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

MUNDAL-1 (4D5B1I2d) MICROWATERSHED

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

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

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

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

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

ICAR-NBSS&LUP, Regional Centre, Bangalore has taken up a project sponsored by the Karnataka Watershed Development Project-II, (Sujala-III), Government of Karnataka funded by the World Bank under Component -1 Land Resource Inventry. This study was taken up to demonstrate the utility of such a database in reviewing, monitoring and evaluating all the land based watershed development programs on a scientific footing. To meet the requirements of various land use planners at grassroots level, the present study on "Land Resource Inventory and Socio-Economic Status of Farm Households for Watershed Planning and Development of for Mundal-1 microwatershed in Yadgir Taluk and District, Karnataka" for integrated development was taken up in collaboration with the State Agricutural Universities, IISC, KSRSAC, KSNDMC as Consortia partners. The project provides detailed land resource information at cadastral level (1:7920 scale) for all the plots and socio-economic status of farm households covering thirty per cent farmers randomely selected representing landed and landless class of farmers in the micro-watershed. The project report with the accompanying maps for the microwatershed will provide required detailed database for evolving effective land use plan, alternative land use options and conservation plans for the planners, administrators, agricutural extention personnel, KVK officials, developmental departments and other land users to manage the land resources in a sustainable manner.

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

Nagpur
Date: 03-10-2019

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PART-A

LAND RESOURCE INVENTORY

Contents

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

The land resource inventory of Mundal-1Microwatershed was conducted using village cadastral maps and IRS satellite imagery on 1:7920 scale. The false colour composites of IRS imagery were interpreted for physiography and the physiographic delineations were used as base for mapping soils. The soils were studied in several transects and a soil map was prepared with phases of soil series as mapping units. Random checks were made all over the area outside the transects to confirm and validate the soil map unit boundaries. The soil map shows the geographic distribution and extent, characteristics, classification, behavior and use potentials of the soils in the microwatershed.

The present study covers an area of 490 ha in Yadgir taluk & district, Karnataka. The climate is semiarid and categorized as drought-prone with an average annual rainfall of 866 mm, of which about 652 mm is received during south-west monsoon, 138 mm during north-east and the remaining 76 mm during the rest of the year. An area of 443 ha in the microwatershed is covered by soils, 5 ha by railway line, 8 ha by rock outcrops and 33 ha by others (habitation and water body). The salient findings from the land resource inventory are summarized briefly below.

- *The soils belong to 9 soil series and 11 soil phases (management units) and 5 land management units.*
- *The length of crop growing period is about 120-150 days starting from 1st week of June to 4th week of October.*
- *From the master soil map, several interpretative and thematic maps like land capability, soil depth, surface soil texture, soil gravelliness, available water capacity, soil slope and soil erosion were generated.*
- *Soil fertility status maps for macro and micronutrients were generated based on the surface soil samples collected at every 320 m grid interval.*
- *Land suitability for growing 29 major agricultural and horticultural crops was assessed and maps showing the degree of suitability along with constraints were generated.*
- *An area about 91 per cent in the microwatershed is suitable for agriculture.*
- *About 21 per cent area of the microwatershed has soils that are deep to very deep (100- >150 cm, 38 per cent soils are moderately deep (75-100), whereas 5 per cent soils are moderately shallow (50 -75 cm) and 27 per cent soils are shallow (25 -50 cm) in the microwatershed.*
- *About 45 per cent area in the microwatershed has sandy soils, 21 percent soils are loamy and 24 per cent clayey soils at the surface.*
- *Maximum area of about 89 percent soils are non gravelly (<15%) and about 1 percent soils are gravelly (15-35%) in the microwatershed.*

- *About 20 per cent area of the microwatershed is very high (>200 mm/m) in available water capacity, 6 percent soils are medium (51-100), 38 per cent soils are low (51-100 mm/m) and 27 per cent area is very low (<50 mm/m) available water capacity.*
- *Entire cultivated area in the microwatershed has very gently sloping (1-3% slope) lands.*
- *An area of about 83 per cent area is moderately (e2) eroded and 7 percent soils are slightly eroded (e1) lands.*
- *An area of about <1 per cent soils are slightly acid (pH 6.0 -6.5), about 32 per cent soil are neutral (pH 6.5-7.3) and 58 per cent soil are slightly to very strongly alkaline (pH 7.3->9.0), soils.*
- *The Electrical Conductivity (EC) of the soils in the entire cultivated area of the microwatershed is dominately <2 ds^{m-1} indicating that the soils are non-saline.*
- *An area of about 42 per cent is low (<0.5%) and 49 percent is medium (0.50-0.75%) in organic carbon content.*
- *Available phosphorus content is medium (23-57 kg/ha) in the entire cultivated area of the microwatershed.*
- *An area of about 18 percent is high (>337kg/ha) and 73 percent is medium (145-337kg/ha) in available potassium.*
- *An area of about 24 percent is medium (10-20ppm), 60 percent area is low (<10ppm) and 6 per cent high (>20ppm) in available sulphur*
- *Available boron is low (<0.5 ppm) in a maximum area of about 62 per cent and medium (0.5-1.0 ppm) in about 29 per cent soils.*
- *Available iron content is sufficient (>4.5 ppm) in an area of 62 per cent and deficient (<4.5 ppm) in about 29 per cent in the microwatershed.*
- *Available manganese and copper are sufficient in all the soils of the microwatershed.*
- *Available zinc is deficient (<0.6 ppm) in the entire cultivated area of the microwatershed*
- *The land suitability for 29 major crops grown in the microwatershed were assessed and the areas that are highly suitable (S1) and moderately suitable (S2) are given below. It is however to be noted that a given soil may be suitable for various crops but what specific crop to be grown may be decided by the farmer looking to his capacity to invest on various inputs, marketing infrastructure, market price and finally the demand and supply position.*

Land suitability for various crops in the Microwatershed

Crop	Suitability Area in ha (%)			Crop	Suitability Area in ha (%)	
	Highly suitable (S1)	Moderately suitable (S2)			Highly suitable (S1)	Moderately suitable (S2)
Sorghum	*176(36)*	*136(28)*		*Guava*	-	*7(1)*
Maize	*49(10)*	*151(31)*		*Sapota*	-	*161(33)*
Bajra	*162(33)*	*151(31)*		*Pomegranate*	-	*288(59)*
Groundnut	-	*161(33)*		*Musambi*	*94(19)*	*284(40)*
Sunflower	*66(14)*	*222(45)*		*Lime*	*94(19)*	*284(40)*
Redgram	-	*288(59)*		*Amla*	*103(21)*	*209(43)*
Bengal gram	*127(26)*	*73(15)*		*Cashew*	-	*49(10)*
Cotton	*101(21)*	*99(20)*		*Jackfruit*	-	*161(33)*
Chilli	-	*312(64)*		*Jamun*	-	*101(21)*
Tomato	*49(10)*	*175(36)*		*Custard apple*	*169(35)*	*143(29)*
Brinjal	57(12)	*256(52)*		*Tamarind*	-	*101(21)*
Onion	46(10)	*185(38)*		*Mulberry*	-	*161(33)*
Bhendi	7(1)	*305(62)*		*Marigold*	-	*312(64)*
Drumstick	-	*288(59)*		*Chrysanthemum*	-	*312(64)*
Mango	-	*7(1)*				

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

Chapter 1

INTRODUCTION

Soil being a vital natural resource on whose proper use depends the life supporting systems of a country and the socioeconomic development of its people. Soils provide food, fodder, fibre and fuel for meeting the basic human and animal needs. With the ever increasing growth in human and animal population, the demand on soil for more food and fodder production is on the increase. The area available for agriculture is about 51 per cent of the total geographical area and more than 60 per cent of the people are still dependant on agriculture for their livelihood. However, the capacity of a soil to produce is limited and the limits to the production are set by its intrinsic characteristics, agro-climatic setting, and, use and management. There is, therefore, tremendous pressure on land and water resources, which is causing decline in soil-health and stagnation in productivity. The soils have been degrading at an estimated rate of one million hectares per year and ground water levels have been receding at an alarming rate resulting in decline in the ground water resource. Further, land degradation has emerged as a serious problem which has already affected about 38 lakh ha of cultivated area in the State. Soil erosion alone has degraded about 35 lakh ha. Almost all the uncultivated areas are facing various degrees of degradation, particularly soil erosion; salinity and alkalinity has emerged as a major problem in more than 3.5 lakh ha in the irrigated areas of the State. Nutrient depletion and declining factor productivity is common in both rainfed and irrigated areas. The degradation is continuing at an alarming rate and there appears to be no systematic effort among the stakeholders to contain this process. In recent times, an aberration of weather due to climate change phenomenon has added another dimension leading to unpredictable situation to be tackled by the farmers.

In this critical juncture, the challenge before us is not only to increase the productivity per unit area which is steadily declining and showing a fatigue syndrome, but also to prevent or at least reduce the severity of degradation. If the situation is not reversed at the earliest, then the sustainability of the already fragile crop production system and the overall ecosystem will be badly affected in the state. Added to this, every year there is a significant diversion of farm lands and water resources for non-agricultural purposes. Thus, developing strategies to slow down the degradation process or reclaim the soils to normal condition and ensure sustainability of production system are the major issues today. This demands a systematic appraisal of our soil and land resources with respect to their extent, geographic distribution, characteristics, behaviour and use potential, which is very important for developing an effective land use and cropping systems for augmenting agricultural production on a sustainable basis.

The soil and land resource inventories made so far in Karnataka had limited utility because the surveys were of different types, scales and intensities carried out at different times with specific objectives. Hence, there is an urgent need to generate detailed site-

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

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

The land resource inventory aims to provide site-specific database for Mundal-1 microwatershed in Yadgir Taluk and Yadgir District, Karnataka State for the Karnataka Watershed Development Department. The database was generated by using cadastral map of the village as a base along with high resolution IRS LISS IV and Cartosat-1 merged satellite imagery. Later, an attempt will be made to uplink this LRI data generated at 1:7920 scale under Sujala-III Project to the proposed Landscape Ecological Units (LEUs) map.

The study was organized and executed by the ICAR- National Bureau of Soil Survey and Land Use Planning, Regional Centre, Bangalore under Generation of Land Resource Inventory Data Base Component-1 of the Sujala-III Project funded by the World Bank.

Chapter 2

GEOGRAPHICAL SETTING

2.1 Location and Extent

The Mundal-1microwatershed is located in the northern part of Karnataka in Yadgir Taluk & District, Karnataka State (Fig.2.1). It comprises parts of Bheemanagara, Yadhagiri B and Mudhanala villages. It lies between 16^0 45' and 16^0 47' North latitudes and 77^0 05' and 77^0 06' East longitudes covering an area of about 490 ha. It is about 7 km southwest of Yadgir town and is surrounded by Mudhanala on the north, east and west, Bheemanagara on the northeast, and Yadgir-B on the southern side.

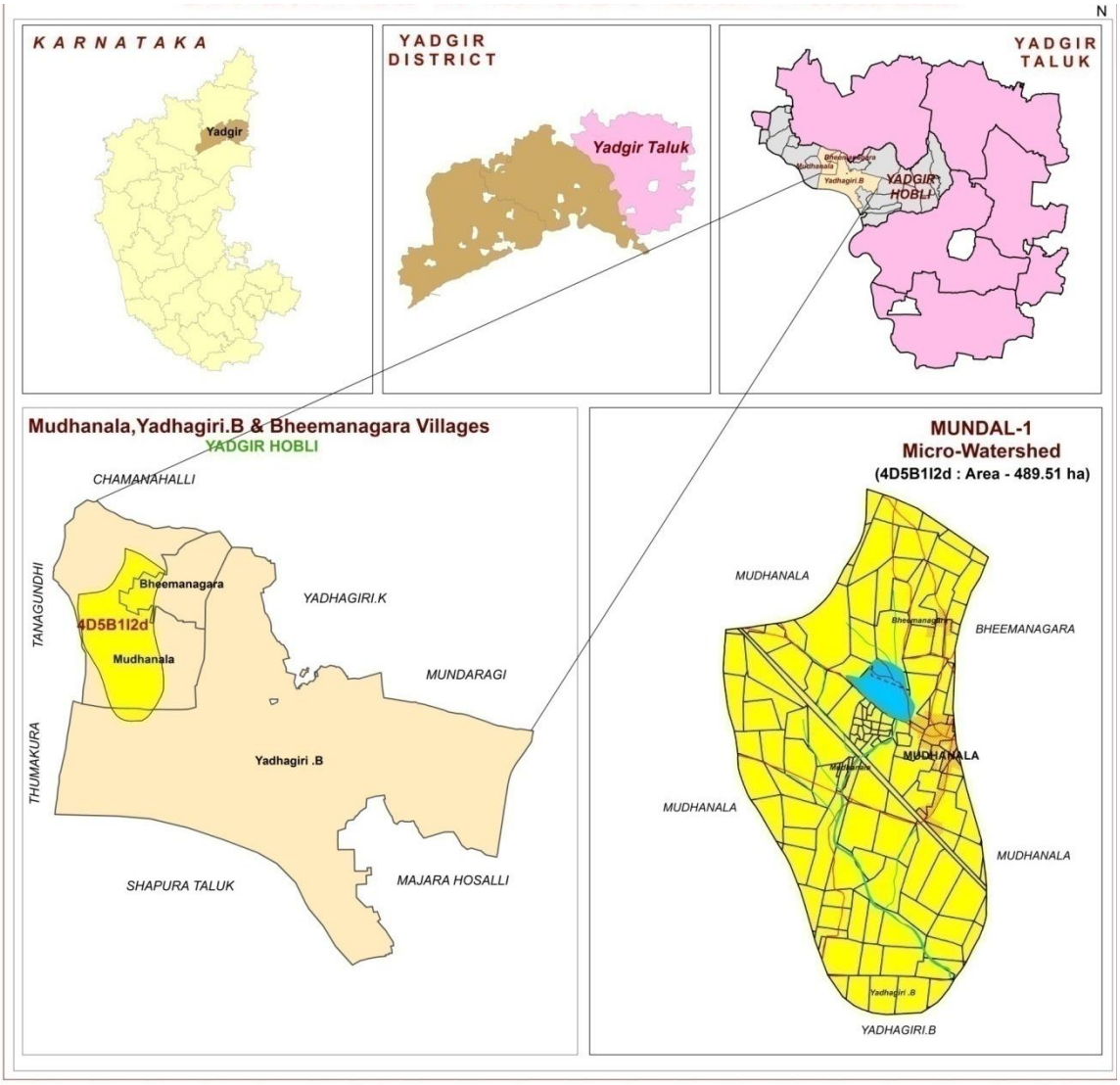

Fig.2.1 Location map of Mundal-1Microwatershed

2.2 Geology

Major rock formations observed in the microwatershed are granite gneiss and alluvium (Figs.2.2a and b). Granite gneisses are essentially pink to gray and are coarse to medium grained. They consist primarily of quartz, feldspar, biotite and hornblende. The gray granite gneisses are highly weathered, fractured and fissured upto a depth of about

10 m. Dolerite dykes and quartz veins are common with variable width and found to occur in Mundal-1microwatershed. The most widespread and characteristic development of alluvium in the watershed region lying between the rivers Krishna and Bhima is a wide belt, the underlying formation is gneiss and alluvial soils occur over gneiss, limestone and shale. The thickness of the alluvium generally is limited to less than a meter, except in river valleys where it is very deep extending to tens of meters. Such soils are transported and represent palaeo black soils originally formed at higher elevation, but now occupying river valleys.

Fig.2.2 Granite and granite gneiss rocks

Fig. 2.2b Alluvium

2.3 Physiography

Physiographically, the area has been identified as granite gneiss and alluvial landscapes based on geology. The area has been further subdivided into five landforms, *viz;* mounds/ridges, summits, side slopes and very gently sloping uplands, plains and valleys based on slope and its relief features. The elevation ranges from 368-389 m above MSL. The mounds and ridges are mostly covered by rock outcrops.

2.4 Drainage

The area is drained by several parallel streams like Bori, Amerja and Kanga which finally join the river Bhima along its course. Though, they are not perennial, during rainy season they carry large quantities of rain water. The microwatershed has only few small tanks which are not capable of storing the water that flows during the rainy season. Due to this, the ground water recharge is very much affected. This is reflected in the failure of many bore wells in the villages. If the available rain water is properly harnessed by constructing new tanks and recharge structures at appropriate places in the villages, then the drinking and irrigation needs of the area can be easily met. The drainage network is parallel to sub parallel and dendritic.

2.5 Climate

The Yadgir district lies in the northern plains of Karnataka and falls under semiarid tract of the state and is categorized as drought- prone with total annual rainfall of 866 mm (Table 2.1). Of the total rainfall, maximum of 652 mm is received during the south–west monsoon period from June to September, the north-east monsoon from October to early December contributes about 138 mm and the remaining 76 mm during the rest of the year. The summer season starts during the middle of February and continues up to the first week of June. The period from December to the middle of February is the coldest season. December is the coldest month with mean daily maximum and minimum temperatures being 29.5^0C and 10^0C respectively. During peak summer, temperature shoots up to 45^0C. Relative humidity varies from 26% in summer to 62% in winter. Rainfall distribution is shown in Figure 2.3. The average Potential Evapo-Transpiration (PET) is 141 mm and varies from a low of 81 mm in December to 199 mm in the month of May. The PET is always higher than precipitation in all the months except July, August and September. Generally, the Length of crop Growing Period (LGP) is 120-150 days and starts from 1st week of June to 4th week of October.

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

Sl. No.	Months	Rainfall	PET	1/2 PET
1	January	4.30	86.0	43.0
2	February	2.30	125.5	62.7
3	March	15.10	166.0	83.0
4	April	18.50	179.8	89.9
5	May	36.0	198.8	97.9
6	June	118.0	175.1	87.5
7	July	171.80	156.3	78.1
8	August	182.9	150.3	75.1
9	September	179.7	142.0	71.0
10	October	105.3	138.5	69.2
11	November	26.4	97.60	48.6
12	December	6.0	80.90	40.4
Total		**866.3**		

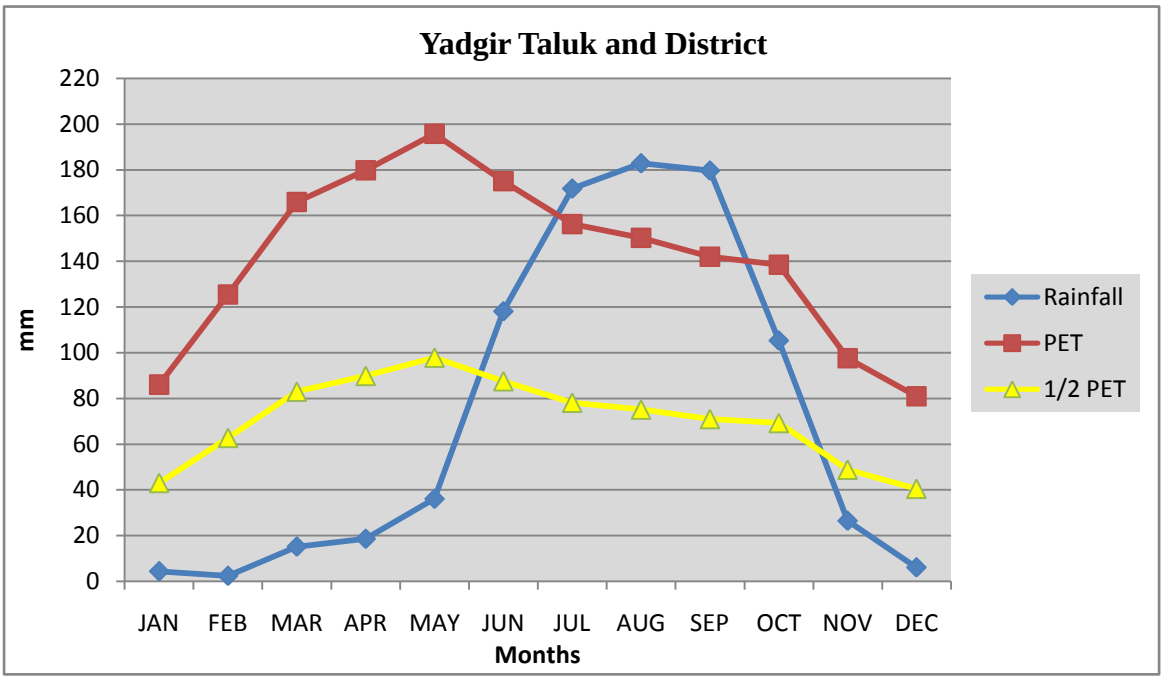

Fig 2.3 Rainfall distribution in Yadgir Taluk, Yadgir District

2.6 Natural Vegetation

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

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

2.7 Land Utilization

About 72 per cent area (Table 2.2) in Yadgir district is cultivated at present. An area of about 2 per cent is permanently under pasture, 20 per cent under current fallows and 6 per cent under non-agricultural land, and 5 per cent under currently barren. Forests occupy an area of about 7 per cent and the tree cover is in a very poor state. Most of the mounds, ridges and bouldery areas have very poor vegetative cover. Major crops grown in the area are sorghum, maize, cotton, sunflower, groundnut, red gram and paddy. The cropping intensity is 120 per cent in the taluk. While carrying out land resource inventory, the land use/land cover particulars are collected from all the survey numbers and a current land use map of the microwatershed is prepared. The current land use map prepared shows the arable and non-arable lands, other land uses and different types of crops grown in the area. The current land use map of Mundal-1microwatershed is presented in Fig.2.4. The different crops and cropping systems adopted in the microwatershed is presented in the Figures 2.5 a & b.

Table 2.2 Land Utilization in Yadgir District

Sl. No.	Agricultural land use	Area (ha)	Per cent
1.	Total geographical area	516088	-
2.	Total cultivated area	373617	72.4
3.	Area sown more than once	74081	14.3
4.	Cropping intensity	-	119.8
5.	Trees and grooves	737	0.14
6.	Forest	33773	6.54
7.	Cultivable wasteland	2385	0.46
8.	Permanent Pasture land	11755	2.28
9.	Barren land	27954	5.41
10.	Non- Agriculture land	29623	5.73
11.	Current Fallows	105212	20.4

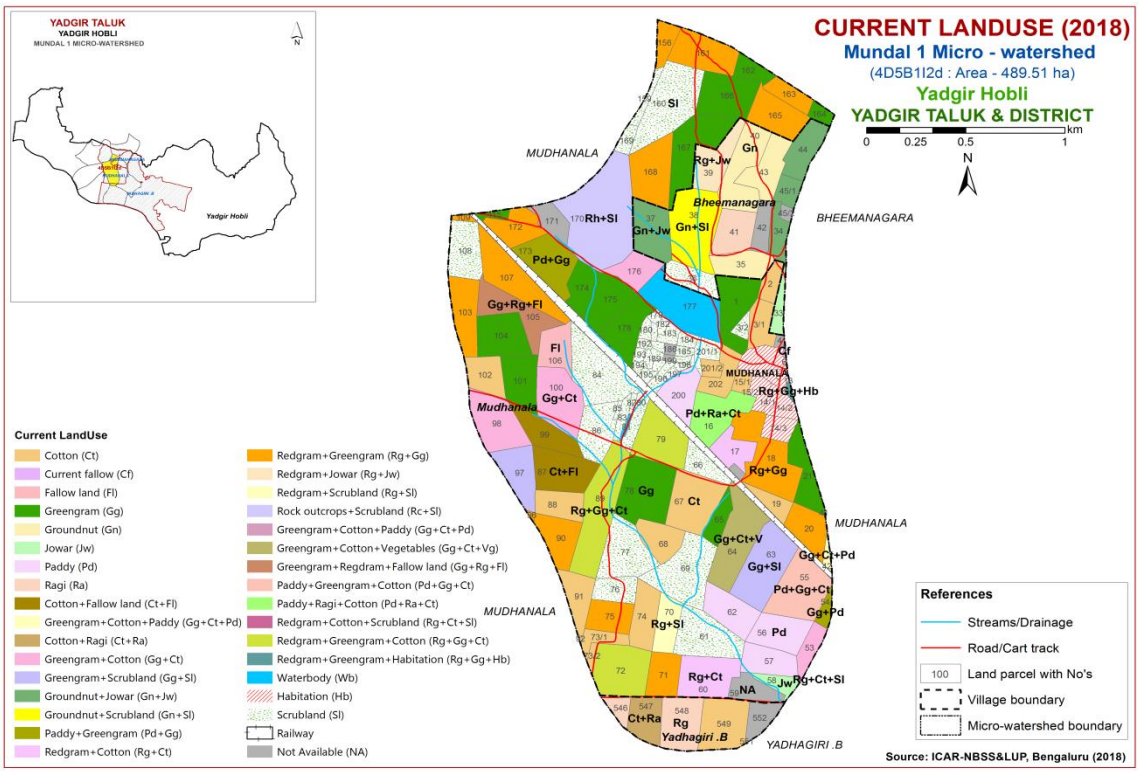

Fig.2.4 Current Land Use map of Mundal-1Microwatershed

Fig 2.5 a. Different Crops and Cropping Systems in Mundal-1Microwatershed

Fig 2.5 b. Different Crops and Cropping Systems in Mundal-1Microwatershed

Chapter 3

SURVEY METHODOLOGY

The purpose of land resource inventory is to delineate similar areas (soil series and phases), which respond or expected to respond similarly for a given level of management. This was achieved in Mundal-1microwatershed by the detailed study of all the soil characteristics (depth, texture, colour, structure, consistence, coarse fragments, porosity, soil reaction, soil horizons etc.) and site characteristics (slope of the land, erosion, drainage, occurrence of rock fragments etc.) followed by grouping of similar areas based on soil-site characteristics into homogeneous (management units) units, and showing the area extent and their geographic distribution on the microwatershed cadastral map. The detailed survey at 1:7920 scale was carried out in an area of 490 ha. The methodology followed for carrying out land resource inventory was as per the guidelines given in Soil Survey Manual (IARI, 1971; Soil Survey Staff, 2006; Natarajan *et al.*, 2015) which is briefly described below.

3.1 Base Maps

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

3.2 Image Interpretation for Physiography

False Colour Composites (FCCs) of Cartosat-I and LISS-IV merged satellite data covering microwatershed area was visually interpreted using image interpretation elements and all the available collateral data with local knowledge. The delineated physiographic boundaries were transferred on to a cadastral map overlaid on satellite imagery. Physiographically, the area has been identified as granite and granite gneiss landscape and alluvial landscape. It was divided into five landforms, *viz;* ridges and mounds, gently and very gently sloping uplands and lowlands based on slope and image characteristics. They were further subdivided into physiographic/image interpretation units based on image characteristics. The image interpretation legend for physiography is given below.

Image Interpretation Legend for Physiography

G- Granite Gneiss Landscape

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

DSe – Alluvial landscape

DSe 1 – Summit

DSe 11 –

DSe 12 –

DSe 2 – Very genetly sloping

DSe 21 – Very gently sloping, dark gray tone

DSe 22 – Very gently sloping, medium gray tone

DSe 23 – Very gently sloping, yellowish grey tone

DSe 24 – Very gently sloping, whitish grey tone

DSe 25 – Very gently sloping, whitish/ eroded/ calcareous tone

DSe 26 – Very gently sloping, medium pink

DSe 3 – Valley/ Lowland

DSe 31 – Whitish gray/Calcareous

DSe 32 – Gray with pink patches

DSe 33 – Medium gray tone

DSe 34 – Lightish gray tone

DSe 35 – Dark gray tone

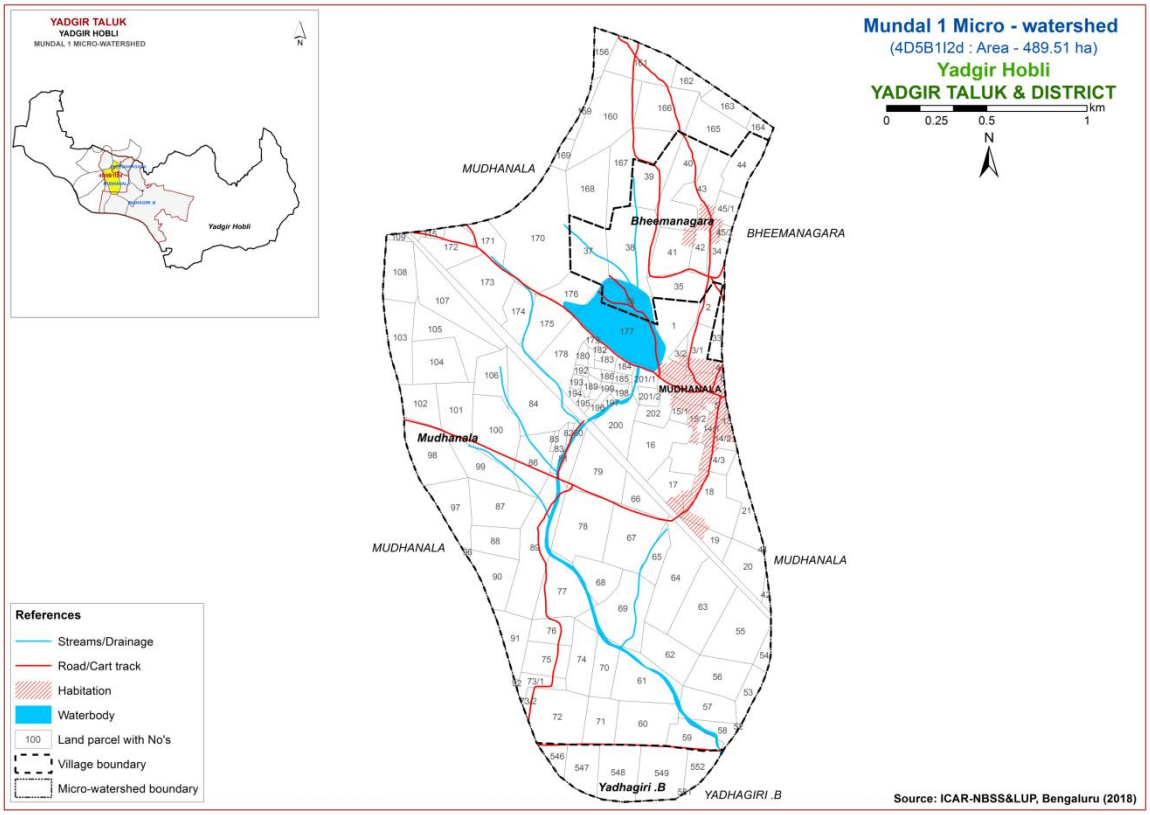

Fig 3.1 Scanned and Digitized Cadastral map of Mundal-1Microwatershed

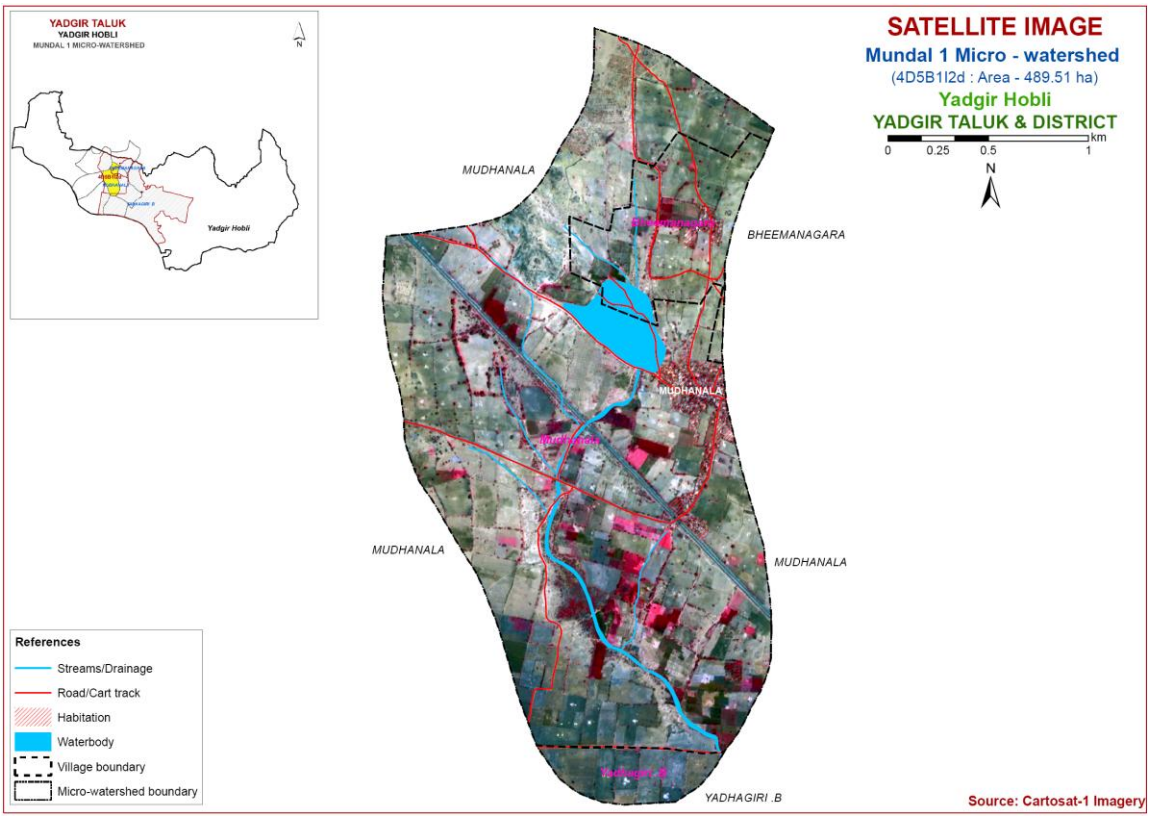

Fig.3.2 Satellite Image of Mundal-1Microwatershed

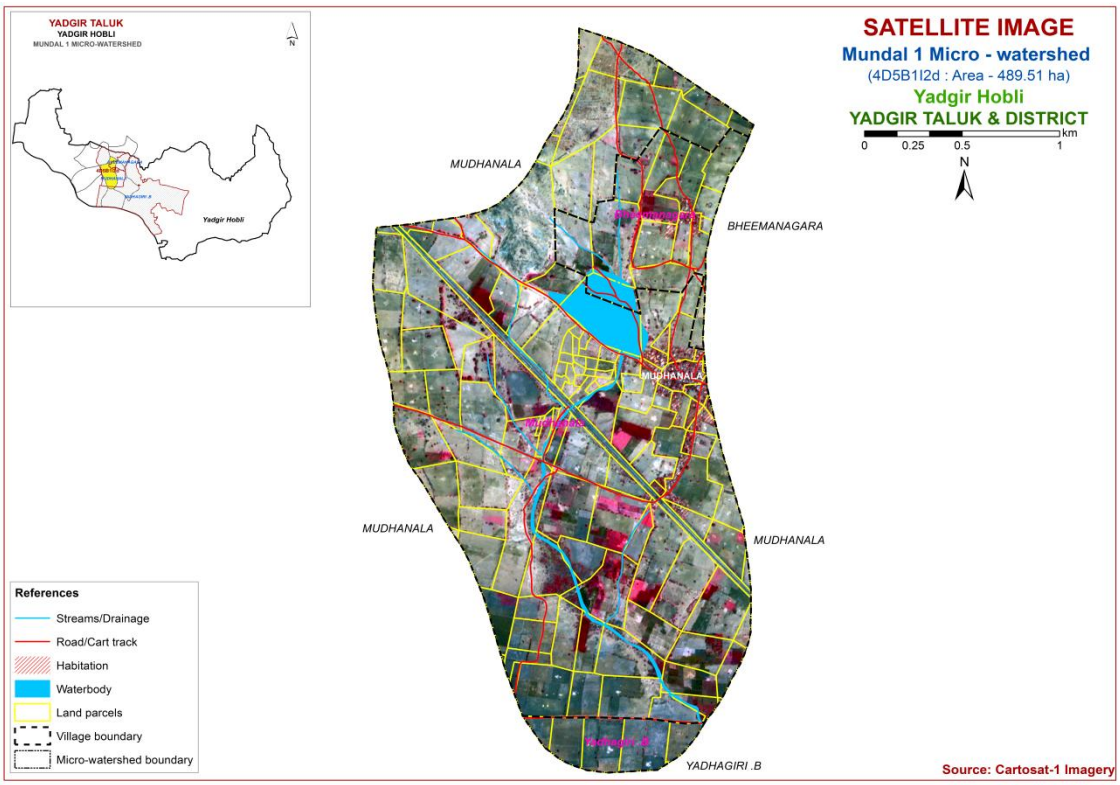

Fig.3.3 Cadastral map overlaid on IRS PAN+LISS IV merged imagery of Mundal-1Microwatershed

3.3 Field Investigation

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

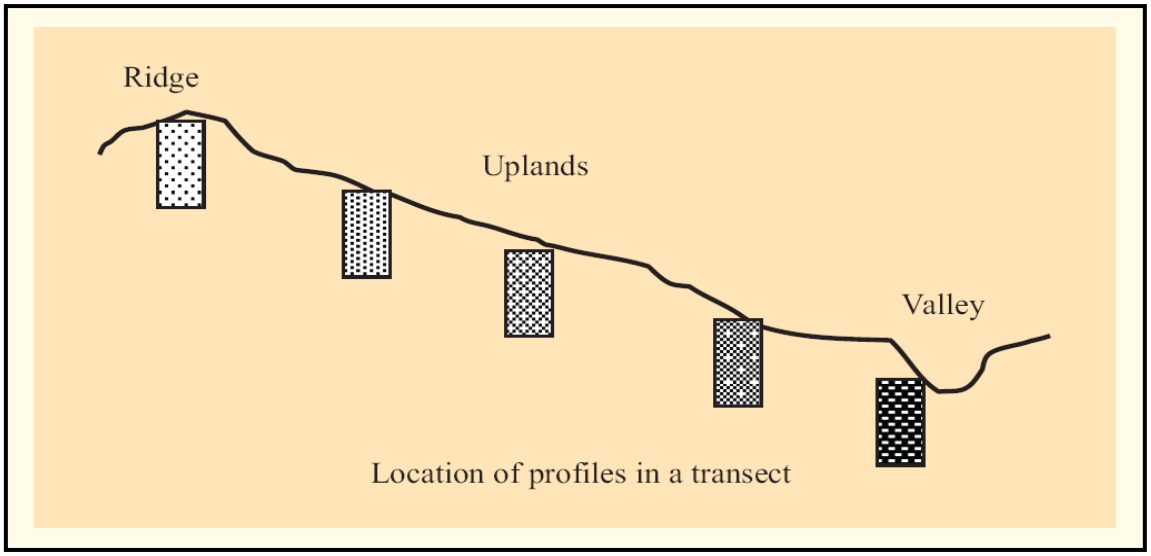

Fig: 3.4. Location of profiles in a transect

In the selected transect, soil profiles were located (Fig. 3.4) at closely spaced intervals to take care of any change in the land features like break in slope, erosion, gravel, stones etc. In the selected sites, soil profiles (vertical cut showing the soil layers from surface to the rock) were opened upto 200 cm or to the depth limited by rock or hard substratum and studied in detail for all their morphological and physical characteristics. The soil and site characteristics were recorded for all profile sites on a standard proforma as per the guidelines given in USDA Soil Survey Manual (Soil Survey Staff, 2012). Apart from the transect study, profiles were also studied at random, almost like in a grid pattern, outside the transect areas.

Based on the soil characteristics, the soils were grouped into different soil series. Soil series is the most homogeneous unit having similar horizons and properties and behaves similarly for a given level of management. Soil depth, texture, colour, kind of horizon and horizon sequence, calcareousness, amount and nature of gravel present, nature of substratum etc, were used as the major differentiating characteristics for identifying soil series occurring in the area. The differentiating characteristics used for identifying the soil series are given in Table 3.1. Based on the above characteristics, 9 soil series were identified in the Mundal-1microwatershed.

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	Calcare-ousness
Soils of Granite gneiss Landscape							
1	BDL (Badiyala)	25-50	7.5 YR 2.5/3,2.5/2,3/3 10YR 3/4,4/3	sl	<15	Ap-Bw	e
2	JNK (Jinkera)	50-75	10YR 3/1,3/2 7.5YR 3/4	scl	<15	Ap-Bw	e
3	PGP (Pogalapur)	75-100	5YR 4/6,3/3 7.5YR4/4	sc	<15	Ap-Bt	-
4	HSL (Hosalli)	75-100	10YR 5/4,4/4,4/6	sc	<15	Ap-Bw	e
5	ANR (Anur)	100-150	10YR 4/3,4/1	c	<15	Ap-Bw	es
6	BGD (Belagundi)	100-150	10YR 5/4,4/4 7.5YR 4/4	c	<15	Ap-Bw	e
7	MDG (Mundargi)	100-150	10YR 4/4,3/3 7.5YR 4/4	scl	<15	Ap-Bw	-
Soils of alluvial Landscape							
8	MGL (Mungala)	75-100	10YR 3/1,4/1	c	<15	Ap-BA-Bss	e
9	HGN (Hegganakera)	>150	10YR 4/2,4/1,3/1,4/1	c	<15	Ap-BA-Bss	e

3.4 Soil Mapping

The area under each soil series was further separated into soil phases and their boundaries delineated on the cadastral map based on the variations observed in the texture of the surface soil, slope, erosion, presence of gravel, stoniness etc. A soil phase is a subdivision of soil series based mostly on surface features that affect its use and management. The soil mapping units are shown on the map (Fig.3.5) in the form of symbols. During the survey many soil profile pits, few minipits and a few auger bores representing different landforms occurring in the microwatershed were studied. In addition to the profile study, spot observations in the form of minipits, road cuts, terrace cuts etc., were studied to validate the soil boundaries on the soil map. The soil map shows the geographic distribution of 11 mapping units representing 9 soil series occurring in the microwatershed. The soil map unit (soil legend) description is presented in Table 3.2. The soil phase map (management units) shows the distribution of 11 soil phases mapped in the microwatershed. Each mapping unit (soil phase) delineated on the map has similar soil and site characteristics. In other words, all the farms or survey numbers included in one soil phase will have similar management needs and have to be treated accordingly.

3.5 Land Management Units (LMU's)

The 11 soil phases identified and mapped in the microwatershed were grouped into 5 Land Management Units (LMU's) for the purpose of preparing a Proposed Crop Plan for sustained development of the microwatershed. The database (soil phases) generated under LRI was utilized for identifying Land Management Units (LMU's) based on the management needs. One or more than one soil site characteristic having influence on the management have been chosen for identification and delineation of LMUs. For Mundal-1 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.

3.6 Laboratory Characterization

Soil samples for each soil 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 (47 samples) for fertility status (major and micronutrients) at 320 m grid interval in the year 2018 were analyzed in the laboratory (Katyal and Rattan, 2003). By linking the soil fertility data to the survey numbers through GIS, soil fertility maps were generated by using Kriging method for the microwatershed.

Table 3.2 Soil map unit description of Mundal-1Microwatershed

Soil Map unit No.	Soil Series	Soil Phase	Mapping Unit Description	Area in ha (%)
Soils of Granite Gneiss Landscape				
	BDL	Badiyala soils are shallow (25-50 cm), well drained, have dark brown to very dark brown and dark yellowish brown, slightly calcareous sandy loam soils occurring on very gently to gently sloping uplands under cultivation		**131(26.77)**
2		BDLbB2	Loamy sand surface, slope 1-3%, moderate erosion	109 (22.26)
4		BDLhB2	Sandy clay loam surface, slope 1-3%, moderate erosion	22 (4.51)
	JNK	Jinkera soils are moderately shallow (50-75 cm), well drained, have dark brown to very dark grayish brown, slightly calcareous sandy clay loam black soils occurring on very gently sloping uplands under cultivation		**24 (4.85)**
20		JNKcB2	Sandy loam surface, slope 1-3%, moderate erosion	24 (4.85)
	PGP	Poglapur soils are moderately deep(75-100 cm), well drained, have brown to dark reddish brown and yellowish red, sandy clay red soils occurring on very gently sloping uplands under cultivation		**49 (10.11)**
40		PGPcB2	Sandy loam surface, slope 1-3%, moderate	49 (10.11)

Soil Map unit No.	Soil Series	Soil Phase	Mapping Unit Description	Area in ha (%)
			erosion	
	HSL	Hosalli soils are moderately deep (75-100 cm), well drained, have yellowish brown to dark yellowish brown, slightly calcareous sandy clay soils occurring on very gently sloping uplands under cultivation		**112 (22.9)**
111		HSLbB2	Loamy sand surface, slope 1-3%, moderate erosion	112 (22.9)
	ANR	Anur soils are deep (100-150 cm), moderately well drained, have dark gray to brown, sodic, calcareous, clay soils occurring on very gently sloping uplands under cultivation		**39 (7.88)**
55		ANRiB2	Sandy clay surface, slope 1-3%, moderate erosion	39 (7.88)
	BGD	Belagundi soils are deep (100-150 cm), well drained, have brown to dark yellowish brown, calcareous clay soils occurring on very gently sloping uplands under cultivation		**2 (0.36)**
115		BGDmB2	Clay surface, slope1-3%, moderate erosion	2 (0.36)
	MDG	Mundargi soils are deep (100-150 cm), moderately well drained, have brown to dark yellowish brown, sodic, sandy clay loam soils occurring on very gently sloping uplands under cultivation		**7 (1.45)**
149		MDGhB2g1	Sandy clay loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	7 (1.45)
Soils of Alluvial Landscape				
	MGL	Mungala soils are moderately deep (75-100 cm), moderately well drained, have dark gray to very dark gray, slightly calcareous black cracking clay soils occurring on very gently sloping plains under cultivation		**26 (5.35)**
82		MGLmB2	Clay surface, slope 1-3%, moderate erosion	26 (5.35)
	HGN	Hegganakera soils are very deep (>150 cm), moderately well drained, have dark gray to very dark grayish brown and brown, slightly calcareous cracking clay black soils occurring on very gently sloping plains under cultivation		**54(10.88)**
95		HGNmB2	Clay surface, slope 1-3%, moderate erosion	19 (3.8)
138		HGNmB1	Clay surface, slope 1-3%, slight erosion	35 (7.08)
992		Railway	Railway line	5 (1.08)
999		Rock outcrops	Rock lands both massive and bouldery with little or no soil	**8 (1.63)**
1000		Others	Habitation & water body	**33 (6.74)**

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

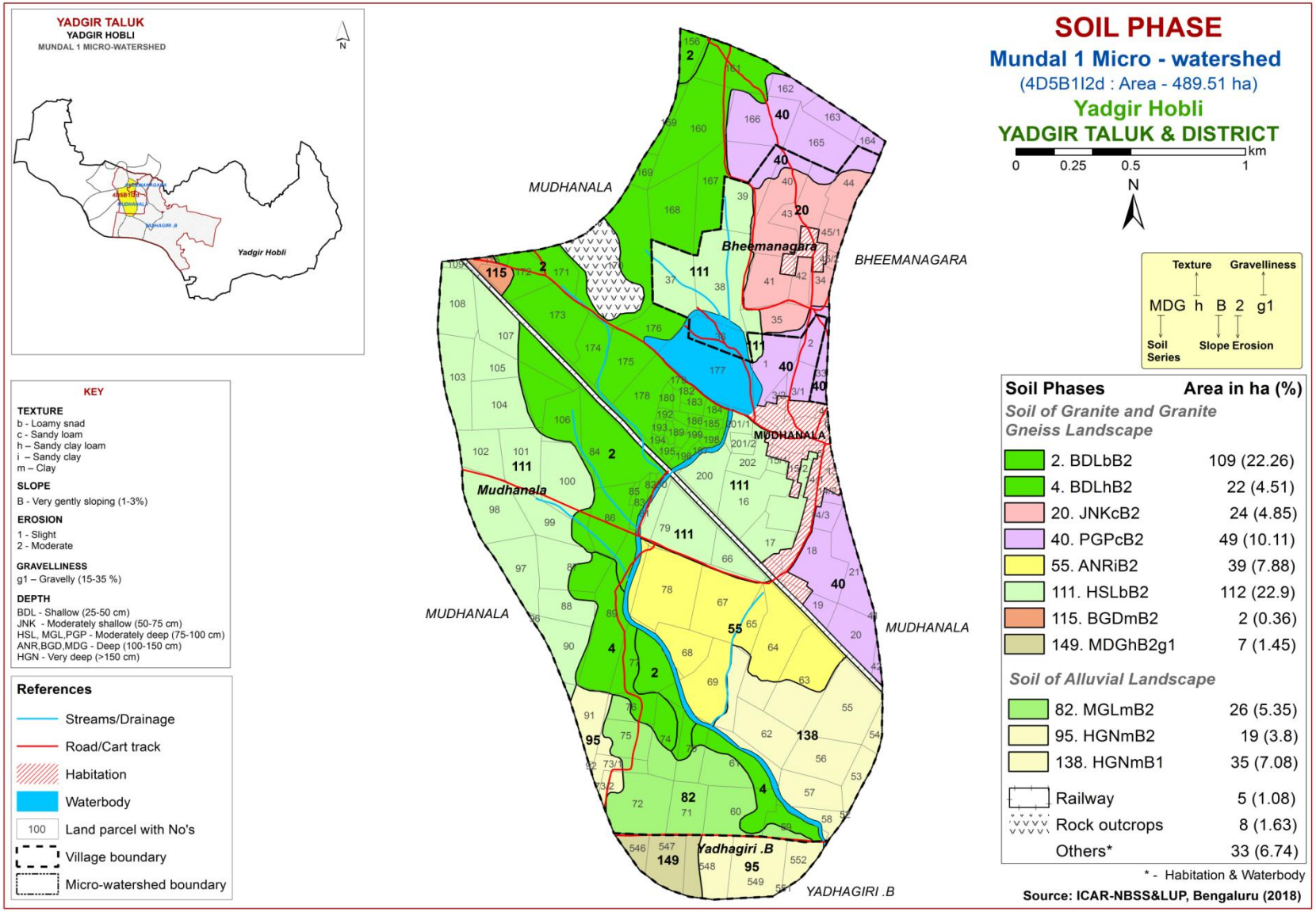

Fig 3.5 Soil Phase or Management Units - Mundal-1Microwatershed

Chapter 4

THE SOILS

Detailed information pertaining to the nature, extent and their distribution of different kinds of soils occurring in Mundal-1microwatershed is provided in this chapter. The microwatershed area has been identified as granite gneiss and alluvial landscapes based on geology. In all, 9 soil series are identified. Soil formation is the result of the combined effect of environmental and terrain factors that are reflected in soil morphology. In the granite gneiss landscape, it is by parent material, relief and climate and in alluvial landscape it is by parent material and time.

