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

KETANAPURA (4B3E1G2e) MICROWATERSHED

Chamarajanagara Taluk and District, Karnataka

Karnataka Watershed Development Project – II

SUJALA – III

World Bank funded Project

THE WORLD BANK

ICAR – NATIONAL BUREAU OF SOIL SURVEY AND LAND USE PLANNING

ICAR - NBSS & LUP

WATERSHED DEVELOPMENT DEPARTMENT
GOVT. OF KARNATAKA, BANGALORE

About ICAR - NBSS&LUP

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

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

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PREFACE

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

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

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

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

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

ICAR-NBSS&LUP, Regional Centre, Bangalore has taken up a project sponsored by the Karnataka Watershed Development Project-II, (Sujala-III), Government of Karnataka funded by the World Bank under Component -1 Land Resource Inventry. This study was taken up to demonstrate the utility of such a database in reviewing, monitoring and evaluating all the land based watershed development programs on a scientific footing. To meet the requirements of various land use planners at grassroots level, the present study on "Land Resource Inventory and Socio-Economic Status of Farm Households for Watershed Planning and Development of Ketanapura Microwatershed, Chamarajanagra 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 micowatershed. The project report with the accompanying maps for the microwatershed will provide required detailed database for evolving effective land use plan, alternative land use options and conservation plans for the planners, administrators, agricutural extention personnel, KVK officials, developmental departments and other land users to manage the land resources in a sustainable manner.

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

Nagpur
Date:30-11-2019

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PART-A

LAND RESOURCE INVENTORY

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EXECUTIVE SUMMARY

The land resource inventory of Ketanapura 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, behaviour and use potentials of the soils in the microwatershed.

The present study covers an area of 599 ha in Ketanapura microwatershed in Chamarajnagar taluk and district, Karnataka. The climate is semiarid and categorized as drought- prone with an average annual rainfall of 769 mm, of which about 316 mm is received during south –west monsoon, 252 mm during north-east and the remaining 201 mm during the rest of the year.

An area of about 96 per cent is covered by soils, <1 per cent area is covered by mining/industrial, 1 per cent area covered by eroded lands and 2 per cent is covered by others (Habitation and Water bodies). The salient findings from the land resource inventory are summarized briefly below.

- *The soils belong to 11 soil series, 26 soil phases (mapping units) and 8 land management units.*
- *The length of crop growing period is about 150 days starting from the last week of July to 4th week of November.*
- *From the master soil map, several interpretative and thematic maps like land capability, soil depth, surface soil texture, soil gravelliness, available water capacity, soil slope and soil erosion were generated.*
- *Soil fertility status maps for macro and micronutrients were generated based on the surface soil samples collected at every 250 m grid interval.*
- *Land suitability for growing major agricultural and horticultural crops were assessed and maps showing the degree of suitability along with constraints were generated.*
- *Entire cultivated area of about 96 per cent is suitable for agriculture.*
- *An area of about 1 per cent has very deep (>150 cm) soils, an area of 32 per cent has moderately deep to deep (75-150 cm) soils. An area of about 36 per cent is under moderately shallow (50-75 cm) soils and shallow (25-50 cm) soils occupy 27 per cent area in the microwatershed.*
- *An area of about 5 per cent has clayey soils at the surface, 38 per cent has loamy soils at the surface and an area of about 53 per cent has sandy at the surface.*

- *An area of about 3 per cent has non-gravelly (<15%) soils, 68 per cent has gravelly (15-35%) soils and 25 per cent has very gravelly to extremely gravelly (35-80%) soils in the microwatershed.*
- *About 49 per cent of the area has very gently sloping (1-3% slope) lands and about 47 per cent area is nearly level (0-1% slope) lands.*
- *An area of about 68 per cent has soils that are slightly eroded (e1), 2 per cent has soils that are moderately eroded (e2) in the microwatershed, 1 per cent area are gullied lands and <1 per cent area are eroded area in the microwatershed.*
- *An area of about 1 per cent area has slightly acid (pH 6.0-6.5) soils, 27 per cent area has neutral (pH 6.5-7.3) soils and 68 per cent has slightly alkaline to very strongly alkaline (pH 7.3->9.0) soils in the microwatershed.*
- *The Electrical Conductivity (EC) of the soils are dominantly <2 dsm^{-1} indicating that the soils are non-saline.*
- *About 60 per cent area is low (<0.5%) and 36 per cent area has soils that are medium (0.5-0.75%) in organic carbon.*
- *An area of about 1 per cent is low (<23 kg/ha), 9 per cent is medium (23-57 kg/ha) and high (>57 kg/ha) in 85 per cent area in available phosphorus.*
- *An area of about 12 per cent has soils that are low (<145 kg/ha), 18 per cent has soils that are medium (145-337 kg/ha) and 66 per cent area has high (>337 kg/ha) in available potassium.*
- *Available sulphur is low (<10 ppm) in <1 per cent area, medium (10-20 ppm) in 70 per cent area and high (>20 ppm) in 26 per cent area of the microwatershed.*
- *Available boron is medium (0.5-1.0 ppm) in 15 per cent area and high (>1.0 ppm) in 81 per cent area of the microwatershed.*
- *About 55 per cent area has soils that are deficient (<4.5 ppm) and 43 per cent area has soils that area sufficient (>4.5ppm) in the available iron.*
- *Available manganese and copper are sufficient in the entire cultivated area of the microwatershed.*
- *An area of about 31 per cent has soils that are deficient (<0.6 ppm) and 65 per cent has soils are sufficient in available zinc.*
- *The land suitability for 9 major crops (agricultural and horticultural) grown in the microwatershed were assessed and the areas that are highly suitable (S1) and moderately suitable (S2) are given below. It is however to be noted that a given soil may be suitable for various crops but what specific crop to be grown may be decided by the farmer looking to his capacity to invest on various inputs, marketing infrastructure, market price, and finally the demand and supply position.*

Land suitability for various crops in the microwatershed

Crops	***Suitability area in ha (%)***	
	Highly Suitable (S1)	***Moderately Suitable (S2)***
Sorghum	*59(10)*	*346(58)*
Maize	*59(10)*	*346(58)*
Finger millet	*59(10)*	*346(58)*
Red gram	-	*91(15)*
Groundnut	*59(10)*	*346(58)*
Cotton	-	*371(62)*
Chilli	*59(10)*	*346(58)*
Mango	-	*32(5)*
Sapota	-	*150(25)*

- *Apart from the individual crop suitability, a proposed crop plan has been prepared for the 8 identified LMUs by considering only the highly and moderately suitable lands for different crops and cropping systems with food, fodder, fibre and horticulture crops that helps in maintaining the ecological balance in the microwatershed.*
- *Maintaining soil-health is vital to crop production and conserve soil and land resource base for maintaining ecological balance and to mitigate climate change. For this, several ameliorative measures have been suggested to these problematic soils like saline/alkali, highly eroded, sandy soils etc.,*
- *Soil and water conservation treatment plan has been prepared that would help in identifying the sites to be treated and also the type of structures required.*
- *As part of the greening programme, several tree species have been suggested to be planted in marginal and submarginal lands, field bunds and also in the hillocks, mounds and ridges. That would help in supplementing the farm income, provide fodder and fuel, generate lot of biomass, which in turn would help in maintaining the ecological balance and contribute to mitigating the climate change.*

Chapter 1

INTRODUCTION

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

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

In this critical juncture, the challenge before us is not only to increase the productivity per unit area which is steadily declining and showing a fatigue syndrome, but also to prevent or at least reduce the severity of degradation. If the situation is not reversed at the earliest, then the sustainability of the already fragile crop production system and the overall ecosystem will be badly affected in the state.

The continued neglect and unscientific use of the resources for a long time has led to the situation observed at present in the state. It is a known fact and established beyond doubt by many studies in the past that the cause for all kinds of degradation is the neglect and irrational use of the land resources. Hence, there is an urgent need to generate a detailed site-specific farm level database on various land resources for all the villages/watersheds in a time bound manner that would help to protect the valuable soil and land resources and also to stabilize the farm production.

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

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

The Land Resource Inventory is basically done for identifying 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 Ketanapura microwatershed in Chamarajnagar Taluk, Chamarajnagar 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. 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 study area of Ketanapura microwatershed (Harve sub-watershed) is located in the southern part of Karnataka in Chamarajnagar Taluk and District, Karnataka State (Fig.2.1). It comprises parts of Kethanapura, Harve, Mukkadhalli and Govindvady villages. It lies between 76°48'1.341'' and 76°49'41.142'' East longitudes and 11°56'3.74'' and 11°58'27.865'' North latitudes and covers an area of 599 ha. It is about 20 km south of Chamarajnagar and is surrounded by Harve village in the south, Kethanapura village on the west, Mukkadhalli village in the north and Govindvady village on the north and eastern part of the microwatershed.

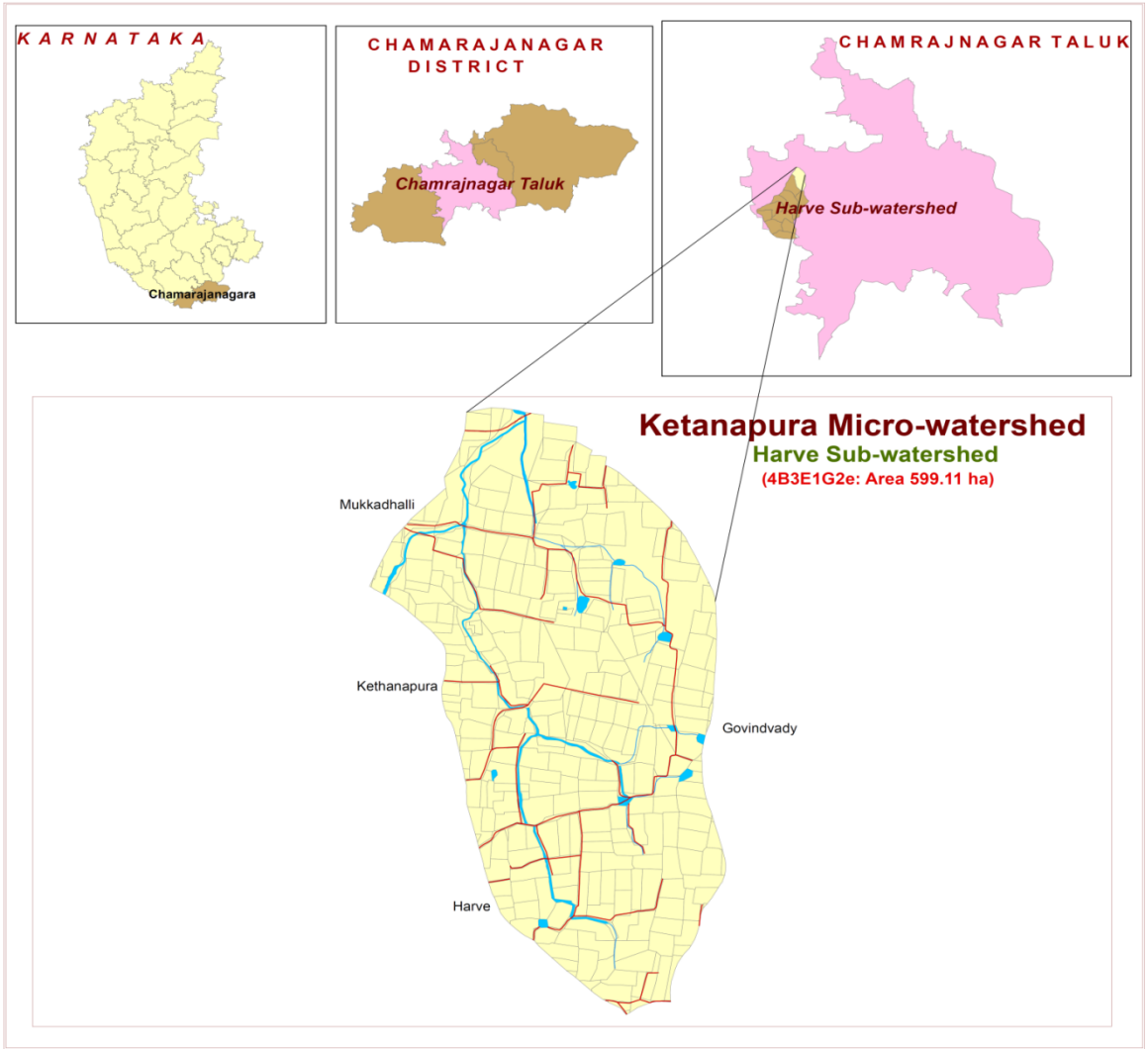


Fig.2.1 Location map of Ketanapura microwatershed

2.2 Geology

Major rock formations observed in the microwatershed are of Archaean age and comprise of (Figs.2.2) granite and granite gneiss. They are essentially pink to gray granite

gneisses. The rocks are coarse to medium grained. They consist primarily of quartz, feldspar, biotite and hornblende. The gray granite gneisses are highly weathered, fractured and fissured upto a depth of about 10 m.

Fig. 2.2 Granite and granite gneiss rocks

2.3 Physiography

Physiographically, the area has been identified as granite gneiss landscape based on geology. It has been further divided into three landforms *viz*; mounds/ ridges uplands and lowlands based on slope and other relief features. They have been further subdivided into four physiographic units, *viz;* summits, side slopes, very gently sloping uplands and lowlands/valleys. The elevation ranges from 800 - 900 m MSL. The mounds and ridges are mostly covered by rock outcrops.

2.4 Drainage

The area is drained by several streams, which originates from southern side of the micro-watershed. Many small streams originating from this micro-watershed join Gowrikere along its course. Though it is not a perennial one, during rainy seasons it carries large quantities of flood water. The micro-watershed has no tanks. The catchment areas around the micro-watershed is small, there are few small tanks to store the water flowing during the rainy seasons. Due to this, and the ground water recharge is very much affected in the micro-watershed. This is reflected in the failure of many bore wells in the micro-watershed. If the available rain water is properly harnessed by constructing tanks and recharge structures at appropriate places in the watershed, then the drinking and irrigation needs of the entire micro-watershed can be easily met.

2.5 Climate

The climate of Chamarajnagar district is quite moderate throughout the year with fairly hot summer and cold winter. March to May is summer months, where mean

maximum temperatures ranges from 32.6°C to 34°C. Average annual rainfall is 769 mm (Table 2.1). Of the total rainfall a maximum of 316 mm is received during southwest monsoon period from June to September, October and November is the north-east monsoon which receives 252 mm and the remaining 201 mm received during rest of the year. During October and November some of the depressions and cyclonic storms originates in Bay of Bengal, which passes through the district, causing wide spread heavy rains and high winds. The mean maximum temperature in the district is 34°C. and the mean minimum temperature is 16.4°C during January month. Relative humidity ranges from 69 to 85% in the morning and in the evening it ranges from 21% to 70%. The wind speed ranges from 8.4 to 14.1 km/h. The Potential Evapo-Transpiration in the district ranged from 106 mm to 165 mm/year. The PET is always higher than precipitation in all months except in September and October (Fig.2.3). Generally, the Length of crop Growing Period (LGP) is 150 days and starts from July last week to 4th week of November.

Table 2.1 Mean Monthly Rainfall, PET, 1/2 PET in Chamarajnagar Taluk and District

Sl. No	Months	Rainfall in mm	PET in mm	½ PET
1	January	1.3	129.1	64.55
2	February	4.4	133.8	66.9
3	March	25.8	164.9	82.45
4	April	64.8	153.8	76.9
5	May	105	147.2	73.6
6	June	57.5	124.6	62.3
7	July	61.0	116.4	58.2
8	August	63.0	117.1	58.55
9	September	134.6	116.8	58.4
10	October	161.5	111.1	55.55
11	November	70.8	106.2	53.1
12	December	19.5	109.9	54.95
Total		**769.2**		

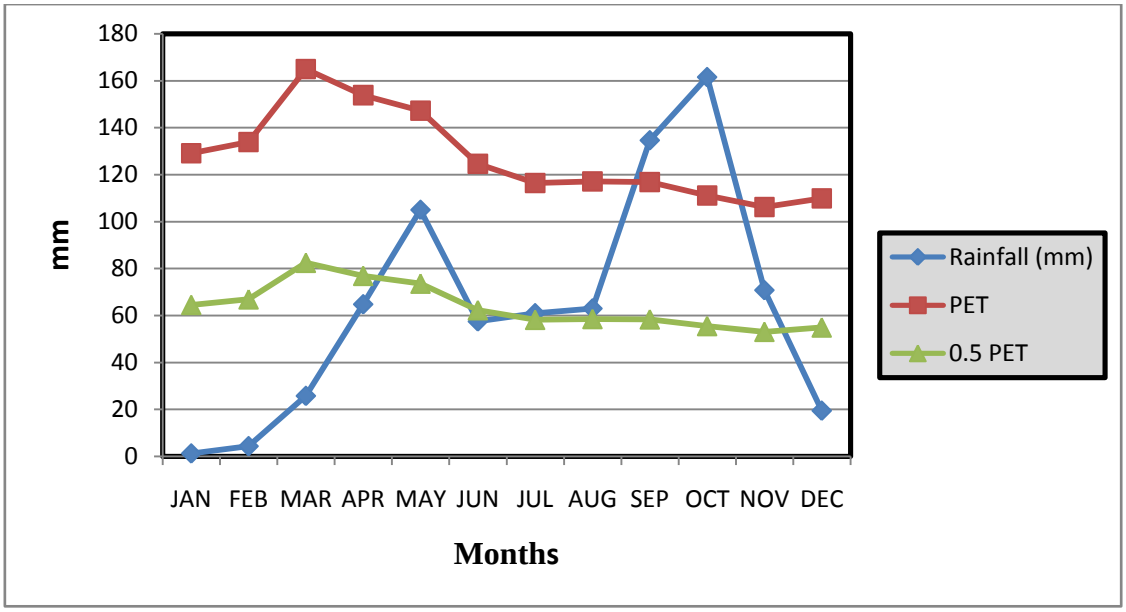


Fig.2.3 Rainfall distribution in Chamarajnagar taluk

2.6. Natural Vegetation

The natural vegetation is sparse, comprising few tree species, shrubs and herbs *viz* Pongamia, Neem, Lantana camera, Tamarind, Soapnut tree, Ficas religiosa. They were under moderate to thick forest vegetation earlier. But due to the encroachment and deforestation, which is very rampant in the area, almost the entire vegetated or forest areas have become barren without any tree cover at present. Still there are some remnants of the past forest cover, which can be seen in patches in some ridges in the watershed. Apart from the continuing deforestation, the presence of large population of goats, sheep and other cattle in the village is causing vegetative degradation of whatever little vegetation is left in the area. The uncontrolled grazing has left no time for the regeneration of the vegetative cover.

2.7 Land Utilization

About 31 per cent area in Chamarajnagar taluk is cultivated at present. Forests occupy about 22 percent areas, but the tree cover is in poor state. Most of the mounds, ridges and bouldery areas have very poor vegetative cover. Major crops grown in this area are Ragi, Sorghum, Maize, Sunflower, Red gram, Bengal gram, Groundnut, Cotton and Marigold. The cropping intensity in Chamarajnagar taluk is 101.63. The current land use map generated shows the arable and non-arable lands, other land uses and different types of crops grown in the area (Fig 2.4). The different crops and cropping systems adopted in the microwatershed is presented in Figures 2.5(a&b). Simultaneously, enumeration of wells (bore wells and open wells) and existing conservation structures in the microwatershed are made and their location in different survey numbers is located on the cadastral map. Map showing the location of existing Conservation structures and wells and other water bodies in Ketanapura microwatershed is given in Fig.2.6.

Table 2.2: Land utilization in Chamarajnagar Taluk

	Agricultural land use	Area (ha)	Per cent (%)
1	Total cultivated area	38554	31.32
2	Cultivable wasteland	2921	2.37
3	Pasture land	11703	9.51
4	Forest area	26903	21.86
5	Area sown more than Ones	631	0.51
6	Cropping intensity	-	101.63
7	Current fallow	29667	24.10
8	Barren land	2763	2.24
9	Total geographical Area	**123078**	

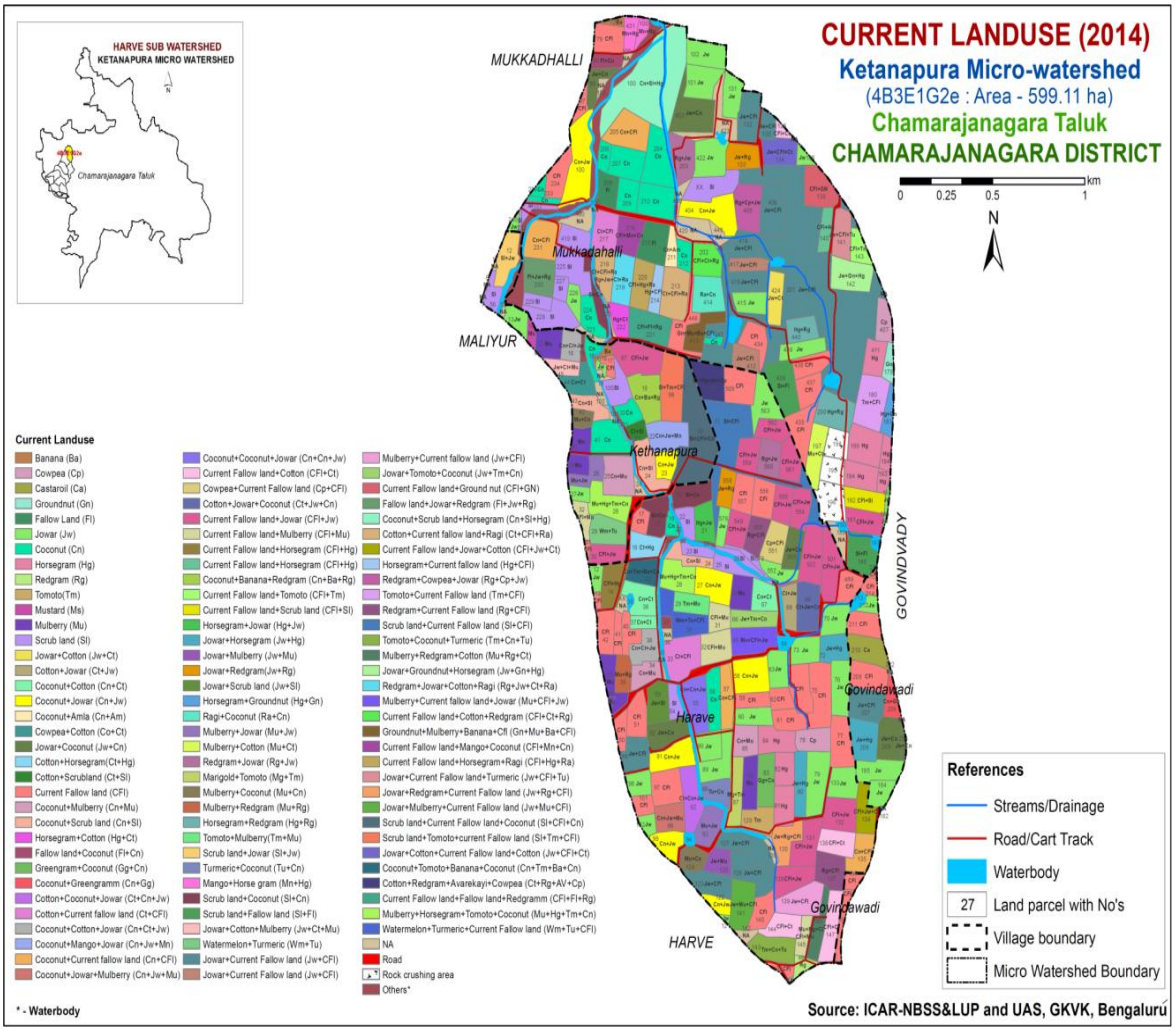


Fig.2.4 Current Land Use – Ketanapura Microwatershed

Fig. 2.5(a) Different crops and cropping systems in Ketanapura Microwatershed

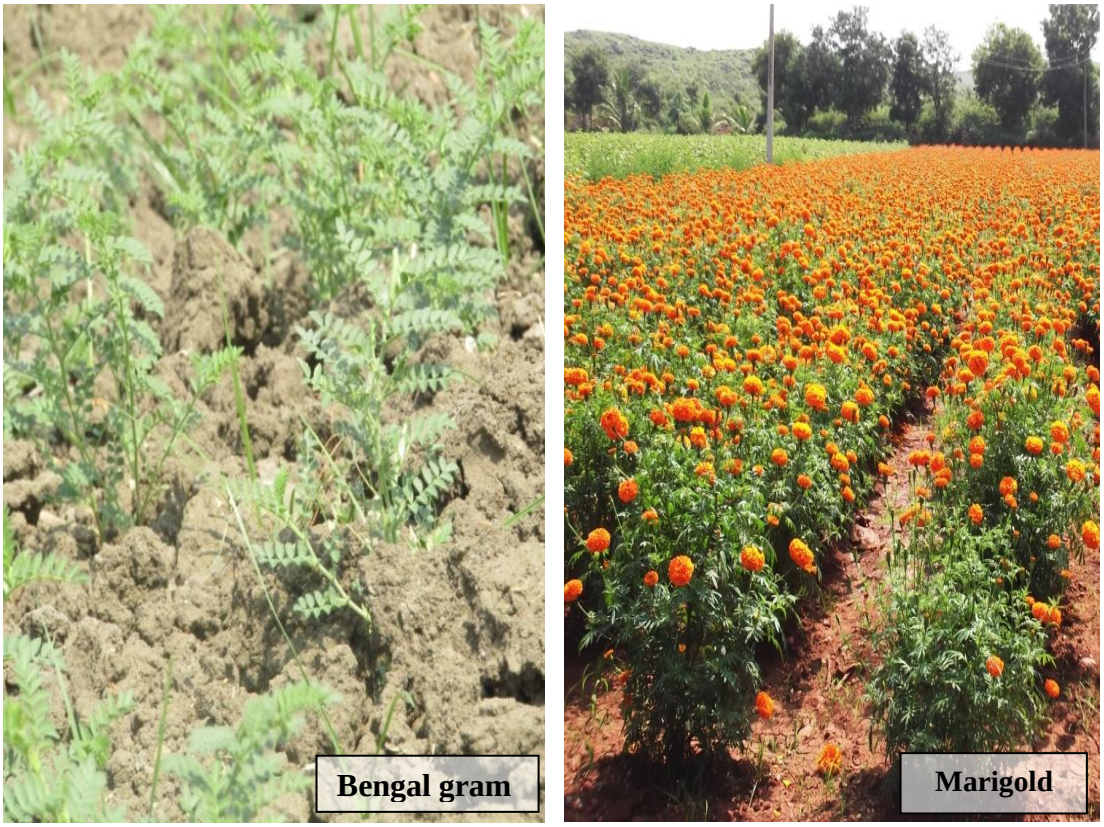


Fig. 2.5(b) Different crops and cropping systems in Ketanapura Microwatershed

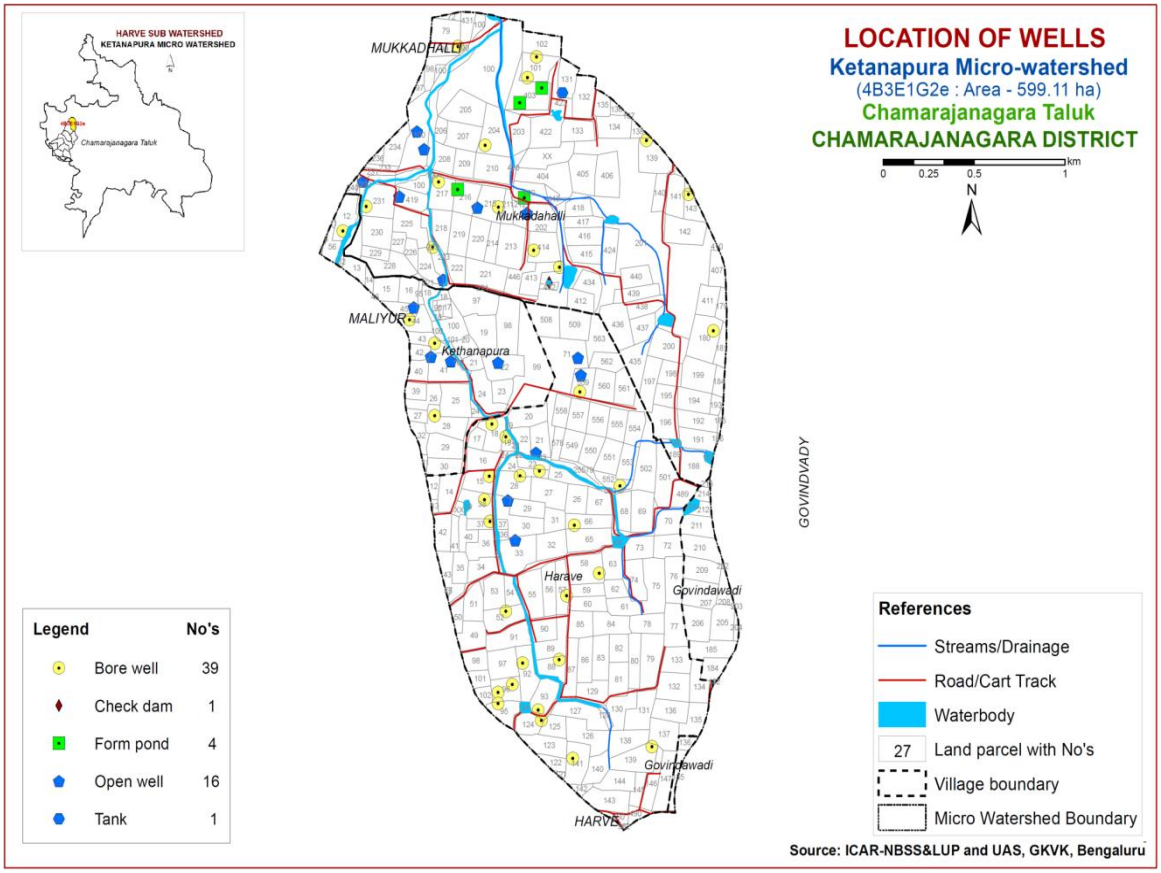


Fig.2.6 Location of Wells and Conservation structures – Ketanapura Microwatershed

Chapter 3

SURVEY METHODOLOGY

The purpose of land resource inventory is to delineate similar areas (soil series and phases), which respond or expected to respond similarly to a given level of management. This was achieved in Ketanapura 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 (slope of the land, 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 area extent and geographic distribution on the microwatershed cadastral map. The detailed survey at 1:7920 scale was carried out in 599 ha area. The methodology followed for carrying out land resource inventory was as per the guidelines given in Soil Survey Manual (IARI, 1971; Soil Survey Staff, 2006; Natarajan *et al.,* 2015) which is briefly described below.

3.1 Base Maps

The detailed survey of the land resources occurring in the microwatershed was carried out by using digitized cadastral map as a base. The cadastral map shows field boundaries with their survey numbers, location of tanks, streams and other permanent features of the area (Fig. 3.1). Apart from the cadastral map, remote sensing data products from Cartosat-1 and LISS-IV merged at the scale of 1:7920 were used in conjunction with the cadastral map to identify the rock types, the landscapes, landforms and other surface features. The imagery helped in the identification and delineation of boundaries between hills, uplands and lowlands, water bodies, forest and vegetated areas, roads, habitations and other cultural features of the area (Fig. 3.2). The cadastral map was overlaid on the satellite imagery (Fig.3.3) that helps to identify the parcel boundaries and other permanent features. Apart from cadastral maps and images, toposheets of the area (1:50,000 scale) were used for initial traversing, identification of geology and landforms, drainage features, present land use and also for selection of transects in the microwatershed.

3.2 Image Interpretation for Physiography

False Colour Composites (FCCs) of Cartosat-I and LISS-IV merged satellite data covering the microwatershed area was visually interpreted using image interpretation elements along with the geology map and all the available collateral data with local knowledge. The delineated physiographic boundaries were transferred on to a cadastral map overlaid on satellite imagery. Physiographically, the area has been identified as granite gneiss landscape and is divided into landforms such as ridges, mounds and uplands based on slope and other relief features. They were further subdivided into physiographic/ image interpretation units based on image characteristics.

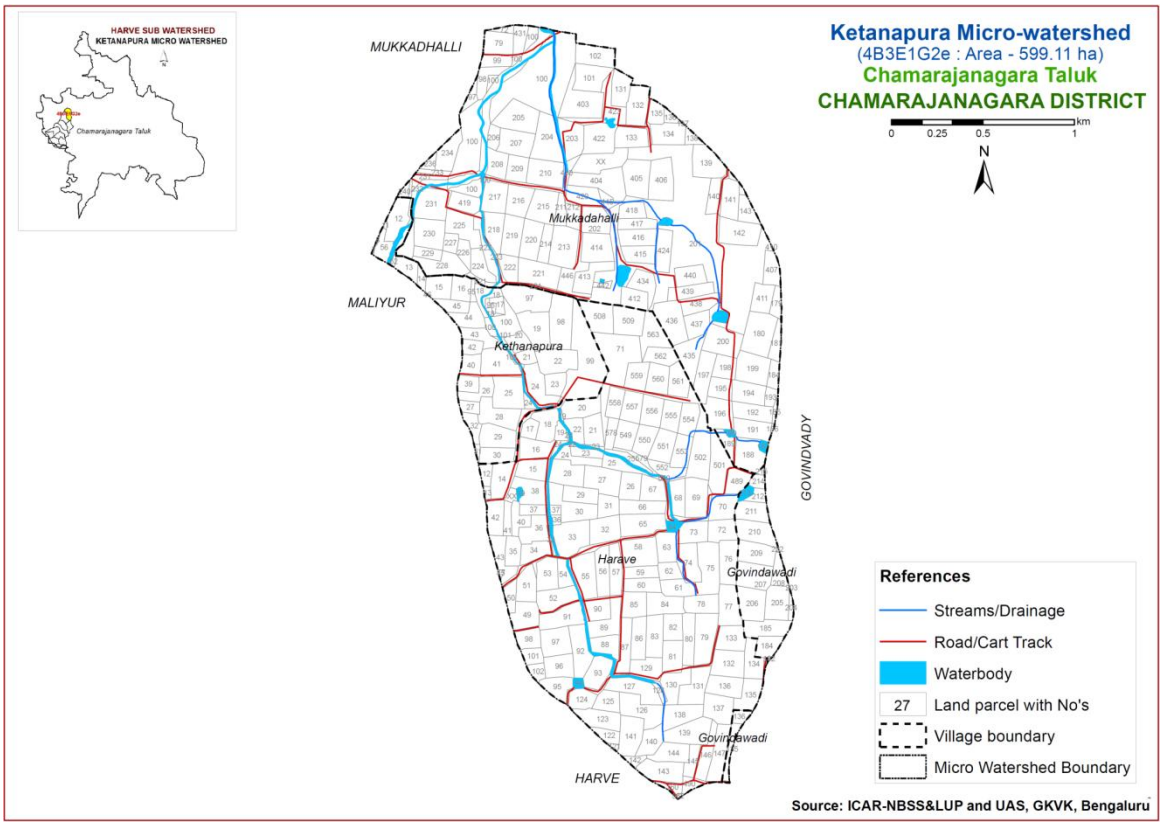


Fig 3.1 Scanned and Digitized Cadastral map of Ketanapura Microwatershed

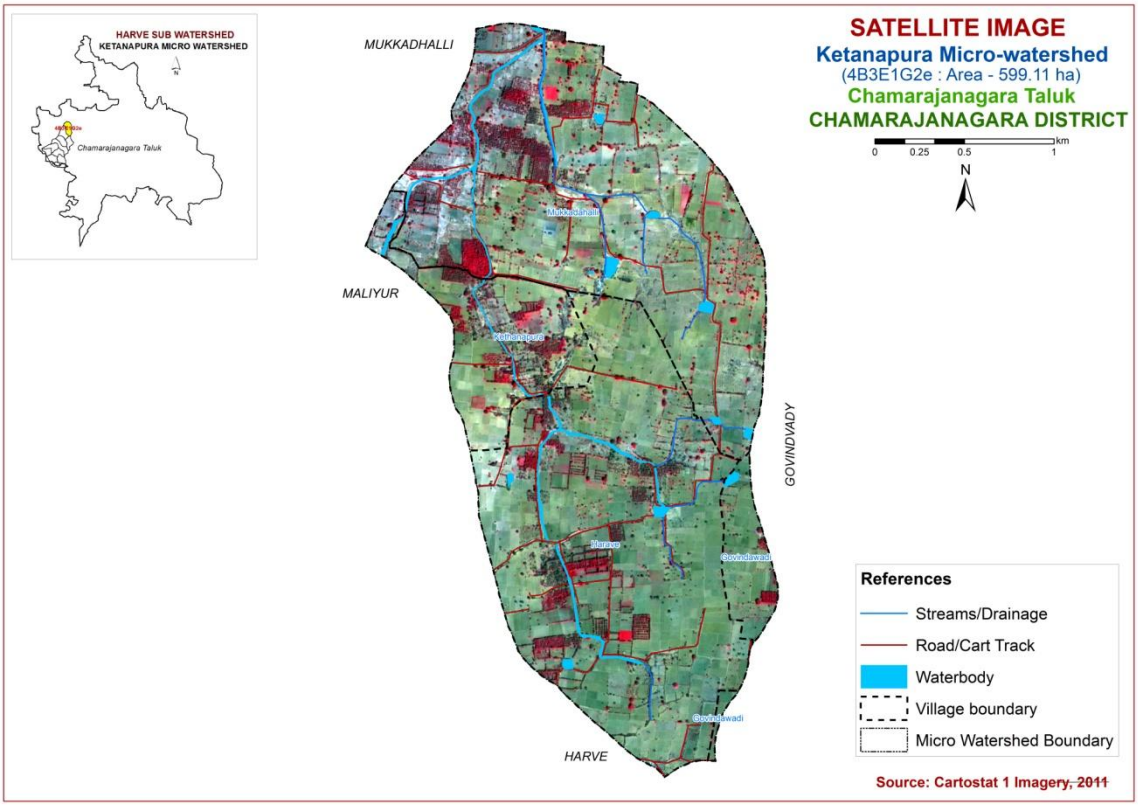


Fig.3.2 Satellite Image of Ketanapura Microwatershed

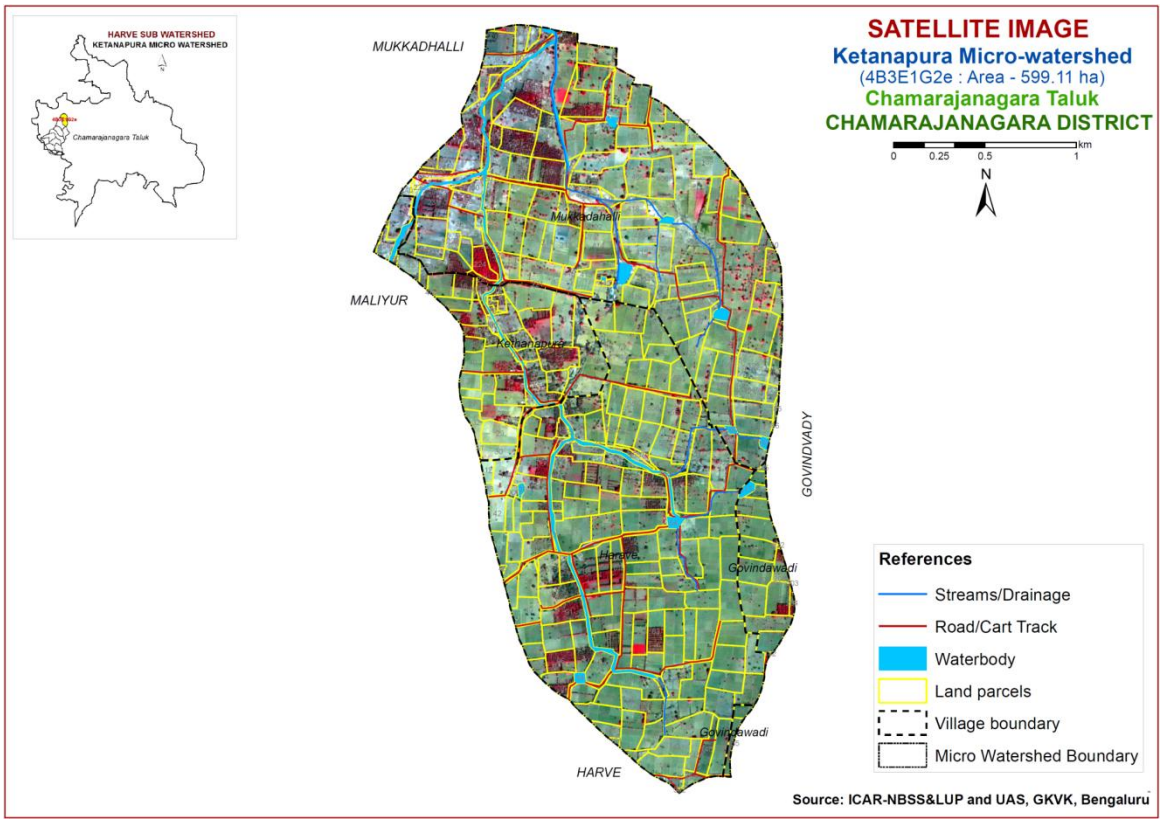


Fig.3.3 Cadastral map overlaid on IRS PAN+LISS IV merged imagery of Ketanapura Microwatershed

3.3 Field Investigation

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 a few selected places. 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. Then, intensive traversing of each physiographic unit like hills, ridges and uplands 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).

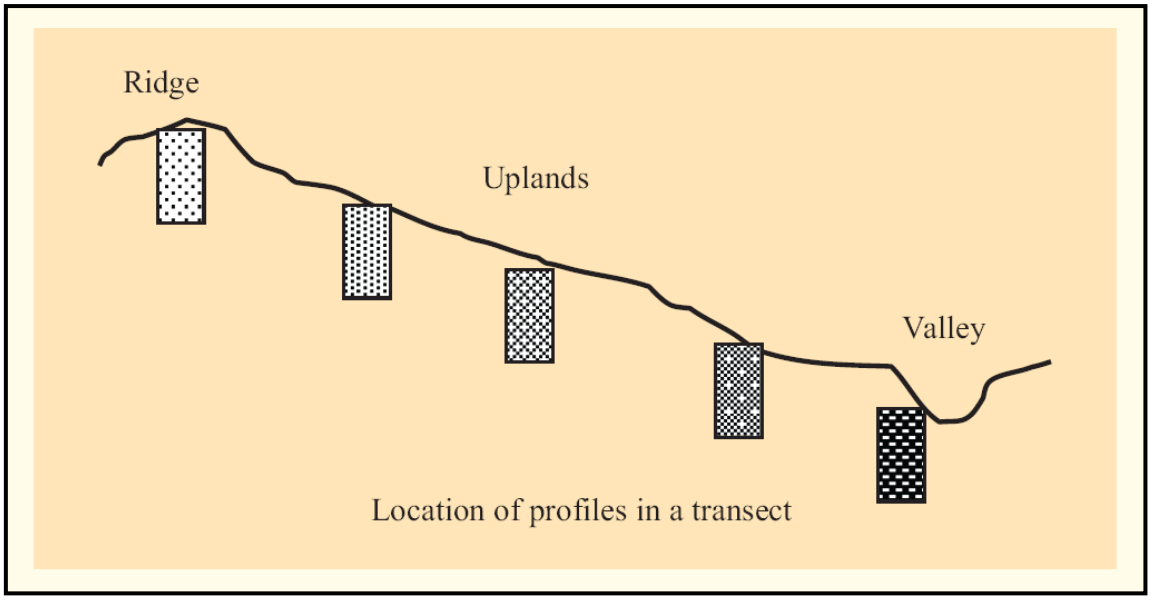


Fig: 3.4. Location of profiles in a transect

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.

Based on the soil-site characteristics, the soils were grouped into different soil series (soil series is the most homogeneous unit having similar horizons and properties and behaves similarly for a given level of management). Soil depth, texture, colour, kind of horizon and horizon sequence, amount and nature of gravel present, 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, 11 soil series were identified in the Ketanapura 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	Harve (HRV)	25-50	2.5YR3/4,3/6 5YR3/3,4/4,3/4	gscl	>35	Ap-Bt-Cr-	-
2	Kaggalipura (KGP)	25-50	2.5YR2.5/4,3/4, 3/6	gsc	15-35	Ap-Bt-Cr	-

3	Honnenahalli (HNH)	50-75	7.5YR3/3,4/3 10YR3/3	sc	<15	Ap-Bw-Cr	-
4	Kutegoudanahundi (KGH)	50-75	7.5YR3/2,3/3,3/4	gscl	15-35	Ap-Bt-Cr	-
5	Kethanapura (KTP)	50-75	2.5YR3/4, 3/6	gsc	15-35	Ap-Bt-Cr	-
6	Lakkur (LKR)	50-75	2.5YR 2.5/3, 2.5/4, 3/4, 3/6	gsc	40-60	Ap-Bt-Bc-Cr	-
7	Gollarahatti (GHT)	75-100	2.5YR3/4,3/6, 4/4,4/6	gscl	15-35	Ap-Bt-Cr	-
8	Hooradhahalli (HDH)	75-100	2.5YR2.5/4,3/4, 3/6	gsc-gc	>35	Ap-Bt-Cr	-
9	Kanchikere (KKR)	75-100	10YR3/3,4/2,5/2 7.5YR3/1,3/2,5/2	sc	<15	Ap-Bw-BC-Cr	-
10	Balapur (BPR)	100-150	2.5YR2.5/4,3/4	gsc-gc	>35	Ap-Bt-Cr	-
11	Kengaki (KGK)	>150	10YR2/12/2,3/1, 3/2,4/1,4/2,4/3	c	<15	Ap-Bw	es

3.4 Soil mapping

The area under each soil series was further separated and mapped as 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 about many 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 of 26 mapping units representing 11 soil series occurring in the microwatershed. The soil map unit (soil legend) description is presented in Table 3.2.

The soil phase map (management units) shows the distribution of 26 soil phases identified and mapped in the microwatershed. Each mapping unit (soil phase) delineated on the map has similar soil and site characteristics. In other words, all the farms or survey numbers included in one phase will have similar management needs and they 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 from farmer's fields for fertility status (major and micronutrients) at 250 m grid interval were analyzed in the laboratory. (Katyal

and Rattan, 2003) By linking the soil fertility data to the survey numbers through GIS, soil fertility maps were generated using Kriging method for the microwatershed.

