrigi micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	32.62	6282.84	12.16
2	Bullock		Pairs/day	1.02	649.45	1.26
3	Tractor		Hours	6.36	4347.97	8.41
4	Machinery		Hours	0.21	126.28	0.24
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	25.47	3186.46	6.17
6	Seed Inter Crop		Kgs.	0	0	0
7	FYM		Quintal	17.97	7746.62	14.99
8	Fertilizer + micronutrients		Quintal	9.03	7220.6	13.97
9	Pesticides (PPC)		Kgs / liters	3.89	4644.94	8.99
10	Irrigation		Number	7.35	0	0
11	Repairs			0	0	0
12	Msc. Charges (Marketing costs etc)			0	0	0
13	Depreciation charges			0	100.66	0.19
14	Land revenue and Taxes			0	1.6	0
II	**Cost B1**					
16	Interest on working capital				2736.79	5.3
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				37044.22	71.67
III	**Cost B2**					
18	Rental Value of Land				203.51	0.39
19	**Cost B2 = (Cost B1 + Rental value)**				37247.73	72.07
IV	**Cost C1**					
20	Family Human Labour			39.48	9731.15	18.83
21	**Cost C1 = (Cost B2 + Family Labour)**				46978.88	90.89
V	**Cost C2**					
22	Risk Premium				7.95	0.02
23	**Cost C2 = (Cost C1 + Risk Premium)**				46986.82	90.91
VI	**Cost C3**					
24	Managerial Cost				4698.68	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				51685.51	100
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		35.16	43389.61	
		b) Main Crop Sales Price (Rs.)			1234.21	
	By Product	e) Main Product (q)		22.45	5789.94	
		f) Main Crop Sales Price (Rs.)			257.89	
b.	Gross Income (Rs.)				49179.55	
c.	Net Income (Rs.)				-2505.95	
d.	Cost per Quintal (Rs./q.)				1470.19	
e.	Benefit Cost Ratio (BC Ratio)				1:1	

Cost of Cultivation of Bajra: The data regarding the cost of cultivation (Rs/ha) of Bajra in Mundrigi micro watershed is presented in Table 31.b. The results indicate that, the total cost of cultivation (Rs/ha) for Bajra was Rs. 24587.06. The gross income realized by the farmers was Rs. 34552.83. The net income from Bajra cultivation was Rs.9965.77, thus the benefit cost ratio was found to be 1:1.40.

Table 31(b). Cost of Cultivation of Bajra in Mundrigi micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	23.17	4086.11	16.62
2	Bullock		Pairs/day	0.93	478.56	1.95
3	Tractor		Hours	4.4	3068.8	12.48
4	Machinery		Hours	0.21	144.08	0.59
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	12.76	1635.85	6.65
6	Seed Inter Crop		Kgs.	0	0	0
7	FYM		Quintal	11.22	2091.53	8.51
8	Fertilizer + micronutrients		Quintal	4.28	3585.48	14.58
9	Pesticides (PPC)		Kgs / liters	1.89	2046.34	8.32
10	Irrigation		Number	6.02	0	0
11	Repairs			0	0	0
12	Msc. Charges (Marketing costs etc)			0	0	0
13	Depreciation charges			0	82.22	0.33
14	Land revenue and Taxes			0	2.26	0.01
II	**Cost B1**					
16	Interest on working capital				1123.58	4.57
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				18344.82	74.61
III	**Cost B2**					
18	Rental Value of Land				329.17	1.34
19	**Cost B2 = (Cost B1 + Rental value)**				18673.99	75.95
IV	**Cost C1**					
20	Family Human Labour			15.97	3673.88	14.94
21	**Cost C1 = (Cost B2 + Family Labour)**				22347.87	90.89
V	**Cost C2**					
22	Risk Premium				4	0.02
23	**Cost C2 = (Cost C1 + Risk Premium)**				22351.87	90.91
VI	**Cost C3**					
24	Managerial Cost				2235.19	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				24587.06	100
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		16.22	28179.1	
		b) Main Crop Sales Price (Rs.)			1737.5	
	By Product	e) Main Product (q)		24.05	6373.73	
		f) Main Crop Sales Price (Rs.)			265	
b.	Gross Income (Rs.)				34552.83	
c.	Net Income (Rs.)				9965.77	
d.	Cost per Quintal (Rs./q.)				1516.02	
e.	Benefit Cost Ratio (BC Ratio)				1:1.4	

Cost of Cultivation of Groundnut: The data regarding the cost of cultivation (Rs/ha) of Groundnut in Mundrigi micro watershed is presented in Table 31.c. The results indicate, the total cost of cultivation (Rs/ha) for Groundnut was Rs.47833.51. The gross income realized by the farmers was Rs. 60268.00. The net income from Groundnut cultivation was Rs. 12434.49, thus the benefit cost ratio was found to be 1:1.30.