A brief description of each of the 9 soil series identified followed by 11 soil phases (management units) mapped are furnished below. The physical and chemical characteristics of soil series identified in Mundal-1microwatershed are given in Table 4.1 along with soil classification. The soils in any one map unit differ from place to place in their depth, texture, slope, gravelliness, erosion or any other site characteristic that affect management. The soil phase map can be used for identifying the suitability of areas for growing specific crops or for other alternative uses and also for deciding the type of conservation structures needed. The detailed information on soil and site-characteristics like soil depth, surface soil texture, slope, erosion, gravelliness, AWC, LCC etc, with respect to each of the soil phase identified is given village/survey number wise for the microwatershed in Appendix-I.

4.1 Soils of granite gneiss landscape

In this landscape, 7 soil series are identified and mapped. Of these, BDL series occupies maximum area of 131 ha (27%) followed by HSL 112 ha (23%), PGP 49 ha (10%), ANR 39 ha (8%), JNK 24 ha (5%), MDG 7 ha (1) and BGD 2 ha (<1%). Brief description of each series identified and number of soil phases mapped is given below.

4.1.1 Badiyala (BDL) Series: Badiyala soils are shallow (25-50 cm), well drained, have very dark brown, dark yellow brown and dark brown, slightly calcareous sandy loam soils. They are developed from weathered granite gneiss and occur on very gently to gently sloping uplands under cultivation. The Badiyala series has been classified as a member of the coarse-loamy, mixed, isohyperthermic family of Fluventic Haplustepts.

The thickness of the solum ranges from 28 to 50 cm. The thickness of A horizon ranges from 4 to 12 cm. Its colour is in 10YR hue with value 3 to 4 and chroma 3 to 4. The texture is loamy sand, sandy clay loam and sandy clay. The thickness of B horizon ranges from 27 to 45 cm. Its colour is in 10 YR and 7.5 YR hue with value 2 to 4 and chroma 3 to 4. Its texture is sandy loam to sandy clay loam and is slightly calcareous. The available water capacity is very low (<50mm/m). Two phases were identified and mapped.

Landscape and Soil Profile characteristics of Badiyala (BDL) Series

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

The thickness of the solum ranges from 51-75 cm. Thickness of A horizon ranges from 6 to 11 cm. Its colour is in hue 10 YR and 7.5 YR with value and chroma of 3 to 4. The texture varies from sandy loam to sandy clay. The thickness of B horizon ranges from 53 to 66 cm. Its colour is in 10 YR and 7.5 YR hue with value and chroma of 2 to 4. The texture varies from sandy clay loam to sandy clay and is slightly calcareous. The available water capacity is low (51-100 mm/m). Only one phase was identified and mapped.

Landscape and Soil Profile characteristics of Jinkera (JNK) Series

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

The thickness of the solum ranges from 78 to 100 cm. The thickness of A horizon ranges from 8 to 17 cm. Its colour is in 7.5 YR hue with value 3 and chroma 3 to 4. Its texture varies from loamy sand to sandy clay loam and sandy clay. The thickness of B horizon ranges from 65 to 92 cm. Its colour is in 2.5 YR, 5 YR and 7.5 YR hue with value 2 to 4 and chroma 2 to 4. Its texture is sandy clay and clay. The available water capacity is medium (101-150 mm/m). Only one phase was identified and mapped.

Landscape and Soil Profile characteristics of Poglapur (PGP) Series

4.1.4 Hosalli (HSL) Series: Hosalli soils are moderately deep (75-100 cm), moderately well drained, have dark yellowish brown to yellowish brown, slightly calcareous sandy clay soils. They are developed from weathered granite gneiss and occur on very gently to gently sloping uplands under cultivation. The Hosalli 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 6 to 15 cm. Its colour is in hue 10 YR and 7.5 YR with value 3 to 5 and chroma 2 to 4. Its texture varies from loamy sand to sandy loam and sandy clay loam. The thickness of B horizon ranges from 62 to 93 cm. Its colour is in hue 10 YR with value 3 to 4 and chroma 2 to 4. Its texture varies from sandy clay loam to sandy clay and clay and is slightly calcareous. The available water capacity is medium (101-150 mm/m). Only one phase was identified and mapped.

Landscape and Soil Profile characteristics of Hosalli (HSL) Series

4.1.5 Anur (ANR) Series: Anur soils are deep (100-150 cm), moderately well drained, have dark gray to dark brown, calcareous sodic clay soils. They are developed from weathered granite gneiss and occur on very gently to gently sloping uplands under cultivation. The Anur series has been classified as a member of the fine, mixed (calc), isohyperthermic family of Typic Haplustepts.

The thickness of the solum ranges from 102 to 148 cm. The thickness of A-horizon ranges from 9 to 17 cm. Its colour is in 10 YR hue with value 3 to 4 and chroma 2 to 4. The texture ranges from loamy sand to sandy clay loam and sandy clay and are calcareous. The thickness of B horizon ranges from 102 to 135 cm. Its colour is in 10 YR hue with value 3 to 5 and chroma 1 to 6. Texture is sandy clay loam to sandy clay and clay and are calcareous sodic soils. The available water capacity is very high (>200 mm/m). Only one phase was identified and mapped.

Landscape and Soil Profile characteristics of Anur (ANR) Series

4.1.6 Belagundi (BGD) Series: Belagundi soils are deep (100-150 cm), moderately well drained, have dark yellowish brown to yellowish brown and dark brown calcareous cracking clay soils. They are developed from weathered granite gneiss and occur on very gently to gently sloping uplands under cultivation. The Belagundi series has been classified as a member of the very fine, mixed (calc), isohyperthermic family of Typic Haplusterts.

The thickness of the solum ranges from 100 to 145 cm. The thickness of A horizon ranges from 5 to 12 cm. Its colour is in 10 YR and 5 YR hue with value 5 and chroma 2 to 4. The texture varies from sandy to loamy sand. The thickness of B horizon ranges from 95 to 135 cm. Its colour is in 10 YR and 7.5 YR hue with value 4 to 5 and chroma 4. Texture is sandy clay to clay. The available water capacity is very high (>200 mm/m). Only one phase was identified and mapped.

Landscape and Soil Profile characteristics of Belagundi (BGD) Series

4.1.7 Mundargi (MDG) Series: Mundargi soils are deep (100-150 cm), moderately well drained, have dark brown to dark yellowish brown, sandy clay loam soils. They are developed from weathered granite gneiss and occur on very gently to gently sloping uplands under cultivation. The Mundargi series has been classified as a member of the fine-loamy, mixed, isohyperthermic family of Fluventic Haplustepts.

The thickness of the solum ranges from 100 to 149 cm. The thickness of A horizon ranges from 8 to 20 cm. Its colour is in 10 YR hue with value 3 and chroma 1 to 4. The texture ranges from sandy loam to sandy clay loam and sandy clay. The thickness of B horizon ranges from 105 to 140 cm. Its colour is in 10 YR hue with value 3 to 4 and chroma 2 to 4. The texture varies from sandy loam to sandy clay loam and sandy clay. The available water capacity is very high (>200 mm/m). Only one phase was identified and mapped.

Landscape and Soil Profile characteristics of Mundargi (MDG) Series

4.2 Soils of Alluvial Landscape

In this landscape, 2 soil series are identified and mapped. Of these, HGN series occupies maximum area of 54 ha (11%) followed by MGL 26 ha (5%), Brief description of each series identified and number of soil phases mapped is given below.

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

The thickness of the solum ranges from 75 to 100 cm. The thickness of A horizon ranges from 9 to 12 cm. Its colour is in hue 10 YR with value 3 to 4 and chroma 2. Its texture is clay and is calcareous. The thickness of B horizon ranges from 64 to 89 cm. Its colour is in hue 10 YR with value 3 and chroma 1 to 3. Its texture is clay and is slightly calcareous. The available water capacity is medium (101-150 mm/m). Only one phase was identified and mapped.

Landscape and Soil Profile characteristics of Mungala (MGL) Series

4.2.2 Hegganakera (HGN) Series: Hegganakera soils are very deep (>150 cm), moderately well drained, have very dark gray to dark grayish brown, slightly calcareous cracking clay soils. They have developed from alluvium and occur on very gently sloping plains under cultivation. The Hegganakera series has been classified as a member of the very fine, smectitic, isohyperthermic family of Typic Haplusterts.

The thickness of the solum is more than 150 cm. The thickness of A horizon ranges from 7 to 9 cm. Its colour is in 10 YR hue with value 3 to 4 and chroma 1 to 3 with clay texture. The thickness of B horizon ranges from 152 to 175 cm. Its colour is in 10 YR hue with value 2 to 4 and chroma 1 to 3. Its texture is clay and is slightly calcareous. The available water capacity is very high (>200 mm/m). Two phases were identified and mapped.

Landscape and Soil Profile characteristics of Hegganakera (HGN) Series

Table: 4.1 Physical and Chemical Characteristics of Soil Series identified in Mundal-1microwatershed

Soil Series: Badiyala **(**BDL) **Pedon:** R-5

Location: $16^0$37'10.0"N $77^0$20'21.5", Gudalagunta village, Balichakra hobli, Yadgir taluk and district

Analysis at: NBSS&LUP, Regional Centre, Bengaluru **Classification:** Coarse-loamy, mixed, isohyperthermic Fluventic Haplustepts

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-12	Ap	87.13	7.04	5.83	10.03	24.32	23.61	23.51	5.67	<15	ls	6.27	2.44
12-28	Bw1	64.63	13.30	22.07	6.74	13.07	22.30	17.01	5.50	<15	scl	16.34	7.83
28-52	BC	73.11	12.02	14.87	3.93	16.03	26.89	18.41	7.86	<15	sl	12.94	5.47

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	6.20	-	-	0.074	1.00	0.00	2.80	0.98	0.14	0.01	3.92	4.20	0.72	93	0.20
12-28	9.04	-	-	0.253	0.80	3.20	-	-	0.16	0.69	-	16.90	0.77	100	4.09
28-52	9.41	-	-	0.364	1.10	3.60	-	-	0.16	1.39	-	11.10	0.75	100	12.52

Contd…

Soil Series: Jinkera **(**JNK) **Pedon:** R-1

Location: $16^0$45'13.5"N $77^0$10'59.8"E, Varkanahalli village, Yadgir hobli, Yadgir taluk and district

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

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-15	Ap	66.84	13.62	19.54	12.15	21.22	11.23	12.56	9.68	10	sl	14.42	7.70
15-38	Bw1	59.08	12.11	28.81	12.53	12.42	17.85	8.77	7.52	20	scl	18.21	12.23
38-50	Bw2	68.21	11.68	20.11	17.90	21.81	10.60	10.80	7.10	10	scl	14.54	8.96

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-15	8.42	-	-	0.148	0.70	0.65	-	-	0.15	0.03	-	14.50	0.74	100	0.18
15-38	8.38	-	-	0.226	0.31	2.21	-	-	0.09	0.23	-	21.70	0.75	100	1.05
38-50	8.40	-	-	0.195	0.25	1.17	-	-	0.07	0.19	-	15.90	0.79	100	1.23

Contd…

Soil Series: Poglapur (PGP) **Pedon:** R-6

Location: $16^0$34'45.2"N $77^0$10'96.4"E, Anura B village, Sydhapura hobli, Yadgir taluk and district

Analysis at: NBSS&LUP, Regional Centre, Bengaluru **Classification:** Fine, mixed, isohyperthermic Rhodic paleustalfs

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-15	Ap	91.81	4.70	3.49	17.80	30.23	15.57	20.93	7.28	-	s	4.94	2.29
15-50	Bt1	46.83	4.99	48.17	11.92	16.22	8.59	6.77	3.33	10	sc	24.59	17.37
50-90	Bt2	45.81	4.73	49.46	17.10	14.09	6.45	5.16	3.01	15	sc	24.44	16.57
90-125	Bt3	58.92	5.86	35.22	28.51	10.45	10.98	5.49	3.48	15	sc	21.73	10.30

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	6.83	-	-	0.210	0.76	0.00	1.79	0.88	0.41	0.09	3.16	3.15	0.90	100	2.83
15-50	6.20	-	-	0.105	0.48	0.00	12.27	4.45	0.30	0.39	17.40	17.54	0.36	99	2.22
50-90	6.23	-	-	0.080	0.40	0.00	11.51	3.92	0.28	0.37	16.09	17.33	0.35	93	2.16
90-125	6.49	-	-	0.068	0.20	0.00	11.19	3.62	0.27	0.40	15.49	17.43	0.49	89	2.29

Contd…

Soil Series: Hosalli (HSL) **Pedon:** R-3

Location: $16^0$46'60.3"N $77^0$05'47.6"E, Mudhanala village, Yadgir hobli, Yadgir taluk and district

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

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-10	Ap	88.43	5.15	6.42	5.69	6.40	36.04	27.31	12.99	-	s	7.40	2.74
10-30	Bw1	58.47	7.24	34.29	4.26	9.37	19.91	19.28	5.64	-	scl	19.07	11.57
30-50	Bw2	51.43	12.67	35.90	3.49	8.89	16.72	15.87	6.46	<15	sc	21.64	12.44
50-90	Bw3	49.89	13.64	36.47	2.43	2.96	20.61	16.17	7.72	<15	sc	21.12	12.95

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}							%	%
0-10	7.16	-	-	0.117	0.48	0.00	2.83	1.50	0.15	0.29	4.76	4.90	0.76	97	5.94
10-30	6.91	-	-	0.040	0.36	0.00	10.64	5.43	0.10	0.26	16.43	17.80	0.52	92	1.47
30-50	8.17	-	-	0.182	0.24	1.43	-	-	0.12	0.22	-	19.90	0.55	100	1.08
50-90	8.60	-	-	0.148	0.20	4.29	-	-	0.13	0.16	-	19.70	0.54	100	0.81

Contd…

Soil Series: Anur (ANR) **Pedon:** R-15

Location: $16^0$32'45.0"N $77^0$23'57.4"E, Duppalli village, Sydhapura hobli, Yadgir taluk and district

Analysis at: NBSS&LUP, Regional Centre, Bengaluru **Classification:** Fine, mixed (calc), 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
0-18	Ap	64.60	13.44	21.96	7.33	10.42	18.68	20.12	8.05	<15	scl	16.59	7.96
18-49	Bw1	56.66	12.19	31.15	4.73	9.80	18.66	17.02	6.45	-	scl	33.38	13.51
49-95	Bw2	39.94	17.81	42.25	3.09	3.30	15.44	10.65	7.45	<15	c	44.68	25.23
95-123	Bw3	30.65	17.58	51.77	1.50	5.57	10.18	9.65	3.75	<15	c	54.94	32.07

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	10.17	-	-	0.365	0.48	6.11	-	-	0.25	3.52	-	19.90	0.91	100	7.08
18-49	10.32	-	-	1.38	0.30	6.76	-	-	0.21	16.03	-	24.60	0.79	100	26.07
49-95	10.08	-	-	2.55	0.17	6.11	-	-	0.33	21.49	-	32.60	0.77	100	26.36
95-123	9.92	-	-	2.56	0.12	7.93	-	-	0.51	26.03	-	36.00	0.70	100	28.92

Contd…

Soil Series: Belagundi **(**BGD) **Pedon:** T_1/P_2

Location: $16^0$31'65.3"N $77^0$20'84.9"E, Kadechoora village, Sydhapura hobli, Yadgir taluk and district

Analysis at: NBSS&LUP, Regional Centre, Bengaluru **Classification:** Very fine, mixed (calc), isohyperthermic Typic Haplusterpts

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-13	Ap	14.90	17.83	67.27	0.77	2.10	2.65	5.96	3.42	-	c	43.97	29.27
13-40	Bw1	13.07	18.32	68.61	0.80	2.05	2.61	4.20	3.41	-	c	41.23	30.48
40-80	Bw2	11.68	17.18	71.13	0.80	2.06	2.29	3.32	3.21	-	c	46.72	32.41
80-113	Bw3	12.17	16.53	71.30	1.95	1.61	3.21	2.41	2.99	-	c	46.87	35.13

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-13	7.85	-	-	0.253	0.87	5.20	-	-	0.67	0.17	-	65.90	0.98	100	0.26
13-40	8.11	-	-	0.172	0.74	4.29	-	-	0.31	0.16	-	66.70	0.97	100	0.23
40-80	8.44	-	-	0.205	0.58	5.59	-	-	0.20	0.27	-	66.30	0.93	100	0.40
80-113	8.82	-	-	0.201	0.39	10.14	-	-	0.19	0.17	-	63.80	0.89	100	0.27

Soil Series: Mundargi **(**MDG) **Pedon:** R-2

Location: $16^0$46'82.4"N $77^0$04'85.2"E, Thumakura village, Yadgir hobli, Yadgir taluk and district

Analysis at: NBSS&LUP, Regional Centre, Bengaluru **Classification:** Fine-loamy, mixed, isohyperthermic Fluventic 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
0-9	Ap	81.23	12.97	5.80	4.84	10.19	14.83	37.94	13.42	<15	ls	11.75	3.31
9-20	A2	76.82	16.19	6.98	4.96	10.12	20.75	27.53	13.46	-	ls	14.52	3.99
20-46	Bw1	42.43	17.43	40.15	2.26	5.59	11.49	14.93	8.16	-	c	34.90	21.14
46-90	Bw2	54.51	16.56	28.93	4.72	5.03	19.92	16.67	8.18	-	scl	36.73	18.88
90-110	Bw3	53.69	11.00	35.30	9.57	9.89	16.23	13.01	4.99	-	sc	38.72	20.53

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}							%	%
0-9	8.2	-	-	0.399	0.44	0.78	-	-	0.16	0.38	-	4.90	0.84	100	3.08
9-20	8.44	-	-	0.075	0.29	1.82	-	-	0.05	0.35	-	4.90	0.70	100	2.88
20-46	9.39	-	-	0.451	0.32	2.73	-	-	0.12	5.22	-	20.77	0.52	100	10.06
46-90	9.75	-	-	0.616	0.24	3.25	-	-	0.12	5.72	-	16.56	0.57	100	13.82
90-110	9.72	-	-	0.725	0.24	3.64	-	-	0.14	6.84	-	19.76	0.56	100	13.836

Contd…

Soil Series: Mungala (MGL) **Pedon:** R-31

Location: $16^0$43'23.3"N 77^{0-}21'07.7"E, Yaleri village, Balichakra hobli, Yadgir taluk and district

Analysis at: NBSS&LUP, Regional Centre, Bengaluru **Classification:** Fine, smectitic, isohyperthermic Typic Haplusterts

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-9	Ap	31.82	22.28	45.90	3.13	4.10	7.34	11.43	5.83	-	c	28.62	18.29
9-24	BA	27.18	20.72	52.10	2.87	3.20	5.64	9.72	5.75	-	c	29.01	20.46
24-41	Bss1	21.90	23.49	54.61	3.58	3.24	4.25	6.03	4.80	-	c	34.49	24.32
41-84	Bss2	20.13	22.62	57.24	1.68	3.13	4.36	6.38	4.59	-	c	37.07	25.99

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}							%	%
0-9	8.25	-	-	0.23	0.46	1.92	-	-	0.58	0.36	-	49.11	1.07	100	0.74
9-24	8.47	-	-	0.14	0.42	4.56	-	-	0.30	0.30	-	50.83	0.98	100	0.59
24-41	8.59	-	-	0.14	0.42	5.64	-	-	0.13	0.35	-	56.18	1.03	100	0.62
41-84	8.58	-	-	0.15	0.35	4.44	-	-	0.17	0.56	-	60.13	1.05	100	0.93

Contd…

Soil Series: Hegganakera (HGN) **Pedon:** R-12

Location: $16^0$46'19.9"N $77^0$04'34.0"E, Thumakura village, Yadgir hobli, Yadgir taluk and district

Analysis at: NBSS&LUP, Regional Centre, Bengaluru **Classification:** Very fine, smectitic, isohyperthermic Typic Haplusterts

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-8	Ap	20.20	25.22	54.58	2.32	2.76	3.53	8.17	3.42	-	c	42.47	25.59
8-24	BA	21.18	21.70	57.12	2.07	3.28	4.69	7.31	3.82	-	c	41.88	24.67
24-50	Bss1	18.76	21.67	59.57	1.20	2.51	3.93	7.09	4.03	-	c	40.46	23.34
50-86	Bss2	16.74	22.24	61.02	0.88	1.53	4.27	6.02	4.05	-	c	42.18	24.76
86-146	Bss3	18.64	20.20	61.16	2.30	2.41	3.73	6.36	3.84	-	c	40.03	28.61
146-170	Bss4	16.08	19.33	64.59	0.88	2.75	3.41	5.95	3.08	-	c	40.28	29.90

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}							%	%
0-8	8.77	-	-	1.33	1.16	8.19	-	-	1.10	5.21	-	36.23	0.66	100	14.38
8-24	8.93	-	-	1.11	0.64	5.46	-	-	0.87	4.23	-	35.50	0.62	100	11.93
24-50	8.85	-	-	0.984	0.32	3.38	-	-	0.71	3.78	-	36.69	0.62	100	10.30
50-86	8.54	-	-	0.562	0.24	3.38	-	-	0.58	3.07	-	39.16	0.64	100	7.84
86-146	8.45	-	-	0.526	0.24	3.38	-	-	0.62	2.82	-	38.52	0.63	100	7.31
146-170	8.64	-	-	0.517	0.20	4.29	-	-	0.60	2.99	-	36.87	0.57	100	8.12

Chapter 5

INTERPRETATION FOR LAND RESOURCE MANAGEMENT

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

5.1 Land Capability Classification

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

Soil Characteristics: Depth, texture, gravelliness, calcareousness.

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

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

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

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

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

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

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

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

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

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

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

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

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

The 11 soil map units identified in Mundal-1microwatershed are grouped under 2 land capability classes and 2 land capability subclasses. An entire area of 443 ha (91%) in the microwatershed is suitable for agriculture. About 8 ha (1%) area is having rock outcrops, 5 ha (1%) railway line and about 33 ha (7%) is covered by others (water body & habitation) (Fig. 5.1).

Good lands (Class II) cover an area of about 312 (64%) and are distributed in the major part of the microwatershed with minor limitations of soil and erosion. Moderately good lands (Class III) cover an area of about 131 (27%) and are distributed in the central, southern, northern and northwestern of the microwatershed with moderate limitations of soil and erosion.

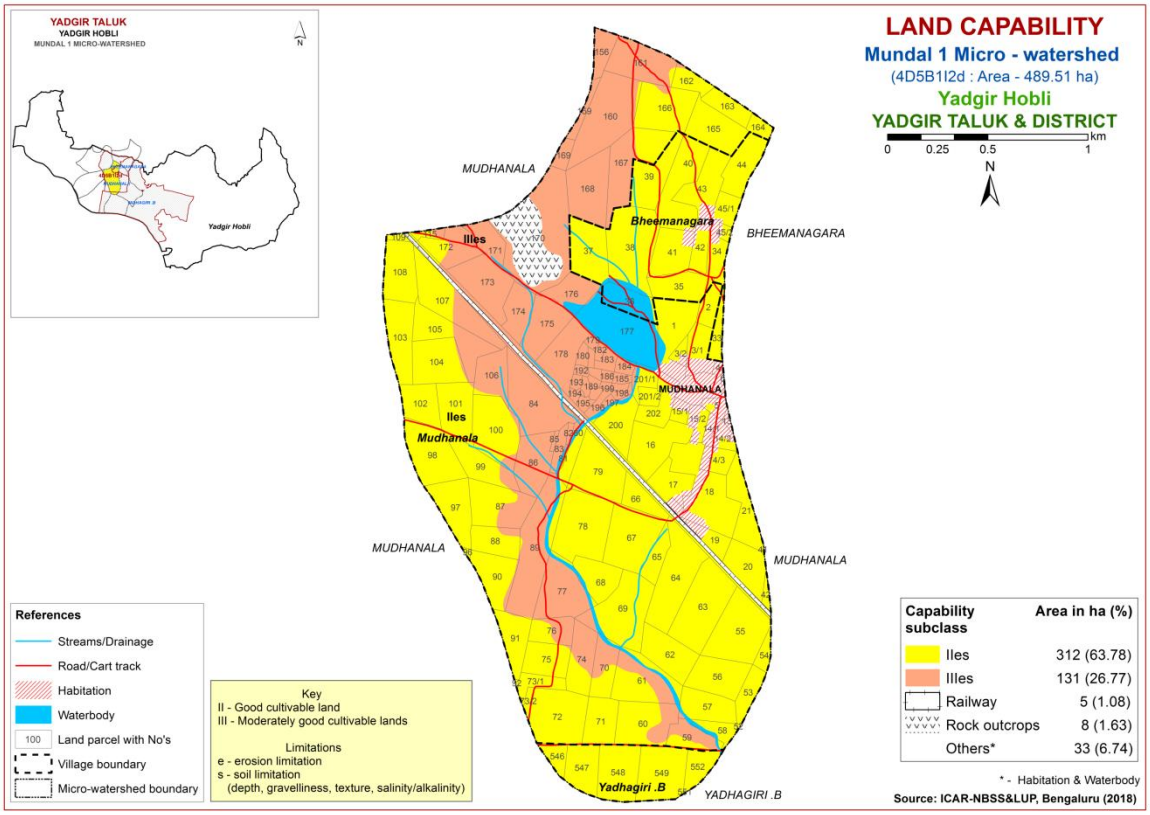

Fig. 5.1 Land Capability map of Mundal-1Microwatershed

5.2 Soil Depth

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

Shallow (25-50 cm) soils occur in an area of 131 ha (27%) and are distributed in central, northern, southern and northwestern of the microwatershed. Moderately shallow (50-75 cm) soils occur in an area of 24 ha (5%) and are distributed in the northern part of the microwatershed. Moderately deep (75-100 cm) soils occur in an area of 188 ha (38%) and is distributed in the major part of the microwatershed. Deep spoils occur in an area of 47 ha (10%) and are distributed in the northwestern, central and southern part of the microwatershed. Very deep (>150 cm) soils cover an area of 53 ha (11%) and are distributed in the southern part of the microwatershed.

The most productive lands cover an area of 100 ha (21%) with respect to soil rooting depth where all climatically adapted annual and perennial crops can be grown are

deep to very deep (100 - >150 cm depth) soils occurring in the major part of the microwatershed. The problem soils covering 131 ha (27%) area are shallow soils, where only short duration crops can be grown occasionally and the probability of crop failure is very high.

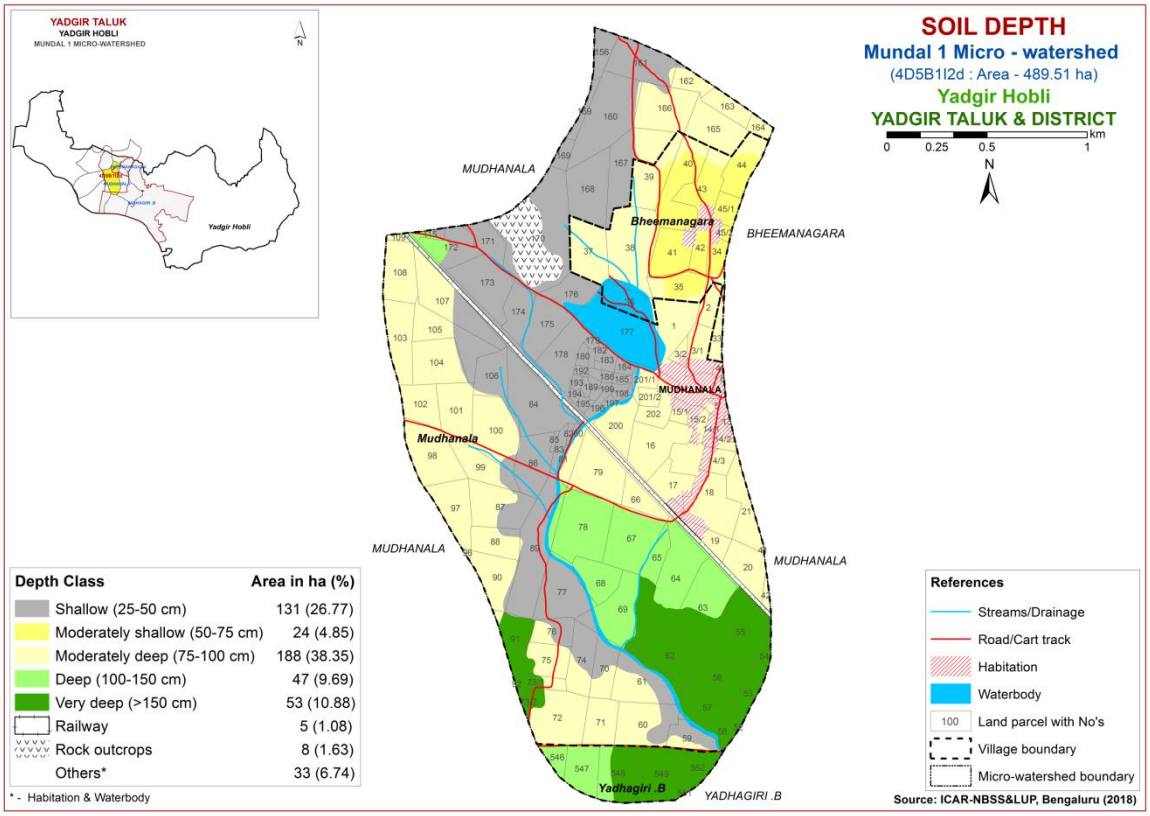

Fig. 5.2 Soil Depth map of Mundal-1Microwatershed

5.3 Surface Soil Texture

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

Maximum area of about 221 ha (45%) of the microwatershed has sandy soils at the surface and are distributed in the major part of the microwatershed. The loamy soils occur in 102 ha (21%) and are distributed in eastern and southern part of the microwatershed. An area of 120 ha (24%) of the microwatershed has soils that are clayey. and are distributed in southern, central and northwestern part of the microwatershed. Both loamy and clay soils soils have high potential for soil-water retention and availability, and

nutrient retention and availability, but clay soils have more problems of drainage, infiltration, workability and other physical problems. Sandy soils are the problematic soils for crop production, since these soils have low water and nutrient retention but good for root or tuber crops with adequate and assured irrigation facility.

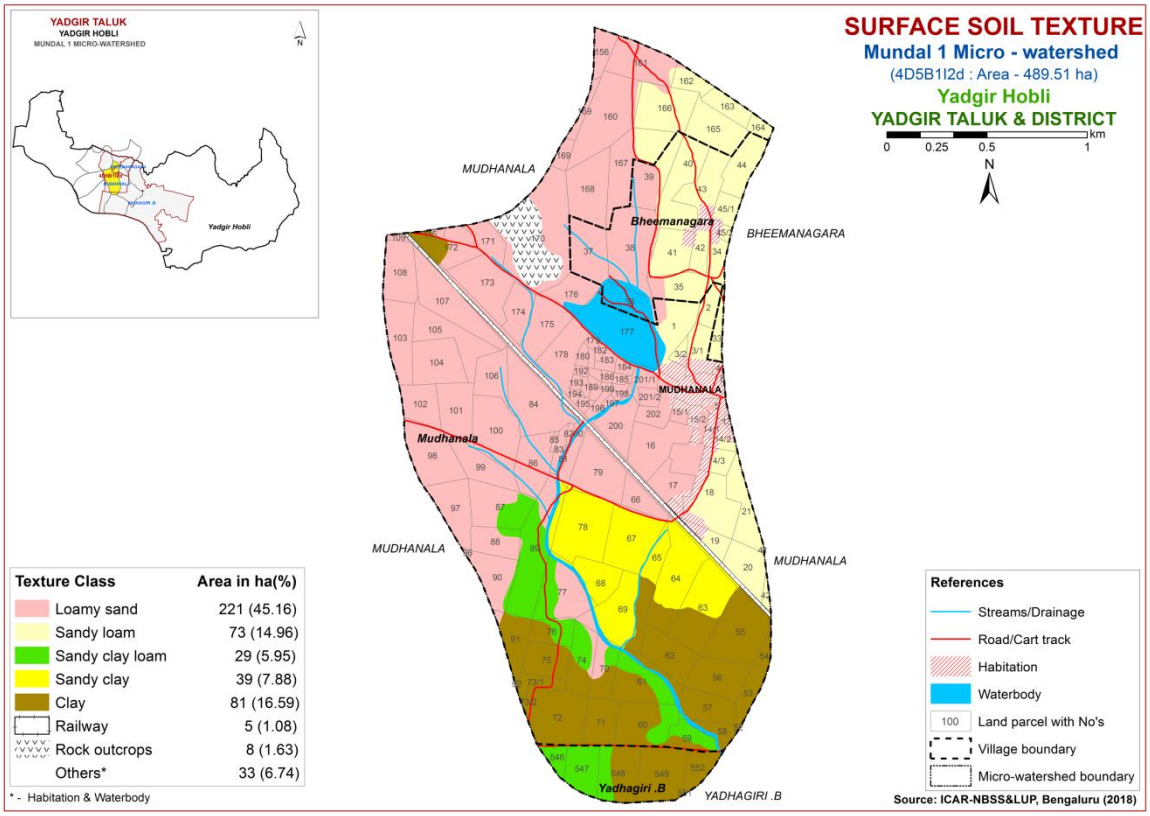

Fig. 5.3 Surface Soil Texture map of Mundal-1Microwatershed

5.4 Soil Gravelliness

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

Non gravelly (<15%) soils cover maximum area of 436 ha (89%) of the microwatershed and distributed in the major part of the microwatershed. These are the most productive soils, where all climatically adapted short and long duration crops can be grown. Gravelly (15-35%) soils occur in an area of 7 ha (1%) and distributed in the southern part of the microwatershed. These lands are low in moisture holding capacity and hence growing of short duration crops is ideal with best management practice.

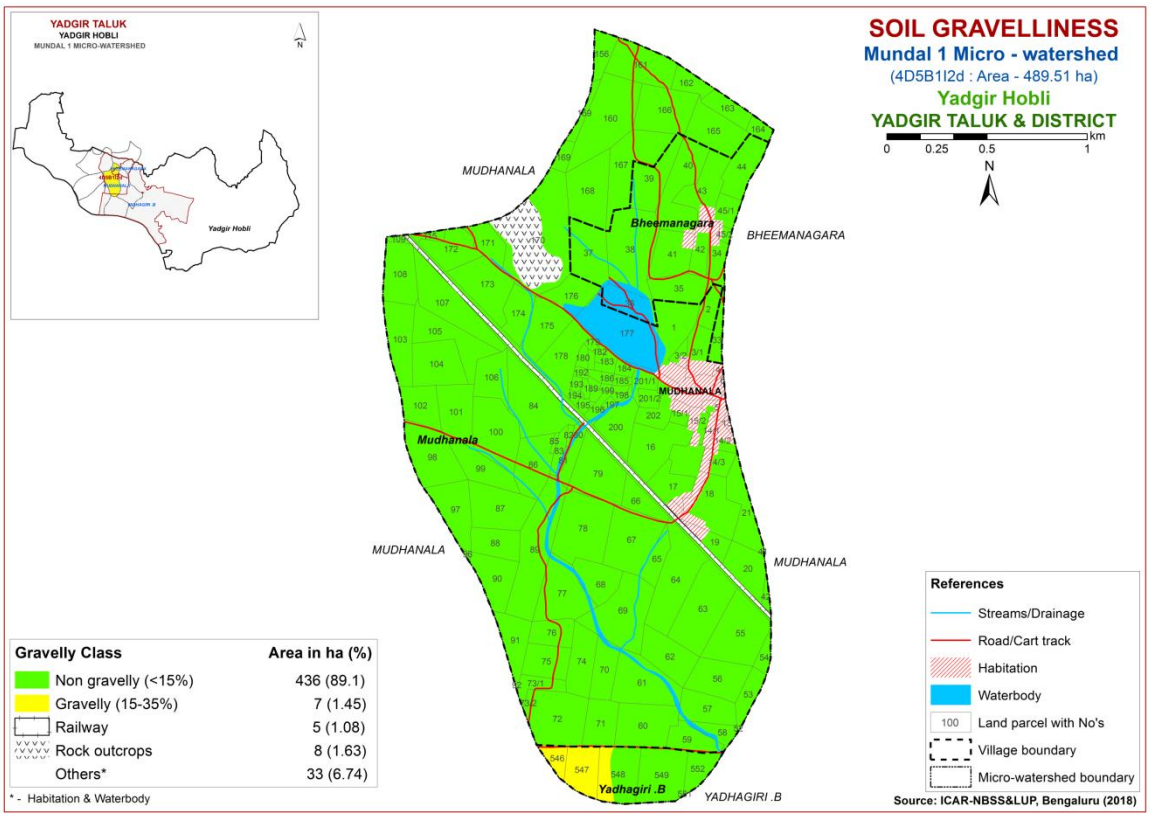

Fig. 5.4 Soil Gravelliness map of Mundal-1Microwatershed

5.5 Available Water Capacity

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

An area of about 131 ha (27%) in the microwatershed has soils that are very low (<50 mm/m) in available water capacity and is distributed in the central and northern part of the microwatershed. An area of about 185 ha (38%) is low (51-100 mm/m) in available water capacity and are distributed in major part of the microwatershed. About 28 ha (6%) is medium (101-150 mm/m) in available water capacity and are distributed in southern part of the microwatershed. Very high (>200 mm/m) in 99 ha (20%) and are distributed in the central and southern part of the microwatershed.

An area of about 316 ha (65%) in the microwatershed has soils that are problematic with regard to available water capacity. Here, only short duration crops can be grown and probability of the crop failure is very high. These areas are best put to other

alternative uses. An area of 99 ha (20%) are potential areas with regard to AWC where all climatically adapted annual and perennial crops can be grown.

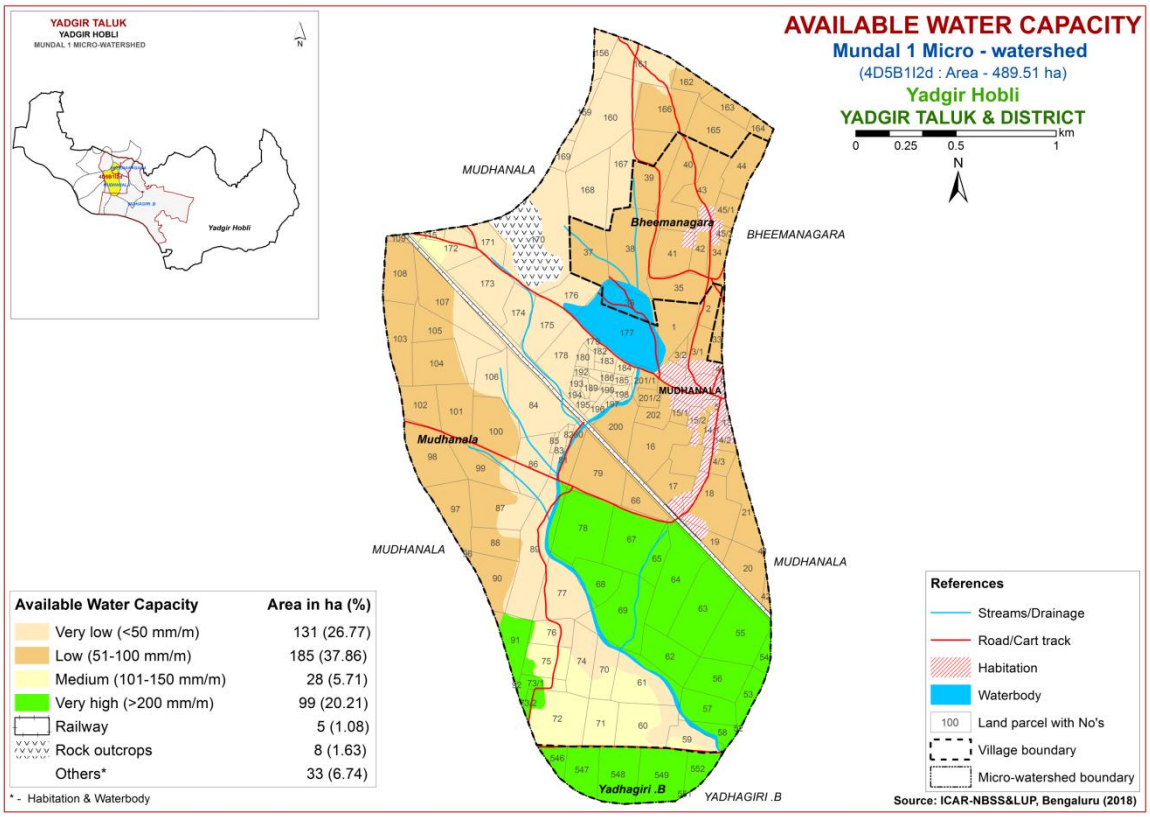

Fig. 5.5 Soil Available Water Capacity map of Mundal-1Microwatershed

5.6 Soil Slope

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

Entire cultivated area of about 443 ha (91%) of the microwatershed falls under very gently sloping (1-3% slope) lands, thus these areas have high potential in respect of soil slopes. In these areas, all climatically adapted annual and perennial crops can be grown without much soil and water conservation and other land development measures.

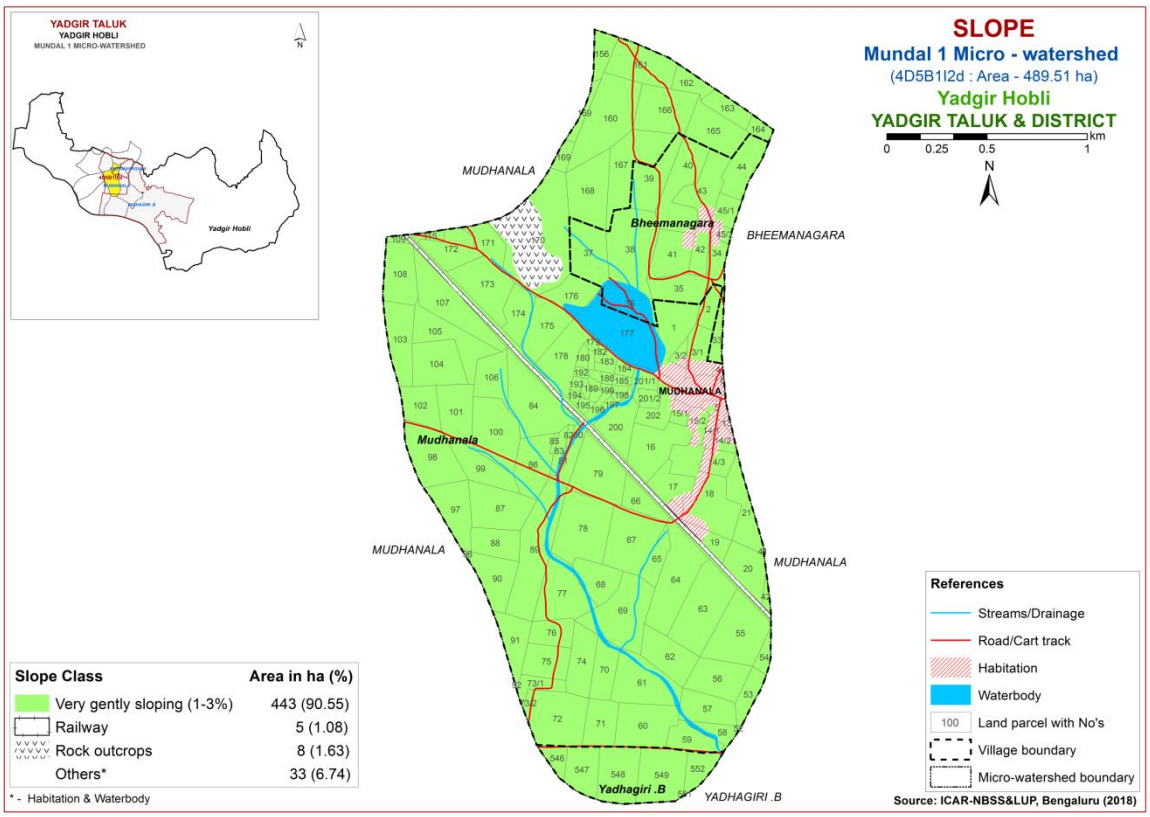

Fig. 5.6 Soil Slope map of Mundal-1Microwatershed

5.7 Soil Erosion

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

Soils that are slightly eroded (e1 class) cover an area of 35 ha (7%) and are distributed in the southern part of the microwatershed. Moderately eroded (e2 class) soils cover a maximum area of 409 ha (83%) and are distributed in the major part of the microwatershed.

An area of about 409 ha of the microwatershed is problematic because of moderate erosion. For these areas, taking up of soil and water conservation and other land development measures are needed.

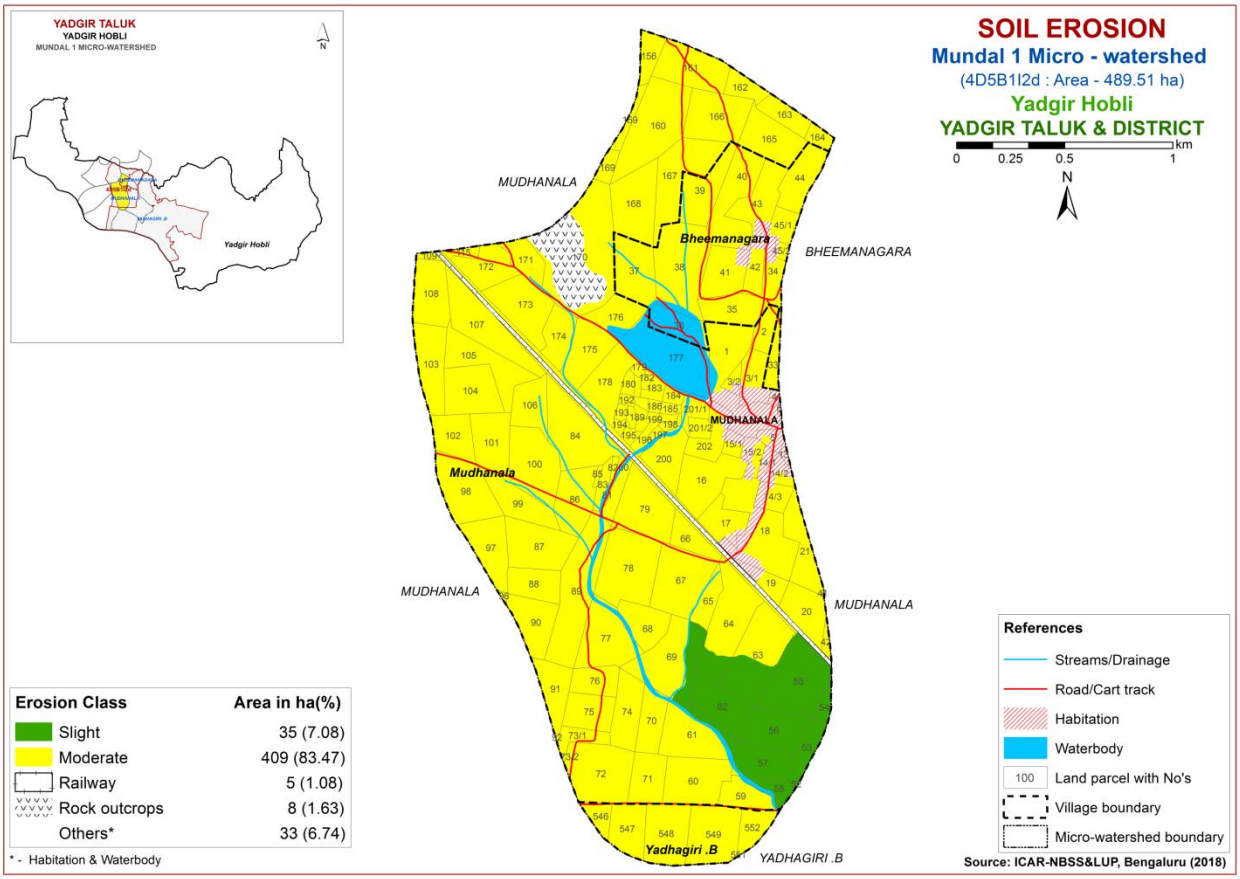

Fig. 5.7 Soil Erosion map of Mundal-1Microwatershed

Chapter 6

FERTILITY STATUS

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

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

6.1 Soil Reaction (pH)

The soil analysis of the Mundal-1microwatershed for soil reaction (pH) showed that an area of 1 ha (<1%) is slightly acid (pH 6.0-6.5) and are distributed in the minor part of the microwatershed. About 158 ha (32%) is neutral (pH 6.5-7.3) and are distributed in the major part of the microwatershed. Slightly alkaline (pH 7.3-7.8) occur in 114 ha (23%) area and are distributed in the central, western and southern part of the microwatershed. An area of about 103 ha (21%) is moderately alkaline (pH 7.8-8.4) and are distributed in the central, western and southern part of the microwatershed. An area of about 61 ha (12%) is strongly alkaline (pH 8.4-9.0) and are distributed in the southern part of the microwatershed. Very strongly alkaline (pH >9.0) soils occur in 6 ha (1%) and is distributed in the southern part of the microwatershed. (Fig. 6.1).

6.2 Electrical Conductivity (EC)

The Electrical Conductivity (EC) of the soils in the entire cultivated area of the microwatershed is dominately <2 ds^{m-1} indicating that the soils are non-saline (Fig. 6.2).

6.3 Organic Carbon

The soil organic carbon content (an index of available Nitrogen) in the soils of the microwatershed is medium (0.5-0.75%) in about 240 ha (49%) and are distributed in the major part of the microwatershed, whereas low (<0.5%) in an area of about 204 ha (42%) and are distributed in the central, northern, southern and northwestern part of the microwatershed (Fig. 6.3).