3.6 Land Management Units

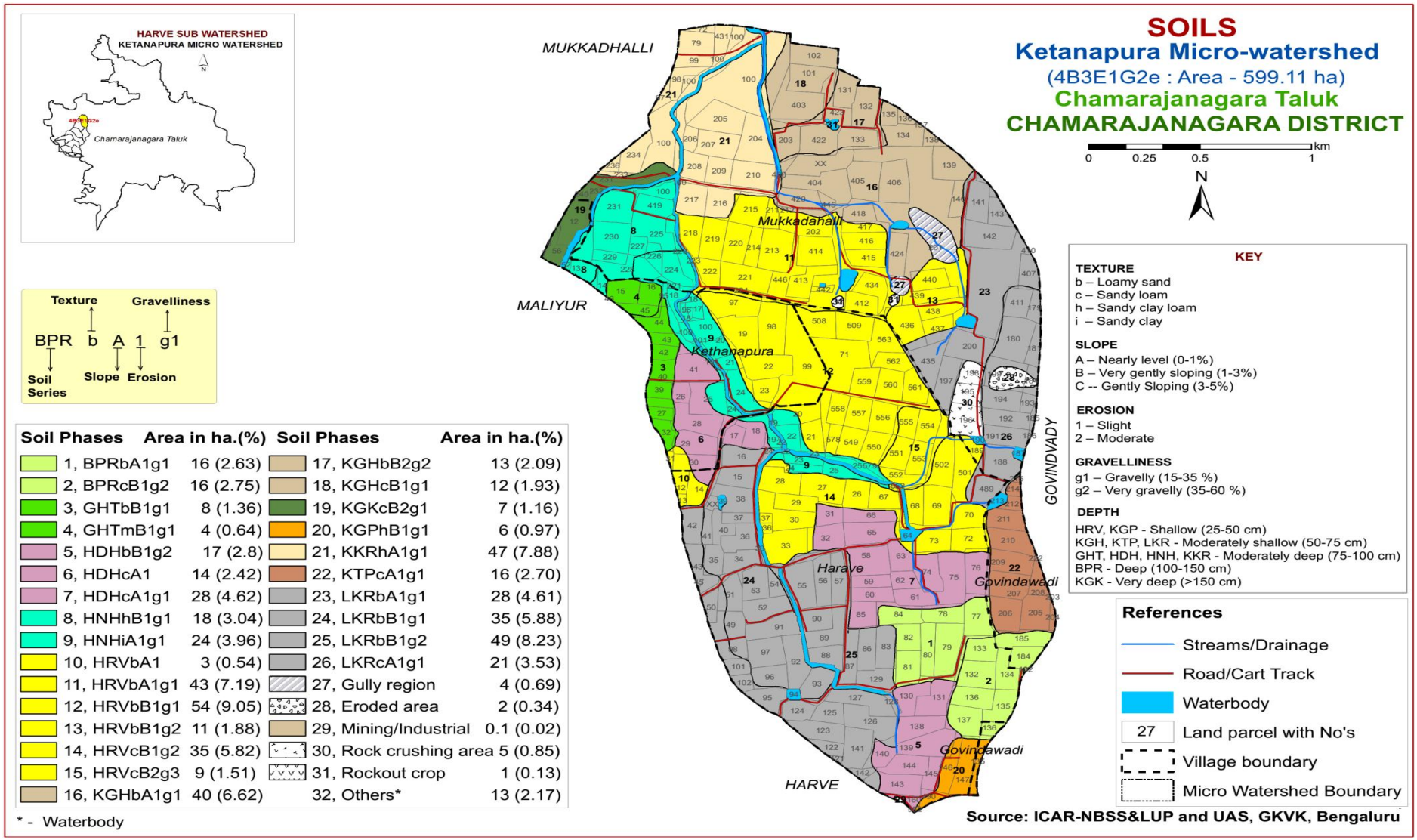
The 26 soil phases identified and mapped in the microwatershed were regrouped into 8 Land Management Units (LMU's) for the purpose of preparing a proposed crop plan for sustained development of the microwatershed. The database (soil phases) generated under LRI was utilized for identifying Land Management 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 Ketanapura 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 Ketanapura Microwatershed

Sl. No.	Soil series	Soil phase	Mapping Unit Description	Area in ha (%)
SOILS OF GRANITE GNEISS LANDSCAPE				
	HRV	Harve soils are shallow (25-50 cm), well drained, have dark red to dark reddish brown, red gravelly loamy soils occurring on nearly level to gently sloping uplands under cultivation		**155.72 (25.99)**
1		HRVbA1	Loamy sand at the surface, slope 0-1%, slight erosion and non-gravelly (<15%).	3.25 (0.54)
2		HRVbA1g1	Loamy sand at the surface, slope 0-1%, slight erosion and gravelly (15-35%).	43.06 (7.19)
3		HRVbB1g1	Loamy sand at the surface, slope 1-3%, slight erosion and gravelly (15-35%).	54.24 (9.05)
4		HRVbB1g2	Loamy sand at the surface, slope 1-3%, slight erosion and very gravelly (35-60%).	11.26 (1.88)
5		HRVcB1g2	Sandy loam at the surface, slope 1-3%, slight erosion and very gravelly (35-60%).	34.85 (5.82)
6		HRVcB2g3	Sandy loam at the surface, slope 1-3%, moderate erosion and extremely gravelly (>60%).	9.06 (1.51)
	KGP	Kaggalipura soils are shallow (25-50 cm), well drained, have dark reddish brown to dark red, gravelly sandy clay soils occurring on nearly level to moderately sloping uplands under cultivation		**5.80 (0.97)**
7		KGPhB1g1	Sandy clay loam at the surface, slope 1-3%, slight erosion and gravelly (15-35%).	5.80 (0.97)
	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		**41.94 (7.00)**
8		HNHhB1g1	Sandy clay loam at the surface, slope 1-3%, slight erosion and slightly gravelly (15-35%).	18.19 (3.04)
9		HNHiA1g1	Sandy clay at the surface, slope 0-1%, slight erosion and gravelly (15-35%).	23.75 (3.96)

Sl. No.	Soil series	Soil phase	Mapping Unit Description	Area in ha (%)
	KGH	Kutegoudanahundi soils are moderately shallow (50-75 cm), well drained, have brown to dark brown, gravelly sandy clay loam soils occurring on very gently to gently sloping uplands under cultivation		**63.77 (10.64)**
10		KGHbA1g1	Loamy sand at the surface, slope 0-1%, slight erosion and gravelly (15-35%).	39.66 (6.62)
11		KGHbB2g2	Loamy sand at the surface, slope 1-3%, moderate erosion and very gravelly (35-60%).	12.55 (2.09)
12		KGHcB1g1	Sandy loam at the surface, slope 1-3%, slight erosion and gravelly (15-35%).	11.56 (1.93)
	KTP	Kethanapura soils are moderately shallow (50-75 cm), well drained, have dark reddish brown, red gravelly sandy clay soils occurring on very gently sloping uplands under cultivation		**16.17 (2.70)**
13		KTPcA1g1	Sandy loam at the surface, slope 0-1%, slight erosion and gravelly (15-35%).	16.17 (2.70)
	LKR	Lakkur soils are moderately shallow (50-75 cm), well drained, have dark reddish brown to dark red, red gravelly sandy clay soils occurring on very gently to moderately sloping uplands under cultivation		**133.26 (22.25)**
14		LKRbA1g1	Loamy sand at the surface, slope 0-1%, slight erosion and gravelly (15-35%).	27.61 (4.61)
15		LKRbB1g1	Loamy sand at the surface, slope 1-3%, slight erosion and gravelly (15-35%).	35.21 (5.88)
16		LKRbB1g2	Loamy sand at the surface, slope 1-3%, slight erosion and very gravelly (35-60%).	49.29 (8.23)
17		LKRcA1g1	Sandy loam at the surface, slope 0-1%, slight erosion and gravelly (15-35%).	21.15 (3.53)
	GHT	Gollarahatti soils are moderately deep (75-100 cm), well drained, have dark reddish brown to dark red gravelly sandy clay loam soils occurring on nearly level very gently sloping uplands under cultivation		**11.99 (2.00)**
18		GHTbB1g1	Loamy sand at the surface, slope 1-3%, slight erosion and gravelly (15-35%).	8.15 (1.36)
19		GHTmB1g1	Clay at the surface, slope 1-3%, slight erosion and gravelly (15-35%).	3.84 (0.64)
	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		**58.96 (9.84)**
20		HDHbB1g2	Loamy sand at the surface, slope 1-3%, slight erosion and very gravelly (35-60%).	16.78 (2.80)
21		HDHcA1	Sandy loam at the surface, slope 0-1%, slight erosion and non-gravelly (<15%).	14.49 (2.42)
22		HDHcA1g1	Sandy loam at the surface, slope 0-1%, slight erosion and gravelly (15-35%).	27.69 (4.62)
	KKR	Kanchikere soils are moderately deep (75-100 cm), well drained, have dark brown to very dark brown, sandy clay soils and occur on very gently to gently sloping uplands.		**47.24 (7.88)**

Sl. No.	Soil series	Soil phase	Mapping Unit Description	Area in ha (%)
23		KKRhA1g1	Sandy clay loam at the surface, slope 0-1%, slight erosion and gravelly (15-35%).	47.24 (7.88)
	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		**32.23 (5.38)**
24		BPRbA1g1	Loamy sand at the surface, slope 0-1%, slight erosion and gravelly (15-35%).	15.74 (2.63)
25		BPRcB1g2	Sandy loam at the surface, slope 1-3%, slight erosion and very gravelly (35-60%).	16.49 (2.75)
	KGK	Kengaki soils are very deep (>150cm), somewhat poorly drained, moderate to strongly alkaline, calcareous clay soils developed from alluvium, occurring on very gently sloping low lands		**6.95 (1.16)**
26		KGKcB2g1	Sandy loam at the surface, slope 1-3%, moderate erosion and gravelly (15-35%).	6.95 (1.16)
27		Gully region	Area under Gully region	**4.11 (0.69)**
28		Eroded Area	Eroded area	**2.03 (0.34)**
29		Mining/ Industrial	Area under Mining/Industrial	**0.10 (0.02)**
30		Rock crushing area	Area under Rock-crushing	**5.11 (0.85)**
31		Rock-out crop	Area under Rock-out crops	**0.77 (0.13)**
32		Water body	Area under Water body	**12.98 (2.17)**
TOTAL				**599.11 (100.00)**



Soil Phases	Area in ha.(%)	Soil Phases	Area in ha.(%)
1, BPRbA1g1	16 (2.63)	17, KGHbB2g2	13 (2.09)
2, BPRcB1g2	16 (2.75)	18, KGHcB1g1	12 (1.93)
3, GHTbB1g1	8 (1.36)	19, KGKcB2g1	7 (1.16)
4, GHTmB1g1	4 (0.64)	20, KGPhB1g1	6 (0.97)
5, HDHbB1g2	17 (2.8)	21, KKRhA1g1	47 (7.88)
6, HDHcA1	14 (2.42)	22, KTPcA1g1	16 (2.70)
7, HDHcA1g1	28 (4.62)	23, LKRbA1g1	28 (4.61)
8, HNHhB1g1	18 (3.04)	24, LKRbB1g1	35 (5.88)
9, HNHiA1g1	24 (3.96)	25, LKRbB1g2	49 (8.23)
10, HRVbA1	3 (0.54)	26, LKRcA1g1	21 (3.53)
11, HRVbA1g1	43 (7.19)	27, Gully region	4 (0.69)
12, HRVbB1g1	54 (9.05)	28, Eroded area	2 (0.34)
13, HRVbB1g2	11 (1.88)	29, Mining/Industrial	0.1 (0.02)
14, HRVcB1g2	35 (5.82)	30, Rock crushing area	5 (0.85)
15, HRVcB2g3	9 (1.51)	31, Rockout crop	1 (0.13)
16, KGHbA1g1	40 (6.62)	32, Others*	13 (2.17)

* - Waterbody

Fig 3.5 Soil phase or management units map of Ketanapura Microwatershed

Chapter 4

THE SOILS

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

A brief description of each of the 11 soil series identified followed by 26 soil phases (management units) mapped under each series are furnished below. The physical and chemical characteristics of soil series identified in Ketanapura 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, 11 soil series are identified and mapped. Of these, Harve (HRV) series occupies major area of 156 ha (26%) followed by Lakkur (LKR) 133 ha (22%), Kutegoudanahundi (KGH) 64 ha (11%), Hooradhahalli (HDH) 59 ha (10%), Kanchikere (KKR) 47 ha (8%), Honnenahalli (HNH) 42 ha (7%), Balapur (BPR) 32 ha (5%), Kethanapura (KTP) 16 ha (3%), Gollarahatti (GHT) 12 ha (2%), Kengaki (KGK) 7 ha (1%) and Kaggalipura (KGP) 6 ha (1%). The brief description of each soil series along with the soil phases identified and mapped is given below.

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

The thickness of the solum ranges from 28 to 50 cm. The thickness of A-horizon ranges from 12 to 17 cm. Its colour is in 5YR and 2.5 YR hue with value 3 to 4 and chroma 4 to 6. The texture varies from loamy sand to sandy loam with 20 to 60 per cent gravel. The thickness of B-horizon ranges from 16 to 32 cm. Its colour is in 2.5 YR and 5 YR hue with value 3 to 4 and chroma 4 to 6. Its texture is sandy clay loam with gravel

content of more than 35 per cent. The available water capacity is very low (<50mm/m). Six soil phases were identified and mapped.

Landscape and soil profile characteristics of Harve (HRV) Series

4.1.2 Kaggalipura (KGP) Series: Kaggalipura soils are shallow (25-50 cm), well drained, have brown to dark reddish brown, gravelly sandy clay soils. They have developed from weathered granite gneiss and occur on very gently sloping uplands. The Kaggalipura series has been classified as a member of the clayey, mixed, isohyperthermic family of (Paralithic) Rhodustalfs.

The thickness of the solum ranges from 30 to 50 cm. The thickness of A-horizon ranges from 10 to 17 cm. Its colour is in 7.5 YR, 5YR and 2.5 YR hue with value 2.5 to 4 and chroma 2 to 6. The texture varies from sandy clay loam to sandy clay with 10 to 25 per cent gravel. The thickness of B horizon ranges from 24 to 50 cm. Its colour is in 2.5 YR hue with value 2.5 and chroma 4. Its texture is sandy clay loam to sandy clay soils with gravel content of 15 to 35 per cent. The available water capacity is low (50-100 mm/m). Only one soil phase was identified and mapped.

Landscape and soil profile characteristics of Kaggalipura (KGP) Series

4.1.3 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). Two soil phases were identified and mapped.

Landscape and soil profile characteristics of Honnenahalli (HNH) Series

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

The thickness of the solum ranges from 50 to 74 cm. The thickness of A-horizon ranges from 12 to 22 cm. Its colour is in 7.5 YR and 10 YR hue with value and chroma 3 to 4. The texture varies from loamy sand to sandy loam with 15 to 30 per cent gravel. The thickness of B horizon ranges from 40 to 62 cm. Its colour is in 7.5 YR hue with value and chroma 3 to 4. Its texture is sandy clay loam with gravel content of 15 to 35 per cent. The available water capacity is medium (100-150 mm/m). Three soil phases were identified and mapped.

Landscape and soil profile characteristics of Kutegoudanahundi (KGH) Series

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

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

Landscape and soil profile characteristics of Kethanapura (KTP) Series

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

The thickness of the solum ranges from 51 to 74 cm. The thickness of A-horizon ranges from 12 to 18 cm. Its colour is in 5YR and 2.5 YR hue with value 3 to 4 and chroma 4 to 6. The texture varies from loamy sand to sandy clay loam with 15 to 50 per cent gravel. The thickness of B horizon ranges from 39 to 58 cm. Its colour is in 2.5 YR hue with value 3 to 4 and chroma 4 to 6. Texture is sandy clay with 40 to 60 per cent gravel. The available water capacity is low (50-100 mm/m). Four soil phases were identified and mapped.

Landscape and soil profile characteristics of Lakkur (LKR) Series

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

The thickness of the solum ranges from 78 to 98 cm. The thickness of A-horizon ranges from 12 to 18cm. Its colour is in 5 YR and 2.5 YR hue with value 3 to 4 and chroma 4 to 6. Texture varies from loamy sand to sandy clay with 15 to 35 per cent gravel. The thickness of B horizon ranges from 66 to 81cm. Its colour is in 2.5 YR hue with value 3 to 4 and chroma 4 to 6. Texture is sandy clay loam with 15 to 35 per cent gravel. The available water capacity is medium (51-100 mm/m). Two soil phases were identified and mapped.

Landscape and soil profile characteristics of Gollarahatti (GHT) Series

4.1.8 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). Three soil phases were identified and mapped.

Landscape and soil profile characteristics of Hooradhahalli (HDH) Series

4.1.9 Kanchikere (KKR) Series: Kanchikere soils are moderately deep (75-100 cm), well drained, have dark brown to very dark brown, sandy clay soils. These soils are developed from weathered granite gneiss and occur on very gently to gently sloping uplands. The Kanchikere series has been classified as a member of the fine, mixed, isohyperthermic family of Typic Haplustepts.

The thickness of the solum ranges from 76 to 100 cm. The thickness of A-horizon ranges from 11 to 20 cm. Its colour is in 7.5YR and 10 YR hue with value 3 to 5 and chroma 3 to 4. Texture varies from loamy sand to sandy clay. The thickness of B horizon ranges from 63 to 82 cm. Its colour is in 7.5 YR and 10 YR hue with value 3 to 5 and chroma 1 to 3. Texture is clay loam to 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 Kanchikere (KKR) Series

4.1.10 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). Two soil phases were identified and mapped.

Landscape and soil profile characteristics of Balapur (BPR) Series

4.1.11 Kengaki (KGK) Series: Kengaki soils are very deep (>150 cm), somewhat poorly drained, have brown to black clay, strongly alkaline alluvial soils. They have developed from alluvium and occur on very gently sloping low lands. The Kengaki series has been classified as a member of the fine, mixed (calcareous), isohyperthermic family of Typic Haplustepts.

The thickness of the solum is > 150 cm. The thickness of A-horizon ranges from 15 to 20cm. Its colour is in 10YR hue with value 2 to 4 and chroma 2 to 3. The texture ranges from sandy clay loam to clay. The thickness of B horizon ranges from 138 to >150 cm. Its colour is in 10YR hue with value 2 to 4 and chroma 1 to 4. Texture is dominantly 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 Kengaki (KGK) Series

Table: 4.1 Physical and Chemical Characteristics of Soil Series identified in Ketanapura microwatershed

Series Name: Harve (HRV) **Pedon:** R-10

Location: $15^0$25'11.63"N, $76^0$22'03.65"E Jabbaragudda village, Koppal Taluk and District

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

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-15	Ap	65.64	9.07	25.28	29.04	12.99	9.00	3.48	11.15	50	scl	12.87	4.81
15-29	Bt1	56.13	7.75	36.12	27.81	11.43	7.21	1.44	8.24	60	sc	15.69	6.24
29-47	Bt2	63.42	6.53	30.05	32.38	13.93	7.48	5.74	3.89	60	scl	15.41	9.29

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-15	6.05	-	-	0.21	0.93	-	8.89	1.96	0.50	0.08	11.43	11.24	0.44	100.00	0.73
15-29	5.99	-	-	0.15	0.29	-	9.72	2.75	0.51	0.09	13.07	12.71	0.35	100.00	0.74
29-47	6.07	-	-	0.11	0.38	-	9.35	2.47	0.49	0.06	12.36	12.71	0.42	97.29	0.44

Contd....

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....

Series Name: Kutegoudanahundi (KGH) **Pedon:** R1

Location: $15^0$24'57"N, $76^0$19'29" E Lambani tanda village, Koppal Taluk and District

Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Fine-loamy, 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
0-12	Ap	79.84	7.93	12.23	30.70	15.50	14.08	12.26	7.29	20	sl	10.46	4.79
12-35	Bt1	64.49	9.69	25.82	33.88	10.92	8.06	7.45	4.18	25	scl	16.40	9.12
35-58	Bt2	62.27	9.51	28.22	35.38	8.90	7.06	3.27	7.67	30	scl	19.13	11.05
58-72	Bc	62.77	7.40	29.83	32.76	11.50	7.63	6.82	4.07	40	scl	19.86	10.16

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	6.66	-	-	0.089	0.83	-	6.39	1.56	0.21	0.08	8.23	8.22	1.03	100	0.93
12-35	7.39	-	-	0.061	0.73	-	-	-	0.25	0.07	-	14.95	1.54	100	0.49
35-58	7.56	-	-	0.064	0.69	-	-	-	0.27	0.08	-	16.34	1.71	100	0.52
58-72	7.92	-	-	0.146	0.47	-	-	-	0.36	0.12	-	17.72	2.39	100	0.69

Contd....

Series Name: Kethanapura (KTP) **Pedon:** R-9

Location: $15^0$25'28.81"N, $76^0$22'00.76" E Jabbaragudda village, Koppal Taluk and District

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

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-18	Ap	83.64	10.52	5.84	25.61	22.36	15.24	13.52	6.91	10	ls	7.92	2.58
18-38	Bt1	46.06	5.63	48.31	21.58	9.54	3.53	4.15	7.26	30	sc	19.62	14.48
38-73	Bt2	52.31	6.91	40.78	24.56	12.74	5.96	5.55	3.49	30	sc	17.73	11.95

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

Contd....

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

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

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

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

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

Contd....

Soil Series: Gollarahatti (GHT), **Pedon:** RM-2

Location: $50^0$04'88.8"N, $75^0$37'65.2"E, (4D4A3I1f), Belhatti village, Shirahatti taluk, Gadag district.

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

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-26	Ap	83.22	5.74	11.05	9.71	11.73	16.68	27.10	16.58	30	ls	-	-
26-63	Bt1	55.91	13.36	30.73	13.05	9.66	11.10	14.29	7.81	20	scl	-	-
63-84	Bt2	57.17	11.38	31.45	10.53	10.11	12.28	13.83	10.42	20	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}							%	%
0-26	5.70	-	-	0.06	0.20	0.00	1.50	0.60	0.09	0.13	2.32	3.17	0.29	73.00	4.10
26-63	6.26	-	-	0.04	0.24	0.00	7.35	1.55	0.09	0.17	9.15	9.89	0.32	93.00	1.72
63-84	6.50	-	-	0.05	0.20	0.47	-	-	0.09	0.21	0.30	10.18	0.32	100.00	2.06

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

Contd....

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

Chapter 5

INTERPRETATION FOR LAND RESOURCE MANAGEMENT

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

5.1 Land Capability Classification

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

The 26 soil map units identified in the Ketanapura microwatershed are grouped under 5 land capability classes and 7 land capability subclasses. Entire cultivated area of about 575 ha (96%) are suitable for agriculture. An area of about <l ha (<1%) is under mining/industrial and 13 ha (2%) is under others (Habitation and Settlements) (Fig. 5.1).

About 125 ha (21%) area in the microwatershed has good cultivable lands (Class II) and distributed in the northern, southern and western part of the microwatershed with minor problems of soil and erosion. Maximum area of about 443 ha (74%) has moderately good lands (Class III) and distributed in the major part of the microwatershed with moderate problems of soil and erosion. An area of about 7 ha (1%) is fairly good lands (IV) and distributed in the northern part of the microwatershed with severe limitations of soil and drainage. An area of about 6 ha (1%) are marginal lands with major limitations suitable for pasture/forestry and distributed in the eastern and northern part of the microwatershed with severe limitations of erosion and soil. An area of about 6 ha (1%) are rock-lands and distributed in the eastern part of the microwatershed.

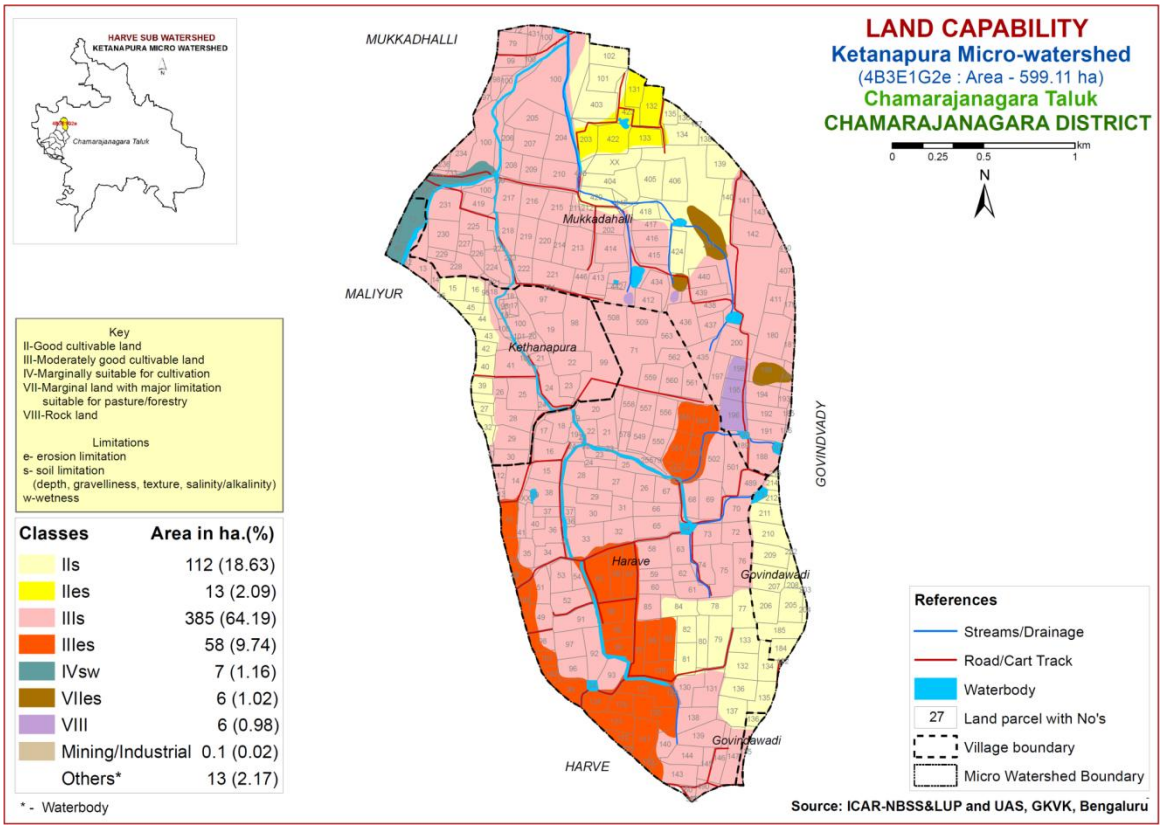


Fig. 5.1 Land Capability map of Ketanapura Microwatershed

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 prepared. The area extent and their geographical distribution in the microwatershed is shown in Figure 5.2.

Very deep soils (>150 cm) cover an area of about 7 ha (1%) and distributed in the northern part of the microwatershed. An area of about 32 ha (5%) is under deep soils (100-150 cm) and distributed in the southern part of the microwatershed. An area of about 160 ha (27%) is under moderately deep (75-100 cm) soils and distributed in the central, western, northern and southern part of the microwatershed. Maximum area of about 213 ha (36%) is moderately shallow (50-75 cm) and distributed in the eastern, northern, western and southern part of the microwatershed. An area of about 162 ha (27%) is under shallow (25-50 cm) soils and distributed in the northern, central, western, southern and northern part of the microwatershed.

About 39 ha (7%) area has most productive lands with respect to soil rooting depth where all climatically adapted annual and perennial crops can be grown are deep soils (100->150 cm) in the microwatershed.

The most problem lands with an area of about 162 ha (27%) having shallow (25-50 cm) soils. They are suitable for growing short duration agricultural crops but well suited for pasture, forestry or other recreational purposes. Occasionally, short duration crops may be grown if rainfall is normal.

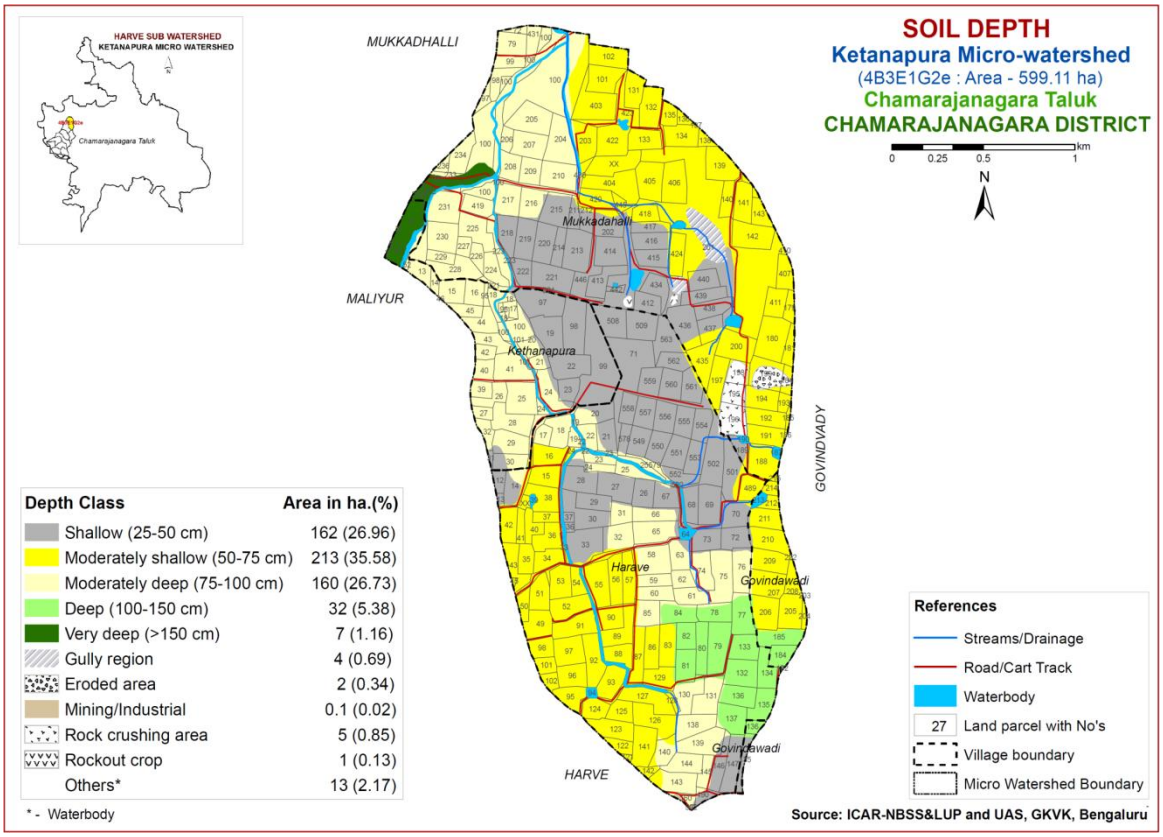


Fig. 5.2 Soil Depth map of Ketanapura Microwatershed

5.3 Surface Soil Texture

Soil 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 for LRI were used to classify and a surface soil texture map was generated. The area extent and their geographical distribution in the microwatershed is shown in Figure 5.3.

An area of about 229 ha (38%) is under loamy soils at the surface. They are distributed in the central, northern, eastern, southern and western part of the microwatershed. Maximum area of about 317 ha (53%) is sandy soils at the surface. They

are distributed in the major part of the microwatershed. An area of about 28 ha (5%) are clayey at the surface soils and distributed in the central and northern part of the microwatershed.

Entire area has most productive lands with respect to surface soil texture except 317 ha (52%) area where they are sandy soils. The clayey soils cover an area of about 28 ha (5%) 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 cover an area of about 229 ha (38%) which also have high potential for soil-water retention and nutrient availability but have no drainage or other physical problems.

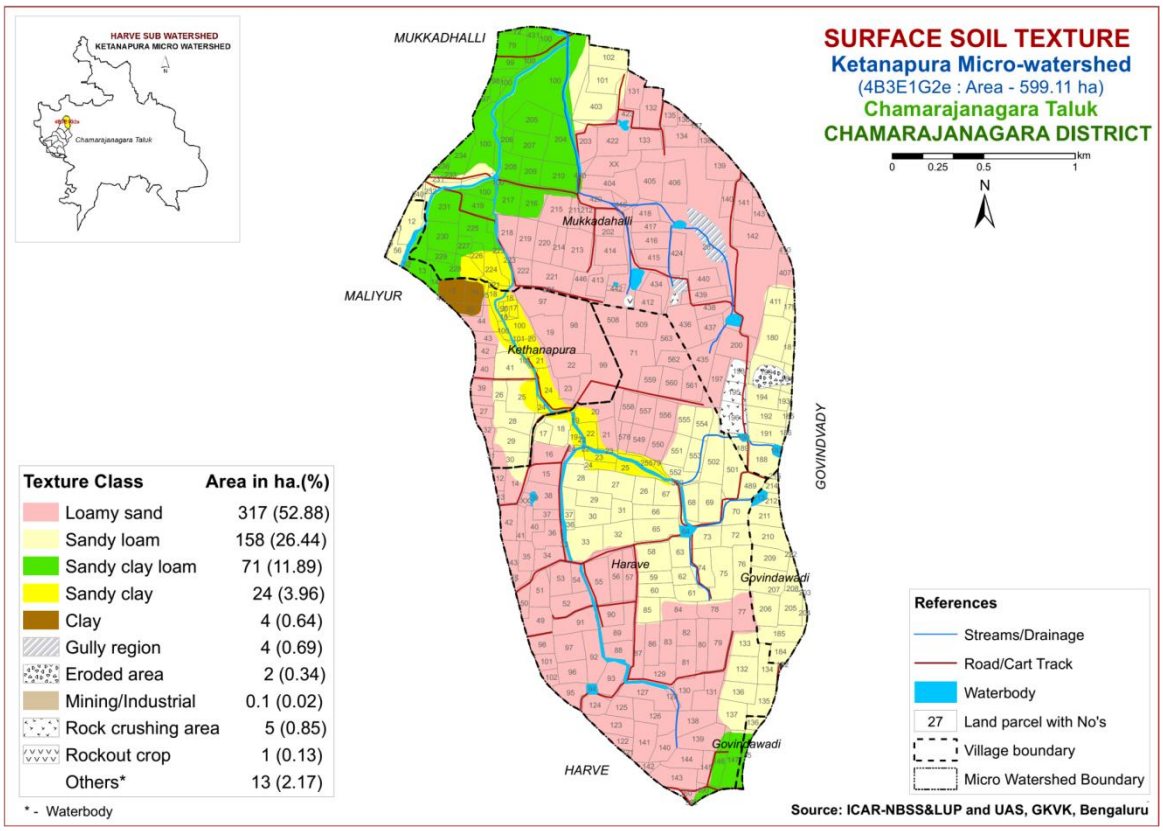


Fig. 5.3 Surface Soil Texture map of Ketanapura microwatershed

5.4 Soil Gravelliness

Gravel is the term used for describing coarse fragments between 2 mm and 7.5 cm diameter and stones for those between 7.5 cm and 25 cm. The presence of gravel and stones in soil reduces the volume of soil responsible for moisture and nutrient storage, drainage, infiltration and runoff and hinders plant growth by impeding root growth and seedling emergence, intercultural operations and farm mechanization. The gravelliness classes used in LRI were used to classify the soils and using these classes a gravelliness map was generated. The area extent and their geographic distribution in the microwatershed is shown in Figure 5.4.

An area of about 18 ha (3%) has non-gravelly (<15%) soils and distributed in the western part of the microwatershed. Maximum area of about 406 ha (68%) in the microwatershed are gravelly (15-35%) and distributed in the major part of the microwatershed. An area of about 141 ha (24%) are very gravelly (35-60%) soils and distributed in the northern and southern part of the microwatershed. Extremely gravelly (60-80%) soils cover an area of about 9 ha (2%) and distributed in the central part of the microwatershed.

An area of about 18 ha (3%) 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 556 ha (93%) that are gravelly to extremely gravelly where only medium or short duration crops can be grown.

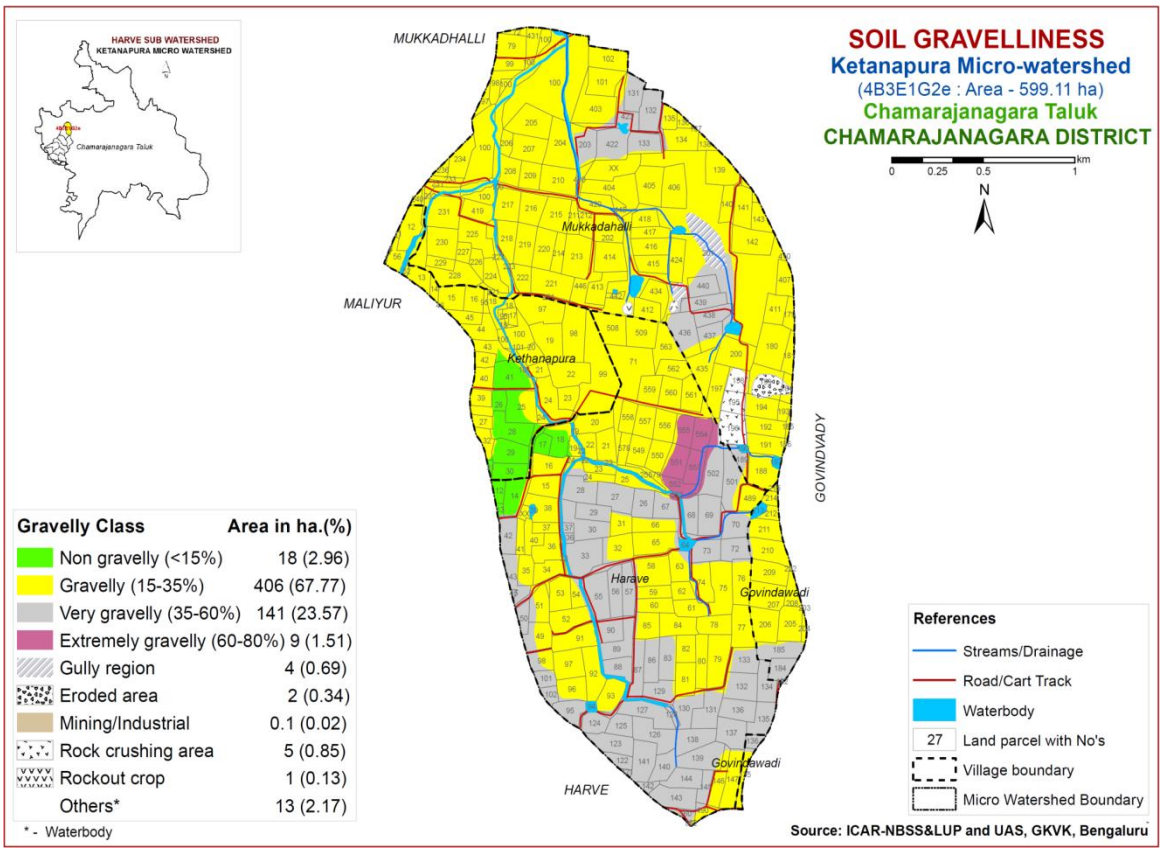


Fig. 5.4 Soil Gravelliness map of Ketanapura Microwatershed

5.5 Soil Slope

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

Major area of about 294 (49%) falls under very gently sloping (1-3% slope) class and is distributed in the central, northern, southern and western part of the microwatershed. An area of about 280 ha (47%) in the microwatershed falls under nearly level (0-1%) lands and distributed in the central, northern, eastern, western and southern 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.

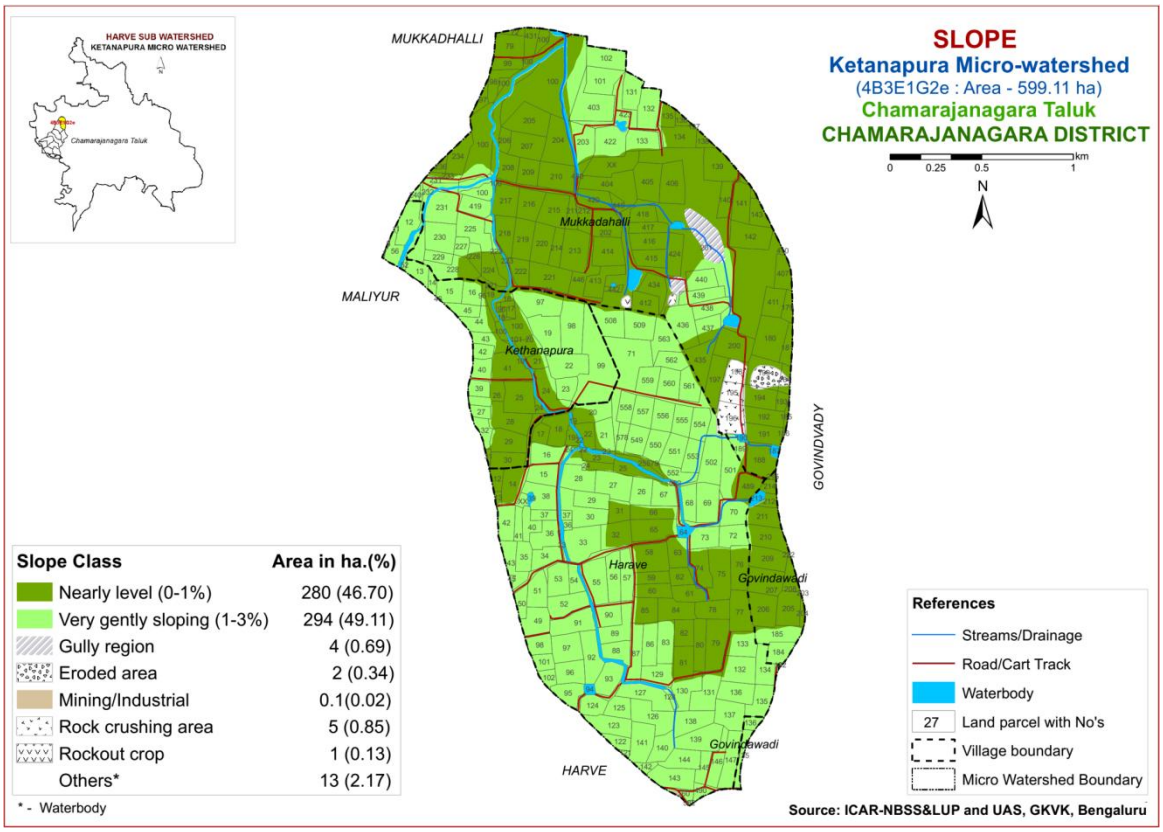


Fig. 5.5 Soil Slope map of Ketanapura Microwatershed

5.6 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 (e4) are recognized. The soil map units were grouped into different erosion classes and soil erosion map prepared. The area extent and their spatial distribution in the microwatershed is given in Figure 5.7.

Soils that are slightly eroded (e1 class) cover major area of about 406 ha (68%) and distributed in the major part of the microwatershed. An area of about 9 ha (2%) are moderately eroded (e2 class) and distributed in the central and northern part of the microwatershed. An area of about 4 ha (1%) are gullied lands and distributed in the northern part of the microwatershed. Eroded lands cover an area of about 2 ha (<1%) and distributed in the eastern part of the microwatershed.

An area of about 15 ha (3%) in the microwatershed is problematic because of moderate, gully and eroded erosion. For these areas, taking up soil and water conservation and other land development measures are needed.

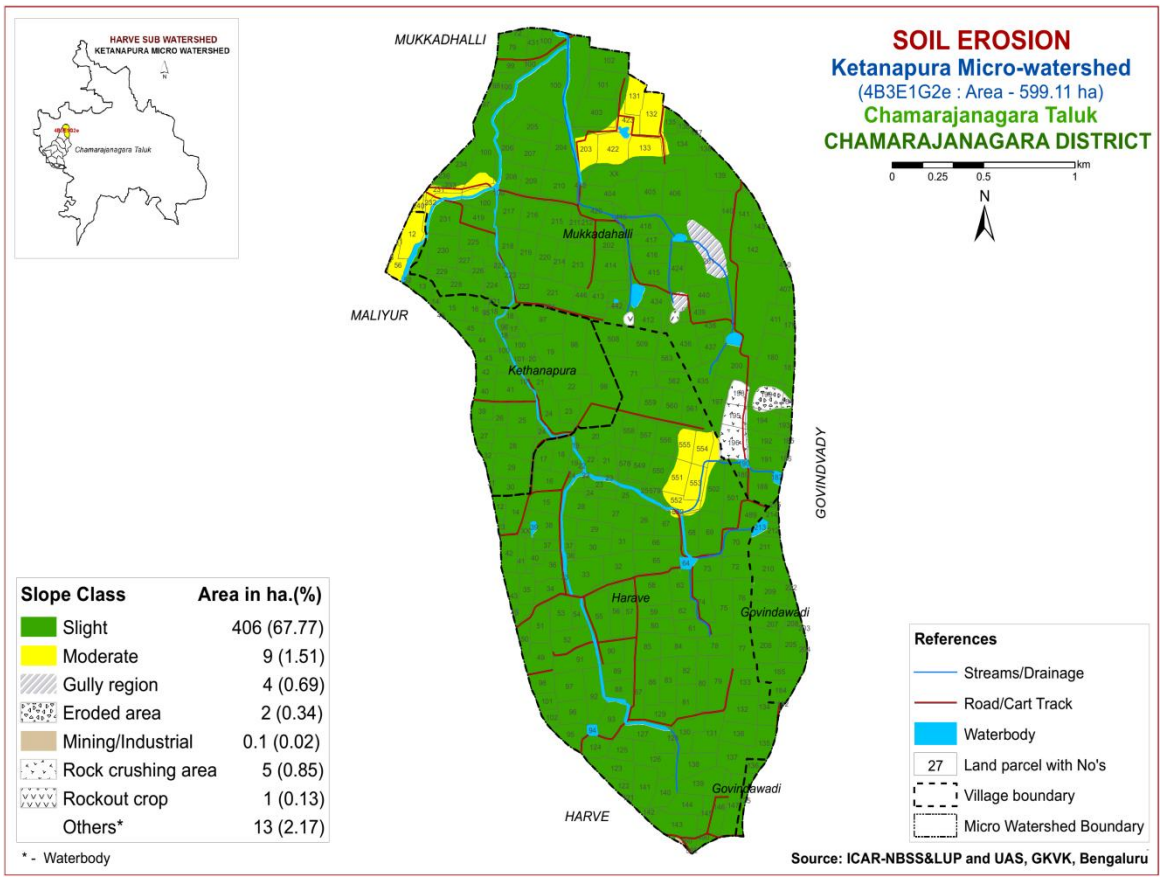


Fig. 5.6 Soil Erosion map of Ketanapura Microwatershed

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 soils are characterised by low rainfall and high temperatures. Hence, it is necessary to know the fertility (macro and micro nutrients) status of the soils of the watersheds for assessing the kind and amount of fertilizers required for each of the crop intended to be grown. For this purpose, the surface soil samples collected from the grid points (one soil sample at every 250 m interval) all over the microwatershed through land resource inventory in the year 2014 were analysed for pH, EC, organic carbon, available phosphorus and potassium and for micronutrients like zinc, copper, iron and manganese, and secondary nutrient sulphur.

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

6.1 Soil Reaction (pH)

The soil fertility analysis of the Ketanapura microwatershed for soil reaction (pH) showed that an area of about 5 ha (1%) are slightly acid (pH 6.0-6.5) and distributed in the northern part of the microwatershed. An area of about 159 ha (27%) are neutral (pH 6.5-7.3) and distributed in the central, northern and southern part of the microwatershed. Maximum area of about 409 ha (68%) is slightly alkaline to strongly alkaline (pH 7.3-9.0) in reaction and distributed in the major part of the microwatershed. Very strongly alkaline (pH >9.0) soils cover an area of about 2 ha (<1%) and distributed in the northern part of the microwatershed (Fig 6.1). Thus, maximum area of about 411 ha (68%) is under alkaline, 159 ha (27%) under neutral and 5 ha (1%) under acidic condition.

6.2 Electrical Conductivity (EC)

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

6.3 Organic Carbon (OC)

The soil organic carbon content (an index of available nitrogen) of the soils in the microwatershed is low (<0.5%) in a major area of about 360 (60%) and distributed in the major part of the microwatershed. Medium (0.5-0.75%) in organic carbon cover an area of about 214 ha (36%) and distributed in the central, eastern, western and southern part of the microwatershed (Fig.6.3).