Table 31(c). Cost of Cultivation of Groundnut in Mundrigi micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	53.11	7335.9	15.34
2	Bullock		Pairs/day	3.71	2223	4.65
3	Tractor		Hours	2.47	1482	3.1
4	Machinery		Hours	0	0	0
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	123.5	9880	20.65
6	Seed Inter Crop		Kgs.	0	0	0
7	FYM		Quintal	1.24	1852.5	3.87
8	Fertilizer + micronutrients		Quintal	8.65	8027.5	16.78
9	Pesticides (PPC)		Kgs / liters	1.24	988	2.07
10	Irrigation		Number	3.71	0	0
11	Repairs			0	0	0
12	Msc. Charges (Marketing costs etc)			0	0	0
13	Depreciation charges			0	615.03	1.29
14	Land revenue and Taxes			0	4.94	0.01
II	**Cost B1**					
16	Interest on working capital				2490.12	5.21
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				34898.99	72.96
III	**Cost B2**					
18	Rental Value of Land				666.67	1.39
19	**Cost B2 = (Cost B1 + Rental value)**				35565.66	74.35
IV	**Cost C1**					
20	Family Human Labour			43.23	7916.35	16.55
21	**Cost C1 = (Cost B2 + Family Labour)**				43482.01	90.9
V	**Cost C2**					
22	Risk Premium				3	0.01
23	**Cost C2 = (Cost C1 + Risk Premium)**				43485.01	90.91
VI	**Cost C3**					
24	Managerial Cost				4348.5	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				47833.51	100
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		14.82	59280	
		b) Main Crop Sales Price (Rs.)			4000	
	By Product	e) Main Product (q)		1.24	988	
		f) Main Crop Sales Price (Rs.)			800	
b.	Gross Income (Rs.)				60268	
c.	Net Income (Rs.)				12434.49	
d.	Cost per Quintal (Rs./q.)				3227.63	
e.	Benefit Cost Ratio (BC Ratio)				1:1.3	

Cost of Cultivation of Cotton: The data regarding the cost of cultivation (Rs/ha) of Cotton in Mundrigi micro watershed is presented in Table 31.d. The results indicate that, the total cost of cultivation (Rs/ha) for Cotton was Rs. 33857.89. The gross income realized by the farmers was Rs.59280.00. The net income from Cotton cultivation was Rs. 25422.11, thus the benefit cost ratio was found to be 1:1.80.

Table 31(d). Cost of Cultivation of Cotton in Mundrigi micro-watershed

Sl.No	Particulars	Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**				
1	Hired Human Labour	Man days	1.24	370.5	1.09
2	Bullock	Pairs/day	0	0	0
3	Tractor	Hours	4.94	3705	10.94
4	Machinery	Hours	0	0	0
5	Seed Main Crop (Establishment and Maintenance)	Kgs (Rs.)	4.94	1482	4.38
6	Seed Inter Crop	Kgs.	0	0	0
7	FYM	Quintal	0	0	0
8	Fertilizer + micronutrients	Quintal	4.94	3705	10.94
9	Pesticides (PPC)	Kgs / liters	2.47	2470	7.3
10	Irrigation	Number	0	0	0
11	Repairs		0	0	0
12	Msc. Charges (Marketing costs etc)		0	0	0
13	Depreciation charges		0	0.02	0
14	Land revenue and Taxes		0	0	0
II	**Cost B1**				
16	Interest on working capital			920.04	2.72
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**			12652.56	37.37
III	**Cost B2**				
18	Rental Value of Land			333.33	0.98
19	**Cost B2 = (Cost B1 + Rental value)**			12985.9	38.35
IV	**Cost C1**				
20	Family Human Labour		71.63	17784	52.53
21	**Cost C1 = (Cost B2 + Family Labour)**			30769.9	90.88
V	**Cost C2**				
22	Risk Premium			10	0.03
23	**Cost C2 = (Cost C1 + Risk Premium)**			30779.9	90.91
VI	**Cost C3**				
24	Managerial Cost			3077.99	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**			33857.89	100
VII	**Economics of the Crop**				
a.	Main Product	a) Main Product (q)	19.76	59280	
		b) Main Crop Sales Price (Rs.)		3000	
b.	Gross Income (Rs.)			59280	
c.	Net Income (Rs.)			25422.11	
d.	Cost per Quintal (Rs./q.)			1713.46	
e.	Benefit Cost Ratio (BC Ratio)			1:1.8	

Cost of Cultivation of Redgram: The data regarding the cost of cultivation (Rs/ha) of Redgram in Mundrigi micro watershed is presented in Table 31.e. The results indicate that, the total cost of cultivation (Rs/ha) for Redgram was Rs.12779.58. The gross income realized by the farmers was Rs. 55575.00. The net income from Redgram cultivation was Rs. 42795.42, thus the benefit cost ratio was found to be 1:4.30.