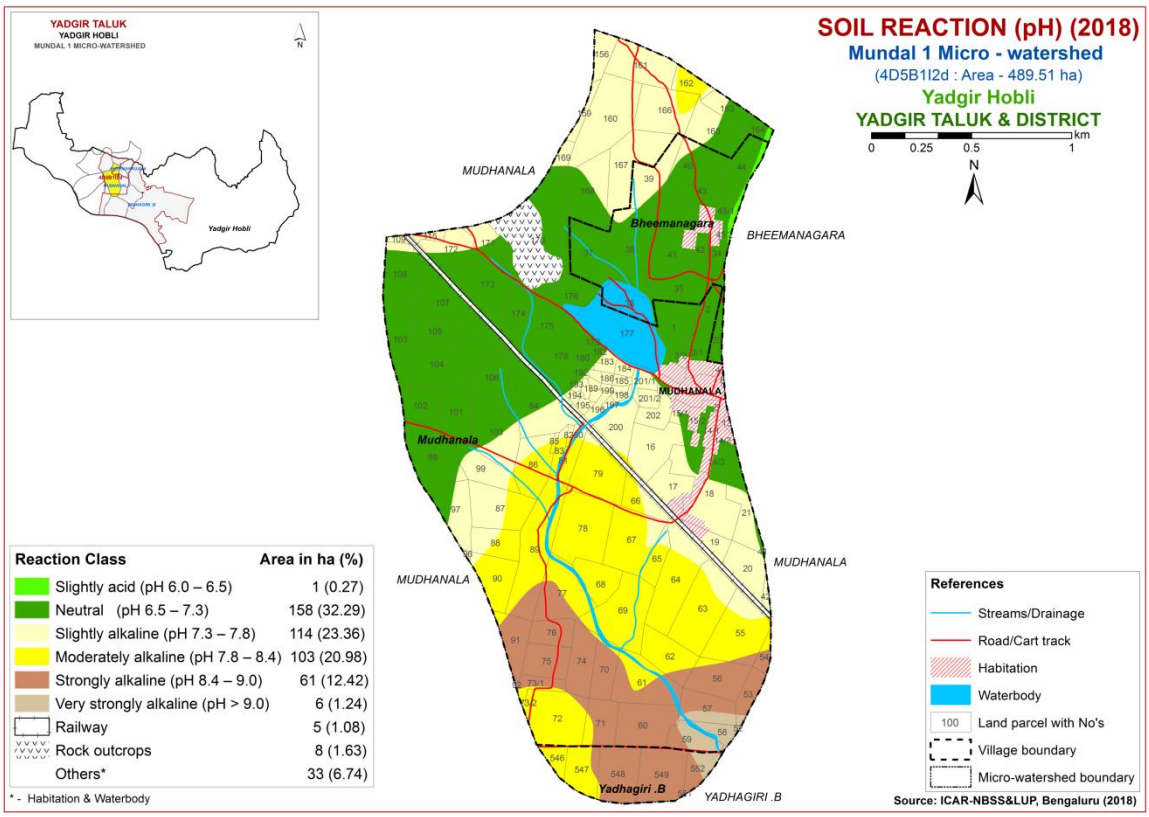

Fig.6.1 Soil Reaction (pH) map of Mundal-1Microwatershed

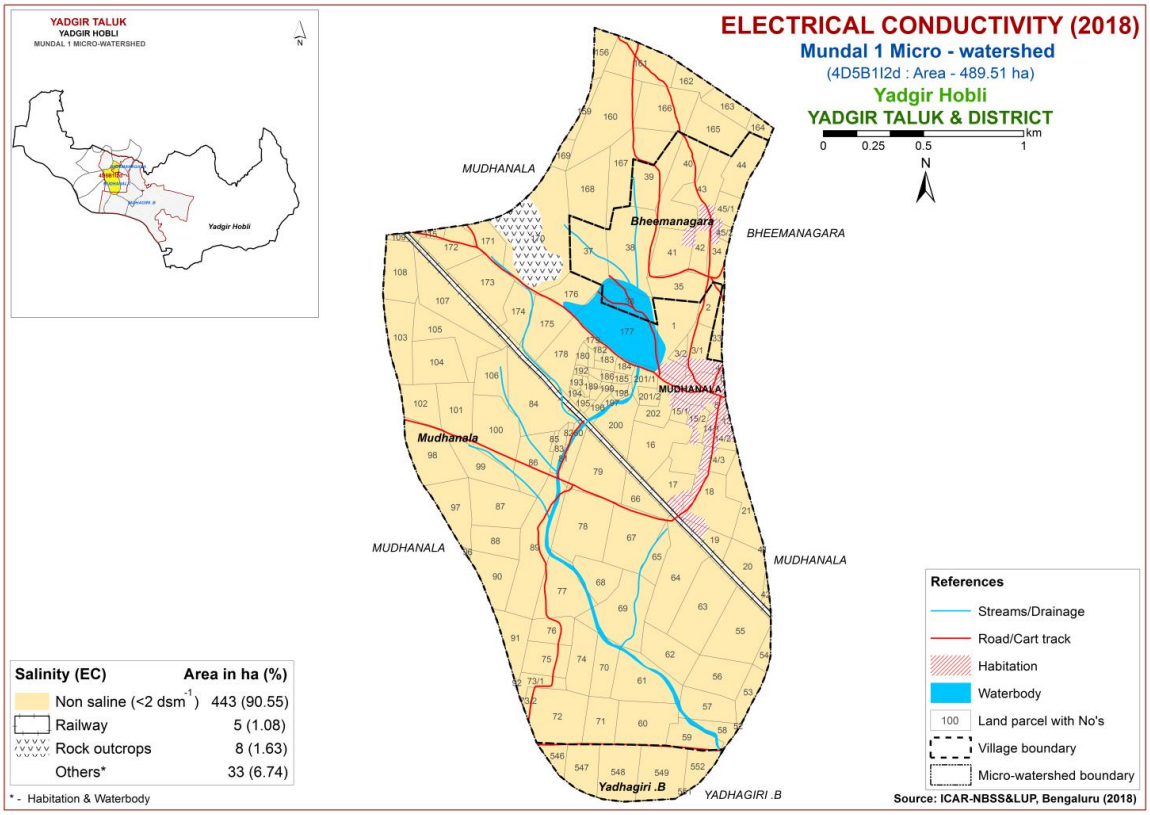

Fig.6.2 Electrical Conductivity (EC) map of Mundal-1Microwatershed

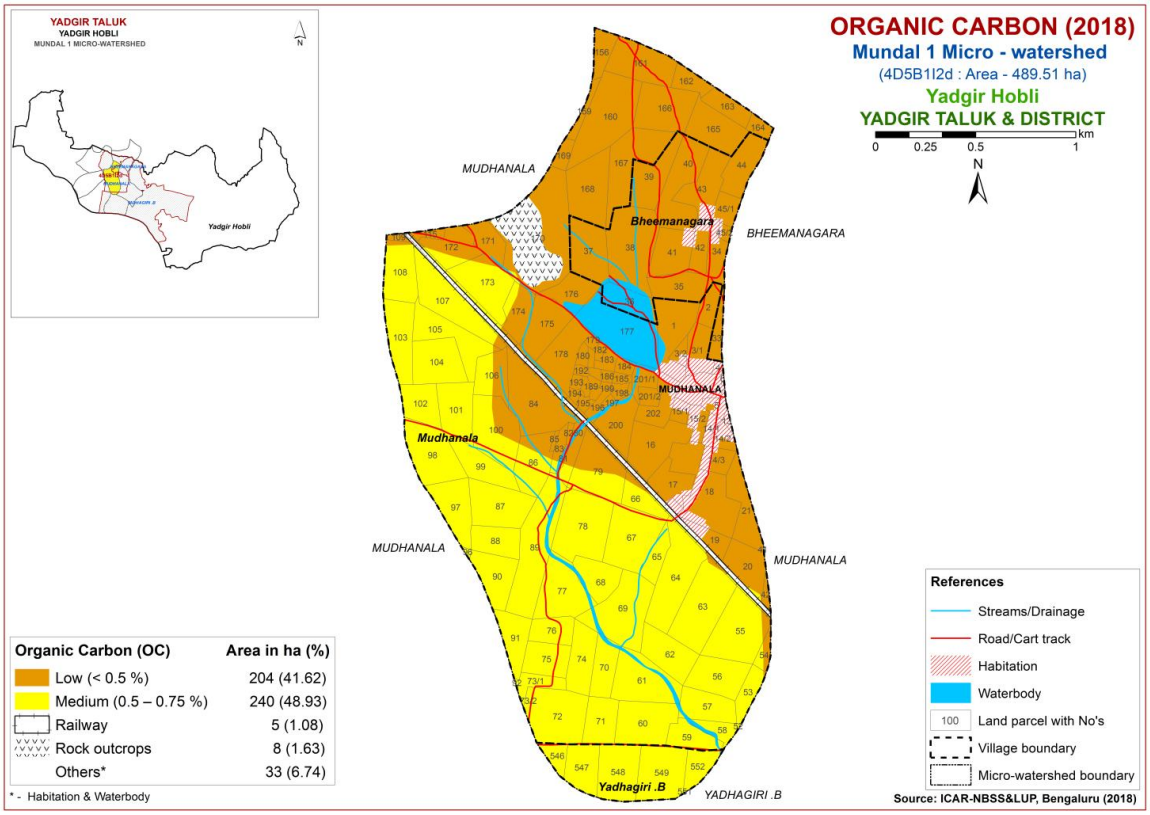

Fig.6.3 Soil Organic Carbon map of Mundal-1Microwatershed

6.4 Available Phosphorus

Available phosphorus content is medium (23-57 kg/ha) in the entire cultivated area of the microwatershed. (Fig. 6.4).

6.5 Available Potassium

Available potassium content is medium (145-337 kg/ha) in maximum area of about 358 ha (73%) and are distributed in the major part of the microwatershed (Fig. 6.5) and about high (>337 kg/ha) in an area of 86 ha (18%) and are distributed in the southern part of the microwatershed.

6.6 Available Sulphur

Maximum area of about 294 ha (60%) is low (<10 ppm) in available sulphur content and are distributed in the major part of the microwatershed. Medium (10-20 ppm) in an area of about 119 ha (24%) and is distributed in the southern and northern part of the microwatershed and high (>20 ppm) in an area of about 31 ha (6%) and is distributed in the northern part of the microwatershed (Fig. 6.6).

6.7 Available Boron

Available boron content is low (<0.5 ppm) in an area of 304 ha (62%) and are distributed in the major part of the microwatershed and medium (0.5-1.0 ppm) in about 140 ha (29%) and are distributed in the southern part of the microwatershed (Fig. 6.7).

6.8 Available Iron

Available iron content is sufficient (>4.5 ppm) in an area of 301 ha (62%) and are distributed in the major part of the microwatershed and deficient (<4.5 ppm) in about 142 ha (29%) and are distributed in the southern part of the microwatershed (Fig 6.8).

6.9 Available Manganese

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

6.10 Available Copper

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

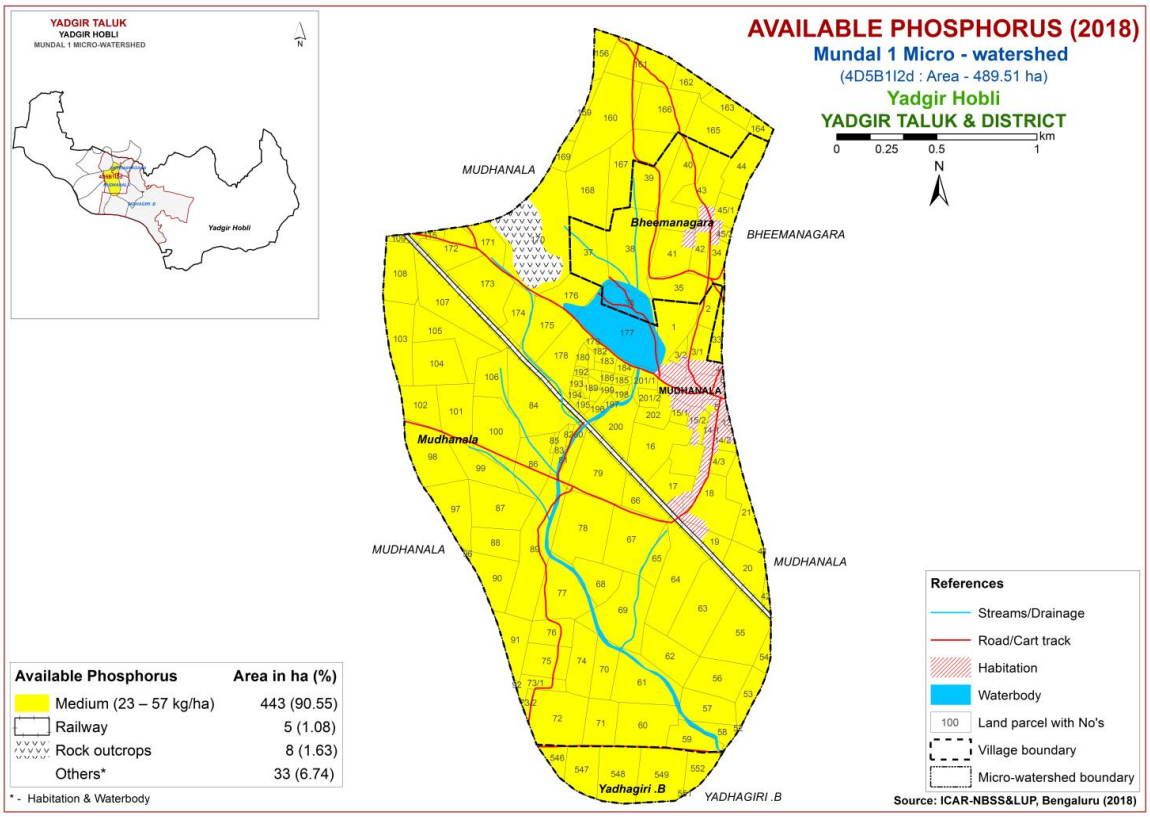

Fig.6.4 Soil Available Phosphorus map of Mundal-1Microwatershed

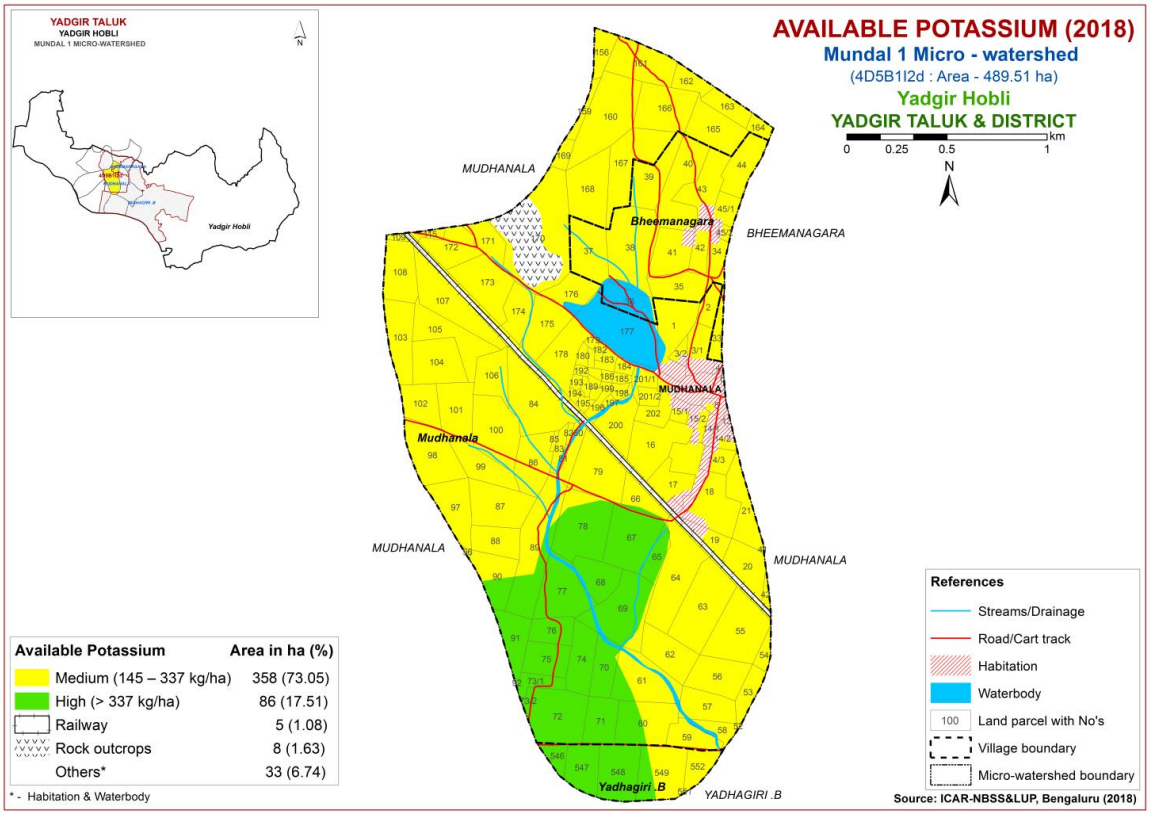

Fig.6.5 Soil Available Potassium map of Mundal-1Microwatershed

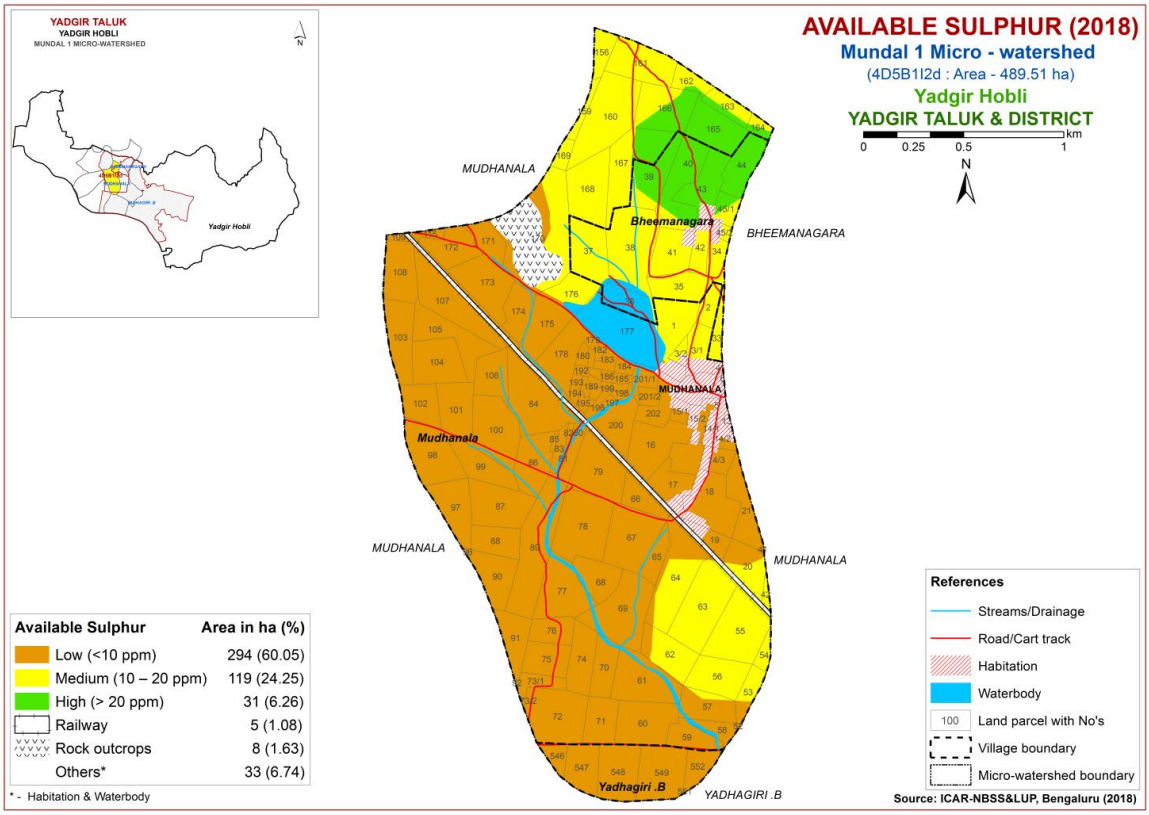

Fig.6.6 Soil Available Sulphur map of Mundal-1Microwatershed

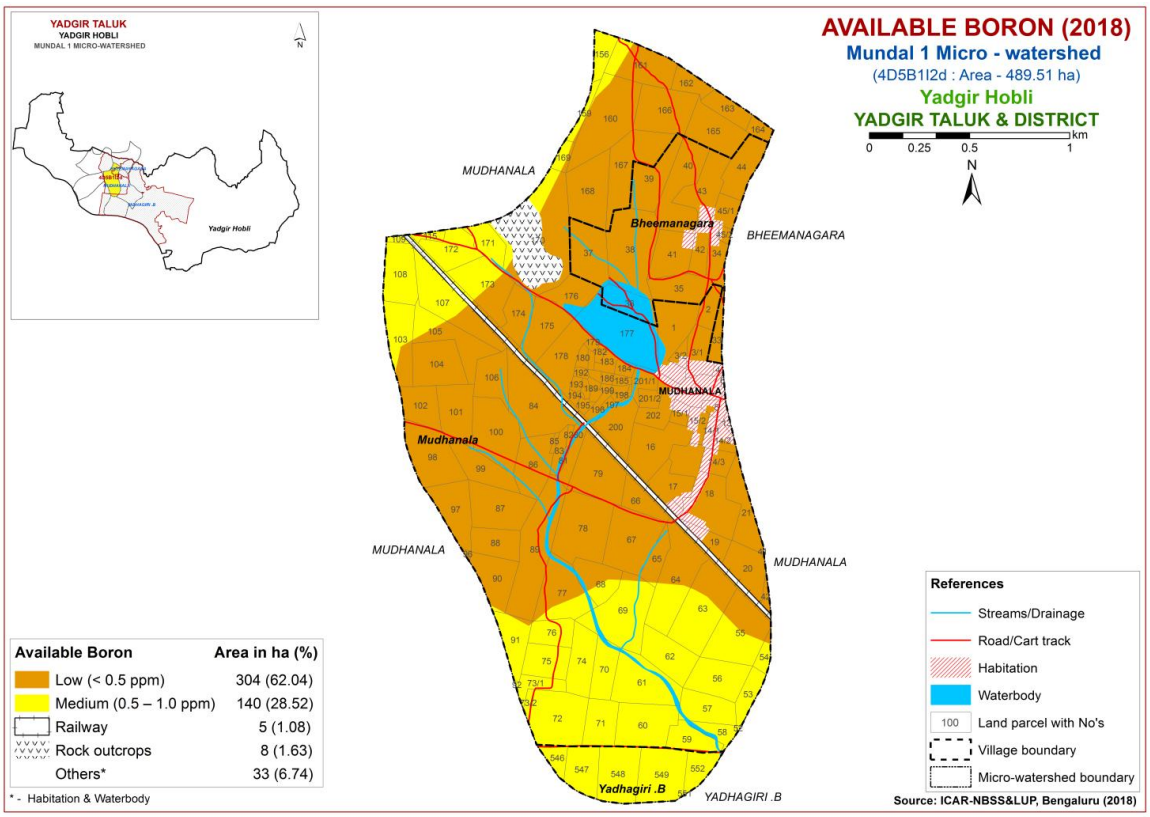

Fig.6.7 Soil Available Boron map of Mundal-1Microwatershed

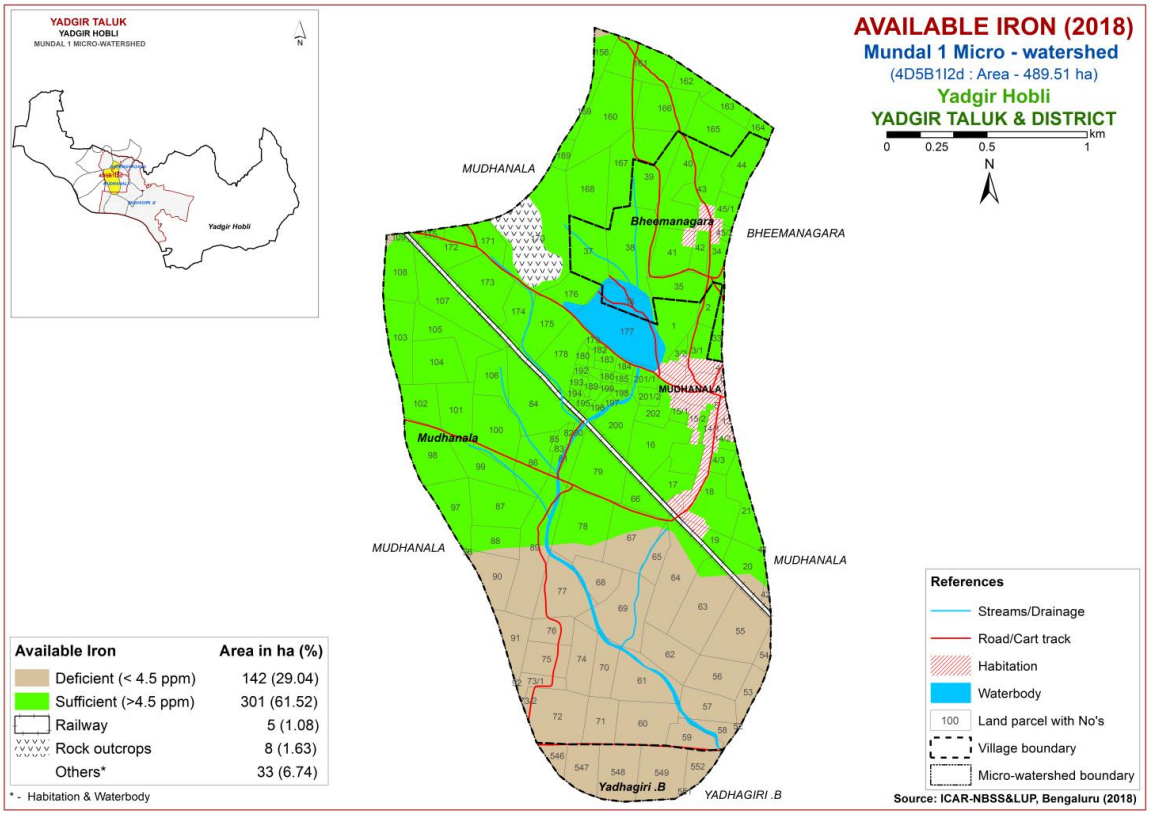

Fig.6.8 Soil Available Iron map of Mundal-1Microwatershed

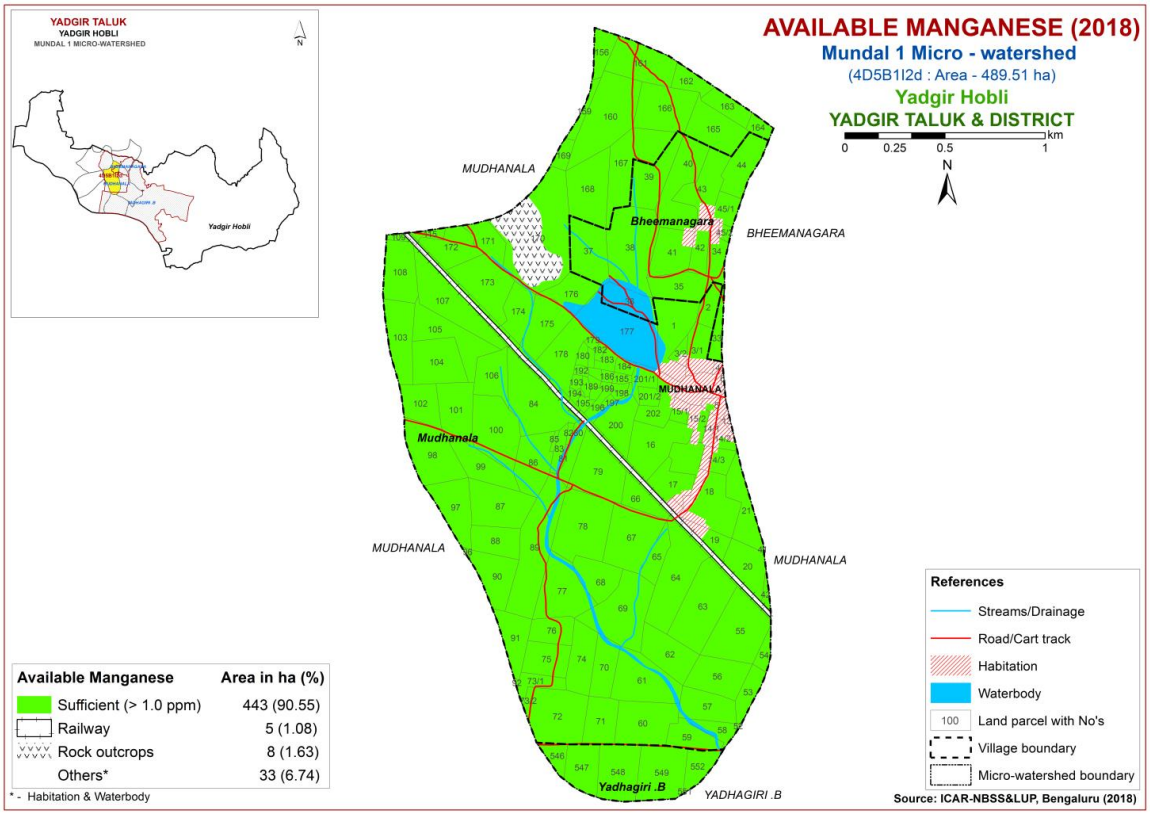

Fig.6.9 Soil Available Manganese map of Mundal-1Microwatershed

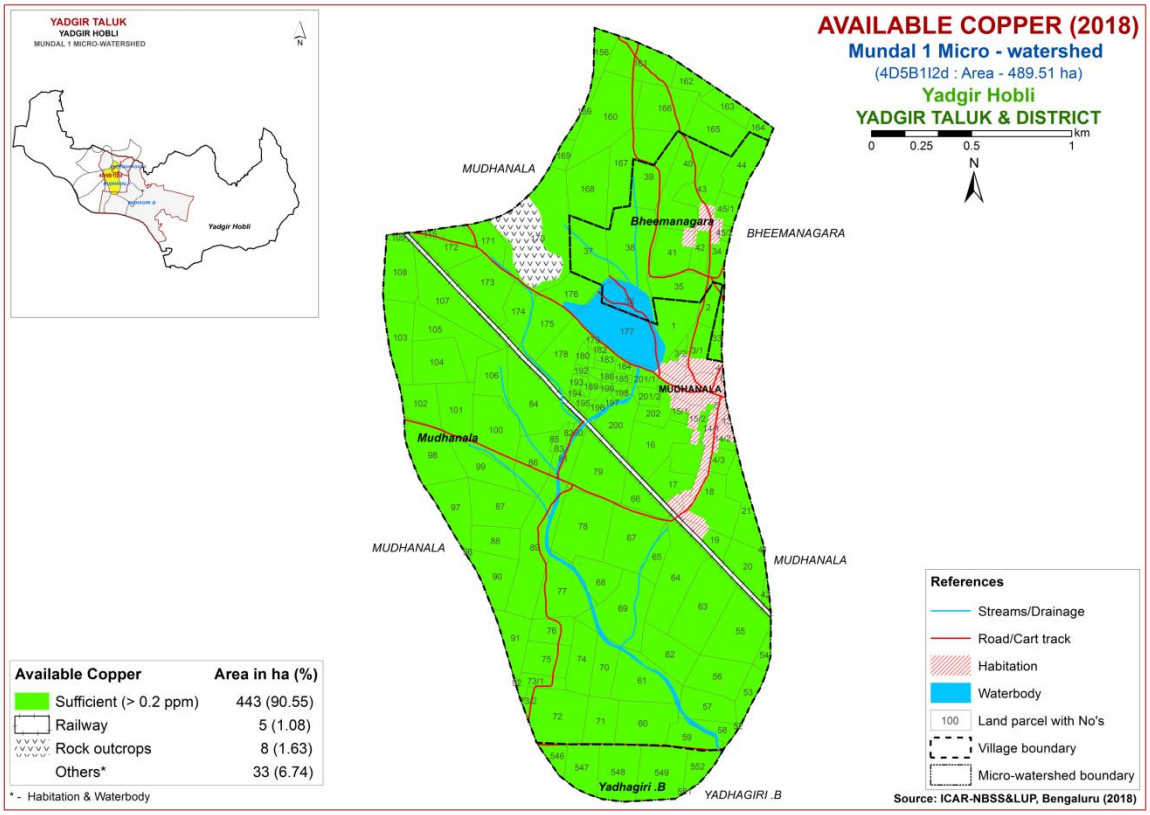

Fig.6.10 Soil Available Copper map of Mundal-1Microwatershed

6.11 Available Zinc

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

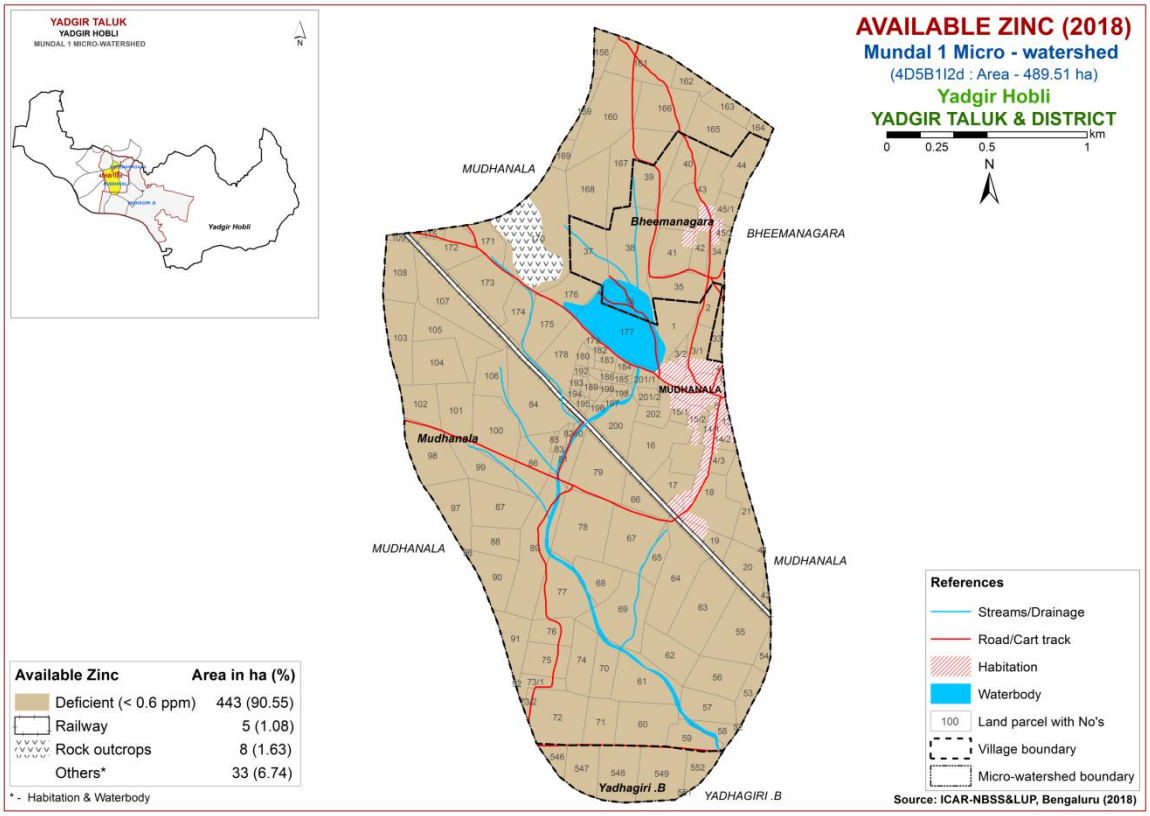

Fig.6.11 Soil Available Zinc map of Mundal-1Microwatershed

Chapter 7

LAND SUITABILITY FOR MAJOR CROPS

The soil and land resource units (soil phases) of Mundal-1microwatershed were assessed for their suitability for growing food, fodder, fibre and other horticulture crops by following the procedure as outlined in FAO, 1976 and 1983. Crop requirements were developed for each of the crop from the available research data and also by referring to Naidu *et. al.* (2006) and Natarajan *et. al* (2015). The soil and land characteristics were matched with the crop requirement to arrive at the crop suitability. The soil and land characteristics table and crop requirement tables are given in Appendix- III. In FAO land suitability classification, two orders are recognized. Order S-Suitable and Order N-Not suitable. The orders have classes, subclasses and units. Order-S has three classes, Class S1-Highly Suitable, Class S2-Moderately Suitable and Class S3- Marginally Suitable. Order N has two classes, N1-Currently not Suitable and N2- Permanently not Suitable. There are no subclasses within the Class S1 as they will have very minor or no limitations for crop growth. Classes S2, S3, N1 and N2 are divided into subclasses based on the kinds of limitations encountered. The limitations that affect crop production are 'c' for erratic rainfall and its distribution and length of growing period (LGP), 'e' for erosion hazard, 'r' for rooting condition, 't' for lighter or heavy texture, 'g' for gravelliness or stoniness, 'n' for nutrient availability, 'l' for topography, 'm' for moisture availability, 'w' for drainage, 's' for sodium and 'z' for calcareousness. These limitations are indicated as lower case letters to the Class symbol. For example, moderately suitable lands with the limitations of soil depth and erosion are designated as S2re. For the microwatershed, the soil mapping units were evaluated and classified up to subclass level.

Using the above criteria, the soil map units of the microwatershed were evaluated and land suitability maps for 29 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-IV.

7.1 Land Suitability for Sorghum (*Sorghum bicolor*)

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

Highly suitable (Class S1) lands for growing sorghum occur in a maximum area of 176 ha (36%) and are distributed in the major part of the microwatershed. An area of about 136 ha (28%) is moderately suitable (Class S2) for growing sorghum and are distributed in the central, western, eastern and northern part of the microwatershed. They

have minor limitations of rooting depth, calcareousness and texture. An area of about 131 ha (27%) is marginally suitable (Class S3) for growing sorghum and is distributed in central, northern, northwestern and southern part of the microwatershed with moderate limitation rooting depth.

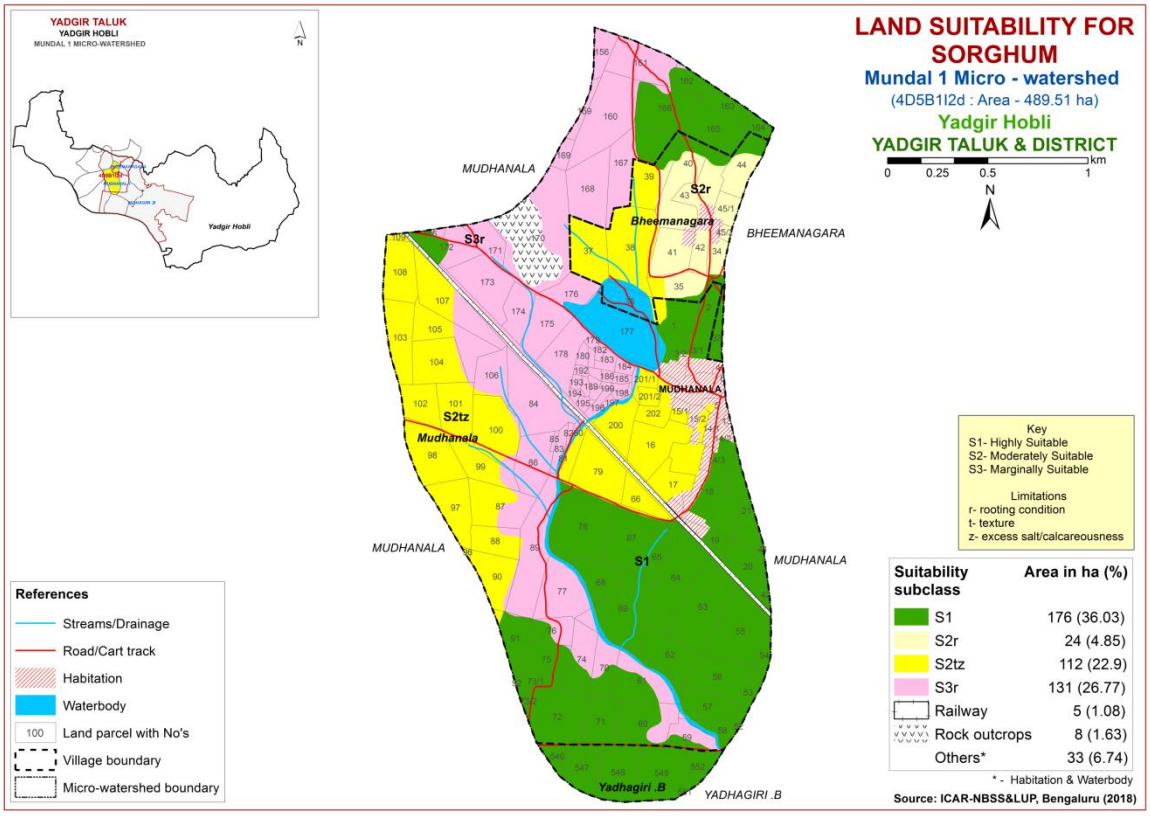

Fig. 7.1 Land Suitability map of Sorghum

7.2 Land Suitability for Maize (*Zea mays*)

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

Highly suitable (Class S1) lands for growing maize occur in an area of 49 ha (10%) and are distributed in the eastern and northern part of the microwatershed. An area of about 151 ha (31%) is moderately suitable (Class S2) for growing maize and are distributed in the southern, northern, northwestern and central have minor limitations of drainage and texture. An area of about 243 ha (50%) is marginally suitable (Class S3) for growing maize and is distributed in major part of the microwatershed with moderate limitations rooting depth, texture and calcareousness.

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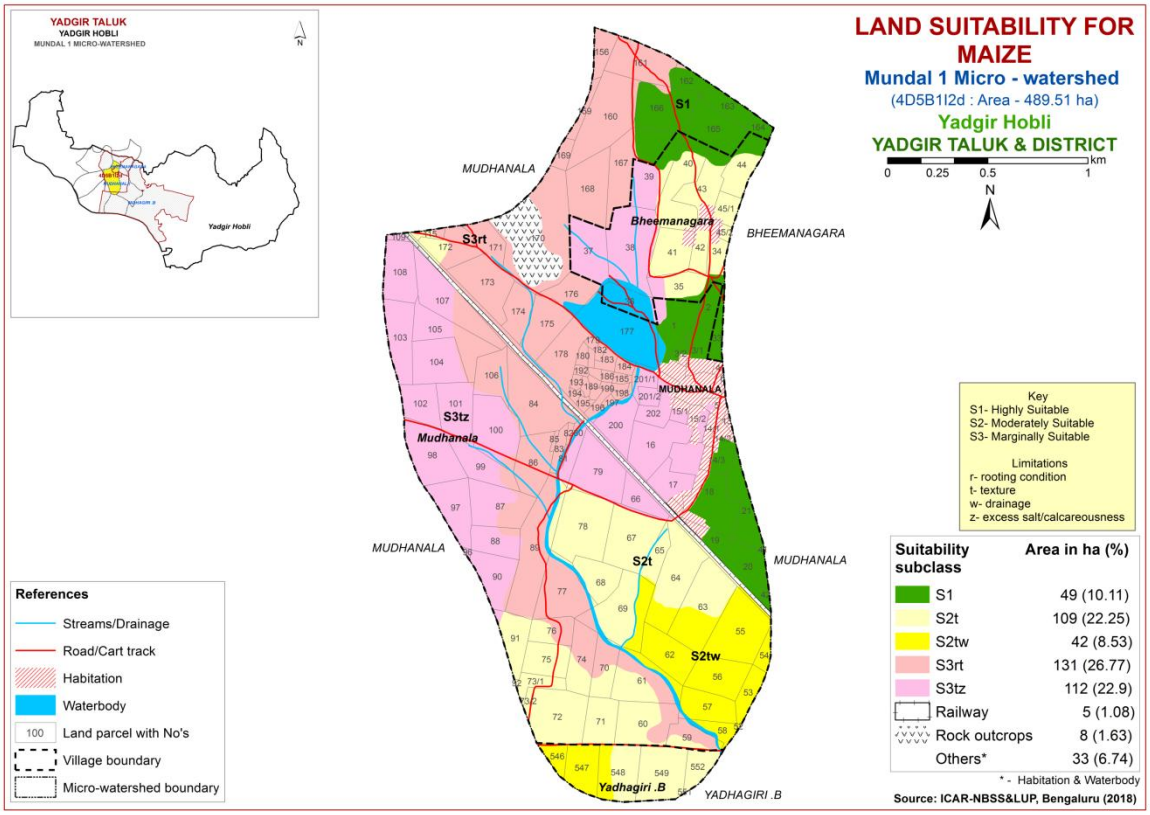


Fig. 7.2 Land Suitability map of Maize

7.3 Land Suitability for Bajra (*Pennisetum glaucum)*

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

Highly suitable (Class S1) lands for growing bajra occur in a maximum area of 162 ha (33%) and are distributed in the major part of the microwatershed. An area of about 151 ha (31%) is moderately suitable (Class S2) for growing bajra and are distributed in the central, southern, northern and northwestern part of the microwatershed. The have minor limitations of rooting depth, calcareousness and texture. An area of about 131 ha (27%) is marginally suitable (Class S3) for growing bajra and is distributed in central, northern, northwestern and southern part of the microwatershed with moderate limitations rooting depth and texture.

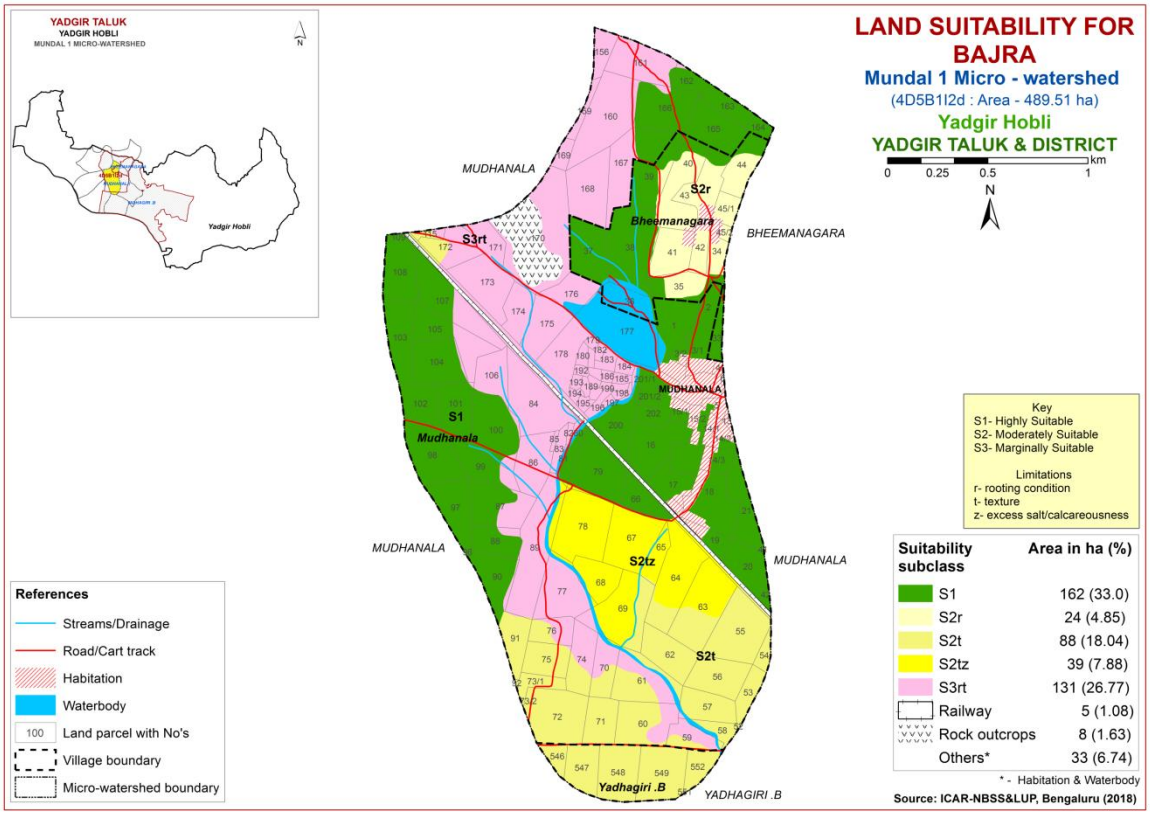


Fig. 7.3 Land Suitability map of Bajra

7.4 Land Suitability for Groundnut (*Arachis hypogaea*)

Groundnut is one of the major oilseed crop grown in an area of 6.54 lakh ha in Karnataka in most of the districts either as rainfed or irrigated crop. The crop requirements for growing groundnut (Table 7.5) were matched with the soil-site characteristics (Table 7.1) of the soils of the microwatershed and a land suitability map for growing groundnut was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.4.

An area of about 161 ha (33%) is moderately suitable (Class S2) for growing groundnut and are distributed in the central, eastern, western and northern part of the microwatershed. They have minor limitations of texture and calcareousness. An area of about 282 ha (58%) is marginally suitable (Class S3) for growing groundnut and is distributed in major part of the microwatershed with moderate limitations rooting depth, drainage and texture.