6.4 Available Phosphorus

The soil fertility analysis revealed that available phosphorus is low (<23 kg/ha) in an area of about 8 ha (1%) and distributed in the southern part of the microwatershed. Medium (23-57 kg/ha) in available phosphorus cover an area of about 57 ha (9%) and distributed in the southern part of the microwatershed. There is an urgent need to increase the dose of phosphorous. High (>57 kg/ha) in available phosphorus cover a maximum area of about 509 ha (85%) and distributed in the major part of the microwatershed (Fig.6.4).

6.5 Available Potassium

Available potassium content is high (>337 kg/ ha) in a major area of about 396 ha (66%) and distributed in the major part of the microwatershed. Medium (145-337 kg/ha) in available potassium cover an area of about 106 ha (18%) and distributed in the northern and southern part of the microwatershed. An area of about 72 ha (12%) is low (<145 kg/ha) in available potassium and distributed in the western, northern and southern part of the microwatershed (Fig 6.5).

6.6 Available Sulphur

Available sulphur content is low (<10 ppm) in an area of about <1 ha (<1%) and distributed in the southern part of the microwatershed. Maximum area of about 417 ha (70%) is medium (10-20 ppm) in available sulphur and distributed in the major part of the microwatershed. An area of about 157 ha (26%) are high (>20 ppm) in available sulphur and distributed in the northern part of the microwatershed (Fig.6.6).

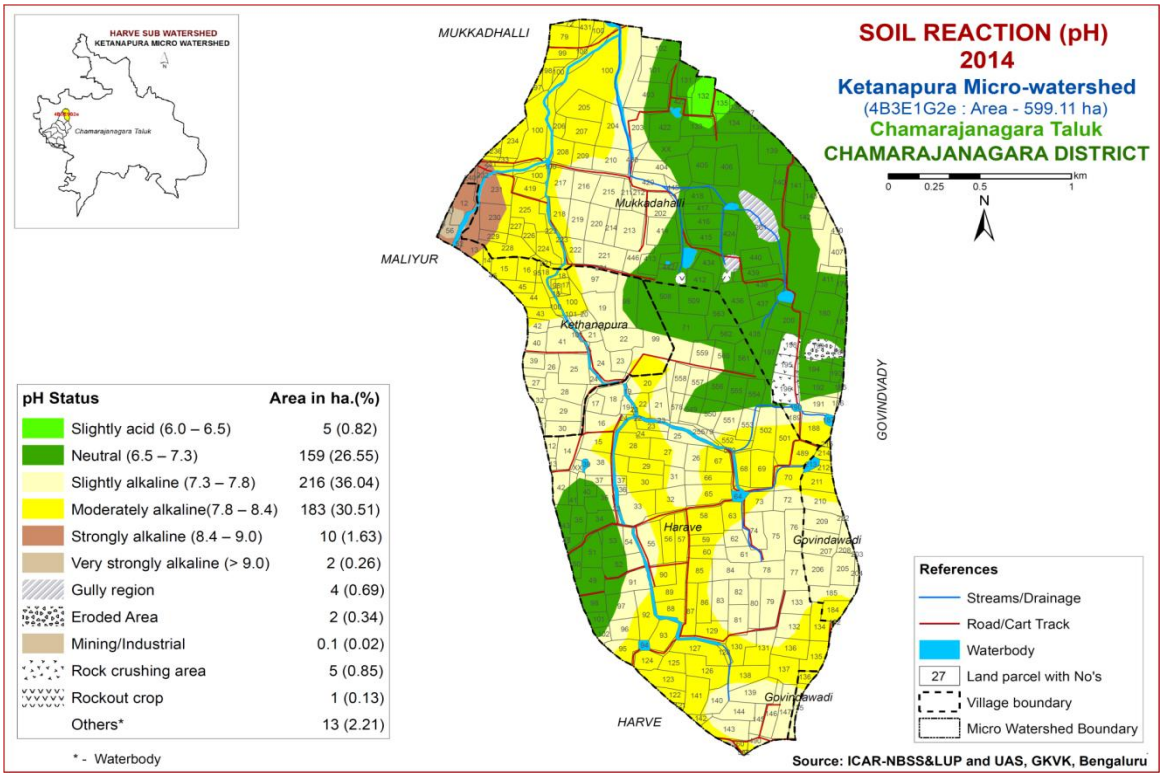


Fig.6.1 Soil Reaction (pH) map of Ketanapura Microwatershed

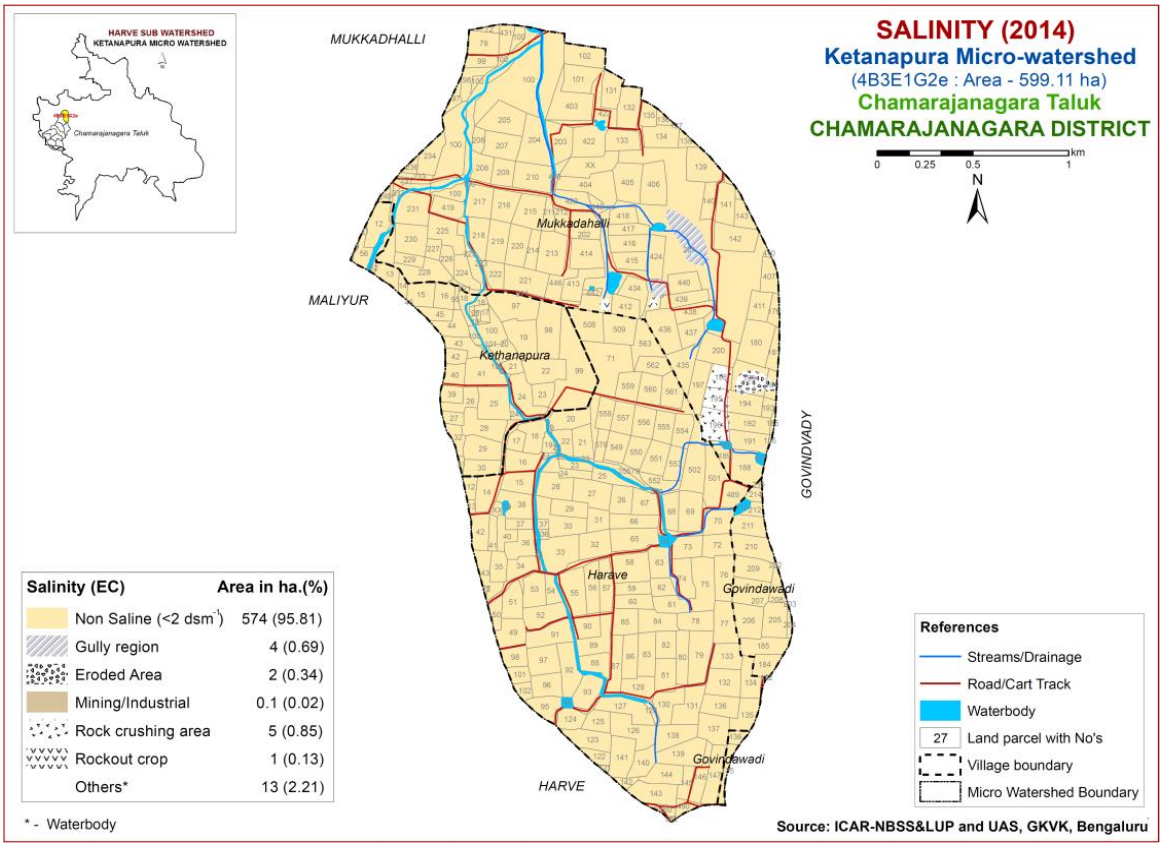


Fig.6.2 Electrical Conductivity (EC) map of Ketanapura Microwatershed

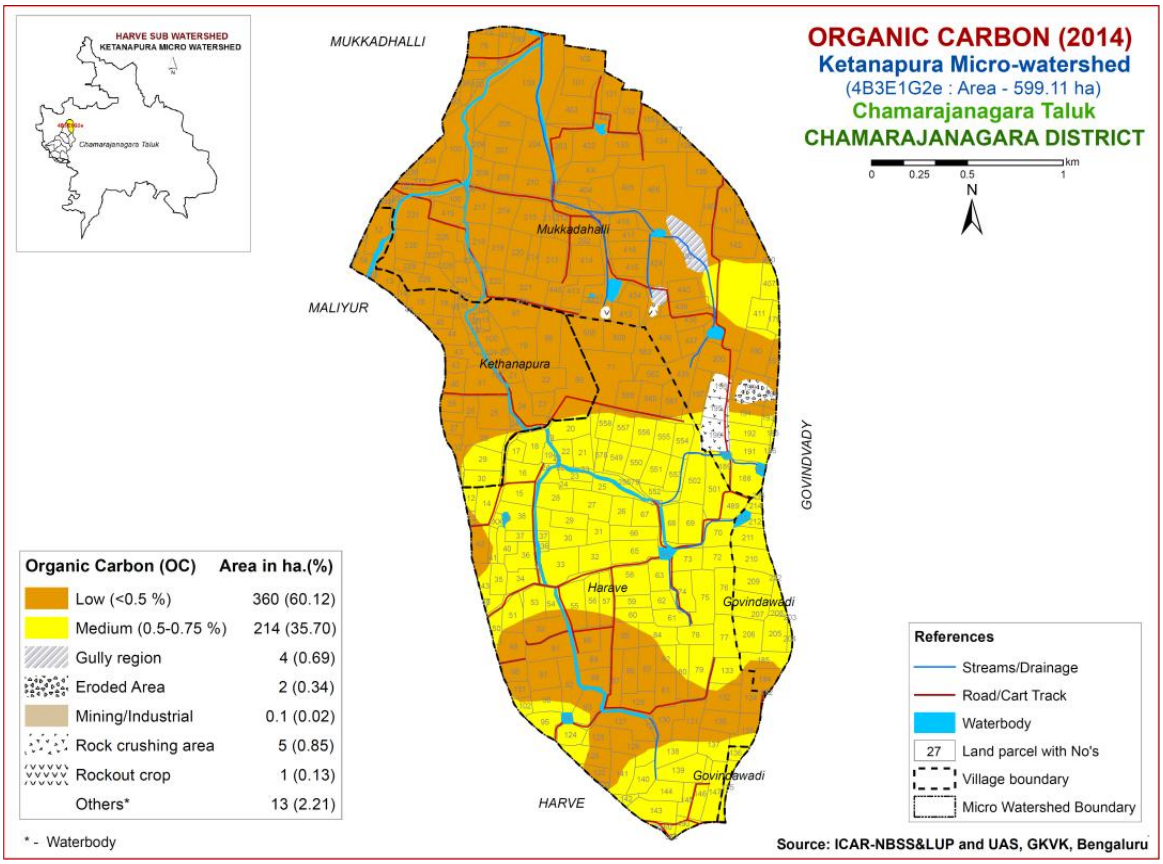


Fig.6.3 Soil Organic Carbon (OC) map of Ketanapura Microwatershed

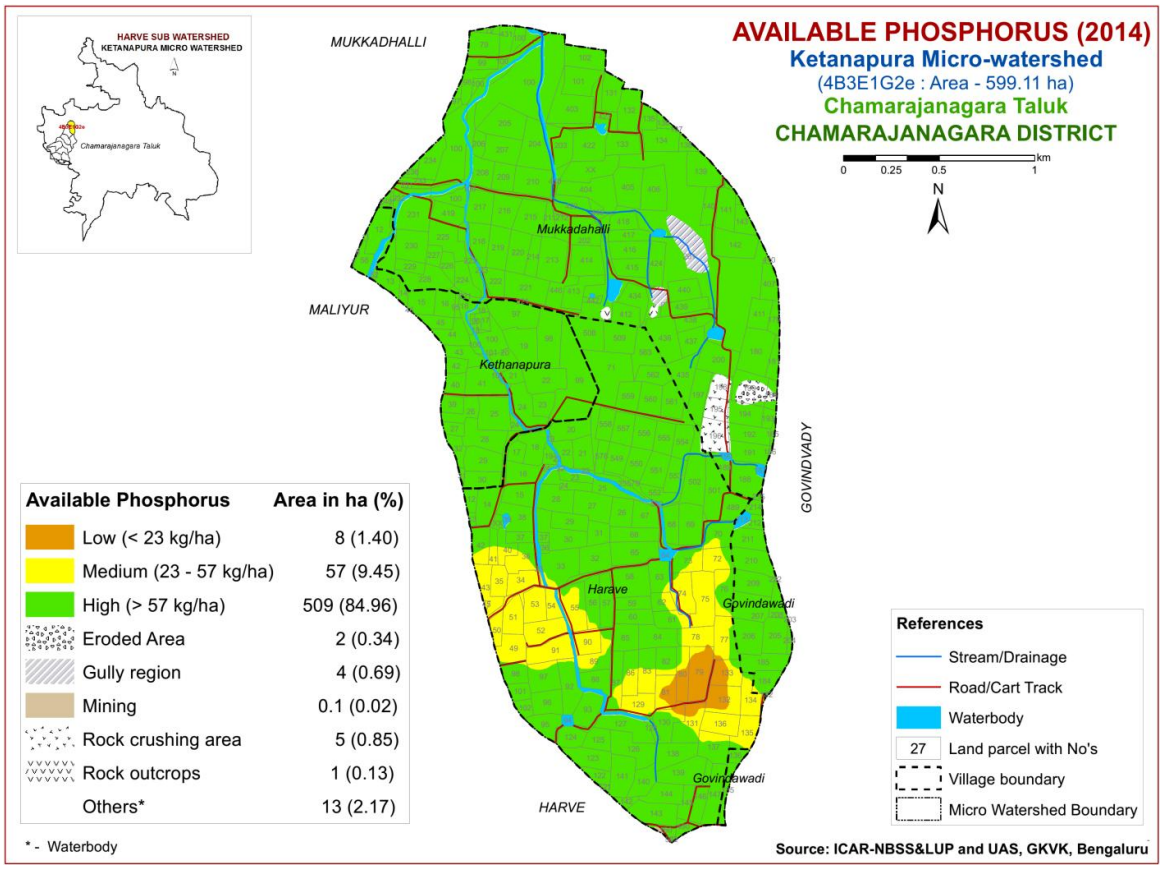


Fig.6.4 Soil available Phosphorus map of Ketanapura Microwatershed

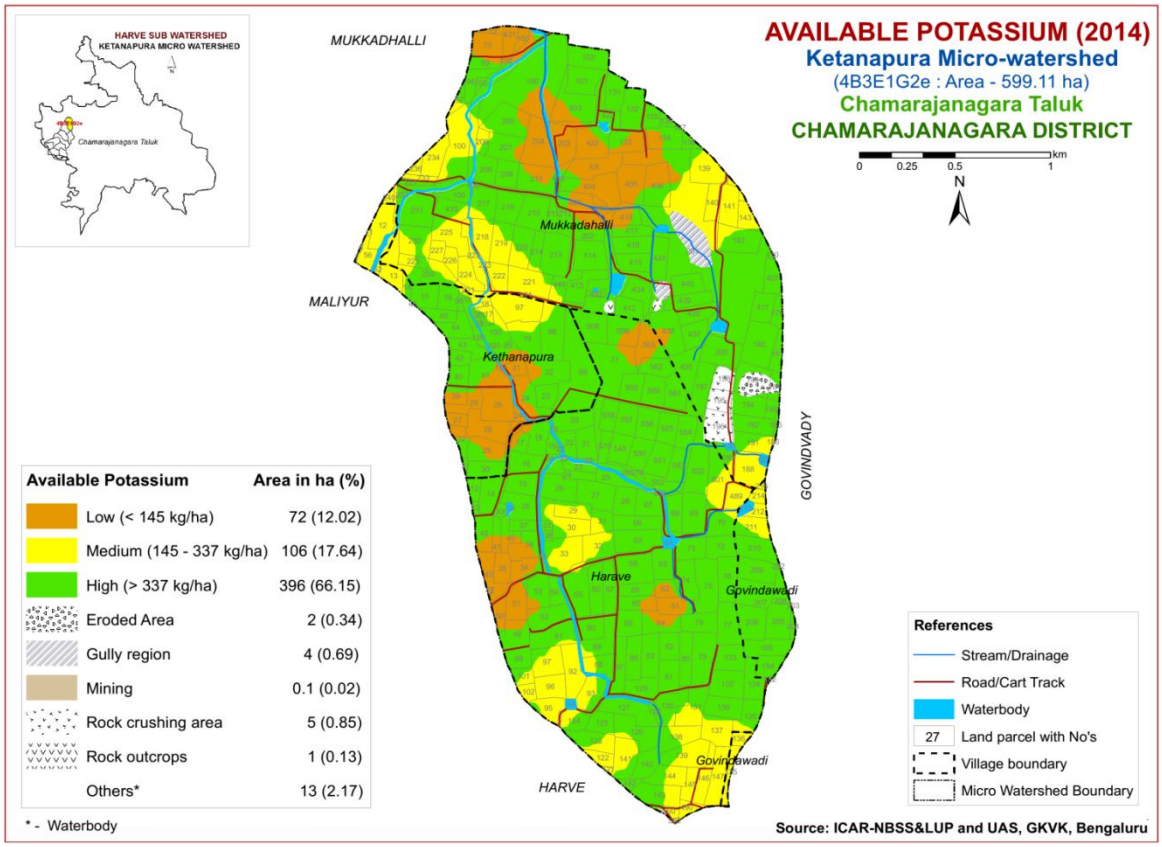


Fig.6.5 Soil available Potassium map of Ketanapura Microwatershed

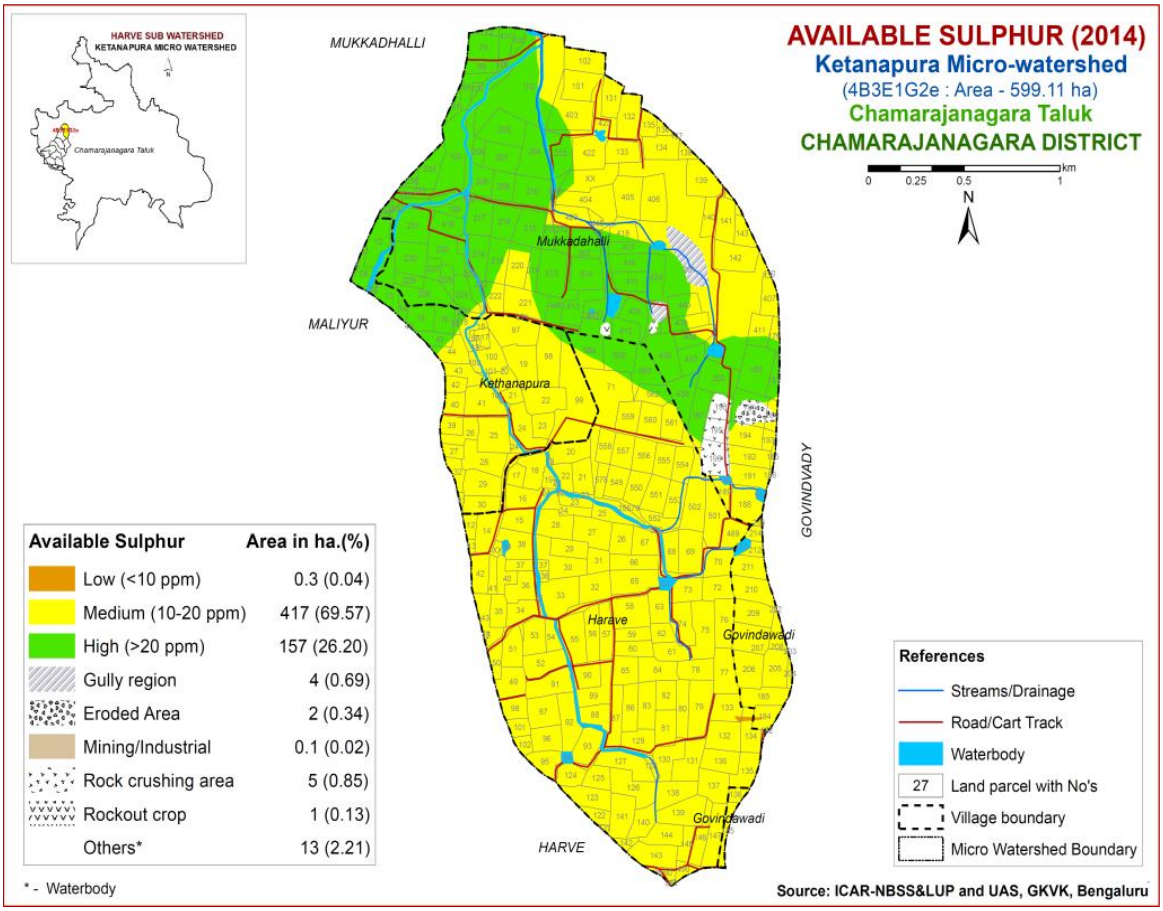


Fig.6.6 Soil available Sulphur map of Ketanapura Microwatershed

6.7 Available Boron

An area of about 91 ha (15%) are medium (0.5-1.0 ppm) in available boron and distributed in the western, northern and southern part of the microwatershed. Maximum area of about 483 ha (81%) are high (>1.0 ppm) in available boron and distributed in the major part of the microwatershed (Fig 6.7).

6.8 Available Iron

Available iron content is deficient (<4.5 ppm) in a major area of about 329 ha (55%) and is distributed in the major part of the microwatershed. An area of about 256 ha (43%) is sufficient (>4.5 ppm) and distributed in the northern and southern part of 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).

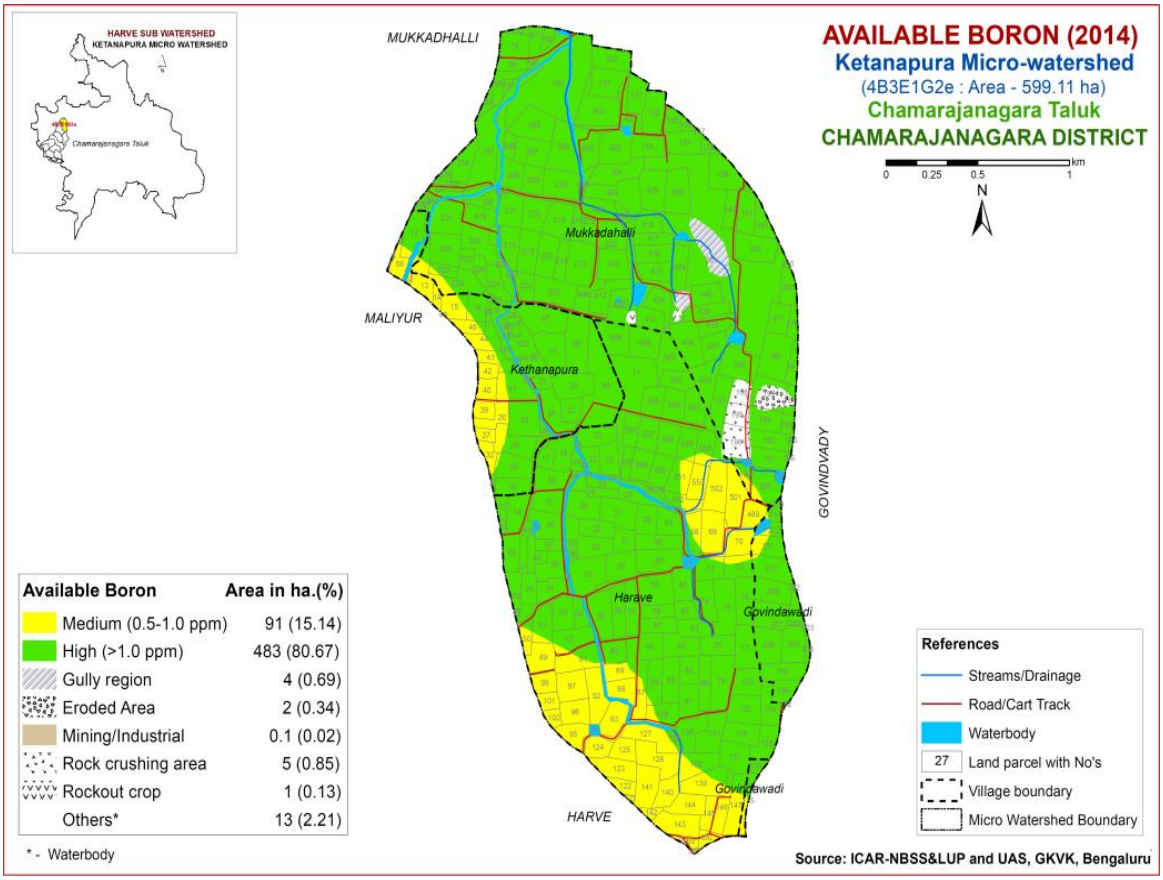


Fig.6.7 Soil available Boron map of Ketanapura Microwatershed

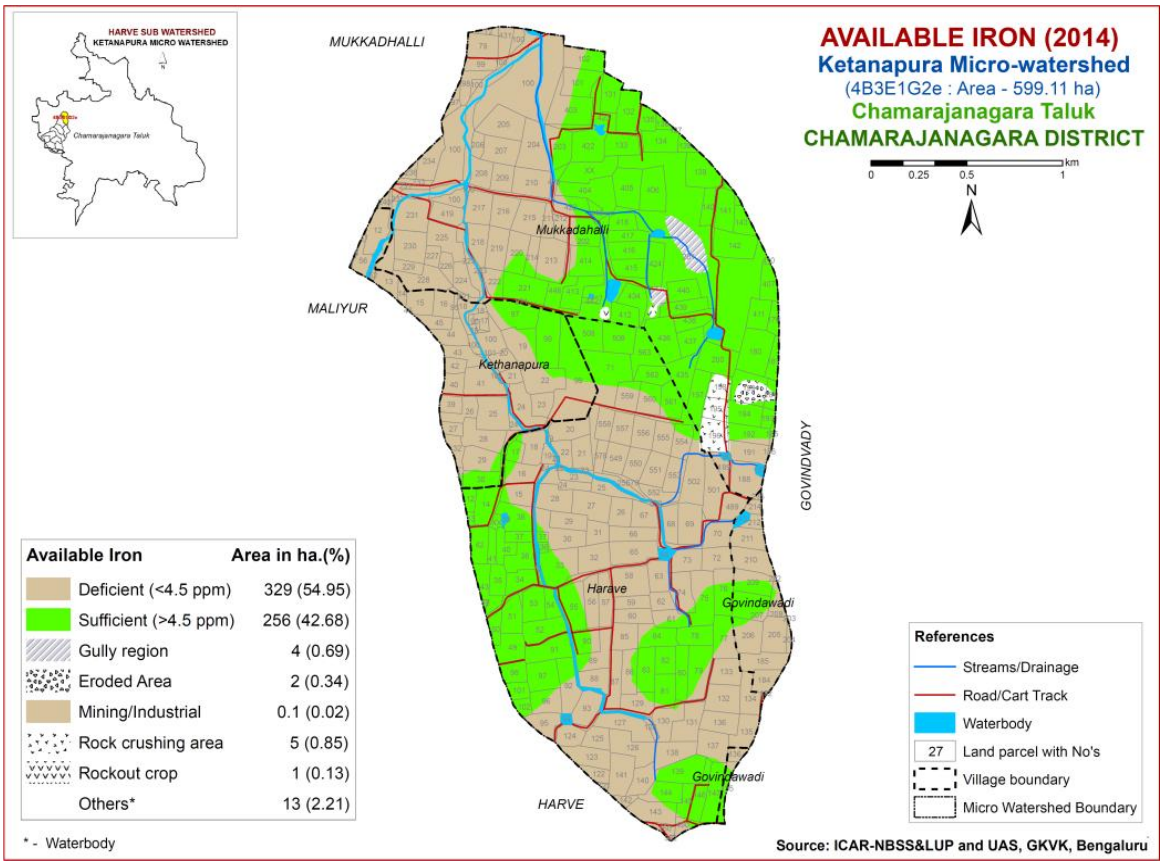


Fig.6.8 Soil available Iron map of Ketanapura Microwatershed

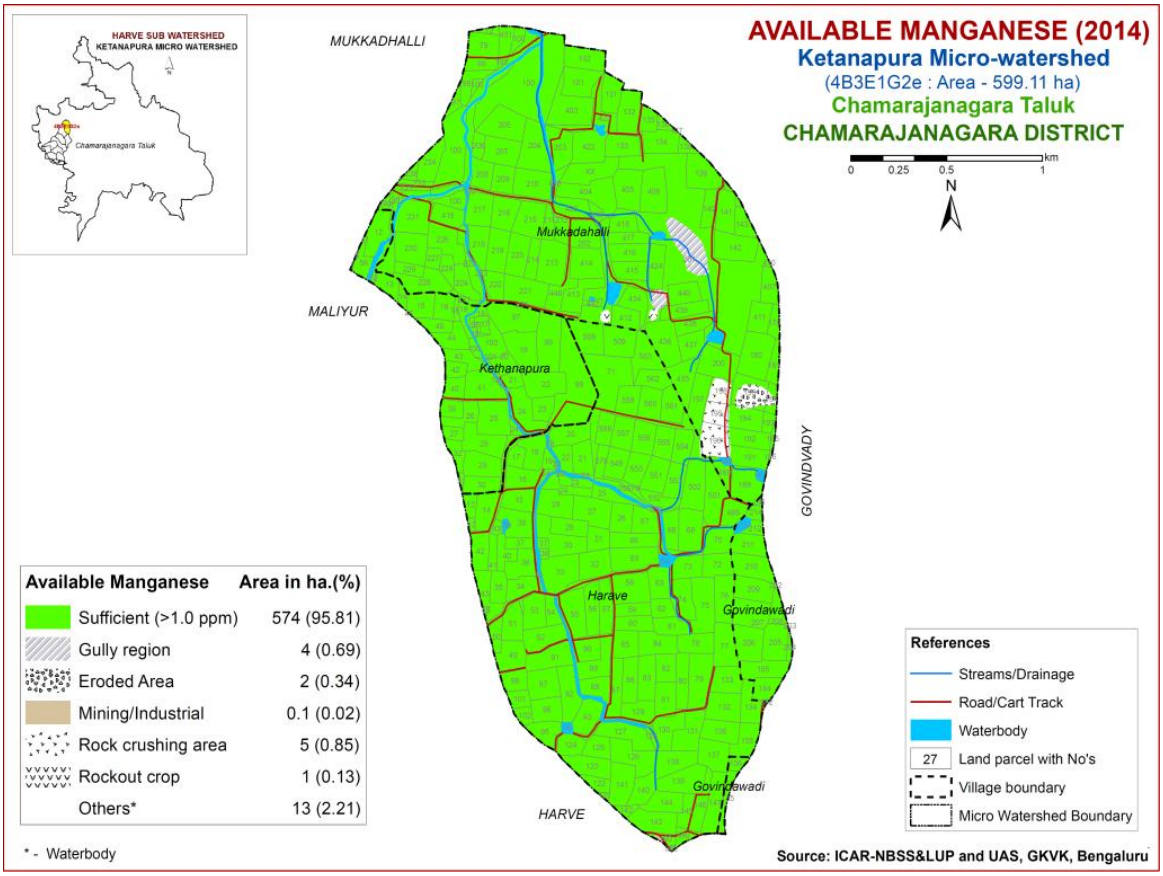


Fig.6.9 Soil available Manganese map of Ketanapura Microwatershed

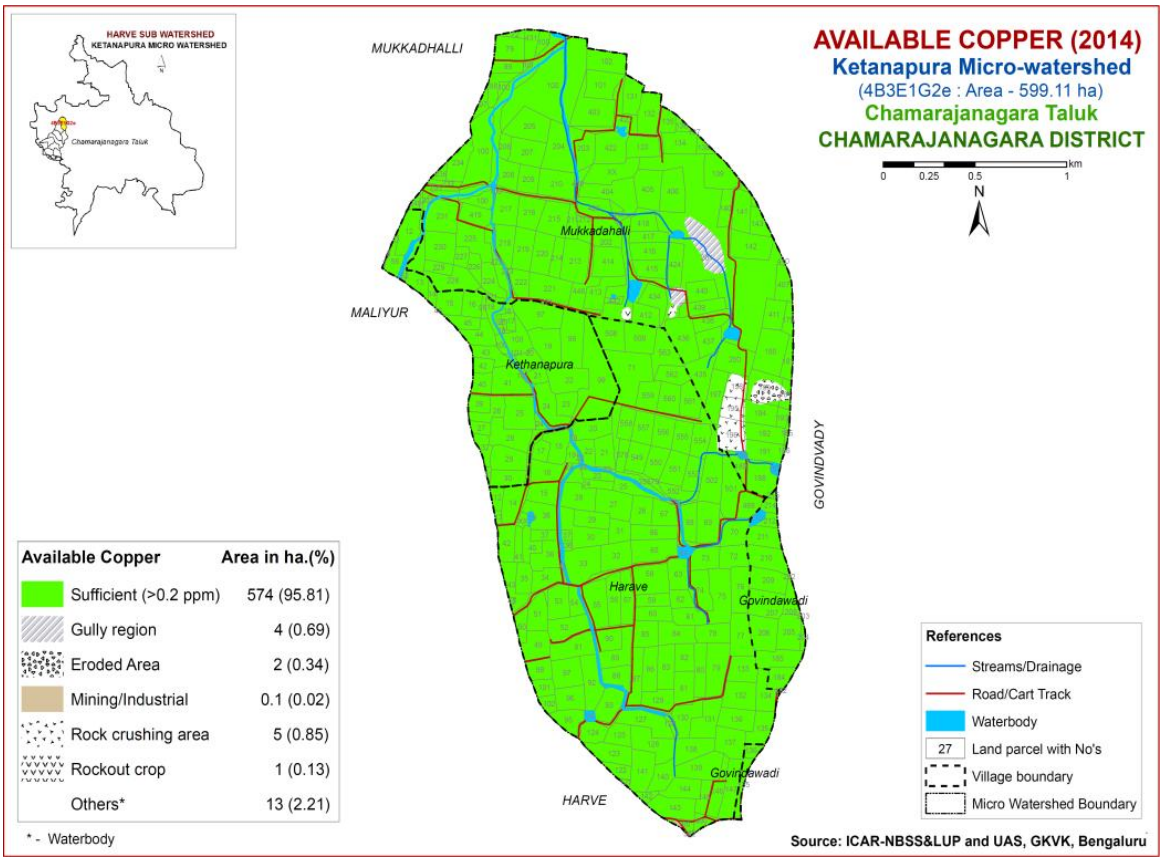


Fig.6.10 Soil available Copper map of Ketanapura Microwatershed

6.11 Available Zinc

Available zinc content is deficient (<0.6 ppm) in an area of about 184 ha (31%) and distributed in the western, northern and southern part of the microwatershed. Maximum area of about 390 ha (65%) is sufficient (>0.6 ppm) and distributed in the major part of the microwatershed (Fig 6.11).

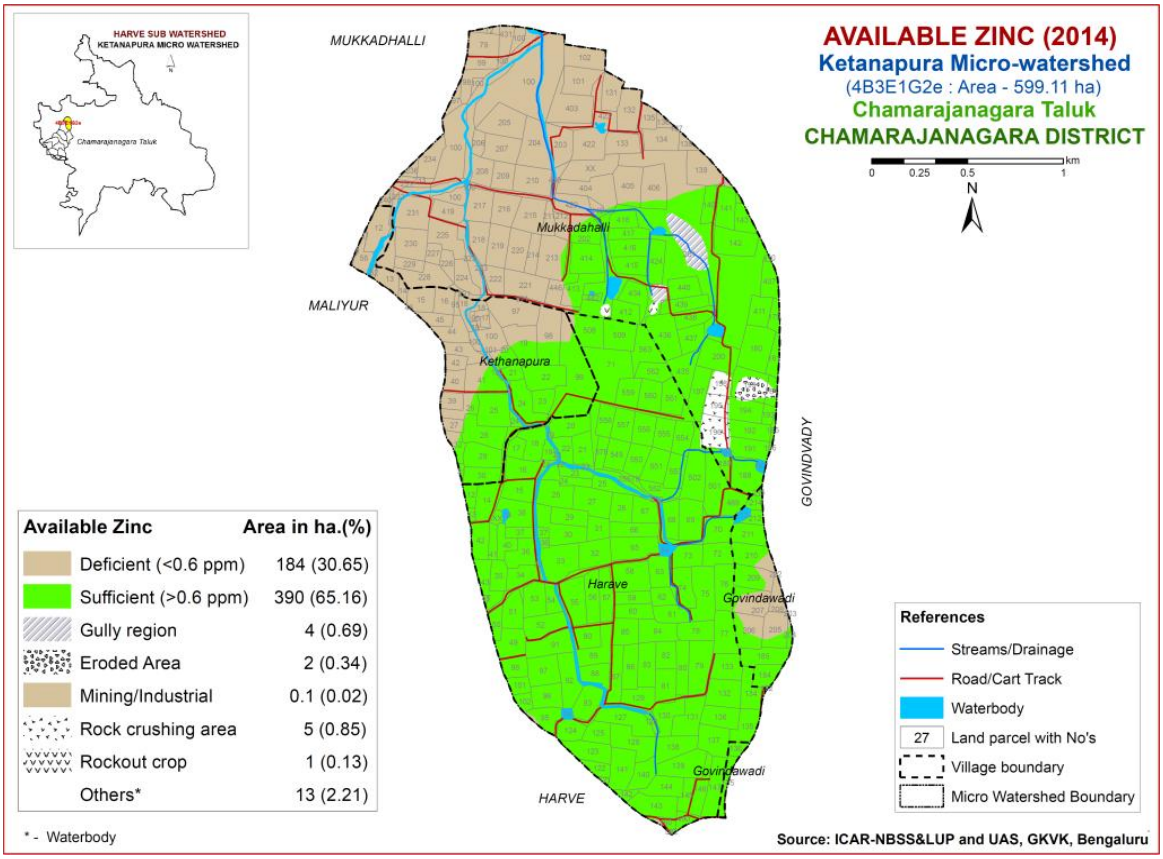


Fig.6.11 Soil available Zinc map of Ketanapura Microwatershed

Chapter 7

LAND SUITABILITY FOR MAJOR CROPS

The soil and land resource units (soil phases) of Ketanapura microwatershed were assessed for their suitability for growing food, fibre, fodder and other horticulture crops by following the procedure as outlined in FAO, 1976 and 1983. Crop requirements were developed for each of the crop from the available research data and also by referring to Naidu *et. al.* (2006) and Natarajan *et. al* (2015). The crop requirements were matched with the soil and land characteristics (Table 7.1) to arrive at the crop suitability. In FAO land suitability classification, two orders are recognized. Order S-Suitable and Order N-Not suitable. The orders have classes, subclasses and units. Order-S has three classes, Class S1-Highly Suitable, Class S2-Moderately Suitable and Class S3-Marginally Suitable. Order N has two classes, N1-Currently not Suitable and N2-Permanently not Suitable. There are no subclasses within the class S1 as they will have very minor or no limitations for crop growth. Classes S2, S3 N1 and N2 are divided into subclasses based on the kinds of limitations encountered. The limitations that affect crop production are 'c' for erratic rainfall and its distribution and length of growing period (LGP), 'e' for erosion hazard, 'r' for rooting condition, 't' for lighter or heavy texture, 'g' for gravelliness or stoniness, 'n' for nutrient availability, 'l' for topography, 'm' for moisture availability, '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 9 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 northern Karnataka in Bijapur, Kalaburagi, Raichur, Bidar, Belgaum, Dharwad and Bellary districts. The crop requirements for growing sorghum (Table 7.2) were matched with the soil-site characteristics (Table 7.1) of the soils of the microwatershed and a land suitability map for growing sorghum was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed is given in Figure. 7.1.

An area of about 59 ha (10%) has highly suitable (Class S1) lands for growing Sorghum and distributed in the western and northern part of the microwatershed. Maximum area of about 346 ha (58%) has moderately suitable (Class S2) lands for growing Sorghum and distributed in the major part of the microwatershed. They have minor limitations of rooting depth, texture and gravelliness. Marginally suitable (Class S3) lands cover an area of about 169 ha (28%) and distributed in the central, northern,

southern and western part of the microwatershed with moderate limitations of rooting depth, texture, nutrient availability and gravelliness.

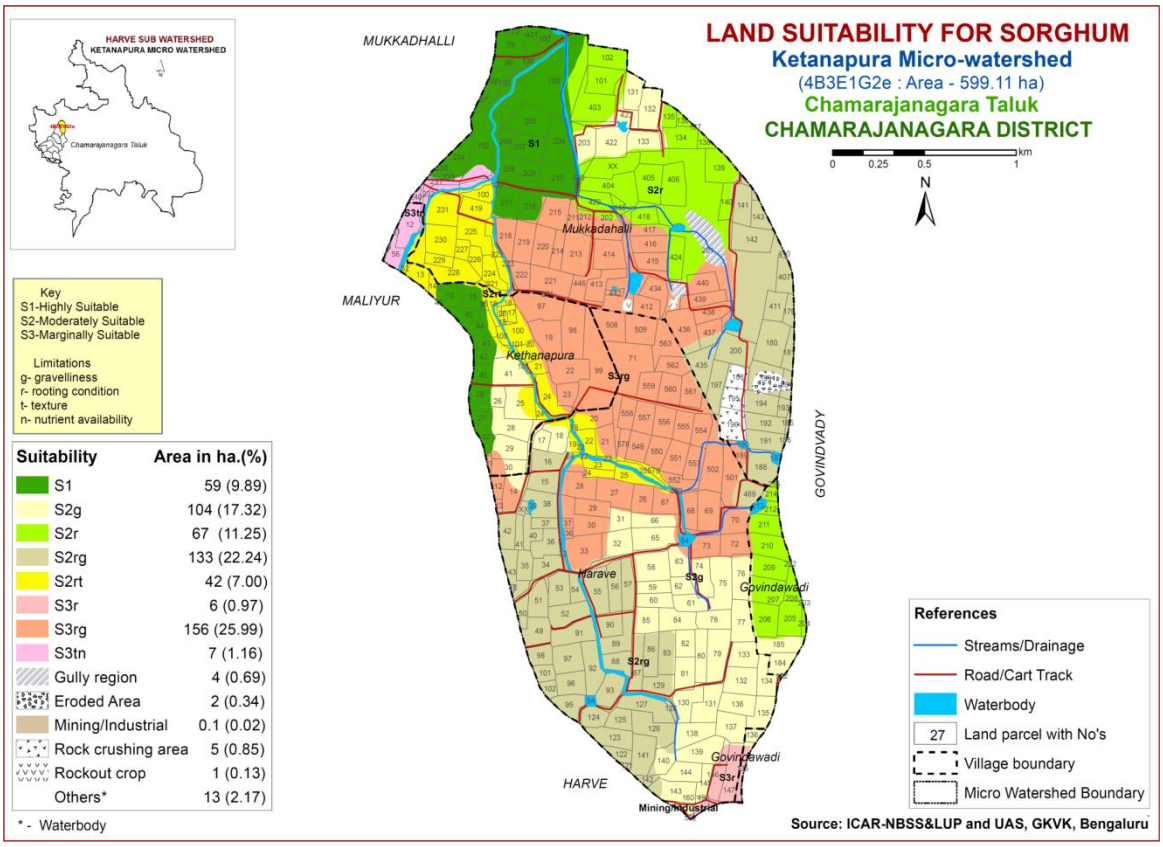


Fig. 7.1 Land Suitability map of Sorghum

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 59 ha (10%) is highly suitable (Class S1) for growing maize and distributed in the northern and western part of the microwatershed. Maximum area of about 346 ha (58%) is moderately suitable (Class S2) for growing maize and distributed in the major part the microwatershed. They have minor limitations of gravelliness, texture and rooting depth. Marginally suitable lands (Class S3) cover an area of about 169 ha (28%) and occur in the central, northern, southern and western part of the microwatershed. They have moderate limitations of gravelliness, texture, nutrient availability and rooting depth.

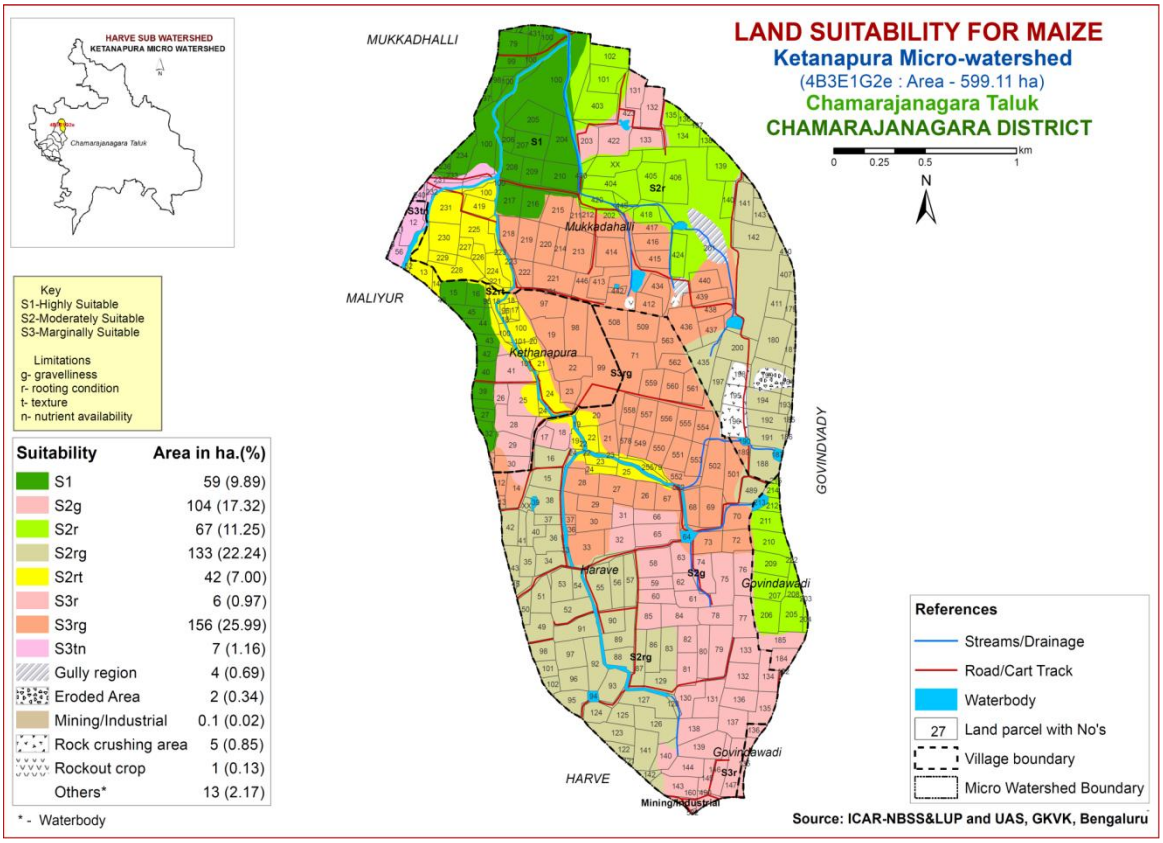


Fig. 7.2 Land Suitability map of Maize

7.3 Land Suitability for Finger millet (*Eleusine Coracana*)

Finger millet is one of the most important food crop grown in an area of 7.08 lakh ha in almost all the districts of south Karnataka. The crop requirements for growing Finger millet (Table 7.4) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing Finger millet was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.3.

An area of about 59 ha (10%) is highly suitable (Class S1) for growing Finger millet and distributed in the western and northern part the microwatershed. Maximum area of about 346 ha (58%) is moderately suitable (Class S2) for growing Finger millet and distributed in the major part the microwatershed. They have minor limitations of gravelliness, texture and rooting depth. Marginally suitable lands (Class S3) cover an area of about 169 ha (28%) and occur in the central, northern, southern and western part of the microwatershed. They have moderate limitations of gravelliness, texture, nutrient availability and rooting depth.