Table 31(e). Cost of Cultivation of Redgram in Mundrigi micro-watershed

Sl.No	Particulars	Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**				
1	Hired Human Labour	Man days	16.67	2297.1	17.97
2	Bullock	Pairs/day	0	0	0
3	Tractor	Hours	0	0	0
4	Machinery	Hours	0.62	370.5	2.9
5	Seed Main Crop (Establishment and Maintenance)	Kgs (Rs.)	12.35	988	7.73
6	Seed Inter Crop	Kgs.	0	0	0
7	FYM	Quintal	12.35	3087.5	24.16
8	Fertilizer + micronutrients	Quintal	1.24	895.38	7.01
9	Pesticides (PPC)	Kgs/liters	0.62	679.25	5.32
10	Irrigation	Number	0	0	0
11	Repairs		0	0	0
12	Msc. Charges (Marketing costs etc)		0	0	0
13	Depreciation charges		0	40.14	0.31
14	Land revenue and Taxes		0	3.29	0.03
II	**Cost B1**				
16	Interest on working capital			678.02	5.31
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**			9039.17	70.73
III	**Cost B2**				
18	Rental Value of Land			133.33	1.04
19	**Cost B2 = (Cost B1 + Rental value)**			9172.5	71.77
IV	**Cost C1**				
20	Family Human Labour		12.97	2445.3	19.13
21	**Cost C1 = (Cost B2 + Family Labour)**			11617.8	90.91
V	**Cost C2**				
22	Risk Premium			0	0
23	**Cost C2 = (Cost C1 + Risk Premium)**			11617.8	90.91
VI	**Cost C3**				
24	Managerial Cost			1161.78	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**			12779.58	100
VII	**Economics of the Crop**				
a.	Main Product	a) Main Product (q)	12.35	55575	
		b) Main Crop Sales Price (Rs.)		4500	
b.	Gross Income (Rs.)			55575	
c.	Net Income (Rs.)			42795.42	
d.	Cost per Quintal (Rs./q.)			1034.78	
e.	Benefit Cost Ratio (BC Ratio)			1:4.3	

Adequacy of fodder: The data regarding the adequacy of fodder in Mundrigi Micro watershed is presented in Table 32. The results indicate that, 17.65 per cent of the households opined that dry fodder was adequate and 5.88 per cent of them opined dry fodder was inadequate. With respect to green fodder availability, 14.71 percent of them opined it was sufficient.

Table 32. Adequacy of fodder in Mundrigi micro-watershed

Sl.No.	Particulars	LL (5)		MF (16)		SF (4)		SMF (5)		MDF (4)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Adequate-Dry Fodder	0	0	3	18.75	0	0	0	0	3	75	6	17.65
2	Inadequate-Dry Fodder	0	0	0	0	0	0	2	40	0	0	2	5.88
3	Adequate-Green Fodder	0	0	2	12.5	0	0	1	20	2	50	5	14.71

Average annual gross income: The data regarding the annual gross income in Mundrigi Micro watershed is presented in Table 33. The results indicate that, the farmers have annual gross income of Rs. 59020.59 in micro-watershed, of which Rs. 40667.65 is from agriculture itself.

Table 33. Average annual gross income in Mundrigi micro-watershed

Sl.No.	Particulars	LL (5)	MF (16)	SF (4)	SMF (5)	MDF (4)	All (34)
		Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1	Service/salary	0	312.5	0	0	0	147.06
2	Business	0	937.5	0	0	0	441.18
3	Wage	13000	17312.5	28750	11400	5000	15705.9
4	Agriculture	2000	19593.8	67500	66240	114500	40667.7
5	Dairy Farm	0	4062.5	750	0	500	2058.82
Income(Rs.)		15000	42218.8	97000	77640	120000	59020.6

Average annual Expenditure: The data regarding the average annual expenditure in Mundrigi Micro watershed is presented in Table 34. The results indicate that, the farmers have annual gross expenditure of Rs. 244106.06 in micro-watershed, of which Rs. 25558.82 is from agriculture itself.

Table 34. Average annual Expenditure in Mundrigi micro-watershed

Sl.No.	Particulars	LL (5)	MF (16)	SF (4)	SMF (5)	MDF (4)	All (34)
		Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1	Service/salary	0	1000	0	0	0	29.41
2	Business	0	10000	0	0	0	294.12
3	Wage	8000	11272.7	10000	7500	7750	6367.65
4	Agriculture	5000	12750	36250	36000	83750	25558.8
5	Dairy Farm	0	13333.3	0	0	1500	1220.59
Total		13000	48356.1	46250	43500	93000	244106

Horticulture species grown: The data regarding horticulture species grown in Mundrigi Micro watershed is presented in Table 35. The results indicate that, the total number of horticultural trees grown (both field and backyard) by the sampled households were coconut (17), Guava (8) and Mango (3).