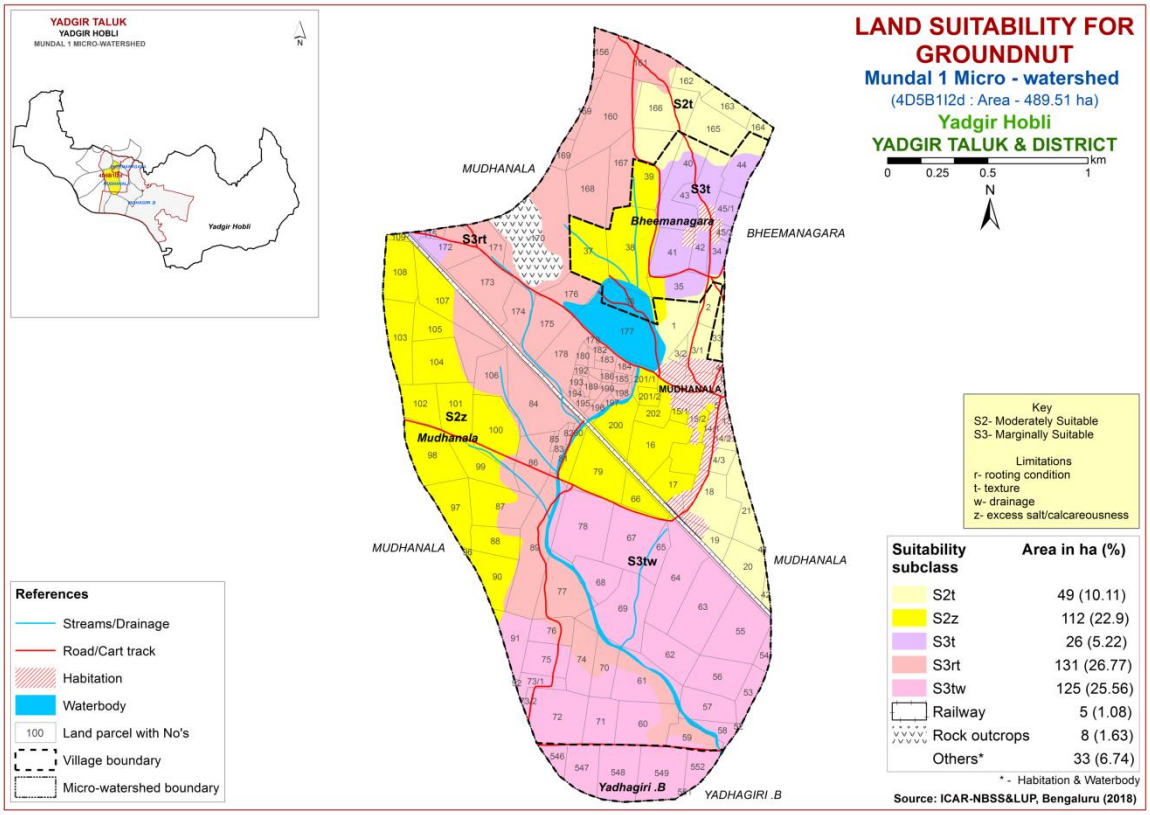


Fig. 7.4 Land Suitability map of Groundnut

7.5 Land Suitability for Sunflower (*Helianthus annus*)

Sunflower is one of the most important oilseed crop grown in an area of 4.1 lakh ha in the State in all the districts. The crop requirements for growing sunflower (Table 7.6) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing sunflower was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.5.

Highly suitable (Class S1) lands for growing sunflower occupy an area of 66 ha (14%) and are distributed in the central, southern and northwestern part of the microwatershed. Maximum area of about 222 ha (45%) is moderately suitable (Class S2) for sunflower and are distributed in the major part of the microwatershed. They have minor limitations of rooting depth, calcareousness and drainage. An area of about 24 ha (5%) is marginally suitable (Class S3) and is distributed in northern part of the microwatershed with moderate limitation of rooting depth. Currently not suitable (Class N1) lands occur in a very small area of 131 ha (27%) and are distributed in the northern, southwestern, central and northwestern part of the microwatershed with severe limitation of rooting depth.

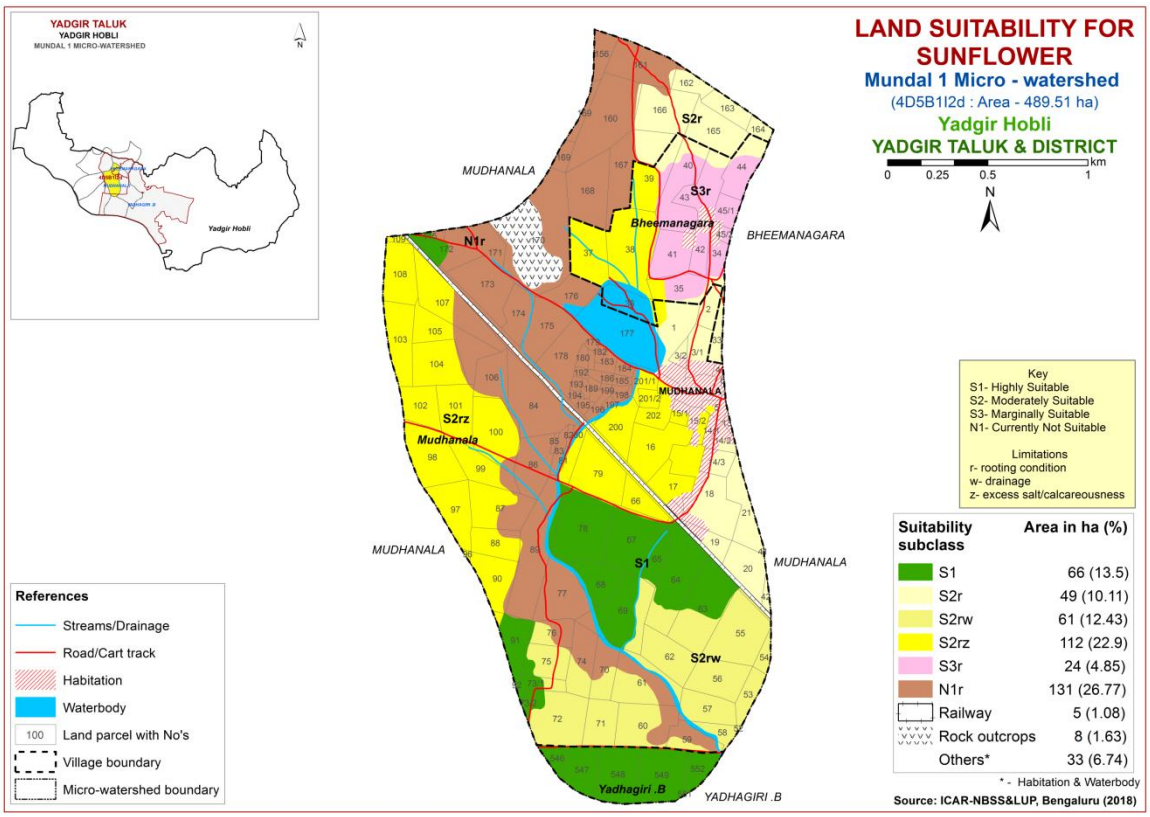


Fig. 7.5 Land Suitability map of Sunflower

7.6 Land Suitability Criteria for Red gram (*Cajanus Cajan)*

Redgram is one of the most important pulse crop grown in an area of 7.28 lakh ha in almost all the districts of the State. The crop requirements for growing red gram (Table 7.7) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing redgram was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.6.

An area of about 288 ha (59%) is moderately suitable (Class S2) for growing redgram and are distributed in the major part of the microwatershed. They have minor limitations of texture, rooting depth, drainage and calcareousness. An area of about 155 ha (32%) is marginally suitable (Class S3) for growing redgram and is distributed in central, southern, northern and northwestern part of the microwatershed with moderate limitations rooting depth and texture.

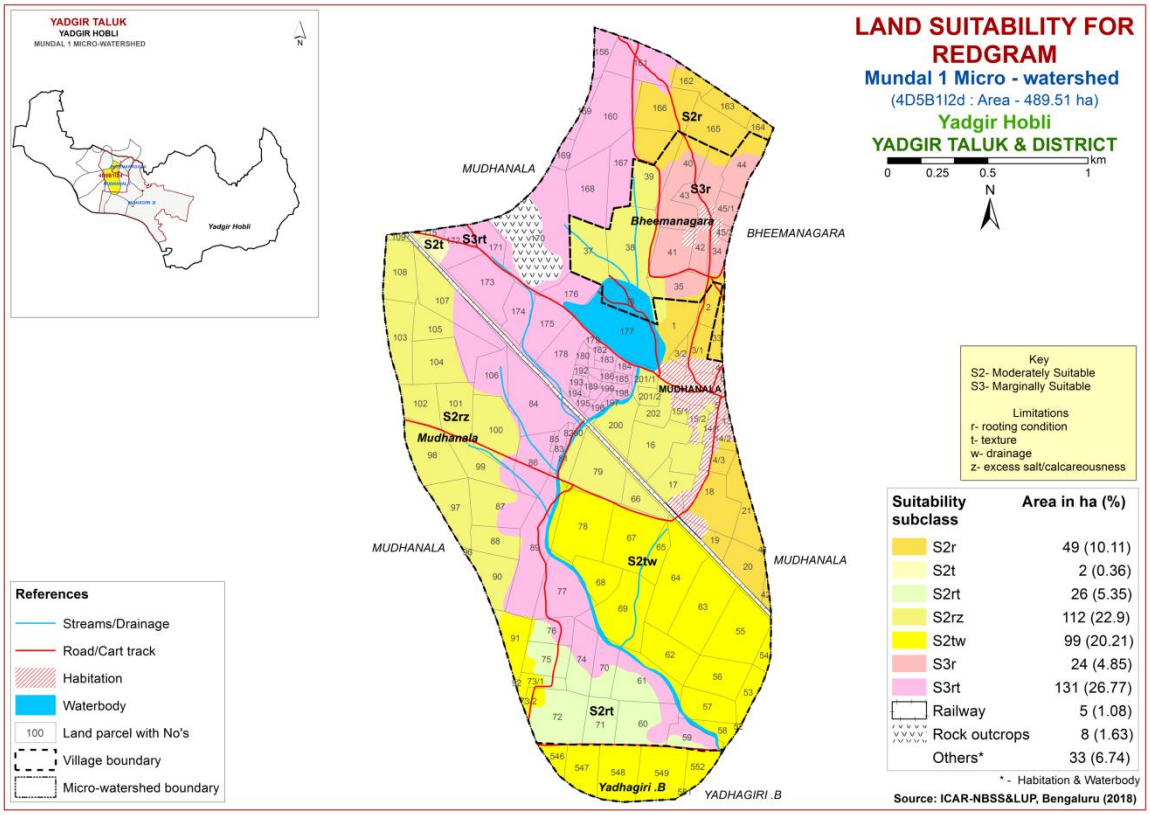


Fig. 7.6 Land Suitability map of Redgram

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

Bengal gram is one of the most important pulse crop grown in about 9.39 lakh ha area in Bijapur, Raichur, Kalaburgi, Dharwad, Belgaum and Bellary districts. The crop requirements for growing Bengal gram (Table 7.8) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing Bengal gram was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.7.

Highly (Class S1) suitable lands for growing Bengal gram occupy an area of 127 ha (26%) and are distributed in the central and southern part of the microwatershed. An area of about 73 ha (15%) is moderately suitable (Class S2) for growing Bengal gram and are distributed in the eastern and northern part of the microwatershed. They have minor limitations of rooting depth and texture. Marginally suitable lands (Class S3) occupy an area of about 243 ha (50%) and are distributed in the major part of the microwatershed. They have moderate limitations of texture and calcareousness.

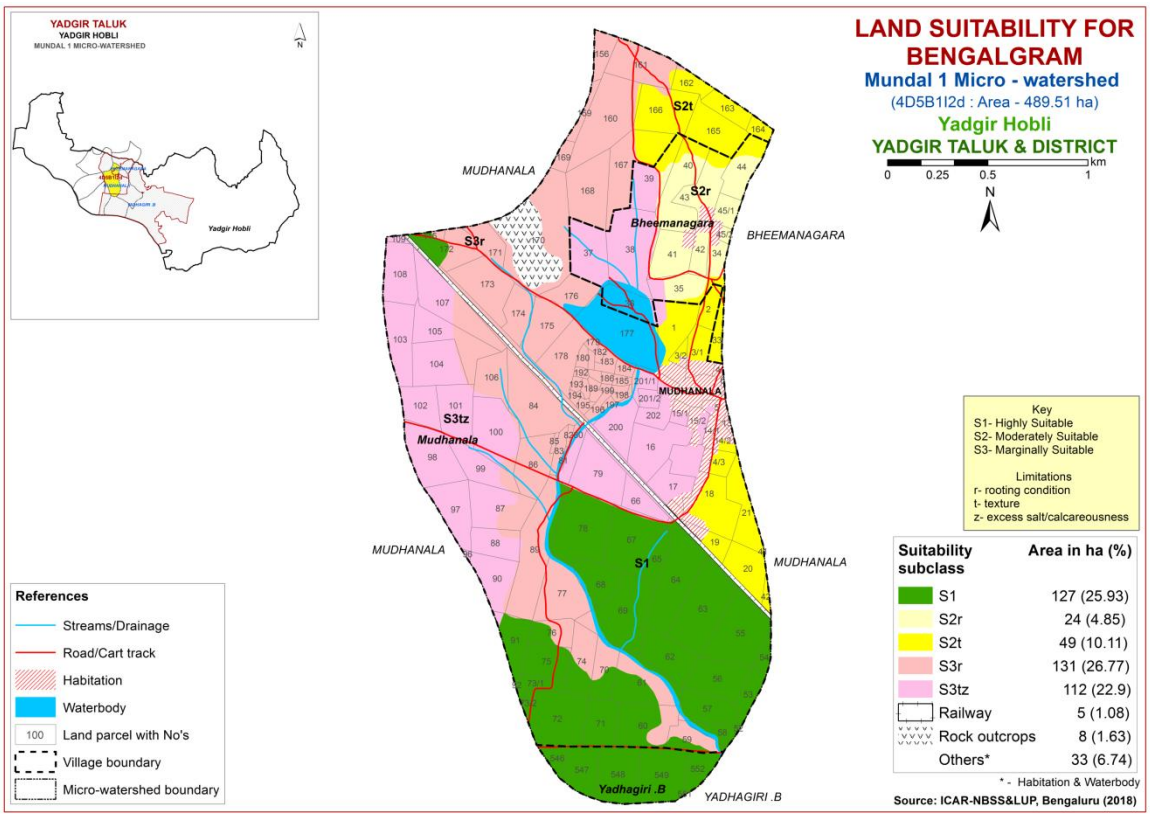


Fig. 7.7 Land Suitability map of Bengal gram

7.8 Land Suitability for Cotton (*Gossypium hirsutum*)

Cotton is one of the most important fibre crop grown in the State in about 8.75 lakh ha area in Raichur, Dharwad, Belgaum, Kalaburgi, Bijapur, Bidar, Bellary, Chitradurga and Chamarajnagar districts. The crop requirements for growing cotton (Table 7.9) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing cotton was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.8.

Highly suitable (Class S1) lands for growing cotton occur in an area of 101 ha (21%) and are distributed in the southern, central and northwestern part of the microwatershed. Moderately suitable (Class S2) lands are found to occur in an area of about 99 ha (20%). These soils have minor limitations of rooting depth and drainage. They are distributed in the eastern, southern and northern part of the microwatershed. Marginally suitable lands (Class S3) occupy an area of about 243 ha (50%) and are distributed in the major part of the microwatershed. They have moderate limitations of texture, rooting depth and calcareousness.

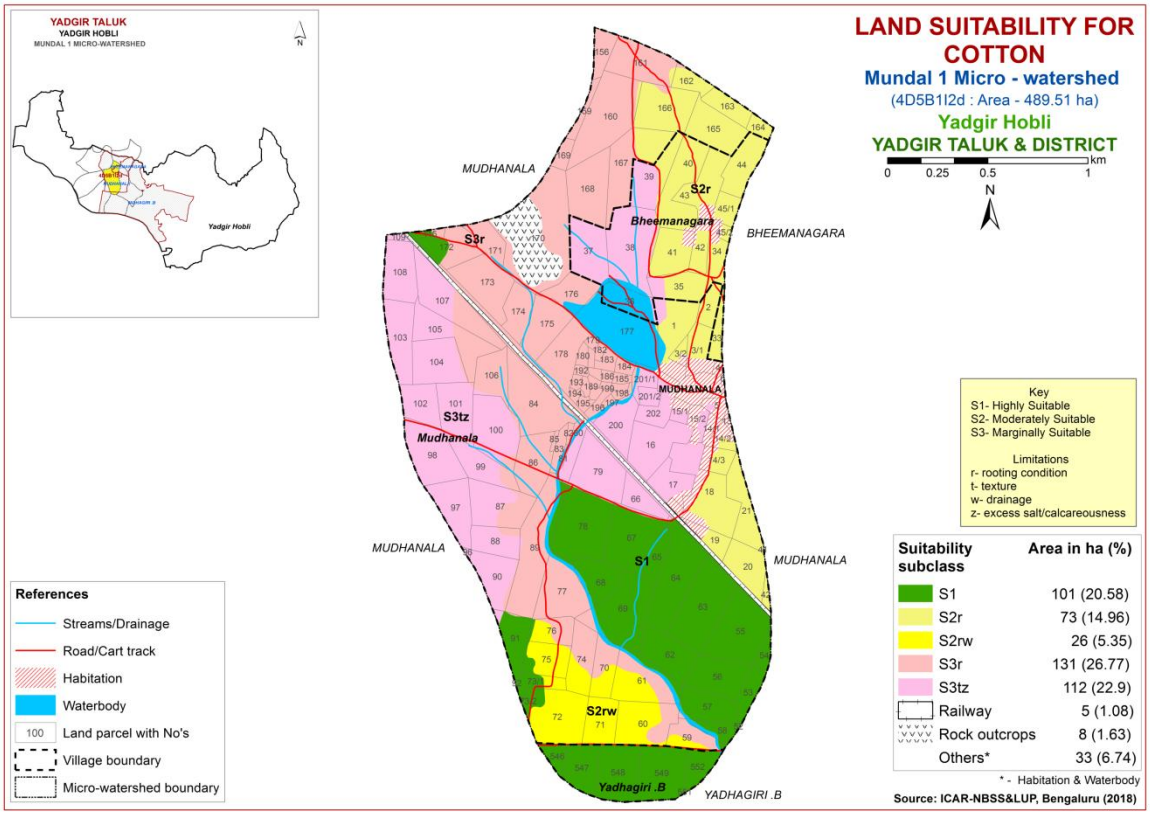


Fig. 7.8 Land Suitability map of Cotton

7.9 Land Suitability for Chilli (*Capsicum annuum)*

Chilli is one of the most important spice crop grown in about 0.42 lakh ha in Karnataka State. The crop requirements for growing chilli (Table 7.10) were matched with the soil-site characteristics (Table 7.1) 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 7.9.

Maximum area of about 312 ha (64%) is moderately suitable (Class S2) for growing chilli and are distributed in the major part of the microwatershed. They have minor limitations of rooting depth, texture, drainage and calcareousness. Marginally suitable lands (Class S3) occupy an area of 131 ha (27%) and are distributed in the central, northern, southern, northern and northwestern part of the microwatershed. They have moderate limitations of rooting depth and texture.

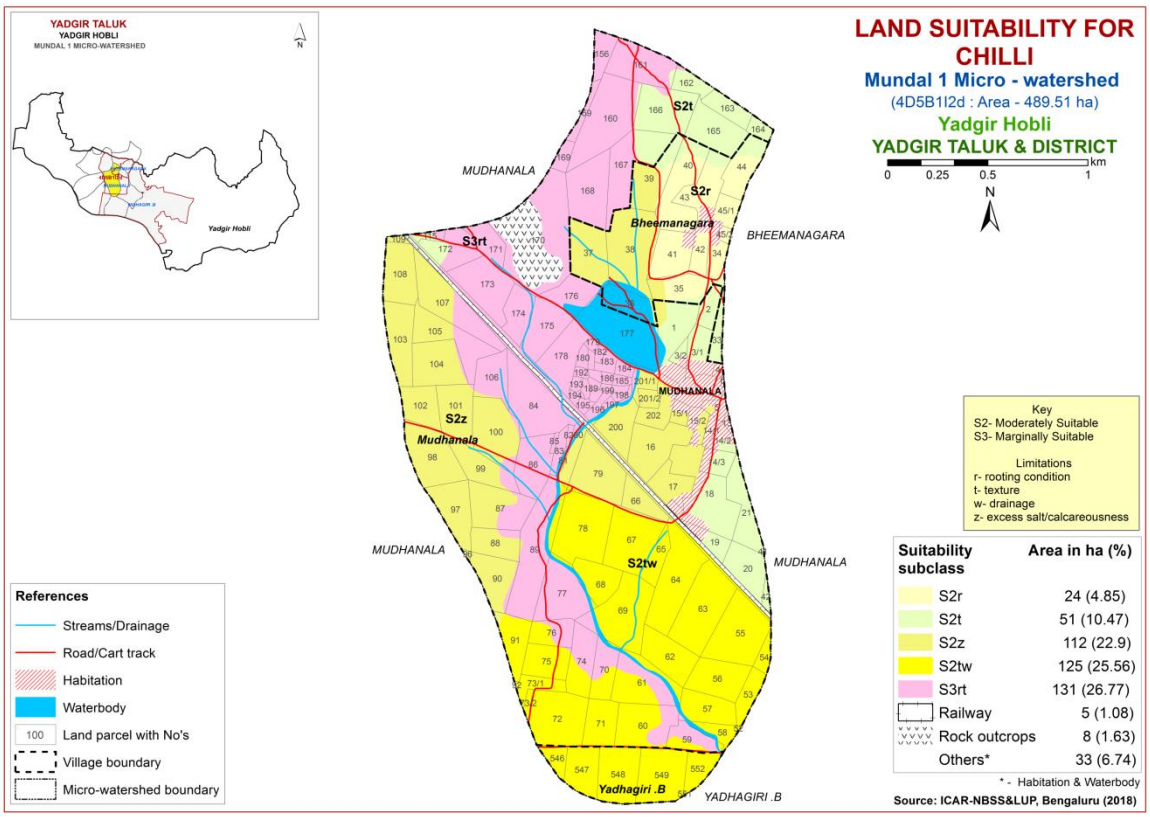


Fig 7.9 Land Suitability map of Chilli

7.10 Land Suitability for Tomato *(Lycopersicon esculentum)*

Tomato is one of the most important vegetable crop grown in about 0.61 lakh ha covering almost all the district of the state. The crop requirements for growing tomato (Table 7.11) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing tomato was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.10.

Highly suitable (Class S1) lands for growing tomato occur in an area of 49 ha (10%) and are distributed in the northern and eastern part of the microwatershed. Maximum area of 175 ha (36%) is moderately suitable (Class S2) and is distributed in the central, southern, western, northern and northwestern part of the microwatershed with minor limitations of rooting depth, drainage and calcareousness. An area of 220 ha (44%) is marginally suitable for tomato (Class S3) and is distributed in the major part of the microwatershed. They have moderate limitations of rooting depth, drainage and texture.

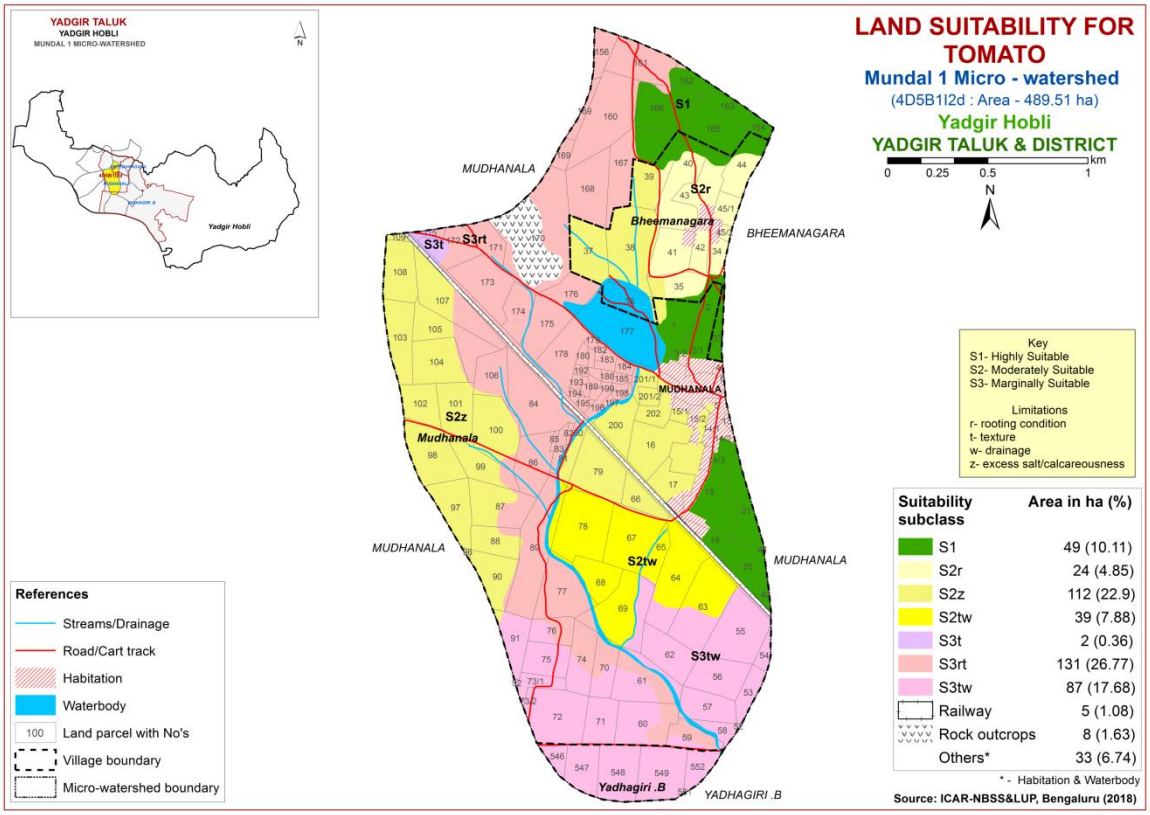


Fig 7.10 Land Suitability map of Tomato

7.11 Land Suitability for Brinjal (*Solanum melongena*)

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

Highly (Class S1) suitable lands for growing brinjal occur in an area of 57 ha (12%) and are distributed in the eastern, northern and southern part of the microwatershed. Maximum area of about 256 ha (52%) is moderately suitable (Class S2) for brinjal and is distributed in the major part of the microwatershed. They have minor limitations of texture, calcareousness and rooting depth. An area of 131 ha (27%) is marginally suitable and is distributed in the central, southern, northwestern and northern part of the microwatershed with moderate limitation of rooting depth.

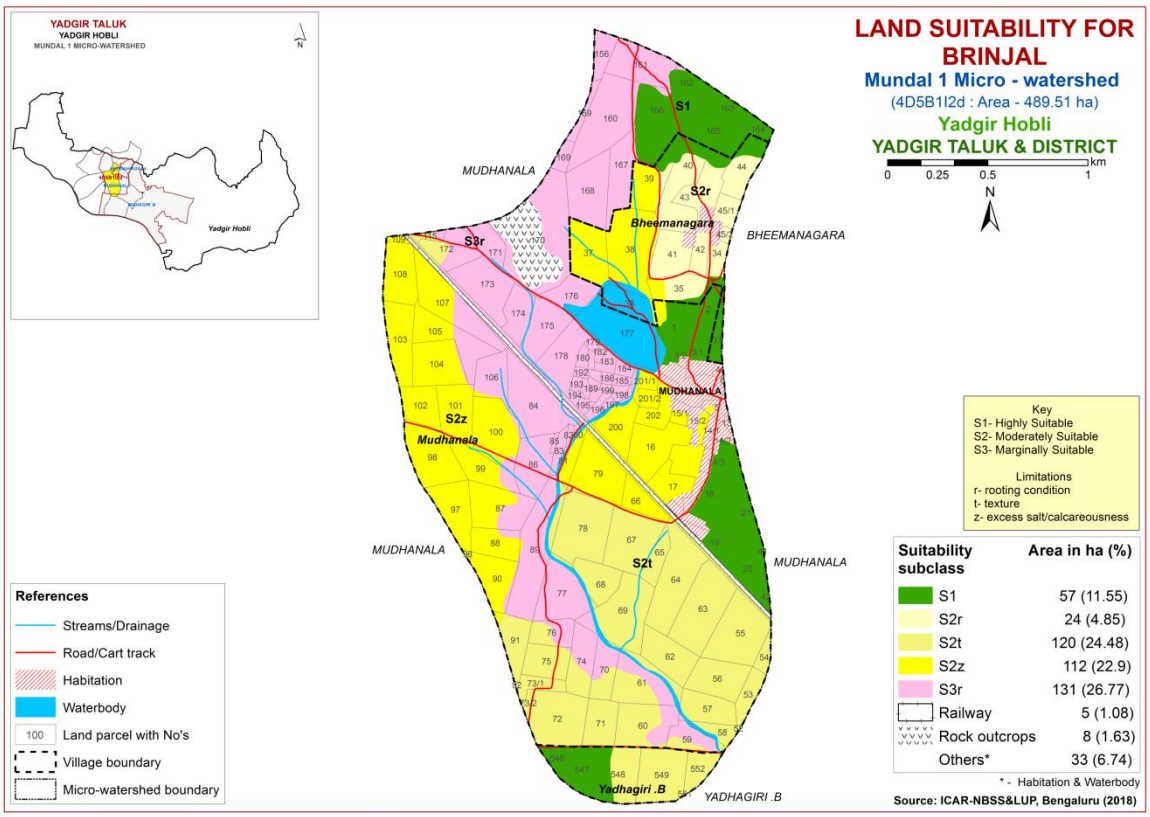


Fig 7.11 Land Suitability map of Brinjal

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

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

Highly (Class S1) suitable lands for growing onion occur in an area of 46 ha (10%) and are distributed in the southern part of the microwatershed. An area of about 185 ha (38%) is moderately suitable (Class S2) for onion and is distributed in the central, eastern, western, northwestern and northern part of the microwatershed. They have minor limitations of rooting depth, texture and calcareousness. An area of 212 ha (43%) is marginally suitable and is distributed in major part of the microwatershed with moderate limitations of rooting depth and texture.

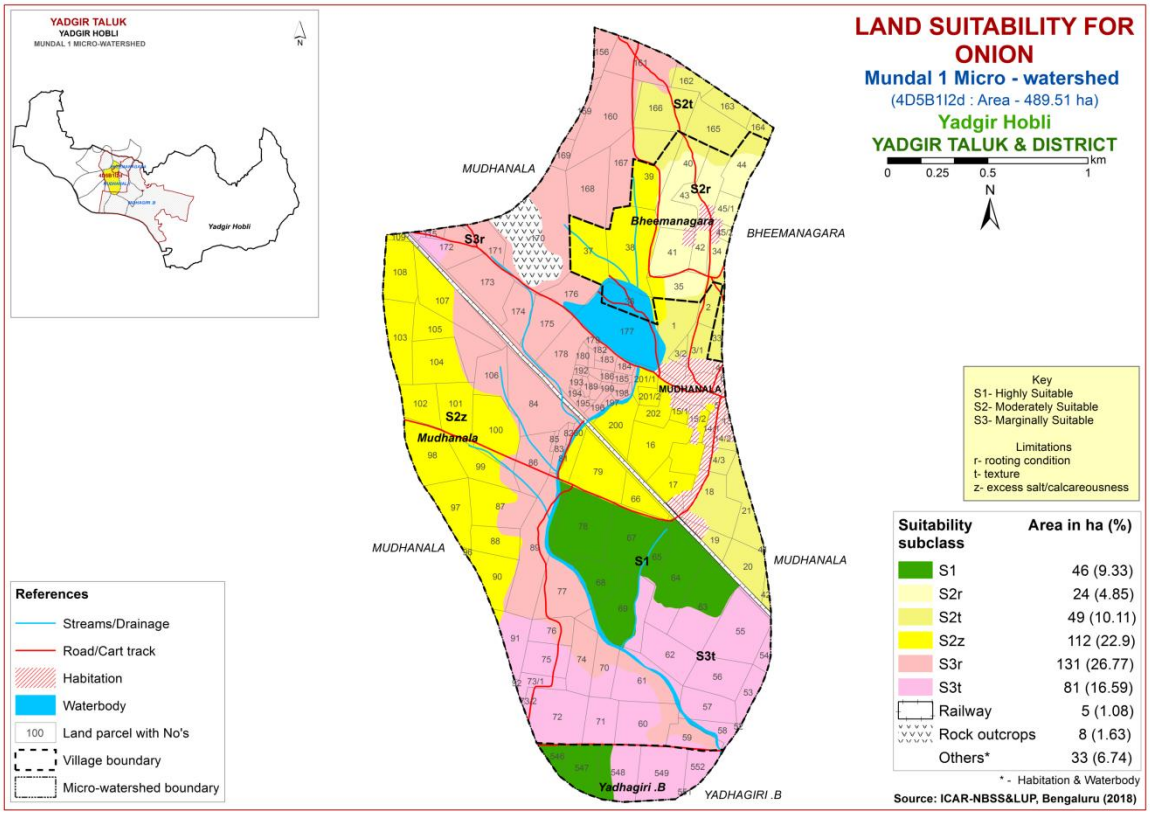


Fig 7.12 Land Suitability map of Onion

7.13 Land Suitability for Bhendi (*Abelmoschus esculentus*)

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

Highly (Class S1) suitable lands for growing bhendi occur in an area of 7 ha (1%) and are distributed in the southern part of the microwatershed. An area of about 305 ha (62%) is moderately suitable (Class S2) for bhendi and is distributed in the major part of the microwatershed. They have minor limitations of texture, calcareousness and calcareousness. An area of 131 ha (27%) is marginally suitable (Class S3) and is distributed in the central, southern, northwestern and northern part of the microwatershed with moderate limitation of rooting depth.

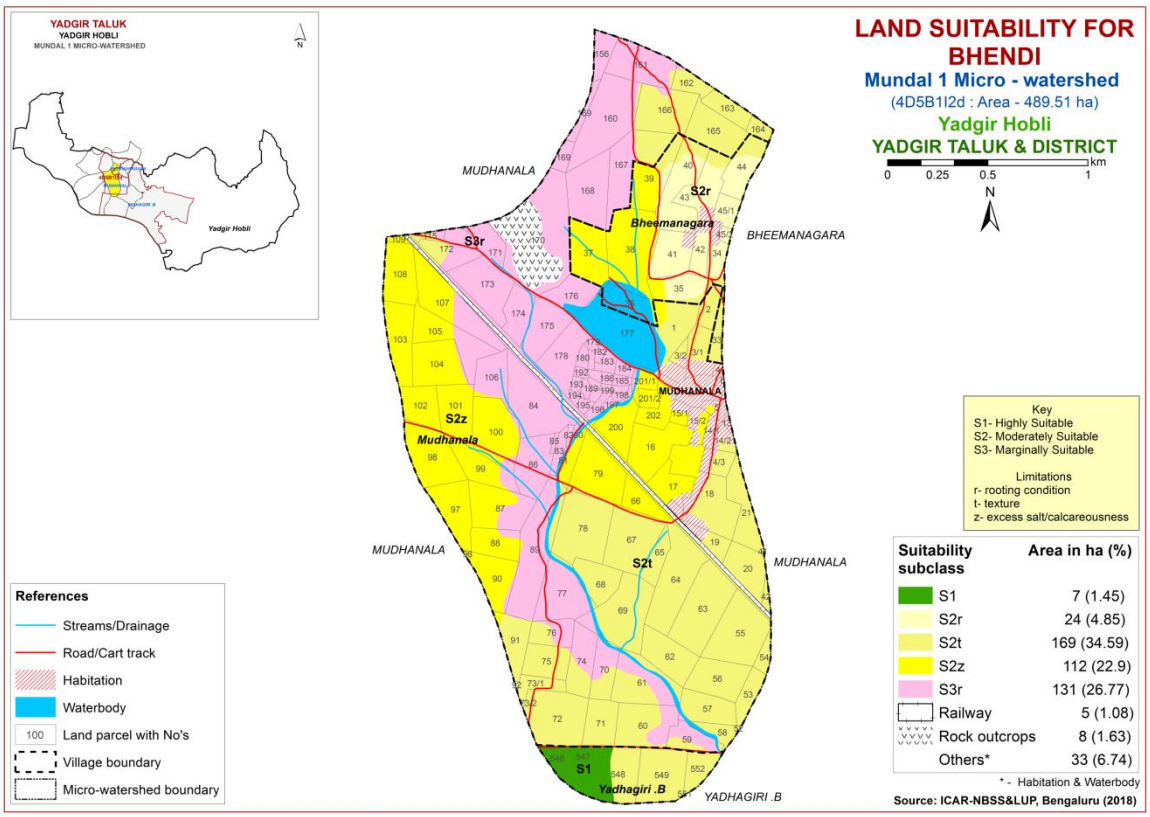


Fig 7.13 Land Suitability map of Bhendi

7.14 Land Suitability for Drumstick (*Moringa oleifera*)

Drumstick is one of the most important vegetable crop grown in about 2403 ha in the state. The crop requirements for growing drumstick (Table 7.15) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing drumstick was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.14.

Maximum area of about 288 ha (59%) is moderately suitable (Class S2) for drumstick and is distributed in the major part of the microwatershed. They have minor limitations of rooting depth, texture, calcareousness and drainage. An area of 24 ha (5%) is marginally suitable (Class S3) and is distributed in the northern part of the microwatershed with moderate limitation of rooting depth. Currently not suitable (Class N1) lands for growing drumstick occur in an small area of 131 ha (27%) and are distributed in the central, southern, northern and northwestern part of the microwatershed. They have severe limitations of rooting depth and texture.

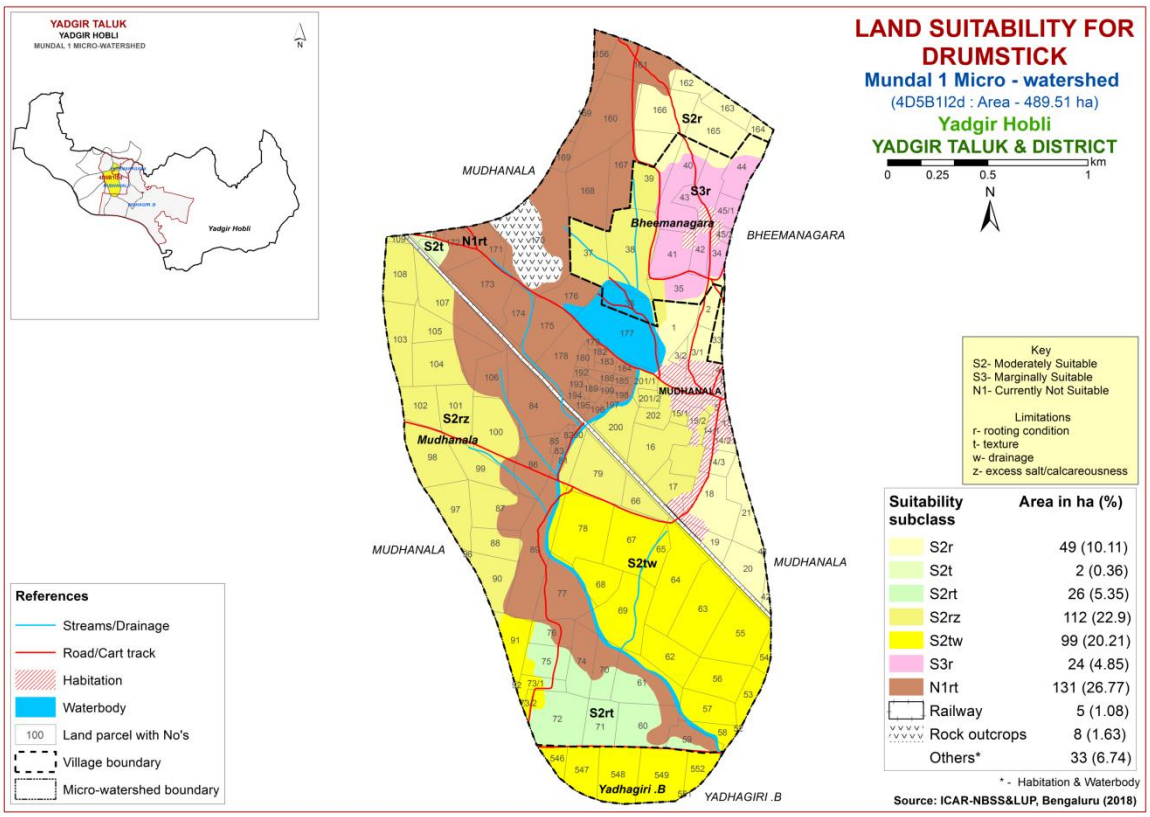


Fig 7.14 Land Suitability map of Drumstick

7.15 Land suitability for Mango (*Mangifera indica*)

Mango is one of the most important fruit crop grown in an area of 1.73 lakh ha in almost all the districts of the State. The crop requirements (Table 7.16) for growing mango were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing mango was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed is given in Figure 7.15.

Moderately suitable (Class S2) lands occur in an area of 7 ha (1%) and are distributed in the southern part of the microwatershed with minor limitation of rooting depth. Maximum area of 281 ha (57%) is marginally suitable (Class S3) for growing mango with moderate limitations of texture, calcareousness and rooting depth and are distributed in the major part of the microwatershed. An area of about 155 ha (32%) is currently not suitable (Class N1) for growing mango and are distributed in the central, southern, northern and northwestern part of the microwatershed with severe limitation of rooting depth.

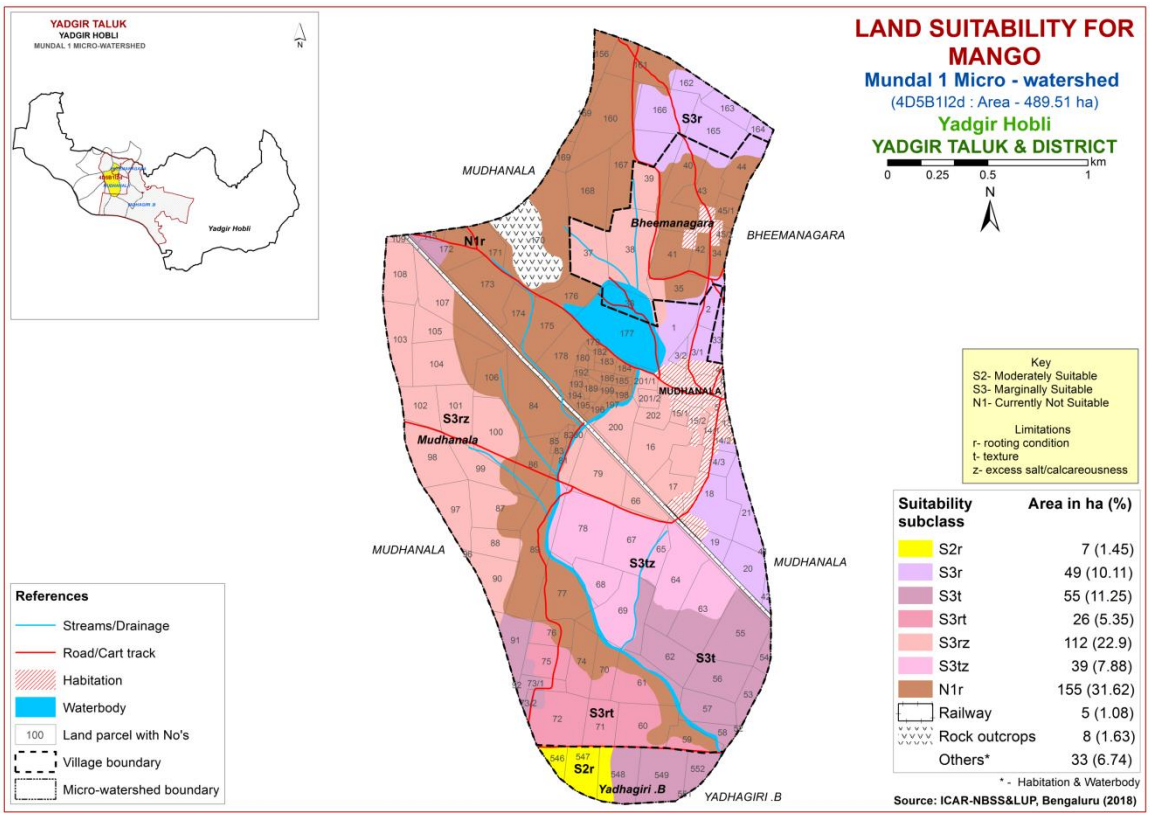


Fig. 7.15 Land Suitability map of Mango

7.16 Land suitability for Guava (*Psidium guajava*)

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

Moderately suitable (Class S2) lands occur in an area of 7 ha (1%) and are distributed in southern part of the microwatershed with minor limitation of rooting depth. Marginally suitable (Class S3) lands cover a maximum area of about 281 ha (57%) and are distributed in the major part of the microwatershed. They have moderate limitations of texture, rooting depth and calcareousness. An area of about 155 ha (32%) is currently not suitable (N1) for growing guava and occur in the southern, central, northern and northwestern part of the microwatershed with severe limitation of rooting depth.

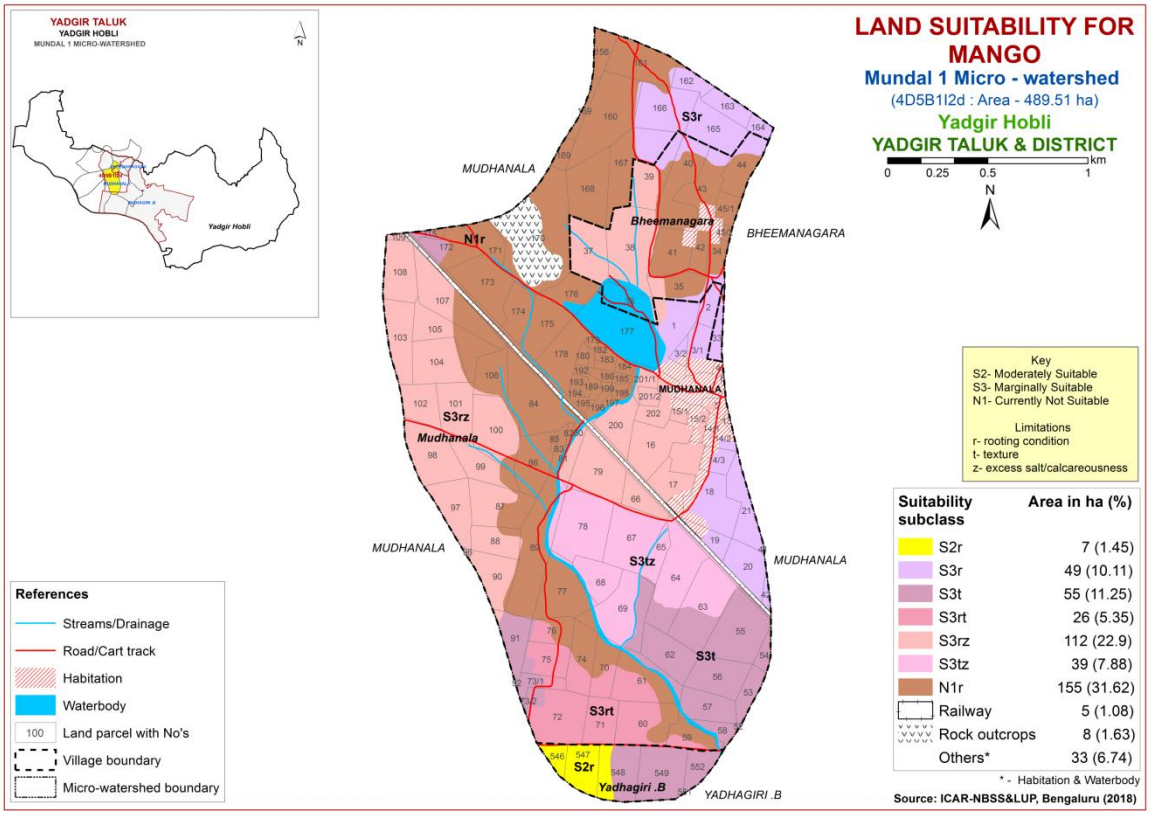


Fig. 7.16 Land Suitability map of Guava

7.17 Land suitability for Sapota (*Manilkara zapota*)

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

Moderately suitable (Class S2) lands occur in an area of 161 ha (33%) and are distributed in the major part of the microwatershed with minor limitations of rooting depth and calcareousness. Maximum area of about 151 ha (31%) is marginally suitable (Class S3) for growing sapota and are distributed in the southern, central, northern and northwestern part of the microwatershed. They have moderate limitations of texture and rooting depth. Currently not suitable (Class N1) lands for growing sapota occur in an area of 131 ha (27%) and are distributed in the central, southern, northern and northwestern part of the microwatershed. They have severe limitation of rooting depth.