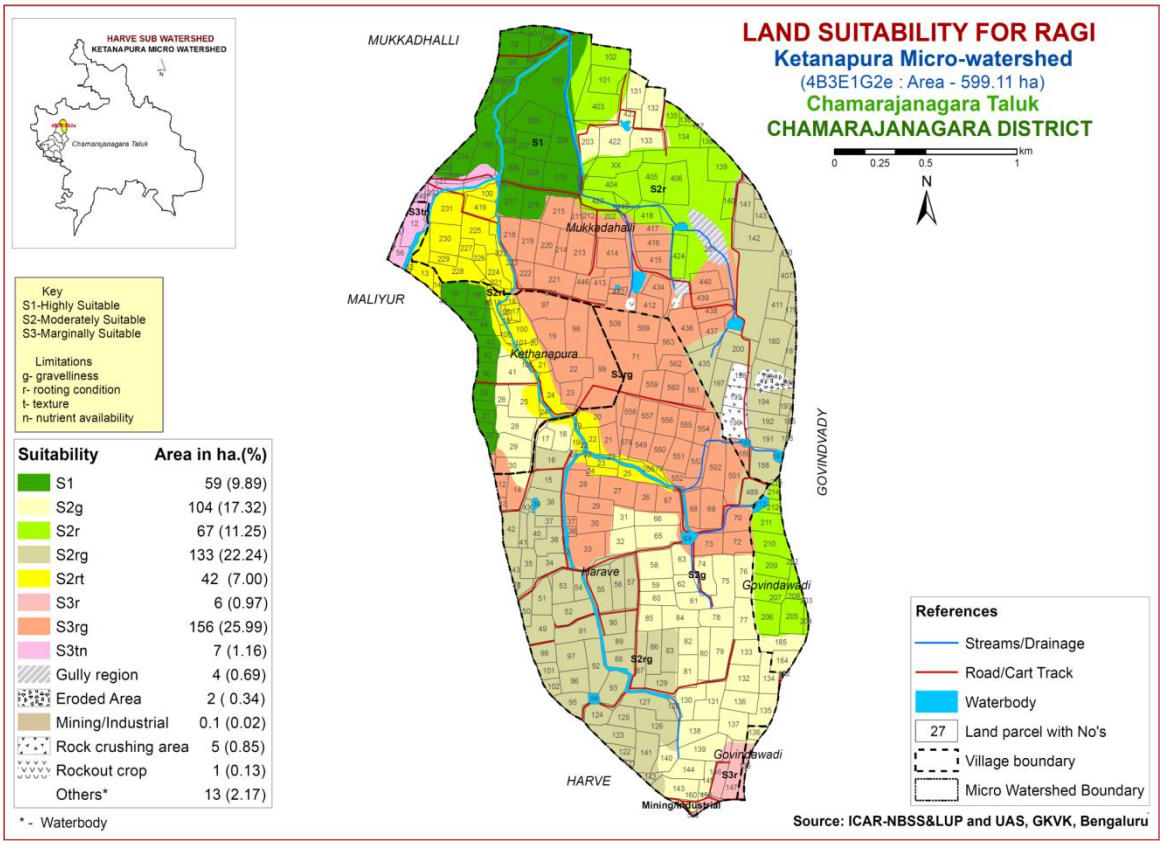


Fig. 7.3 Land Suitability map of Finger millet

7.4 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 7.4) were matched with the soil-site characteristics (Table 7.1) of the soils of the microwatershed and land suitability map for growing red gram was generated. The area extent and their geographic distribution of different suitability subclasses in the micro watershed is given in Figure 7.4.

Highly suitable (Class S1) lands for growing Red gram are not available in this microwatershed. An area of about 91 ha (15%) is moderately suitable (Class S2) for growing Red gram and distributed in the western northern and southern part the microwatershed. They have minor limitations of gravelliness and rooting depth. Marginally suitable lands (Class S3) cover a major area of about 482 ha (81%) and occur in the major part of the microwatershed. They have moderate limitations of gravelliness, texture, nutrient availability and rooting depth.

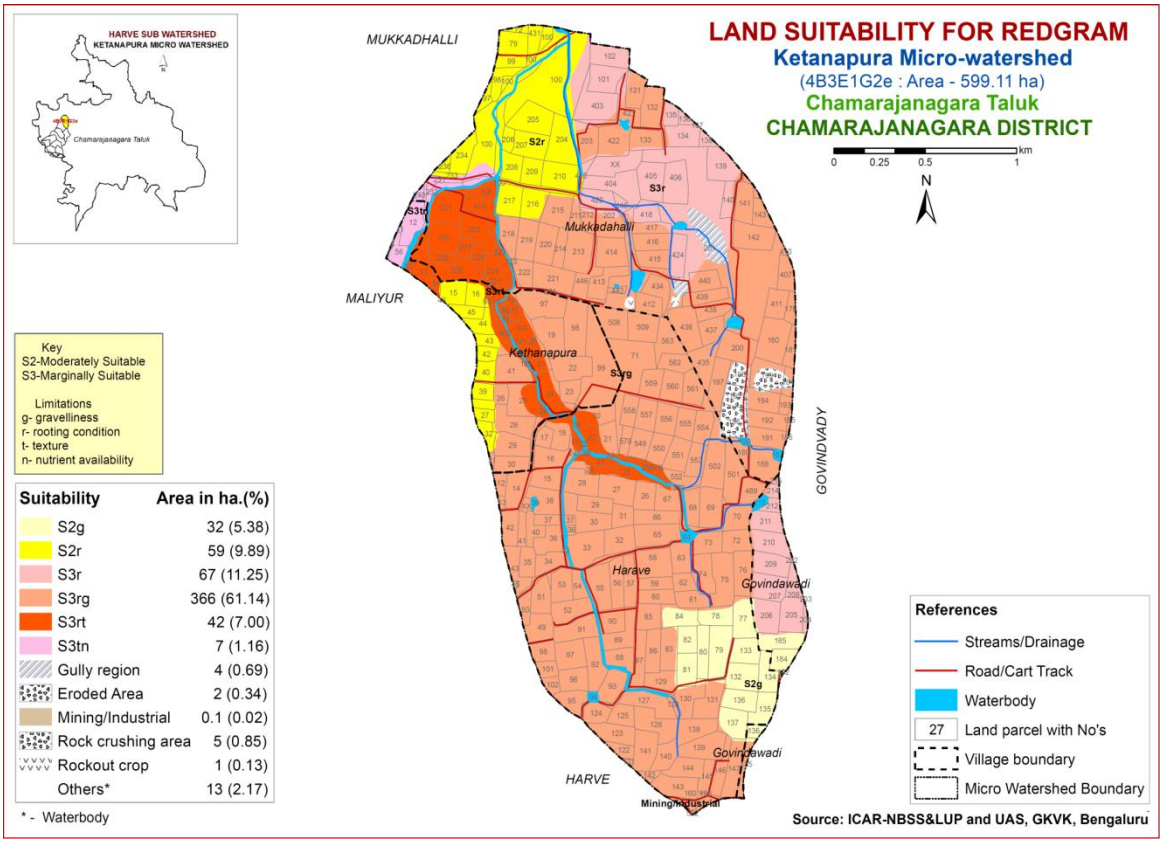


Fig. 7.4 Land Suitability map of Red gram

7.5 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 7.6) were matched with the soil-site characteristics (Table 7.1) of the soils of the microwatershed and 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 7.5.

An area of about 59 ha (10%) is highly suitable (Class S1) for growing Groundnut and distributed in the western and northern part of the microwatershed. Maximum area of about 346 ha (58%) is moderately suitable (Class S2) for growing Groundnut and distributed in the major part the microwatershed. They have minor limitations of gravelliness and rooting depth. Marginally suitable lands (Class S3) cover an area of about 169 ha (28%) and occur in the central, northern, southern and western part of the microwatershed. They have moderate limitations of gravelliness, texture, nutrient availability and rooting depth.

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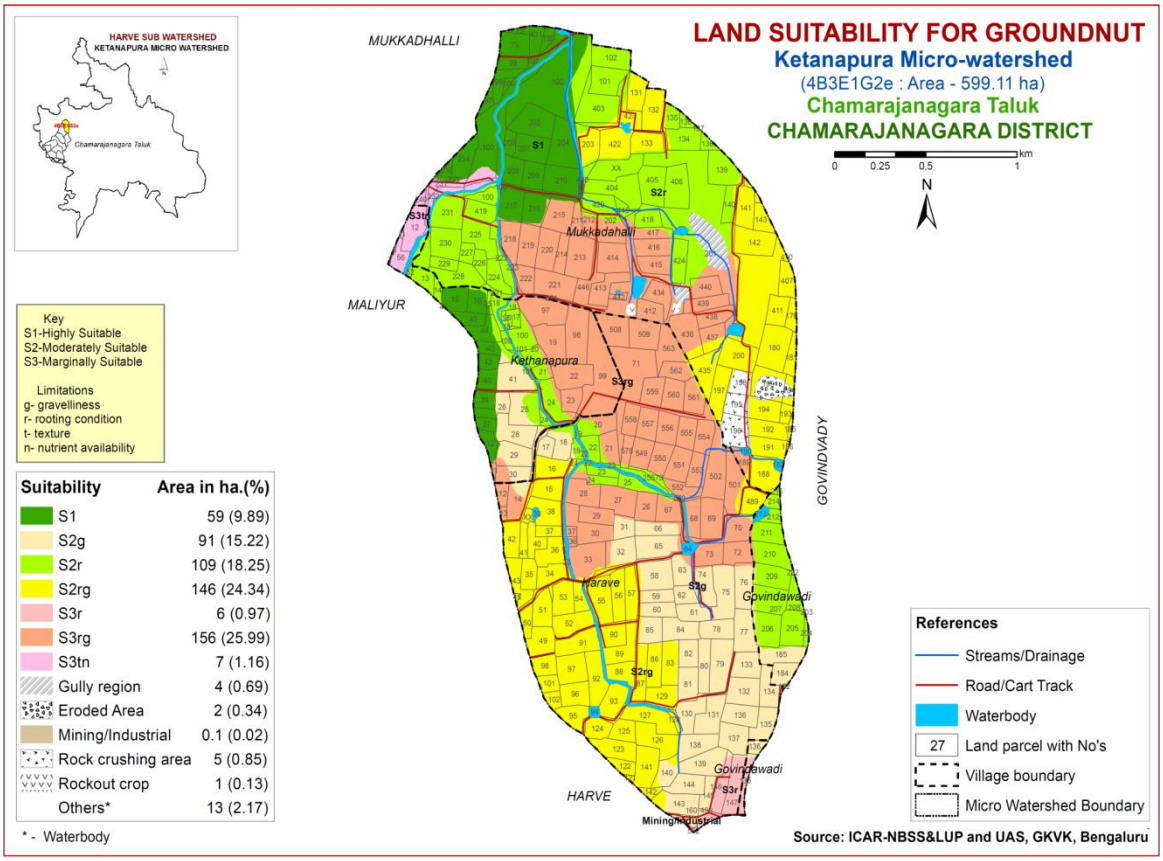


Fig. 7.5 Land Suitability map of Groundnut

7.6 Land Suitability for Cotton (*Gossypium hirsutum*)

Cotton is the most important fibre crop grown in the State in about 8.75 lakh ha area in Raichur, Dharwad, Belgaum, 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.

Highly suitable (Class S1) lands for growing Cotton are not available in this microwatershed. Maximum area of about 371 ha (62%) is moderately suitable (Class S2) for growing Cotton and distributed in the major part the microwatershed. They have minor limitations of gravelliness, texture, nutrient availability and rooting depth. Marginally suitable lands (Class S3) cover an area of about 204 ha (34%) and occur in the central, northern, southern and western part of the microwatershed. They have moderate limitations of gravelliness, texture and rooting depth.

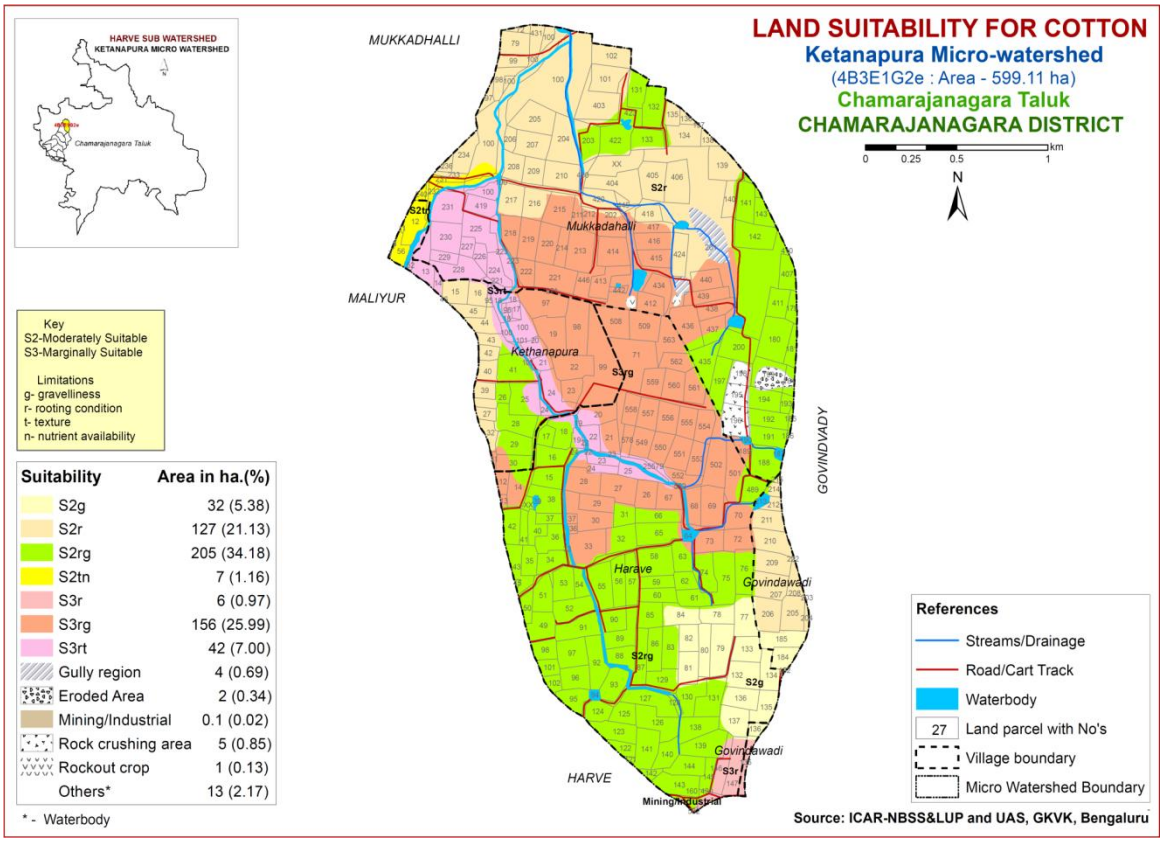


Fig. 7.6 Land Suitability map of Cotton

7.7 Land Suitability for Chilli (*Capsicum annuum L.*)

Chilli is one of the most important spice crop grown in an area of 0.42 lakh ha in the State in all the districts. The crop requirements for growing Chilli (Table 7.8) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing Chilli was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.7.

An area of about 59 ha (10%) is highly suitable (Class S1) for growing chilli and distributed in the western and northern part the microwatershed. Maximum area of about 346 ha (58%) is moderately suitable (Class S2) for growing Chilli and distributed in the major part the microwatershed. They have minor limitations of gravelliness, texture and rooting depth. Marginally suitable lands (Class S3) cover an area of about 169 ha (28%) and occur in the central, northern, southern and western part of the microwatershed. They have moderate limitations of gravelliness, texture, nutrient availability and rooting depth.

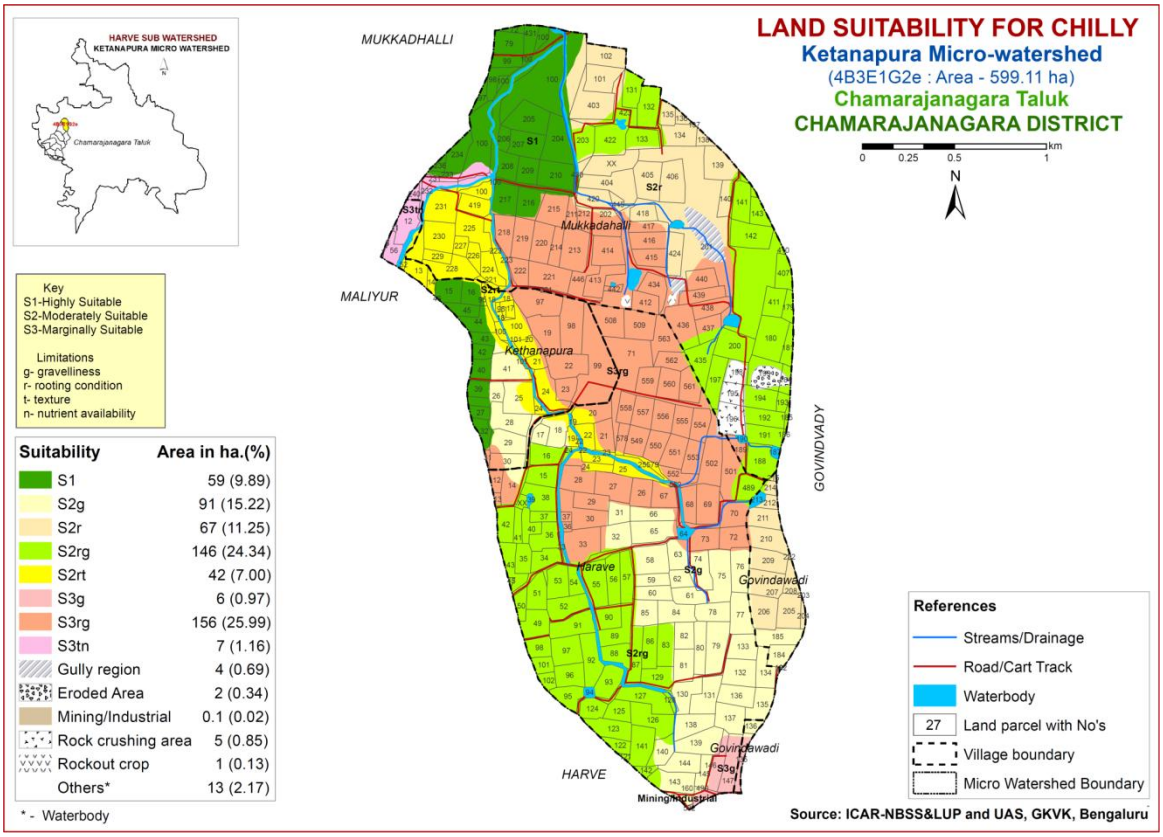


Fig. 7.7 Land Suitability map of Chilli

7.8 Land Suitability for Mango (*Mangifera indica*)

Mango is one of the most important fruit crop grown in an area of 1.73 lakh ha and distributed in all the districts of the State. The crop requirements for growing mango (Table 7.9) 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 geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.8.

Highly (Class S1) suitable lands for growing Mango are not available in this microwatershed. Moderately (Class S2) suitable lands for growing Mango cover an area of about 32 ha (5%) and distributed in the southern part of the microwatershed with minor limitation of gravelliness. Marginally suitable (Class S3) lands for growing Mango cover an area of 118 ha (20%) and distributed in the western, northern and southern part of the microwatershed. They have moderate limitations of gravelliness and rooting depth. Major area of about 424 ha (71%) is currently not suitable (Class N) lands for growing Mango and distributed in the major part of the microwatershed.

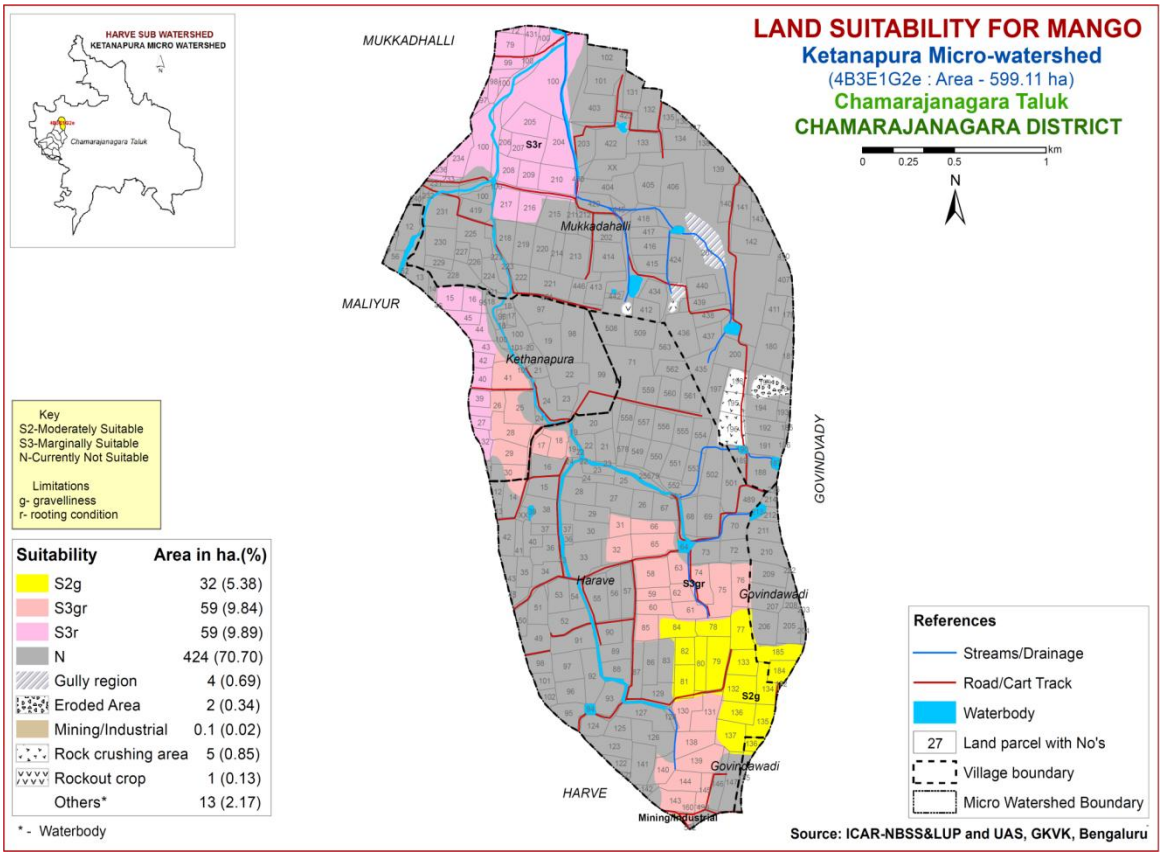


Fig. 7.8 Land Suitability map of Mango

7.9 Land Suitability for Sapota (*Manilkara zapota*)

Sapota is one of the most important fruit crop grown in an area of 0.29 lakh ha and distributed in almost all the districts of the state. The crop requirements for growing sapota (Table 7.9) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing sapota was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.9.

Highly (Class S1) suitable lands for growing Sapota are not available in this microwatershed. Moderately (Class S2) suitable lands for growing Sapota cover an area of about 150 ha (25%) and distributed in the northern, western and southern part of the microwatershed with minor limitations of rooting depth and gravelliness. Marginally suitable (Class S3) lands for growing Sapota cover a major area of about 255 ha (43%) and distributed in the central, northern and southern part of the microwatershed. They have moderate limitations of gravelliness and rooting depth. An area of about 168 ha (28%) is currently not suitable (Class N) for growing Sapota and distributed in the central, northern, southern and western part of the microwatershed.

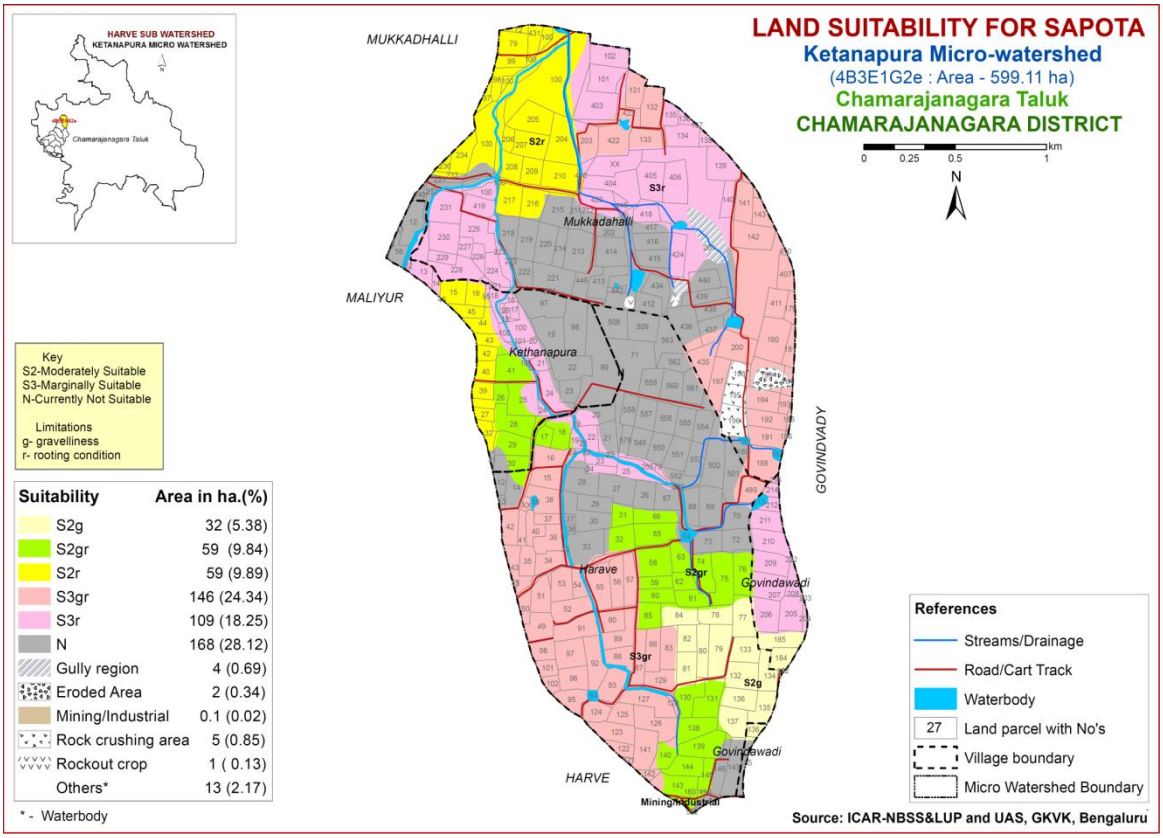


Fig. 7.9 Land Suitability map of Sapota

Table 7.1 Soil-Site Characteristics of Ketanapura Microwatershed

Soil Map Units	Climate (P) (mm)	Growing period (Days)	Drainage class	Soil depth (cm)	Soil texture		Gravelliness		AWC (mm/m)	Slope (%)	Erosion	pH	EC (dSm-^{1})	ESP (%)	CEC [Cmol (p^{+}) kg^{-1}]	BS (%)
					Sur-face	Sub surface	Surface (%)	Sub-surface (%)								
HRVbA1	769	150	WD	25-50	ls	gscl	<15	>35	<50	0-1	Slight	6.05	0.21	0.73	11.24	100
HRVbA1g1	769	150	WD	25-50	ls	gscl	15-35	>35	<50	0-1	Slight	6.05	0.21	0.73	11.24	100
HRVbB1g1	769	150	WD	25-50	ls	gscl	15-35	>35	<50	1-3	Slight	6.05	0.21	0.73	11.24	100
HRVbB1g2	769	150	WD	25-50	ls	gscl	35-60	>35	<50	1-3	Slight	6.05	0.21	0.73	11.24	100
HRVcB1g2	769	150	WD	25-50	sl	gscl	35-60	>35	<50	1-3	Slight	6.05	0.21	0.73	11.24	100
HRVcB2g3	769	150	WD	25-50	sl	gscl	60-80	>35	<50	1-3	Moderate	6.05	0.21	0.73	11.24	100
KGPhB1g1	769	150	WD	25-50	scl	gsc	15-35	15-35	51-100	1-3	Slight	-	-	-	-	-
HNHhB1g1	769	150	MWD	50-75	scl	sc	15-35	<15	101-150	1-3	Slight	7.94	0.99	2.13	18.00	99.15
HNHiA1g1	769	150	MWD	50-75	sc	sc	15-35	<15	101-150	0-1	Slight	7.94	0.99	2.13	18.00	99.15
KGHbA1g1	769	150	WD	50-75	ls	gscl	15-35	15-35	101-150	0-1	Slight	6.66	0.089	0.93	8.22	100
KGHbB2g2	769	150	WD	50-75	ls	gscl	35-60	15-35	101-150	1-3	Moderate	6.66	0.089	0.93	8.22	100
KGHcB1g1	769	150	WD	50-75	sl	gscl	15-35	15-35	101-150	1-3	Slight	6.66	0.089	0.93	8.22	100
KTPcA1g1	769	150	WD	50-75	sl	gsc	15-35	15-35	101-150	0-1	Slight	6.42	0.07	0.05	4.41	100
LKRbA1g1	769	150	WD	50-75	ls	gsc	15-35	40-60	51-100	0-1	Slight	8.18	0.30	4.51	12.19	100
LKRbB1g1	769	150	WD	50-75	ls	gsc	15-35	40-60	51-100	1-3	Slight	8.18	0.30	4.51	12.19	100
LKRbB1g2	769	150	WD	50-75	ls	gsc	35-60	40-60	51-100	1-3	Slight	8.18	0.30	4.51	12.19	100
LKRcA1g1	769	150	WD	50-75	sl	gsc	15-35	40-60	51-100	0-1	Slight	8.18	0.30	4.51	12.19	100
GHTbB1g1	769	150	WD	75-100	ls	gscl	15-35	15-35	101-150	1-3	Slight	5.70	0.06	4.10	3.17	73
GHTmB1g1	769	150	WD	75-100	c	gscl	15-35	15-35	101-150	1-3	Slight	5.70	0.06	4.10	3.17	73
HDHbB1g2	769	150	WD	75-100	ls	gsc-gc	35-60	>35	51-100	1-3	Slight	6.54	0.07	7.11	5.84	84.07
HDHcA1	769	150	WD	75-100	sl	gsc-gc	<15	>35	51-100	0-1	Slight	6.54	0.07	7.11	5.84	84.07
HDHcA1g1	769	150	WD	75-100	sl	gsc-gc	15-35	>35	51-100	0-1	Slight	6.54	0.07	7.11	5.84	84.07
KKRhA1g1	769	150	WD	75-100	scl	sc	15-35	<15	101-150	0-1	Slight	-	-	-	-	-
BPRbA1g1	769	150	WD	100-150	ls	gsc-gc	15-35	>35	101-150	0-1	Slight	6.64	0.03	0.51	5.45	63.48
BPRcB1g2	769	150	WD	100-150	sl	gsc-gc	35-60	>35	101-150	1-3	Slight	6.64	0.03	0.51	5.45	63.48
KGKcB2g1	769	150	PD	>150	sl	c	15-35	<15	151-200	1-3	Moderate	-	-	-	-	-

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

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 Finger millet

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	>110	90-110	60-90	<60
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well to mod. drained	Imperfectly drained	Poorly/ excessively	V.poorly
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	l, sil, sl, cl, sicl, scl	sic, c, sc	ls, s,c >60%	
	pH	1:2.5	5.5-7.3	7.3-8.4	8.4-9.0	>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	<1.0	1.0-2.0	2.0-4.0	>8
	Sodicity (ESP)	%	<10	10-15	15-25	>25
Erosion hazard	Slope	%	0-3	3-5	5-10	>10

Table 7.5 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 7.6 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 7.7 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 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 7.9 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 7.10 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

7.10 Land Management Units (LMU)

The 26 soil map units identified in Ketanapura microwatershed have been regrouped into 8 Land Management Unit (LMU) for the purpose of preparing a Proposed Crop Plan. Land Management Unit 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.7.10) has been generated. These Land Management Unit are expected to behave similarly for a given level of management.

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

LMU	Soil map units	Soil and site characteristics
1	BPRbA1g1 BPRcB1g2	Deep soils (100-150 cm), gravelly sandy loam to loamy sand soils, slope of 0-3%, slight erosion, gravelly to very gravelly (15-35%)
2	GHTbB1g1 GHTmB1g1	Moderately deep soils (75-100 cm), loamy sand to clay soils, slopes of 1-3%, slight erosion, gravelly (15-35%)
3	HDHbB1g2 HDHcA1 HDHcA1g1	Moderately deep soils (75-100 cm), gravelly sandy loam to loamy sand soils, slopes of 0-3%, slight erosion, non-gravelly to very gravelly (<15-60%)
4	KGHbA1g1 KGHbB2g2 KGHcB1g1 KTPcA1g1 LKRbA1g1 LKRbB1g1 LKRbB1g2 LKRcA1g1	Moderately shallow (50-75 cm), gravelly sandy loam to loamy sand soils, slopes of 0-3%, slight to moderate erosion, gravelly to very gravelly (15-60%)
5	KKRhA1g1	Moderately deep (75-100 cm), sandy clay loam soils, slopes of 0-1%, slight erosion, gravelly (15-35%)
6	HNHhB1g1 HNHiA1g1	Moderately shallow (50-75 cm), sandy clay loam to sandy clay soils, slopes of 0-3%, slight erosion, gravelly (15-35%)
7	KGKcB2g1	Very deep soils (>150 cm), sandy loam soils, slopes of 1-3%, moderate erosion, gravelly (15-35%)
8	HRVbA1 HRVbA1g1 HRVbB1g1 HRVbB1g2 HRVcB1g2 HRVcB2g3 KGPhB1g1	Shallow soils (25-50 cm), gravelly loamy sand to sandy loam soils, slopes of 0-3%, slight erosion, non-gravelly to extremely gravelly (<15-80%)

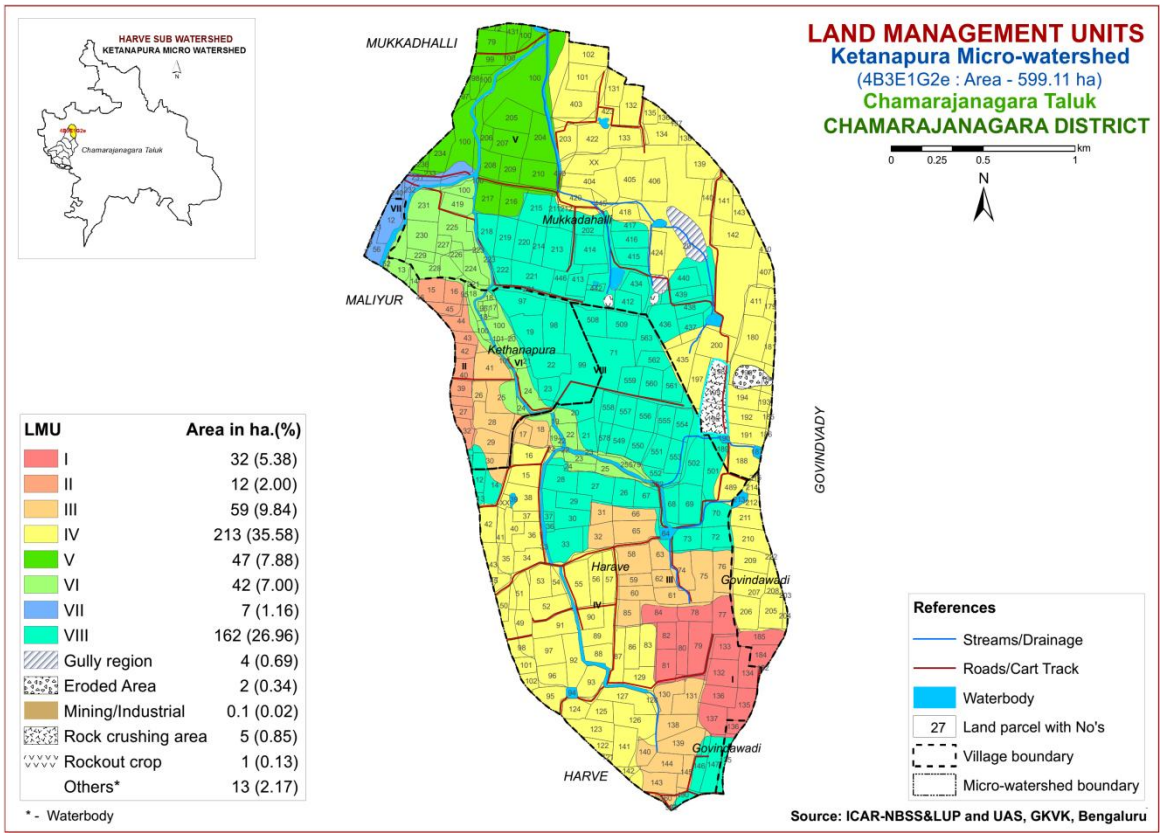


Fig. 7.10 Land Management Unit map of - Ketanapura microwatershed

7.11 Proposed Crop Plan for Ketanapura Microwatershed

After assessing the land suitability for the 9 crops, a proposed crop plan has been generated for the 8 identified LMUs by considering only the highly (Class S1) and moderately suitable (Class S2) lands for each of the 9 crops. The resultant proposed crop plan is presented below in Table 7.11.

Table 7.11 Proposed Crop Plan for Ketanapura Microwatershed

LMU	Mapping Units	Survey Numbers	Field Crops/ Forestry Crops	Suitable Horticulture Crops	Suitable Interventions
1	BPRbA1g1 BPRcB1g2	**Govindawadi**:136,182,184,185 **Harave**:77,78,79,80,81,82,84,132,133,134,135,136,137	**Sole crop:** Ragi, Bajra, Sorghum, Sunflower, Horse gram, Cotton **Multiple/crop rotation**: Redgram+Maize,Redgram+ Groundnut,Redgram+Fodder Sorghum, Pulses+Sorghum, Pulses+Ragi	**Perennial component:** Mango, Sapota, Jackfruit, Tamarind, Jamun **Intercrops:** Groundnut, Hebbal Avare, Cluster Bean, Coriander **Vegetables:** Tomato, Capsicum, Green Chillies, French bean, Bhendi, Vegetable Cowpea, Cucurbits **Flower crops:** Marigold, Gaillardia, Aster	Drip irrigation, mulching, crop suitable conservation practices (crescent Bunding with catch pit, etc.)
2	GHTbB1g1 GHTmB1g1	**Kethanapura**:15,16,27,32,39, 40, 42,43,44,45	-do-	-do-	-do-
3	HDHbB1g2 HDHcA1 HDHcA1g1	**Harave:**17,18,31,32,58,59,60,61,62,63,65,66,74,75,76,85,130,131,138, 139,140,143,144,145,160 **Kethanapura:**25,26,28,29,30,41	Redgram (Short duration). Bajra, Sorghum, Sesamum, Green gram, Black gram, Horse gram, Redgram+Maize, Redgram+Groundnut, Redgram + Fodder Sorghum	**Perennial component:** Mango, Tamarind, Aonla, Pomelo **Intercrops:** Groundnut, Hebbal avare, Cluster bean, Coriander. **Annual component:** **Vegetables:** Tomato, Green Chillies, French Bean, Bhendi, Vegetable Cowpea, Cucurbits **Flower Crops:** Marigold, Gaillardia	-do-
4	KGHbA1g1 KGHbB2g2 KGHcB1g1 KTPcA1g1 LKRbA1g1 LKRbB1g1 LKRbB1g2 LKRcA1g1	**Govindawadi**:203,204,205,206,207,208,209,210,211,212,214,215,222 **Harave**:15,16,34,35,36,37,38,40,41,42,43,45,49,50,51,52,53,54,55,56,57,83,86,87,88,89,90,91,92,93,95,96, 97,98,101,102,121,122,123,124,125,126,127,128,129,141,142,489 **Mukkadahalli**:101,102,131,132,133,134,135,136,137,138,139,140,141	Ragi, Maize, Groundnut, Sorghum, Bajra, Castor, Sunflower, Sesamum	Ber, Aonla, Custard Apple **Vegetables:** Cluster Bean, Bhendi **Flower Crops:** Gaillardia, Marigold	-do-

		,142,143,179,180,181,184,185,186,188,191,192,193,194,197,200,201,203,403,404,405,406,407,410,411,418,420,422,423,424,430,435,445,XX			
5	KKRhA1g1	**Mukkadahalli**:72,79,97,98,99,100,204,205,206,207,208,209,210,216,217,233,234,236,431, STREAM	**Sole crop:** Ragi, Bajra, Sorghum, Sunflower, Horse gram, Cotton **Multiple/crop rotation:** Redgram+Maize,Redgram+ Groundnut,Redgram+Fodder Sorghum,Pulses+Sorghum, Pulses+Ragi	**Perennial component:** Mango, Aonla Sapota, Jack Fruit, Tamarind, **Intercrops:** Groundnut, Hebbal Avare, Cluster Bean, Coriander **Vegetables:** Tomato, Capsicum, Green Chillies, French bean, Bhendi, Vegetable Cowpea, Cucurbits **Flower crops:** Marigold, Gaillardia,	-do-
6	HNHhB1g1 HNHiA1g1	**Harave**:19,22,23,24,25,579 **Kethanapura**:13,14,17,18,20,21,24,52,95,96,100,101 **Mukkadahalli**:223,224,225,226,227,228,229,230,231,419	Ragi, Maize, Sorghum, Cotton	Ber, Aonla **Vegetables:** Bhendi, Cluster Bean **Flower crops:** Marigold, Gaillardia	-do-
7	KGKcB2g1	**Kethanapura**:7,8,11,12,56 **Mukkadahalli**: 232,240	Anjan Grass, Marvel Grass, *Styloxantheshamata*	Ber, Noni	----
8	HRVbA1 HRVbA1g1 HRVbB1g1 HRVbB1g2 HRVcB1g2 HRVcB2g3 KGPhB1g1	**Govindawadi**:135 **Harave**:12,13,14,20,21,26,27,28,29,30,33,67,68,69,70,71,72,73,146,147,490,501,502,508,509,549,550,551,552,553,554,555,556,557,558,559,560,561,562,563,578,582 **Kethanapura**:19,22,23,31,97,98,99 **Mukkadahalli**:189,202,211,212,213,214,215,218,219,220,221,222,412,413,414,415,416,417,434,436,437,438,439,440,442,446	Ragi, Groundnut, Maize, Bajra, Horse gram, Castor **Silviculture:** Simaruba, Acacia auriculiformis, Glyricidia, Subabul, Agave, Cassia Sp.	Ber, Fig, Aonla, Bael, Wood Apple	Drip irrigation, mulching, crop suitable conservation practices (crescent bunding with catch pit)

Chapter 8

SOIL HEALTH MANAGEMENT

8.1 Soil Health

Soil is fundamental to crop production. Without soil, no food could be produced nor would livestock be fed on a large scale. Because it is finite and fragile, soil is a precious resource that requires special care from its users.

Soil health or the capacity of the soil to function is critical to human survival. Soil health has been defined as: "the capacity of the soil to function as a living system without adverse effect on the ecosystem". Healthy soils maintain a diverse community of soil organisms that help to form beneficial symbiotic associations with plant roots, recycle essential plant nutrients, improve soil structure with positive repercussions for soil, water and nutrient holding capacity and ultimately improve crop production and also contribute to mitigating climate change by maintaining or increasing its carbon content.

Functional interactions of soil biota with organic and inorganic components, air and water determine a soil's potential to store and release nutrients and water to plants and to promote and sustain plant growth. Thus, maintaining soil health is vital to crop production and conserve soil resource base for sustaining agriculture.

The most important characteristics of a healthy soil are

- Good soil tilth
- Sufficient soil depth
- Good water storage and good drainage
- Adequate supply, but not excess of nutrients
- Large population of beneficial organisms
- Small proportion of plant pathogens and insect pests
- Low weed pressure
- Free of chemicals and toxins that may harm the crop
- Resistance to soil degradation
- Resilience when unfavourable conditions occur

Characteristics of Ketanapura Microwatershed

- The soil phases with sizeable area identified in the microwatershed belonged to the soil series of Harve (HRV) series occupies major area of 156 ha (26%) followed by Lakkur (LKR) 133 ha (22%), Kutegoudanahundi (KGH) 64 ha (11%), Hooradhahalli (HDH) 59 ha (10%), Kanchikere (KKR) 47 ha (8%), Honnenahalli (HNH) 42 ha (7%), Balapur (BPR) 32 ha (5%), Kethanapura (KTP) 16 ha (3%), Gollarahatti (GHT) 12 ha (2%), Kengaki (KGK) 7 ha (1%) and Kaggalipura (KGP) 6 ha (1%).

- As per land capability classification, entire cultivated area falls under both arable and non-arable land category (Class II, III, IV, VII & VIII). The major limitations identified in the arable lands were soil, drainage and erosion.
- An area of about 5 ha (1%) has slightly acid (pH 6.0-6.5) soils, 159 ha (27%) has neutral (pH 6.5-7.3) soils and 411 ha (68%) has slightly alkaline to very strongly alkaline (pH 7.3->9.0) soils in the microwatershed.

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 occurs in an area of about 5 ha (1%) in the microwatershed.

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

Liming materials:

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

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

Neutral soils

Neutral soils occur in an area of about 159 ha (27%) 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 to very strongly alkaline soils cover an area of about 411 ha (68%) 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 $ZnSO_4$ – 12.5 kg/ha (once in three years).

5. Application of Boron – 5kg/ha (once in three years).

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

Soil Degradation

Soil erosion is one of the major factor affecting the soil health in the microwatershed. An area of about 15 ha (3%) is suffering from moderate, gullied and eroded lands. 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 and Radio 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 Plan for each plot or farm.
2. Productivity enhancement measures/ interventions for existing crops/livestock/other farm enterprises.
3. Diversification of farming mainly with perennial horticultural crops and livestock.
4. Improving livelihood opportunities and income generating activities.

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

- **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 highly suitable for crops like groundnut and 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 may be adopted.

- **Gravelliness:** More gravel content is favourable 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 Ketanapura microwatershed.
- **Organic Carbon:** The OC content is low (<0.5%) in an area of about 360 ha (60%) and medium (0.5-0.75%) in 214 ha (36%) area of the microwatershed. The areas that are low and medium in OC needs to be further improved by applying farmyard manure and rotating crops with cereals and legumes or mixed cropping.
- **Promoting green manuring:** Growing of green manuring crops costs Rs. 1250/ha (green manuring seeds) and about Rs. 2000/ha towards cultivation that totals to Rs. 3250/- per ha. On the other hand, application of organic manure @ 10 tons/ha costs Rs. 5000/ha. The practice needs to be continued for 2-3 years or more. Nitrogen fertilizer needs to be supplemented by 25% in addition to the recommended level in 574 ha (96%) 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**: An area of about 8 ha (1%) is low (<23 kg/ha), 57 ha (9%) is medium (23-57 kg/ha) and 509 ha (85%) is 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 72 ha (12%), medium (145-337 kg/ha) in 106 ha (18%) area and high (>337 kg/ha) in 396 ha (66%) 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 high (>20 ppm) in 157 ha (26%) area, medium (10-20ppm) in 417 ha (70%) area and low (<10 ppm) in <1 ha (<1%) 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:** Available Boron is medium (0.5-1.0 ppm) in an area of about 91 ha (15%) and high (>1.0 ppm) in 483 ha (81%) area of the microwatershed. These low and medium areas need to be applied with sodium borate @ 10kg/ha as soil application or 0.2% borax as foliar spray to correct the deficiency.