Table 35. Horticulture species grown in Mundrigi micro-watershed

Sl.No.	Particulars	LL (5)		MF (16)		SF (4)		SMF (5)		MDF (4)		All (34)	
		F	B	F	B	F	B	F	B	F	B	F	B
1	Coconut	0	0	0	0	0	0	15	0	2	0	17	0
2	Guava	0	0	0	0	0	0	0	0	8	0	8	0
3	Mango	0	0	0	0	0	0	0	0	3	0	3	0

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

Forest species grown: The data regarding forest species grown in Mundrigi Micro watershed is presented in Table 36. The results indicate that, households have planted 30 neem trees, 1 tamarind trees and 4 banyan trees together in both field and backyard.

Table 36. Forest species grown in Mundrigi micro-watershed

Sl.No.	Particulars	LL (5)		MF (16)		SF (4)		SMF (5)		MDF (4)		All (34)	
		F	B	F	B	F	B	F	B	F	B	F	B
1	Neem	0	0	4	0	9	0	13	0	4	0	30	0
2	Tamarind	0	0	1	0	0	0	0	0	0	0	1	0
3	Banyan	0	0	0	0	0	0	4	0	0	0	4	0

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

Marketing of agricultural produce: The data regarding marketing of the agricultural produce in Mundrigi Micro watershed is presented in Table 37. The results indicated that, 90.24 percent of output of Bajra was sold in the market with average price of Rs. 1985.71; 100.00 percent of output of Cotton was sold in the market with average price of Rs. 3000.00; 58.33 percent of output of Groundnut was sold in the market with average price of Rs. 4000.00; 96.10 percent of output of Maize was sold in the market with average price of Rs. 1172.50 and 75.00 percent of output of Paddy was sold in the market with average price of Rs. 2000.00.

Table 37. Marketing of agricultural produce in Mundrigi micro-watershed

Sl.No	Crops	Output obtained (q)	Output retained (q)	Output sold (q)	Output sold (%)	Avg. Price obtained (Rs/q)
1	Bajra	164	16	148	90	1986
2	Cotton	16	0	16	100	3000
3	Groundnut	12	5	7	58	4000
4	Maize	667	26	641	96	1173
5	Paddy	20	5	15	75	2000
6	Redgram	20	5	15	75	4500
7	Sugarcane	600	0	600	100	2400

Marketing channels used for sale of agricultural produce: The data regarding marketing channels used for sale of agricultural produce in Mundrigi Micro watershed is presented in Table 38. The results indicated that, 61.76 cent of the households have sold agricultural produce to the local/village merchants, 5.88 per cent have sold to Agent/Traders, 23.53 per cent of regulated market and 2.94 per cent of contract marketing arrangement.

Table 38. Marketing channels used for sale of agricultural produce in Mundrigi micro-watershed

Sl.No.	Particulars	LL (5)		MF (16)		SF (4)		SMF (5)		MDF (4)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Agent/Traders	0	0	1	6.3	0	0	1	20	0	0	2	5.88
2	Local/village Merchant	0	0	12	75	3	75	3	60	3	75	21	61.76
3	Regulated Market	0	0	3	19	1	25	2	40	2	50	8	23.53
4	Contract marketing arrangement	0	0	0	0	0	0	0	0	1	25	1	2.94

Mode of transport of agricultural produce: The data regarding mode of transport of agricultural produce in Mundrigi Micro watershed is presented in Table 39. The results indicated that, 85.29 cent of the households have used tractor and 5.88 per cent have used Cart by Bus for the transport of agriculture commodity.

Table 39. Mode of transport of agricultural produce in Mundrigi micro-watershed

Sl.No.	Particulars	LL (5)		MF (16)		SF (4)		SMF (5)		MDF (4)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Cart	0	0	1	6.3	1	25	0	0	0	0	2	5.88
2	Tractor	0	0	15	94	3	75	6	120	5	125	29	85.29
3	Truck	0	0	0	0	0	0	0	0	1	25	1	2.94

Incidence of soil and water erosion problems: The data regarding incidence of incidence of soil and water erosion problems in Mundrigi Micro watershed is presented in Table 40. The results indicate that, 52.94 per cent of the households have experienced soil and water erosion problems.

Table 40. Incidence of soil and water erosion problems in Mundrigi micro-watershed

Sl.No.	Particulars	LL (5)		MF (16)		SF (4)		SMF (5)		MDF (4)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Soil and water erosion problems in the farm	0	0	10	63	3	75	3	60	2	50	18	52.94

Interest towards soil testing: The data regarding Interest shown towards soil testing in Mundrigi Micro watershed is presented in Table 41. The results indicated that, 58.82 per cent of the households were interested towards soil testing.