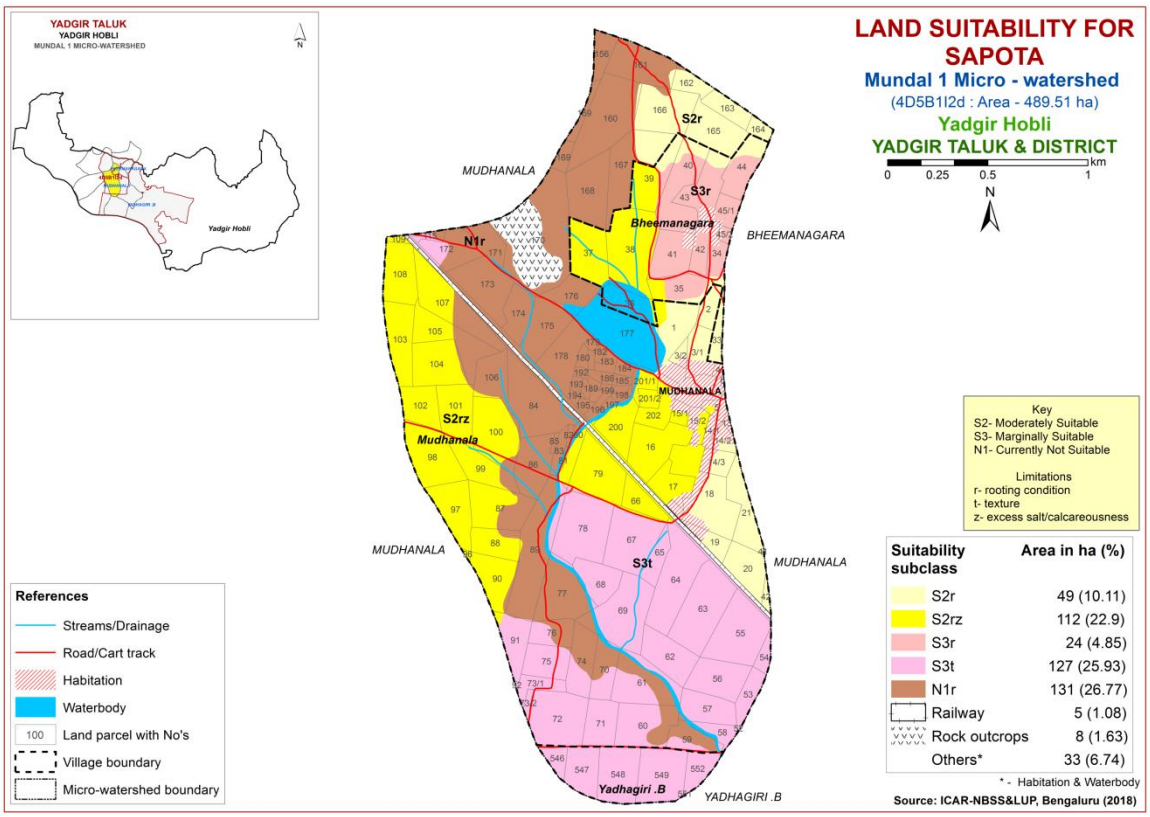


Fig. 7.17 Land Suitability map of Sapota

7.18 Land Suitability for Pomegranate (*Punica granatum*)

Pomegranate is one of the most important fruit crop commercially grown in about 18488 ha in Karnataka, mainly in Bijapur, Bagalkot, Koppal, Gadag and Chitradurga districts. The crop requirements for growing pomegranate (Table 7.19) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing pomegranate was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.18.

Maximum area of about 288 ha (59%) is moderately suitable (Class S2) for pomegranate and is distributed in the major part of the microwatershed. They have minor limitations of rooting depth, texture and calcareousness. An area of 24 ha (5%) is marginally suitable and is distributed in the northern part of the microwatershed with moderate limitation of rooting depth. Currently not suitable (Class N1) lands for growing pomegranate occur in an area of 131 ha (27%) and are distributed in the central, southern, northern and northwestern part of the microwatershed. They have severe limitation of rooting depth.

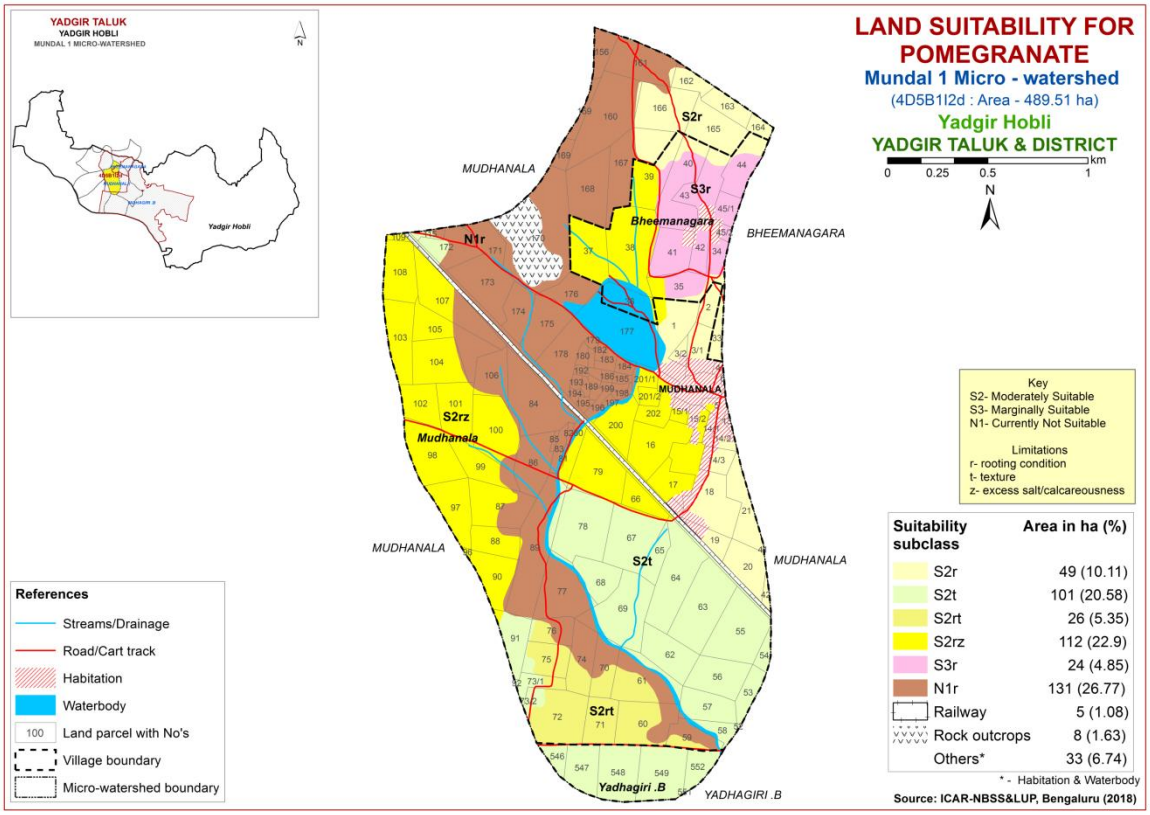


Fig 7.18 Land Suitability map of Pomegranate

7.19 Land Suitability for Musambi (*Citrus limetta*)

Musambi is one of the important fruit crop grown in an area of 3446 ha in almost all the districts of the State. The crop requirements for growing musambi (Table 7.20) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing musambi was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.19.

Highly suitable (Class S1) lands for growing musambi occur in an area of 94 ha (19%) and are distributed in central, southern, northwestern part of the microwatershed. Maximum area of about 284 ha (40%) is moderately suitable (Class S2) for growing musambi and are distributed in the major part of the microwatershed. They have minor limitations of calcareousness and rooting depth. An area of about 24 ha (5%) is marginally suitable and is distributed in the northern part of the microwatershed with moderate limitation of gravelliness. Currently not suitable (Class N1) lands for growing musambi occur in an area of 131 ha (27%) and are distributed in the central, southern, northern and northwestern part of the microwatershed. They have severe limitation of rooting depth.

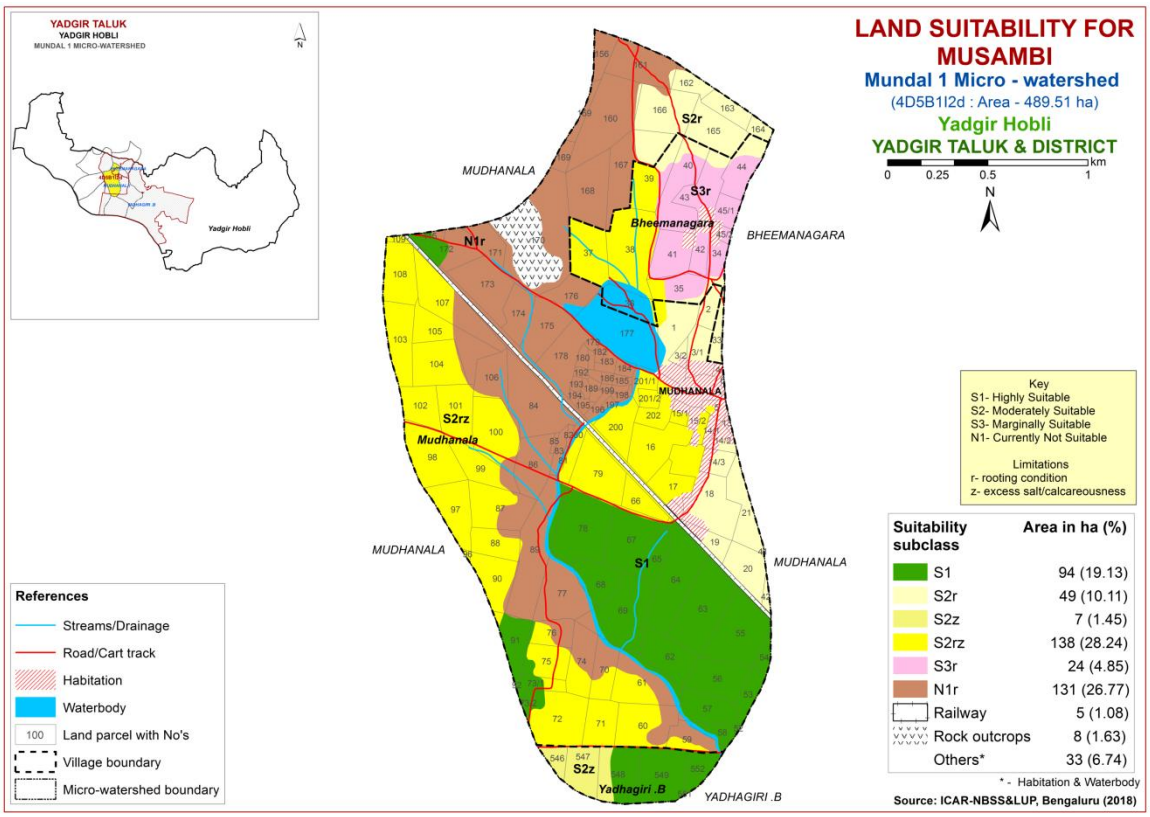


Fig. 7.19 Land Suitability map of Musambi

7.20 Land Suitability for Lime (*Citrus sp*)

Lime is one of the most important fruit crop grown in an area of 0.11 lakh ha in almost all the districts of the State. The crop requirements for growing lime (Table 7.21) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing lime was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7. 20.

Highly suitable (Class S1) lands for growing lime occur in an area of 94 ha (19%) and are distributed in central, southern, northwestern part of the microwatershed. Maximum area of about 284 ha (40%) is moderately suitable (Class S2) for growing lime and are distributed in the major part of the microwatershed. They have minor limitations of calcareousness and rooting depth. An area of about 24 ha (5%) is marginally suitable and is distributed in the northern part of the microwatershed with moderate limitation of gravelliness. Currently not suitable (Class N1) lands for growing lime occur in an area of 131 ha (27%) and are distributed in the central, southern, northern and northwestern part of the microwatershed. They have severe limitation of rooting depth.

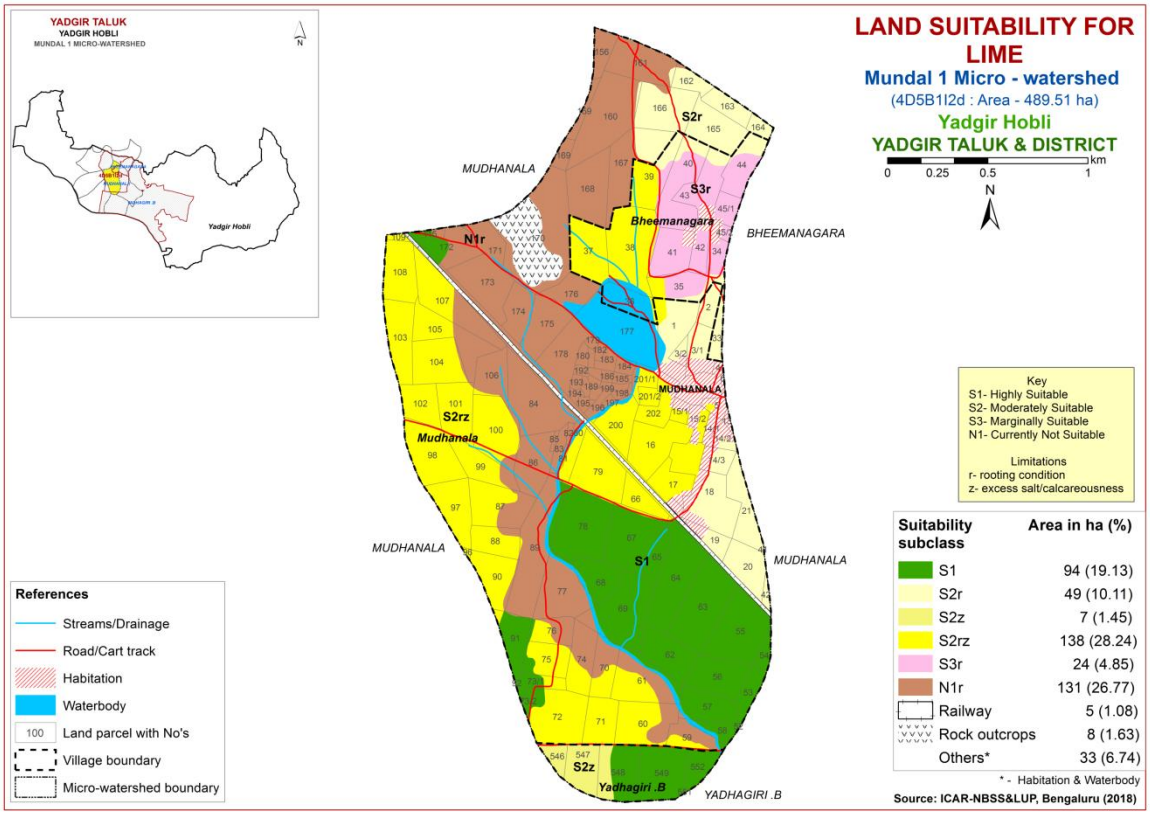


Fig. 7.20 Land Suitability map of Lime

7.21 Land Suitability for Amla (*Phyllanthus emblica*)

Amla is one of the medicinal fruit crop grown in almost all the districts of the State. The crop requirements for growing amla (Table 7.22) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing amla was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.21.

Highly suitable (Class S1) lands for growing amla occur in an area of 103 ha (21%) and are distributed in the southern, eastern and northern part of the microwatershed. Maximum area of about 209 ha (43%) has soils that are moderately suitable (Class S2) for growing amla with minor limitations of rooting depth, texture and calcareousness and are distributed in the major part of the microwatershed. An area of 131 ha (27%) is marginally suitable (Class S3) for growing amla with moderate limitations of rooting depth and texture and is distributed in the central, southern northern and northwestern part of the microwatershed.

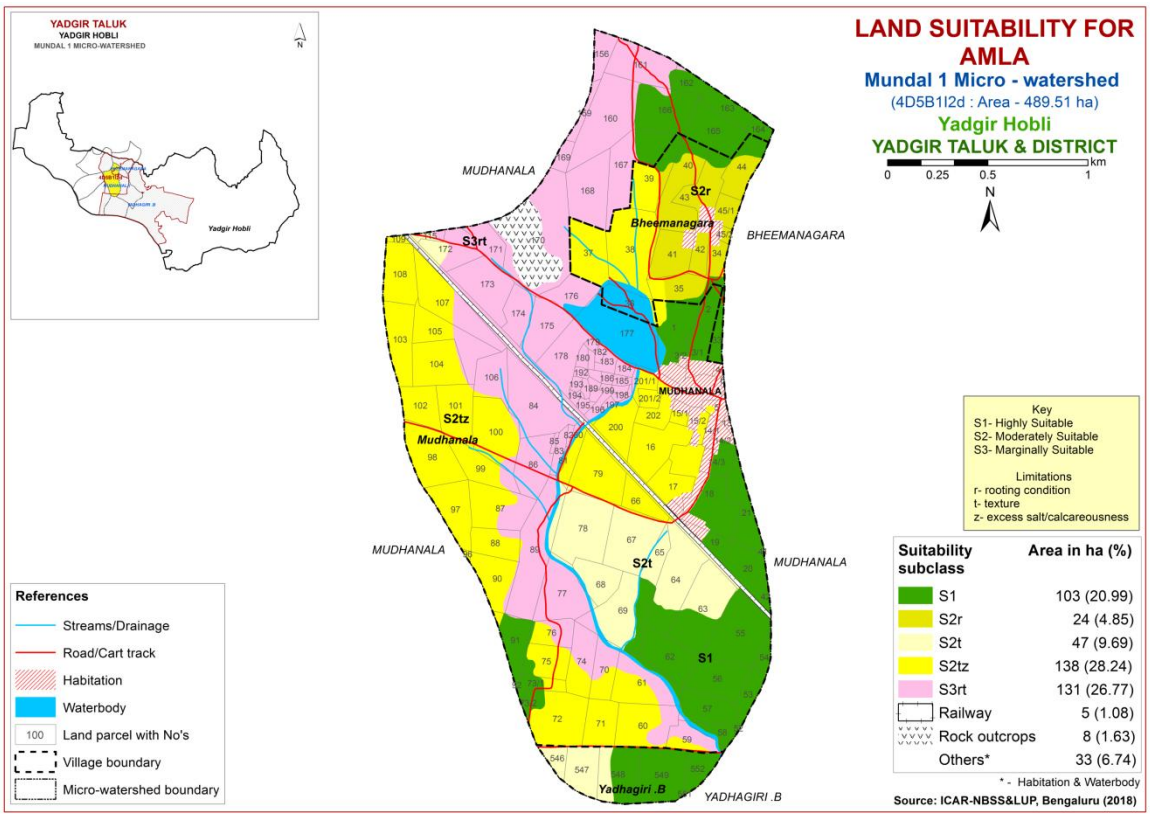


Fig. 7.21 Land Suitability map of Amla

7.22 Land Suitability for Cashew (*Anacardium occidentale)*

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

An area of 49 ha (10%) is moderately suitable (Class S2) for cashew and are distributed in the southern, eastern and northern part of the microwatershed with minor limitations of rooting depth and texture. Maximum area of 394 ha (80%) is currently not suitable (Class N1) for cashew and is distributed in the major part of the microwatershed with severe limitations of rooting depth, texture and calcareousness.

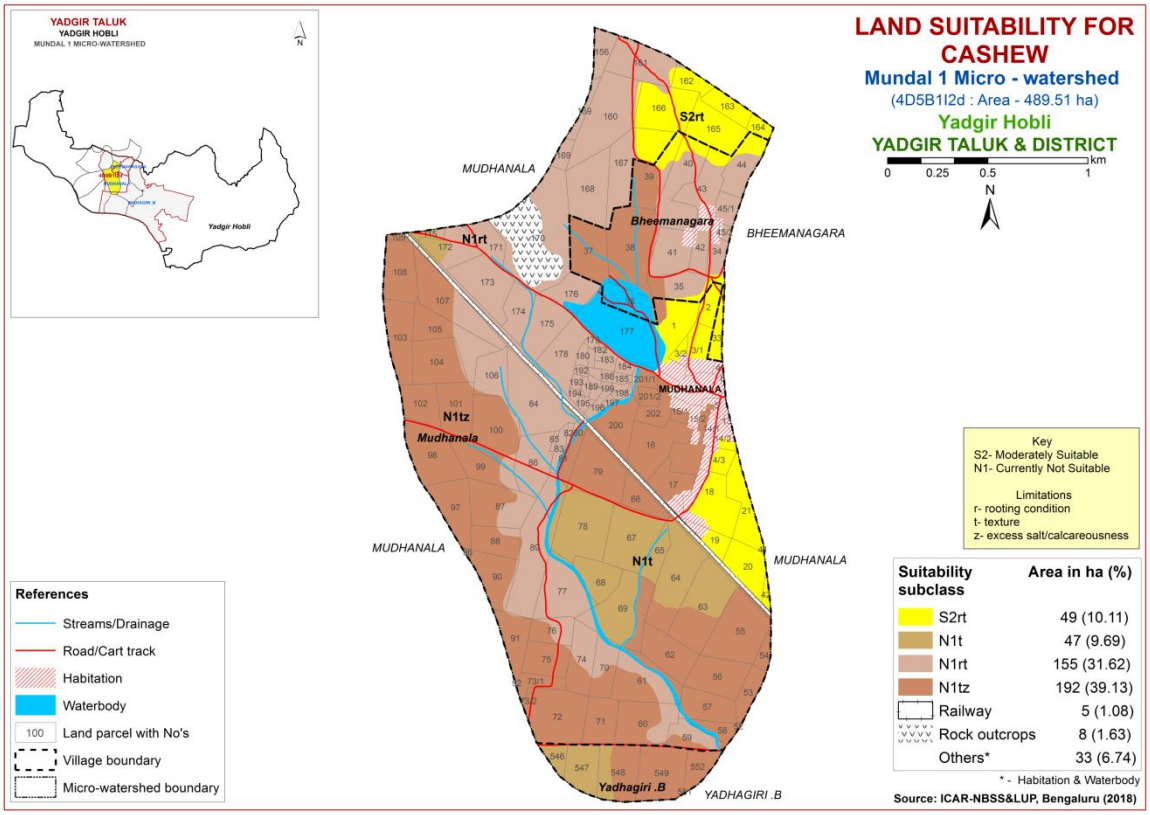


Fig. 7.22 Land Suitability map of Cashew

7. 23 Land Suitability for Jackfruit (*Artocarpus heterophyllus*)

Jackfruit is one of the most important fruit crop grown in an area of 5368 ha in almost all the districts of the State. The crop requirements for growing jackfruit (Table 7.24) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing jackfruit was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.23.

An area of about 161 ha (33%) is moderately suitable (Class S2) for growing jackfruit and are distributed in the major part of the microwatershed. They have minor limitations of calcareousness and rooting depth. An area of about 151 ha (31%) is marginally suitable (Class S3) and is distributed in the southern, central and northwestern part of the microwatershed with moderate limitations of rooting depth and texture. An area of 131 ha (27%) is currently not suitable (Class N1) for growing jackfruit with moderate limitations of rooting depth and texture and is distributed in the central, southern northern and northwestern part of the microwatershed.

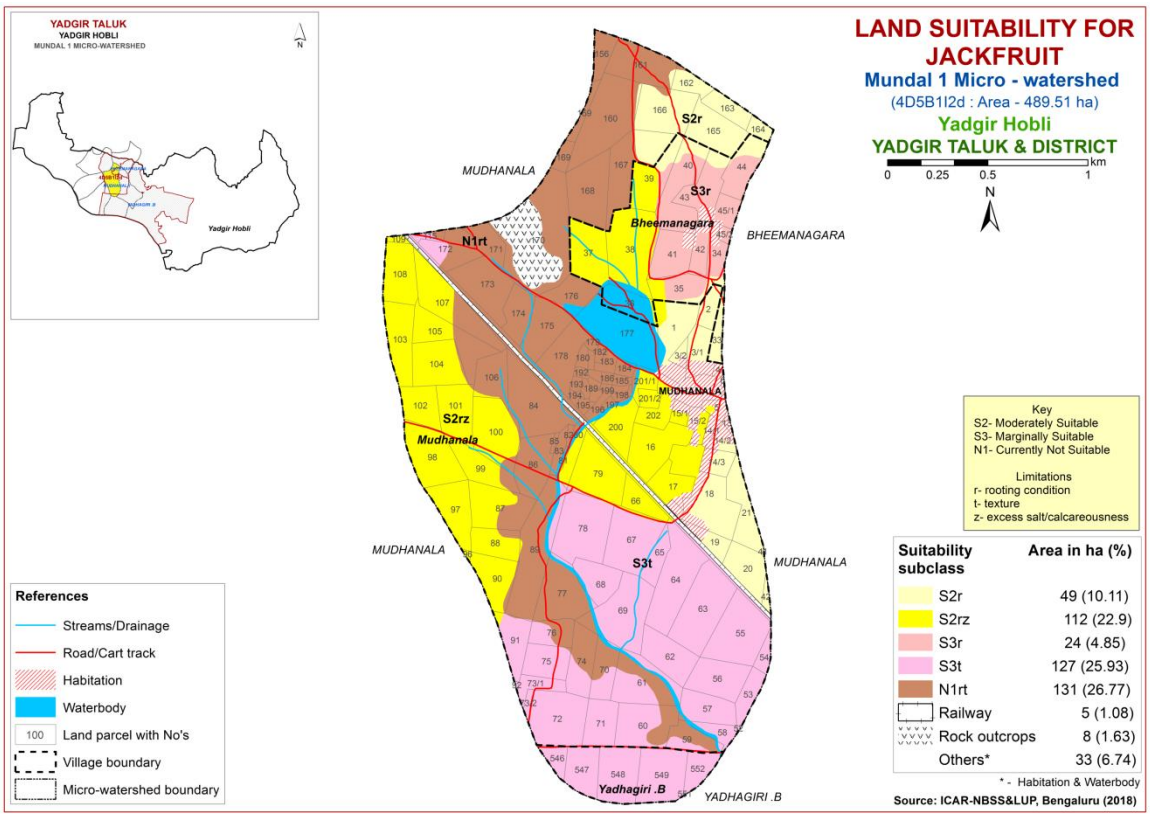


Fig. 7.23 Land Suitability map of Jackfruit

7.24 Land Suitability for Jamun (*Syzygium cumini*)

Jamun is an important fruit crop grown in almost all the districts of the State. The crop requirements for growing jamun (Table 25) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing jamun was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.24.

Maximum area of about 101 ha (21%) is moderately suitable (Class S2) for growing Jamun and are distributed in the central, southern and northwestern part of the microwatershed. They have minor limitation of texture. An area of about 211 ha (43%) is marginally suitable (Class S3) for growing Jamun and is distributed in major part of the microwatershed. They have moderate limitations of texture, calcareousness and rooting depth. An area of about 131 ha (27%) is currently not suitable (Class N1) and is distributed in the central, northern, northwestern and southern part of the microwatershed with severe limitations of rooting depth and texture.

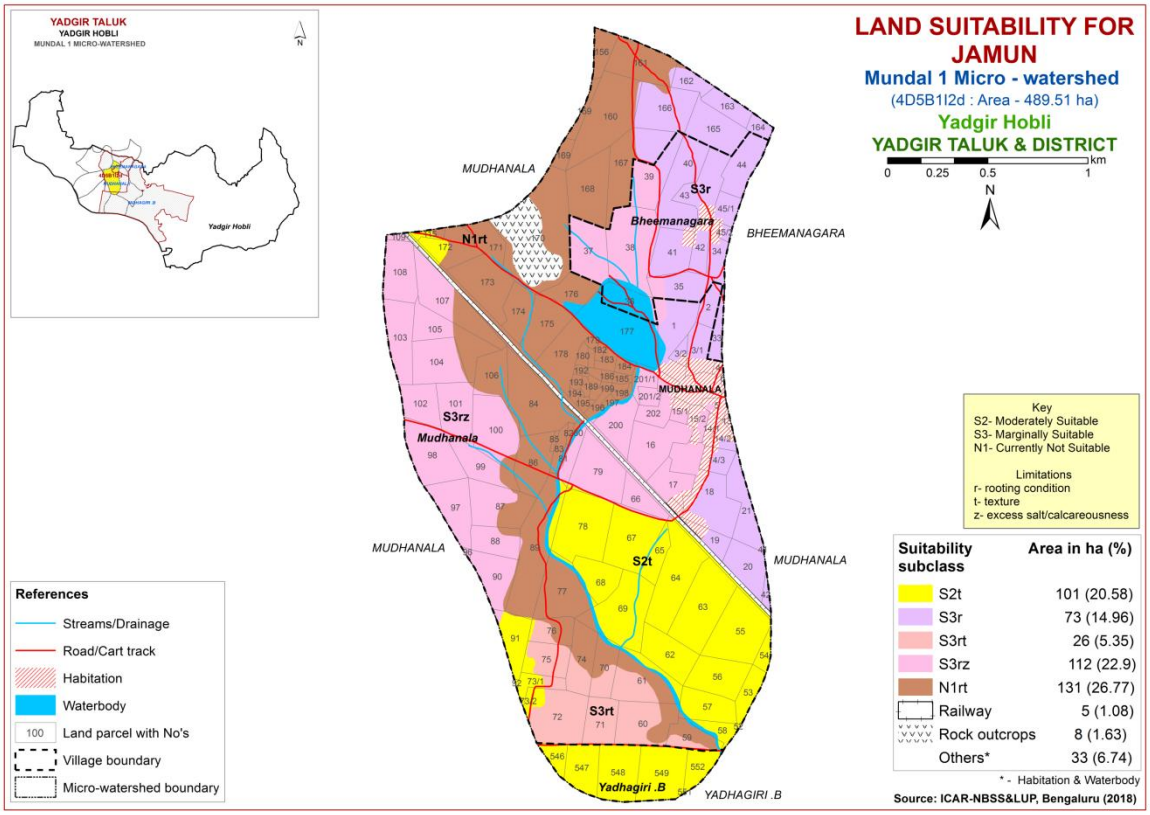


Fig. 7.24 Land Suitability map of Jamun

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

Custard apple is one of the most important fruit crop grown in almost all the districts of the State. The crop requirements for growing custard apple (Table7.26) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing custard apple was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.25.

Highly suitable (Class S1) lands for growing custard apple occur in an area of 169 ha (35%) and is distributed in the major part of the microwatershed. An area of about 143 ha (29%) is moderately suitable (Class S2) for growing custard apple and is distributed in the central, western, southern and northern part of the microwatershed with minor limitations of calcareousness and rooting depth. Marginally suitable (Class S3) lands occur in an area of 131 ha (27%) and are distributed in central, southern, northern and northwestern part of the microwatershed with moderate limitation of rooting depth.

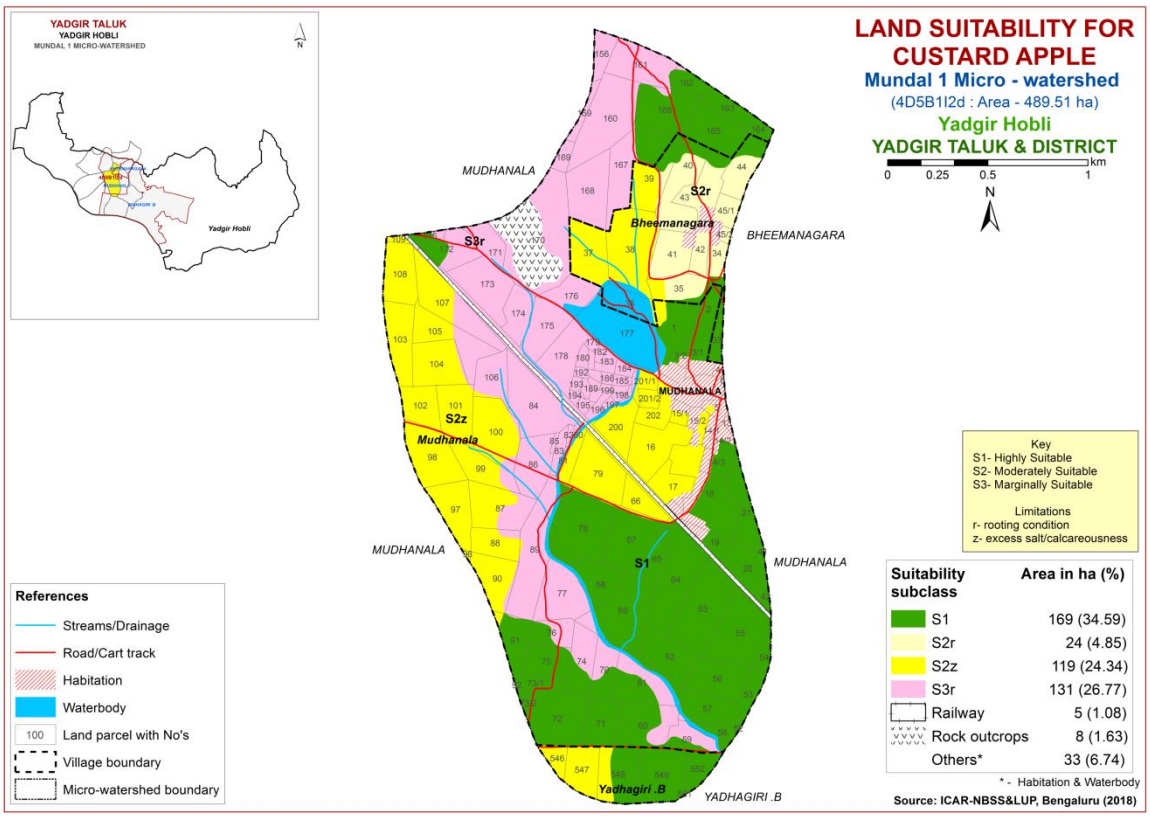


Fig. 7.25 Land Suitability map of Custard Apple

7.26 Land Suitability for Tamarind (*Tamarindus indica*)

Tamarind is one of the most important spice crop grown in almost all the districts of the state. The crop requirements for growing tamarind (Table 7.27) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing tamarind was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.26.

An area of about 101 ha (21%) is moderately suitable (Class S2) for growing Tamarind and are distributed in the central, southern and northwestern part of the microwatershed. They have minor limitation of texture. Marginally suitable (Class S3) lands for growing Tamarind occupy an area of about 188 ha (38%) and are distributed in the major part of the microwatershed. They have moderate limitations of rooting depth and calcareousness. An area of about 155 ha (32%) is currently not suitable (Class N1) for growing Tamarind and occur in the southern, central, northern and northwestern part of the microwatershed with severe limitations of rooting depth and texture.

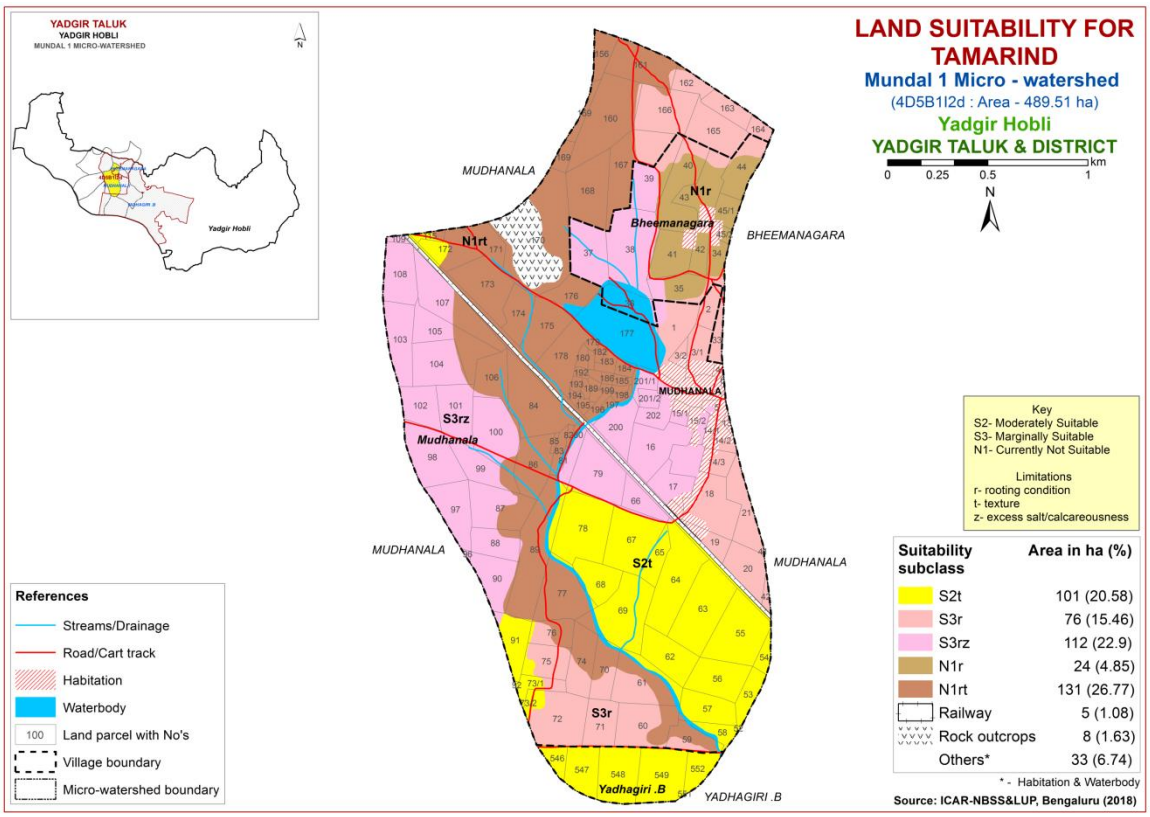


Fig. 7.26 Land Suitability map of Tamarind

7.27 Land Suitability for Mulberry (*Morus nigra*)

Mulberry is one of the important leaf crop grown for rearing silk worms in about 1.6 lakh ha area in all the districts of the state. The crop requirements for growing mulberry (Table 7.28) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing mulberry was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.27.

An area of about 161 ha (33%) is moderately suitable (Class S2) for growing mulberry and are distributed in the major part of the microwatershed. They have minor limitations of calcareousness and rooting depth. An area of about 151 ha (31%) is marginally suitable (Class S3) and is distributed in the southern, northern central and northwestern part of the microwatershed with moderate limitations of rooting depth, drainage and texture. An area of 131 ha (27%) is currently not suitable (Class N1) for growing mulberry with moderate limitations of rooting depth and texture and is distributed in the central, southern northern and northwestern part of the microwatershed

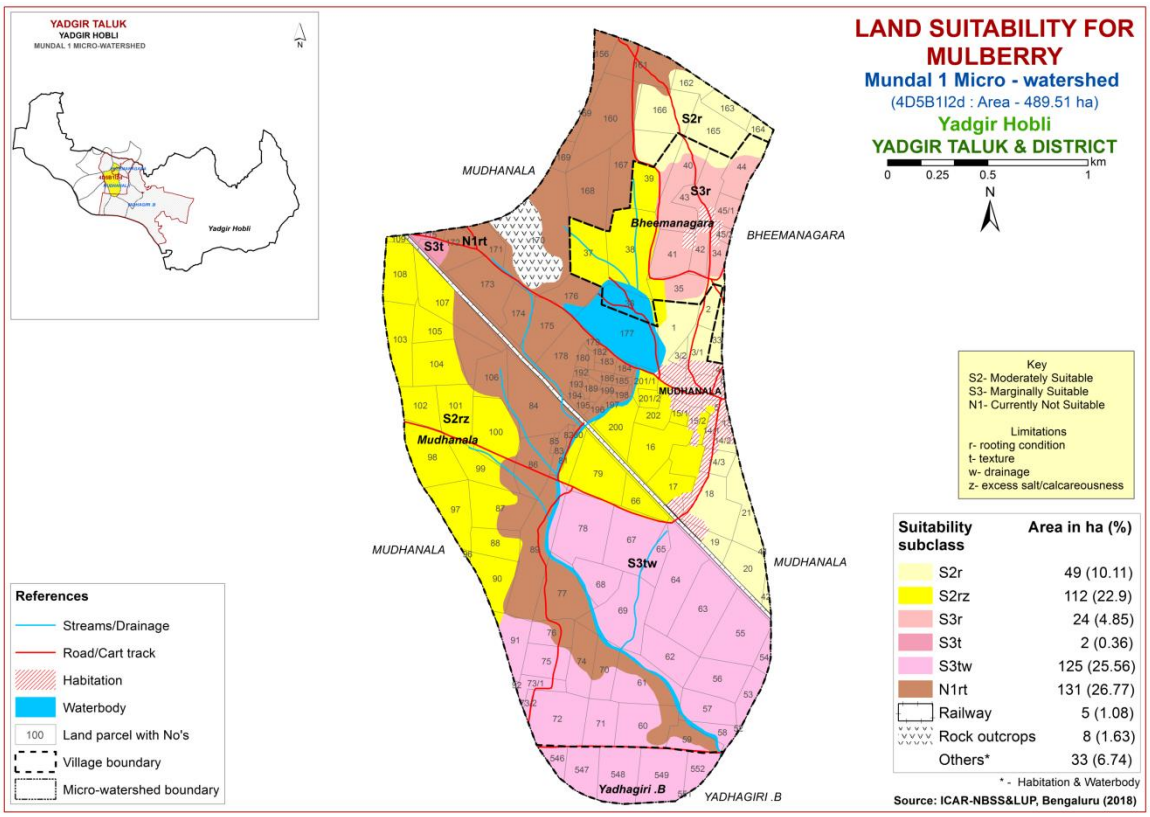


Fig 7.27 Land Suitability map of Mulberry

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

Marigold is one of the most important flower crop grown in an area of 9108 ha in almost all the districts of the State. The crop requirements (Table 7.29) for growing marigold were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing marigold was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.28.

Maximum area of about 312 ha (64%) is moderately suitable (Class S2) for growing marigold and are distributed in the major part of the microwatershed. They have minor limitations of rooting depth, texture, drainage and calcareousness. Marginally suitable (Class S3) lands occupy an area of about 131 ha (27%) and are distributed in the northern, central, northwestern and southern part of the microwatershed. They have moderate limitations of rooting depth and texture.

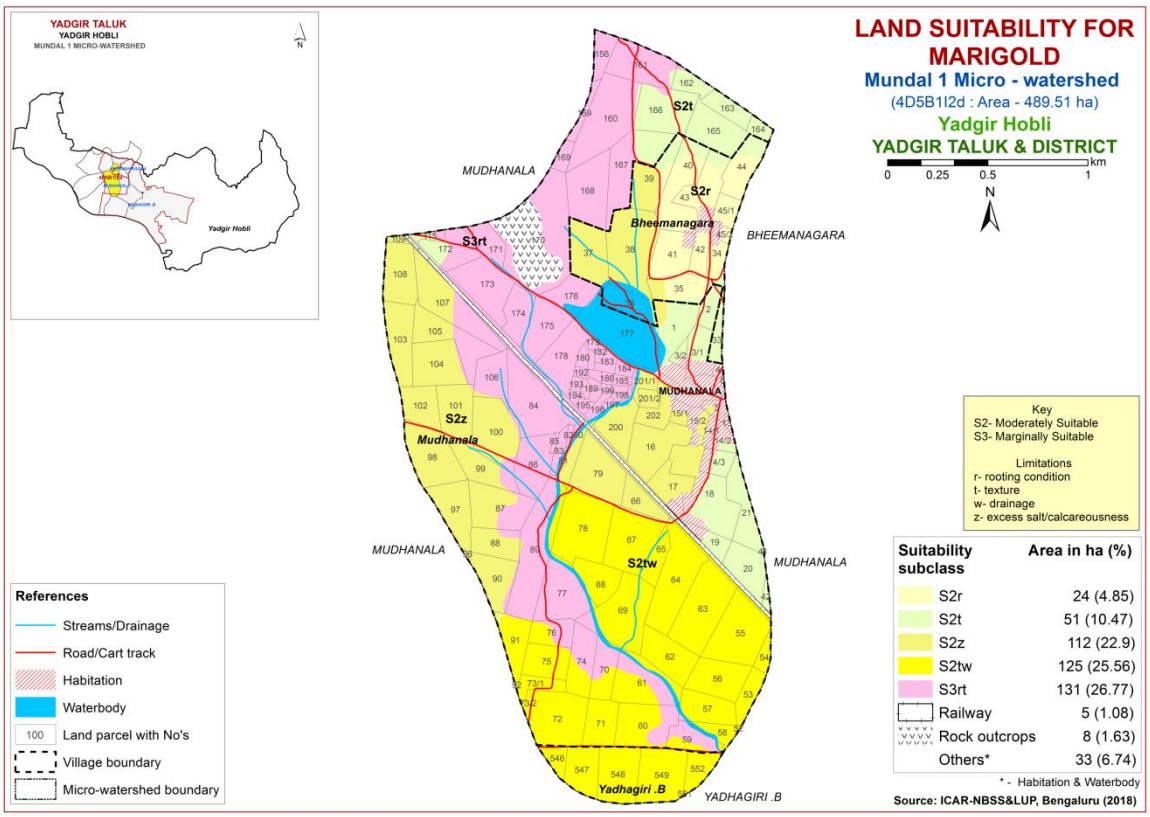


Fig. 7.28 Land Suitability map of Marigold

7.29 Land Suitability for Chrysanthemum (*Dendranthema grandiflora*)

Chrysanthemum is one of the most important flower crop grown in an area of 4978 ha in almost all the districts of the State. The crop requirements (Table 7.30) for growing chrysanthemum were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing chrysanthemum was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.29.

Maximum area of about 312 ha (64%) is moderately suitable (Class S2) for growing chrysanthemum and are distributed in the major part of the microwatershed. They have minor limitations of rooting depth, texture, drainage and calcareousness. Marginally suitable (Class S3) lands occupy an area of about 131 ha (27%) and are distributed in the northern, central, northwestern and southern part of the microwatershed. They have moderate limitations of rooting depth and texture.

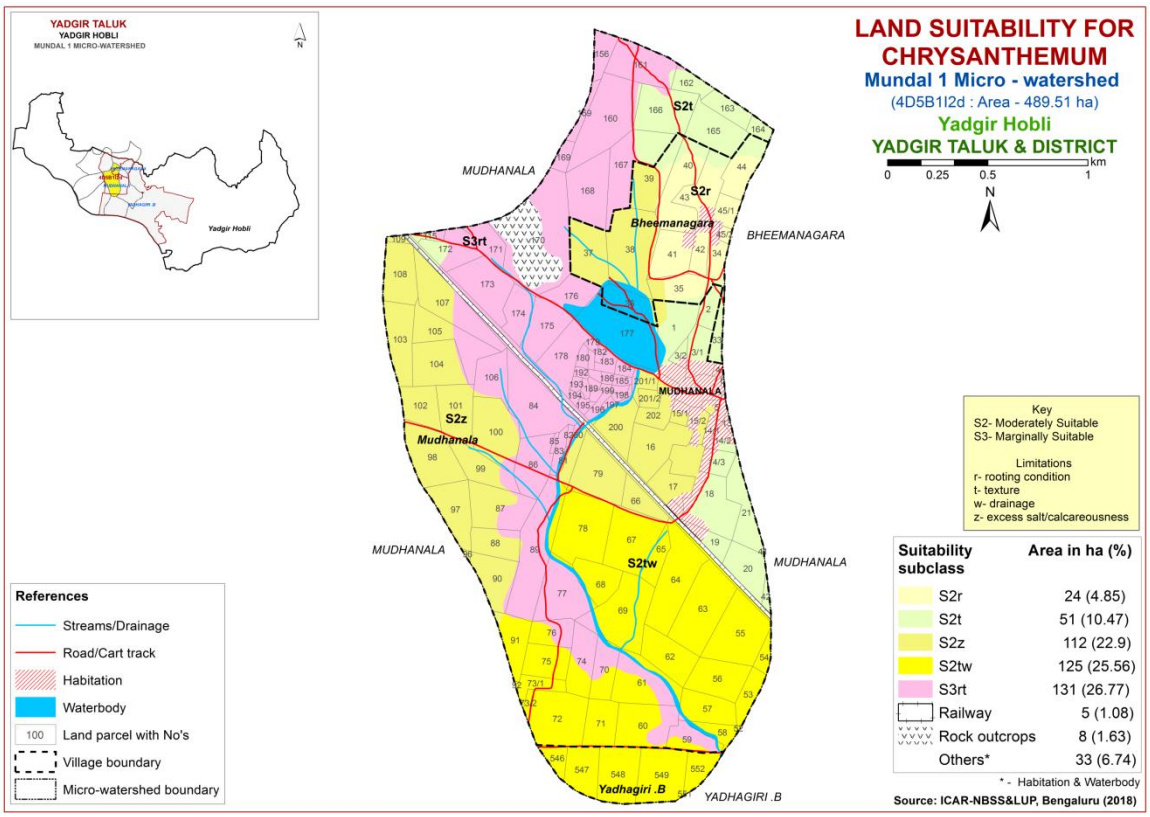


Fig. 7.29 Land Suitability map of Chrysanthemum

Table 7.1 Soil-Site Characteristics of Mundal -1 Microwatershed

Soil Map units	Climate (P) (mm)	Growing period (Days)	Drain-age Class	Soil depth (cm)	Soil texture		Gravelliness		AWC (mm/m)	Slope (%)	Erosion	pH	EC (dSm^{-1})	ESP (%)	CEC [Cmol (p^{+})kg^{-1}]	BS (%)
					Sur-face	Sub-surface	Surface (%)	Sub-surface (%)								
BDLbB2	866	150	WD	25-50	ls	sl	<15	<15	<50	1-3	moderate	6.20	0.074	0.20	4.20	93
BDLhB2	866	150	WD	25-50	scl	sl	<15	<15	<50	1-3	moderate	6.20	0.074	0.20	4.20	93
JNKcB2	866	150	w	50-75	sl	scl	<15	<15	51-100	1-3	moderate	8.42	0.148	0.18	14.50	100
PGPcB2	866	150	WD	75-100	sl	sc	<15	<15	51-100	1-3	moderate	6.83	0.210	2.83	3.15	100
HSLbB2	866	150	MWD	75-100	ls	sc	<15	<15	101-150	1-3	moderate	7.16	0.117	5.94	4.90	97
ANRiB2	866	150	MWD	100-150	sc	c	<15	<15	>200	1-3	moderate	10.17	0.365	7.08	19.90	100
BGDmB2	866	150	MWD	100-150	c	c	<15	<15	>200	1-3	moderate	7.85	0.253	0.26	65.90	100
MDGhB2g1	866	150	WD	100-150	scl	scl	15-35	<15	>200	1-3	moderate	8.20	0.399	3.08	4.90	100
MGLmB2	866	150	mw	75-100	c	c	<15	<15	101-150	1-3	moderate	8.25	0.23	0.74	49.11	100
HGNmB2	866	150	MWD	>150	c	c	<15	<15	>200	1-3	moderate	8.77	1.33	14.38	36.23	100
HGNmB1	866	150	MWD	>150	c	c	<15	<15	>200	1-3	moderate	8.77	1.33	14.38	36.23	100

*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 characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Moderately well drained	Poorly drained	V.poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	sc, c (red), c (black)	scl, cl	ls, sl	-
	pH	1:2.5	5.5-7.8	5.0-5.5 7.8-9.0	>9.0	-
	CEC	C mol (p+)/Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	10-15
	OC	%				
Rooting conditions	Effective soil depth	cm	>75	50-75	25-50	<25
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	ds/m	<2	2-4	4-8	>8
	Sodicity (ESP)	%	5-10	10-15	>15	
Erosion hazard	Slope	%	0-3	3-5	5-10	>10

Table 7.3 Land suitability criteria for Maize

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

Table 7.4 Land suitability criteria for Bajra

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

Table 7.5 Land suitability criteria for Groundnut

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

Table 7.6 Land suitability criteria for Sunflower

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

Table 7.7 Land suitability criteria for Redgram

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

Table 7.8 Land suitability criteria for Bengal gram

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

Table 7.9 Land suitability criteria for Cotton

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

Table 7.10 Land suitability criteria for Chilli

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

Table 7.11 Land suitability criteria for Tomato

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

Table 7.12 Land suitability criteria for Brinjal

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

Table 7.13 Land suitability criteria for Onion

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C	20-30	30-35	35-40	>40
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Moderately /imperfectly	-	Poorly to V poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	sl,scl,cl,sc,c (red)	-	c (Black),ls	-
	pH	1:2.5	6.0-7.3	5.0-6.0 7.3-7.8	7.8-8.4	>8.4
	CEC	C mol (p+)/ Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>75	50-75	25-50	<25
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	ds/m	<1.0	1.0-2.0	2.0-4.0	<4
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	<3	3-5	5-10	>10

Table 7.14 Land suitability criteria for Bhendi

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

Table 7.15 Land suitability criteria for Drumstick

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

Table 7.16 Land suitability criteria for Mango

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

Table 7.17 Land suitability criteria for Guava

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C	28-32	33-36 24-27	37-42 20-23	
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Moderately well drained	Poorly drained	V.Poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	scl, cl, sc, c (red)	sl	c (black), ls	-
	pH	1:2.5	6.0-7.8	5.0-6.0	7.8-8.4	>8.4
	CEC	C mol (p+)/ Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>100	75-100	50-75	<50
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	ds/m	<2.0	2-4	4-8	>8.0
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	<3	3-5	5-10	>10

Table 7.18 Land suitability criteria for Sapota

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

Table 7.19 Land suitability criteria for Pomegranate

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

Table 7.20 Land suitability criteria for Musambi

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

Table 7.21 Land suitability criteria for Lime

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

Table 7.22 Land suitability criteria for Amla

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C				
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Mod. well drained	Poorly drained	V. Poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	scl, cl, sc, c (red)	c (black)	ls, sl	-
	pH	1:2.5	5.5-7.3	5.0-5.5 7.3-7.8	7.8-8.4	>8.4
	CEC	C mol (p+)/Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>75	50-75	25-50	<25
	Stoniness	%				
	Coarse fragments	Vol %	<15-35	35-60	60-80	-
Soil toxicity	Salinity (EC saturation extract)	ds/m	<2.0	2-4	4-8	>8.0
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	0-3	3-5	5-10	>10

Table 7.23 Land suitability criteria for Cashew

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

Table 7.24 Land suitability criteria for Jackfruit

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C				
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Mod. well	Poorly	V. Poorly
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	scl, cl, sc, c (red)	-	sl, ls, c (black)	-
	pH	1:2.5	5.5-7.3	5.0-5.5 7.3-7.8	7.8-8.4	>8.4
	CEC	C mol (p+)/ Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>100	75-100	50-75	<50
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	>60
Soil toxicity	Salinity (EC saturation extract)	ds/m	<2.0	2-4	4-8	>8.0
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	0-3	3-5	5-10	>10-

Table 7.25 Land suitability criteria for Jamun

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C				
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well	Mod. well	Poorly	V.Poorly
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	scl, cl, sc, c(red)	sl, c (black)	ls	-
	pH	1:2.5	6.0-7.8	5.0-6.0	7.8-8.4	>8.4
	CEC	C mol (p+)/ Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>150	100-150	50-100	<50
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	>60
Soil toxicity	Salinity (EC saturation extract)	ds/m	<2.0	2-4	4-8	>8.0
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	0-3	3-5	5-10	>10

Table 7.26 Land suitability criteria for Custard apple

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

Table 7.27 Land suitability criteria for Tamarind

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C				
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Mod.well drained	Poorly drained	V.Poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	scl, cl,sc, c (red)	sl, c (black)	ls	-
	pH	1:2.5	6.0-7.3	5.0-6.0 7.3-7.8	7.8-8.4	>8.4
	CEC	C mol (p+)/ Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>150	100-150	75-100	<75
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	ds/m	<2	2-4	4-8	>8
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	0-3	3-5	5-10	>10

Table 7.28 Land suitability criteria for Mulberry

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

Table 7.29 Land suitability criteria for Marigold

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

Table 7.30 Land suitability criteria for Chrysanthemum

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

7.30 Land Management Units (LMUs)

The 11 soil map units identified in Mundal-1microwatershed have been grouped into 5 Land Management Units (LMU's) for the purpose of preparing a Proposed Crop Plan. Land Management Units are grouped based on the similarities in respect of the type of soil, the depth of the soil, the surface soil texture, gravel content, AWC, slope, erosion etc. and a Land Management Units map (Fig. 7.30) has been generated. These Land Management Units are expected to behave similarly for a given level of management.