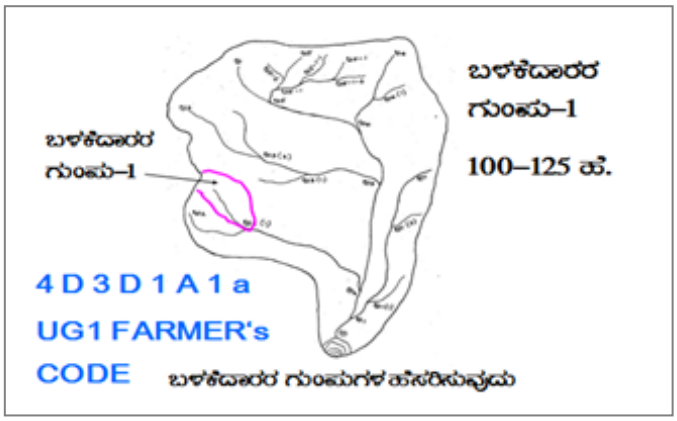
- **Available Iron:** Available Iron content is deficient (<4.5 ppm) in an area of about 329 ha (55%) and sufficient (>4.5 ppm) in 256 ha (43%) area of the microwatershed. To manage iron deficiency, iron sulphate @ 25kg /ha needs to be applied for 2-3 years.
- **Available Manganese:** Entire cultivated 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 deficient (<0.6 ppm) in an area of about 184 ha (31%) and sufficient (>0.6 ppm) in 390 ha (65%) area of the microwatershed. Application of zinc sulphate @ 25kg/ha is to be applied to correct the deficiency.
- **Soil alkalinity:** An area of about 411 ha (68%) microwatershed has soils that are slightly alkaline to very strongly alkaline (pH 7.3->9.0). 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, subsurface drainage and growing of salt tolerant crops like Casuarina, Acasia, Neem, Ber etc, are recommended.
- **Land Suitability for various crops:** Areas that are highly, moderately and marginally suitable for growing various crops are indicated. Along with the suitability, various constraints that are limiting the productivity are also indicated. For example, in case of cotton, gravel content, rooting depth and salinity/alkalinity are the major constraints in various plots. With suitable management interventions, the productivity can be enhanced. In order to increase water holding capacity of light textured soils, growing of green manure crops and application of organic manure is recommended.

Chapter 9

SOIL AND WATER CONSERVATION TREATMENT PLAN

For preparing soil and water conservation treatment plan for Ketanapura microwatershed, the land resource inventory database generated under Sujala-III project has been transformed as information through series of interpretative (thematic) maps using soil phase map as a base. The various thematic maps (1:7920 scale) generated were

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



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

Steps for Survey and Preparation of Treatment Plan

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

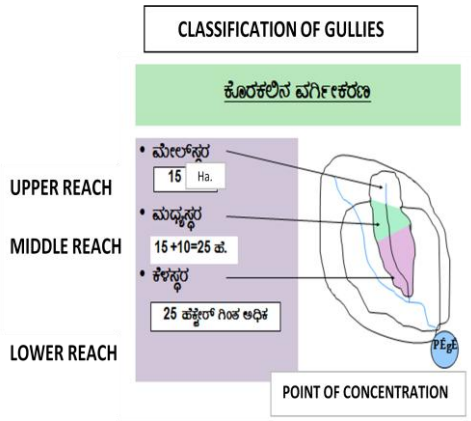
- Naming of user groups and farmers
- Identification of arable and non arable lands
- Identification of drainage lines and gullies
- Identification of non treatable areas
- Identification of priority areas in the arable lands
- Treatment plan for arable lands
- Location of water harvesting and recharge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

9.1 Treatment Plan

The treatment plan recommended for arable lands is briefly described below

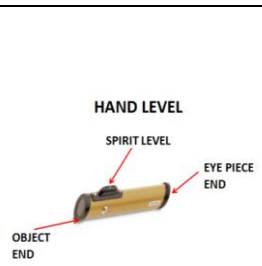
9.1.1 Arable Land Treatment

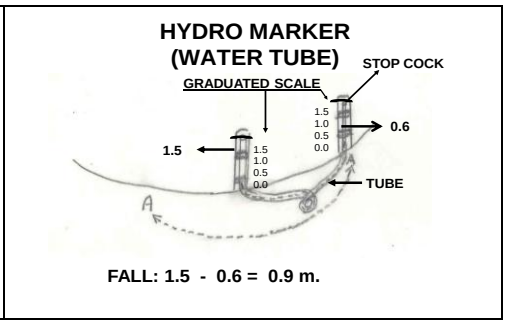
A. BUNDING

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

Measurement of Land Slope

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





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

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

Note: (i) The above intervals are maximum.

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

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

Section of the Bund

Bund section is decided considering the soil texture class and gravelliness class (bg_0...b= loamy sand, g0=<15% gravel). The recommended Sections for different soils are given below.

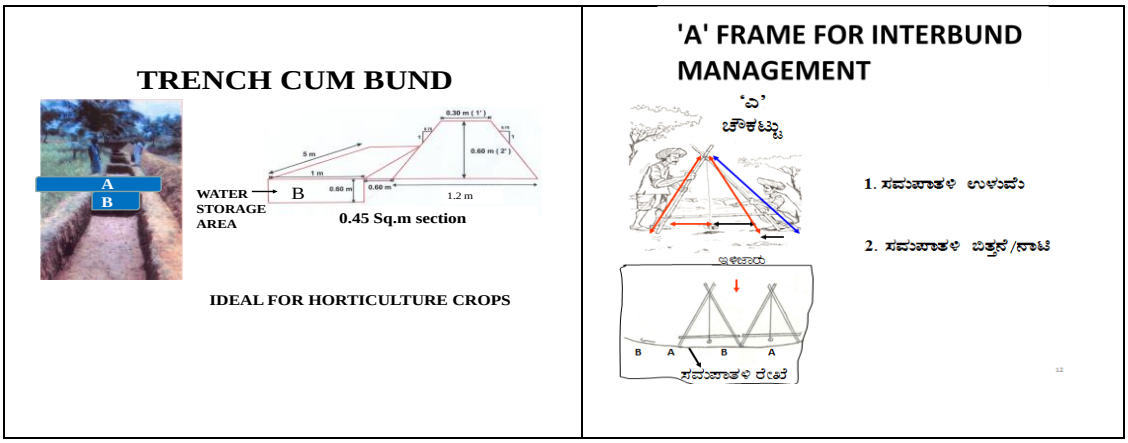
Recommended Bund Section

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

Formation of Trench cum Bund

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

Details of Borrow Pit dimensions are given below



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

Bund section	Bund length	Earth quantity	Pit				Berm (pit to pit)	Soil depth class
m^2	m	m^3	L(m)	W(m)	D(m)	QUANTITY (m^3)	m	
0.375	6	2.25	5.85	0.85	0.45	2.24	0.15	Shallow
0.45	6	2.7	5.4	1.2	0.43	2.79	0.6	Shallow
0.45	6	2.7	5	0.85	0.65	2.76	1	Moderately Shallow
0.54	5.6	3.02	5.5	0.85	0.7	3.27	0.1	Moderately shallow
0.54	5.5	2.97	5	1.2	0.5	3	0.5	Shallow
0.72	6.2	4.46	6	1.2	0.7	5.04	0.2	Moderately shallow
0.72	5.2	3.74	5.1	0.85	0.9	3.9	0.1	Moderately deep

B. Waterways

- Existing water ways are marked on the cadastral map (1:7920 scale) and their dimensions are recorded.
- Considering the contour plan of the MWS, additional waterways/ modernization of the existing ones can be thought of.
- 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 Bunds are formed in the field.

9.1.3 Treatment of Natural Water Course/ Drainage Lines

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

9.2 Recommended Soil and Water Conservation Measures

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

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

A map (Fig. 9.1) showing soil and water conservation plan with different kinds of structures recommended has been generated which shows the spatial distribution and extent of area. An area of about 280 ha (47%) needs TCB/strengthening of bunds, an area of about 287 ha (48%) needs trench cum bunding and 7 ha (1%) needs soil reclamation for alkaline soils.

The conservation plan generated 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.

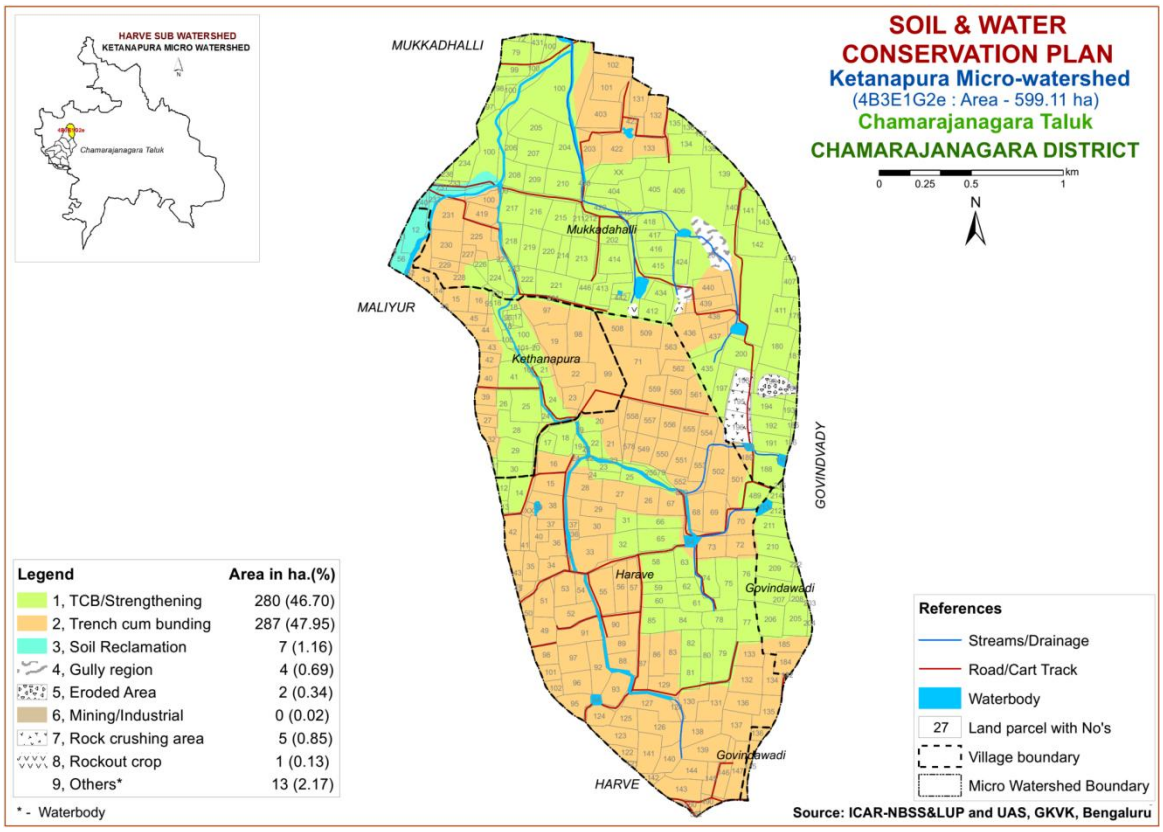


Fig. 9.1 Soil and Water Conservation Plan of Ketanapura Microwatershed

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

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

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

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Appendix I

Kethanapura (1G2e) Microwatershed

Soil Phase Information

Village	Survey Number	Area (ha)	Soil Phase	LMU	Surface Soil Texture	Soil Gravelliness	Soil Depth	Slope	Soil Erosion	Current Land Use	WELLS	Land Capability	Conservation Plan
Govindawadi	135	1.05	KGPhB1g1	LMU-8	Sandy clay loam	Gravelly (15-35%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Slight	Current fallow land(CFl)	Not Available	IIIs	Trench cum bunding
Govindawadi	136	0.63	BPRcB1g2	LMU-1	Sandy loam	Very gravelly (35-60%)	Deep (100-150 cm)	Very gently sloping (1-3%)	Slight	Current fallow land(CFl)	Not Available	IIs	Trench cum bunding
Govindawadi	182	0.04	BPRcB1g2	LMU-1	Sandy loam	Very gravelly (35-60%)	Deep (100-150 cm)	Very gently sloping (1-3%)	Slight	NA	Not Available	IIs	Trench cum bunding
Govindawadi	184	1.43	BPRcB1g2	LMU-1	Sandy loam	Very gravelly (35-60%)	Deep (100-150 cm)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	IIs	Trench cum bunding
Govindawadi	185	2.23	BPRcB1g2	LMU-1	Sandy loam	Very gravelly (35-60%)	Deep (100-150 cm)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	IIs	Trench cum bunding
Govindawadi	203	0	KTPcA1g1	LMU-4	Sandy loam	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	NA	Not Available	IIs	TCB/Strengthening
Govindawadi	204	0.36	KTPcA1g1	LMU-4	Sandy loam	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	Jowar+Coconut (Jw+Cn)	Not Available	IIs	TCB/Strengthening
Govindawadi	205	2.34	KTPcA1g1	LMU-4	Sandy loam	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	Jowar+Coconut (Jw+Cn)	Not Available	IIs	TCB/Strengthening
Govindawadi	206	2.54	KTPcA1g1	LMU-4	Sandy loam	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	Jowar+Horsegramm (Jw+Hg)	Not Available	IIs	TCB/Strengthening
Govindawadi	207	2.56	KTPcA1g1	LMU-4	Sandy loam	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	Jowar+Current fallow land (Jw+CFl)	Not Available	IIs	TCB/Strengthening
Govindawadi	208	1.14	KTPcA1g1	LMU-4	Sandy loam	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	Coconut+Greengramm(Cn+Gg)	Not Available	IIs	TCB/Strengthening
Govindawadi	209	2.29	KTPcA1g1	LMU-4	Sandy loam	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	Current fallow land(CFl)	Not Available	IIs	TCB/Strengthening
Govindawadi	210	2.42	KTPcA1g1	LMU-4	Sandy loam	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	Castaroil (Ca)	Not Available	IIs	TCB/Strengthening
Govindawadi	211	1.85	KTPcA1g1	LMU-4	Sandy loam	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	Current fallow land(CFl)	Not Available	IIs	TCB/Strengthening
Govindawadi	212	0.63	KTPcA1g1	LMU-4	Sandy loam	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	Jowar(Jw)	Not Available	IIs	TCB/Strengthening
Govindawadi	213	0.47	Waterbody	Others	Others	Others	Others	Others	Others	Water body	Not Available	Others	Others
Govindawadi	214	0.58	KTPcA1g1	LMU-4	Sandy loam	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	Current fallow land(CFl)	Not Available	IIs	TCB/Strengthening
Govindawadi	215	0.14	KTPcA1g1	LMU-4	Sandy loam	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	Current fallow land(CFl)	Not Available	IIs	TCB/Strengthening
Govindawadi	222	0.04	KTPcA1g1	LMU-4	Sandy loam	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	NA	Not Available	IIs	TCB/Strengthening
Kethanapura	7	0.04	KGKcB2g1	LMU-7	Sandy loam	Gravelly (15-35%)	Very deep (>150 cm)	Very gently sloping (1-3%)	Moderate	NA	Not Available	IVsw	Soil Reclamation
Kethanapura	8	0.04	KGKcB2g1	LMU-7	Sandy loam	Gravelly (15-35%)	Very deep (>150 cm)	Very gently sloping (1-3%)	Moderate	NA	Not Available	IVsw	Soil Reclamation
Kethanapura	11	0.08	KGKcB2g1	LMU-7	Sandy loam	Gravelly (15-35%)	Very deep (>150 cm)	Very gently sloping (1-3%)	Moderate	NA	Not Available	IVsw	Soil Reclamation

Village	Survey Number	Area (ha)	Soil Phase	LMU	Surface Soil Texture	Soil Gravelliness	Soil Depth	Slope	Soil Erosion	Current Land Use	WELLS	Land Capability	Conservation Plan
Kethana pura	12	2.17	KGKcB2g1	LMU-7	Sandy loam	Gravelly (15-35%)	Very deep (>150 cm)	Very gently sloping (1-3%)	Moderate	Scrub land+Jowar (Sl+Jw)	1 Bore well	IVsw	Soil Reclamation
Kethana pura	13	1.22	HNHhB1g1	LMU-6	Sandy clay loam	Gravelly (15-35%)	Moderately deep (75-100 cm)	Very gently sloping (1-3%)	Slight	Jowar(Jw)	Not Available	IIIs	Trench cum bunding
Kethana pura	14	0.5	HNHhB1g1	LMU-6	Sandy clay loam	Gravelly (15-35%)	Moderately deep (75-100 cm)	Very gently sloping (1-3%)	Slight	Mustard (Ms)	Not Available	IIIs	Trench cum bunding
Kethana pura	15	1.75	GHTmB1g1	LMU-2	Clay	Gravelly (15-35%)	Moderately deep (75-100 cm)	Very gently sloping (1-3%)	Slight	Mulberry	Not Available	IIs	Trench cum bunding
Kethana pura	16	1.41	GHTmB1g1	LMU-2	Clay	Gravelly (15-35%)	Moderately deep (75-100 cm)	Very gently sloping (1-3%)	Slight	Coconut+Cotton+Jowar(Cn+Ct+Jw)	Not Available	IIs	Trench cum bunding
Kethana pura	17	0.52	HNHiA1g1	LMU-6	Sandy clay	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Current fallow land(CFl)	Not Available	IIIs	TCB/Strengthening
Kethana pura	18	1.36	HNHiA1g1	LMU-6	Sandy clay	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Coconut(Cn)+Water Body	Not Available	IIIs	TCB/Strengthening
Kethana pura	19	2.9	HRVbB1g1	LMU-8	Loamy sand	Gravelly (15-35%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Slight	Coconut+Banana+Redgramm(Cn+Ba+Rg)	Not Available	IIIs	Trench cum bunding
Kethana pura	20	1.13	HNHiA1g1	LMU-6	Sandy clay	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Coconut(Cn)	Not Available	IIIs	TCB/Strengthening
Kethana pura	21	0.78	HNHiA1g1	LMU-6	Sandy clay	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Cotton+Scrubland (Ct+Sl)	Not Available	IIIs	TCB/Strengthening
Kethana pura	22	2.7	HRVbB1g1	LMU-8	Loamy sand	Gravelly (15-35%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Slight	Coconut+Mango+Jowar(Cn+Jw+Mn)	1 Open well	IIIs	Trench cum bunding
Kethana pura	23	1.3	HRVbB1g1	LMU-8	Loamy sand	Gravelly (15-35%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Slight	Coconut+Jowar(Cn+Jw)	Not Available	IIIs	Trench cum bunding
Kethana pura	24	2.89	HNHiA1g1	LMU-6	Sandy clay	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight		Not Available	IIIs	TCB/Strengthening
Kethana pura	25	2.84	HDHcA1	LMU-3	Sandy loam	Non gravelly (<15%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Coconut+Mulberry(Cn+Mu)	Not Available	IIIs	TCB/Strengthening
Kethana pura	26	1.45	HDHcA1	LMU-3	Sandy loam	Non gravelly (<15%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Mulberry+Jowar(Mu+Jw)	Not Available	IIIs	TCB/Strengthening
Kethana pura	27	0.72	GHTbB1g1	LMU-2	Loamy sand	Gravelly (15-35%)	Moderately deep (75-100 cm)	Very gently sloping (1-3%)	Slight	Jowar(Jw)	Not Available	IIs	Trench cum bunding
Kethana pura	28	2.59	HDHcA1	LMU-3	Sandy loam	Non gravelly (<15%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Mulberry+Horsegramm+Tomoto+Coconut(Mu+Hg+Tm+Cn)	1 Bore well	IIIs	TCB/Strengthening
Kethana pura	29	2.28	HDHcA1	LMU-3	Sandy loam	Non gravelly (<15%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Watermelon+Turmeric(Wm+Tu)	Not Available	IIIs	TCB/Strengthening
Kethana pura	30	1.59	HDHcA1	LMU-3	Sandy loam	Non gravelly (<15%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Current fallow land+Jowar(CFl+Jw)	Not Available	IIIs	TCB/Strengthening
Kethana pura	31	0.2	HRVbA1	LMU-8	Loamy sand	Non gravelly (<15%)	Shallow (25-50 cm)	Nearly level (0-1%)	Slight	Current fallow land(CFl)	Not Available	IIIs	TCB/Strengthening
Kethana pura	32	1.02	GHTbB1g1	LMU-2	Loamy sand	Gravelly (15-35%)	Moderately deep (75-100 cm)	Very gently sloping (1-3%)	Slight	Current Fallow land+Mulberry(CFl+Mu)	Not Available	IIs	Trench cum bunding
Kethana pura	39	1.03	GHTbB1g1	LMU-2	Loamy sand	Gravelly (15-35%)	Moderately deep (75-100 cm)	Very gently sloping (1-3%)	Slight	Mulberry	Not Available	IIs	Trench cum bunding
Kethana pura	40	1.26	GHTbB1g1	LMU-2	Loamy sand	Gravelly (15-35%)	Moderately deep (75-100 cm)	Very gently sloping (1-3%)	Slight	Mulberry(Mu)	Not Available	IIs	Trench cum bunding
Kethana pura	41	2.84	HDHcA1	LMU-3	Sandy loam	Non gravelly (<15%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Coconut(Cn)	2 Open well	IIIs	TCB/Strengthening

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Kethana pura	42	0.88	GHTbB1g1	LMU-2	Loamy sand	Gravelly (15-35%)	Moderately deep (75-100 cm)	Very gently sloping (1-3%)	Slight	Mulberry+Coconut (Mu+Cn)	Not Available	IIs	Trench cum bunding
Kethana pura	43	1.45	GHTbB1g1	LMU-2	Loamy sand	Gravelly (15-35%)	Moderately deep (75-100 cm)	Very gently sloping (1-3%)	Slight	Coconut+Scrubland (Cn+Sl)	1 Bore well	IIs	Trench cum bunding
Kethana pura	44	1.74	GHTbB1g1	LMU-2	Loamy sand	Gravelly (15-35%)	Moderately deep (75-100 cm)	Very gently sloping (1-3%)	Slight	Cowpea+Cotton (Co+Ct)	1 Bore well	IIs	Trench cum bunding
Kethana pura	45	1.1	GHTmB1g1	LMU-2	Clay	Gravelly (15-35%)	Moderately deep (75-100 cm)	Very gently sloping (1-3%)	Slight	Jowar+Cotton+Mulberry (Jw+Ct+Mu)	1 Open well	IIs	Trench cum bunding
Kethana pura	52	0.14	HNHhB1g1	LMU-6	Sandy clay loam	Gravelly (15-35%)	Moderately deep (75-100 cm)	Very gently sloping (1-3%)	Slight	NA	Not Available	IIIs	Trench cum bunding
Kethana pura	56	1.07	KGKcB2g1	LMU-7	Sandy loam	Gravelly (15-35%)	Very deep (>150 cm)	Very gently sloping (1-3%)	Moderate	Scrub land (Sl)	Not Available	IVsw	Soil Reclamation
Kethana pura	95	0.3	HNHiA1g1	LMU-6	Sandy clay	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Water Body	Not Available	IIIs	TCB/Strengthening
Kethana pura	96	0.27	HNHiA1g1	LMU-6	Sandy clay	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Jowar	Not Available	IIIs	TCB/Strengthening
Kethana pura	97	3.34	HRVbB1g1	LMU-8	Loamy sand	Gravelly (15-35%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Slight	Current fallow land+Jowar(CFl+Jw)	Not Available	IIIs	Trench cum bunding
Kethana pura	98	3.56	HRVbB1g1	LMU-8	Loamy sand	Gravelly (15-35%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Slight	Scrub land+Tomoto+currentfallowland (Sl+Tm+CFl)	Not Available	IIIs	Trench cum bunding
Kethana pura	99	7.28	HRVbB1g1	LMU-8	Loamy sand	Gravelly (15-35%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Slight	Scrub land+Currentfallowland+Coconut (Sl+CFl+Cn)	Not Available	IIIs	Trench cum bunding
Kethana pura	100	2.18	HNHiA1g1	LMU-6	Sandy clay	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Scrub land (Sl)	Not Available	IIIs	TCB/Strengthening
Kethana pura	101	0.45	HNHiA1g1	LMU-6	Sandy clay	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Water Body	Not Available	IIIs	TCB/Strengthening
Mukkadahalli	72	0.37	KKRhA1g1	LMU-5	Sandy clay loam	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Banana (Ba)	Not Available	IIIs	TCB/Strengthening
Mukkadahalli	79	1.94	KKRhA1g1	LMU-5	Sandy clay loam	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Current fallow land	Not Available	IIIs	TCB/Strengthening
Mukkadahalli	97	0.64	KKRhA1g1	LMU-5	Sandy clay loam	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Current fallow land(CFl)	Not Available	IIIs	TCB/Strengthening
Mukkadahalli	98	1.32	KKRhA1g1	LMU-5	Sandy clay loam	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Jowar+Coconut(J+Cn)	Not Available	IIIs	TCB/Strengthening
Mukkadahalli	99	1.16	KKRhA1g1	LMU-5	Sandy clay loam	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Fallow land+Coconut(Fl+Cn)	1 Bore well	IIIs	TCB/Strengthening
Mukkadahalli	100	19.12	KKRhA1g1	LMU-5	Sandy clay loam	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Coconut+Scrub land+Horsegram(Cn+Sl+Hg)	2 Open well	IIIs	TCB/Strengthening
Mukkadahalli	101	2.42	KGHcB1g1	LMU-4	Sandy loam	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Jowar(Jw)	2 Bore well	IIs	Trench cum bunding
Mukkadahalli	102	2.31	KGHcB1g1	LMU-4	Sandy loam	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Jowar(Jw)	Not Available	IIs	Trench cum bunding
Mukkadahalli	131	1.8	KGHbB2g2	LMU-4	Loamy sand	Very gravelly (35-60%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Moderate	Jowar(Jw)	1 Tank	IIes	Trench cum bunding
Mukkadahalli	132	2.41	KGHbB2g2	LMU-4	Loamy sand	Very gravelly (35-60%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Moderate	Jowar+Current fallow land(Jw+Cfl	Not Available	IIes	Trench cum bunding

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Mukkadahalli	133	1.95	KGHbB2g2	LMU-4	Loamy sand	Very gravelly (35-60%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Moderate	Jowar+Redgramm(Jw+Rg)	Not Available	IIes	Trench cum bunding
Mukkadahalli	134	2.14	KGHbA1g1	LMU-4	Loamy sand	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	Jowar+Cotton+CurrentFallow land+Cotton (Jw+Ct+CFl)	Not Available	IIs	TCB/Strengthening
Mukkadahalli	135	1.01	KGHbA1g1	LMU-4	Loamy sand	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	Jowar+Current fallow land(Jw+Cfl	Not Available	IIs	TCB/Strengthening
Mukkadahalli	136	0.46	KGHbA1g1	LMU-4	Loamy sand	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	Current fallow land+Cotton(Cf+Jw)	Not Available	IIs	TCB/Strengthening
Mukkadahalli	137	0	KGHbA1g1	LMU-4	Loamy sand	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	NA	Not Available	IIs	TCB/Strengthening
Mukkadahalli	138	0.57	KGHbA1g1	LMU-4	Loamy sand	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	Jowar(Jw)	Not Available	IIs	TCB/Strengthening
Mukkadahalli	139	2.64	KGHbA1g1	LMU-4	Loamy sand	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	Current fallow land+Ground nut(CFl+GN)	1 Bore well	IIs	TCB/Strengthening
Mukkadahalli	140	1.21	KGHbA1g1	LMU-4	Loamy sand	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	Current fallow land+Horsegramm (CFl+Hg)	Not Available	IIs	TCB/Strengthening
Mukkadahalli	141	2	LKRbA1g1	LMU-4	Loamy sand	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	Jowar+Current fallow land+Turmeric (Jw+CFl+Tu)	Not Available	IIIs	TCB/Strengthening
Mukkadahalli	142	2.92	LKRbA1g1	LMU-4	Loamy sand	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	Jowar+Groundnut+Horsegramm(Jw+Gn+Hg)	Not Available	IIIs	TCB/Strengthening
Mukkadahalli	143	1.23	LKRbA1g1	LMU-4	Loamy sand	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	Current fallow land +Tomoto (CFl+Tm)	1 Bore well	IIIs	TCB/Strengthening
Mukkadahalli	179	0.83	LKRcA1g1	LMU-4	Sandy loam	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	Groundnut (Gn)	Not Available	IIIs	TCB/Strengthening
Mukkadahalli	180	3.57	LKRcA1g1	LMU-4	Sandy loam	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	Tomoto+Current fallow land(Tm+CFl)	1 Bore well	IIIs	TCB/Strengthening
Mukkadahalli	181	1.04	LKRcA1g1	LMU-4	Sandy loam	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	Horsegramm+Groundnut (Hg+Gn)	Not Available	IIIs	TCB/Strengthening
Mukkadahalli	184	0.88	LKRcA1g1	LMU-4	Sandy loam	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	Horsegramm(Hg)	Not Available	IIIs	TCB/Strengthening
Mukkadahalli	185	0.24	LKRcA1g1	LMU-4	Sandy loam	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	Jowar(Jw)	Not Available	IIIs	TCB/Strengthening
Mukkadahalli	186	0.08	LKRcA1g1	LMU-4	Sandy loam	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	Jowar(Jw)	Not Available	IIIs	TCB/Strengthening
Mukkadahalli	187	0.29	Waterbody	Others	Others	Others	Others	Others	Others	Water Body	Not Available	Others	Others
Mukkadahalli	188	2.58	LKRcA1g1	LMU-4	Sandy loam	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	Scrub land+Fallowland (Sl+Fl)	Not Available	IIIs	TCB/Strengthening
Mukkadahalli	189	0.99	HRVcB1g2	LMU-8	Sandy loam	Very gravelly (35-60%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Slight	NA	Not Available	IIIs	Trench cum bunding
Mukkadahalli	190	0.22	Waterbody	Others	Others	Others	Others	Others	Others	Tank	Not Available	Others	Others
Mukkadahalli	191	2.02	LKRcA1g1	LMU-4	Sandy loam	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	Current fallow land+Jowar(CFl+Jw)	Not Available	IIIs	TCB/Strengthening

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Mukkadahalli	192	1.95	LKRcA1g1	LMU-4	Sandy loam	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	Current fallow land+Scrub land(CFl+Sl)	Not Available	IIIs	TCB/Strengthening
Mukkadahalli	193	0.61	LKRcA1g1	LMU-4	Sandy loam	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	Horsegramm(Hg)	Not Available	IIIs	TCB/Strengthening
Mukkadahalli	194	2.06	LKRcA1g1	LMU-4	Sandy loam	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	Horsegramm(Hg)	Not Available	IIIs	TCB/Strengthening
Mukkadahalli	195	1.41	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock Crushing area	Not Available	VIII	Rock crushing area
Mukkadahalli	196	2.44	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock Crushing area	Not Available	VIII	Rock crushing area
Mukkadahalli	197	2.2	LKRbA1g1	LMU-4	Loamy sand	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	Mulberry+Cotton (Mu+Ct)	Not Available	IIIs	TCB/Strengthening
Mukkadahalli	198	1.49	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Not Available	VIII	Rock crushing area
Mukkadahalli	199	2.83	Eroded Area	Eroded Area	Eroded Area	Eroded Area	Eroded Area	Eroded Area	Eroded Area	Horsegramm(Hg)	Not Available	VIIes	Eroded Area
Mukkadahalli	200	2.87	LKRbA1g1	LMU-4	Loamy sand	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	Horsegramm+Redgramm (Hg+Rg)	Not Available	IIIs	TCB/Strengthening
Mukkadahalli	201	35.5	KGHbA1g1	LMU-4	Loamy sand	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	Jowar+Current fallowland+Sl+Tu+Gn+Tm	Not Available	IIs	TCB/Strengthening
Mukkadahalli	202	2.23	HRVbA1g1	LMU-8	Loamy sand	Gravelly (15-35%)	Shallow (25-50 cm)	Nearly level (0-1%)	Slight	Currentfallland+Cotton+Redgramm(CFl+Ct+Rg)	Not Available	IIIs	TCB/Strengthening
Mukkadahalli	203	2.54	KGHbB2g2	LMU-4	Loamy sand	Very gravelly (35-60%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Moderate	Redgramm+Jowar(Rg+Jw)	Not Available	IIes	Trench cum bunding
Mukkadahalli	204	3.48	KKRhA1g1	LMU-5	Sandy clay loam	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Coconut+Coconut(Cn+Cn)	1 Bore well	IIIs	TCB/Strengthening
Mukkadahalli	205	3.15	KKRhA1g1	LMU-5	Sandy clay loam	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	coconut+Current fallow land (Cn+CFl	Not Available	IIIs	TCB/Strengthening
Mukkadahalli	206	0.8	KKRhA1g1	LMU-5	Sandy clay loam	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Coconut(Cn)	Not Available	IIIs	TCB/Strengthening
Mukkadahalli	207	2.47	KKRhA1g1	LMU-5	Sandy clay loam	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Coconut (Cn)	Not Available	IIIs	TCB/Strengthening
Mukkadahalli	208	1.6	KKRhA1g1	LMU-5	Sandy clay loam	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Fallow Land (Fl)	Not Available	IIIs	TCB/Strengthening
Mukkadahalli	209	1.58	KKRhA1g1	LMU-5	Sandy clay loam	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Coconut (Cn)	Not Available	IIIs	TCB/Strengthening
Mukkadahalli	210	2.73	KKRhA1g1	LMU-5	Sandy clay loam	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Coconut(Cn)	Not Available	IIIs	TCB/Strengthening
Mukkadahalli	211	0.9	HRVbA1g1	LMU-8	Loamy sand	Gravelly (15-35%)	Shallow (25-50 cm)	Nearly level (0-1%)	Slight	Coconut+Amla(Cn+Am)	Not Available	IIIs	TCB/Strengthening
Mukkadahalli	212	0.99	HRVbA1g1	LMU-8	Loamy sand	Gravelly (15-35%)	Shallow (25-50 cm)	Nearly level (0-1%)	Slight	Coconut (Cn)	1 Open well	IIIs	TCB/Strengthening
Mukkadahalli	213	3.16	HRVbA1g1	LMU-8	Loamy sand	Gravelly (15-35%)	Shallow (25-50 cm)	Nearly level (0-1%)	Slight	Cotton+Current fallow land+Ragi (Ct+CFl+Ra)	Not Available	IIIs	TCB/Strengthening

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Mukkadahalli	214	1.21	HRVbA1g1	LMU-8	Loamy sand	Gravelly (15-35%)	Shallow (25-50 cm)	Nearly level (0-1%)	Slight	Horsegramm+Current fallow land (Hg+CFl)	Not Available	IIIs	TCB/Strengthening
Mukkadahalli	215	2.57	HRVbA1g1	LMU-8	Loamy sand	Gravelly (15-35%)	Shallow (25-50 cm)	Nearly level (0-1%)	Slight	Fallow land	1 Open well,1 Bore well	IIIs	TCB/Strengthening
Mukkadahalli	216	2.1	KKRhA1g1	LMU-5	Sandy clay loam	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Current fallow land+Mango+Coconut (CFl+Mn+Cn)	1 Form pond	IIIs	TCB/Strengthening
Mukkadahalli	217	2.22	KKRhA1g1	LMU-5	Sandy clay loam	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Cotton+Current fallow land (Ct+CFl)	1 Bore well	IIIs	TCB/Strengthening
Mukkadahalli	218	1.91	HRVbA1g1	LMU-8	Loamy sand	Gravelly (15-35%)	Shallow (25-50 cm)	Nearly level (0-1%)	Slight	Cotton+Currentfallowland+Ragi(Ct+CFl+Ra)	Not Available	IIIs	TCB/Strengthening
Mukkadahalli	219	2.29	HRVbA1g1	LMU-8	Loamy sand	Gravelly (15-35%)	Shallow (25-50 cm)	Nearly level (0-1%)	Slight	Redgramm+Jowar+Cotton+Ragi(Rg+Jw+Ct+Ra)	Not Available	IIIs	TCB/Strengthening
Mukkadahalli	220	2.27	HRVbA1g1	LMU-8	Loamy sand	Gravelly (15-35%)	Shallow (25-50 cm)	Nearly level (0-1%)	Slight	Current fallow land+Horsegramm+Ragi (CFl+Hg+Ra)	Not Available	IIIs	TCB/Strengthening
Mukkadahalli	221	3.89	HRVbA1g1	LMU-8	Loamy sand	Gravelly (15-35%)	Shallow (25-50 cm)	Nearly level (0-1%)	Slight	CFl+Fallow land+Redgramm (CFl+Fl+Rg)	Not Available	IIIs	TCB/Strengthening
Mukkadahalli	222	1.37	HRVbA1g1	LMU-8	Loamy sand	Gravelly (15-35%)	Shallow (25-50 cm)	Nearly level (0-1%)	Slight	Horsegramm+Cotton (Hg+Ct)	Not Available	IIIs	TCB/Strengthening
Mukkadahalli	223	1.69	HNHiA1g1	LMU-6	Sandy clay	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Scrub land+Coconut (Sl+Cn)	1 Bore well,1 Open well	IIIs	TCB/Strengthening
Mukkadahalli	224	1.55	HNHiA1g1	LMU-6	Sandy clay	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Coconut	Not Available	IIIs	TCB/Strengthening
Mukkadahalli	225	2.68	HNHhB1g1	LMU-6	Sandy clay loam	Gravelly (15-35%)	Moderately deep (75-100 cm)	Very gently sloping (1-3%)	Slight	Scrub land (Sl)	Not Available	IIIs	Trench cum bunding
Mukkadahalli	226	0.92	HNHiA1g1	LMU-6	Sandy clay	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Jowar (Jw)	Not Available	IIIs	TCB/Strengthening
Mukkadahalli	227	0.81	HNHhB1g1	LMU-6	Sandy clay loam	Gravelly (15-35%)	Moderately deep (75-100 cm)	Very gently sloping (1-3%)	Slight	Scrub land (Sl)	Not Available	IIIs	Trench cum bunding
Mukkadahalli	228	2.58	HNHhB1g1	LMU-6	Sandy clay loam	Gravelly (15-35%)	Moderately deep (75-100 cm)	Very gently sloping (1-3%)	Slight	Scrub land (Sl)	Not Available	IIIs	Trench cum bunding
Mukkadahalli	229	0.9	HNHhB1g1	LMU-6	Sandy clay loam	Gravelly (15-35%)	Moderately deep (75-100 cm)	Very gently sloping (1-3%)	Slight	Scrub land (Sl)	Not Available	IIIs	Trench cum bunding
Mukkadahalli	230	2.59	HNHhB1g1	LMU-6	Sandy clay loam	Gravelly (15-35%)	Moderately deep (75-100 cm)	Very gently sloping (1-3%)	Slight	Fallow land+Jowar+Redgramm(Fl+Jw+Rg)	Not Available	IIIs	Trench cum bunding
Mukkadahalli	231	3.68	HNHhB1g1	LMU-6	Sandy clay loam	Gravelly (15-35%)	Moderately deep (75-100 cm)	Very gently sloping (1-3%)	Slight	Coconut+Fallow land (Cn+Fl)	1 Bore well,1 Open well	IIIs	Trench cum bunding
Mukkadahalli	232	0.15	KGKcB2g1	LMU-7	Sandy loam	Gravelly (15-35%)	Very deep (>150 cm)	Very gently sloping (1-3%)	Moderate	Scrub land (Sl)	Not Available	IVsw	Soil Reclamation
Mukkadahalli	233	0.47	KKRhA1g1	LMU-5	Sandy clay loam	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Coconut(Cn)	Not Available	IIIs	TCB/Strengthening
Mukkadahalli	234	1.94	KKRhA1g1	LMU-5	Sandy clay loam	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Current fallow land	Not Available	IIIs	TCB/Strengthening
Mukkadahalli	236	0.46	KKRhA1g1	LMU-5	Sandy clay loam	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Coconut (Cn)	Not Available	IIIs	TCB/Strengthening

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Mukkadahalli	240	0.33	KGKcB2g1	LMU-7	Sandy loam	Gravelly (15-35%)	Very deep (>150 cm)	Very gently sloping (1-3%)	Moderate	Jowar (Jw)	Not Available	IVsw	Soil Reclamation
Mukkadahalli	403	3.57	KGHcB1g1	LMU-4	Sandy loam	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Jowar+Coconut(Jw+Cn)	2 Form pond	IIs	Trench cum bunding
Mukkadahalli	404	3.33	KGHbA1g1	LMU-4	Loamy sand	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	Coconut+Jowar (Cn+Jw)	Not Available	IIs	TCB/Strengthening
Mukkadahalli	405	2.82	KGHbA1g1	LMU-4	Loamy sand	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	Redgramm+Cowpea+Jowar(Rg+Cp+Jw)	Not Available	IIs	TCB/Strengthening
Mukkadahalli	406	2.91	KGHbA1g1	LMU-4	Loamy sand	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	Jowar+Current fallow land(Jw+CFl)	Not Available	IIs	TCB/Strengthening
Mukkadahalli	407	1.5	LKRbA1g1	LMU-4	Loamy sand	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	Cowpea(Cp)	Not Available	IIIs	TCB/Strengthening
Mukkadahalli	410	0	LKRbA1g1	LMU-4	Loamy sand	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	NA	Not Available	IIIs	TCB/Strengthening
Mukkadahalli	411	1.7	LKRcA1g1	LMU-4	Sandy loam	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	Horsegramm (Hg)	Not Available	IIIs	TCB/Strengthening
Mukkadahalli	412	1.51	HRVbA1g1	LMU-8	Loamy sand	Gravelly (15-35%)	Shallow (25-50 cm)	Nearly level (0-1%)	Slight	Jowar+Current fallow land (Jw+CFl)	Not Available	IIIs	TCB/Strengthening
Mukkadahalli	413	1.99	HRVbA1g1	LMU-8	Loamy sand	Gravelly (15-35%)	Shallow (25-50 cm)	Nearly level (0-1%)	Slight	Groundnut+Mulberry+Banana+Cfl (Gn+Mu+Ba+CFl)	1 Bore well	IIIs	TCB/Strengthening
Mukkadahalli	414	2.59	HRVbA1g1	LMU-8	Loamy sand	Gravelly (15-35%)	Shallow (25-50 cm)	Nearly level (0-1%)	Slight	Ragi+Coconut(Ra+Cn)	1 Bore well	IIIs	TCB/Strengthening
Mukkadahalli	415	1.7	HRVbA1g1	LMU-8	Loamy sand	Gravelly (15-35%)	Shallow (25-50 cm)	Nearly level (0-1%)	Slight	Jowar	Not Available	IIIs	TCB/Strengthening
Mukkadahalli	416	1.91	HRVbA1g1	LMU-8	Loamy sand	Gravelly (15-35%)	Shallow (25-50 cm)	Nearly level (0-1%)	Slight	Jowar+Current fallow land (Jw+CFl)	Not Available	IIIs	TCB/Strengthening
Mukkadahalli	417	1.24	HRVbA1g1	LMU-8	Loamy sand	Gravelly (15-35%)	Shallow (25-50 cm)	Nearly level (0-1%)	Slight	Jowar+Current fallow landi (Jw+CFl)	Not Available	IIIs	TCB/Strengthening
Mukkadahalli	418	1.26	KGHbA1g1	LMU-4	Loamy sand	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	Jowar+Current Fallow land (Jw+CFl)	Not Available	IIs	TCB/Strengthening
Mukkadahalli	419	1.56	HNHhB1g1	LMU-6	Sandy clay loam	Gravelly (15-35%)	Moderately deep (75-100 cm)	Very gently sloping (1-3%)	Slight	Scrub land (Sl)	1 Open well	IIIs	Trench cum bunding
Mukkadahalli	420	1.97	KGHbA1g1	LMU-4	Loamy sand	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	NA	1 Form pond	IIs	TCB/Strengthening
Mukkadahalli	422	2.79	KGHbB2g2	LMU-4	Loamy sand	Very gravelly (35-60%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Moderate	Jowar(Jw)	Not Available	IIes	Trench cum bunding
Mukkadahalli	423	2.67	KGHbB2g2	LMU-4	Loamy sand	Very gravelly (35-60%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Moderate	NA	Not Available	IIes	Trench cum bunding
Mukkadahalli	424	1.81	KGHbA1g1	LMU-4	Loamy sand	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	Jowar+Cotton(Jw+Ct)	Not Available	IIs	TCB/Strengthening
Mukkadahalli	430	0.76	KGHbA1g1	LMU-4	Loamy sand	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	NA	Not Available	IIs	TCB/Strengthening
Mukkadahalli	431	1.09	KKRhA1g1	LMU-5	Sandy clay loam	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Mango+Horse gramm (Mn+Hg)	Not Available	IIIs	TCB/Strengthening
Mukkadahalli	434	1.69	HRVbA1g1	LMU-8	Loamy sand	Gravelly (15-35%)	Shallow (25-50 cm)	Nearly level (0-1%)	Slight	Current fallow land	Not Available	IIIs	TCB/Strengthening
Mukkadahalli	435	2.4	LKRbA1g1	LMU-4	Loamy sand	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	Current fallow land (CFl)	Not Available	IIIs	TCB/Strengthening

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Mukkadahalli	436	3.08	HRVbB1g2	LMU-8	Loamy sand	Very gravelly (35-60%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Slight	Scrub land+Fallow land (Sl+Fl)	Not Available	IIIs	Trench cum bunding
Mukkadahalli	437	1.66	HRVbB1g2	LMU-8	Loamy sand	Very gravelly (35-60%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Slight	Current fallow land(CFl)	Not Available	IIIs	Trench cum bunding
Mukkadahalli	438	1.72	HRVbB1g2	LMU-8	Loamy sand	Very gravelly (35-60%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Slight	Current fallow land(CFl)	Not Available	IIIs	Trench cum bunding
Mukkadahalli	439	1.71	HRVbB1g2	LMU-8	Loamy sand	Very gravelly (35-60%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	IIIs	Trench cum bunding
Mukkadahalli	440	1.68	HRVbB1g2	LMU-8	Loamy sand	Very gravelly (35-60%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Slight	Horsegramm+Redgramm (Hg+Rg)	Not Available	IIIs	Trench cum bunding
Mukkadahalli	442	0.29	HRVbA1g1	LMU-8	Loamy sand	Gravelly (15-35%)	Shallow (25-50 cm)	Nearly level (0-1%)	Slight	Coconut (Cn)	Not Available	IIIs	TCB/Strengthening
Mukkadahalli	445	0.63	KGHbA1g1	LMU-4	Loamy sand	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	NA	Not Available	IIs	TCB/Strengthening
Mukkadahalli	446	2.06	HRVbA1g1	LMU-8	Loamy sand	Gravelly (15-35%)	Shallow (25-50 cm)	Nearly level (0-1%)	Slight	Current fallow land(CFl)	Not Available	IIIs	TCB/Strengthening
Harave	12	0.75	HRVbA1	LMU-8	Loamy sand	Non gravelly (<15%)	Shallow (25-50 cm)	Nearly level (0-1%)	Slight	Jowar(Jw)	Not Available	IIIs	TCB/Strengthening
Harave	13	0.25	HRVbA1	LMU-8	Loamy sand	Non gravelly (<15%)	Shallow (25-50 cm)	Nearly level (0-1%)	Slight	Current fallow land(CFl)	Not Available	IIIs	TCB/Strengthening
Harave	14	2.25	HRVbA1	LMU-8	Loamy sand	Non gravelly (<15%)	Shallow (25-50 cm)	Nearly level (0-1%)	Slight	Current fallow land+Horsegramm(CFl+Hg)	Not Available	IIIs	TCB/Strengthening
Harave	15	1.89	LKRbB1g1	LMU-4	Loamy sand	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Coconut+Tomoto+Banana+Coconut(Cn+Tm+Ba+Cn)	1 Bore well	IIIs	Trench cum bunding
Harave	16	1.94	LKRbB1g1	LMU-4	Loamy sand	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Cotton+Horsegramm(Ct+Hg)	Not Available	IIIs	Trench cum bunding
Harave	17	0.87	HDHcA1	LMU-3	Sandy loam	Non gravelly (<15%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Current fallow land(CFl)	Not Available	IIIs	TCB/Strengthening
Harave	18	1.9	HDHcA1	LMU-3	Sandy loam	Non gravelly (<15%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Scrub land+Coconut(Sl+Cn)	1 Bore well	IIIs	TCB/Strengthening
Harave	19	0.6	HNHiA1g1	LMU-6	Sandy clay	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Coconut(Cn)	1 Bore well	IIIs	TCB/Strengthening
Harave	20	2.07	HRVbB1g1	LMU-8	Loamy sand	Gravelly (15-35%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Slight	Scrub land+Coconut(Sl+Cn)	Not Available	IIIs	Trench cum bunding
Harave	21	1.73	HRVbB1g1	LMU-8	Loamy sand	Gravelly (15-35%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Slight	Horsegramm+Jowar(Hg+Jw)	1 Open well	IIIs	Trench cum bunding
Harave	22	1.18	HNHiA1g1	LMU-6	Sandy clay	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Scrub land (Sl)	Not Available	IIIs	TCB/Strengthening
Harave	23	0.95	HNHiA1g1	LMU-6	Sandy clay	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Scrub land	Not Available	IIIs	TCB/Strengthening
Harave	24	1.53	HNHiA1g1	LMU-6	Sandy clay	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Coconut+Scrub land(Cn+Sl)	2 Bore well	IIIs	TCB/Strengthening
Harave	25	1.89	HNHiA1g1	LMU-6	Sandy clay	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Scrub land	Not Available	IIIs	TCB/Strengthening
Harave	26	1.7	HRVcB1g2	LMU-8	Sandy loam	Very gravelly (35-60%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Slight	Mulberry(Mu)	Not Available	IIIs	Trench cum bunding