Table 41. Interest regarding soil testing in Mundrigi micro-watershed

Sl. No.	Particulars	LL (5)		MF (16)		SF (4)		SMF (5)		MDF (4)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Interest in soil test	0	0	11	69	3	75	4	80	2	50	20	58.82

Table 42. Usage pattern of fuel for domestic use in Mundrigi micro-watershed

Sl.No.	Particulars	LL (5)		MF (16)		SF (4)		SMF (5)		MDF (4)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Fire Wood	5	100	16	100	4	100	5	100	4	100	34	100

Usage pattern of fuel for domestic use: The data on usage pattern of fuel for domestic use in Mundrigi Micro watershed is presented in Table 42. The results indicated that,

firewood was the major source of fuel for domestic use for 100 per cent of the households.

Source of drinking water: The data on source of drinking water in Mundrigi Micro watershed is presented in Table 43. The results indicated that, piped supply of water was the major source for drinking water for 79.41 per cent of the households followed by bore well water (20.59%).

Table 43. Source of drinking water in Mundrigi micro-watershed

Sl.No.	Particulars	LL (5)		MF (16)		SF (4)		SMF (5)		MDF (4)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Piped supply	5	100	12	75	3	75	5	100	2	50	27	79.41
2	Bore Well	0	0	4	25	1	25	0	0	2	50	7	20.59

Source of light: The data on source of light in Mundrigi Micro watershed is presented in Table 44. The results indicated that, electricity was the major source of light for 97.06 per cent of the households followed by kerosene lamp (2.94 %).

Table 44. Source of light in Mundrigi micro-watershed

Sl.No.	Particulars	LL (5)		MF (16)		SF (4)		SMF (5)		MDF (4)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Kerosene Lamp	0	0	1	6.3	0	0	0	0	0	0	1	2.94
2	Electricity	5	100	15	94	4	100	5	100	4	100	33	97.1

Existence of sanitary toilet facility: The data on availability of toilet facility in Mundrigi Micro watershed is presented in Table 45. The results indicated that, 50.00 per cent of the households possess toilets.

Table 45. Existence of sanitary toilet facility in Mundrigi micro-watershed

Sl.No.	Particulars	LL (5)		MF (16)		SF (4)		SMF (5)		MDF (4)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Sanitary toilet facility	5	100	2	13	4	100	2	40	4	100	17	50

Possession of PDS card: The data regarding possession of PDS card in Mundrigi Micro watershed is presented in Table 46. The results indicated that, 100 per cent of the households possessed BPL card.

Table 46. Possession of PDS card in Mundrigi micro-watershed

Sl.No.	Particulars	LL (5)		MF (16)		SF (4)		SMF (5)		MDF (4)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	BPL	5	100	16	100	4	100	5	100	4	100	34	100

Table 47. Participation in NREGA programme in Mundrigi micro-watershed

Sl.No.	Particulars	LL (5)		MF (16)		SF (4)		SMF (5)		MDF (4)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Participation in NREGA programme	1	20	2	12.5	0	0	2	40	0	0	5	14.7

Participation in NREGA programme: The data regarding Participation in NREGA programme in Mundrigi Micro watershed is presented in Table 47. The results indicated that, only 14.71 percent of the participate have participated in NREGA programme.

Adequacy of food items: The data regarding adequacy of food items in Mundrigi Micro watershed is presented in Table 48. The results indicated that, the extent of adequacy of food items for cereals, pulses, Oilseeds and vegetables were 58.82, 55.88, 20.59 and 32.35 per cent respectively, similarly for Fruits (14.71%), milk (29.41%), Egg (14.71%) and Meat (17.65%).

Table 48. Adequacy of food items in Mundrigi micro-watershed

Sl.No.	Particulars	LL (5)		MF (16)		SF (4)		SMF (5)		MDF (4)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Cereals	1	20	9	56.3	3	75	4	80	3	75	20	58.82
2	Pulses	1	20	10	62.5	3	75	3	60	2	50	19	55.88
3	Oilseed	0	0	4	25	1	25	1	20	1	25	7	20.59
4	Vegetables	2	40	5	31.3	1	25	1	20	2	50	11	32.35
5	Fruits	0	0	2	12.5	1	25	2	40	0	0	5	14.71
6	Milk	0	0	5	31.3	2	50	1	20	2	50	10	29.41
7	Egg	0	0	4	25	0	0	1	20	0	0	5	14.71
8	Meat	1	20	4	25	0	0	1	20	0	0	6	17.65

Inadequacy of food items: The data regarding in adequacy of food items in Mundrigi Micro watershed is presented in Table 49. The results indicated that, the extent of in adequacy of food items for cereals, pulses, Oilseeds and vegetables were 20.59, 20.59, 61.76, 50.00 and 61.76 per cent respectively, similarly for fruits (38.24%), milk (47.06%), egg (55.88%) and meat (61.76%).