The 11 map units that have been grouped into 5 Land Management Units along with brief description of soil and site characteristics are given below.

LMU	Soil map units	Soil and site characteristics
1	55.ANRiB2 82.MGLmB2 95.HGNmB2 111.HSLbB2 115.BGDmB2 138.HGNmB1	Deep to very deep, black clay soils, 1-3% slopes, non gravelly (<15%), moderate erosion.
2	40.PGPcB2	Moderately deep, brown sandy clay soils, 1-3% slopes, non gravelly, moderate erosion.
3	149.MDGhB2g1	Deep, black sandy clay loam soils, 1-3% slopes, gravelly, moderate erosion.
4	20.JNKcB2	Moderately shallow, sandy clay loam soils , 1-3%, slopes, non gravelly, moderate erosion
5	2.BDLbB2 4.BDLhB2	Shallow, black sandy loam soils, 1-3% slopes, non gravelly moderate erosion.

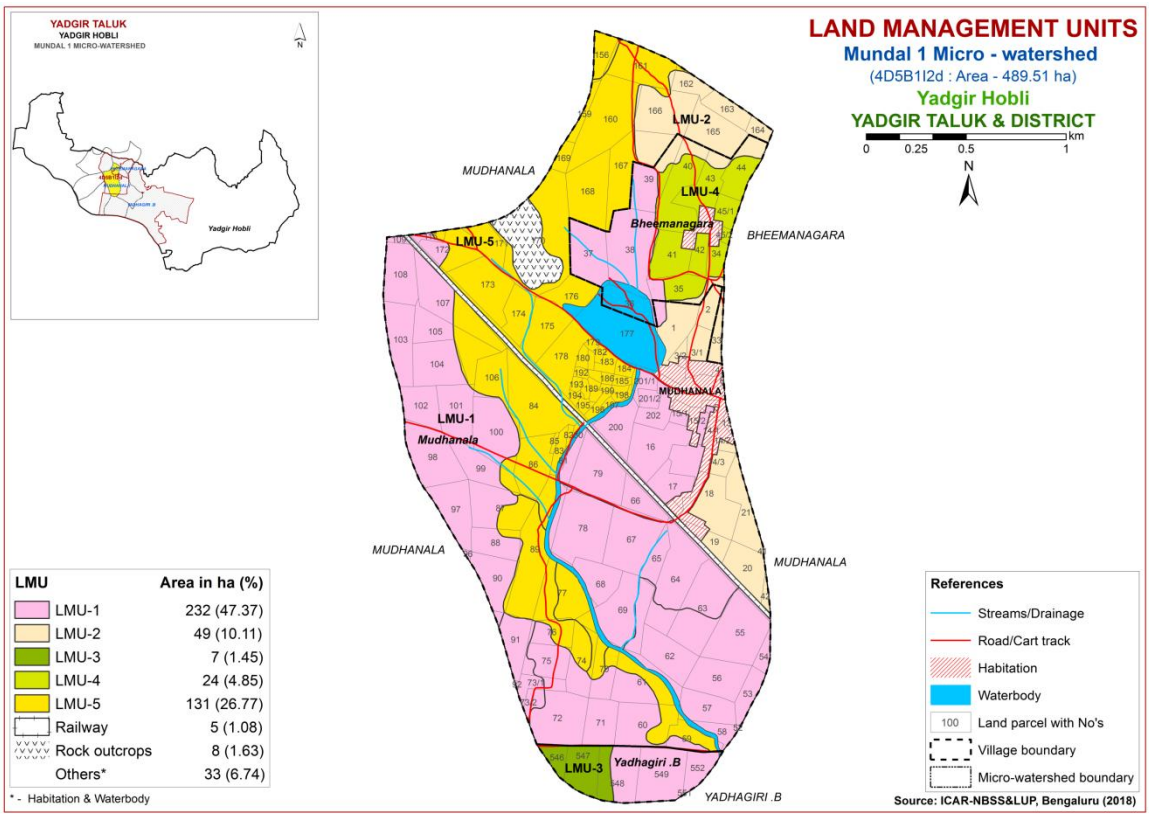


Fig. 7.30 Land Management Units Map- Mundal-1Microwatershed

7.31 Proposed Crop Plan for Mundal-1Microwatershed

After assessing the land suitability for the 29 crops, the Proposed Crop Plan has been prepared for the 5 identified LMUs by considering only the highly (Class S1) and moderately (Class S2) suitable lands for each of the 29 crops. The resultant proposed crop plan is presented below in Table 7.31.

Table 7.31 Proposed Crop Plan for Mundal-1Microwatershed

LMU	Soil Map Units	Survey Number	Field Crops/ Commercial crops	Horticulture Crops (Rainfed/Irrigated)	Suitable Interventions
1	55.ANRiB2 82.MGLmB2 95.HGNmB2 111.HSLbB2 115.BGDmB2 138.HGNmB1	**Bheemanagara :** 37,38,39 **Mudhanala:**15/1,16,17,52,53,54,55,56,57,58,60,61,62,63,64,65,66,67,68,69,70,71,72,73/1,73/2,75,78,79,80,87,88,90,91,92,96,97,98,99,100,101,102,103,104,107,108,109,115,200,201/1,201/2,202 **Yadagiri.B :** 548,549,551,552	Sunflower, Sorghum, Maize, Soybean, Cotton, Bengal gram, Safflower, Linseed, Bajra	**Fruit crops:** Pomegranate, Lime, Musambi, Tamarind, Jamun, Amla, Custard apple **Vegetables:** Drumstick, Chilli, Bhendi, Cluster bean, Coriander **Flowers:** Marigold, Chrysanthemum	Application of FYM, Biofertilizers and micronutrients, drip irrigation, mulching, suitable soil and water conservation practices
2	40.PGPcB2	**Bheemanagara :** 33 **Mudhanala:**1,2,14/3,18,19,20,21,3/1,3/2,41,42,162,163,164,165,166	Maize, Sorghum, Sunflower, Bajra, Finger millet, Groundnut, Red gram, Cowpea, Field bean, Castor, Mulberry	**Fruit crops:** Mango, Pomegranate, Guava, Sapota, Jackfruit, Jamun, Tamarind, Lime, Musambi, Amla, Custard apple, Cashew **Vegetable crops:** Drumstick, Tomato, Bhendi, Chilli, Brinjal, Onion, Curry leaves **Flower crops:** Marigold, Chrysanthemum, Jasmine, Crossandra	Drip irrigation, mulching, suitable soil and water conservation practises (Crescent Bunding with Catch Pit etc)
3	149.MDGhB2g1	**Yadagiri.B :** 546,547	Sunflower, Sorghum, Maize, Groundnut, Soybean, Safflower, Linseed, Bajra, Mulberry	**Fruit crops:** Mango, Sapota**,** Pomegranate, Guava, Lime, Musambi, Jamun, Jackfruit, Tamarind, Amla, Custard apple **Vegetables:** Onion, Tomato, Bhendi, Drumstick,	Application of FYM, Biofertilizers and micronutrients, drip irrigation, mulching, suitable soil and water conservation practices

LMU	Soil Map Units	Survey Number	Field Crops/ Commercial crops	Horticulture Crops (Rainfed/Irrigated)	Suitable Interventions
				Chilli, Coriander **Flowers:** Marigold, Chrysanthemum	
4	20.JNKcB2	**Bheemanagara:**34,35,40,41,42,43, 44, 45/1, 45/2	Maize, Sorghum, Cotton, Bengalgram, Bajra	**Fruit crops:** Amla, Custard apple **Vegetables**: Coriander, Bhendi **Flowers:** Marigold, Jasmine Chrysanthemum	Application of FYM, Biofertilizers and micronutrients, drip irrigation, mulching, suitable soil and water conservation practices
5	2.BDLbB2 4.BDLhB2	**Mudhanala:**,59,74,76,77,82,83,84, 85,86,89,105,106,156,159,160,161, 167,168,169,170,171,172,173,174, 175,176,178,179,180,181,182,183, 184,185,186,187,188,189,190,191, 192,193,194,195,196,197, 198,199	-	**Agri-Silvi-Pasture:** Hybrid Napier, *Styloxanthes hamata, Styloxanthes scabra*	Use of short duration varieties, sowing across the slope, drip irrigation and mulching is recommended

Chapter 8

SOIL HEALTH MANAGEMENT

8.1 Soil Health

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

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

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

The most important characteristics of a healthy soil are

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

Characteristics of Mundal-1Microwatershed

- The soil phases identified in the microwatershed belonged to the soil series of BDL series occupies maximum area of 131 ha (27%) followed by HSL 112 ha (23%), HGN 54 ha (11%), PGP 49 ha (10%), ANR 39 ha (8%), MGL 26 ha (5%), JNK 24 ha (5%), MDG 7 ha (1) and BGD 2 ha (<1%).
- As per land capability classification entire area of the microwatershed falls under arable land category (Class II & III). The major limitations identified in the arable lands were soil and erosion.
- On the basis of soil reaction, an area of 1 ha (<1%) is slightly acid (pH 6.0-6.5). About 158 ha (32%) is neutral (pH 6.5-7.3). About 114 ha (23%) is slightly alkaline (pH 7.3-

7.8). An area of about 103 ha (21%) is moderately alkaline (pH 7.8-8.4). About 61 ha (12%) is strongly alkaline (pH 8.4-9.0) and about 6 ha (1%) is very strongly alkaline (pH >9.0) 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

Acid soils cover about 1 ha area in the microwatershed.

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

Liming materials:

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

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

Alkaline soils

Slightly alkaline to very strongly alkaline soils cover about 284 ha area 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, Azatobacter, Rhizobium).
3. Application of 25% extra N and P (125 % RDN&P).
4. Application of $ZnSO_4$ – 12.5 kg/ha (once in three years).
5. Application of Boron – 5kg/ha (once in three years).

Neutral soils

Neutral soils occur in 158 ha area 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.

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

Soil Degradation

Soil erosion is one of the major factor affecting the soil health in the microwatershed. Out of total 490 ha area in the microwatershed, about 409 ha (83%) is suffering from moderate and 35 ha (7%) is slight erosion. In areas of moderate and slight erosion immediate soil and water conservation and, other land development and land husbandry practices are required for restoring soil health.

Dissemination of Information and Communication of Benefits

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

Inputs for Net Planning (Saturation Plan) and Interventions needed

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

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

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

- **Soil Depth:** The depth of a soil decides the amount of moisture and nutrients it can hold, what crops can be taken up or not, depending on the rooting depth and the length of growing period available for raising any crop. Deeper the soil, better for a wide variety of crops. If sufficient depth is not available for growing deep rooted crops, either choose medium or short duration crops or deeper planting pits need to be opened and additional good quality soil brought from outside has to be filled into the planting pits.
- **Surface Soil Texture:** Lighter soil texture in the top soil means, better rain water infiltration, less run-off and soil moisture conservation, less capillary rise and less evaporation losses. Lighter surface textured soils are amenable to good soil tilth and are highly suitable for crops like groundnut, root vegetables (carrot, raddish, potato etc) but not ideal for crops that need stagnant water like lowland paddy. Heavy textured soils are poor in water infiltration and percolation. They are prone for sheet erosion; such soils can be improved by sand mulching. The technology that is

developed by the AICRP-Dryland Agriculture, Vijayapura, Karnataka can be adopted.

- **Gravelliness:** More gravel content is favorable for run-off harvesting but poor in soil moisture storage and nutrient availability. It is a significant parameter that decides the kind of crop to be raised.
- **Land Capability Classification:** The land capability map shows the areas suitable and not suitable for agriculture and the major constraints in each of the plot/survey number. Hence, one can decide what kind of enterprise is possible in each of these units. In general, erosion and soil are the major constraints in Mundal-1microwatershed.
- **Organic Carbon:** The OC content (an index of available Nitrogen) is medium (0.5-0.75%) in 240 ha (49%) area and low (<0.5%) in 204 ha (42%). The areas that are medium and low in OC needs to be further improved by applying farmyard manure and crop rotation 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 entire area of about 444 ha 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**: Available Phosphorus content is medium (23-57 kg/ha) in the entire cultivated area of the microwatershed. In medium areas, for all the crops 25% additional P needs to be applied.
- **Available Potassium:** Available potassium content is medium (145-337 kg/ha) in an area of 358 ha (73%) of the microwatershed and high (>337 kg/ha) in 86 ha (18%). All the plots, where available potassium is medium, for all the crops, additional 25% potassium may be applied.
- **Available Sulphur:** Available sulphur is a very critical nutrient for oilseed crops. It is high (>20ppm) in 31 ha (6%), medium in 119 ha (24%) and low in 294 ha (60%). Low and medium areas need to be applied with magnesium sulphate or gypsum or Factamphos (p) fertilizer (13% sulphur) for 2-3 years for the deficiency to be corrected.
- **Available Boron:** An area of 304 ha (62%) is low and 140 ha (29%) is medium in available boron. Application of sodium tetra borate @ 10 kg/ha as soil application or 0.2 % borax as foliar spray is recommended.
- **Available Iron:** Available iron content is sufficient (>4.5 ppm) in an area of 301 ha (62%) and deficient (<4.5 ppm) in about 142 ha (29%) and in the microwatershed.

For deficient areas, apply iron sulphate @25 Kg/ha for 2-3 years to soil applications to correct the deficiency.

- **Available Manganese:** All the soils in the microwatershed are sufficient (>1.0 ppm) in available manganese.
- **Available Copper:** All the soils in the microwatershed are sufficient (>0.2 ppm) in available copper.
- **Available Zinc:** Available zinc content is deficient (<0.6 ppm) in the entire cultivated area of the microwatershed. Application of zinc sulphate @25 kg/ha is recommended for these areas.
- **Soil Alkalinity**: Maximum area of 284 ha (57%) in the microwatershed has soils that are slightly to very strongly alkaline. These areas need application of gypsum and wherever calcium is in excess, iron pyrites and element sulphur can be recommended. Management practices like treating repeatedly with good quality water to drain out the excess salts and provision of subsurface drainage and growing of salt tolerant crops like Casuarina, Acacia, Neem, Ber etc, are recommended.

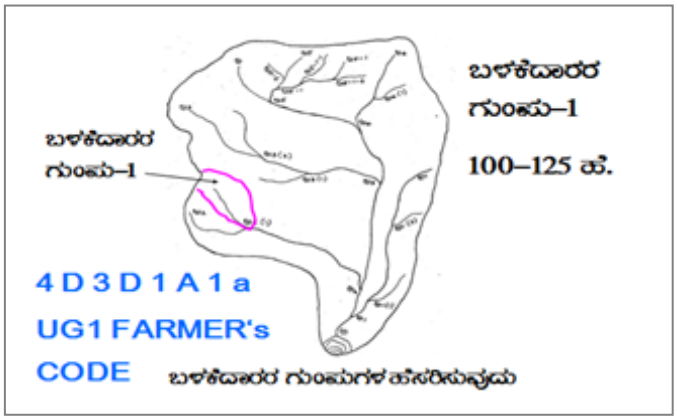
Land Suitability for various crops: Areas that are highly, moderately and marginally suitable and not suitable for growing various crops are indicated. Along with the suitability, various constraints that are limiting the productivity are also indicated. For example, in case of cotton, gravel content, rooting depth and salinity/alkalinity are the major constraints in various plots. With suitable management interventions, the productivity can be enhanced. In order to increase the water holding capacity of light textured soils, growing of green manure crops and application of organic manure is recommended.

Chapter 9

SOIL AND WATER CONSERVATION TREATMENT PLAN

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

- Soil depth
- Surface soil texture
- Available water capacity
- Soil slope
- Soil gravelliness
- Land capability
- Present land use and land cover
- Crop suitability
- Rainfall
- Hydrology
- Water Resources
- Socio-economic data



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

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

Steps for Survey and Preparation of Treatment Plan

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

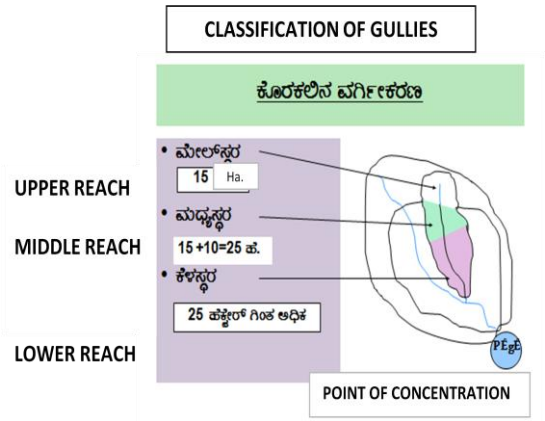
- Naming of user groups and farmers
- Identification of arable and non arable lands
- Identification of drainage lines and gullies
- Identification of non treatable areas
- Identification of priority areas in the arable lands
- Treatment plan for arable lands
- Location of water harvesting and recharge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

9.1 Treatment Plan

The treatment plan recommended for arable lands is briefly described below

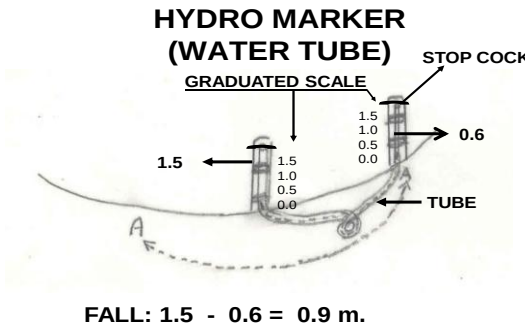
9.1.1 Arable Land Treatment

A. BUNDING

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

Measurement of Land Slope

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



FALL: 1.5 - 0.6 = 0.9 m.

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

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

Note: (i) The above intervals are maximum.

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

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

Section of the Bund

Bund section is decided considering the soil texture class and gravelliness class ($bg_{0...}$ b=loamy sand, g_0 = <15% gravel). The recommended Sections for different soils are given below.

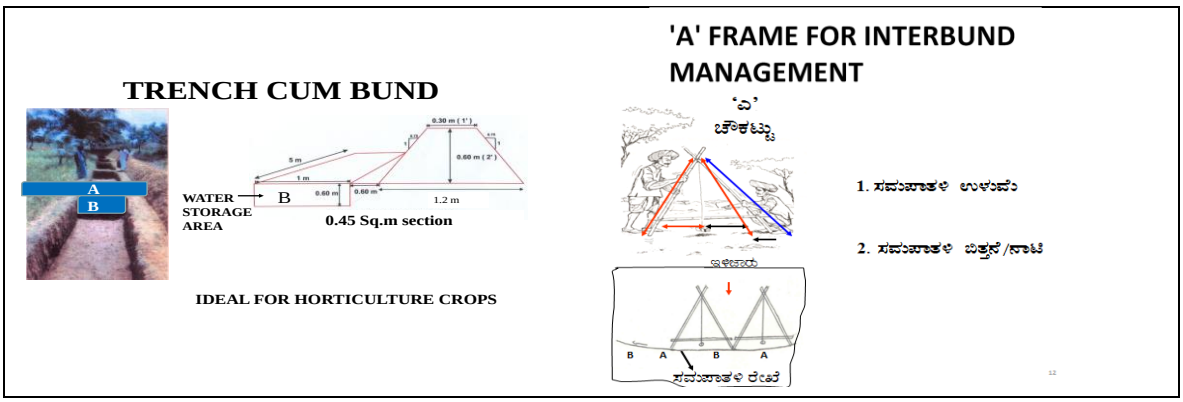
Recommended Bund Section

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

Formation of Trench cum Bund

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

Details of Borrow Pit dimensions are given below:



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

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

B. Water Ways

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

C. Farm Ponds

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

D. Diversion Channel

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

9.1.2 Non-Arable Land Treatment

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

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

9.2 Recommended Soil and Water Conservation Measures

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

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

A map (Fig. 9.1) showing soil and water conservation plan with different kinds of structures recommended has been prepared which shows the spatial distribution and extent of area. An area of about 49 ha (10%) needs Trench Cum Bunding and maximum area of about 394 ha (80%) needs Graded Bunding

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

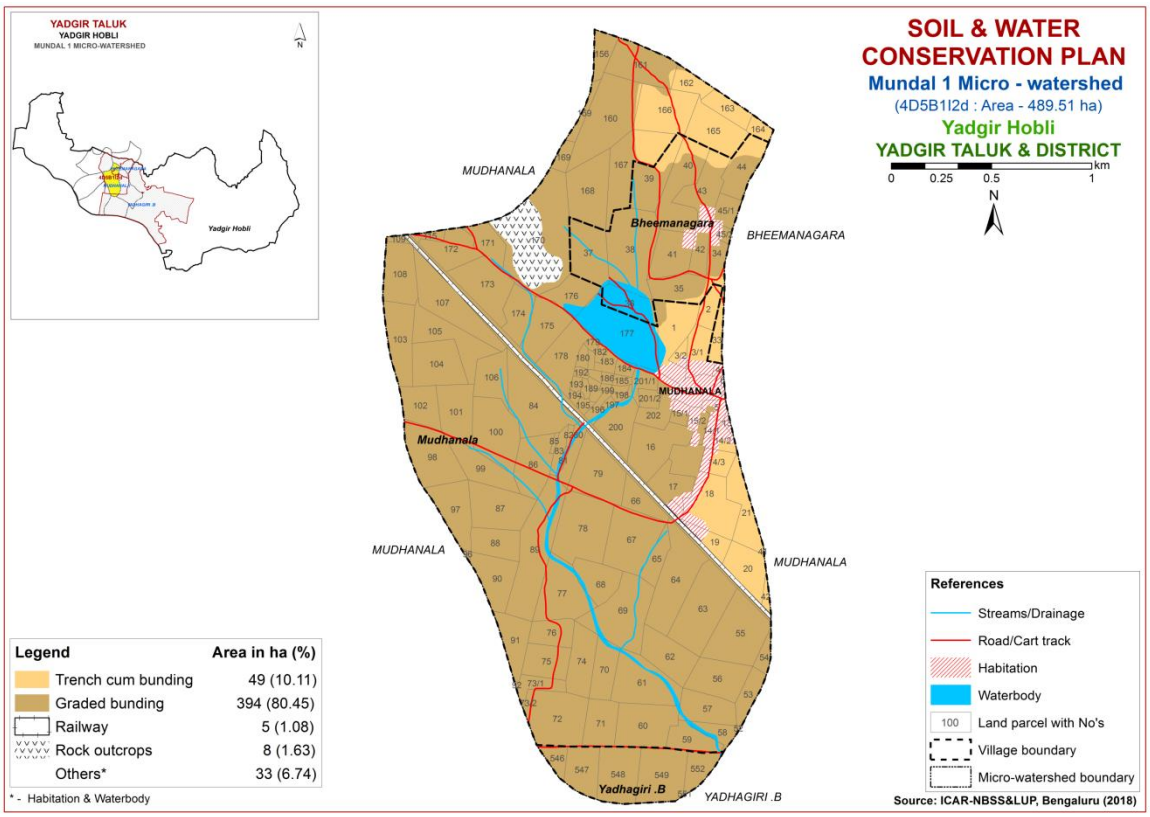


Fig. 9.1 Soil and Water Conservation Plan map of Mundal-1Microwatershed

9.3 Greening of Microwatershed

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

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

The tree species suitable for the area considering rainfall, temperature and adaptability is listed below; waterlogged areas are recommended to be planted with species like 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

Mundal -1 Microwatershed

Soil Phase Information

Village	Survey NO	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	Wells	Land Capability	Conservation Plan
Bheemanagara	33	1.54	PGPcB2	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar (Jw)	Not Available	IIes	TCB
Bheemanagara	34	2.38	JNKcB2	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut+Jowar (Gn+Jw)	Not Available	IIes	Graded bunding
Bheemanagara	35	3.82	JNKcB2	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut (Gn)	Not Available	IIes	Graded bunding
Bheemanagara	36	3.09	Waterbody	Others	Others	Others	Others	Others	Others	Others	Scrubland (Sl)	Not Available	Others	Others
Bheemanagara	37	5.3	HSLbB2	LMU-1	Moderately deep (75-100 cm)	Loamy sand	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut+Jowar (Gn+Jw)	Not Available	IIes	Graded bunding
Bheemanagara	38	9.17	HSLbB2	LMU-1	Moderately deep (75-100 cm)	Loamy sand	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut+Scrubland (Gn+Sl)	Not Available	IIes	Graded bunding
Bheemanagara	39	4.75	HSLbB2	LMU-1	Moderately deep (75-100 cm)	Loamy sand	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Jowar (Rg+Jw)	Not Available	IIes	Graded bunding
Bheemanagara	40	6.65	JNKcB2	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut (Gn)	Not Available	IIes	Graded bunding
Bheemanagara	41	4.3	JNKcB2	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Ragi (Rg)	Not Available	IIes	Graded bunding
Bheemanagara	42	2.12	JNKcB2	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIes	Graded bunding
Bheemanagara	43	4.64	JNKcB2	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut (Gn)	Not Available	IIes	Graded bunding
Bheemanagara	44	4.04	JNKcB2	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut+Jowar (Gn+Jw)	Not Available	IIes	Graded bunding
Bheemanagara	45/1	1.72	JNKcB2	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut+Jowar (Gn+Jw)	Not Available	IIes	Graded bunding
Bheemanagara	45/2	0.47	JNKcB2	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIes	Graded bunding
Mudhanala	1	5.67	PGPcB2	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Greengram (Gg)	Not Available	IIes	TCB
Mudhanala	2	1.79	PGPcB2	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	TCB
Mudhanala	3/1	2.88	PGPcB2	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	TCB
Mudhanala	3/2	0.76	PGPcB2	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland (Sl)	Not Available	IIes	TCB
Mudhanala	4	0.29	Habitation	Others	Others	Others	Others	Others	Others	Others	Not Available (NA)	Not Available	Others	Others
Mudhanala	5	1.04	Habitation	Others	Others	Others	Others	Others	Others	Others	Habitation (Hb)	Not Available	Others	Others
Mudhanala	6	0.09	Habitation	Others	Others	Others	Others	Others	Others	Others	Current fallow (Cf)	Not Available	Others	Others
Mudhanala	13	0.28	Habitation	Others	Others	Others	Others	Others	Others	Others	Redgram+Greengram+Habitation (Rg+Gg+Hb)	Not Available	Others	Others

Village	Survey NO	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	Wells	Land Capability	Conservation Plan
Mudhanala	14/1	0.73	Habitation	Others	Others	Others	Others	Others	Others	Others	Habitation (Hb)	Not Available	Others	Others
Mudhanala	14/2	1.33	Habitation	Others	Others	Others	Others	Others	Others	Others	Habitation (Hb)	Not Available	Others	Others
Mudhanala	14/3	1.87	PGPcB2	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Habitation (Hb)	Not Available	IIes	TCB
Mudhanala	15/1	0.94	HSLbB2	LMU-1	Moderately deep (75-100 cm)	Loamy sand	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Mudhanala	15/2	1.44	Habitation	Others	Others	Others	Others	Others	Others	Others	Habitation (Hb)	Not Available	Others	Others
Mudhanala	16	5.69	HSLbB2	LMU-1	Moderately deep (75-100 cm)	Loamy sand	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy+Ragi+Cotton (Pd+Rg+Ct)	1 Bore well	IIes	Graded bunding
Mudhanala	17	3.02	HSLbB2	LMU-1	Moderately deep (75-100 cm)	Loamy sand	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Cotton (Rg+Ct)	Not Available	IIes	Graded bunding
Mudhanala	18	8.75	PGPcB2	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Greengram (Rg+Gg)	Not Available	IIes	TCB
Mudhanala	19	1.83	PGPcB2	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	TCB
Mudhanala	20	3.92	PGPcB2	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Greengram (Rg+Gg)	Not Available	IIes	TCB
Mudhanala	21	4.12	PGPcB2	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Greengram (Gg)	Not Available	IIes	TCB
Mudhanala	41	0.03	PGPcB2	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Greengram (Gg)	Not Available	IIes	TCB
Mudhanala	42	0.5	PGPcB2	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Greengram+Cotton+Paddy (Gg+Ct+Pd)	Not Available	IIes	TCB
Mudhanala	52	0.04	HGNmB1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Cotton+Scrubland (Rg+Ct+Sl)	Not Available	IIes	Graded bunding
Mudhanala	53	2.14	HGNmB1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Greengram+Cotton (Gg+Ct)	Not Available	IIes	Graded bunding
Mudhanala	54	1.03	HGNmB1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Greengram+Paddy (Gg+Pd)	Not Available	IIes	Graded bunding
Mudhanala	55	7.71	HGNmB1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Paddy+Greengram+Cotton (Pd+Gg+Ct)	1 Bore well	IIes	Graded bunding
Mudhanala	56	4.9	HGNmB1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Paddy (Pd)	1 Bore well	IIes	Graded bunding
Mudhanala	57	3.92	HGNmB1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Paddy (Pd)	Not Available	IIes	Graded bunding
Mudhanala	58	1.63	HGNmB1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Jowar (Jw)	Not Available	IIes	Graded bunding
Mudhanala	59	2.88	BDLhB2	LMU-5	Shallow (25-50 cm)	Sandy clay loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIIes	Graded bunding
Mudhanala	60	6.07	MGLmB2	LMU-1	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Cotton (Rg+Ct)	Not Available	IIes	Graded bunding
Mudhanala	61	6.76	MGLmB2	LMU-1	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland (Sl)	Not Available	IIes	Graded bunding
Mudhanala	62	4.7	HGNmB1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Paddy (Pd)	1 Bore well	IIes	Graded bunding

Village	Survey NO	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	Wells	Land Capability	Conservation Plan
Mudhanala	63	8.41	ANRiB2	LMU-1	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Greengram+Scrubland (Gg+Sl)	Not Available	IIes	Graded bunding
Mudhanala	64	8.22	ANRiB2	LMU-1	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Greengram+Cotton+Vegetables (Gg+Ct+V)	1 Bore well	IIes	Graded bunding
Mudhanala	65	2.11	ANRiB2	LMU-1	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Greengram (Gg)	Not Available	IIes	Graded bunding
Mudhanala	66	2.4	HSLbB2	LMU-1	Moderately deep (75-100 cm)	Loamy sand	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland (Sl)	Not Available	IIes	Graded bunding
Mudhanala	67	7.12	ANRiB2	LMU-1	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Mudhanala	68	3.62	ANRiB2	LMU-1	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Mudhanala	69	8.36	ANRiB2	LMU-1	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland (Sl)	1 Bore well	IIes	Graded bunding
Mudhanala	70	3.33	MGLmB2	LMU-1	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Scrubland (Rg+Sl)	1 Bore well	IIes	Graded bunding
Mudhanala	71	3.67	MGLmB2	LMU-1	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Greengram (Rg+Gg)	Not Available	IIes	Graded bunding
Mudhanala	72	7.12	MGLmB2	LMU-1	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Greengram+Cotton (Rg+Gg+Ct)	Not Available	IIes	Graded bunding
Mudhanala	73/1	1.82	HGNmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Mudhanala	73/2	0.5	HGNmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Mudhanala	74	4.19	BDLhB2	LMU-5	Shallow (25-50 cm)	Sandy clay loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIIes	Graded bunding
Mudhanala	75	3.62	MGLmB2	LMU-1	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Greengram (Rg+Gg)	Not Available	IIes	Graded bunding
Mudhanala	76	2.78	BDLhB2	LMU-5	Shallow (25-50 cm)	Sandy clay loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland (Sl)	Not Available	IIIes	Graded bunding
Mudhanala	77	6.41	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland (Sl)	Not Available	IIIes	Graded bunding
Mudhanala	78	8.28	ANRiB2	LMU-1	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Greengram (Gg)	1 Bore well	IIes	Graded bunding
Mudhanala	79	6.33	HSLbB2	LMU-1	Moderately deep (75-100 cm)	Loamy sand	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Greengram+Cotton (Rg+Gg+Ct)	1 Bore well	IIes	Graded bunding
Mudhanala	80	1.78	HSLbB2	LMU-1	Moderately deep (75-100 cm)	Loamy sand	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland (Sl)	Not Available	IIes	Graded bunding
Mudhanala	81	0.27	Waterbody	Others	Others	Others	Others	Others	Others	Others	Waterbody (Wb)	Not Available	Others	Others
Mudhanala	82	0.27	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland (Sl)	Not Available	IIIes	Graded bunding
Mudhanala	83	1.03	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland (Sl)	Not Available	IIIes	Graded bunding
Mudhanala	84	7.97	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland (Sl)	Not Available	IIIes	Graded bunding

Village	Survey NO	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	Wells	Land Capability	Conservation Plan
Mudhanala	85	0.21	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland (Sl)	Not Available	IIIes	Graded bunding
Mudhanala	86	4.87	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland (Sl)	Not Available	IIIes	Graded bunding
Mudhanala	87	6.01	HSLbB2	LMU-1	Moderately deep (75-100 cm)	Loamy sand	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton+Fallow land (Ct+Fl)	Not Available	IIes	Graded bunding
Mudhanala	88	3.42	HSLbB2	LMU-1	Moderately deep (75-100 cm)	Loamy sand	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	1 Bore well	IIes	Graded bunding
Mudhanala	89	10.13	BDLhB2	LMU-5	Shallow (25-50 cm)	Sandy clay loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Greengram+Cotton (Rg+Gg+Ct)	Not Available	IIIes	Graded bunding
Mudhanala	90	4.36	HSLbB2	LMU-1	Moderately deep (75-100 cm)	Loamy sand	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Greengram (Rg+Gg)	Not Available	IIes	Graded bunding
Mudhanala	91	3.54	HGNmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Mudhanala	92	0.07	HGNmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Mudhanala	96	0.14	HSLbB2	LMU-1	Moderately deep (75-100 cm)	Loamy sand	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Greengram (Rg+Gg)	Not Available	IIes	Graded bunding
Mudhanala	97	4.7	HSLbB2	LMU-1	Moderately deep (75-100 cm)	Loamy sand	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Greengram+Scrubland (Gg+Sl)	Not Available	IIes	Graded bunding
Mudhanala	98	6.53	HSLbB2	LMU-1	Moderately deep (75-100 cm)	Loamy sand	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Greengram+Cotton (Gg+Ct)	1 Bore well	IIes	Graded bunding
Mudhanala	99	4.12	HSLbB2	LMU-1	Moderately deep (75-100 cm)	Loamy sand	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton+Fallow land (Ct+Fl)	Not Available	IIes	Graded bunding
Mudhanala	100	6.78	HSLbB2	LMU-1	Moderately deep (75-100 cm)	Loamy sand	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Greengram+Cotton (Gg+Ct)	Not Available	IIes	Graded bunding
Mudhanala	101	4.66	HSLbB2	LMU-1	Moderately deep (75-100 cm)	Loamy sand	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Greengram (Gg)	Not Available	IIes	Graded bunding
Mudhanala	102	3.49	HSLbB2	LMU-1	Moderately deep (75-100 cm)	Loamy sand	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	1 Bore well	IIes	Graded bunding
Mudhanala	103	4.91	HSLbB2	LMU-1	Moderately deep (75-100 cm)	Loamy sand	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Greengram (Rg+Gg)	Not Available	IIes	Graded bunding
Mudhanala	104	5.44	HSLbB2	LMU-1	Moderately deep (75-100 cm)	Loamy sand	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Greengram (Gg)	Not Available	IIes	Graded bunding
Mudhanala	105	5.55	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Greengram+Regdram+Fallow land (Gg+Rg+Fl)	Not Available	IIIes	Graded bunding
Mudhanala	106	3.59	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Fallow land (Fl)	Not Available	IIIes	Graded bunding
Mudhanala	107	7.17	HSLbB2	LMU-1	Moderately deep (75-100 cm)	Loamy sand	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Greengram (Rg+Gg)	Not Available	IIes	Graded bunding
Mudhanala	108	4.73	HSLbB2	LMU-1	Moderately deep (75-100 cm)	Loamy sand	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland (Sl)	Not Available	IIes	Graded bunding
Mudhanala	109	0.37	HSLbB2	LMU-1	Moderately deep (75-100 cm)	Loamy sand	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Greengram (Rg+Gg)	Not Available	IIes	Graded bunding
Mudhanala	115	0.68	BGDmB2	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Greengram (Gg)	Not Available	IIes	Graded bunding
Mudhanala	156	1.94	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Greengram (Rg+Gg)	Not Available	IIIes	Graded bunding

Village	Survey NO	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	Wells	Land Capability	Conservation Plan
Mudhanala	159	1.05	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland (Sl)	Not Available	IIIes	Graded bunding
Mudhanala	160	9.24	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland (Sl)	Not Available	IIIes	Graded bunding
Mudhanala	161	5.66	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Greengram (Rg+Gg)	Not Available	IIIes	Graded bunding
Mudhanala	162	1.8	PGPcB2	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Greengram (Gg)	Not Available	IIes	TCB
Mudhanala	163	2.26	PGPcB2	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Greengram (Rg+Gg)	Not Available	IIes	TCB
Mudhanala	164	1.02	PGPcB2	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Greengram (Gg)	Not Available	IIes	TCB
Mudhanala	165	4.95	PGPcB2	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Greengram (Rg+Gg)	Not Available	IIes	TCB
Mudhanala	166	6.13	PGPcB2	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Greengram (Gg)	Not Available	IIes	TCB
Mudhanala	167	7.12	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Greengram (Gg)	Not Available	IIIes	Graded bunding
Mudhanala	168	6.42	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Greengram (Rg+Gg)	Not Available	IIIes	Graded bunding
Mudhanala	169	1.05	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland (Sl)	Not Available	IIIes	Graded bunding
Mudhanala	170	16.27	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Rock outcrops+Scrubland (Rc+Sl)	Not Available	IIIes	Graded bunding
Mudhanala	171	2.53	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	1 Bore well	IIIes	Graded bunding
Mudhanala	172	3.88	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Greengram (Rg+Gg)	Not Available	IIIes	Graded bunding
Mudhanala	173	5.93	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy+Greengram (Pd+Gg)	1 Bore well	IIIes	Graded bunding
Mudhanala	174	3.23	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Greengram (Gg)	Not Available	IIIes	Graded bunding
Mudhanala	175	4.57	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Greengram (Gg)	Not Available	IIIes	Graded bunding
Mudhanala	176	3.35	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Greengram+Cotton (Gg+Ct)	Not Available	IIIes	Graded bunding
Mudhanala	177	8.29	Waterbody	Others	Others	Others	Others	Others	Others	Others	Waterbody (Wb)	Not Available	Others	Others
Mudhanala	178	4.87	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Greengram (Gg)	Not Available	IIIes	Graded bunding
Mudhanala	179	0.37	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland (Sl)	Not Available	IIIes	Graded bunding
Mudhanala	180	0.56	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland (Sl)	Not Available	IIIes	Graded bunding
Mudhanala	181	0.31	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland (Sl)	Not Available	IIIes	Graded bunding

Village	Survey NO	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	Wells	Land Capability	Conservation Plan
Mudhanala	182	0.39	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland (Sl)	Not Available	IIIes	Graded bunding
Mudhanala	183	0.82	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland (Sl)	Not Available	IIIes	Graded bunding
Mudhanala	184	0.71	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland (Sl)	Not Available	IIIes	Graded bunding
Mudhanala	185	0.46	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland (Sl)	Not Available	IIIes	Graded bunding
Mudhanala	186	0.34	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIIes	Graded bunding
Mudhanala	187	0.19	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIIes	Graded bunding
Mudhanala	188	0.31	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland (Sl)	Not Available	IIIes	Graded bunding
Mudhanala	189	0.36	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland (Sl)	Not Available	IIIes	Graded bunding
Mudhanala	190	0.3	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland (Sl)	Not Available	IIIes	Graded bunding
Mudhanala	191	0.3	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland (Sl)	Not Available	IIIes	Graded bunding
Mudhanala	192	0.36	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland (Sl)	Not Available	IIIes	Graded bunding
Mudhanala	193	0.37	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland (Sl)	Not Available	IIIes	Graded bunding
Mudhanala	194	0.36	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland (Sl)	Not Available	IIIes	Graded bunding
Mudhanala	195	0.46	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland (Sl)	Not Available	IIIes	Graded bunding
Mudhanala	196	0.87	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland (Sl)	Not Available	IIIes	Graded bunding
Mudhanala	197	0.26	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland (Sl)	Not Available	IIIes	Graded bunding
Mudhanala	198	0.4	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland (Sl)	Not Available	IIIes	Graded bunding
Mudhanala	199	0.31	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland (Sl)	Not Available	IIIes	Graded bunding
Mudhanala	200	3.89	HSLbB2	LMU-1	Moderately deep (75-100 cm)	Loamy sand	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIes	Graded bunding
Mudhanala	201/1	1.55	HSLbB2	LMU-1	Moderately deep (75-100 cm)	Loamy sand	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland (Sl)	Not Available	IIes	Graded bunding
Mudhanala	201/2	0.94	HSLbB2	LMU-1	Moderately deep (75-100 cm)	Loamy sand	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Mudhanala	202	2.95	HSLbB2	LMU-1	Moderately deep (75-100 cm)	Loamy sand	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Yadhagiri .B	546	1.47	MDGhB2g1	LMU-3	Deep (100-150 cm)	Sandy clay loam	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Ragi (Rg)	Not Available	IIes	Graded bunding
Yadhagiri .B	547	3.77	MDGhB2g1	LMU-3	Deep (100-150 cm)	Sandy clay loam	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton+Ragi (Ct+Rg)	Not Available	IIes	Graded bunding

Village	Survey NO	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	Wells	Land Capability	Conservation Plan
Yadhagiri .B	548	5.6	HGNmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Ragi (Rg)	Not Available	IIes	Graded bunding
Yadhagiri .B	549	6.24	HGNmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Yadhagiri .B	551	0.02	HGNmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton+Ragi (Ct+Rg)	Not Available	IIes	Graded bunding
Yadhagiri .B	552	2.38	HGNmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIes	Graded bunding

Appendix II

Mundal-1 Microwatershed

Soil Fertility Information

Village	Survey NO	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Bheemanagara	33	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Bheemanagara	34	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Bheemanagara	35	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Bheemanagara	36	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Bheemanagara	37	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Bheemanagara	38	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Bheemanagara	39	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Bheemanagara	40	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Bheemanagara	41	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Bheemanagara	42	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Bheemanagara	43	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Bheemanagara	44	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Bheemanagara	45/1	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Bheemanagara	45/2	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	1	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	2	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	3/1	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	3/2	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	4	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Mudhanala	5	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Mudhanala	6	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Mudhanala	13	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others

Village	Survey NO	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Mudhanala	14/1	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Mudhanala	14/2	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Mudhanala	14/3	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	15/1	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	15/2	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Mudhanala	16	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	17	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	18	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	19	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	20	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	21	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	41	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	42	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	52	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	53	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	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)
Mudhanala	54	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	55	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	56	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	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)
Mudhanala	57	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	58	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	59	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	60	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	61	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	62	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)

Village	Survey NO	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Mudhanala	63	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	64	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	65	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	66	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	67	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	68	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	69	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	70	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	71	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	72	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	73/1	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	73/2	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	74	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	75	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	76	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	77	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	78	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	79	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	80	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	81	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Mudhanala	82	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	83	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	84	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)

Village	Survey NO	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Mudhanala	85	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	86	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	87	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	88	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	89	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	90	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	91	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	92	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	96	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	97	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	98	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	99	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	100	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	101	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	102	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	103	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	104	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	105	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	106	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	107	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	108	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	109	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	115	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)

Village	Survey NO	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Mudhanala	156	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	159	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	160	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	161	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	162	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	163	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	164	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	165	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	166	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	167	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	168	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	169	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	170	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Rock outcrops	Rock outcrops	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	171	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	172	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	173	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	174	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	175	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	176	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	177	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Mudhanala	178	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	179	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	180	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	181	Neutral (pH 6.5 –	Non saline	Low (< 0.5 %)	Medium (23 – 57	Medium (145 –	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient	Sufficient (>	Sufficient (>	Deficient (<

Village	Survey NO	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
		7.3)	(<2 dsm)		kg/ha)	337 kg/ha)			(>4.5 ppm)	1.0 ppm)	0.2 ppm)	0.6 ppm)
Mudhanala	182	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	183	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	184	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	185	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	186	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	187	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	188	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	189	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	190	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	191	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	192	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	193	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	194	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	195	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	196	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	197	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	198	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	199	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	200	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	201/1	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	201/2	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhanala	202	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)

Village	Survey NO	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Yadhagiri .B	546	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Yadhagiri .B	547	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Yadhagiri .B	548	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Yadhagiri .B	549	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Yadhagiri .B	551	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Yadhagiri .B	552	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)