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Harave	27	2.69	HRVcB1g2	LMU-8	Sandy loam	Very gravelly (35-60%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Slight	Coconut+Jowar(Cn+Jw)	Not Available	IIIs	Trench cum bunding
Harave	28	2.33	HRVcB1g2	LMU-8	Sandy loam	Very gravelly (35-60%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Slight	Mulberry+Horsegramm+ Tomoto+Coconut(Mu+Hg +Tm+Cn)	Not Available	IIIs	Trench cum bunding
Harave	29	1.64	HRVcB1g2	LMU-8	Sandy loam	Very gravelly (35-60%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Slight	Tomoto+Mulberry(Tm+ Mu)	Not Available	IIIs	Trench cum bunding
Harave	30	2.81	HRVcB1g2	LMU-8	Sandy loam	Very gravelly (35-60%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Slight	Watermelon+Turmeric+ Current fallow land(Wm+Tu+CFl)	1 Open well	IIIs	Trench cum bunding
Harave	31	1.34	HDHcA1g1	LMU-3	Sandy loam	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Current fallow land+Mulberry(CFl+Mu)	Not Available	IIIs	TCB/Strengthening
Harave	32	2.26	HDHcA1g1	LMU-3	Sandy loam	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Current fallow land+Mulberry(CFl+Mu)	Not Available	IIIs	TCB/Strengthening
Harave	33	3.38	HRVcB1g2	LMU-8	Sandy loam	Very gravelly (35-60%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Slight	Cotton+Current fallow land(Ct+CFl)	1 Open well	IIIs	Trench cum bunding
Harave	34	1.62	LKRbB1g1	LMU-4	Loamy sand	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Coconut+Mulberry(Cn+Mu)	Not Available	IIIs	Trench cum bunding
Harave	35	1.35	LKRbB1g1	LMU-4	Loamy sand	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Mulberry+Redgramm(Mu+Rg)	Not Available	IIIs	Trench cum bunding
Harave	36	2.19	LKRbB1g1	LMU-4	Loamy sand	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Coconut+Cotton+Jowar(Cn+Ct+Jw)	Not Available	IIIs	Trench cum bunding
Harave	37	1.16	LKRbB1g1	LMU-4	Loamy sand	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Cotton+Coconut(Ct+Cn)	1 Bore well	IIIs	Trench cum bunding
Harave	38	2.22	LKRbB1g1	LMU-4	Loamy sand	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Coconut+Cotton(Cn+Ct)	1 Bore well	IIIs	Trench cum bunding
Harave	39	0.2	Waterbody	Others	Others	Others	Others	Others	Others	Water body	Not Available	Others	Others
Harave	40	1.22	LKRbB1g1	LMU-4	Loamy sand	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Current fallow land(CFl)	Not Available	IIIs	Trench cum bunding
Harave	41	0.8	LKRbB1g1	LMU-4	Loamy sand	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Current fallow land(CFl)	Not Available	IIIs	Trench cum bunding
Harave	42	1.73	LKRbB1g2	LMU-4	Loamy sand	Very gravelly (35-60%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Current fallow land(CFl)	Not Available	IIIes	Trench cum bunding
Harave	43	1.78	LKRbB1g2	LMU-4	Loamy sand	Very gravelly (35-60%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Mulberry(Mu)	Not Available	IIIes	Trench cum bunding
Harave	45	0.11	LKRbB1g2	LMU-4	Loamy sand	Very gravelly (35-60%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Mulberry(Mu)	Not Available	IIIes	Trench cum bunding
Harave	49	2.04	LKRbB1g1	LMU-4	Loamy sand	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Jowar+Current fallow land(Jw+CFl)	Not Available	IIIs	Trench cum bunding
Harave	50	0.93	LKRbB1g2	LMU-4	Loamy sand	Very gravelly (35-60%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Current fallow land(CFl)	Not Available	IIIes	Trench cum bunding
Harave	51	1.88	LKRbB1g1	LMU-4	Loamy sand	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Current fallow land(CFl)	Not Available	IIIs	Trench cum bunding
Harave	52	2.24	LKRbB1g1	LMU-4	Loamy sand	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Jowar+Coconut (Jw+Cn)	1 Bore well	IIIs	Trench cum bunding
Harave	53	1.99	LKRbB1g1	LMU-4	Loamy sand	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Jowar+Scrub land (Jw+Sl)	Not Available	IIIs	Trench cum bunding

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Harave	54	0.97	LKRbB1g1	LMU-4	Loamy sand	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Scrub land	Not Available	IIIs	Trench cum bunding
Harave	55	2.88	LKRbB1g2	LMU-4	Loamy sand	Very gravelly (35-60%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Coconut+Coconut+Jowar (Cn+Cn+Jw)	Not Available	IIIes	Trench cum bunding
Harave	56	1.99	LKRbB1g2	LMU-4	Loamy sand	Very gravelly (35-60%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Coconut	Not Available	IIIes	Trench cum bunding
Harave	57	1.84	LKRbB1g2	LMU-4	Loamy sand	Very gravelly (35-60%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Coconut+Current fallow land(Cn+CFl)	1 Bore well	IIIes	Trench cum bunding
Harave	58	3.02	HDHcA1g1	LMU-3	Sandy loam	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Coconut+Jowar	1 Bore well	IIIs	TCB/Strengthening
Harave	59	1.26	HDHcA1g1	LMU-3	Sandy loam	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Current fallow land(CFl)	Not Available	IIIs	TCB/Strengthening
Harave	60	1.59	HDHcA1g1	LMU-3	Sandy loam	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Jowar(Jw)	Not Available	IIIs	TCB/Strengthening
Harave	61	1.61	HDHcA1g1	LMU-3	Sandy loam	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Current fallow land(CFl)	Not Available	IIIs	TCB/Strengthening
Harave	62	1.12	HDHcA1g1	LMU-3	Sandy loam	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Current fallow land(CFl)	Not Available	IIIs	TCB/Strengthening
Harave	63	1.73	HDHcA1g1	LMU-3	Sandy loam	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Jowar	Not Available	IIIs	TCB/Strengthening
Harave	64	0.47	Waterbody	Others	Others	Others	Others	Others	Others	Water Body	Not Available	Others	Others
Harave	65	2.72	HDHcA1g1	LMU-3	Sandy loam	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Mulberry+Current fallow land+Jowar(Mu+CFl+Jw)	Not Available	IIIs	TCB/Strengthening
Harave	66	1.87	HDHcA1g1	LMU-3	Sandy loam	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Jowar+Tomoto+Coconut(Jw+Tm+Cn)	1 Bore well	IIIs	TCB/Strengthening
Harave	67	1.71	HRVcB1g2	LMU-8	Sandy loam	Very gravelly (35-60%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Slight	Coconut+Cotton(Cn+Ct)	Not Available	IIIs	Trench cum bunding
Harave	68	1.51	HRVcB1g2	LMU-8	Sandy loam	Very gravelly (35-60%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Slight	Cotton+Jowar (Ct+Jw)	Not Available	IIIs	Trench cum bunding
Harave	69	2.59	HRVcB1g2	LMU-8	Sandy loam	Very gravelly (35-60%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Slight	Cotton+Jowar+Coconut (Ct+Jw+Cn)	Not Available	IIIs	Trench cum bunding
Harave	70	2.01	HRVcB1g2	LMU-8	Sandy loam	Very gravelly (35-60%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Slight	Jowar(Jw)	Not Available	IIIs	Trench cum bunding
Harave	71	7.8	HRVbB1g1	LMU-8	Loamy sand	Gravelly (15-35%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Slight	Scrub land+Current fallow land (Sl+CFl+Sl)	1 Open well	IIIs	Trench cum bunding
Harave	72	1.8	HRVcB1g2	LMU-8	Sandy loam	Very gravelly (35-60%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Slight	Jowar+Horsegramm (Jw+Hg)	Not Available	IIIs	Trench cum bunding
Harave	73	1.86	HRVcB1g2	LMU-8	Sandy loam	Very gravelly (35-60%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Slight	Jowar	Not Available	IIIs	Trench cum bunding
Harave	74	2.34	HDHcA1g1	LMU-3	Sandy loam	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Current fallow land(CFl)	Not Available	IIIs	TCB/Strengthening
Harave	75	3.29	HDHcA1g1	LMU-3	Sandy loam	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Current fallow land(CFl)	Not Available	IIIs	TCB/Strengthening
Harave	76	2.37	HDHcA1g1	LMU-3	Sandy loam	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Jowar(Jw)	Not Available	IIIs	TCB/Strengthening
Harave	77	2.51	BPRbA1g1	LMU-1	Loamy sand	Gravelly (15-35%)	Deep (100-150 cm)	Nearly level (0-1%)	Slight	Current fallow land(CFl)	Not Available	IIs	TCB/Strengthening

Village	Survey Number	Area (ha)	Soil Phase	LMU	Surface Soil Texture	Soil Gravelliness	Soil Depth	Slope	Soil Erosion	Current Land Use	WELLS	Land Capability	Conservation Plan
Harave	78	1.88	BPRbA1g1	LMU-1	Loamy sand	Gravelly (15-35%)	Deep (100-150 cm)	Nearly level (0-1%)	Slight	Cowpea(Cp)	Not Available	IIs	TCB/Strengthening
Harave	79	3.08	BPRbA1g1	LMU-1	Loamy sand	Gravelly (15-35%)	Deep (100-150 cm)	Nearly level (0-1%)	Slight	Jowar (Jw)	Not Available	IIs	TCB/Strengthening
Harave	80	1.85	BPRbA1g1	LMU-1	Loamy sand	Gravelly (15-35%)	Deep (100-150 cm)	Nearly level (0-1%)	Slight	Jowar+Horsegramm (Jw+Hg)	Not Available	IIs	TCB/Strengthening
Harave	81	1.93	BPRbA1g1	LMU-1	Loamy sand	Gravelly (15-35%)	Deep (100-150 cm)	Nearly level (0-1%)	Slight	Horsegramm(Hg)	Not Available	IIs	TCB/Strengthening
Harave	82	1.54	BPRbA1g1	LMU-1	Loamy sand	Gravelly (15-35%)	Deep (100-150 cm)	Nearly level (0-1%)	Slight	Horsegramm(Hg)	Not Available	IIs	TCB/Strengthening
Harave	83	2.13	LKRbB1g2	LMU-4	Loamy sand	Very gravelly (35-60%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Greengramm+Coconut(Gg+Cn)	Not Available	IIIes	Trench cum bunding
Harave	84	2.19	BPRbA1g1	LMU-1	Loamy sand	Gravelly (15-35%)	Deep (100-150 cm)	Nearly level (0-1%)	Slight	Horsegramm(Hg)	Not Available	IIs	TCB/Strengthening
Harave	85	1.93	HDHcA1g1	LMU-3	Sandy loam	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Coconut+Mulberry(Cn+Mu)	Not Available	IIIs	TCB/Strengthening
Harave	86	1.88	LKRbB1g2	LMU-4	Loamy sand	Very gravelly (35-60%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Mulberry(Mu)	Not Available	IIIes	Trench cum bunding
Harave	87	2.2	LKRbB1g2	LMU-4	Loamy sand	Very gravelly (35-60%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Marigold+Tomoto (Mg+Tm)	Not Available	IIIes	Trench cum bunding
Harave	88	1.54	LKRbB1g2	LMU-4	Loamy sand	Very gravelly (35-60%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Turmeric+Coconut(Tu+Cn)	1 Bore well	IIIes	Trench cum bunding
Harave	89	2.25	LKRbB1g2	LMU-4	Loamy sand	Very gravelly (35-60%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	IIIes	Trench cum bunding
Harave	90	1.74	LKRbB1g2	LMU-4	Loamy sand	Very gravelly (35-60%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	IIIes	Trench cum bunding
Harave	91	2.45	LKRbB1g1	LMU-4	Loamy sand	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Coconut+Jowar(Cn+Jw)	Not Available	IIIs	Trench cum bunding
Harave	92	2.53	LKRbB1g1	LMU-4	Loamy sand	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Cotton+Coconut+Jowar(Ct+Cn+Jw)	1 Bore well	IIIs	Trench cum bunding
Harave	93	1.99	LKRbB1g1	LMU-4	Loamy sand	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Mulberry+Jowar	1 Bore well	IIIs	Trench cum bunding
Harave	94	0.33	Waterbody	Others	Others	Others	Others	Others	Others	Water body	Not Available	Others	Others
Harave	95	1.64	LKRbB1g2	LMU-4	Loamy sand	Very gravelly (35-60%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Coconut+Jowar(Cn+Jw)	1 Bore well	IIIes	Trench cum bunding
Harave	96	1.91	LKRbB1g1	LMU-4	Loamy sand	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Coconut+Jowar+Mulberry(Cn+Jw+Mu)	2 Bore well	IIIs	Trench cum bunding
Harave	97	2.41	LKRbB1g1	LMU-4	Loamy sand	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Current fallow land(CFl)	Not Available	IIIs	Trench cum bunding
Harave	98	1.36	LKRbB1g1	LMU-4	Loamy sand	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	IIIs	Trench cum bunding
Harave	101	0.94	LKRbB1g2	LMU-4	Loamy sand	Very gravelly (35-60%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Current fallow land(CFl)	Not Available	IIIes	Trench cum bunding
Harave	102	0.73	LKRbB1g2	LMU-4	Loamy sand	Very gravelly (35-60%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	IIIes	Trench cum bunding
Harave	121	0.15	LKRbB1g2	LMU-4	Loamy sand	Very gravelly (35-60%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Jowar(Jw)	Not Available	IIIes	Trench cum bunding]

Village	Survey Number	Area (ha)	Soil Phase	LMU	Surface Soil Texture	Soil Gravelliness	Soil Depth	Slope	Soil Erosion	Current Land Use	WELLS	Land Capability	Conservation Plan
Harave	122	0.91	LKRbB1g2	LMU-4	Loamy sand	Very gravelly (35-60%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Coconut+Jowar(Cn+Jw)	Not Available	IIIes	Trench cum bunding
Harave	123	2.21	LKRbB1g2	LMU-4	Loamy sand	Very gravelly (35-60%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Jowar+Current fallow land(Jw+CFl)	Not Available	IIIes	Trench cum bunding
Harave	124	1.42	LKRbB1g2	LMU-4	Loamy sand	Very gravelly (35-60%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Mulberry+Coconut(Mu+Cn)	1 Bore well	IIIes	Trench cum bunding
Harave	125	1.44	LKRbB1g2	LMU-4	Loamy sand	Very gravelly (35-60%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Jowar+Mulberry(Jw+Mu)	Not Available	IIIes	Trench cum bunding
Harave	126	2.82	LKRbB1g2	LMU-4	Loamy sand	Very gravelly (35-60%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Jowar+Current fallow land(Jw+CFl)	Not Available	IIIes	Trench cum bunding
Harave	127	2.63	LKRbB1g2	LMU-4	Loamy sand	Very gravelly (35-60%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Jowar+Current fallow land(Jw+CFl)	Not Available	IIIes	Trench cum bunding
Harave	128	0.4	LKRbB1g2	LMU-4	Loamy sand	Very gravelly (35-60%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	NA	Not Available	IIIes	Trench cum bunding
Harave	129	1.88	LKRbB1g2	LMU-4	Loamy sand	Very gravelly (35-60%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Tomoto(Tm)	Not Available	IIIes	Trench cum bunding
Harave	130	2.03	HDHbB1g2	LMU-3	Loamy sand	Very gravelly (35-60%)	Moderately deep (75-100 cm)	Very gently sloping (1-3%)	Slight	Jowar+Redgramm+Current fallow land(Jw+Rg+CFl)	Not Available	IIIs	Trench cum bunding
Harave	131	2.47	HDHbB1g2	LMU-3	Loamy sand	Very gravelly (35-60%)	Moderately deep (75-100 cm)	Very gently sloping (1-3%)	Slight	Current fallow land+Jowar(CFl+Jw)	Not Available	IIIs	Trench cum bunding
Harave	132	2.5	BPRcB1g2	LMU-1	Sandy loam	Very gravelly (35-60%)	Deep (100-150 cm)	Very gently sloping (1-3%)	Slight	Current fallow land+Jowar(CFl+Jw)	Not Available	IIs	Trench cum bunding
Harave	133	2	BPRcB1g2	LMU-1	Sandy loam	Very gravelly (35-60%)	Deep (100-150 cm)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	IIs	Trench cum bunding
Harave	134	1.86	BPRcB1g2	LMU-1	Sandy loam	Very gravelly (35-60%)	Deep (100-150 cm)	Very gently sloping (1-3%)	Slight	Current fallow land+Jowar+Cotton(CFl)	Not Available	IIs	Trench cum bunding
Harave	135	1.95	BPRcB1g2	LMU-1	Sandy loam	Very gravelly (35-60%)	Deep (100-150 cm)	Very gently sloping (1-3%)	Slight	Coconut+Current fallow land(Cn+CFl)	Not Available	IIs	Trench cum bunding
Harave	136	2.08	BPRcB1g2	LMU-1	Sandy loam	Very gravelly (35-60%)	Deep (100-150 cm)	Very gently sloping (1-3%)	Slight	Current fallow land+Cotton(CFl+Ct)	Not Available	IIs	Trench cum bunding
Harave	137	2.33	BPRcB1g2	LMU-1	Sandy loam	Very gravelly (35-60%)	Deep (100-150 cm)	Very gently sloping (1-3%)	Slight	Redgramm+Current fallow land(Rg+CFl)	Not Available	IIs	Trench cum bunding
Harave	138	2.36	HDHbB1g2	LMU-3	Loamy sand	Very gravelly (35-60%)	Moderately deep (75-100 cm)	Very gently sloping (1-3%)	Slight	Current fallow land+Jowar(CFl+Jw)	Not Available	IIIs	Trench cum bunding
Harave	139	2.87	HDHbB1g2	LMU-3	Loamy sand	Very gravelly (35-60%)	Moderately deep (75-100 cm)	Very gently sloping (1-3%)	Slight	Mulberry+Current fallow land(Jw+CFl)	1 Bore well	IIIs	Trench cum bunding
Harave	140	1.65	HDHbB1g2	LMU-3	Loamy sand	Very gravelly (35-60%)	Moderately deep (75-100 cm)	Very gently sloping (1-3%)	Slight	Current fallow land(CFl)	Not Available	IIIs	Trench cum bunding
Harave	141	2.55	LKRbB1g2	LMU-4	Loamy sand	Very gravelly (35-60%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	Jowar+Mulberry+Current fallow land(Jw+Mu+CFl)	1 Bore well	IIIes	Trench cum bunding
Harave	142	0.49	LKRbB1g2	LMU-4	Loamy sand	Very gravelly (35-60%)	Moderately shallow (50-75 cm)	Very gently sloping (1-3%)	Slight	NA	Not Available	IIIes	Trench cum bunding
Harave	143	2.55	HDHbB1g2	LMU-3	Loamy sand	Very gravelly (35-60%)	Moderately deep (75-100 cm)	Very gently sloping (1-3%)	Slight	Tomoto+Coconut+Turmeric(Tm+Cn+Tu)	Not Available	IIIs	Trench cum bunding
Harave	144	1.94	HDHbB1g2	LMU-3	Loamy sand	Very gravelly (35-60%)	Moderately deep (75-100 cm)	Very gently sloping (1-3%)	Slight	Current fallow land+Cotton(CFl+Ct)	Not Available	IIIs	Trench cum bunding
Harave	145	1.02	HDHbB1g2	LMU-3	Loamy sand	Very gravelly (35-60%)	Moderately deep (75-100 cm)	Very gently sloping (1-3%)	Slight	Current fallow land+Mulberry (CFl+Mu)	Not Available	IIIs	Trench cum bunding

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Harave	146	1.85	KGPhB1g1	LMU-8	Sandy clay loam	Gravelly (15-35%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Slight	Mulberry+Redgramm+Cotton(Mu+Rg+Ct)	Not Available	IIIs	Trench cum bunding
Harave	147	2.44	KGPhB1g1	LMU-8	Sandy clay loam	Gravelly (15-35%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Slight	Current fallow land+Cotton(CFl+Ct)	Not Available	IIIs	Trench cum bunding
Harave	160	0.63	HDHbB1g2	LMU-3	Loamy sand	Very gravelly (35-60%)	Moderately deep (75-100 cm)	Very gently sloping (1-3%)	Slight	Current fallow land (CFl)	Not Available	IIIs	Trench cum bunding
Harave	489	1.49	LKRcA1g1	LMU-4	Sandy loam	Gravelly (15-35%)	Moderately shallow (50-75 cm)	Nearly level (0-1%)	Slight	Current fallow land(CFl)	Not Available	IIIs	TCB/Strengthening
Harave	490	0.75	KGPhB1g1	LMU-8	Sandy clay loam	Gravelly (15-35%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Slight	Redgramm(Rg)	Not Available	IIIs	Trench cum bunding
Harave	501	2.94	HRVcB1g2	LMU-8	Sandy loam	Very gravelly (35-60%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Slight	Current fallow land+Jowar(CFl+Jw)	Not Available	IIIs	Trench cum bunding
Harave	502	2.93	HRVcB1g2	LMU-8	Sandy loam	Very gravelly (35-60%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Slight	Current fallow land+Jowar(CFl+Jw)	Not Available	IIIs	Trench cum bunding
Harave	508	2.55	HRVbB1g1	LMU-8	Loamy sand	Gravelly (15-35%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Slight	Cotton+Redgramm+Avarekayi+Cowpea(Ct+Rg+AV+Cp)	Not Available	IIIs	Trench cum bunding
Harave	509	2.53	HRVbB1g1	LMU-8	Loamy sand	Gravelly (15-35%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Slight	Current fallow land(CFl)	Not Available	IIIs	Trench cum bunding
Harave	549	1.68	HRVbB1g1	LMU-8	Loamy sand	Gravelly (15-35%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Slight	Current fallow land+Jowar(CFl+Jw)	Not Available	IIIs	Trench cum bunding
Harave	550	1.71	HRVbB1g1	LMU-8	Loamy sand	Gravelly (15-35%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Slight	Redgramm+Current fallow land (Rg+CFl)	Not Available	IIIs	Trench cum bunding
Harave	551	2.02	HRVcB2g3	LMU-8	Sandy loam	Extremely gravelly (60-80%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Moderate	Cowpea+Current fallow land (Cp+CFl)	Not Available	IIIes	Trench cum bunding
Harave	552	1.27	HRVcB2g3	LMU-8	Sandy loam	Extremely gravelly (60-80%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Moderate	Jowar(Jw)	1 Bore well	IIIes	Trench cum bunding
Harave	553	1.71	HRVcB2g3	LMU-8	Sandy loam	Extremely gravelly (60-80%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Moderate	Jowar+Coconut(Jw+Cn)	Not Available	IIIes	Trench cum bunding
Harave	554	1.69	HRVcB2g3	LMU-8	Sandy loam	Extremely gravelly (60-80%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Moderate	Current fallow land+Jowar(CFl+Jw)	Not Available	IIIes	Trench cum bunding
Harave	555	1.63	HRVcB2g3	LMU-8	Sandy loam	Extremely gravelly (60-80%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Moderate	Current fallow land+Jowar(CFl+Jw)	Not Available	IIIes	Trench cum bunding
Harave	556	1.84	HRVbB1g1	LMU-8	Loamy sand	Gravelly (15-35%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Slight	Current fallow land(CFl)	Not Available	IIIs	Trench cum bunding
Harave	557	1.77	HRVbB1g1	LMU-8	Loamy sand	Gravelly (15-35%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Slight	Current fallow land(CFl)	Not Available	IIIs	Trench cum bunding
Harave	558	1.36	HRVbB1g1	LMU-8	Loamy sand	Gravelly (15-35%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Slight	Jowar+Redgramm(Jw+Rg)	Not Available	IIIs	Trench cum bunding
Harave	559	1.73	HRVbB1g1	LMU-8	Loamy sand	Gravelly (15-35%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Slight	Current fallow land+Jowar(CFl+Jw)	1 Bore well,1 Open well	IIIs	Trench cum bunding
Harave	560	1.87	HRVbB1g1	LMU-8	Loamy sand	Gravelly (15-35%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Slight	Redgramm+Jowar(Rg+Jw)	Not Available	IIIs	Trench cum bunding
Harave	561	1.82	HRVbB1g1	LMU-8	Loamy	Gravelly (15-	Shallow (25-50	Very gently sloping	Slight	Current fallow	Not Available	IIIs	Trench cum

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					sand	35%)	cm)	(1-3%)		land+Jowar (CFl+Jw)			bunding
Harave	562	1.56	HRVbB1g1	LMU-8	Loamy sand	Gravelly (15-35%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Slight	Current fallow land+Jowar (CFl+Jw)	Not Available	IIIs	Trench cum bunding
Harave	563	2.34	HRVbB1g1	LMU-8	Loamy sand	Gravelly (15-35%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	IIIs	Trench cum bunding
Harave	578	0.9	HRVbB1g1	LMU-8	Loamy sand	Gravelly (15-35%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Slight	Jowar	Not Available	IIIs	Trench cum bunding
Harave	579	0.56	HNHiA1g1	LMU-6	Sandy clay	Gravelly (15-35%)	Moderately deep (75-100 cm)	Nearly level (0-1%)	Slight	Scrub land	Not Available	IIIs	TCB/Strengthening
Harave	582	0.08	KGPhB1g1	LMU-8	Sandy clay loam	Gravelly (15-35%)	Shallow (25-50 cm)	Very gently sloping (1-3%)	Slight	NA	Not Available	IIIs	Trench cum bunding

Appendix II

Kethanapura (1G2e) 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
Govinda wadi	135	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Govinda wadi	136	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Govinda wadi	182	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Govinda wadi	184	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Govinda wadi	185	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Govinda wadi	203	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Govinda wadi	204	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Govinda wadi	205	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Govinda wadi	206	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Govinda wadi	207	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Govinda wadi	208	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Govinda wadi	209	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Govinda wadi	210	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Govinda wadi	211	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Govinda wadi	212	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Govinda wadi	213	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Govinda wadi	214	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Govinda wadi	215	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Govinda wadi	222	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Kethana pura	7	Very strongly alkaline (pH >9.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	High (>20 ppm)	Medium (0.5-1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Kethana pura	8	Strongly alkaline (pH 8.4-9.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	High (>20 ppm)	Medium (0.5-1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Kethana pura	11	Very strongly alkaline (pH >9.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)

Village	Survey Number	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Kethana pura	12	Strongly alkaline (pH 8.4-9.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Kethana pura	13	Strongly alkaline (pH 8.4-9.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	High (>20 ppm)	Medium (0.5-1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Kethana pura	14	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	Medium (0.5-1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Kethana pura	15	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	Medium (0.5-1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Kethana pura	16	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Kethana pura	17	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Kethana pura	18	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Kethana pura	19	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Kethana pura	20	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kethana pura	21	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kethana pura	22	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kethana pura	23	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kethana pura	24	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kethana pura	25	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kethana pura	26	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Kethana pura	27	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Kethana pura	28	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kethana pura	29	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kethana pura	30	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kethana pura	31	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kethana pura	32	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Kethana pura	39	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Kethana pura	40	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Kethana pura	41	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)

Village	Survey Number	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Kethana pura	42	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Kethana pura	43	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Kethana pura	44	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Kethana pura	45	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	Medium (0.5-1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Kethana pura	52	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	Medium (0.5-1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Kethana pura	56	Strongly alkaline (pH 8.4-9.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	High (>20 ppm)	Medium (0.5-1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Kethana pura	95	Very strongly alkaline (pH >9.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	High (>20 ppm)	Medium (0.5-1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Kethana pura	96	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Kethana pura	97	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Kethana pura	98	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Kethana pura	99	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Kethana pura	100	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Kethana pura	101	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Mukkad ahalli	72	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Low (<145 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	79	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Low (<145 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	97	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	98	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	99	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	100	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	101	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	102	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	131	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	132	Slightly acid (pH 6.0-6.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	133	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)

Village	Survey Number	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Mukkad ahalli	134	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	135	Slightly acid (pH 6.0-6.5)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	136	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	137	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	138	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	139	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	140	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Mukkad ahalli	141	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Mukkad ahalli	142	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Mukkad ahalli	143	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Mukkad ahalli	179	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Mukkad ahalli	180	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Mukkad ahalli	181	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Mukkad ahalli	184	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Mukkad ahalli	185	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Mukkad ahalli	186	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Mukkad ahalli	187	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Mukkad ahalli	188	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Mukkad ahalli	189	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Mukkad ahalli	190	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Mukkad ahalli	191	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Mukkad ahalli	192	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Mukkad ahalli	193	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Mukkad ahalli	194	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)

Village	Survey Number	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Mukkad ahalli	195	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area
Mukkad ahalli	196	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area
Mukkad ahalli	197	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Mukkad ahalli	198	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area
Mukkad ahalli	199	Eroded Area	Eroded Area	Eroded Area	Eroded Area	Eroded Area	Eroded Area	Eroded Area	Eroded Area	Eroded Area	Eroded Area	Eroded Area
Mukkad ahalli	200	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Mukkad ahalli	201	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Mukkad ahalli	202	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Mukkad ahalli	203	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Low (<145 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	204	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Low (<145 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	205	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	206	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	207	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	208	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	209	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	210	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	211	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	212	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	213	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	214	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	215	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	216	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	217	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	218	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)

Village	Survey Number	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Mukkad ahalli	219	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	220	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	221	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	222	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	223	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	224	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	225	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	226	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	227	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	228	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	229	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	230	Strongly alkaline (pH 8.4-9.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	231	Strongly alkaline (pH 8.4-9.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	232	Strongly alkaline (pH 8.4-9.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	233	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	234	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	236	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	240	Strongly alkaline (pH 8.4-9.0)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	403	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	404	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	405	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	406	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	407	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Mukkad ahalli	410	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)

Village	Survey Number	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Mukkad ahalli	411	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Mukkad ahalli	412	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Mukkad ahalli	413	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Mukkad ahalli	414	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Mukkad ahalli	415	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Mukkad ahalli	416	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Mukkad ahalli	417	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Mukkad ahalli	418	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Mukkad ahalli	419	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	420	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	422	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	423	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	424	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Mukkad ahalli	430	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	431	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Low (<145 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Mukkad ahalli	434	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Mukkad ahalli	435	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Mukkad ahalli	436	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Mukkad ahalli	437	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Mukkad ahalli	438	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Mukkad ahalli	439	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Mukkad ahalli	440	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Mukkad ahalli	442	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Mukkad ahalli	445	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)

Village	Survey Number	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Mukkad ahalli	446	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Deficient (<0.6 ppm)
Harave	12	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	13	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	14	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	15	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	16	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	17	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	18	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	19	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	20	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	21	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	22	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	23	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	24	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	25	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	26	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	27	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	28	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	29	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	30	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	31	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	32	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	33	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	34	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	Medium (23-57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)

Village	Survey Number	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Harave	35	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	Medium (23-57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	36	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	Medium (23-57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	37	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	38	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	39	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Harave	40	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	Medium (23-57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	41	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	Medium (23-57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	42	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	43	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	Medium (23-57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	45	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	Medium (23-57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	49	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	Medium (23-57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	50	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	Medium (23-57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	51	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	Medium (23-57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	52	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	Medium (23-57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	53	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	Medium (23-57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	54	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	Medium (23-57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	55	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	Medium (23-57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	56	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	57	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	58	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	59	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	60	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	61	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	62	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	63	Moderately alkaline	Non saline	Medium	High (>57	High (>337	Medium (10-	High (>1.0	Deficient	Sufficient	Sufficient	Sufficient

Village	Survey Number	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
		(pH 7.8-8.4)	(<2 dsm)	(0.5-0.75 %)	kg/ha)	kg/ha)	20 ppm)	ppm)	(<4.5 ppm)	(>1.0 ppm)	(>0.2 ppm)	(>0.6 ppm)
Harave	64	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Harave	65	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	66	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	67	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	68	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	69	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	70	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	71	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	72	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	Medium (23-57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	73	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	74	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	Medium (23-57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	75	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	Medium (23-57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	76	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	77	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	Medium (23-57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	78	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	Medium (23-57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	79	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	Low (<23 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	80	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	Low (<23 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	81	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	Medium (23-57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	82	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	83	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	Medium (23-57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	84	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	85	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	86	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	Medium (23-57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	87	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>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
Harave	88	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	89	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	90	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	Medium (23-57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	91	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	Medium (23-57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	92	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	93	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	94	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Harave	95	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	96	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	97	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	98	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	101	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	102	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	121	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	122	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	123	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	124	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	125	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	126	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	127	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	128	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	129	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	Medium (23-57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	130	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	131	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	132	Slightly alkaline	Non saline	Low (<0.5	Medium (23-	High (>337	Medium (10-	High (>1.0	Deficient	Sufficient	Sufficient	Sufficient

Village	Survey Number	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
		(pH 7.3-7.8)	(<2 dsm)	%)	57 kg/ha)	kg/ha)	20 ppm)	ppm)	(<4.5 ppm)	(>1.0 ppm)	(>0.2 ppm)	(>0.6 ppm)
Harave	133	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	Low (<23 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	134	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	Medium (23-57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	135	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	Medium (23-57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	136	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Low (<0.5 %)	Medium (23-57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	137	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	138	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	139	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	140	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	141	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	142	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	143	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	144	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	145	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	146	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	147	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	160	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	489	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	490	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	501	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	502	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	508	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	509	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	549	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	550	Slightly alkaline	Non saline	Medium	High (>57	High (>337	Medium (10-	High (>1.0	Deficient	Sufficient	Sufficient	Sufficient

Village	Survey Number	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
		(pH 7.3-7.8)	(<2 dsm)	(0.5-0.75 %)	kg/ha)	kg/ha)	20 ppm)	ppm)	(<4.5 ppm)	(>1.0 ppm)	(>0.2 ppm)	(>0.6 ppm)
Harave	551	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	552	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	553	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	554	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	555	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	556	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	557	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	558	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	559	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	560	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	561	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	562	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	563	Neutral (pH 6.5-7.3)	Non saline (<2 dsm)	Low (<0.5 %)	High (>57 kg/ha)	Low (<145 kg/ha)	High (>20 ppm)	High (>1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	578	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	579	Slightly alkaline (pH 7.3-7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10-20 ppm)	High (>1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)
Harave	582	Moderately alkaline (pH 7.8-8.4)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (>57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0 ppm)	Deficient (<4.5 ppm)	Sufficient (>1.0 ppm)	Sufficient (>0.2 ppm)	Sufficient (>0.6 ppm)

Appendix III

Kethanapura (1G2e) Microwatershed

Soil Suitability Information

Village	Survey Number	Mango	Maize	Sapota	Sorghum	Cotton	Redgram	Ragi	Groundnut	Chilly
Govindawadi	135	N	S3r	N	S3r	S3r	S3rg	S3r	S3r	S3g
Govindawadi	136	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g
Govindawadi	182	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g
Govindawadi	184	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g
Govindawadi	185	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g
Govindawadi	203	N	S2r	S3r	S2r	S2r	S3r	S2r	S2r	S2r
Govindawadi	204	N	S2r	S3r	S2r	S2r	S3r	S2r	S2r	S2r
Govindawadi	205	N	S2r	S3r	S2r	S2r	S3r	S2r	S2r	S2r
Govindawadi	206	N	S2r	S3r	S2r	S2r	S3r	S2r	S2r	S2r
Govindawadi	207	N	S2r	S3r	S2r	S2r	S3r	S2r	S2r	S2r
Govindawadi	208	N	S2r	S3r	S2r	S2r	S3r	S2r	S2r	S2r
Govindawadi	209	N	S2r	S3r	S2r	S2r	S3r	S2r	S2r	S2r
Govindawadi	210	N	S2r	S3r	S2r	S2r	S3r	S2r	S2r	S2r
Govindawadi	211	N	S2r	S3r	S2r	S2r	S3r	S2r	S2r	S2r
Govindawadi	212	N	S2r	S3r	S2r	S2r	S3r	S2r	S2r	S2r
Govindawadi	213	Others	Others	Others	Others	Others	Others	Others	Others	Others
Govindawadi	214	N	S2r	S3r	S2r	S2r	S3r	S2r	S2r	S2r
Govindawadi	215	N	S2r	S3r	S2r	S2r	S3r	S2r	S2r	S2r
Govindawadi	222	N	S2r	S3r	S2r	S2r	S3r	S2r	S2r	S2r
Kethanapura	7	N	S3tn	N	S3tn	S2tn	S3tn	S3tn	S3tn	S3tn
Kethanapura	8	N	S3tn	N	S3tn	S2tn	S3tn	S3tn	S3tn	S3tn
Kethanapura	11	N	S3tn	N	S3tn	S2tn	S3tn	S3tn	S3tn	S3tn
Kethanapura	12	N	S3tn	N	S3tn	S2tn	S3tn	S3tn	S3tn	S3tn
Kethanapura	13	N	S2rt	S3r	S2rt	S3rt	S3rt	S2rt	S2r	S2rt
Kethanapura	14	N	S2rt	S3r	S2rt	S3rt	S3rt	S2rt	S2r	S2rt
Kethanapura	15	S3r	S1	S2r	S1	S2r	S2r	S1	S1	S1
Kethanapura	16	S3r	S1	S2r	S1	S2r	S2r	S1	S1	S1
Kethanapura	17	N	S2rt	S3r	S2rt	S3rt	S3rt	S2rt	S2r	S2rt

Village	Survey Number	Mango	Maize	Sapota	Sorghum	Cotton	Redgram	Ragi	Groundnut	Chilly
Kethanapura	18	N	S2rt	S3r	S2rt	S3rt	S3rt	S2rt	S2r	S2rt
Kethanapura	19	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Kethanapura	20	N	S2rt	S3r	S2rt	S3rt	S3rt	S2rt	S2r	S2rt
Kethanapura	21	N	S2rt	S3r	S2rt	S3rt	S3rt	S2rt	S2r	S2rt
Kethanapura	22	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Kethanapura	23	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Kethanapura	24	N	S2rt	S3r	S2rt	S3rt	S3rt	S2rt	S2r	S2rt
Kethanapura	25	S3gr	S2g	S2gr	S2g	S2rg	S3rg	S2g	S2g	S2g
Kethanapura	26	S3gr	S2g	S2gr	S2g	S2rg	S3rg	S2g	S2g	S2g
Kethanapura	27	S3r	S1	S2r	S1	S2r	S2r	S1	S1	S1
Kethanapura	28	S3gr	S2g	S2gr	S2g	S2rg	S3rg	S2g	S2g	S2g
Kethanapura	29	S3gr	S2g	S2gr	S2g	S2rg	S3rg	S2g	S2g	S2g
Kethanapura	30	S3gr	S2g	S2gr	S2g	S2rg	S3rg	S2g	S2g	S2g
Kethanapura	31	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Kethanapura	32	S3r	S1	S2r	S1	S2r	S2r	S1	S1	S1
Kethanapura	39	S3r	S1	S2r	S1	S2r	S2r	S1	S1	S1
Kethanapura	40	S3r	S1	S2r	S1	S2r	S2r	S1	S1	S1
Kethanapura	41	S3gr	S2g	S2gr	S2g	S2rg	S3rg	S2g	S2g	S2g
Kethanapura	42	S3r	S1	S2r	S1	S2r	S2r	S1	S1	S1
Kethanapura	43	S3r	S1	S2r	S1	S2r	S2r	S1	S1	S1
Kethanapura	44	S3r	S1	S2r	S1	S2r	S2r	S1	S1	S1
Kethanapura	45	S3r	S1	S2r	S1	S2r	S2r	S1	S1	S1
Kethanapura	52	N	S2rt	S3r	S2rt	S3rt	S3rt	S2rt	S2r	S2rt
Kethanapura	56	N	S3tn	N	S3tn	S2tn	S3tn	S3tn	S3tn	S3tn
Kethanapura	95	N	S2rt	S3r	S2rt	S3rt	S3rt	S2rt	S2r	S2rt
Kethanapura	96	N	S2rt	S3r	S2rt	S3rt	S3rt	S2rt	S2r	S2rt
Kethanapura	97	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Kethanapura	98	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Kethanapura	99	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Kethanapura	100	N	S2rt	S3r	S2rt	S3rt	S3rt	S2rt	S2r	S2rt

Village	Survey Number	Mango	Maize	Sapota	Sorghum	Cotton	Redgram	Ragi	Groundnut	Chilly
Kethanapura	101	N	S2rt	S3r	S2rt	S3rt	S3rt	S2rt	S2r	S2rt
Mukkadahalli	72	S3r	S1	S2r	S1	S2r	S2r	S1	S1	S1
Mukkadahalli	79	S3r	S1	S2r	S1	S2r	S2r	S1	S1	S1
Mukkadahalli	97	S3r	S1	S2r	S1	S2r	S2r	S1	S1	S1
Mukkadahalli	98	S3r	S1	S2r	S1	S2r	S2r	S1	S1	S1
Mukkadahalli	99	S3r	S1	S2r	S1	S2r	S2r	S1	S1	S1
Mukkadahalli	100	S3r	S1	S2r	S1	S2r	S2r	S1	S1	S1
Mukkadahalli	101	N	S2r	S3r	S2r	S2r	S3r	S2r	S2r	S2r
Mukkadahalli	102	N	S2r	S3r	S2r	S2r	S3r	S2r	S2r	S2r
Mukkadahalli	131	N	S2g	S3gr	S2g	S2rg	S3rg	S2g	S2rg	S2rg
Mukkadahalli	132	N	S2g	S3gr	S2g	S2rg	S3rg	S2g	S2rg	S2rg
Mukkadahalli	133	N	S2g	S3gr	S2g	S2rg	S3rg	S2g	S2rg	S2rg
Mukkadahalli	134	N	S2r	S3r	S2r	S2r	S3r	S2r	S2r	S2r
Mukkadahalli	135	N	S2r	S3r	S2r	S2r	S3r	S2r	S2r	S2r
Mukkadahalli	136	N	S2r	S3r	S2r	S2r	S3r	S2r	S2r	S2r
Mukkadahalli	137	N	S2r	S3r	S2r	S2r	S3r	S2r	S2r	S2r
Mukkadahalli	138	N	S2r	S3r	S2r	S2r	S3r	S2r	S2r	S2r
Mukkadahalli	139	N	S2r	S3r	S2r	S2r	S3r	S2r	S2r	S2r
Mukkadahalli	140	N	S2r	S3r	S2r	S2r	S3r	S2r	S2r	S2r
Mukkadahalli	141	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Mukkadahalli	142	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Mukkadahalli	143	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Mukkadahalli	179	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Mukkadahalli	180	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Mukkadahalli	181	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Mukkadahalli	184	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Mukkadahalli	185	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Mukkadahalli	186	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Mukkadahalli	187	Others	Others	Others	Others	Others	Others	Others	Others	Others
Mukkadahalli	188	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg

Village	Survey Number	Mango	Maize	Sapota	Sorghum	Cotton	Redgram	Ragi	Groundnut	Chilly
Mukkadahalli	189	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Mukkadahalli	190	Others	Others	Others	Others	Others	Others	Others	Others	Others
Mukkadahalli	191	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Mukkadahalli	192	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Mukkadahalli	193	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Mukkadahalli	194	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Mukkadahalli	195	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area
Mukkadahalli	196	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area
Mukkadahalli	197	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Mukkadahalli	198	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area	Rock crushing area
Mukkadahalli	199	Eroded Area	Eroded Area	Eroded Area	Eroded Area	Eroded Area	Eroded Area	Eroded Area	Eroded Area	Eroded Area
Mukkadahalli	200	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Mukkadahalli	201	N	S2r	S3r	S2r	S2r	S3r	S2r	S2r	S2r
Mukkadahalli	202	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Mukkadahalli	203	N	S2g	S3gr	S2g	S2rg	S3rg	S2g	S2rg	S2rg
Mukkadahalli	204	S3r	S1	S2r	S1	S2r	S2r	S1	S1	S1
Mukkadahalli	205	S3r	S1	S2r	S1	S2r	S2r	S1	S1	S1
Mukkadahalli	206	S3r	S1	S2r	S1	S2r	S2r	S1	S1	S1
Mukkadahalli	207	S3r	S1	S2r	S1	S2r	S2r	S1	S1	S1
Mukkadahalli	208	S3r	S1	S2r	S1	S2r	S2r	S1	S1	S1
Mukkadahalli	209	S3r	S1	S2r	S1	S2r	S2r	S1	S1	S1
Mukkadahalli	210	S3r	S1	S2r	S1	S2r	S2r	S1	S1	S1
Mukkadahalli	211	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Mukkadahalli	212	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Mukkadahalli	213	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Mukkadahalli	214	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Mukkadahalli	215	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Mukkadahalli	216	S3r	S1	S2r	S1	S2r	S2r	S1	S1	S1
Mukkadahalli	217	S3r	S1	S2r	S1	S2r	S2r	S1	S1	S1
Mukkadahalli	218	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg

Village	Survey Number	Mango	Maize	Sapota	Sorghum	Cotton	Redgram	Ragi	Groundnut	Chilly
Mukkadahalli	219	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Mukkadahalli	220	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Mukkadahalli	221	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Mukkadahalli	222	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Mukkadahalli	223	N	S2rt	S3r	S2rt	S3rt	S3rt	S2rt	S2r	S2rt
Mukkadahalli	224	N	S2rt	S3r	S2rt	S3rt	S3rt	S2rt	S2r	S2rt
Mukkadahalli	225	N	S2rt	S3r	S2rt	S3rt	S3rt	S2rt	S2r	S2rt
Mukkadahalli	226	N	S2rt	S3r	S2rt	S3rt	S3rt	S2rt	S2r	S2rt
Mukkadahalli	227	N	S2rt	S3r	S2rt	S3rt	S3rt	S2rt	S2r	S2rt
Mukkadahalli	228	N	S2rt	S3r	S2rt	S3rt	S3rt	S2rt	S2r	S2rt
Mukkadahalli	229	N	S2rt	S3r	S2rt	S3rt	S3rt	S2rt	S2r	S2rt
Mukkadahalli	230	N	S2rt	S3r	S2rt	S3rt	S3rt	S2rt	S2r	S2rt
Mukkadahalli	231	N	S2rt	S3r	S2rt	S3rt	S3rt	S2rt	S2r	S2rt
Mukkadahalli	232	N	S3tn	N	S3tn	S2tn	S3tn	S3tn	S3tn	S3tn
Mukkadahalli	233	S3r	S1	S2r	S1	S2r	S2r	S1	S1	S1
Mukkadahalli	234	S3r	S1	S2r	S1	S2r	S2r	S1	S1	S1
Mukkadahalli	236	S3r	S1	S2r	S1	S2r	S2r	S1	S1	S1
Mukkadahalli	240	N	S3tn	N	S3tn	S2tn	S3tn	S3tn	S3tn	S3tn
Mukkadahalli	403	N	S2r	S3r	S2r	S2r	S3r	S2r	S2r	S2r
Mukkadahalli	404	N	S2r	S3r	S2r	S2r	S3r	S2r	S2r	S2r
Mukkadahalli	405	N	S2r	S3r	S2r	S2r	S3r	S2r	S2r	S2r
Mukkadahalli	406	N	S2r	S3r	S2r	S2r	S3r	S2r	S2r	S2r
Mukkadahalli	407	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Mukkadahalli	410	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Mukkadahalli	411	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Mukkadahalli	412	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Mukkadahalli	413	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Mukkadahalli	414	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Mukkadahalli	415	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Mukkadahalli	416	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg

Village	Survey Number	Mango	Maize	Sapota	Sorghum	Cotton	Redgram	Ragi	Groundnut	Chilly
Mukkadahalli	417	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Mukkadahalli	418	N	S2r	S3r	S2r	S2r	S3r	S2r	S2r	S2r
Mukkadahalli	419	N	S2rt	S3r	S2rt	S3rt	S3rt	S2rt	S2r	S2rt
Mukkadahalli	420	N	S2r	S3r	S2r	S2r	S3r	S2r	S2r	S2r
Mukkadahalli	422	N	S2g	S3gr	S2g	S2rg	S3rg	S2g	S2rg	S2rg
Mukkadahalli	423	N	S2g	S3gr	S2g	S2rg	S3rg	S2g	S2rg	S2rg
Mukkadahalli	424	N	S2r	S3r	S2r	S2r	S3r	S2r	S2r	S2r
Mukkadahalli	430	N	S2r	S3r	S2r	S2r	S3r	S2r	S2r	S2r
Mukkadahalli	431	S3r	S1	S2r	S1	S2r	S2r	S1	S1	S1
Mukkadahalli	434	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Mukkadahalli	435	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Mukkadahalli	436	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Mukkadahalli	437	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Mukkadahalli	438	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Mukkadahalli	439	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Mukkadahalli	440	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Mukkadahalli	442	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Mukkadahalli	445	N	S2r	S3r	S2r	S2r	S3r	S2r	S2r	S2r
Mukkadahalli	446	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Harave	12	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Harave	13	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Harave	14	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Harave	15	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Harave	16	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Harave	17	S3gr	S2g	S2gr	S2g	S2rg	S3rg	S2g	S2g	S2g
Harave	18	S3gr	S2g	S2gr	S2g	S2rg	S3rg	S2g	S2g	S2g
Harave	19	N	S2rt	S3r	S2rt	S3rt	S3rt	S2rt	S2r	S2rt
Harave	20	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Harave	21	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Harave	22	N	S2rt	S3r	S2rt	S3rt	S3rt	S2rt	S2r	S2rt

Village	Survey Number	Mango	Maize	Sapota	Sorghum	Cotton	Redgram	Ragi	Groundnut	Chilly
Harave	23	N	S2rt	S3r	S2rt	S3rt	S3rt	S2rt	S2r	S2rt
Harave	24	N	S2rt	S3r	S2rt	S3rt	S3rt	S2rt	S2r	S2rt
Harave	25	N	S2rt	S3r	S2rt	S3rt	S3rt	S2rt	S2r	S2rt
Harave	26	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Harave	27	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Harave	28	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Harave	29	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Harave	30	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Harave	31	S3gr	S2g	S2gr	S2g	S2rg	S3rg	S2g	S2g	S2g
Harave	32	S3gr	S2g	S2gr	S2g	S2rg	S3rg	S2g	S2g	S2g
Harave	33	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Harave	34	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Harave	35	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Harave	36	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Harave	37	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Harave	38	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Harave	39	Others	Others	Others	Others	Others	Others	Others	Others	Others
Harave	40	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Harave	41	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Harave	42	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Harave	43	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Harave	45	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Harave	49	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Harave	50	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Harave	51	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Harave	52	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Harave	53	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Harave	54	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Harave	55	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Harave	56	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg

Village	Survey Number	Mango	Maize	Sapota	Sorghum	Cotton	Redgram	Ragi	Groundnut	Chilly
Harave	57	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Harave	58	S3gr	S2g	S2gr	S2g	S2rg	S3rg	S2g	S2g	S2g
Harave	59	S3gr	S2g	S2gr	S2g	S2rg	S3rg	S2g	S2g	S2g
Harave	60	S3gr	S2g	S2gr	S2g	S2rg	S3rg	S2g	S2g	S2g
Harave	61	S3gr	S2g	S2gr	S2g	S2rg	S3rg	S2g	S2g	S2g
Harave	62	S3gr	S2g	S2gr	S2g	S2rg	S3rg	S2g	S2g	S2g
Harave	63	S3gr	S2g	S2gr	S2g	S2rg	S3rg	S2g	S2g	S2g
Harave	64	Others	Others	Others	Others	Others	Others	Others	Others	Others
Harave	65	S3gr	S2g	S2gr	S2g	S2rg	S3rg	S2g	S2g	S2g
Harave	66	S3gr	S2g	S2gr	S2g	S2rg	S3rg	S2g	S2g	S2g
Harave	67	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Harave	68	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Harave	69	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Harave	70	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Harave	71	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Harave	72	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Harave	73	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Harave	74	S3gr	S2g	S2gr	S2g	S2rg	S3rg	S2g	S2g	S2g
Harave	75	S3gr	S2g	S2gr	S2g	S2rg	S3rg	S2g	S2g	S2g
Harave	76	S3gr	S2g	S2gr	S2g	S2rg	S3rg	S2g	S2g	S2g
Harave	77	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g
Harave	78	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g
Harave	79	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g
Harave	80	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g
Harave	81	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g
Harave	82	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g
Harave	83	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Harave	84	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g
Harave	85	S3gr	S2g	S2gr	S2g	S2rg	S3rg	S2g	S2g	S2g
Harave	86	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg

Village	Survey Number	Mango	Maize	Sapota	Sorghum	Cotton	Redgram	Ragi	Groundnut	Chilly
Harave	87	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Harave	88	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Harave	89	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Harave	90	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Harave	91	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Harave	92	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Harave	93	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Harave	94	Others	Others	Others	Others	Others	Others	Others	Others	Others
Harave	95	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Harave	96	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Harave	97	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Harave	98	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Harave	101	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Harave	102	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Harave	121	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Harave	122	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Harave	123	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Harave	124	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Harave	125	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Harave	126	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Harave	127	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Harave	128	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Harave	129	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Harave	130	S3gr	S2g	S2gr	S2g	S2rg	S3rg	S2g	S2g	S2g
Harave	131	S3gr	S2g	S2gr	S2g	S2rg	S3rg	S2g	S2g	S2g
Harave	132	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g
Harave	133	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g
Harave	134	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g
Harave	135	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g
Harave	136	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g

Village	Survey Number	Mango	Maize	Sapota	Sorghum	Cotton	Redgram	Ragi	Groundnut	Chilly
Harave	137	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g
Harave	138	S3gr	S2g	S2gr	S2g	S2rg	S3rg	S2g	S2g	S2g
Harave	139	S3gr	S2g	S2gr	S2g	S2rg	S3rg	S2g	S2g	S2g
Harave	140	S3gr	S2g	S2gr	S2g	S2rg	S3rg	S2g	S2g	S2g
Harave	141	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Harave	142	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Harave	143	S3gr	S2g	S2gr	S2g	S2rg	S3rg	S2g	S2g	S2g
Harave	144	S3gr	S2g	S2gr	S2g	S2rg	S3rg	S2g	S2g	S2g
Harave	145	S3gr	S2g	S2gr	S2g	S2rg	S3rg	S2g	S2g	S2g
Harave	146	N	S3r	N	S3r	S3r	S3rg	S3r	S3r	S3g
Harave	147	N	S3r	N	S3r	S3r	S3rg	S3r	S3r	S3g
Harave	160	S3gr	S2g	S2gr	S2g	S2rg	S3rg	S2g	S2g	S2g
Harave	489	N	S2rg	S3gr	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg
Harave	490	N	S3r	N	S3r	S3r	S3rg	S3r	S3r	S3g
Harave	501	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Harave	502	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Harave	508	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Harave	509	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Harave	549	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Harave	550	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Harave	551	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Harave	552	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Harave	553	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Harave	554	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Harave	555	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Harave	556	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Harave	557	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Harave	558	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Harave	559	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Harave	560	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg

Village	Survey Number	Mango	Maize	Sapota	Sorghum	Cotton	Redgram	Ragi	Groundnut	Chilly
Harave	561	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Harave	562	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Harave	563	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Harave	578	N	S3rg	N	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg
Harave	579	N	S2rt	S3r	S2rt	S3rt	S3rt	S2rt	S2r	S2rt
Harave	582	N	S3r	N	S3r	S3r	S3rg	S3r	S3r	S3g

PART-B

SOCIO-ECONOMIC STATUS OF FARM HOUSEHOLDS

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Chapter 1

EXECUTIVE SUMMARY

Baseline socioeconomic characterisation is prerequisite to prepare action plan for program implementation and to assess the project performance before making any changes in the watershed development program. The baseline provides appropriate policy direction for enhancing productivity and sustainability in agriculture.

Methodology: *Kethanapura micro-watershed (Chamarajanagara taluk and district) is located in between $15^0$18' – $15^0$20' North latitudes and $76^0$3' – $76^0$5' East longitudes, covering an area of about 599.11 ha, bounded by Harave, Mukkadhalli, Govindawadi and Maliyur villages with a length of growing period (LGP) 120-150 days. We used soil resource map as basis for sampling farm households to test the hypothesis that soil quality influence crop selection, and conservation investment of farm households. The level of technology adoption and productivity gaps and livelihood patterns were analyses. The cost of soil degradation and ecosystem services were quantified.*

Results: *The socio-economic outputs for the Kethanapura Microwatershed in Chamarajanagara taluk and district are presented here.*

Social Indicators;

- *Male and female ratio is 53.8 to 46.2 per cent to the total sample population.*
- *Younger age 18 to 50 years group of population is around 56.4 per cent to the total population.*
- *Literacy population is around 71.8 per cent.*
- *Social groups belong to other backward caste (OBC) is around 40.0 per cent.*
- *Fire wood is the source of energy for a cooking among 36.4 per cent.*
- *About 60.0 per cent of households have a yashaswini health card.*
- *Majority of farm households (30.0 %) are having MGNREGA card for rural employment.*
- *Dependence on ration cards for food grains through public distribution system among the all sample households.*
- *Swach bharath program providing closed toilet facilities around 80 per cent of sample households.*
- *Institutional participation is only 5.1 per cent of sample households.*
- *Rural migration to unban centre for employment is prevalent among 10 per cent of farm households.*
- *Women participation in decisions making are around 9.9 per cent of households were found.*

Economic Indicators;

- *The average land holding is 0.97 ha indicates that majority of farm households are belong to marginal and small farmers. The dry land of 37.8 % and irrigated land 62.2 % of total cultivated land area among the sample farmers.*
- *Agriculture is the main occupation among 60 per cent and Agriculture is the main and non agriculture labour is subsidiary occupation for 5.7 per cent of sample households.*
- *The average value of domestic assets is around Rs. 15838 per household. Mobile and television are popular most mass communication.*
- *The average value of farm assets is around Rs.2022 per household, about 30.0 per cent of sample farmers own plough.*
- *The average value of livestock is around Rs.40625 per household; about 54.5 per cent of household are having livestock.*
- *The average per capita food consumption is around 749 grams (1939 kilo calories) against national institute of nutrition (NIN) recommendation at 827.7 gram. Around 70 per cent of sample households are consuming less than the NIN recommendation.*
- *The annual average income is around Rs.74659 per household. About 80 per cent of farm households are below poverty line.*
- *The per capita monthly average expenditure is around Rs.1119.*

Environmental Indicators-Ecosystem Services;

- *The value of ecosystem service helps to support investment to decision on soil and water conservation and in promoting sustainable land use.*
- *The onsite cost of different soil nutrients lost due to soil erosion is around Rs.360 per ha/year. The total cost of annual soil nutrients is around Rs.149262 per year for the total area of 599.11 ha.*
- *The average value of ecosystem service for food grain production is around Rs. 51293/ha/year. Per hectare food grain production services is maximum in coconut (Rs. 71534) followed by maize (Rs. 15241), horse gram (Rs. 4084), sorghum (Rs. 254) and cowpea (Rs. 24400), sunflower is negative returns.*
- *The average value of ecosystem service for fodder production is around Rs. 1572/ ha/year. Per hectare fodder production services is maximum in horse gram (Rs. 2099) followed by maize (Rs. 1650) and sorghum (Rs. 968).*
- *The data on water requirement for producing one quintal of grain is considered for estimating the total value of water required for crop production. Per hectare value of water used and value of water was maximum in coconut (Rs. 126417) followed by sorghum (Rs. 43928), maize (Rs. 35648), horse gram (Rs. 23639), sunflower (Rs. 16628) and cowpea (Rs. 9797).*

Economic Land Evaluation;

- *The major cropping pattern is horse gram (41.9 %) followed by maize (29.3 %), sorghum (18.6 %), coconut (7.5 %), sunflower (1.4 %) and cowpea (1.4 %).*
- *In Ketanapura micro-watershed, major soils are alluvial landscape of Harve (HRV) soil series is having shallow soil depth cover around 25.99 % of area. On this soil farmers are presently growing cowpea (50 %) and sunflower (50 %). Soil of granite and granite gneiss landscape of Lakkur (LKR) are also having moderately shallow soil depth cover 22.25 % of area; crops are coconut (13.9 %), horse gram and maize (43.1 %) each. Hooradahalli (HDH) soil series having moderately deep soil depth cover around 9.66 % of area. Crops are horse gram (48 %), maize (18.4 %) and sorghum (33.5). Kengaki (KGK) soil series having very deep soil depth cover around 1.16 % of area, crops are horse gram and sorghum.*
- *The total cost of cultivation and benefit cost ratio (BCR) in study area for sunflower ranges between Rs. 48471 /ha in HRV soil (with BCR of 1.16).*
- *In cowpea the cost of cultivation Rs. 64960 /ha in HRV soil (with BCR of 0.62).*
- *In coconut the cost of cultivation Rs. 13152 /ha in HRV soil (with BCR of 6.48).*
- *In horse gram the cost of cultivation ranges between Rs. 26637/ha in HDH soil (with BCR of 1.85) and Rs. 12160/ha in KGK soil (with BCR of 1.40).*
- *In maize the cost of cultivation ranges between Rs. 68431/ha in HDH soil (with BCR of 1.84) and Rs. 33997/ha in LKR soil (with BCR of 1.32).*
- *In sorghum the cost of cultivation range between is Rs. 28048/ha in HDH soil (with BCR of 1.48) and Rs. 26732/ha in KGK soil (with BCR of 1.20).*
- *The land management practices reported by the farmers are crop rotation, tillage practices, fertilizer application and use of farm yard manure (FYM). Due to higher wages farmer are following labour saving strategies is not prating soil and water conservation measures. Less ownership of livestock limiting application of FYM.*
- *It was observed soil quality influences on the type and intensity of land use. More fertilizer applications on deeper soil to maximize returns.*

Suggestions;

- *Involving farmers is watershed planning helps in strengthing institutional participation.*
- *The per capita food consumption and monthly income is very low. Diversifying income generation activities from crop and livestock production in order to reduce risk related to drought and market prices.*
- *Majority of farmers reported that they are not getting timely support/extension services from the concerned development departments.*

- *By strengthing agricultural extension for providing timely advice improved technology there is scope to increase in net income of farm households.*
- *By adopting recommended package of practices by following the soil test fertiliser recommendation, there is scope to increase yield in horse gram (30.4 to 16.2 %), coconut (74.2 %), maize (57.3 to 72.7 %), sorghum (47.2 to 51.6 %), sunflower (69.6 %) and cowpea (36.1%).*

Chapter 2

INTRODUCTION

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

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

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

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

Objectives of the study

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

Chapter 3

METHODOLOGY

Study area

Kethanapura Microwatershed is located in Southern Dry Zone of Karnataka (Figure 1). It has a total geographical area of 1.56 M ha with 0.74 M ha under cultivation of which 0.22 M ha is irrigated. The mean elevation ranges from 450 to 900 m MSL; most part of the zone is situated at 800-900m. The major soils are red loams with pockets of black soils in Kollegal, Yalandur and T.N. Pura taluks of Mysore district. The average annual rainfall ranges from 670 to 890 mm, of which about 55 to 75 per cent is received during the kharif season. The major crops of the zone are rice, ragi, sugarcane, pulses and minor millets. Its represented Agro Ecological Region (AER) – 3 having LGP 60-90 days.

Kethanapura Microwatershed (Chamarajanagara taluk and district) is located in between $15^0$18' – $15^0$20' North latitudes and $76^0$3' – $76^0$5' East longitudes, covering an area of about 599.11 ha, bounded by Hireshindhogi, Narasapura, Katrahalli and Honavala villages.

Sampling Procedure:

In this study we have followed soil variability as criterion for sampling the farm households. In each micro-watershed the survey numbers and associated soil series are listed. Minimum three farm households for each soil series were taken and summed up to arrive at total sample for analysis.

Sources of data and analysis:

For evaluating the specific objectives of the study, primary data was collected from the sample respondents by personal interview method with the help of pre-tested questionnaire. The data on socio-economic characteristics of respondents such as family size and composition, land holdings, asset position, occupational pattern and education level was collected. The present cropping pattern and the level of input use and yields collected during survry. The data collected from the representative farm households were analysed using Automated Land Potential Evalution System (Figure 2).

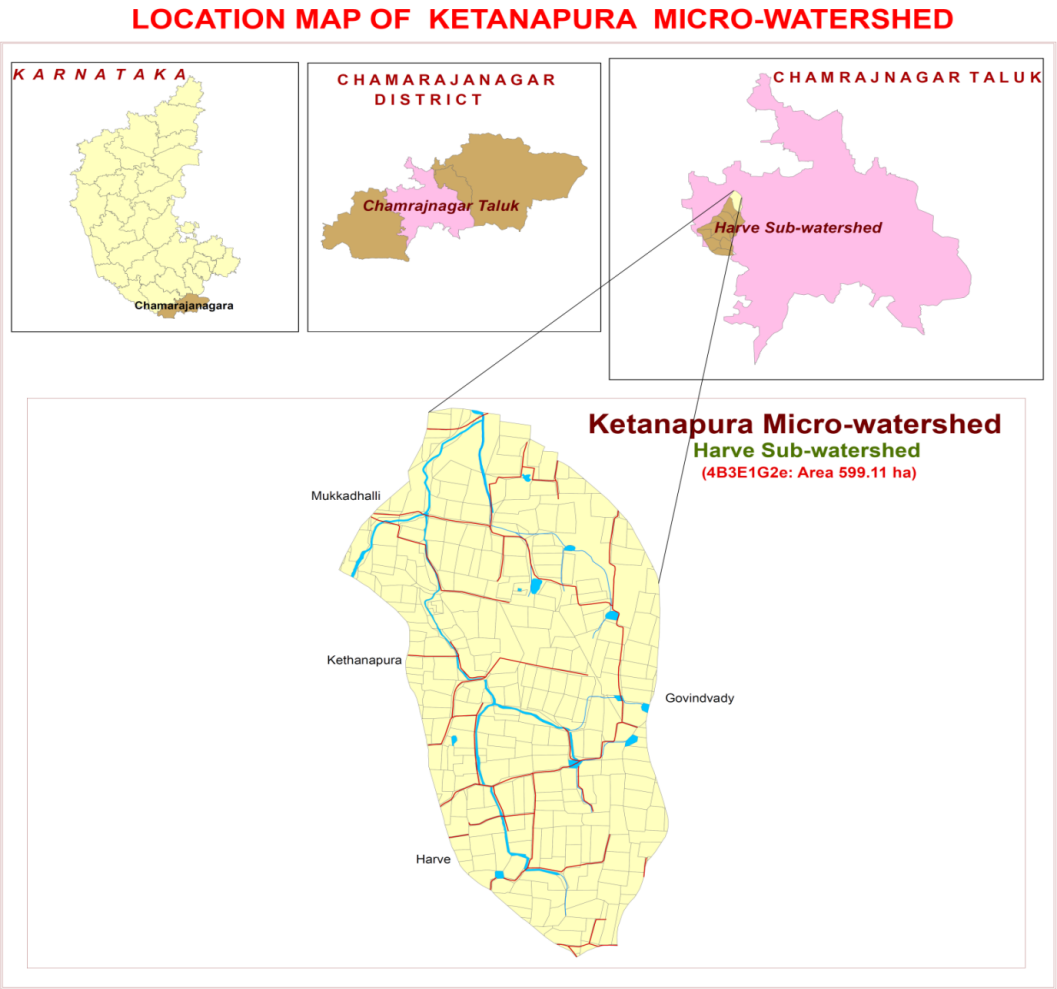


Figure 1: Location of study area

Steps followed in socio-economic assessment

1. •After the completion of soil profile study link the cadastral number to the soil profile in the micro watershed.
2. • Download the names of the farmers who are owning the land for each cadastral number in the Karnataka BHOOMI Website.
3. • Compiling the names of the farmers representing for all the soil profiles studied in the micro watershed for socio-economic Survey.
4. • Conducting the socioeconomic survey of selected farm households in the micro watershed .
5. • Farm households database created using the Automated Land Potential Evaluation System (ALPES) for analysis of socio economic status for each micro watershed .
6. • Synthesis of tables and preparation of report for each micro watershed .

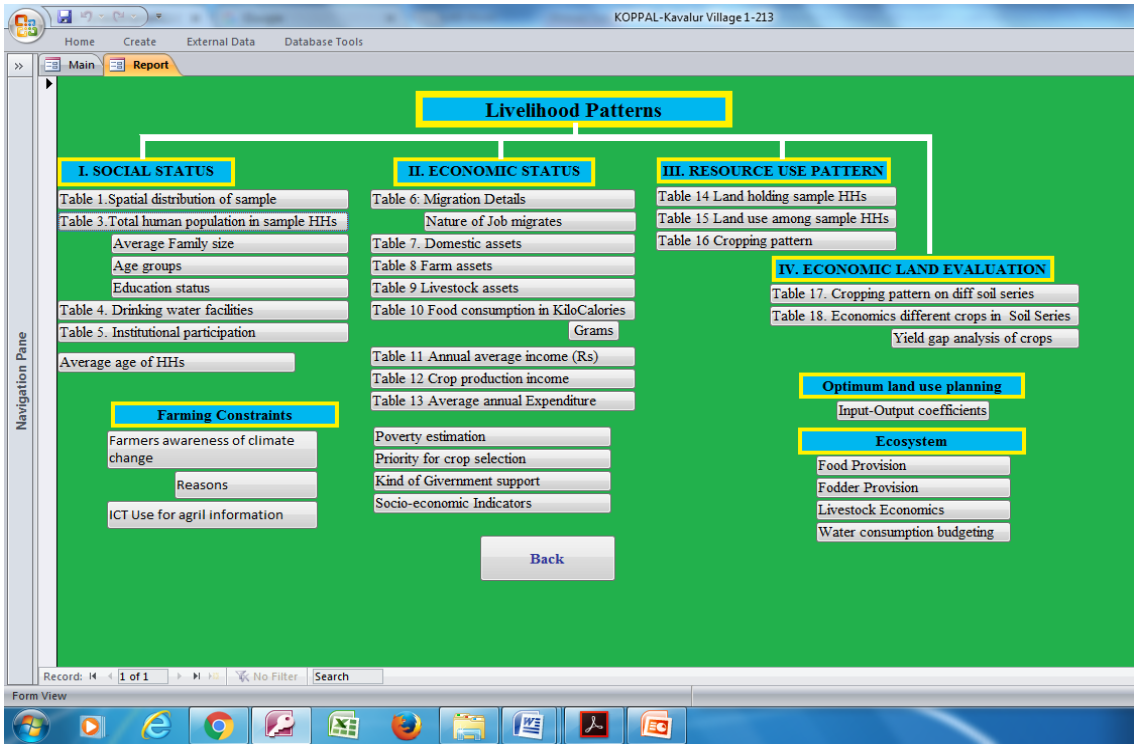


Figure 2: ALPES FRAMEWORK

The sample farmers were post classified in to marginal and small (0.0 to <=2 ha), medium and semi medium (>2 to <=10 ha) and large (>10 ha). The steps involved in estimation of soil potential involve estimation of total cost of cultivation, the yield/gross returns and net income per hectare. The cost of inputs such seed, manure and fertilizer, plant protection chemicals, payment towards human and bullock labour and interest on working capita are included under operational costs. In the case of perennial crops, the cost of establishment was estimated by using actual physical requirements and prevailing market prices. Estimation cost included maintenance cost up to bearing period. The value of main product and by product from the crop enterprise at the market rates were the gross returns of the crop. Net returns were worked out by deducting establishment and maintained cost from gross returns.

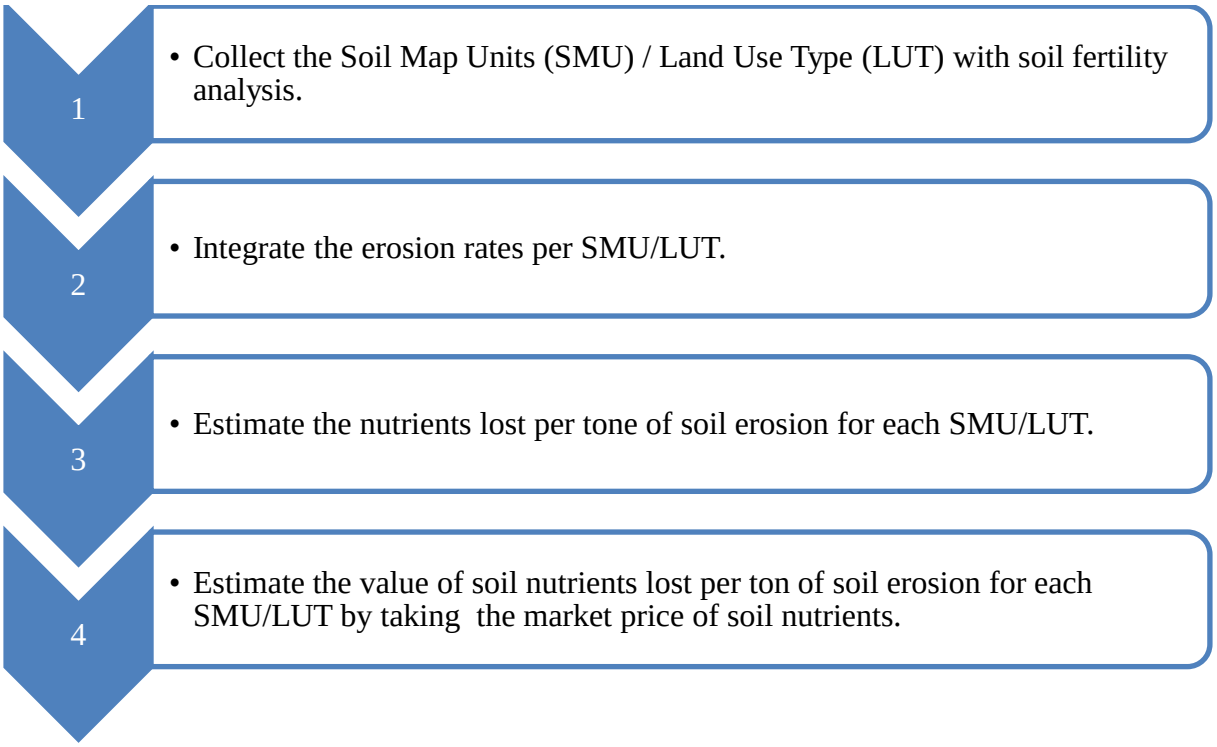
Operational Cost = cost of seeds, fertilizers, pesticides. Cost of human and bullock labour, cost of machinery, cost of irrigation water + interest on working capital.
Gross returns = Yield (Quintals/hectare)*Price (Rs/Quintal)
Net returns = Gross returns-Operational cost.
Benefit Cost Ratio = Net returns/Total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

Economic suitability classes: once each land use –land area combination has been assigned an economic value by the land evaluation, the question arises as to its 'suitability', that is, the degree to which it satisfies the land user. The FAO framework defines two suitability orders: 'S'(suitable if benefit cost ratio (BCR)>1) and 'N'(not suitable if (BCR<1), which are dived into five economic suitability classes:'S1'(highly suitable if BCR>3), 'S2'(suitable if BCR>2 and <3),'S3'(Marginally suitable if BCR >1 and <2), 'N1'(Not suitable for economic reasons but physically suitable) and 'N2'(not suitable for physical reasons). The limit between 'S3' and 'N1'must be at least at the point of financial feasibility (i.e. net returns, NPV, or IRR>0 and BCR>1). The other limits depend on social factors such as farm size, family size, alternative employment or investment possibilities and wealth expectations; these need to be specified for the Soil series.

Economic Valuation of Soil ecosystem services:

The replacement cost approach was followed for estimating the onsite cost of soil erosion, Market price method was followed for estimating the value of food and fodder production. Value transfer menthods was followed for estimating the value of water demand by different crops in the micro watershed.

Steps followed in Replacement cost methods for estimation of onsite cost of soil erosion



Chapter 4

RESULTS AND DISCUSSIONS

The demographic information shows that the household population dynamics encompasses the socioeconomic status of the farmer. For a rural family, the household size should be optimal to earn a comfortable livelihood through farm and non-farm wage earning. The total number of population in watershed area was 39, out of which 53.8 per cent were males and 46.2 per cent females. Average family size of the households is 3.9. Age is an important factor, which affects the potential employment and mobility status of respondents. The data on age wise distribution of farmers in the sample households indicated that majority of the farmers are coming under the age group of 30 to 50 years (35.9 %) followed by more than 50 years (33.3 %), 18 to 30 years (20.5 %), and 0 to18 years (10.3%). Hence, in the study area in general, the respondents were of young and middle age, indicating thereby that the households had almost settled with whatever livelihood options they were practicing and sample respondents were young by age who could venture into various options of livelihood sources. Data on literacy indicated that 28.2 per cent of respondents were illiterate and 71.8 per cent literate (Table 1).

Table 1: Human population among sample households in Ketanapura Microwatershed

Particulars	**Units**	**Value**
Total human population in sample HHs	Number	39
Male	% to total Population	53.8
Female	% to total Population	46.2
Average family size	Number	3.9
Age group		
0 to 18 years	% to total Population	10.3
18 to 30 years	% to total Population	20.5
30 to 50 years	% to total Population	35.9
>50 years	% to total Population	33.3
Average age	Age in years	40.8
Education Status		
Illiterates	% to total Population	28.2
Literates	% to total Population	71.8
Primary School (<5 class)	% to total Population	15.4
Middle School (6- 8 class)	% to total Population	12.8
High School (9- 10 class)	% to total Population	15.4
Others	% to total Population	28.2

The ethnic groups among the sample farm households found to be 30 per cent belonging to schedule caste (SC) followed by 40 per cent belonging to other backward

caste (OBC) and 30 per cent belong to general caste (Table 2 and Figure 3). About 36.4per cent of sample households are using fire wood as source of fuel for cooking and 63.6 per cent of gas. All the sample farmers are having electricity connection. About 60.0 percent are sample households having health cards. Only 30.0 per cent of having MNREGA job cards for employment generation. About 100 per cent of farm households are having ration cards for taking food grains from public distribution system. About 80.0per cent of farm households are having toilet facilities.

Table 2: Basic needs of sample households in Ketanapura Microwatershed

Particulars	Units	Value
Social groups		
SC	% of Households	30.0
OBC	% of Households	40.0
General	% of Households	30.0
Types of fuel use for cooking		
Fire wood	% of Households	36.4
Gas	% of Households	63.6
Energy supply for home		
Electricity	% of Households	100.0
Number of households having Health card		
Yes	% of Households	60.0
No	% of Households	40.0
MGNREGA Card		
Yes	% of Households	30.0
No	% of Households	70.0
Ration Card		
Yes	% of Households	100.0
No	% of Households	00.0
Households with toilet		
Yes	% of Households	80.0
No	% of Households	20.0
Drinking water facilities		
Tube Well	% of Households	100

The data collected on the source of drinking water in the study area is presented in Table 2. Majority of the sample respondents are having tube well source for water supply for domestic purpose (100 %).

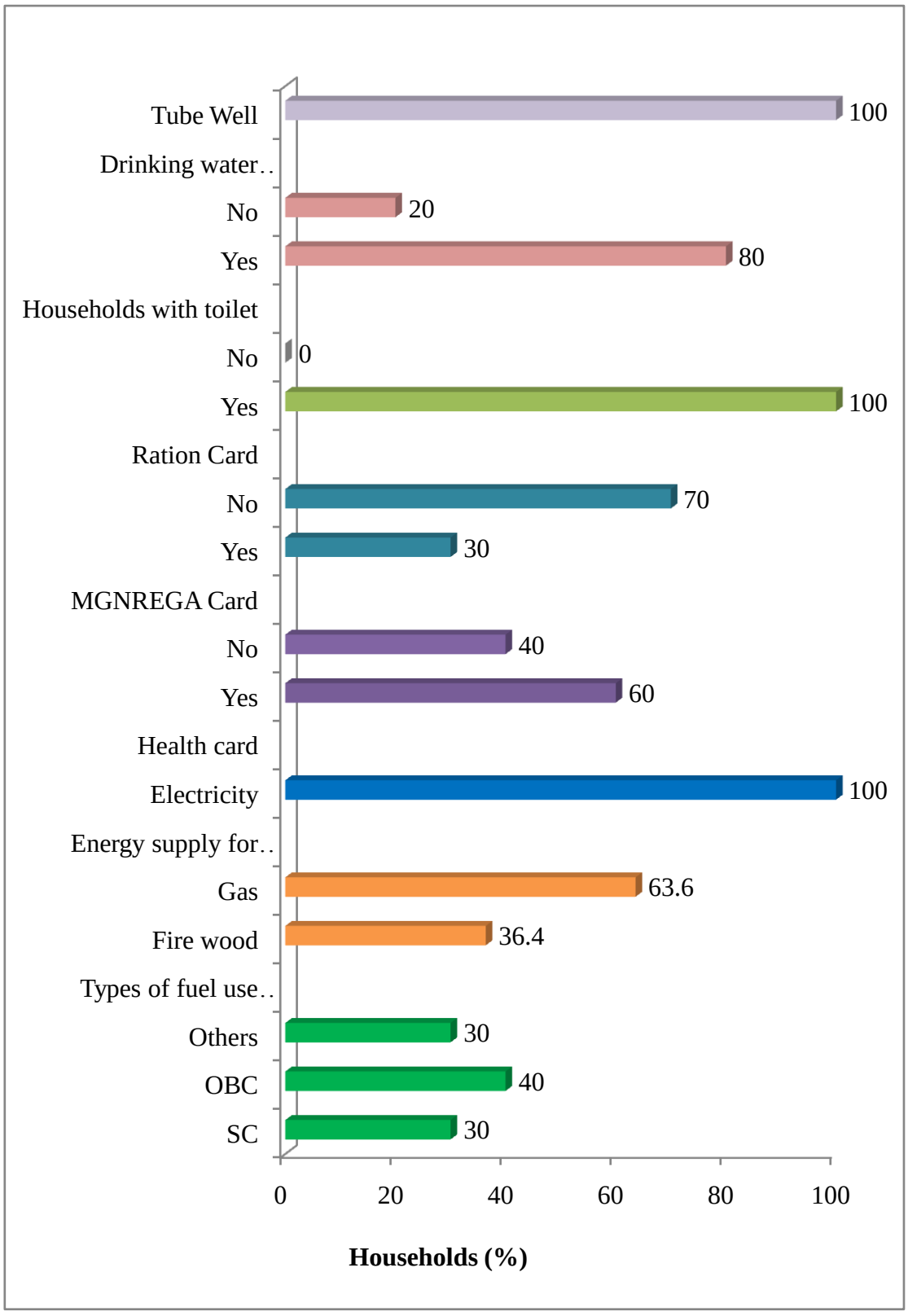


Figure 3: Basic needs of sample households in Ketanapura Microwatershed

Only 5 per cent of farmers are participating in community based organizations (Table 3). Among them majority were participating credit co-operative society and user group were 2.5 per cent, each of sample households.

Table 3: Institutional participation among the sample population in Ketanapura Microwatershed

Particulars	Units	Value
No. Of people participating	% to total	5.0
Co-operative society credit	% to total	2.5
User Group	% to total	2.5
No. Of people not participating	% to total	94.8

The data on migration in Ketanapura Micro-watershed is given in Table 4. It indicated that around 10 percent of samples households were migrated. The average distance travelled for seeking employment is 90 km.

Table 4: Migration details among the sample households in Ketanapura Microwatershed

Particulars	Value
% of households showing migration	10
% of persons migrating	17.9
No. of months migrated in a year	10
Average Distance of migration(Km)	90
Nature of job (%)	
Job/wage/work	94.6
Education of Children	3.5
Business	1.7

The occupational pattern (Table. 5) among sample households shows that agriculture is the main occupation around 20 percent of farmers followed by subsidiary occupations like non agricultural labour (60 %) and trade and business is 5.7 percent. The private service is a main occupation and non agricultural labour is a subsidiary occupation was 14.3 percent of the sample households.

Table 5: Occupational pattern in sample farmers in Ketanapura Microwatershed

Occupation		% to total population
Main	**Subsidiary**	
Agriculture	Agriculture	20
	Agriculture Labour	60
	Trade and Business	5.7
Private service	Non agriculture Labour	14.3
Grand Total		100.0
Family labour availability		**(Man days/month)**
Male		33.3
Female		22.2
Total Labour availability		55.5

The important assets especially with reference to domestic assets were analyzed and are given in Table 6 and Figure 4. The important domestic assets possessed by all categories of farmers are mobile phones (60 %) followed by television (80 %), motorcycle (30 %), mixer/grinder (60 %), bicycle (10 %), computer/laptop (10 %), microwave (10 %) and landline phone (10 %). The average value of domestic assets is around Rs.15838 per households.

Table 6: Domestic assets among the sample households in Ketanapura Microwatershed

Particulars	% of households	Average value in Rs
Mixer/grinder	60.0	3183
Mobile phone	60.0	6866
Motorcycle	30.0	53666
Television	80.0	6887
Microwave	10.0	1300
Bicycle	10.0	800
Computer/Laptop	10.0	48000
Landline Phone	10.0	6000
Average value	15838	

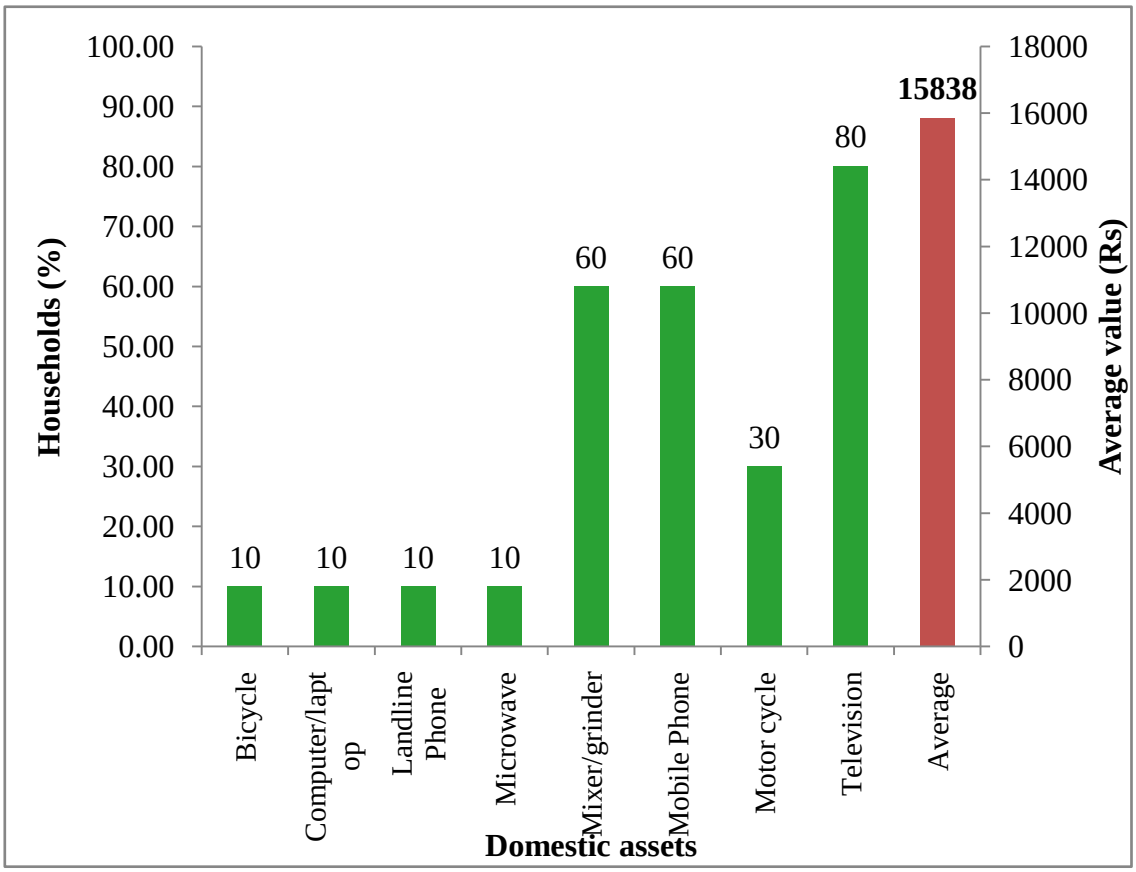


Figure 4: Domestic assets among the sample households in Ketanapura Micro-watershed

The most popularly owned farm equipments were sickles, plough, cattle shed; pump sets, chaff cutter, bullock cart, sprayer and thresher. Plough and sickle were commonly present in all the sampled farmers; these were primary implements in agriculture. The per cent of households owned drip/sprinkler (10 %) , plough (30 %) and weeder (30%) was found among the sample farmers. the average value of farm assets is around Rs. 2022 per households (Table 7 and Figure 5).

Table 7: Farm assets among samples households in Ketanapura Microwatershed

Particulars	% of households	Average value in Rs
Drip/sprinkler	10.0	4000
Plough	30.0	2000
Weeder	30.0	67
Average Value	2022	

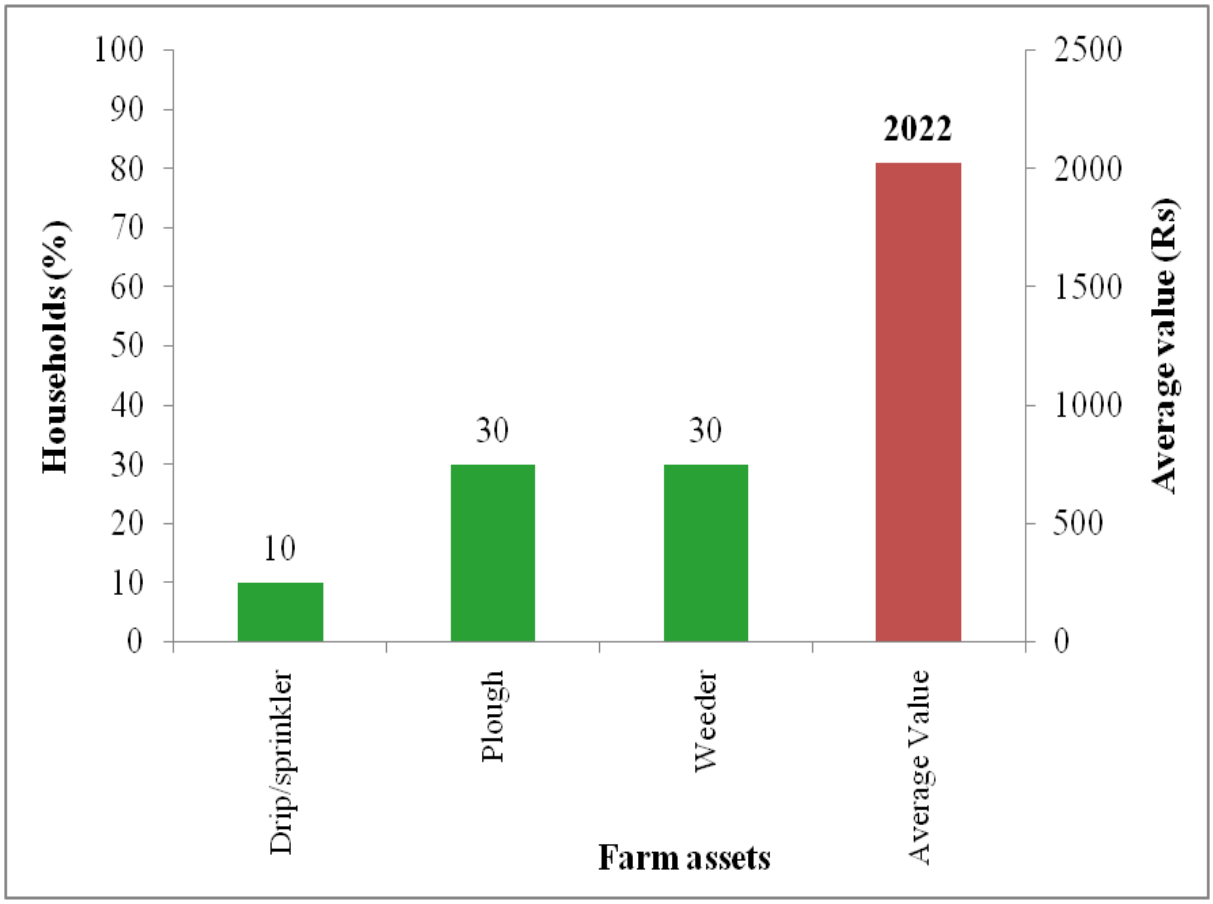


Figure5: Farm assets among samples households in Ketanapura Microwatershed

Livestock is an integral component of the conventional farming systems (Table 8 and Figure 6). The highest livestock population is crossbred mulching cow were around 33.3 per cent followed by local mulching cow (33.3 %), local dry cow (16.7 %), Bullocks (16.7 %). The average livestock value was Rs .40625 per livestock.