Table 49. Inadequacy of food items in Mundrigi micro-watershed

Sl.No.	Particulars	LL (5)		MF (16)		SF (4)		SMF (5)		MDF (4)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Cereals	2	40	4	25	0	0	0	0	1	25	7	20.59
2	Pulses	2	40	2	12.5	0	0	1	20	2	50	7	20.59
3	Oilseed	3	60	9	56.3	3	75	3	60	3	75	21	61.76
4	Vegetables	1	20	8	50	3	75	3	60	2	50	17	50
5	Fruits	1	20	6	37.5	2	50	2	40	2	50	13	38.24
6	Milk	4	80	7	43.8	1	25	2	40	2	50	16	47.06
7	Egg	3	60	8	50	3	75	3	60	2	50	19	55.88
8	Meat	3	60	9	56.3	4	100	3	60	2	50	21	61.76

Table 50. Response on market surplus of food items in Mundrigi micro-watershed

Sl.No.	Particulars	LL (5)		MF (16)		SF (4)		SMF (5)		MDF (4)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Cereals	2	40	3	18.8	1	25	1	20	0	0	7	20.59
2	Pulses	2	40	3	18.8	1	25	1	20	0	0	7	20.59
3	Oilseed	2	40	3	18.8	0	0	1	20	0	0	6	17.65
4	Vegetables	2	40	3	18.8	0	0	1	20	0	0	6	17.65
5	Fruits	4	80	5	31.3	0	0	1	20	0	0	10	29.41
6	Milk	1	20	1	6.25	0	0	1	20	0	0	3	8.82
7	Egg	2	40	2	12.5	0	0	1	20	0	0	5	14.71
8	Meat	1	20	2	12.5	0	0	1	20	0	0	4	11.76

Response on market surplus of food items: The data regarding adequacy of food items in Mundrigi Micro watershed is presented in Table 50. The results indicated that, the extent of adequacy of food items for cereals, pulses, Oilseeds and vegetables were 20.59, 20.59, 17.65, 17.65 per cent respectively, similarly for fruits (29.41%), milk (8.82%), egg (14.71%) and meat (11.76%).

Farming constraints: The data regarding farming constraints experienced by households in Mundrigi Micro watershed is presented in Table 51. The results indicated that, lower fertility status of the soil was the constraint experienced by (52.94 %) per cent of the households, wild animal menace on farm field (70.59%), frequent incidence of pest and diseases (26.47%), inadequacy of irrigation water (11.76%), high cost of fertilizers and plant protection chemicals (35.29%), high rate of interest on credit (20.59%), low price for the agricultural commodities (11.76 %), lack of marketing facilities in the area (29.41%), inadequate extension services (11.76 %), lack of transport for safe transport of the agricultural produce to the market (29.41%), less rainfall (52.94%), source of agri-technology information (Newspaper/Tv/Mobile) (20.59%).

Table 51. Farming constraints experienced in Mundrigi micro-watershed

SN	Particulars	LL (5)		MF (16)		SF (4)		SMF (5)		MDF (4)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Lower fertility status of the soil	0	0	10	62.5	3	75	3	60	2	50	18	52.94
2	Wild animal menace on farm field	0	0	15	93.75	3	75	3	60	3	75	24	70.59
3	Frequent incidence of pest and diseases	0	0	4	25	1	25	3	60	1	25	9	26.47
4	Inadequacy of irrigation water	0	0	2	12.5	1	25	1	20	0	0	4	11.76
5	High cost of Fertilizers and plant protection chemicals	0	0	5	31.25	2	50	4	80	1	25	12	35.29
6	High rate of interest on credit	0	0	4	25	1	25	1	20	1	25	7	20.59
7	Low price for the agricultural commodities	0	0	2	12.5	0	0	2	40	0	0	4	11.76
8	Lack of marketing facilities in the area	0	0	4	25	1	25	2	40	3	75	10	29.41
9	Inadequate extension services	0	0	2	12.5	0	0	2	40	0	0	4	11.76
10	Lack of transport for safe transport of the Agril produce to the market.	0	0	5	31.25	2	50	2	40	1	25	10	29.41
11	Less rainfall	0	0	9	56.25	2	50	5	100	2	50	18	52.94
12	Source of Agri-technology information	0	0	4	25	2	50	1	20	0	0	7	20.59

Chapter 5

SUMMARY AND IMPLICATIONS

In order to assess the socio-economic condition of the farmers in the watershed 34 households located in the micro watershed were interviewed for the survey. The study was conducted in Mundrigi micro-watershed (Karkihalli sub-watershed, Koppal taluk & District) is located at North latitude 15^0 16' 58.624" and 15^0 14' 44.725" and East longitude 76^0 12' 48.228" and 75^0 11' 55.13"covering an area of about 411.61 ha bounded by under Mallikeri, Kunakeri and Lachananakeri Villages.