Appendix III

Mundal-1 Microwatershed

Soil Suitability Information

Village	Survey Number	Mango	Maize	Sapota	Sorghum	Guava	Cotton	Tamarind	Lime	Bengal gram	Sunflower	Red gram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Onion	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Brinjal	Bhendi	Drumstick	Mulberry
Bheemanagara	33	S3r	S1	S2r	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S2rt	S3r	S2r	S2t	S2t	S2t	S1	S2t	S2t	S2r	S1	S1	S2t	S2r	S2r
Bheemanagara	34	N1r	S2t	S3r	S2r	S3r	S2r	N1r	S3r	S2r	S3r	S3r	S2r	S3r	S2r	N1rt	S3r	S3r	S3t	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Bheemanagara	35	N1r	S2t	S3r	S2r	S3r	S2r	N1r	S3r	S2r	S3r	S3r	S2r	S3r	S2r	N1rt	S3r	S3r	S3t	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Bheemanagara	36	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Bheemanagara	37	S3rz	S3tz	S2rz	S2tz	S2rz	S3tz	S3rz	S2rz	S3tz	S2rz	S2rz	S2tz	S2rz	S2z	N1tz	S3rz	S2rz	S2z	S2z	S2z	S2z	S2z	S2z	S2rz	S1	S2z	S2z	S2rz	S2rz
Bheemanagara	38	S3rz	S3tz	S2rz	S2tz	S2rz	S3tz	S3rz	S2rz	S3tz	S2rz	S2rz	S2tz	S2rz	S2z	N1tz	S3rz	S2rz	S2z	S2z	S2z	S2z	S2z	S2z	S2rz	S1	S2z	S2z	S2rz	S2rz
Bheemanagara	39	S3rz	S3tz	S2rz	S2tz	S2rz	S3tz	S3rz	S2rz	S3tz	S2rz	S2rz	S2tz	S2rz	S2z	N1tz	S3rz	S2rz	S2z	S2z	S2z	S2z	S2z	S2z	S2rz	S1	S2z	S2z	S2rz	S2rz
Bheemanagara	40	N1r	S2t	S3r	S2r	S3r	S2r	N1r	S3r	S2r	S3r	S3r	S2r	S3r	S2r	N1rt	S3r	S3r	S3t	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Bheemanagara	41	N1r	S2t	S3r	S2r	S3r	S2r	N1r	S3r	S2r	S3r	S3r	S2r	S3r	S2r	N1rt	S3r	S3r	S3t	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Bheemanagara	42	N1r	S2t	S3r	S2r	S3r	S2r	N1r	S3r	S2r	S3r	S3r	S2r	S3r	S2r	N1rt	S3r	S3r	S3t	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Bheemanagara	43	N1r	S2t	S3r	S2r	S3r	S2r	N1r	S3r	S2r	S3r	S3r	S2r	S3r	S2r	N1rt	S3r	S3r	S3t	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Bheemanagara	44	N1r	S2t	S3r	S2r	S3r	S2r	N1r	S3r	S2r	S3r	S3r	S2r	S3r	S2r	N1rt	S3r	S3r	S3t	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Bheemanagara	45/1	N1r	S2t	S3r	S2r	S3r	S2r	N1r	S3r	S2r	S3r	S3r	S2r	S3r	S2r	N1rt	S3r	S3r	S3t	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Bheemanagara	45/2	N1r	S2t	S3r	S2r	S3r	S2r	N1r	S3r	S2r	S3r	S3r	S2r	S3r	S2r	N1rt	S3r	S3r	S3t	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Mudhanala	1	S3r	S1	S2r	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S2rt	S3r	S2r	S2t	S2t	S2t	S1	S2t	S2t	S2r	S1	S1	S2t	S2r	S2r
Mudhanala	2	S3r	S1	S2r	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S2rt	S3r	S2r	S2t	S2t	S2t	S1	S2t	S2t	S2r	S1	S1	S2t	S2r	S2r
Mudhanala	3/1	S3r	S1	S2r	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S2rt	S3r	S2r	S2t	S2t	S2t	S1	S2t	S2t	S2r	S1	S1	S2t	S2r	S2r
Mudhanala	3/2	S3r	S1	S2r	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S2rt	S3r	S2r	S2t	S2t	S2t	S1	S2t	S2t	S2r	S1	S1	S2t	S2r	S2r
Mudhanala	4	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Mudhanala	5	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Mudhanala	6	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others

Village	Survey Number	Mango	Maize	Sapota	Sorghum	Guava	Cotton	Tamarind	Lime	Bengal gram	Sunflower	Red gram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Onion	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Brinjal	Bhendi	Drumstick	Mulberry
Mudhanala	13	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Mudhanala	14/1	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Mudhanala	14/2	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Mudhanala	14/3	S3r	S1	S2r	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S2rt	S3r	S2r	S2t	S2t	S2t	S1	S2t	S2t	S2r	S1	S1	S2t	S2r	S2r
Mudhanala	15/1	S3rz	S3tz	S2rz	S2tz	S2rz	S3tz	S3rz	S2rz	S3tz	S2rz	S2rz	S2tz	S2rz	S2z	N1tz	S3rz	S2rz	S2z	S2z	S2z	S2z	S2z	S2z	S2rz	S1	S2z	S2z	S2rz	S2rz
Mudhanala	15/2	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Mudhanala	16	S3rz	S3tz	S2rz	S2tz	S2rz	S3tz	S3rz	S2rz	S3tz	S2rz	S2rz	S2tz	S2rz	S2z	N1tz	S3rz	S2rz	S2z	S2z	S2z	S2z	S2z	S2z	S2rz	S1	S2z	S2z	S2rz	S2rz
Mudhanala	17	S3rz	S3tz	S2rz	S2tz	S2rz	S3tz	S3rz	S2rz	S3tz	S2rz	S2rz	S2tz	S2rz	S2z	N1tz	S3rz	S2rz	S2z	S2z	S2z	S2z	S2z	S2z	S2rz	S1	S2z	S2z	S2rz	S2rz
Mudhanala	18	S3r	S1	S2r	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S2rt	S3r	S2r	S2t	S2t	S2t	S1	S2t	S2t	S2r	S1	S1	S2t	S2r	S2r
Mudhanala	19	S3r	S1	S2r	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S2rt	S3r	S2r	S2t	S2t	S2t	S1	S2t	S2t	S2r	S1	S1	S2t	S2r	S2r
Mudhanala	20	S3r	S1	S2r	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S2rt	S3r	S2r	S2t	S2t	S2t	S1	S2t	S2t	S2r	S1	S1	S2t	S2r	S2r
Mudhanala	21	S3r	S1	S2r	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S2rt	S3r	S2r	S2t	S2t	S2t	S1	S2t	S2t	S2r	S1	S1	S2t	S2r	S2r
Mudhanala	41	S3r	S1	S2r	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S2rt	S3r	S2r	S2t	S2t	S2t	S1	S2t	S2t	S2r	S1	S1	S2t	S2r	S2r
Mudhanala	42	S3r	S1	S2r	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S2rt	S3r	S2r	S2t	S2t	S2t	S1	S2t	S2t	S2r	S1	S1	S2t	S2r	S2r
Mudhanala	52	S3t	S2tw	S3t	S1	S3t	S1	S2t	S1	S1	S2rw	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S3t	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2t	S2t	S2tw	S3tw
Mudhanala	53	S3t	S2tw	S3t	S1	S3t	S1	S2t	S1	S1	S2rw	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S3t	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2t	S2t	S2tw	S3tw
Mudhanala	54	S3t	S2tw	S3t	S1	S3t	S1	S2t	S1	S1	S2rw	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S3t	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2t	S2t	S2tw	S3tw
Mudhanala	55	S3t	S2tw	S3t	S1	S3t	S1	S2t	S1	S1	S2rw	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S3t	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2t	S2t	S2tw	S3tw
Mudhanala	56	S3t	S2tw	S3t	S1	S3t	S1	S2t	S1	S1	S2rw	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S3t	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2t	S2t	S2tw	S3tw
Mudhanala	57	S3t	S2tw	S3t	S1	S3t	S1	S2t	S1	S1	S2rw	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S3t	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2t	S2t	S2tw	S3tw
Mudhanala	58	S3t	S2tw	S3t	S1	S3t	S1	S2t	S1	S1	S2rw	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S3t	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2t	S2t	S2tw	S3tw
Mudhanala	59	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt
Mudhanala	60	S3rt	S2t	S3t	S1	S3t	S2rw	S3r	S2rz	S1	S2rw	S2rt	S2tz	S3t	S1	N1tz	S3rt	S2rz	S3tw	S3t	S2tw	S3tw	S2tw	S2tw	S2rt	S2t	S2t	S2t	S2rt	S3tw
Mudhanala	61	S3rt	S2t	S3t	S1	S3t	S2rw	S3r	S2rz	S1	S2rw	S2rt	S2tz	S3t	S1	N1tz	S3rt	S2rz	S3tw	S3t	S2tw	S3tw	S2tw	S2tw	S2rt	S2t	S2t	S2t	S2rt	S3tw
Mudhanala	62	S3t	S2tw	S3t	S1	S3t	S1	S2t	S1	S1	S2rw	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S3t	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2t	S2t	S2tw	S3tw
Mudhanala	63	S3tz	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S1	S2tw	S2tw	S2tw	S2tw	S2t	S2tz	S2t	S2t	S2tw	S3tw
Mudhanala	64	S3tz	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S1	S2tw	S2tw	S2tw	S2tw	S2t	S2tz	S2t	S2t	S2tw	S3tw

Village	Survey Number	Mango	Maize	Sapota	Sorghum	Guava	Cotton	Tamarind	Lime	Bengal gram	Sunflower	Red gram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Onion	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Brinjal	Bhendi	Drumstick	Mulberry
Mudhanala	65	S3tz	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S1	S2tw	S2tw	S2tw	S2tw	S2t	S2tz	S2t	S2t	S2tw	S3tw
Mudhanala	66	S3rz	S3tz	S2rz	S2tz	S2rz	S3tz	S3rz	S2rz	S3tz	S2rz	S2rz	S2tz	S2rz	S2z	N1tz	S3rz	S2rz	S2z	S2z	S2z	S2z	S2z	S2z	S2rz	S1	S2z	S2z	S2rz	S2rz
Mudhanala	67	S3tz	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S1	S2tw	S2tw	S2tw	S2tw	S2t	S2tz	S2t	S2t	S2tw	S3tw
Mudhanala	68	S3tz	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S1	S2tw	S2tw	S2tw	S2tw	S2t	S2tz	S2t	S2t	S2tw	S3tw
Mudhanala	69	S3tz	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S1	S2tw	S2tw	S2tw	S2tw	S2t	S2tz	S2t	S2t	S2tw	S3tw
Mudhanala	70	S3rt	S2t	S3t	S1	S3t	S2rw	S3r	S2rz	S1	S2rw	S2rt	S2tz	S3t	S1	N1tz	S3rt	S2rz	S3tw	S3t	S2tw	S3tw	S2tw	S2tw	S2rt	S2t	S2t	S2t	S2rt	S3tw
Mudhanala	71	S3rt	S2t	S3t	S1	S3t	S2rw	S3r	S2rz	S1	S2rw	S2rt	S2tz	S3t	S1	N1tz	S3rt	S2rz	S3tw	S3t	S2tw	S3tw	S2tw	S2tw	S2rt	S2t	S2t	S2t	S2rt	S3tw
Mudhanala	72	S3rt	S2t	S3t	S1	S3t	S2rw	S3r	S2rz	S1	S2rw	S2rt	S2tz	S3t	S1	N1tz	S3rt	S2rz	S3tw	S3t	S2tw	S3tw	S2tw	S2tw	S2rt	S2t	S2t	S2t	S2rt	S3tw
Mudhanala	73/1	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S3t	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2t	S2t	S2tw	S3tw
Mudhanala	73/2	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S3t	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2t	S2t	S2tw	S3tw
Mudhanala	74	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt
Mudhanala	75	S3rt	S2t	S3t	S1	S3t	S2rw	S3r	S2rz	S1	S2rw	S2rt	S2tz	S3t	S1	N1tz	S3rt	S2rz	S3tw	S3t	S2tw	S3tw	S2tw	S2tw	S2rt	S2t	S2t	S2t	S2rt	S3tw
Mudhanala	76	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt
Mudhanala	77	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt
Mudhanala	78	S3tz	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S1	S2tw	S2tw	S2tw	S2tw	S2t	S2tz	S2t	S2t	S2tw	S3tw
Mudhanala	79	S3rz	S3tz	S2rz	S2tz	S2rz	S3tz	S3rz	S2rz	S3tz	S2rz	S2rz	S2tz	S2rz	S2z	N1tz	S3rz	S2rz	S2z	S2z	S2z	S2z	S2z	S2z	S2rz	S1	S2z	S2z	S2rz	S2rz
Mudhanala	80	S3rz	S3tz	S2rz	S2tz	S2rz	S3tz	S3rz	S2rz	S3tz	S2rz	S2rz	S2tz	S2rz	S2z	N1tz	S3rz	S2rz	S2z	S2z	S2z	S2z	S2z	S2z	S2rz	S1	S2z	S2z	S2rz	S2rz
Mudhanala	81	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Mudhanala	82	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt
Mudhanala	83	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt
Mudhanala	84	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt
Mudhanala	85	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt
Mudhanala	86	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt
Mudhanala	87	S3rz	S3tz	S2rz	S2tz	S2rz	S3tz	S3rz	S2rz	S3tz	S2rz	S2rz	S2tz	S2rz	S2z	N1tz	S3rz	S2rz	S2z	S2z	S2z	S2z	S2z	S2z	S2rz	S1	S2z	S2z	S2rz	S2rz
Mudhanala	88	S3rz	S3tz	S2rz	S2tz	S2rz	S3tz	S3rz	S2rz	S3tz	S2rz	S2rz	S2tz	S2rz	S2z	N1tz	S3rz	S2rz	S2z	S2z	S2z	S2z	S2z	S2z	S2rz	S1	S2z	S2z	S2rz	S2rz
Mudhanala	89	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt
Mudhanala	90	S3rz	S3tz	S2rz	S2tz	S2rz	S3tz	S3rz	S2rz	S3tz	S2rz	S2rz	S2tz	S2rz	S2z	N1tz	S3rz	S2rz	S2z	S2z	S2z	S2z	S2z	S2z	S2rz	S1	S2z	S2z	S2rz	S2rz

Village	Survey Number	Mango	Maize	Sapota	Sorghum	Guava	Cotton	Tamarind	Lime	Bengal gram	Sunflower	Red gram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Onion	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Brinjal	Bhendi	Drumstick	Mulberry
Mudhanala	91	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S3t	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2t	S2t	S2t	S2tw	S3tw
Mudhanala	92	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S3t	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2t	S2t	S2t	S2tw	S3tw
Mudhanala	96	S3rz	S3tz	S2rz	S2tz	S2rz	S3tz	S3rz	S2rz	S3tz	S2rz	S2rz	S2tz	S2rz	S2z	N1tz	S3rz	S2rz	S2z	S2z	S2z	S2z	S2z	S2z	S2rz	S1	S2z	S2z	S2rz	S2rz
Mudhanala	97	S3rz	S3tz	S2rz	S2tz	S2rz	S3tz	S3rz	S2rz	S3tz	S2rz	S2rz	S2tz	S2rz	S2z	N1tz	S3rz	S2rz	S2z	S2z	S2z	S2z	S2z	S2z	S2rz	S1	S2z	S2z	S2rz	S2rz
Mudhanala	98	S3rz	S3tz	S2rz	S2tz	S2rz	S3tz	S3rz	S2rz	S3tz	S2rz	S2rz	S2tz	S2rz	S2z	N1tz	S3rz	S2rz	S2z	S2z	S2z	S2z	S2z	S2z	S2rz	S1	S2z	S2z	S2rz	S2rz
Mudhanala	99	S3rz	S3tz	S2rz	S2tz	S2rz	S3tz	S3rz	S2rz	S3tz	S2rz	S2rz	S2tz	S2rz	S2z	N1tz	S3rz	S2rz	S2z	S2z	S2z	S2z	S2z	S2z	S2rz	S1	S2z	S2z	S2rz	S2rz
Mudhanala	100	S3rz	S3tz	S2rz	S2tz	S2rz	S3tz	S3rz	S2rz	S3tz	S2rz	S2rz	S2tz	S2rz	S2z	N1tz	S3rz	S2rz	S2z	S2z	S2z	S2z	S2z	S2z	S2rz	S1	S2z	S2z	S2rz	S2rz
Mudhanala	101	S3rz	S3tz	S2rz	S2tz	S2rz	S3tz	S3rz	S2rz	S3tz	S2rz	S2rz	S2tz	S2rz	S2z	N1tz	S3rz	S2rz	S2z	S2z	S2z	S2z	S2z	S2z	S2rz	S1	S2z	S2z	S2rz	S2rz
Mudhanala	102	S3rz	S3tz	S2rz	S2tz	S2rz	S3tz	S3rz	S2rz	S3tz	S2rz	S2rz	S2tz	S2rz	S2z	N1tz	S3rz	S2rz	S2z	S2z	S2z	S2z	S2z	S2z	S2rz	S1	S2z	S2z	S2rz	S2rz
Mudhanala	103	S3rz	S3tz	S2rz	S2tz	S2rz	S3tz	S3rz	S2rz	S3tz	S2rz	S2rz	S2tz	S2rz	S2z	N1tz	S3rz	S2rz	S2z	S2z	S2z	S2z	S2z	S2z	S2rz	S1	S2z	S2z	S2rz	S2rz
Mudhanala	104	S3rz	S3tz	S2rz	S2tz	S2rz	S3tz	S3rz	S2rz	S3tz	S2rz	S2rz	S2tz	S2rz	S2z	N1tz	S3rz	S2rz	S2z	S2z	S2z	S2z	S2z	S2z	S2rz	S1	S2z	S2z	S2rz	S2rz
Mudhanala	105	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt
Mudhanala	106	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt
Mudhanala	107	S3rz	S3tz	S2rz	S2tz	S2rz	S3tz	S3rz	S2rz	S3tz	S2rz	S2rz	S2tz	S2rz	S2z	N1tz	S3rz	S2rz	S2z	S2z	S2z	S2z	S2z	S2z	S2rz	S1	S2z	S2z	S2rz	S2rz
Mudhanala	108	S3rz	S3tz	S2rz	S2tz	S2rz	S3tz	S3rz	S2rz	S3tz	S2rz	S2rz	S2tz	S2rz	S2z	N1tz	S3rz	S2rz	S2z	S2z	S2z	S2z	S2z	S2z	S2rz	S1	S2z	S2z	S2rz	S2rz
Mudhanala	109	S3rz	S3tz	S2rz	S2tz	S2rz	S3tz	S3rz	S2rz	S3tz	S2rz	S2rz	S2tz	S2rz	S2z	N1tz	S3rz	S2rz	S2z	S2z	S2z	S2z	S2z	S2z	S2rz	S1	S2z	S2z	S2rz	S2rz
Mudhanala	115	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S2t	S3t	S2t	S2t	S2t	S2t	S2t	S2t	S2t	S2t	S3t
Mudhanala	156	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt
Mudhanala	159	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt
Mudhanala	160	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt
Mudhanala	161	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt
Mudhanala	162	S3r	S1	S2r	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S2rt	S3r	S2r	S2t	S2t	S2t	S1	S2t	S2t	S2r	S1	S1	S2t	S2r	S2r
Mudhanala	163	S3r	S1	S2r	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S2rt	S3r	S2r	S2t	S2t	S2t	S1	S2t	S2t	S2r	S1	S1	S2t	S2r	S2r
Mudhanala	164	S3r	S1	S2r	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S2rt	S3r	S2r	S2t	S2t	S2t	S1	S2t	S2t	S2r	S1	S1	S2t	S2r	S2r
Mudhanala	165	S3r	S1	S2r	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S2rt	S3r	S2r	S2t	S2t	S2t	S1	S2t	S2t	S2r	S1	S1	S2t	S2r	S2r
Mudhanala	166	S3r	S1	S2r	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S2rt	S3r	S2r	S2t	S2t	S2t	S1	S2t	S2t	S2r	S1	S1	S2t	S2r	S2r
Mudhanala	167	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt

Village	Survey Number	Mango	Maize	Sapota	Sorghum	Guava	Cotton	Tamarind	Lime	Bengal gram	Sunflower	Red gram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Onion	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Brinjal	Bhendi	Drumstick	Mulberry
Mudhanala	168	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt
Mudhanala	169	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt
Mudhanala	170	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt
Mudhanala	171	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt
Mudhanala	172	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt
Mudhanala	173	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt
Mudhanala	174	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt
Mudhanala	175	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt
Mudhanala	176	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt
Mudhanala	177	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Mudhanala	178	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt
Mudhanala	179	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt
Mudhanala	180	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt
Mudhanala	181	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt
Mudhanala	182	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt
Mudhanala	183	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt
Mudhanala	184	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt
Mudhanala	185	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt
Mudhanala	186	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt
Mudhanala	187	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt
Mudhanala	188	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt
Mudhanala	189	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt
Mudhanala	190	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt
Mudhanala	191	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt
Mudhanala	192	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt
Mudhanala	193	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt
Mudhanala	194	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt

Village	Survey Number	Mango	Maize	Sapota	Sorghum	Guava	Cotton	Tamarind	Lime	Bengal gram	Sunflower	Red gram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Onion	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Brinjal	Bhendi	Drumstick	Mulberry
Mudhanala	195	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt
Mudhanala	196	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt
Mudhanala	197	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt
Mudhanala	198	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt
Mudhanala	199	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3r	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	S3r	S3r	N1rt	N1rt
Mudhanala	200	S3rz	S3tz	S2rz	S2tz	S2rz	S3tz	S3rz	S2rz	S3tz	S2rz	S2rz	S2tz	S2rz	S2z	N1tz	S3rz	S2rz	S2z	S2z	S2z	S2z	S2z	S2z	S2rz	S1	S2z	S2z	S2rz	S2rz
Mudhanala	201/1	S3rz	S3tz	S2rz	S2tz	S2rz	S3tz	S3rz	S2rz	S3tz	S2rz	S2rz	S2tz	S2rz	S2z	N1tz	S3rz	S2rz	S2z	S2z	S2z	S2z	S2z	S2z	S2rz	S1	S2z	S2z	S2rz	S2rz
Mudhanala	201/2	S3rz	S3tz	S2rz	S2tz	S2rz	S3tz	S3rz	S2rz	S3tz	S2rz	S2rz	S2tz	S2rz	S2z	N1tz	S3rz	S2rz	S2z	S2z	S2z	S2z	S2z	S2z	S2rz	S1	S2z	S2z	S2rz	S2rz
Mudhanala	202	S3rz	S3tz	S2rz	S2tz	S2rz	S3tz	S3rz	S2rz	S3tz	S2rz	S2rz	S2tz	S2rz	S2z	N1tz	S3rz	S2rz	S2z	S2z	S2z	S2z	S2z	S2z	S2rz	S1	S2z	S2z	S2rz	S2rz
Yadhagiri .B	546	S2r	S2tw	S3t	S1	S3t	S1	S2t	S2z	S1	S1	S2tw	S2t	S3t	S2z	N1t	S2t	S2z	S3tw	S1	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S1	S1	S2tw	S3tw
Yadhagiri .B	547	S2r	S2tw	S3t	S1	S3t	S1	S2t	S2z	S1	S1	S2tw	S2t	S3t	S2z	N1t	S2t	S2z	S3tw	S1	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S1	S1	S2tw	S3tw
Yadhagiri .B	548	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S3t	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2t	S2t	S2tw	S3tw
Yadhagiri .B	549	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S3t	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2t	S2t	S2tw	S3tw
Yadhagiri .B	551	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S3t	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2t	S2t	S2tw	S3tw
Yadhagiri .B	552	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S3t	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2t	S2t	S2tw	S3tw

PART-B

SOCIO-ECONOMIC STATUS OF FARM HOUSEHOLDS

CONTENTS

LIST OF TABLES

Chapter 1

Findings of the socio-economic survey

- *The survey was conducted in Mundal-1 is located at $16^0$47'57.577'' to 16^0 45'44.961'' and East longitude 77^0 6'21.991'' to $77^0$5'11.137'' covering an area of about 487.74 ha coming under Mudhanala, Bheemanagara and Yadgiri B villages of Yadagiri taluk.*
- *Socio-economic analysis indicated that, out of the total sample of 40 respondents, 5 (12.5%) were landless, 22 (55%) were marginal, 7 (17.5%) were small farmers and 6 (15%) were semi medium farmers.*
- *The population characteristics of households indicated that, there were 122 (58.94%) men and 85 (41.06%) women among the sampled households.*
- *The average family size of landless farmers' was 4, marginal farmers' was 5.5, small farmers' was 5.6 and semi medium farmers' was 4.5.*
- *Majority of the respondents 52 (25.12%) people were in 0-15 years of age, 86 (41.55%) were in 16-35 years of age, 55 (26.57%) were in 36-60 years of age and 14 (6.76%) were above 61 years of age.*
- *Education level of the sample households indicated that, majority there were 47.83 per cent illiterates, 10.14 per cent of them had primary school, 10.63 per cent of them had Middle school education, 19.81 per cent of them had high school, 6.28 per cent of them had PUC, 4.83 per cent of them had degree and 0.48 per cent of them had masters education.*
- *About, 12.50 per cent of household heads were practicing agriculture, 85 per cent of the household heads were agricultural laborers and 2.50 per cent of the household heads were government services.*
- *Agriculture was the major occupation for 5.8 per cent of the household members, 46.86 per cent were agricultural labourers, 0.48 per cent were general labour, 1.45 per cent were government service, 1.93 per cent were were private service, 28.5 per cent student and 2.90 per cent were housewives and children.*
- *100 per cent of the population in the micro watershed has not participated in any local institutions.*
- *In the study area, 15 per cent of the households possess thatched, 40 per cent of the households possess katcha house and 45 per cent of the households possess pucca/RCC.*
- *The durable assets owned by the households showed that, 70 per cent of the households possess TV, 42.5 per cent of the households possess mixer/grinder and motor cycle, 7.5 per cent of the households possess refrigerator, 2.5 per cent of the households posses auto and 87.5 per cent of the households possess mobile phones.*
- *Farm implements owned by the households indicated that, 25 per cent each of the households possess bullock cart, 35 per cent each of the households possess*

plough and weeder, 2.50 per cent of the households possess seed/fertilizer drill, sprinkler and harvester, and 12.5 per cent of the households possess sprayer.

- *Regarding livestock possession by the households, 30 per cent of the households possess bullocks, 5 per cent of the households possess local cow, buffalo, goat and poultry birds, 2.50 per cent of the households possess crossbreed cow, sheep and pigs.*
- *The average own labour men available in the micro watershed was 1.75, average own labour (women) available was 1.44, average hired labour (men) available was 8.3 and average hired labour (women) available was 8.55.*
- *Out of the total land holding of the sample respondents 32.43 ha (95.25%) of dry land and 1.62 ha (4.75%) of irrigated land.*
- *Marginal farmers possess 11.85 ha (100%) of dry land. Small farmers possess 9.9 ha (100%) of dry land.*
- *Semi medium farmers possess 10.68 ha (86.83%) of dry land and 1.62 ha (13.17 %) of irrigated land.*
- *There were 1 functioning and de-functioning bore wells in the micro watershed. There were 1 functioning and de-functioning open wells in the micro watershed.*
- *Bore well and open well was the major irrigation source in the micro water shed for 2.5 per cent of the farmers.*
- *The major crops have grown cotton (10.62%), green gram (6.83 ha), horse gram (0.46 ha), jowar (3.44 ha), marry gold (0.13 ha), paddy (0.94 ha), red gram (7.06 ha), sorghum (1.2 ha).*
- *The cropping intensity in micro watershed was found to be 97.36 per cent.*
- *The sample households possessed 82.50 per cent of the households have bank account and 50 per cent have savings.*
- *About 15 per cent of the households have availed credit from different sources.*
- *The sample households have borrowed 25 per cent from commercial and cooperative bank, 6.25 per cent of the households have borrowed from friends/relatives and SHGs/CBOs.*
- *The average credit amount borrowed by households in micro-watershed was Rs. 30,875.*
- *The households possessed, 83.33 per cent of the households borrowed from institutional sources for the purpose of agricultural production.*
- *The households possessed, 50 per cent of the households borrowed from Private sources for the purpose of agricultural production.*
- *The households possessed, 50 per cent of the households fully paid and do not repay their loan from institutional sources.*
- *The households possessed, 25 per cent opined that the loan amount borrowed from helped to perform timely agricultural operations, 12.5 per cent opined that the loan amount borrowed from easy accessibility of credit and forced to sell the*

produce at low price to repay loan in time and 37.5 per cent opined that the loan amount borrowed from higher rate of interest.

- *The households possessed, 100 per cent opined that the loan amount borrowed from forced to sell the produce at low price to repay loan in time.*
- *The per hectare cost of cultivation for Cotton, Green gram, Red gram, Horse gram, Jowar, paddy and Sorghum was Rs. 28607.12, 94010.18, 49250.98, 53641.09, 33369.24, 81933.24 and 24536.53 with benefit cost ratio of 1:3.05, 1:0.94, 1:2.04, 1:0.61, 1:1.36, 1:0.59 and 1:1.08, respectively.*
- *Further, 20 per cent of the households opined that dry fodder was adequate, 7.50 per cent of the households opined that dry fodder was inadequate, 10 per cent of the households opined that green fodder was adequate and 5 per cent of the households opined that green fodder was inadequate.*
- *The average annual gross income was Rs. 87,545.45 for marginal farmers, for small farmers it was Rs. 139,428.57 and semi medium farmers it was Rs. 109,583.33.*
- *The average annual expenditure is Rs. 7,982.72. For marginal farmers it was Rs. 6,505.92, for small farmers it was Rs. 6,442.18and for semi medium farmers it was Rs. 21,847.22.*
- *Sampled households have planted 2 coconut trees in their field to cultivate horticultural crops.*
- *Households have planted 1 eucalyptus and tamarind, 49 neem and 4 banyan trees in their field and also 1 neem trees in their backyard to cultivate forest species.*
- *Households have an average investment capacity of Rs. 1,150 for land development, Rs. 125 for irrigation facility, Rs.600 for improved crop production and Rs.225 for improved livestock management.*
- *Source of funds for additional investment is concerned; loan from bank was the source of additional investment for 7.32 per cent for land development and 2.44 per cent for improved crop production and improved livestock managemnet.*
- *Own funds was the source of additional investment for 12.2 per cent for land development, 7.32 per cent for improved crop production and 2.44 per cent for improved livestock management.*
- *Soft loan was the source of additional investment for 2.44 for irrigation facility and improved livestock management.*
- *Regarding marketing channels, 2.50 per cent of the farmers sold their produce to agent/traders and cooperative marketing society, 70 per cent of the farmers sold their produce to local/village merchant and 17.50 per cent of the farmers sold their produce to regulated market.*
- *Further, 22.50 per cent of the households have used truck and 70 per cent of the households used tractor as a mode of transportation.*

- *Majority of the households 67.5 per cent have shown incidence of soil and water erosion problems.*
- *The household possess, (85%) were interested towards soil testing. and 12.5 per cent of the households used LPG as a source of fuel.*
- *piped supply was the major source of drinking water for 95 per cent and 5 per cent of the households used used bore well in the micro watershed.*
- *Electricity was the major source of light for 100 per cent of the households. In the study area, 40 per cent of the households possess toilet facility.*
- *Regarding possession of PDS card, 100 per cent of the households possessed BPL card.*
- *cereals were adequate for 92.5 per cent of the households, pulses were adequate for 90 per cent, oilseeds were adequate for 17.5 per cent, vegetables were adequate for 52.5 per cent, milk were adequate for 82.5 per cent and egg were adequate for 65 per cent and meat were adequate for 32.5 per cent of the households.*
- *Cereals were inadequate for 7.5 per cent of the households, pulses were inadequate for 10 per cent, oilseed were inadequate for 82.5 per cent, vegetables were inadequate for 47.5 per cent, fruits were inadequate for 97.5 per cent, milk were inadequate for 17.50 per cent, egg were inadequate for 32.5 per cent and meat were inadequate for 67.5 per cent of the households.*
- *Farming constraints experienced by households in the micro watersheds were lower fertility status of the soil and wild animal menace on farm field was the constraint experienced by 90 per cent of the households, frequent incidence of pest and diseases and Lack of transport for safe transport of the Agril produce to the market (87.5%), Inadequacy of irrigation water (35 %), high cost of fertilizer and plant protection chemicals, high rate of interest on credit and Low price for the agricultural commodities (82.5%), lack of marketing facilities in the area (62.5%), inadequate extension service (15%), less rainfall (12.5%) and Source of Agri-technology information (7.5%).*

Chapter 2

INTRODUCTION

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

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

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

Scope and importance of survey

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

Chapter 3

METHODOLOGY

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

1. Description of the study area

Yadgir District is one of the 30 districts of Karnataka state in southern India. This district was carved out from the erstwhile Gulbarga district as the 30th district of Karnataka on 10 April 2010. Yadgir town is the administrative headquarters of the district. The district comprises of 3 taluks namely, Shahapur, Yadgiri and Shorapur (There are 16 hoblies, 117 Gram Panchayats, 4 Municipalities,8 Towns/ Urban agglomeration and 487 inhabited & 32 un-inhabited villages The district occupies an area of 5,160.88 km².

Yadgir district is the second smallest district in the state, area wise is very rich in cultural traditions. The vast stretch of fertile black soil of the district is known for bumper red gram and jowar crops. The district is a "Daal bowl" of the state. The district is also known for cluster of cement industries and a distinct stone popularly known as "Malakheda Stone". Two main rivers, Krishna and Bhima, and a few tributaries flow in this region. Krishna and Bhima Rivers drain the district. They constitute the two major river basins of the district. Kagna and Amarja are the two sub - basins of Bhima River, which occur within the geographical area of the district

According to the 2011 census Yadgir district has a population of 1, 172,985, roughly equal to the nation of Timor-Lesteor the US state of Rhode Island. This gives it a ranking of 404th in India (out of a total of 640). The district has a population density of 224 inhabitants per square kilometre (580/sq mi). Its population growth rate over the decade 2001-2011 was 22.67%. Yadgir has a sex ratio of 984 females for every 1000 males, and a literacy rate of 52.36%.

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

The study was conducted in Mundal-1 is located at $16^0$47’57.577’’ to 16^0 45’44.961’’ and East longitude 77^0 6’21.991’’ to $77^0$5’11.137’’ covering an area of about 487.74 ha coming under Mudhanala, Bheemanagara and Yadgiri B Villages of Yadagiri taluk.

3. Selection of the respondents for the study

The micro-watershed is marked with 320 square meters grids. One farmer from every alternate grid in the micro-watershed was selected for the study and interviewed for socio-economic data. Totally 40 households were interviewed for the survey.

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

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

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

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

5. Development of interview schedule and data collection

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

6. Tools used to analyze the data

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

Abbreviations used in the report

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

Chapter 4

SALIENT FEATURES OF THE SURVEY

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

Households sampled for socio-economic survey: The data on households sampled for socio economic survey in Mundal-1 Micro watershed is presented in Table 1 and it indicated that 40 farmers were sampled in Mundal-1 micro-watershed among them 5 (12.5%) were landless, 22 (55%) were marginal, 7 (17.5%) were small farmers and 6 (15%) were semi medium farmers.

Table 1: Households sampled for socio economic survey in Mundal-1 Micro watershed

Sl.No.	Particulars	LL (5)		MF (22)		SF (7)		SMF (6)		All (40)	
		N	%	N	%	N	%	N	%	N	%
1	Farmers	5	12.50	22	55	7	17.50	6	15	40	100

Population characteristics: The population characteristics of households sampled for socio-economic survey in Mundal-1 Micro watershed is presented in Table 2. The data indicated that there were 122 (58.94%) men and 85 (41.06%) women among the sampled households. The average family size of landless farmers' was 4, marginal farmers' was 5.5, small farmers' was 5.6 and semi medium farmers' was 4.5.

Table 2: Population characteristics of Mundal-1 Micro watershed

Sl.No.	Particulars	LL (20)		MF (121)		SF (39)		SMF (27)		All (207)	
		N	%	N	%	N	%	N	%	N	%
1	Men	15	75	68	56.20	22	56.41	17	62.96	122	58.94
2	Women	5	25	53	43.80	17	43.59	10	37.04	85	41.06
Total		20	100	121	100	39	100	27	100	207	100
Average		4		5.5		5.6		4.5		5.1	

Age wise classification of population: The age wise classification of household members in Mundal-1 Micro watershed is presented in Table 3. The data indicated that, 52 (25.12%) people were in 0-15 years of age, 86 (41.55%) were in 16-35 years of age, 55 (26.57%) were in 36-60 years of age and 14 (6.76%) were above 61 years of age.

Table 3: Age wise classification of household members in Mundal-1 Micro watershed

Sl.No.	Particulars	LL (20)		MF (121)		SF (39)		SMF (27)		All (207)	
		N	%	N	%	N	%	N	%	N	%
1	0-15 years of age	5	25	30	24.79	14	35.90	3	11.11	52	25.12
2	16-35 years of age	9	45	53	43.80	15	38.46	9	33.33	86	41.55
3	36-60 years of age	6	30	28	23.14	9	23.08	12	44.44	55	26.57
4	> 61 years	0	0	10	8.26	1	2.56	3	11.11	14	6.76
Total		20	100	121	100	39	100	27	100	207	100

Education level of household members: Education level of household members in Mundal-1 Micro watershed is presented in Table 4. The results indicated that Mundal-1had 47.83 per cent illiterates, 10.14 per cent of them had primary school, 10.63 per cent of them had Middle school education, 19.81 per cent of them had high school, 6.28 per cent of them had PUC, 4.83 per cent of them had degree and 0.48 per cent of them had masters education.

Table 4. Education level of household members in Mundal-1 Micro watershed

Sl.No.	Particulars	LL (20)		MF (121)		SF (39)		SMF (27)		All (207)	
		N	%	N	%	N	%	N	%	N	%
1	Illiterate	13	65	56	46.28	12	30.77	18	66.67	99	47.83
2	Primary School	1	5	13	10.74	6	15.38	1	3.70	21	10.14
3	Middle School	4	20	12	9.92	6	15.38	0	0	22	10.63
4	High School	2	10	27	22.31	6	15.38	6	22.22	41	19.81
5	PUC	0	0	6	4.96	6	15.38	1	3.70	13	6.28
6	Degree	0	0	6	4.96	3	7.69	1	3.70	10	4.83
7	Masters	0	0	1	0.83	0	0	0	0	1	0.48
Total		20	100	121	100	39	100	27	100	207	100

Occupation of household heads: The data regarding the occupation of the household heads in Mundal-1 Micro watershed is presented in Table 5. The results indicate that, 12.50 per cent of household heads were practicing agriculture, 85 per cent of the household heads were agricultural labourers and 2.50 per cent of the household heads were government services.

Table 5: Occupation of household heads in Mundal-1 Micro watershed

Sl.No.	Particulars	LL (5)		MF (22)		SF (7)		SMF (6)		All (40)	
		N	%	N	%	N	%	N	%	N	%
1	Agriculture	0	0	1	4.55	2	28.57	2	33.33	5	12.50
2	Agricultural Labour	5	100	20	90.91	5	71.43	4	66.67	34	85
3	Government Service	0	0	1	4.55	0	0	0	0	1	2.50
Total		5	100	22	100	7	100	6	100	40	100

Table 6: Occupation of family members in Mundal-1 Micro watershed

Sl.No.	Particulars	LL (20)		MF (121)		SF (39)		SMF (27)		All (207)	
		N	%	N	%	N	%	N	%	N	%
1	Agriculture	0	0	2	1.65	4	10.26	6	22.22	12	5.80
2	Agricultural Labour	12	60	61	50.41	9	23.08	15	55.56	97	46.86
3	General Labour	0	0	0	0	1	2.56	0	0	1	0.48
4	Government Service	0	0	3	2.48	0	0	0	0	3	1.45
5	Private Service	0	0	2	1.65	2	5.13	0	0	4	1.93
6	Student	4	20	35	28.93	15	38.46	5	18.52	59	28.50
7	Others	0	0	1	0.83	3	7.69	0	0	4	1.93
8	Housewife	2	10	14	11.57	4	10.26	1	3.70	21	10.14
9	Children	2	10	3	2.48	1	2.56	0	0	6	2.90
Total		20	100	121	100	39	100	27	100	207	100

Occupation of the household members: The data regarding the occupation of the household members in Mundal-1 Micro watershed is presented in Table 6. The results

indicate that agriculture was the major occupation for 5.8 per cent of the household members, 46.86 per cent were agricultural labourers, 0.48 per cent were general labour, 1.45 per cent were government service, 1.93 per cent were were private service, 28.5 per cent student and 2.90 per cent were housewives and children.

Institutional participation of the household members: The data regarding the institutional participation of the household members in Mundal-1 Micro watershed is presented in Table 7. The results show that, 100 per cent of the population in the micro watershed has not participated in any local institutions.

Table 7. Institutional Participation of household members in Mundal-1 Micro watershed

Sl.No.	Particulars	LL (20)		MF (121)		SF (39)		SMF (27)		All (207)	
		N	%	N	%	N	%	N	%	N	%
1	No Participation	20	100	121	100	39	100	27	100	207	100
Total		20	100	121	100	39	100	27	100	207	100

Type of house owned: The data regarding the type of house owned by the households in Mundal-1 Micro watershed is presented in Table 8. The results indicate that 15 per cent of the households possess thatched, 40 per cent of the households possess katcha house and 45 per cent of the households possess pucca/RCC.

Table 8. Type of house owned by households in Mundal-1 Micro watershed

Sl.No.	Particulars	LL (5)		MF (22)		SF (7)		SMF (6)		All (40)	
		N	%	N	%	N	%	N	%	N	%
1	Thatched	2	40	4	18.18	0	0	0	0	6	15
2	Katcha	3	60	6	27.27	3	42.86	4	66.67	16	40
3	Pucca/RCC	0	0	12	54.55	4	57.14	2	33.33	18	45
Total		5	100	22	100	7	100	6	100	40	100

Durable Assets owned by the households: The data regarding the Durable Assets owned by the households in Mundal-1 Micro watershed is presented in Table 9. The results show that 70 per cent of the households possess TV, 42.5 per cent of the households possess mixer/grinder and motor cycle, 7.5 per cent of the households possess refrigerator, 2.5 per cent of the households posses auto and 87.5 per cent of the households possess mobile phones.

Table 9. Durable Assets owned by households in Mundal-1 Micro watershed

Sl.No.	Particulars	LL (5)		MF (22)		SF (7)		SMF (6)		All (40)	
		N	%	N	%	N	%	N	%	N	%
1	Television	1	20	16	72.73	6	85.71	5	83.33	28	70
2	Mixer/Grinder	2	40	13	59.09	2	28.57	0	0	17	42.50
3	Refrigerator	0	0	3	13.64	0	0	0	0	3	7.50
4	Motor Cycle	2	40	12	54.55	2	28.57	1	16.67	17	42.50
5	Auto	0	0	1	4.55	0	0	0	0	1	2.50
6	Mobile Phone	3	60	21	95.45	7	100	4	66.67	35	87.50

Average value of durable assets: The data regarding the average value of durable assets owned by the households in Mundal-1 Micro watershed is presented in Table 10. The

results show that the average value of television was Rs. 6,750, mixer/grinder was Rs. 1,205, refrigerator was Rs. 10,000, motor cycle was Rs. 47,352, auto was Rs. 50,000 and mobile phone was Rs. 1,762.

Table 10. Average value of durable assets owned by households in Mundal-1 Micro watershed **Average value (Rs.)**

Sl.No.	Particulars	LL (5)	MF (22)	SF (7)	SMF (6)	All (40)
1	Television	6,000	7,562	6,500	4,600	6,750
2	Mixer/Grinder	1,200	1,207	1,200	0	1,205
3	Refrigerator	0	10,000	0	0	10,000
4	Motor Cycle	36,000	47,333	52,500	60,000	47,352
5	Auto	0	50,000	0	0	50,000
6	Mobile Phone	1,350	1,827	1,810	1,566	1,762

Farm Implements owned: The data regarding the farm implements owned by the households in Mundal-1 Micro watershed is presented in Table 11. About 25 per cent each of the households possess bullock cart, 35 per cent each of the households possess plough and weeder, 2.50 per cent of the households possess seed/fertilizer drill, sprinkler and harvester, and 12.5 per cent of the households possess sprayer.

Table 11. Farm Implements owned by households in Mundal-1 Micro watershed

Sl.No.	Particulars	LL (5)		MF (22)		SF (7)		SMF (6)		All (40)	
		N	%	N	%	N	%	N	%	N	%
1	Bullock Cart	0	0	6	27.27	2	28.57	2	33.33	10	25
2	Plough	0	0	7	31.82	4	57.14	3	50	14	35
3	Seed/Fertilizer Drill	0	0	0	0	0	0	1	16.67	1	2.50
4	Sprayer	0	0	2	9.09	1	14.29	2	33.33	5	12.50
5	Sprinkler	0	0	0	0	1	14.29	0	0	1	2.50
6	Weeder	1	20	9	40.91	2	28.57	2	33.33	14	35
7	Harvester	0	0	0	0	0	0	1	16.67	1	2.50

Average value of farm implements: The data regarding the average value of farm Implements owned by the households in Mundal-1 Micro watershed is presented in Table 12. The results show that the average value of bullock cart was Rs. 17,409, plough was Rs. 18,557, seed/fertilizer drill was Rs. 7,000, sprayer was Rs. 152,200, sprinkler was Rs. 3,000, weeder was Rs. 160 and the average value of harvester was Rs. 200.

Table 12. Average value of farm implements owned by households in Mundal-1 Micro watershed Average Value (Rs.)

Sl.No.	Particulars	LL (5)	MF (22)	SF (7)	SMF (6)	All (40)
1	Bullock Cart	0	15,928	20,000	20,000	17,409
2	Plough	0	29,257	8,500	7,000	18,557
3	Seed/Fertilizer Drill	0	0	0	7,000	7,000
4	Sprayer	0	376,500	3,000	2,500	152,200
5	Sprinkler	0	0	3,000	0	3,000
6	Weeder	100	148	180	333	160
7	Harvester	0	0	0	200	200

Livestock possession by the households: The data regarding the Livestock possession by the households in Mundal-1 Micro watershed is presented in Table 13. The results indicate that, 30 per cent of the households possess bullocks, 5 per cent of the households possess local cow, buffalo, goat and poultry birds, 2.50 per cent of the households possess crossbreed cow, sheep and pigs.

Table 13. Livestock possession by households in Mundal-1 Micro watershed

Sl.No.	Particulars	LL (5)		MF (22)		SF (7)		SMF (6)		All (40)	
		N	%	N	%	N	%	N	%	N	%
1	Bullock	0	0	7	31.82	2	28.57	3	50	12	30
2	Local cow	0	0	0	0	2	28.57	0	0	2	5
3	Crossbred cow	0	0	0	0	1	14.29	0	0	1	2.50
4	Buffalo	0	0	2	9.09	0	0	0	0	2	5
5	Sheep	1	20	0	0	0	0	0	0	1	2.50
6	Goat	0	0	2	9.09	0	0	0	0	2	5
7	Pigs	0	0	1	4.55	0	0	0	0	1	2.50
8	Poultry birds	0	0	2	9.09	0	0	0	0	2	5
9	blank	4	80	13	59.09	4	57.14	3	50	24	60

Average Labour availability: The data regarding the average labour availability in Mundal-1 Micro watershed is presented in Table 14. The results indicate that, average own labour men available in the micro watershed was 1.75, average own labour (women) available was 1.44, average hired labour (men) available was 8.3 and average hired labour (women) available was 8.55.

In case of marginal farmers, average own labour men available was 1.6, average own labour (women) was 1.85, average hired labour (men) was 6.15 and average hired labour (women) available was 5.81. In case of small farmers, average own labour men available was 1, average own labour (women) was 1.25, average hired labour (men) was 10.63 and average hired labour (women) available was 11.25. In case of semi medium farmers, average own labour men available was 2, average own labour (women) was 1.25, average hired labour (men) was 14 and average hired labour (women) available was 17.5.

Table 14. Average Labour availability in Mundal-1 Micro watershed

Sl.No.	Particulars	LL (5)	MF (22)	SF (7)	SMF (6)	All (40)
1	Hired labour Female	5	5.85	11.25	17.50	8.55
2	Own Labour Female	2	1.60	1	1.25	1.44
3	Own labour Male	2	1.85	1.29	2	1.75
4	Hired labour Male	10	6.15	10.63	14	8.30

Table 15. Adequacy of Hired Labour in Mundal-1 Micro watershed

Sl.No.	Particulars	LL (5)		MF (22)		SF (7)		SMF (6)		All (40)	
		N	%	N	%	N	%	N	%	N	%
1	Adequate	1	20	21	95.45	8	114.29	3	50	33	82.50
2	Inadequate	0	0	0	0	0	0	1	16.67	1	2.50

Adequacy of Hired Labour: The data regarding the adequacy of hired labour in Mundal-1 Micro watershed is presented in Table 15. The results indicate that, 82.50 per cent of the households opined that the hired labour was adequate and 2.5 per cent of the households opined that the hired labour was inadequate.

Migration among the households: The data regarding the migration among the household members in Mundal-1 micro-watershed is presented in Table 16. The results show that, 1.45 per cent of the population in the micro watershed has migrated.

Table 16. Migration among the households in Mundal-1 micro-watershed

Sl.No.	Particulars	LL (20)		MF (121)		SF (39)		SMF (27)		All (207)	
		N	%	N	%	N	%	N	%	N	%
1	Migration	1	5	2	1.65	0	0	0	0	3	1.45

Average distance and duration of migration: The data regarding the average distance and duration of migration of household members in Mundal-1 micro-watershed is presented in Table 17. The results show that, average distance of migration was 369.67 kms and average duration of migration was 4 months.

Table 17. Average distance and duration of migration of households in Mundhal-1 micro-watershed

Sl.No.	Particulars	LL (1)	MF (2)	SF (0)	SMF (0)	All (3)
1	Avg. Distance (kms)	500	304.50	0	0	369.67
2	Avg. Duration (months)	3	4	0	0	4

Purpose of migration by household members: The data regarding the average distance and duration of migration of household members in Mundal-1 micro-watershed is presented in Table 18. The results show that, 100 per cent of the population has migrated for the purpose of job/wage/work and business.

Table 18. Purpose of migration of households in Mundal-1 micro-watershed

Sl.No.	Particulars	LL (1)		MF (2)		SF (0)		SMF (0)		All (3)	
		N	%	N	%	N	%	N	%	N	%
1	Job/wage/work	1	100	2	100	0	0	0	0	3	100
Total		1	100	2	100	0	100	0	100	3	100

Distribution of land (ha): The data regarding the distribution of land (ha) in Mundal-1 Micro watershed is presented in Table 19. The results indicate that, households of the Mundal-1 Micro watershed possess 32.43 ha (95.25%) of dry land and 1.62 ha (4.75%) of irrigated land. Marginal farmers possess 11.85 ha (100%) of dry land. Small farmers possess 9.9 ha (100%) of dry land. Semi medium farmers possess 10.68 ha (86.83%) of dry land and 1.62 ha (13.17 %) of irrigated land.