Table 8: Livestock assets among sample households in Ketanapura Microwatershed

Particulars	% of livestock population	Average value in Rs
Local Dry Cow	16.7	60000
Local Mulching Cow	33.3	20000
Crossbred Mulching Cow	33.3	40000
Bullocks	16.7	42500
Average value	40625	

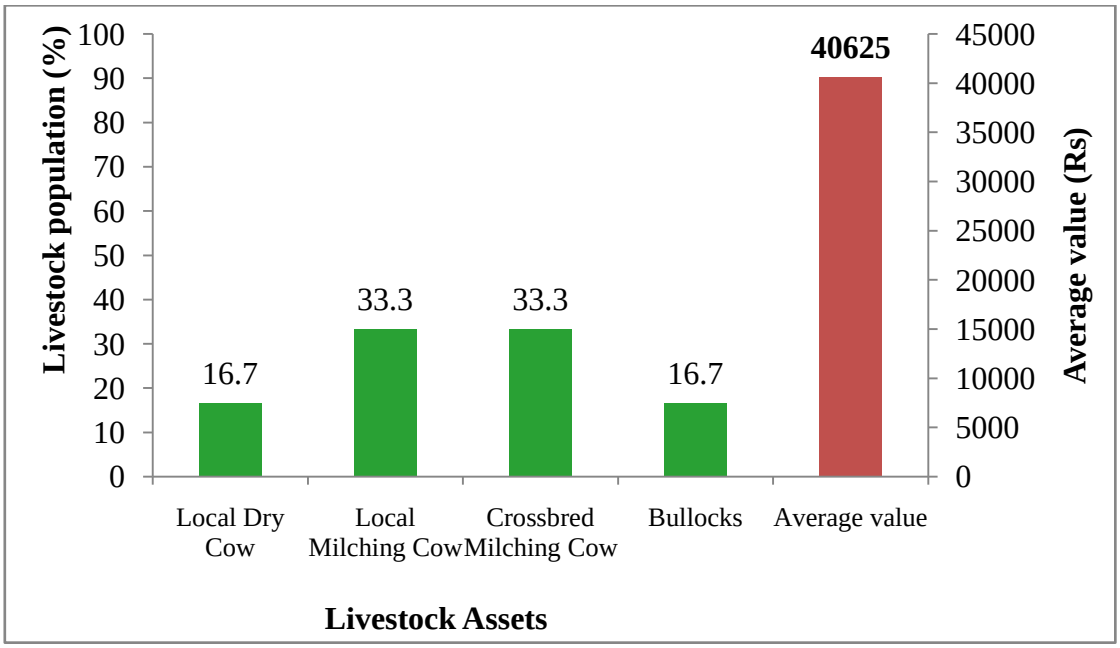


Figure 6: Livestock assets among sample households in Ketanapura Microwatershed

Average milk produced in sample households is 1620 litters/ annum. Among the farm households, sorghum, horse gram and maize are the main crops for domestic food and fodder for animals. About 2179 kg /ha of average fodder is available per season for the livestock feeding (Table 9).

Table 9: Milk produced and fodder availability of sample households in Ketanapura Microwatershed

Particulars	
Name of the Livestock	**Ltr./Lactation/animal**
Local Mulching Cow	1440
Crossbred Mulching Cow	1800
Average Milk produced	1620
Fodder produces	**Fodder yield (kg/ha.)**
Maize	3204
Sorghum	1666
Horse gram	1666
Average fodder availability	2179
Livestock having households (%)	54.5
Livestock population (Numbers)	10

A woman participation in decision making is in this micro-watershed is presented in Table 10. About 20 percent of women participation in local organisation activates. 9.9 percent of women taking decision in her family and agriculture related activities.

Table 10: Women empowerment of sample households in Ketanapura Microwatershed

% to Grand Total

Particulars	**Yes**	**No**
Women participation in local organization activities	20.0	80.0
Women elected as panchayat member	0.0	100
Women earning for her family requirement	0.0	100
Women taking decision in her family and agriculture related activities	9.9	90.1

The food intake in terms of kilo calorie (kcal) per person per day was calculated and presented in the Table 11 and Figure 7. More quantity of cereals is consumed by sample farmers which accounted for 1398.5 kcal per person. The other important food items consumed was pulses 143.4 kcal followed by cooking oil 245.1 kcal, milk 120.6 kcal, vegetables 13.3 kcal, egg 15 kcal and meat 3 kcal. In the sampled households, farmers were consuming less than (1939 kcal) NIN- recommended food requirement (2250 kcal).

Table 11: per capita daily consumption of food among the sample households in Ketanapura Microwatershed

Particulars	**NIN recommendation (gram/ per day/ person)**	**Present level of consumption (gram/ per day/ person)**	**Kilo Calories /day/person**
Cereals	396.0	411.3	1398.5
Pulses	43.0	41.3	143.4
Milk	200.0	185.6	120.6
Vegetables	143.0	55.4	13.3
Cooking Oil	31.0	43	245.1
Egg	0.5	10	15.0
Meat	14.2	2	3.0
Total	**827.7**	**749.2**	**1939**
Threshold of NIN recommendation		827 gram*	2250 Kcal*
% Below NIN		70	80
% Above NIN		30	20

Note: * day/person

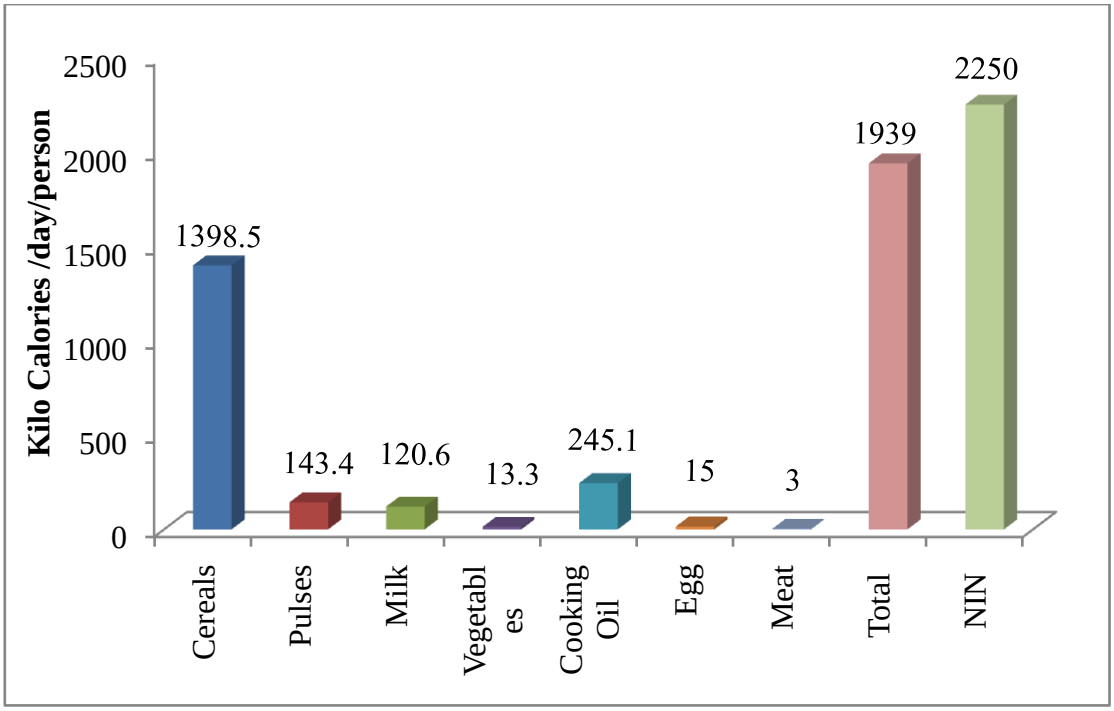


Figure 7: Per capita daily consumption of food among the sample households in Ketanapura Microwatershed

Annual income of the sample HHs: The average annual household income is around Rs 74659. Major source of income to the farmers in the study area is from livestock (Rs 36250) followed by crop production (Rs. 21890). The income from Non farm income was at Rs 16520. The monthly per capita income is Rs. 1595, which is less than the threshold monthly income of Rs 975 for considering above poverty line. Due to the fact that erratic rainfall and shortage of water, farmers are diverting from crop production activities to enable the household for a comfortable livelihood. The incomes from the other aforesaid sources are very meagre (Table 12).

Table 12: Annual average income of HHs from various sources in Ketanapura Microwatershed

Particulars	**Income ***
Nonfarm income (Rs)	16520 (10)
Livestock income (Rs)	36250 (40)
Crop Production (Rs)	21890 (100)
Total Annual Income (Rs)	***74659***
Average monthly per capita income (Rs)	1595
Threshold for Poverty level (Rs 975 per month/person)	
% of households below poverty line	80.0
% of households above poverty line	20.0

* Figure in the parenthesis indicates % of Households

The average annual expenditure of farm households indicated that farmers in the study area spend highest on food (Rs. 30062) followed by education, clothing, social function and health. Now a day's education is most important among all of us. In today's competitive world, education is a necessity for man after food, clothing and shelter. It is the only fundamental way by which a desired change in the society can happen. The average per capita monthly expenditure is around Rs. 1119 (Table 13 and Figure 8).

Table 13: Average annual expenditure of sample HHs in Ketanapura Microwatershed

Particulars	Value in Rupees	Per cent
Food	30062	57.4
Education	1850	3.5
Clothing	5300	10.1
Social functions	5800	11.1
Health	9400	17.9
Total Expenditure (Rs/year)	52412	100
Monthly per capita expenditure (Rs)	1119	

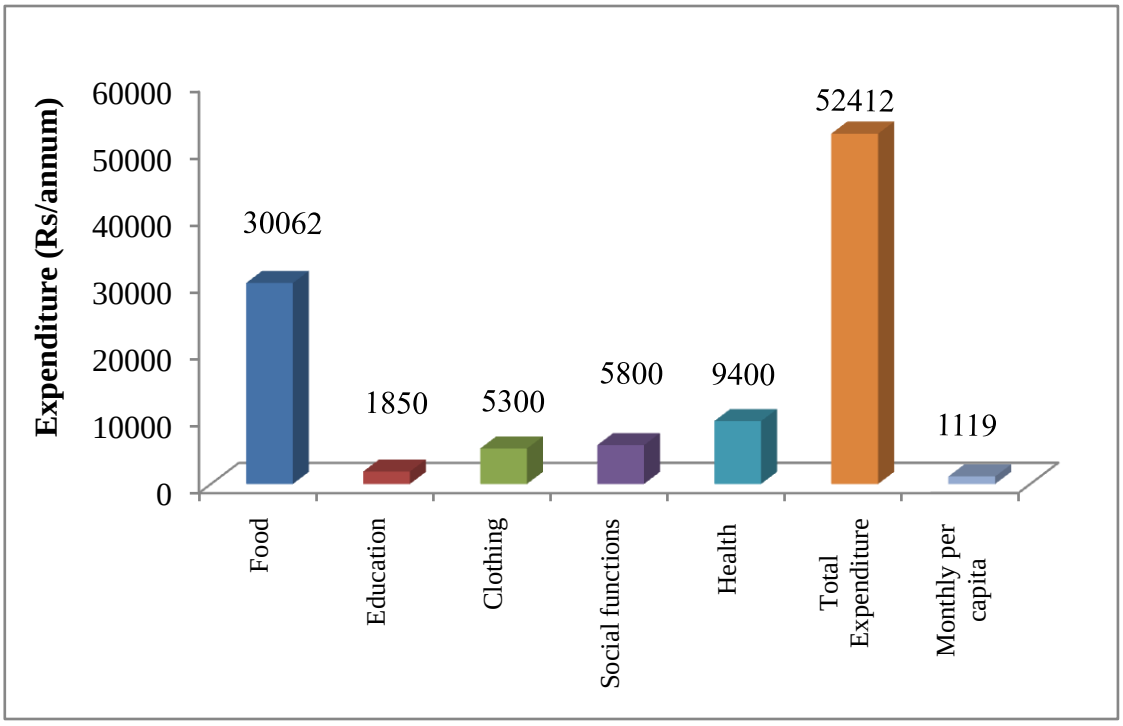


Figure 8: Average annual expenditure of sample HHs in Ketanapura Microwatershed

Land holding: Total area cultivated by them is 9.6 ha. The average land holding of sample HHs is 0.9 ha. Large number of sample HHs belong to small size (90 %) group with an average holding size of 0.6 ha followed by medium farmers (10 %) with an average holding size of 3.7 ha (Table 14).

Table 14: Distribution of land holding among the sample households in Ketanapura Microwatershed

Particulars	Units	Values
Small farmers		
Total Land	ha	5.9
Sample size	Per cent	90
Average Total land holding	ha	0.6
Medium farmers		
Total Land	ha	3.7
Total Sample size	Per cent	10.0
Average Total land holding	ha	3.7
Total Sample HHs in number		
Total Land	ha	9.6
Sample size	Per cent	100
Average Total land holding	ha	0.9

Land use: The total land holding in the Ketanapura micro-watershed is 9.7 ha (Table 15). Of which 3.7 ha is dry land and 6 ha is irrigated land. The average land holding per household is worked out to be 0.97 ha.

Table 15: Land use among samples households in Ketanapura Microwatershed

Particulars	Per cent	Area in ha
Irrigated land	62.2	6
Dry Land	37.8	3.7
Fallow land	0.0	0.0
Total land holding	100	9.7
Average land holding	0.97	

In the micro-watershed, the prevalent present land uses under perennial plants are neem trees (4.6 %) followed by jack fruit (0.7 %), people tree (arali) (0.7 %), banyan (3 %), mango (0.7 %), acacia (0.7 %) and coconut (88.4 %) (Table 16).

Table 16: Number of trees/plants covered in sample farm households in Ketanapura Microwatershed

Particulars	Number of Plants/trees	Per cent
Coconut	115	88.4
Banyan tree(Alada)	4	3
Mango	1	0.7
Neem Trees	6	4.6
People Tree(Arali)	1	0.7
Acacia	1	0.7
Jack fruit	1	0.7
Teak	1	0.7
Grand Total	130	100

The land use decisions are usually based on experience of farmers, tradition, expected profit, personal preferences, resources and social requirements.

The present dominant crops grown in dry lands in the study area were by maize (29.3 %) followed by sorghum (18.6 %), coconut (7.5 %) and sunflower (1.4 %) which are taken during kharif and horse gram (41.9 %) and cowpea (1.4 %),which are taken rabi season, respectively. The cropping intensity was 176 per cent (Table 17 and Figure 9).

Table 17: Present cropping pattern and cropping intensity in Ketanapura Microwatershed

% to Grand Total

Crops	**Kharif**	**Rabi**	**Grand Total**
Coconut	7.5	0.00	7.5
Cowpea	0.0	1.4	1.4
Horse gram	0.0	41.9	41.9
Maize	29.3	0.0	29.3
Sorghum	18.6	0.0	18.6
Sunflower	1.4	0.0	1.4
Grand Total	56.7	43.3	100.0
Cropping intensity (%)	176		

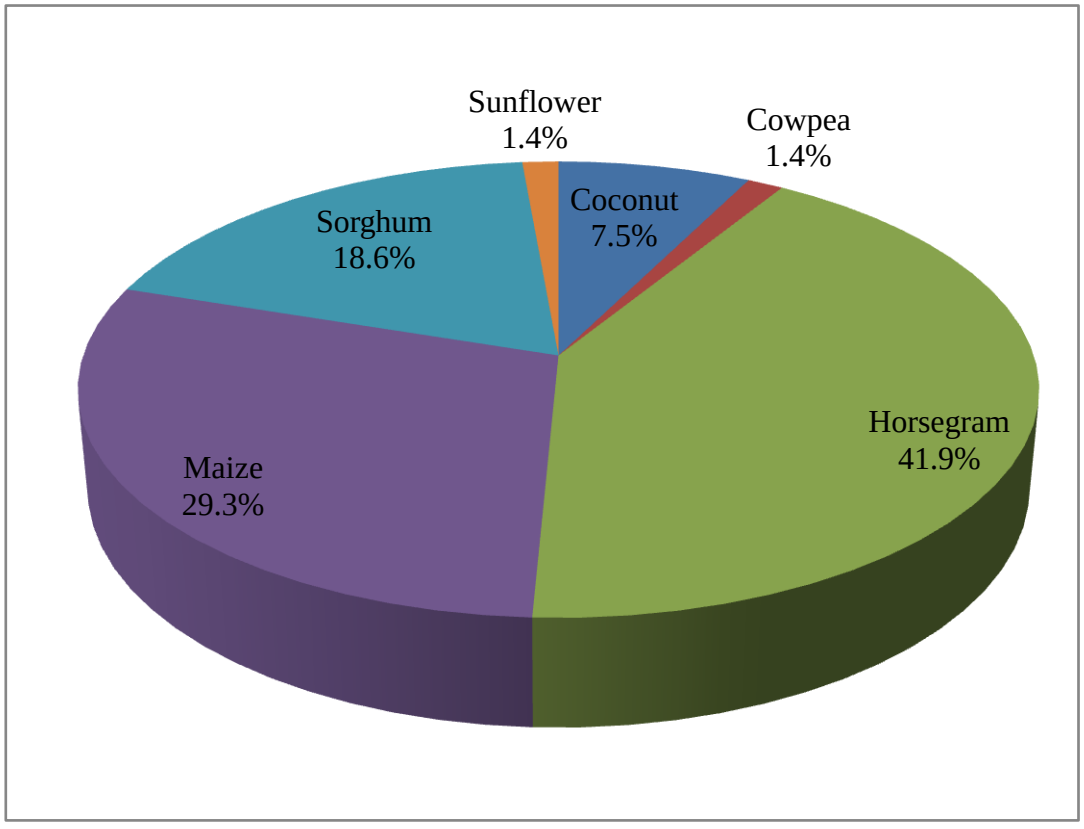


Figure 9: Present cropping pattern in Ketanapura Microwatershed

Economic land evaluation

The main purpose of economic land evaluation in the watershed is to identify the existing production constraints and propose the potential/alternate options for agro-technology transfer and for bridging the adoption and yield gap.

In Ketanapura micro-watershed, 11 soil series are identified and mapped (Table 18). The distribution of major soil series are Balapur (BPR) covering an area around 32.23 ha (5.38 %) followed by Gollarahatti (GHT) 11.99 ha (2 %), Hooradalli (HDH) 42.18 ha (9.84%), Honnenahalli (HNH) 42 ha (7 %), Harave (HRV) 155.72 ha (26 %), (KGH) Kutegaudanahundi 63.77 ha (10.64 %), Kengaki (KGK) 6.95 ha (1.16 %), Kaggalipura (KGP) 5.8 ha (0.97 %), Kanchikere (KKR) 11.0 ha (2.2 %), Ketanapura (KTP) 16.17 ha (2.70 %) and Lakkur (LKR) 7 ha 133.26 (22.25 %).

Table 18: Distribution of soil series in Ketanapura Microwatershed

Soil phase	Description	Area in ha (%)
BPR bA1g1	Deep (100-150cm), well drained, gravelly clay soils developed from weathered granite gneiss, occurring on very gently sloping uplands under cultivation. Loamy sand surface, slope <1%, slight erosion and slightly gravelly (15-35%).	15.74 (2.63)
BPR cB1g2	Deep (100-150cm), well drained, gravelly clay soils developed from weathered granite gneiss, occurring on very gently sloping uplands under cultivation. Sandy clay loam surface, slope 1-3%, slight erosion and moderately gravelly (35-60%).	16.49 (2.75)
GHT bB1g1	Moderately deep (75-100cm), well drained, gravelly loam soils developed from weathered granite gneiss, occurring on very gently sloping uplands under cultivation. Loamy sand surface, slope 1-3%, slight erosion and slightly gravelly (15-35%).	8.15 (1.36)
GHT mB1g 1	Moderately deep (75-100cm), well drained, gravelly loam soils developed from weathered granite gneiss, occurring on very gently sloping uplands under cultivation. Clay surface, slope 1-3%, slight erosion and slightly gravelly (15-35%).	3.84 (0.64)
HDH bB1g2	Moderately deep (75-100cm), well drained, gravelly clay soils developed from weathered granite gneiss, occurring on very gently sloping uplands under cultivation. Loamy sand surface, slope 1-3%, slight erosion and moderately gravelly (35-60%).	16.78 (2.80)
HDH cA1	Moderately deep (75-100cm), well drained, gravelly clay soils developed from weathered granite gneiss, occurring on very gently sloping uplands under cultivation. Sandy loam surface, slope 1-3%, slight erosion.	14.49 (2.42)
HDH cA1g1	Moderately deep (75-100cm), well drained, gravelly clay soils developed from weathered granite gneiss, occurring on very gently sloping uplands under cultivation. Sandy loam surface, slope 1-3%, slight erosion and slightly gravelly (15-35%).	27.69 (4.62)
HNH hB1g1	Moderately shallow (50-75cm), well drained, clay soils developed from alluvium, occurring on very gently sloping lowlands under cultivation. Sandy clay loam surface, slope 1-3%, slight erosion and slightly gravelly (15-35%).	18.19 (3.04)

HNHiA1g1	Moderately shallow (50-75cm), well drained, clay soils developed from alluvium, occurring on nearly level lowlands under cultivation. Sandy clay surface, slope 1-3%, slight erosion and slightly gravelly (15-35%).	23.75 (3.96)
HRVbA1	Shallow (25-50cm), well drained, gravelly loam soils developed from granite gneiss, occurring on nearly level uplands under cultivation. Loamy sand surface, slope <1%, slight erosion.	3.25 (0.54)
HRVbA1g1	Shallow (25-50cm), well drained, gravelly loam soils developed from granite gneiss, occurring on nearly level uplands under cultivation. Loamy sand surface, slope <1%, slight erosion and slightly gravelly (15-35%).	43.06 (7.19)
HRVbB1g1	Shallow (25-50cm), well drained, gravelly loam soils developed from granite gneiss, occurring on very gently sloping uplands under cultivation. Loamy sand surface, slope 1-3%, slight erosion and slightly gravelly (15-35%).	54.24 (9.05)
HRVbB1g2	Shallow (25-50cm), well drained, gravelly loam soils developed from granite gneiss, occurring on very gently sloping uplands under cultivation. Loamy sand surface, slope 1-3%, slight erosion and moderately gravelly (35-60%).	11.26 (1.88)
HRVcB1g2	Shallow (25-50cm), well drained, gravelly loam soils developed from granite gneiss, Sandy loam surface, slope 1-3%, slight erosion and moderately gravelly (35-60%).	34.85 (5.82)
HRVcB2g3	Shallow (25-50cm), well drained, gravelly loam soils developed from granite gneiss, Sandy loam surface, slope 1-3%, moderate erosion and extremely gravelly (>60%).	9.06 (1.51)
KGHbA1g1	Moderately shallow (50-75cm), well drained, gravelly loam soils developed from weathered granite gneiss, occurring on nearly level uplands under cultivation. Loamy sand surface, slope <1%, slight erosion and slightly gravelly (15-35%).	39.66 (6.62)
KGHbB2g2	Moderately shallow (50-75cm), well drained, gravelly loam soils developed from weathered granite gneiss, occurring on very gently sloping uplands under cultivation. Loamy sand surface, slope 1-3%, moderate erosion and moderately gravelly (35-60%).	12.55 (2.09)
KGHcB1g1	Moderately shallow (50-75cm), well drained, gravelly loam soils developed from weathered granite gneiss, occurring on nearly level uplands under cultivation. Sandy clay loam surface, slope 1-3%, slight erosion and slightly gravelly (15-35%).	11.56 (1.93)
KGKcB2g1	Very deep (>150cm), somewhat poorly drained, moderate to strongly alkaline clayey soils developed from alluvium, occurring on very gently sloping low lands. Sandy loam surface, slope 1-3%, slight erosion and slightly gravelly (15-35%).	6.95 (1.16)
KGPhB1g1	Moderately shallow (50-75cm), well drained, gravelly loam soils developed from weathered granite gneiss, occurring on nearly level uplands under cultivation. Sandy clay loam surface, slope 1-3%, slight erosion and slightly gravelly (15-35%).	5.80 (0.97)
KKRhA1g1	Moderately deep (75-100cm), well drained, clayey soils developed from weathered granite gneiss, occurring on nearly level uplands under cultivation. Sandy clay loam surface, slope <1%, slight erosion and slightly gravelly(15-35%).	47.24 (7.88)

KTP cA1g1	Moderately shallow (50-75cm), well drained, gravelly loam soils developed from weathered granite gneiss, occurring on nearly level uplands under cultivation. Sandy clay loam surface, slope <1%, slight erosion and slightly gravelly (15-35%).	16.17 (2.70)
LKR bA1g1	Moderately shallow (50-75cm), well drained, gravelly loam soils developed from granite gneiss, occurring on very nearly level uplands under cultivation. Loamy sand surface, slope <1%, slight erosion and slightly gravelly (15-35%).	27.61 (4.61)
LKR bB1g1	Moderately shallow (50-75 cm), well drained, gravelly loam soils developed from granite gneiss, occurring on very gently sloping uplands under cultivation. Loamy sand surface, slope 1-3%, slight erosion and slightly gravelly (15-35%).	35.21 (5.88)
LKR bB1g2	Moderately shallow (50-75 cm), well drained, gravelly loam soils developed from granite gneiss, occurring on very gently sloping uplands under cultivation. Loamy sand surface, slope 1-3%, slight erosion and moderately gravelly (35-60%).	49.29 (8.23)
LKR cA1g1	Moderately shallow (50-75cm), well drained, gravelly loam soils developed from granite gneiss, occurring on very gently sloping uplands under cultivation. Sandy loam surface, slope 0-1%, slight erosion and slightly gravelly (15-35%).	21.15 (3.53)
Gully region		4.11 (0.69)
Eroded Area		2.03 (0.34)
Mining/Industrial		0.10 (0.02)
Rock crushing area		5.11 (0.85)
Rock out crop		0.77 (0.13)
Water body		12.9 (2.17)
Total		599.1 (100)

Present cropping pattern on different soil series are given in Table 19. Crops grown on Harave soils are Cowpea, sunflower. Coconut, horse gram and maize grow on Lakkur soils are grown. Horse gram, maize, and sorghum are grown on Hooradahalli soils. Horse gram and sorghum on Kengaki soils are grow.

Table 19: Cropping pattern on major soil series in Ketanapura Microwatershed

(Area in per cent)

Soil Series	Soil Depth	Crops	Dry		Irrigated		Grand Total
			Kharif	Rabi	Kharif	Rabi	
HRV	Shallow (25-50 cm)	Cowpea	0.0	0.0	0.0	50.0	50.0
		Sunflower	0.0	0.0	50.0	0.0	50.0
LKR	Moderately shallow (50-75 cm)	Coconut	0.0	0.0	13.9	0.0	13.9
		Horse gram	0.0	43.1	0.0	0.0	43.1
		Maize	34.8	0.0	8.3	0.0	43.1
HDH	Moderately deep (75-100 cm)	Horse gram	0	48.0	0.0	0.0	48.0
		Maize	18.4	0.0	0.0	0.0	18.4
		Sorghum	33.5	0.0	0.0	0.0	33.5
KGK	Very deep (>150 cm)	Horse gram	0.0	50.0	0.0	0.0	50.0
		Sorghum	50.0	0.0	0.0	0.0	50.0

Land is used for agricultural use for growing cereals, pulse, oilseeds and commercial crops. The soil/ land potential are measures in terms of physical yield and net income. The alternative land use options for each micro-watershed are given below (Table 20).

Table 20: Alternative land use options for different size group of farmers (Benefit Cost Ratio) in Ketanapura Microwatershed.

Soil Series	Small Farmers	Medium Farmers
HDH	Horse gram (1.85), Maize (1.84), Sorghum (1.48)	
HRV	Cowpea (1.04) Sunflower (1.16)	
KGK	Horse gram (1.40) sorghum (1.20)	
LKR	Coconut (6.48), horse gram (2.19), maize(1.26)	Horse gram (1.54) maize (1.44)

The productivity of different crops grown in Ketanapura micro-watershed under potential yield of the crops is given in Table 21.

The data on cost of cultivation and benefit cost ratio (BCR) of different crops is given in Table 21. The total cost of cultivation and benefit cost ratio (BCR) in study area for coconut ranges between Rs. 13152 /ha in HRV soil (with BCR of 6.48), sunflower the cost of cultivation Rs. 48471 /ha in HRV soil (with BCR of 1.16), cowpea the cost of cultivation of Rs. 64960 /ha in HRV soil (with BCR of 0.62), horse gram the cost of cultivation ranges between Rs.26637/ha in HDH soil (with BCR of 1.85) and Rs. 12160/ha in KGK soil (with BCR of 1.40), maize the cost of cultivation ranges between Rs. 68431/ha in HDH soil (with BCR of 1.84) and Rs. 33997/ha in LKR soil (with BCR of 1.32) and sorghum cost of cultivation range between is Rs. 28048/ha in HDH soil (with BCR of 1.48) and Rs. 26732/ha in KGK soil (with BCR of 1.20).

Table 21: Economic land evaluation and bridging yield gap for different crops in Ketanapura Microwatershed

Particulars	HRV (25-50 cm)		LKR (50-75 cm)			HDH (75-100 cm)			KGK (>150 cm)	
	Cowpea	Sunflower	Coconut	Horse gram	Maize	Horse gram	Maize	Sorghum	Horse gram	Sorghum
Total cost (Rs/ha)	64960	48471	13152	20324	33997	26637	68431	28048	12160	26732
Gross Return (Rs/ha)	40560	56316	85274	34578	44445	45663	100632	42052	16995	31951
Net returns (Rs/ha)	-24400	7845	72122	14254	10448	19026	32201	14004	4836	5219
BCR	0.62	1.16	6.48	1.76	1.32	1.85	1.84	1.48	1.40	1.20
Farmers Practices (FP)										
FYM (t/ha)	0.0	5.0	2.4	1.1	3.4	1.9	3.7	3.8	0.0	4.6
Nitrogen (kg/ha)	52.1	52.1	0.0	41.5	41.5	66.5	74.4	75.2	19.5	19.5
Phosphorus (kg/ha)	133.2	133.2	0.0	59.5	59.5	72.6	132.1	66.1	41.3	41.3
Potash (kg/ha)	37.5	37.5	0.0	25.4	25.4	7.2	102.6	2.7	0.0	0.0
Grain (Qtl/ha)	7.9	5.0	47.6	8.3	22.9	7.6	35.9	15.0	6.9	13.8
Price of Yield (Rs/Qtl)	5200	3800	1800	3550	1933	3500	2500	1800	2500	2200
Soil test based fertilizer Recommendation (STBR)										
FYM (t/ha)	7.4	6.6	10.0	0.0	8.6	0.0	8.6	7.4	0.0	7.4
Nitrogen (kg/ha)	30.9	69.0	128.1	30.9	154.4	24.7	133.8	81.5	30.9	101.9
Phosphorus (kg/ha)	37.1	44.5	48.8	30.9	51.5	27.8	46.3	42.6	27.8	42.6
Potash (kg/ha)	18.5	27.8	183.8	22.6	29.4	20.6	29.4	34.6	24.7	39.5
Grain (Qtl/ha)	12.4	16.5	184.5	9.9	84.0	9.9	84.0	28.4	9.9	28.4
% of Adoption/yield gap (STBR-FP) / (STBR)										
FYM (%)	100.0	24.1	76.2	0.0	60.2	0.0	57.6	49.4	0.0	38.1
Nitrogen (%)	-68.8	24.4	100.0	-34.4	73.1	-169.0	44.4	7.8	36.9	80.9
Phosphorus (%)	-259.4	-199.5	100.0	-92.7	-15.6	-161.2	-185.1	-55.1	-48.6	3.1
Potash (%)	-102.4	-35.0	100.0	-12.0	13.9	64.9	-248.5	92.3	0.0	100.0
Grain (%)	36.1	69.6	74.2	16.2	72.7	23.4	57.3	47.2	30.4	51.6
Value of yield and Fertilizer (Rs)										
Additional Cost (Rs/ha)	2547	-2308	14977	-2509	6290	-4096	460	3341	37	4660
Additional Benefits (Rs/ha)	23167	43573	246386	5680	118034	8106	120206	24129	7498	32216
Net change Income (Rs/ha)	20620	45881	231409	8189	111743	12202	119746	20788	7461	27556

The data on FYM, Nitrogen, Phosphorus and Potash application by the farmers to different crops and recommended FYM for different crops is given in Table 21. There is a huge gap between FYM application by farmers and recommended FYM in all the crops across the soils. There is a larger yield gap in crops grown across different soil series. Adequate knowledge about recommended package of practices is the pre-requisite for their use in cultivation of crops. It is a fact that, recommended practices are major contributing factors to yield. Inadequate knowledge about recommended practices leads to their improper adoption. Strengthening of extension services by concerned agency is required to increase adoption of recommended cultivation practices and ultimately reducing the gap. By adopting soil-test fertiliser recommendation, there is scope to increase yield and income to a maximum of Rs 231409 in coconut and a minimum of Rs 7461 in horse gram cultivation.

Economic valuation of Ecosystem Services (ES) was aimed at combining use and non-use values to determine Total Economic Value (TEV) of ES. Ecosystem Services (ES) were valued based on their annual flow or utilization in common monetary units, Rs/year. The valuation of ES was based on market price in 2017 or market cost approaches whichever is applicable, and in other cases on value or benefit transfer from previous valuation studies.

The onsite cost of different soil nutrients lost due to soil erosion is given in Table 22 and Figure 10. The average value of soil nutrient loss is around Rs 360 per ha/year. The total cost of annual soil nutrients is around Rs. 149262 per year for the total area of 599.11 ha.

Table 22: Estimation of onsite cost of soil erosion in Ketanapura Microwatershed

Particulars	**Quantity(kg)**		**Value (Rs)**	
	Per ha	**Total**	**Per ha**	**Total**
Organic matter	47.72	19803.1	300.6	124760
Phosphorus	0.84	349.6	37.1	15380
Potash	0.06	24.5	1.2	490
Iron	0.02	7.4	0.9	355
Manganese	0.04	16.6	11.0	4575
Cupper	0.00	1.7	2.2	930
Zinc	0.00	0.9	0.1	37
Sulphur	0.16	67.1	6.5	2684
Boron	0.00	1.3	0.1	51
Total	44.17	20272	359.67	149262

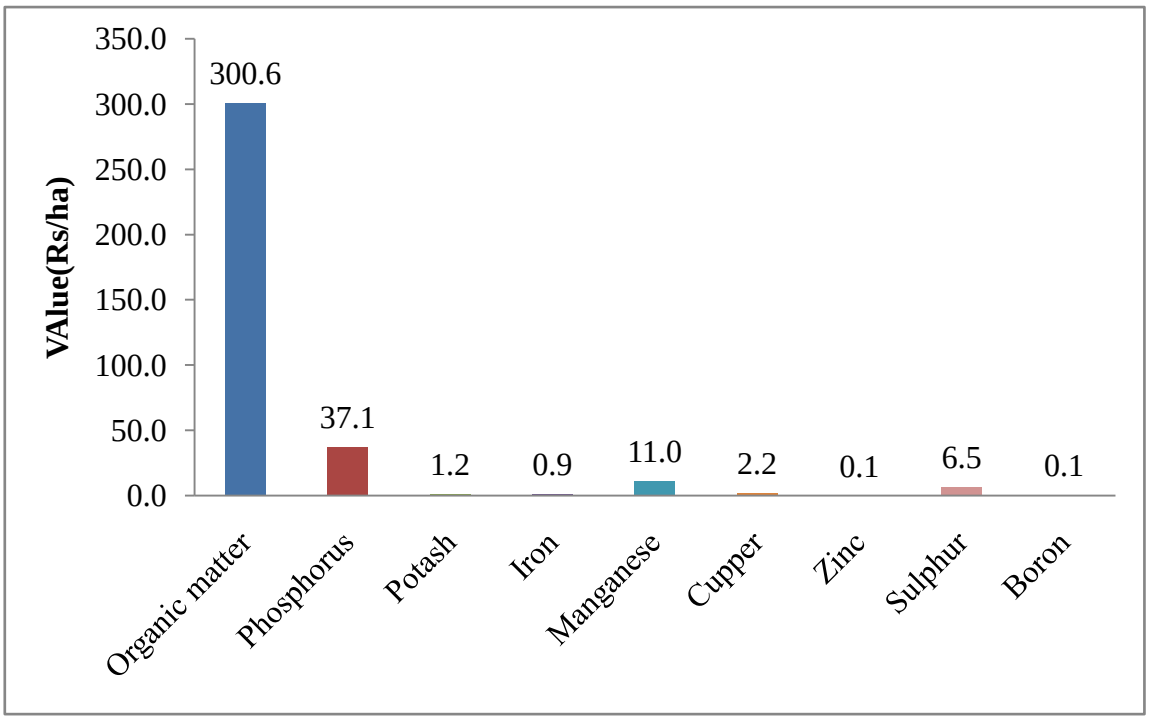


Figure 10: Estimation of onsite cost of soil erosion in Ketanapura Microwatershed

The average value of ecosystem service for food grain production is around Rs. 51293/ ha/year. Per hectare food production services is maximum in coconut (Rs. 71534) followed by maize (Rs. 15241), horse gram (Rs. 4084), sorghum (Rs. 254) and cowpea and sunflower is negative returns.

Table 23: Ecosystem services of food grain production in Ketanapura Microwatershed

Production items	Crops	Area in ha	Yield (Qtl/ha)	Price (Rs/Qtl)	Gross Returns (Rs/ha)	Cost of Cultivation (Rs/ha)	Net Returns (Rs/ha)
Cereals	Maize	3.3	29.0	2160	63011	47770	15241
	Sorghum	2.1	14.0	1933	27863	27609	254
Pulses	Cowpea	0.2	8.0	5200	40560	64960	-24400
	Horse gram	5.3	8.0	3379	25948	21864	4084
Oil seeds	Coconut	0.9	47.0	1800	84686	13152	71534
	Sunflower	0.4	5.0	3800	18772	48471	-29699
Average value		12.2	18.5	3045	43473	37304	6169

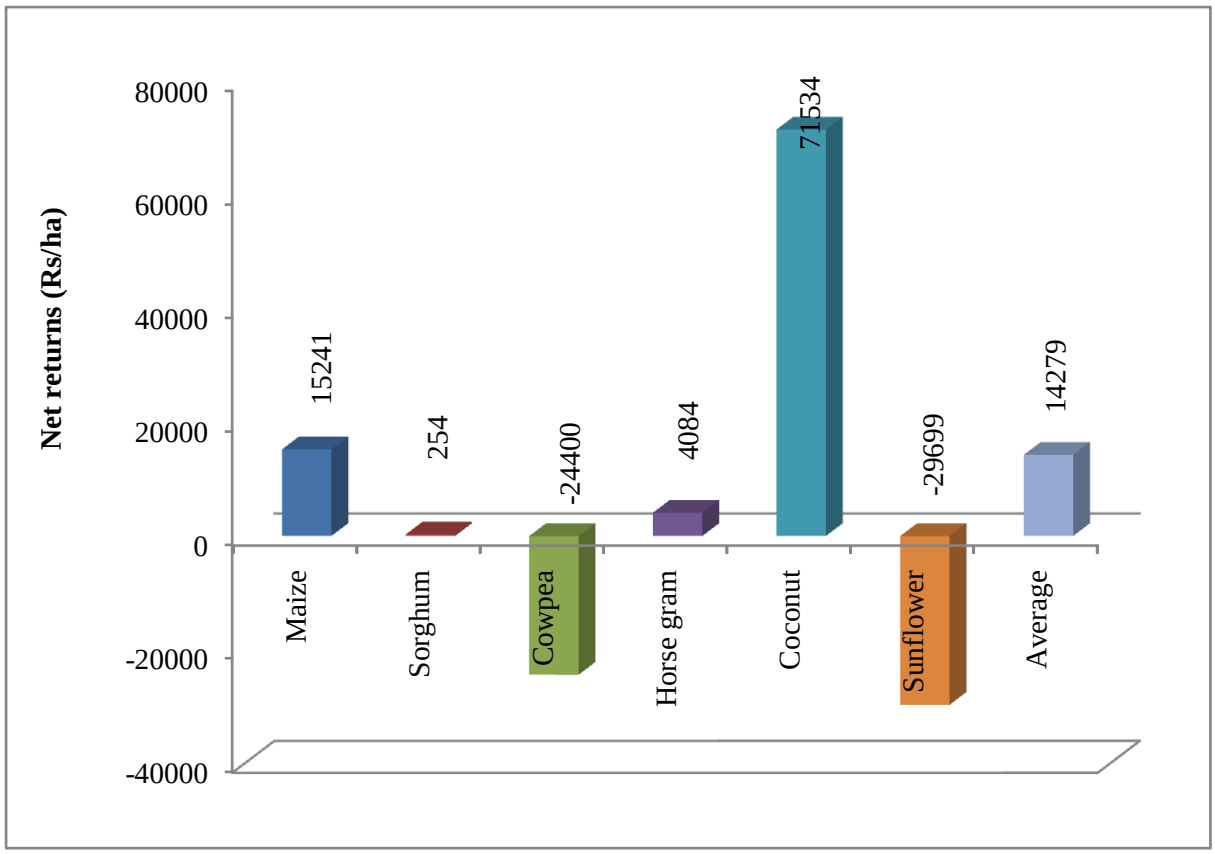


Figure 11: Ecosystem services of food production in Ketanapura Microwatershed

The average value of ecosystem service for fodder production is around Rs. 1572/ ha/year (Table 24). Per hectare fodder production services is maximum in horse gram (Rs. 2099) followed by maize (Rs. 1650) and sorghum (Rs. 968).

Table 24: Ecosystem services of fodder production in Ketanapura Micro-watershed

Production items	Crops	Area in ha	Yield (Qtl/ha)	Average of Price (Rs/Qtl)	Net Returns (Rs/ha)
Cereals	Maize	3.3	2.8	600	1650
	Sorghum	2.1	1.6	600	968
Pulses	Horse gram	5.3	3.6	579	2099
Average value		10.7	2.7	593	1572

The water demand for production of different crops was worked out in arriving at the ecosystem services of water support to crop growth. The data on water requirement for producing one quintal of grain is considered for estimating the total value of water required for crop production. Per hectare value of water used and value of water was maximum (Table 25 and Figure 12) in coconut (Rs 126417) followed by sorghum (Rs 43928), maize (Rs 35648), horse gram (Rs 23639), sunflower (Rs. 16628) and cowpea (Rs. 9797).

Table 25: Ecosystem services of water supply in Ketanapura Microwatershed

Crops	Yield (Qtl/ha)	Virtual water (cubic meter) per ha	Value of Water (Rs/ha)	Water consumption (Cubic meters/Qtl)
Coconut	47	12642	126417	269
Cowpea	7.8	980	9797	126
Horse gram	7.7	2364	23639	308
Maize	29.2	3565	35648	122
Sorghum	14.4	4393	43928	305
Sunflower	4.9	1663	16628	337
Grand Total	18.5	4268	42676	245

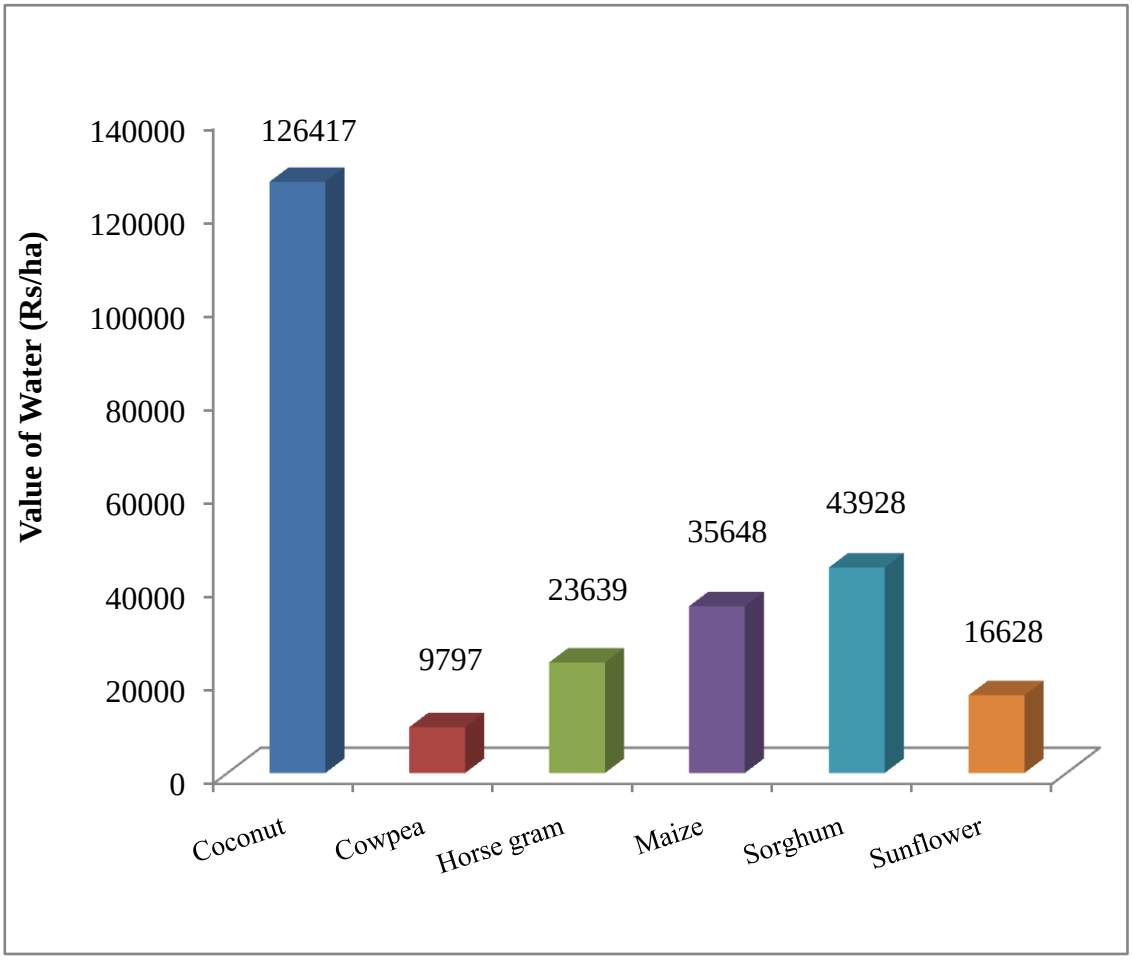


Figure 12: Ecosystem services of water supply in Ketanapura Microwatershed

The main farming constraints in Ketanapura micro-watershed to be found are less rainfall, lack of good quality seeds, lack of storage, damage of crops by wild animals and non availability of plant protection chemicals. Majority of farmers depend up on money lender of the sources of loan for purpose of crop production. Farmers to sell the agriculture produce through village market and the farmers getting the agriculture related information on newspaper and television. Farmers reported that they are not getting timely support/extension services from the concerned development department (Table 26).

Table 26: Farming constraints related land resources of sample households in Ketanapura Microwatershed

Sl. No	Particulars	Per cent
1	Less Rainfall	100.0
2	Lack of good quality seeds	20.0
3	Lack of transportation	20.0
4	Lack of storage	10.0
5	Damage of crops by Wild Animals	100.0
6	Non availability of Plant Protection Chemicals	80.0
7	**Source of loan**	
	Money Leander	100.0
8	**Market for selling**	
	Village market	100.0
9	**Sources of Agri-Technology information**	
	Newspaper	90.0
	Television	10.0

The findings of the study would be very much useful to the planners and policy makers of the study area to identify the irrationality in the existing production pattern and to suggest appropriate production plans for efficient utilization of their scarce resources resulting in increased net farm incomes and employment. The study also throws light on future potentialities of increasing net farm income and employment under different situations viz., with existing and recommended technology.