Socio-economic analysis indicated that, out of the total sample of 34 respondents, 16 (47.06%) were marginal, 4(11.76%) were small and 5 (14.71%) were semi medium and 4 (11.76%) were medium farmers. The population characteristics of households indicated that, there were 103 (58.19%) men and 74 (41.81%) were women. Majority of the respondents (40.68%) were in the age group of 35-60 years. Education level of the sample households indicated that, majority there were 29.94 per cent illiterates, 0.00 per cent were functional literates and only 1.69 per cent attained graduation. About, 82.35 per cent of household heads practicing agriculture and 17.65 per cent of the household heads were engaged as agricultural labourers. Agriculture was the major occupation for 31.64 per cent of the household members.

In the study area, 82.35 per cent of the households possess katcha house. The durable assets owned by the households showed that, 70.59 per cent possess TV, 29.41 per cent possess mixer grinder and 85.29 per cent possess mobile phones. Farm implements owned by the households indicated that, 11.76 per cent of the households possess plough and only 20.59 per cent sprayer. Regarding livestock possession by the households, 8.82 per cent possess local cow and 2.94 per cent possess buffalo respectively.

The average labour availability in the study area showed that**,** own men and women labour availability in the micro watershed was 15.45 each, while the hired labour (men) availability was 1.82. Further, 67.65 per cent of the households opined that hired labour was inadequate during the agricultural season.

Out of the total land holding of the sample respondents (35.53 ha), 54.77 per cent of the area is under dry condition and the remaining 45.23 per cent area is irrigated land. There were 20.00 bore wells and 20.00 dry bore wells among the sampled households. Bore well was the major source of irrigation for 58.82 per cent of the households. The major crops grown by sample farmers are Maize, Bajra, Groundnut, Cotton, Paddy, Peral millet and Redgram and cropping intensity was recorded as 91.29 per cent.

The sample households possessed 52.94 per cent bank account and 52.94 per cent of them have savings in the account. About 52.94 per cent of the respondents borrowed credit from various sources. Among the credit borrowed by households, 11.11 per cent

have borrowed loan from from Cooperative bank. Majority of the respondents (100.00 %) have borrowed loan for agriculture purpose. Regarding the opinion on institutional sources of credit, 100.00 per cent of the households opined that credit helped to perform timely agricultural operations.

The per hectare cost of cultivation for Maize, Bajra, Groundnut, Cotton and Redgram was Rs.51685.51 , 24587.06, 47833.51, 33857.89 and 12779.58 with benefit cost ratio of 1:1.00, 1: 1.40, 1: 1.30, 1: 1.80 and 1:4.30 respectively.

Further, 17.65 per cent of the households opined that dry fodder was adequate and 14.71 per cent of the households have opined that the green fodder was adequate.

The average annual gross income of the farmers was Rs. 59020.59 in micro-watershed, of which Rs. 40667.65 comes from agriculture.

Sampled households have grown Mango, Guava and Mango trees in the fields. None of the households shown interest to cultivate horticultural crops.

Regarding marketing channels, 61.76 per cent of the households have sold agricultural produce to the local/village merchants, while, 23.53 per cent have sold by Agents/Traders. Further, 85.29 per cent of the households have used tractor for the transport of agriculture commodity.

Majority of the farmers (52.94 %) have experienced soil and water erosion problems in the watershed and 58.82 per cent of the households were interested towards soil testing.

Firewood connection was the major source of fuel for domestic use for 100.00 per cent of the households. Piped supply was the major source for drinking water for 79.41 per cent of the households. Electricity was the major source of light for 97.06 per cent of the households. In the study area, 50.00 per cent of the households possess toilet facility. Regarding possession of PDS card, 100.00 per cent of the households possessed BPL card. Cereals (58.82%), pulses (55.88%), oilseeds (20.59%) were adequate for consumption.

Farming constraints experienced by households in the micro watersheds were lower fertility status of the soil (52.94%) wild animal menace on farm field (70.59%), frequent incidence of pest and diseases (26.47%), inadequacy of irrigation water (11.76%), high cost of fertilizers and plant protection chemicals (35.29%), high rate of interest on credit (20.59%), low price for the agricultural commodities (11.76%), lack of marketing facilities in the area (29.41%), inadequate extension services (11.76%), lack of transport for safe transport of the agricultural produce to the market (29.41%), Less rainfall (52.94%) and Source of Agri-technology information (Newspaper/TV/Mobile) (20.59%).

Implications of the survey

- ✓ Result indicated that, there were 29.94 per cent were illiterate hence, extension methodologies such as demonstration, street play, drama, video shows will be effective in dissemination of the technologies in the micro watershed.
- ✓ The data indicate that, 82.35 per cent of the households possess katcha house. Hence, the development department while implementing the watershed plan should focus on agriculture to enhance the productivity of major crops in the area to increase the income of the farmers.
- ✓ Results indicated that the local institutional participation of the household members in the micro watershed is minimal hence, activities like membership campaign, awareness creation about the benefits of membership in local institutions and strengths of organized groups must be conveyed.
- ✓ Majority of the households in the watershed have experience in use of mobile phones, and television hence, these mass media can be effectively utilized for transfer of technology as well as for information dissemination.
- ✓ The farm machinery/implement possession in the micro watershed was found to be minimum the reasons may lack of knowledge or lack of financial ability which can be addressed through training on use of different farm implements, providing information on different sources of finance for purchase of farm implements.
- ✓ The possession of livestock such as crossbred cow found is less hence, farmers must be made aware of the benefits of crossbred cow in increased milk production.
- ✓ The possession of livestock such as sheep, goat and poultry was found to be low hence, farmers may be informed the role of subsidiary enterprises in enhancing the income and information on financial support for subsidiary activities.
- ✓ The data indicate that, job/work was the reason for all the migrants hence, farmers may be trained on profitable agriculture or self employment such has animal husbandry, plate making, sheep rearing, goat rearing, rabbit rearing with suitable information on sources of financial support.
- ✓ The results indicate that there was a change in quality of life due to migration hence, the developmental departments should take actions to arrest migration and to improve the quality of the life in rural areas.
- ✓ Households possess 19.46 ha (54.77 %) of dry land and 16.07 ha (45.23 %) of irrigated land hence, the availability of the dryland agricultural technologies such as short duration crops, high yielding drought resistance crop varieties, drip irrigation technology and subsidy information will be helpful for the farmers to enhance the productivity of land and as well as farmers income.
- ✓ Few of the bore well in micro watershed found non functional hence, farmers may be trained on possibility of bore well rejuvenation.
- ✓ Bore well was major source of irrigation for 58.82 per cent of the households. hence, in order to increase the area under irrigation as well as to increase the water use

efficiency farmers may trained on drip irrigation and provide the information on subsidy for drip irrigation equipment's along with the information on different agencies which provides the financial assistance for drip irrigation.

- ✓ Farmers have grown 17 coconut, 8 Guava and 3 Mango trees in the fields. Hence, production technologies related to these crops can be made available to the farmers for better adoption.
- ✓ The cropping intensity in the micro watershed was found to be (91.29 %) hence, care must be taken by the implementing agency to bring uncultivated land into cultivation through suitable measures.
- ✓ Many of the household members have borrowed loan from cooperative banks which has higher rate of interest hence, farmers may be sensitized on the different sources of credit with lesser interest rate such SHGs etc.
- ✓ The results indicated the non availability of both green and dry fodder throughout the year hence, fodder development activities can be taken up in the micro watershed.
- ✓ The average annual gross income of the households Rs.40667.65 from agriculture, Rs.441.18 from business and Rs. 15705.88 from wages and. Agriculture was found to be the major source of income for households hence; the development activities should focus on productivity enhancement, marketing arrangements and agricultural technology dissemination to have a direct impact on the farmers.
- ✓ The cultivation of forest species is found minimal hence, information and production technology related to agro-forestry and integrated farming system.
- ✓ The data indicated that, 52.94 per cent of the households have experienced soil and water erosion problems. Hence, those farmers who reported the soil and water erosion problems may be given attention while implementation of the watershed development plan.
- ✓ The data indicated that, 58.82 per cent of the households have interest in soil testing hence, farmers must be provided with the information on various institutions which are involved in soil testing for the benefit of the farmers.
- ✓ Except summer ploughing the adoption of other soil and water conservation structures is minimum hence, the farmers in the micro watershed should be sensitized on the use of different conservation structures for soil water conservation.
- ✓ Cereals and pulses found be adequate for per cent of the households respectively hence, farm households and the farm women must be trained on importance of balanced nutrition and role of vegetable, milk, egg, meat in balanced diet.
- ✓ Lower fertility status of the soil (52.94%), wild animal menace on farm field (70.59%), frequent incidence of pest and diseases (26.47%), high cost of fertilizers and plant protection chemicals (35.29%), high rate of interest on credit (20.59%), low price for the agricultural commodities (11.76%), lack of marketing facilities in the area (29.41%), inadequate extension services (11.76%), lack of transport for safe transport of the agricultural produce to the market (29.41%) were the major

farming constraints experienced hence, these constraints must be addressed immediately for the welfare of the farmers. Awareness to be created among the farmers to approach nearest KVKs/RSKs and other developmental departments for technical and for subsidized inputs and utilize the well established regulated markets, approaching the contract firms, direct markets to avoid the involvement of middlemen.