Table 19. Distribution of land (Ha) in Mundal-1 Micro watershed

Sl.No.	Particulars	LL (5)		MF (22)		SF (7)		SMF (6)		All (40)	
		ha	%	ha	%	ha	%	ha	%	ha	%
1	Dry	0	0	11.85	100	9.90	100	10.68	86.83	32.43	95.25
2	Irrigated	0	0	0	0	0	0	1.62	13.17	1.62	4.75
Total		0	100	11.85	100	9.90	100	12.29	100	34.05	100

Average land value (Rs./ha): The data regarding the average land value (Rs./ha) in Mundal-1 Micro watershed is presented in Table 20. The results indicate that, the average value of dry land was Rs. 570,239.47 and the average value of irrigated land was Rs. 494,000. In case of marginal famers, the average land value was Rs. 1,012,191.37 for dry land. In case of small famers, the average land value was Rs. 393,665.71 for dry land. In case of semi medium famers, the average land value was Rs. 243,442 for dry land and the average land value was Rs. 494,000 for irrigated.

Table 20. Average land value (Rs./ha) in Mundal-1 Micro watershed

Sl.No.	Particulars	LL (5)	MF (22)	SF (7)	SMF (6)	All (40)
1	Dry	0	1,012,191.37	393,665.71	243,442	570,239.47
2	Irrigated	0	0	0	494,000	494,000

Status of bore wells: The data regarding the status of bore wells in Mundal-1 Micro watershed is presented in Table 21. The results indicate that, there were 1 functioning and de-functioning bore wells in the micro watershed.

Table 21. Status of bore wells in Mundal-1 Micro watershed

Sl.No.	Particulars	LL (5)	MF (22)	SF (7)	SMF (6)	All (40)
1	De-functioning	0	1	0	0	1
2	Functioning	0	1	0	0	1

Status of open wells: The data regarding the status of open wells in Mundal-1 micro watershed is presented in Table 22. The results indicate that, there were 1 functioning and de-functioning open wells in the micro watershed.

Table 22. Status of open wells in Mundal-1 Micro watershed

Sl.No.	Particulars	LL (5)	MF (22)	SF (7)	SMF (6)	All (40)
1	De-functioning	0	0	1	0	1
2	Functioning	0	0	1	0	1

Source of irrigation: The data regarding the source of irrigation in Mundal-1 Micro watershed is presented in Table 23. The results indicate that, bore well and open well was the major irrigation source in the micro water shed for 2.5 per cent of the farmers.

Table 23. Source of irrigation in Mundal-1 Micro watershed

Sl.No.	Particulars	LL (5)		MF (22)		SF (7)		SMF (6)		All (40)	
		N	%	N	%	N	%	N	%	N	%
1	Bore Well	0	0	1	4.55	0	0	0	0	1	2.50
2	Open Well	0	0	0	0	1	14.29	0	0	1	2.50

Depth of Water (Avg. in meters): The data regarding the depth of water in Mundal-1 Micro watershed is presented in Table 24. The results indicate that, the depth of bore well was found to be 2.67 meters and open well was found to be 1.52 meters.

Table 24. Depth of water (Avg in meters) in Mundal-1 Micro watershed

Sl.No.	Particulars	LL (5)	MF (22)	SF (7)	SMF (6)	All (40)
1	Bore Well	0	4.85	0	0	2.67
2	Open Well	0	0	8.71	0	1.52

Irrigated Area (ha): The data regarding the irrigated area (ha) in Mundal-1 Micro watershed is presented in Table 25. The results indicate that, marginal and small farmers had an irrigated area of 0.94 ha and 1.62 ha respectively.

Table 25. Irrigated Area (ha) in Mundal-1 Micro watershed

Sl.No.	Particulars	LL (5)	MF (22)	SF (7)	SMF (6)	All (40)
1	Kharif	0	0.94	1.62	0	2.56
Total		0	0.94	1.62	0	2.56

Cropping pattern: The data regarding the cropping pattern in Mundal-1 Micro watershed is presented in Table 26. The results indicate that, farmers have grown cotton (10.62%), green gram (6.83 ha), horse gram (0.46 ha), jowar (3.44 ha), marry gold (0.13 ha), paddy (0.94 ha), red gram (7.06 ha), sorghum (1.2 ha).

Table 26. Cropping pattern in Mundal-1 Micro watershed (Area in ha)

Sl.No.	Particulars	LL (5)	MF (22)	SF (7)	SMF (6)	All (40)
1	Kharif - Cotton	0	1.86	5.82	2.94	10.62
2	Kharif - Green gram	0	3.51	1.30	2.02	6.83
3	Kharif - Horse gram	0	0.46	0	0	0.46
4	Kharif - Jowar	0	1.94	1.50	0	3.44
5	Kharif - Marry gold	0	0.13	0	0	0.13
6	Kharif - Paddy	0	0.94	0	0	0.94
7	Kharif - Red gram	0	2.12	1.30	3.64	7.06
8	Kharif - Sorghum	0	0.81	0	0	0.81
9	Rabi - Green gram	0	0.40	0	0	0.40
10	Rabi - Sorghum	0	0	0	0.40	0.40
11	Summer - Green gram	0	0.40	0	0	0.40
Total		0	12.58	9.91	9.02	31.50

Cropping intensity: The data regarding the cropping intensity in Mundal-1 Micro watershed is presented in Table 27. The results indicate that, the cropping intensity in Mundal-1 Micro watershed was found to be 97.36 per cent.

Table 27. Cropping intensity (%) in Mundal-1 Micro watershed

Sl.No.	Particulars	LL (5)	MF (22)	SF (7)	SMF (6)	All (40)
1	Cropping Intensity	0	106.88	100	84.42	97.36

Possession of Bank account and savings: The data regarding the possession of bank account and saving in Mundal-1 micro-watershed is presented in Table 28. The results indicate that, 82.50 per cent of the households have bank account and 50 per cent have savings.

Table 28. Possession of bank account and savings in Mundal-1 micro-watershed

Sl.No.	Particulars	LL (5)		MF (22)		SF (7)		SMF (6)		All (40)	
		N	%	N	%	N	%	N	%	N	%
1	Account	1	20	21	95.45	6	85.71	5	83.33	33	82.50
2	Savings	0	0	13	59.09	5	71.43	2	33.33	20	50

Borrowing status: The data regarding the borrowing status in Mundal-1 micro-watershed is presented in Table 29. The results indicate that, 15 per cent of the households have availed credit from different sources.

Table 29. Borrowing status in Mundal-1 micro-watershed

Sl.No.	Particulars	LL (5)		MF (22)		SF (7)		SMF (6)		All (40)	
		N	%	N	%	N	%	N	%	N	%
1	Credit Availed	0	0	1	4.55	3	42.86	2	33.33	6	15

Source of credit availed by households: The data regarding the source of credit availed by households in Mundal-1 micro-watershed is presented in Table 30. The results indicate that, 25 per cent of the households have borrowed from commercial and cooperative bank, 6.25 per cent of the households have borrowed from friends/relatives and SHGs/CBOs.

Table 30. Source of credit availed by households in Mundal-1 micro-watershed

Sl.No.	Particulars	LL (0)		MF (11)		SF (3)		SMF (2)		All (16)	
		N	%	N	%	N	%	N	%	N	%
1	Commercial Bank	0	0	3	27.27	0	0	1	50	4	25
2	Cooperative Bank	0	0	3	27.27	0	0	1	50	4	25
3	Friends/Relatives	0	0	0	0	0	0	1	50	1	6.25
4	SHGs/CBOs	1	100	0	0	0	0	0	0	1	6.25

Avg. Credit amount: The data regarding the avg. Credit amount in Mundal-1 micro-watershed is presented in Table 31. The results indicate that, the average credit amount borrowed by households in micro-watershed was Rs. 30,875.

Table 31. Avg. credit amount by household Mundal-1 micro-watershed

Sl.No.	Particulars	LL (0)	MF (11)	SF (3)	SMF (2)	All (16)
1	Average Credit	0	34,909.09	0	30,000	30,875

Purpose of credit borrowed - Institutional Credit: The data regarding the purpose of credit borrowed - Institutional Credit in mudnal-1 micro-watershed is presented in Table 32. The results indicate that, 83.33 per cent of the households borrowed from institutional sources for the purpose of agricultural production

Table 32. Purpose of credit borrowed - Institutional Credit by household in Mudnal-1 micro-watershed

Sl.No.	Particulars	LL (0)		MF (4)		SF (0)		SMF (2)		All (6)	
		N	%	N	%	N	%	N	%	N	%
1	Agriculture production	0	0	4	100	0	0	1	50	5	83.33

Table 33. Purpose of credit borrowed - Private Credit by household in Mudnal-1 micro-watershed

Sl.No.	Particulars	LL (1)		MF (0)		SF (0)		SMF (1)		All (2)	
		N	%	N	%	N	%	N	%	N	%
1	Agriculture production	1	100	0	0	0	0	0	0	1	50

Purpose of credit borrowed - Private Credit: The data regarding the purpose of credit borrowed - Private Credit in Mudnal-1 micro-watershed is presented in Table 33. The

results indicate that, 50 per cent of the households borrowed from private sources for the purpose of agricultural production

Repayment status of households – Institutional: The data regarding the repayment status of credit borrowed from institutional sources by households in Mudnal-1 micro watershed is presented in Table 34. The results indicated that 50 per cent of the households fully paid and do not repay their loan from institutional sources.

Table 34. Repayment status of households – Institutional Credit in Mudnal-1 micro-watershed

Sl.No.	Particulars	LL (1)		MF (0)		SF (0)		SMF (1)		All (2)	
		N	%	N	%	N	%	N	%	N	%
1	Fully paid	0	0	0	0	0	0	1	100	1	50
2	Un paid	1	100	0	0	0	0	0	0	1	50

Opinion on institutional sources of credit: The data regarding the opinion on institutional sources of credit in Mudnal-1 micro watershed is presented in Table 35. The results indicate that, 25 per cent opined that the loan amount borrowed from helped to perform timely agricultural operations, 12.5 per cent opined that the loan amount borrowed from easy accessibility of credit and forced to sell the produce at low price to repay loan in time and 37.5 per cent opined that the loan amount borrowed fron higher rate of interest.

Table 35. Opinion on institutional sources of credit in Mudnal-1 micro watershed

Sl.No.	Particulars	LL (0)		MF (6)		SMF(2)		All (8)	
		N	%	N	%	N	%	N	%
1	Helped to perform timely agricultural operations	0	0	2	33.33	0	0	2	25
2	Easy accessibility of credit	0	0	1	16.67	0	0	1	12.50
3	Higher rate of interest	0	0	2	33.33	1	50	3	37.50
4	Forced to sell the produce at low price to repay loan in time	0	0	1	16.67	0	0	1	12.50

Opinion on non-institutional sources of credit: The data regarding the opinion on non-institutional sources of credit in Mudnal-1 micro watershed is presented in Table 36. The results indicate that, 100 per cent opined that the loan amount borrowed from forced to sell the produce at low price to repay loan in time.

Table 36. Opinion on non-institutional sources of credit in Mudnal-1 micro watershed

Sl.No.	Particulars	LL (1)		MF (0)		SF (0)		SMF (1)		All (2)	
		N	%	N	%	N	%	N	%	N	%
1	Helped to perform timely agricultural operations	1	100	0	0	0	0	0	0	1	50

Cost of cultivation of Cotton: The data regarding the cost of cultivation of Cotton in Mundal-1 Micro watershed is presented in Table 37. The results indicate that, the total cost of cultivation for Cotton was Rs. 28607.12. The gross income realized by the farmers was Rs. 87197.01. The net income from Cotton cultivation was Rs. 58589.88. Thus the benefit cost ratio was found to be 1:3.05.

Table 37. Cost of Cultivation of Cotton in Mundal-1 Micro watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	33.09	6131.33	21.43
2	Bullock		Pairs/day	1	1001.51	3.50
3	Tractor		Hours	4.01	2682.75	9.38
4	Machinery		Hours	0.41	82.33	0.29
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	15.23	1710.68	5.98
6	Seed Inter Crop		Kgs.	0	0	0
7	FYM		Quintal	3.22	4832.47	16.89
8	Fertilizer + micronutrients		Quintal	3.12	2717.69	9.50
9	Pesticides (PPC)		Kgs / liters	2.26	1989.14	6.95
10	Irrigation		Number	0	0	0
11	Repairs			0	0	0
12	Msc. Charges (Marketing costs etc)			0	0	0
13	Depreciation charges			0	240.11	0.84
14	Land revenue and Taxes			0	0	0
II	**Cost B1**					
16	Interest on working capital				1351.06	4.72
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				22739.08	79.49
III	**Cost B2**					
18	Rental Value of Land				96.30	0.34
19	**Cost B2 = (Cost B1 + Rental value)**				22835.38	79.82
IV	**Cost C1**					
20	Family Human Labour			14.13	3162.21	11.05
21	**Cost C1 = (Cost B2 + Family Labour)**				25997.59	90.88
V	**Cost C2**					
22	Risk Premium				8.89	0.03
23	**Cost C2 = (Cost C1 + Risk Premium)**				26006.48	90.91
VI	**Cost C3**					
24	Managerial Cost				2600.65	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				28607.12	100
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		18.38	87197.01	
		b) Main Crop Sales Price (Rs.)			4744.44	
b.	Gross Income (Rs.)				87197.01	
c.	Net Income (Rs.)				58589.88	
d.	Cost per Quintal (Rs./q.)				1556.53	
e.	Benefit Cost Ratio (BC Ratio)				1:3.05	

Cost of Cultivation of Green gram: The data regarding the cost of cultivation of green gram in Mundal-1 Micro watershed is presented in Table 38. The results indicate that, the total cost of cultivation for green gram was Rs. 94010.18. The gross income realized by the farmers was Rs. 87940.08. The net income from green gram cultivation was Rs. -6070.10. Thus the benefit cost ratio was found to be 1:0.94.

Table 38. Cost of Cultivation of green gram in Mundal-1 Micro watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	47.45	10881.26	11.57
2	Bullock		Pairs/day	5.38	4825.32	5.13
3	Tractor		Hours	13.93	9749.67	10.37
4	Machinery		Hours	0	0	0
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	75.18	4003.87	4.26
7	FYM		Quintal	9.62	14172.30	15.08
8	Fertilizer + micronutrients		Quintal	8.74	7378.88	7.85
9	Pesticides (PPC)		Kgs/liters	4.71	3343.54	3.56
10	Irrigation		Number	0	0	0
11	Repairs			0	0	0
12	Msc. Charges (Marketing costs etc)			0	0	0
13	Depreciation charges			0	5828.28	6.20
14	Land revenue and Taxes			0	0	0
II	**Cost B1**					
16	Interest on working capital				3469.03	3.69
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				63652.16	67.71
III	**Cost B2**					
18	Rental Value of Land				143.33	0.15
19	**Cost B2 = (Cost B1 + Rental value)**				63795.49	67.86
IV	**Cost C1**					
20	Family Human Labour			96.83	21658.31	23.04
21	**Cost C1 = (Cost B2 + Family Labour)**				85453.80	90.90
V	**Cost C2**					
22	Risk Premium				10	0.01
23	**Cost C2 = (Cost C1 + Risk Premium)**				85463.80	90.91
VI	**Cost C3**					
24	Managerial Cost				8546.38	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				94010.18	100
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		19.03	87549.22	
		b) Main Crop Sales Price (Rs.)			4600	
	By Product	e) Main Product (q)		1.95	390.86	
		f) Main Crop Sales Price (Rs.)			200	
b.	Gross Income (Rs.)				87940.08	
c.	Net Income (Rs.)				-6070.10	
d.	Cost per Quintal (Rs./q.)				4939.47	
e.	Benefit Cost Ratio (BC Ratio)				1:0.94	

Cost of cultivation of Red gram: The data regarding the cost of cultivation of Red gram in Mundal-1 Micro watershed is presented in Table 39. The results indicate that, the total cost of cultivation for Red gram was Rs. 49250.98. The gross income realized by the farmers was Rs. 100379.47. The net income from Red gram cultivation was Rs. 51128.49. Thus the benefit cost ratio was found to be 1:2.04.

Table 39. Cost of Cultivation of Red gram in Mundal-1 Micro watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	61.55	10566.66	21.45
2	Bullock		Pairs/day	1.06	1062.26	2.16
3	Tractor		Hours	7.32	4554.06	9.25
4	Machinery		Hours	4.12	823.33	1.67
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	14.74	1514.65	3.08
7	FYM		Quintal	2.74	5331.99	10.83
8	Fertilizer + micronutrients		Quintal	6.11	5295.96	10.75
9	Pesticides (PPC)		Kgs / liters	2.40	3044.54	6.18
10	Irrigation		Number	0	0	0
11	Repairs			0	0	0
12	Msc. Charges (Marketing costs etc)			0	0	0
13	Depreciation charges			0	23.98	0.05
14	Land revenue and Taxes			0	0	0
II	**Cost B1**					
16	Interest on working capital				2423.06	4.92
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				34640.50	70.33
III	**Cost B2**					
18	Rental Value of Land				61.11	0.12
19	**Cost B2 = (Cost B1 + Rental value)**				34701.61	70.46
IV	**Cost C1**					
20	Family Human Labour			21.77	5067.01	10.29
21	**Cost C1 = (Cost B2 + Family Labour)**				39768.62	80.75
V	**Cost C2**					
22	Risk Premium				5005	10.16
23	**Cost C2 = (Cost C1 + Risk Premium)**				44773.62	90.91
VI	**Cost C3**					
24	Managerial Cost				4477.36	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				49250.98	100
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		23.03	100194.22	
		b) Main Crop Sales Price (Rs.)			4350	
	By Product	e) Main Product (q)		0.74	185.25	
		f) Main Crop Sales Price (Rs.)			250	
b.	Gross Income (Rs.)				100379.47	
c.	Net Income (Rs.)				51128.49	
d.	Cost per Quintal (Rs./q.)				2138.26	
e.	Benefit Cost Ratio (BC Ratio)				1:2.04	

Cost of cultivation of horse gram: The data regarding the cost of cultivation of horse gram in Mundal-1 Micro watershed is presented in Table 40. The results indicate that, the total cost of cultivation for horse gram was Rs. 53641.09. The gross income realized by the farmers was Rs. 32787.61. The net income from horse gram cultivation was Rs. -20853.48. Thus the benefit cost ratio was found to be 1:0.61.

Table 40. Cost of Cultivation of horse gram in Mundal-1 Micro watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	78.69	13115.04	24.45
2	Bullock		Pairs/day	2.19	2185.84	4.07
3	Tractor		Hours	6.56	4590.27	8.56
4	Machinery		Hours	0	0	0
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	10.93	2732.30	5.09
6	Seed Inter Crop		Kgs.	0	0	0
7	FYM		Quintal	4.37	6557.52	12.22
8	Fertilizer + micronutrients		Quintal	10.93	6032.92	11.25
9	Pesticides (PPC)		Kgs / liters	2.19	1530.09	2.85
10	Irrigation		Number	0	0	0
11	Repairs			0	0	0
12	Msc. Charges (Marketing costs etc)			0	0	0
13	Depreciation charges			0	17.49	0.03
14	Land revenue and Taxes			0	0	0
II	**Cost B1**					
16	Interest on working capital				2023.54	3.77
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				38785.01	72.30
III	**Cost B2**					
18	Rental Value of Land				133.33	0.25
19	**Cost B2 = (Cost B1 + Rental value)**				38918.34	72.55
IV	**Cost C1**					
20	Family Human Labour			37.16	9836.28	18.34
21	**Cost C1 = (Cost B2 + Family Labour)**				48754.63	90.89
V	**Cost C2**					
22	Risk Premium				10	0.02
23	**Cost C2 = (Cost C1 + Risk Premium)**				48764.63	90.91
VI	**Cost C3**					
24	Managerial Cost				4876.46	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				53641.09	100
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		10.93	32787.61	
		b) Main Crop Sales Price (Rs.)			3000	
b.	Gross Income (Rs.)				32787.61	
c.	Net Income (Rs.)				-20853.48	
d.	Cost per Quintal (Rs./q.)				4908.05	
e.	Benefit Cost Ratio (BC Ratio)				1:0.61	

Cost of cultivation of Jowar: The data regarding the cost of cultivation of jowar in Mundal-1 Micro watershed is presented in Table 41. The results indicate that, the total cost of cultivation for jowar was Rs. 33369.24. The gross income realized by the farmers was Rs. 45499.92. The net income from jowar cultivation was Rs. 12130.68. Thus the benefit cost ratio was found to be 1:1.36.

Table 41. Cost of Cultivation of Jowar in Mundal-1 Micro watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	38.91	6952.27	20.83
2	Bullock		Pairs/day	4.65	4647.52	13.93
3	Tractor		Hours	2.54	1780.23	5.33
4	Machinery		Hours	0	0	0
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	28.06	1713.97	5.14
6	Seed Inter Crop		Kgs.	0	0	0
7	FYM		Quintal	2.77	3876.32	11.62
8	Fertilizer + micronutrients		Quintal	7.45	5715.11	17.13
9	Pesticides (PPC)		Kgs / liters	0	0	0
10	Irrigation		Number	0	0	0
11	Repairs			0	0	0
12	Msc. Charges (Marketing costs etc)			0	0	0
13	Depreciation charges			0	153.33	0.46
14	Land revenue and Taxes			0	0	0
II	**Cost B1**					
16	Interest on working capital				1357.85	4.07
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				26196.59	78.51
III	**Cost B2**					
18	Rental Value of Land				116.67	0.35
19	**Cost B2 = (Cost B1 + Rental value)**				26313.26	78.85
IV	**Cost C1**					
20	Family Human Labour			16.84	4012.42	12.02
21	**Cost C1 = (Cost B2 + Family Labour)**				30325.67	90.88
V	**Cost C2**					
22	Risk Premium				10	0.03
23	**Cost C2 = (Cost C1 + Risk Premium)**				30335.67	90.91
VI	**Cost C3**					
24	Managerial Cost				3033.57	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				33369.24	100
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		19.12	43012.24	
		b) Main Crop Sales Price (Rs.)			2250	
	By Product	e) Main Product (q)		3.98	2487.68	
		f) Main Crop Sales Price (Rs.)			625	
b.	Gross Income (Rs.)				45499.92	
c.	Net Income (Rs.)				12130.68	
d.	Cost per Quintal (Rs./q.)				1745.57	
e.	Benefit Cost Ratio (BC Ratio)				1:1.36	

Cost of cultivation of paddy: The data regarding the cost of cultivation of paddy in Mundal-1 Micro watershed is presented in Table 42. The results indicate that, the total cost of cultivation for paddy was Rs. 81933.24. The gross income realized by the farmers was Rs. 48545.71. The net income from paddy cultivation was Rs. -33387.53. Thus the benefit cost ratio was found to be 1:0.59.

Table 42. Cost of Cultivation of Paddy in Mundal-1 Micro watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	75.40	14938.86	18.23
2	Bullock		Pairs/day	1.24	1235	1.51
3	Tractor		Hours	6.80	4758	5.81
4	Machinery		Hours	0	0	0
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	160.78	26266.96	32.06
6	Seed Inter Crop		Kgs.	0	0	0
7	FYM		Quintal	7.41	11115	13.57
8	Fertilizer + micronutrients		Quintal	4.02	4007.71	4.89
9	Pesticides (PPC)		Kgs/liters	3.09	2288	2.79
10	Irrigation		Number	0	0	0
11	Repairs			0	0	0
12	Msc. Charges (Marketing costs etc)			0	0	0
13	Depreciation charges			0	9.90	0.01
14	Land revenue and Taxes			0	0	0
II	**Cost B1**					
16	Interest on working capital				5242.52	6.40
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				69861.96	85.27
III	**Cost B2**					
18	Rental Value of Land				116.67	0.14
19	**Cost B2 = (Cost B1 + Rental value)**				69978.62	85.41
IV	**Cost C1**					
20	Family Human Labour			17.61	4496.14	5.49
21	**Cost C1 = (Cost B2 + Family Labour)**				74474.76	90.90
V	**Cost C2**					
22	Risk Premium				10	0.01
23	**Cost C2 = (Cost C1 + Risk Premium)**				74484.76	90.91
VI	**Cost C3**					
24	Managerial Cost				7448.48	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				81933.24	100
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		30.92	47928.21	
		b) Main Crop Sales Price (Rs.)			1550	
	By Product	e) Main Product (q)		2.47	617.50	
		f) Main Crop Sales Price (Rs.)			250	
b.	Gross Income (Rs.)				48545.71	
c.	Net Income (Rs.)				-33387.53	
d.	Cost per Quintal (Rs./q.)				2649.72	
e.	Benefit Cost Ratio (BC Ratio)				1:0.59	

Cost of cultivation of Sorghum: The data regarding the cost of cultivation of sorghum in Mundal-1 Micro watershed is presented in Table 43. The results indicate that, the total cost of cultivation for sorghum was Rs. 24536.53. The gross income realized by the farmers was Rs. 26595.40. The net income from sorghum cultivation was Rs. 2058.87. Thus the benefit cost ratio was found to be 1:1.08.

Table 43. Cost of Cultivation of Sorghum in Mundal-1 Micro watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	27.63	2900.20	11.82
2	Bullock		Pairs/day	4.24	5800.39	23.64
3	Tractor		Hours	3.71	0	0
4	Machinery		Hours	0	0	0
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	7.38	980.63	4
6	Seed Inter Crop		Kgs.	0	0	0
7	FYM		Quintal	4.94	7410	30.20
8	Fertilizer + micronutrients		Quintal	1.58	1321.04	5.38
9	Pesticides (PPC)		Kgs /liters	0	0	0
10	Irrigation		Number	0	0	0
11	Repairs			0	0	0
12	Msc. Charges (Marketing costs etc)			0	0	0
13	Depreciation charges			0	247.59	1.01
14	Land revenue and Taxes			0	0	0
II	**Cost B1**					
16	Interest on working capital				1286	5.24
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				19945.84	81.29
III	**Cost B2**					
18	Rental Value of Land				50	0.20
19	**Cost B2 = (Cost B1 + Rental value)**				19995.84	81.49
IV	**Cost C1**					
20	Family Human Labour			7.84	1305.09	5.32
21	**Cost C1 = (Cost B2 + Family Labour)**				21300.93	86.81
V	**Cost C2**					
22	Risk Premium				1005	4.10
23	**Cost C2 = (Cost C1 + Risk Premium)**				22305.93	90.91
VI	**Cost C3**					
24	Managerial Cost				2230.59	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				24536.53	100
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		11.01	24769.48	
		b) Main Crop Sales Price (Rs.)			2250	
	By Product	e) Main Product (q)		3.65	1825.91	
		f) Main Crop Sales Price (Rs.)			500	
b.	Gross Income (Rs.)				26595.40	
c.	Net Income (Rs.)				2058.87	
d.	Cost per Quintal (Rs./q.)				2228.84	
e.	Benefit Cost Ratio (BC Ratio)				1:1.08	

Adequacy of fodder: The data regarding the adequacy of fodder in Mundal-1 Micro watershed is presented in Table 44. The results indicate that, 20 per cent of the households opined that dry fodder was adequate, 7.50 per cent of the households opined that dry fodder was inadequate, 10 per cent of the households opined that green fodder was adequate and 5 per cent of the households opined that green fodder was inadequate.

Table 44. Adequacy of fodder in Mundal-1 Micro watershed

Sl.No.	Particulars	LL (5)		MF (22)		SF (7)		SMF (6)		All (40)	
		N	%	N	%	N	%	N	%	N	%
1	Adequate-Dry Fodder	0	0	5	22.73	2	28.57	1	16.67	8	20
2	Inadequate-Dry Fodder	0	0	2	9.09	1	14.29	0	0	3	7.50
3	Adequate-Green Fodder	0	0	2	9.09	2	28.57	0	0	4	10
4	Inadequate-Green Fodder	0	0	1	4.55	1	14.29	0	0	2	5

Annual gross income: The data regarding the annual gross income in Mundal-1 Micro watershed is presented in Table 45. The results indicate that the annual gross income was Rs. 87,545.45 for marginal farmers, for small farmers it was Rs. 139,428.57 and semi medium farmers it was Rs. 109,583.33.

Table 45. Annual gross income in Mundal-1 Micro watershed

(Avg value in Rs.)

Sl.No.	Particulars	LL (5)	MF (22)	SF (7)	SMF (6)	All (40)
1	Service/salary	0	9,090.91	0	0	5,000
2	Business	0	9,090.91	0	0	5,000
3	Wage	0	30,000	37,857.14	29,166.67	27,500
4	Agriculture	0	37,000	101,571.43	80,416.67	50,187.50
5	Dairy Farm	0	90.91	0	0	50
6	Goat Farming	0	2,272.73	0	0	1,250
Income(Rs.)		0	87,545.45	139,428.57	109,583.33	88,987.50

Average annual expenditure: The data regarding the average annual expenditure in Mundal-1 Micro watershed is presented in Table 46. The results indicate that the average annual expenditure is Rs. 7,982.72. For marginal farmers it was Rs. 6,505.92, for small farmers it was Rs. 6,442.18and for semi medium farmers it was Rs. 21,847.22.

Table 46. Average annual expenditure in Mundal-1 Micro watershed

(Avg value in Rs.)

Sl.No.	Particulars	LL (5)	MF (22)	SF (7)	SMF (6)	All (40)
1	Service/salary	0	60,000	0	0	1,500
2	Business	0	30,000	0	0	1,500
3	Wage	0	13,221.05	13,666.67	10,500	9,380
4	Agriculture	0	18,909.09	31,428.57	120,583.33	33,987.50
5	Dairy Farm	0	1,000	0	0	25
6	Goat Farming	0	20,000	0	0	500
Total		0	143,130.14	45,095.24	131,083.33	319,308.71
Average		0	6,505.92	6,442.18	21,847.22	7,982.72

Horticulture species grown: The data regarding horticulture species grown in Mundal-1 Micro watershed is presented in Table 47. The results indicate that, households have planted 2 coconut trees in their field.

Table 47: Horticulture species grown in Mundal-1 Micro watershed

Sl.No.	Particulars	LL (5)		MF (22)		SF (7)		SMF (6)		All (40)	
		F	B	F	B	F	B	F	B	F	B
1	Coconut	0	0	0	0	2	0	0	0	2	0

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

Forest species grown: The data regarding forest species grown in Mundal-1 Micro watershed is presented in Table 48. The results indicate that, households have planted 1 eucalyptus and tamarind, 49 neem and 4 banyan trees in their field and also 1 neem trees in their backyard.

Table 48: Forest species grown in Mundal-1 Micro watershed

Sl.No.	Particulars	LL (5)		MF (22)		SF (7)		SMF (6)		All (40)	
		F	B	F	B	F	B	F	B	F	B
1	Eucalyptus	0	0	0	0	1	0	0	0	1	0
2	Neem	0	0	25	1	14	0	10	0	49	1
3	Tamarind	0	0	1	0	0	0	0	0	1	0
4	Banyan	0	0	2	0	0	0	2	0	4	0

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

Average Additional investment capacity: The data regarding average additional investment capacity in Mundal-1 Micro watershed is presented in Table 49. The results indicated that, households have an average investment capacity of Rs. 1,150 for land development, Rs. 125 for irrigation facility, Rs.600 for improved crop production and Rs.225 for improved livestock management.

Table 49: Average additional investment capacity in Mundal-1 Micro watershed

Sl.No.	Particulars	LL (5)	MF (22)	SF (7)	SMF (6)	All (40)
1	Land development	0	1,636.36	0	1,666.67	1,150
2	Irrigation facility	0	227.27	0	0	125
3	Improved crop production	0	1,090.91	0	0	600
4	Improved livestock management	0	409.09	0	0	225

Table 50: Source of funds for additional investment capacity in Mundal-1 Micro watershed

Sl. No	Item	Land development		Irrigation facility		Improved crop production		Improved livestock management	
		N	%	N	%	N	%	N	%
1	Loan from bank	3	7.32	0	0.0	1	2.44	1	2.44
2	Own funds	5	12.2	0	0.0	3	7.32	1	2.44
3	Soft loan	0	0.0	1	2.44	1	2.44	0	0.0

Source of additional investment: The data regarding source of funds for additional investment in Mundal-1 Micro watershed is presented in Table 50. The results indicated that loan from bank was the source of additional investment for 7.32 per cent for land

development and 2.44 per cent for improved crop production and improved livestock management. Own funds was the source of additional investment for 12.2 per cent for land development, 7.32 per cent for improved crop production and 2.44 per cent for improved livestock management. Soft loan was the source of additional investment for 2.44 for irrigation facility and improved livestock management.

Marketing of the agricultural produce: The data regarding marketing of the agricultural produce in Mundal-1 Micro watershed is presented in Table 51. The results indicated that, cotton and marigold was sold to the extent of 100 per cent, green gram was sold to the extent of 99.77 per cent, horse gram was sold to extent of 80 per cent, jowar was sold to the extent of 86.67 per cent, paddy was sold to the extent of 76.67 per cent, red gram was sold to the extent of 90.54 per cent and sorghum was sold to the extent of 83.33.

Table 51. Marketing of the agricultural produce in Mundal-1 Micro watershed

Sl.No	Crops	Output obtained (q)	Output retained (q)	Output sold (q)	Output sold (%)	Avg. Price obtained (Rs/q)
1	Cotton	194.0	0.0	194.0	100.0	4744.44
2	Green gram	87.0	0.2	86.8	99.77	4600.0
3	Horse gram	5.0	1.0	4.0	80.0	3000.0
4	Jowar	60.0	8.0	52.0	86.67	2250.0
5	marigold	5.0	0.0	5.0	100.0	4000.0
6	Paddy	30.0	7.0	23.0	76.67	1550.0
7	Red gram	148.0	14.0	134.0	90.54	3637.5
8	Sorghum	30.0	5.0	25.0	83.33	2250.0

Marketing Channels used for sale of agricultural produce: The data regarding marketing channels used for sale of agricultural produce in Mundal-1 Micro watershed is presented in Table 52. The results indicated that, about 2.50 per cent of the farmers sold their produce to agent/traders and cooperative marketing society, 70 per cent of the farmers sold their produce to local/village merchant and 17.50 per cent of the farmers sold their produce to regulated market.

Table 52. Marketing Channels used for sale of agricultural produce in Mundal-1 Micro watershed

Sl.No.	Particulars	LL (5)		MF (22)		SF (7)		SMF (6)		All (40)	
		N	%	N	%	N	%	N	%	N	%
1	Agent/Traders	0	0	1	4.55	0	0	0	0	1	2.50
2	Local/village Merchant	0	0	19	86.36	7	100	2	33.33	28	70
3	Regulated Market	0	0	2	9.09	1	14.29	4	66.67	7	17.50
4	Cooperative marketing Society	0	0	1	4.55	0	0	0	0	1	2.50

Mode of transport of agricultural produce: The data regarding mode of transport of agricultural produce in Mundal-1 Micro watershed is presented in Table 53. The results indicated that, 22.50 per cent of the households have used truck and 70 per cent of the households used tractor as a mode of transportation.

Table 53. Mode of transport of agricultural produce in Mundal-1 Micro watershed

Sl.No.	Particulars	LL (5)		MF (22)		SF (7)		SMF (6)		All (40)	
		N	%	N	%	N	%	N	%	N	%
1	Cart	0	0	3	13.64	5	71.43	1	16.67	9	22.50
2	Tractor	0	0	20	90.91	3	42.86	5	83.33	28	70

Incidence of soil and water erosion problems: The data regarding incidence of incidence of soil and water erosion problems in Mundal-1 Micro watershed is presented in Table 54. The results indicated that, 67.5 per cent have shown interest in soil test.

Table 54. Incidence of soil and water erosion problems in Mundal-1 Micro watershed

Sl. No.	Particulars	LL (5)		MF (22)		SF (7)		SMF (6)		All (40)	
		N	%	N	%	N	%	N	%	N	%
1	Soil and water erosion problems in the farm	0	0	20	90.91	5	71.43	2	33.33	27	67.50

Interest shown towards soil testing: The data regarding Interest shown towards soil testing in Mundal-1 Micro watershed is presented in Table 55. The results indicated that, 85 per cent have shown interest in soil test.

Table 55. Interest shown towards soil testing in Mundal-1 Micro watershed

Sl.No.	Particulars	LL (5)		MF (22)		SF (7)		SMF (6)		All (40)	
		N	%	N	%	N	%	N	%	N	%
1	Interest in soil test	0	0	21	95.45	7	100	6	100	34	85

Usage pattern of fuel for domestic use: The data regarding usage pattern of fuel for domestic use in Mundal-1 Micro watershed is presented in Table 56. The results indicated that, 2.5 per cent of the households used dung cake, 85 per cent of the households used fire wood and 12.5 per cent of the households used LPG as a source of fuel.

Table 56. Usage pattern of fuel for domestic use in Mundal-1 Micro watershed

Sl.No.	Particulars	LL (5)		MF (22)		SF (7)		SMF (6)		All (40)	
		N	%	N	%	N	%	N	%	N	%
1	Dung Cake	0	0	1	4.55	0	0	0	0	1	2.50
2	Fire Wood	5	100	19	86.36	5	71.43	5	83.33	34	85
3	LPG	0	0	2	9.09	2	28.57	1	16.67	5	12.50

Source of drinking water: The data regarding source of drinking water in Mundal-1 Micro watershed is presented in Table 57. The results indicated that, piped supply was the major source of drinking water for 95 per cent and 5 per cent of the households used used bore well in the micro watershed.

Table 57. Source of drinking water in Mundal-1 Micro watershed

Sl.No.	Particulars	LL (5)		MF (22)		SF (7)		SMF (6)		All (40)	
		N	%	N	%	N	%	N	%	N	%
1	Piped supply	5	100	20	90.91	7	100	6	100	38	95
2	Bore Well	0	0	2	9.09	0	0	0	0	2	5

Source of light: The data regarding source of light in Mundal-1 Micro watershed is presented in Table 58. The results indicated that, Electricity was the major source of light for 100 per cent of the households in micro watershed.

Table 58. Source of light in Mundal-1 Micro watershed

Sl.No.	Particulars	LL (5)		MF (22)		SF (7)		SMF (6)		All (40)	
		N	%	N	%	N	%	N	%	N	%
1	Electricity	5	100	22	100	7	100	6	100	40	100

Existence of Sanitary toilet facility: The data regarding existence of sanitary toilet facility in Mundal-1 Micro watershed is presented in Table 59. The results indicated that, 40 per cent of the households possess sanitary toilet facility.

Table 59. Existence of Sanitary toilet facility in Mundal-1 Micro watershed

Sl.No.	Particulars	LL (5)		MF (22)		SF (7)		SMF (6)		All (40)	
		N	%	N	%	N	%	N	%	N	%
1	Sanitary toilet facility	4	80	7	31.82	3	42.86	2	33.33	16	40

Possession of PDS card: The data regarding possession of PDS card in Mundal-1 Micro watershed is presented in Table 60. The results indicated that, 100 per cent of the sampled households possessed BPL cards.

Table 60. Possession of PDS card in Mundal-1 Micro watershed

Sl.No.	Particulars	LL (5)		MF (22)		SF (7)		SMF (6)		All (40)	
		N	%	N	%	N	%	N	%	N	%
1	BPL	5	100	22	100	7	100	6	100	40	100

Participation in NREGA program: The data regarding participation in NREGA programme in Mundal-1 Micro watershed is presented in Table 61. The results indicated that, 95 per cent of the households participated in NREGA programme.

Table 61. Participation in NREGA programme in Mundal-1 Micro watershed

Sl.No.	Particulars	LL (5)		MF (22)		SF (7)		SMF (6)		All (40)	
		N	%	N	%	N	%	N	%	N	%
1	Participation in NREGA programme	5	100	21	95.45	6	85.71	6	100	38	95

Table 62. Adequacy of food items in Mundal-1 Micro watershed

Sl.No.	Particulars	LL (5)		MF (22)		SF (7)		SMF (6)		All (40)	
		N	%	N	%	N	%	N	%	N	%
1	Cereals	3	60	22	100	7	100	5	83.33	37	92.50
2	Pulses	3	60	22	100	7	100	4	66.67	36	90
3	Oilseed	0	0	4	18.18	2	28.57	1	16.67	7	17.50
4	Vegetables	1	20	13	59.09	2	28.57	5	83.33	21	52.50
5	Milk	1	20	22	100	5	71.43	5	83.33	33	82.50
6	Egg	1	20	16	72.73	5	71.43	4	66.67	26	65
7	Meat	1	20	7	31.82	4	57.14	1	16.67	13	32.50

Adequacy of food items: The data regarding adequacy of food items in Mundal-1 Micro watershed is presented in Table 62. The results indicated that, cereals were adequate for 92.5 per cent of the households, pulses were adequate for 90 per cent, oilseeds were adequate for 17.5 per cent, vegetables were adequate for 52.5 per cent, milk were adequate for 82.5 per cent and egg were adequate for 65 per cent and meat were adequate for 32.5 per cent of the households.

Response on Inadequacy of food items: The data regarding inadequacy of food items in Mundal-1 Micro watershed is presented in Table 63. The results indicated that, cereals

were inadequate for 7.5 per cent of the households, pulses were inadequate for 10 per cent, oilseed were inadequate for 82.5 per cent, vegetables were inadequate for 47.5 per cent, fruits were inadequate for 97.5 per cent, milk were inadequate for 17.50 per cent, egg were inadequate for 32.5 per cent and meat were inadequate for 67.5 per cent of the households.

Table 63. Response on Inadequacy of food items in Mundal-1 Micro watershed

Sl.No.	Particulars	LL (5)		MF (22)		SF (7)		SMF (6)		All (40)	
		N	%	N	%	N	%	N	%	N	%
1	Cereals	2	40	0	0	0	0	1	16.67	3	7.50
2	Pulses	2	40	0	0	0	0	2	33.33	4	10
3	Oilseed	5	100	18	81.82	5	71.43	5	83.33	33	82.50
4	Vegetables	4	80	9	40.91	5	71.43	1	16.67	19	47.50
5	Fruits	5	100	21	95.45	7	100	6	100	39	97.50
6	Milk	4	80	0	0	2	28.57	1	16.67	7	17.50
7	Egg	4	80	6	27.27	2	28.57	1	16.67	13	32.50
8	Meat	4	80	15	68.18	3	42.86	5	83.33	27	67.50

Farming constraints: The data regarding farming constraints experienced by households in Mundal-1 Micro watershed is presented in Table 64. The results indicated that, lower fertility status of the soil and wild animal menace on farm field was the constraint experienced by 90 per cent of the households, frequent incidence of pest and diseases and Lack of transport for safe transport of the Agril produce to the market (87.5%), Inadequacy of irrigation water (35 %), high cost of fertilizer and plant protection chemicals, high rate of interest on credit and Low price for the agricultural commodities (82.5%), lack of marketing facilities in the area (62.5%), inadequate extension service (15%), less rainfall (12.5%) and Source of Agri-technology information (7.5%).

Table 64. Farming constraints Experienced in Mundal-1 Micro watershed

Sl.No.	Particulars	LL(5)		MF (22)		SF (7)		SMF(6)		All (40)	
		N	%	N	%	N	%	N	%	N	%
1	Lower fertility status of the soil	1	20	22	100	7	100	6	100	36	90
2	Wild animal menace on farm field	1	20	22	100	7	100	6	100	36	90
3	Frequent incidence of pest and diseases	1	20	22	100	6	85.71	6	100	35	87.50
4	Inadequacy of irrigation water	0	0	10	45.45	3	42.86	1	16.67	14	35
5	High cost of Fertilizers and plant protection chemicals	1	20	22	100	4	57.14	6	100	33	82.50
6	High rate of interest on credit	1	20	22	100	4	57.14	6	100	33	82.50
7	Low price for the agricultural commodities	2	40	22	100	5	71.43	4	66.67	33	82.50
8	Lack of marketing facilities in the area	1	20	13	59.09	5	71.43	6	100	25	62.50
9	Inadequate extension services	0	0	2	9.09	3	42.86	1	16.67	6	15
10	Lack of transport for safe transport of the Agril produce to the market.	1	20	22	100	6	85.71	6	100	35	87.50
11	Less rainfall	0	0	1	4.55	2	28.57	2	33.33	5	12.50
12	Source of Agri-technology information	0	0	1	4.55	1	14.29	1	16.67	3	7.50

Chapter 5

SUMMARY AND IMPLICATIONS

In order to assess the socio-economic condition of the farmers in the watershed 40 households located in the micro watershed were interviewed for the survey. The survey was conducted in Mundal-1 is located at $16^0$47'57.577'' to 16^0 45'44.961'' and East longitude 77^0 6'21.991'' to $77^0$5'11.137'' covering an area of about 487.74 ha coming under Mudhanala, Bheemanagara and Yadgiri B villages of Yadagiri taluk.

Socio-economic analysis indicated that, out of the total sample of 40 respondents, 5 (12.5%) were landless, 22 (55%) were marginal, 7 (17.5%) were small farmers and 6 (15%) were semi medium farmers. The population characteristics of households indicated that, there were 122 (58.94%) men and 85 (41.06%) women among the sampled households. The average family size of landless farmers' was 4, marginal farmers' was 5.5, small farmers' was 5.6 and semi medium farmers' was 4.5. Majority of the respondents 52 (25.12%) people were in 0-15 years of age, 86 (41.55%) were in 16-35 years of age, 55 (26.57%) were in 36-60 years of age and 14 (6.76%) were above 61 years of age. Education level of the sample households indicated that, majority there were 47.83 per cent illiterates, 10.14 per cent of them had primary school, 10.63 per cent of them had Middle school education, 19.81 per cent of them had high school, 6.28 per cent of them had PUC, 4.83 per cent of them had degree and 0.48 per cent of them had masters education. About, 12.50 per cent of household heads were practicing agriculture, 85 per cent of the household heads were agricultural labourers and 2.50 per cent of the household heads were government services. Agriculture was the major occupation for 5.8 per cent of the household members, 46.86 per cent were agricultural labourers, 0.48 per cent were general labour, 1.45 per cent were government service, 1.93 per cent were were private service, 28.5 per cent student and 2.90 per cent were housewives and children. 100 per cent of the population in the micro watershed has not participated in any local institutions.

In the study area, 15 per cent of the households possess thatched, 40 per cent of the households possess katcha house and 45 per cent of the households possess pucca/RCC. The durable assets owned by the households showed that, 70 per cent of the households possess TV, 42.5 per cent of the households possess mixer/grinder and motor cycle, 7.5 per cent of the households possess refrigerator, 2.5 per cent of the households posses auto and 87.5 per cent of the households possess mobile phones. Farm implements owned by the households indicated that, 25 per cent each of the households possess bullock cart, 35 per cent each of the households possess plough and weeder, 2.50 per cent of the households possess seed/fertilizer drill, sprinkler and harvester, and 12.5 per cent of the households possess sprayer. Regarding livestock possession by the households, 30 per cent of the households possess bullocks, 5 per cent of the households possess local cow,

buffalo, goat and poultry birds, 2.50 per cent of the households possess crossbreed cow, sheep and pigs.

The average own labour men available in the micro watershed was 1.75, average own labour (women) available was 1.44, average hired labour (men) available was 8.3 and average hired labour (women) available was 8.55.

Out of the total land holding of the sample respondents 32.43 ha (95.25%) of dry land and 1.62 ha (4.75%) of irrigated land. Marginal farmers possess 11.85 ha (100%) of dry land. Small farmers possess 9.9 ha (100%) of dry land. Semi medium farmers possess 10.68 ha (86.83%) of dry land and 1.62 ha (13.17 %) of irrigated land. There were 1 functioning and de-functioning bore wells in the micro watershed. There were 1 functioning and de-functioning open wells in the micro watershed. Bore well and open well was the major irrigation source in the micro water shed for 2.5 per cent of the farmers. The major crops have grown cotton (10.62%), green gram (6.83 ha), horse gram (0.46 ha), jowar (3.44 ha), marry gold (0.13 ha), paddy (0.94 ha), red gram (7.06 ha), sorghum (1.2 ha). The cropping intensity in micro watershed was found to be 97.36 per cent.

The sample households possessed 82.50 per cent of the households have bank account and 50 per cent have savings. About 15 per cent of the households have availed credit from different sources. The sample households have borrowed 25 per cent from commercial and cooperative bank, 6.25 per cent of the households have borrowed from friends/relatives and SHGs/CBOs. The average credit amount borrowed by households in micro-watershed was Rs. 30,875. The households possessed, 83.33 per cent of the households borrowed from institutional sources for the purpose of agricultural production. The households possessed, 50 per cent of the households borrowed from Private sources for the purpose of agricultural production. The households possessed, 50 per cent of the households fully paid and do not repay their loan from institutional sources. The households possessed, 25 per cent opined that the loan amount borrowed from helped to perform timely agricultural operations, 12.5 per cent opined that the loan amount borrowed from easy accessibility of credit and forced to sell the produce at low price to repay loan in time and 37.5 per cent opined that the loan amount borrowed from higher rate of interest. The households possessed, 100 per cent opined that the loan amount borrowed from forced to sell the produce at low price to repay loan in time.

The per hectare cost of cultivation for Cotton, Green gram, Red gram, Horse gram, Jowar, paddy and Sorghum was Rs. 28607.12, 94010.18, 49250.98, 53641.09, 33369.24, 81933.24 and 24536.53 with benefit cost ratio of 1:3.05, 1:0.94, 1:2.04, 1:0.61, 1:1.36, 1:0.59 and 1:1.08, respectively.

Further, 20 per cent of the households opined that dry fodder was adequate, 7.50 per cent of the households opined that dry fodder was inadequate, 10 per cent of the

households opined that green fodder was adequate and 5 per cent of the households opined that green fodder was inadequate.

The average annual gross income was Rs. 87,545.45 for marginal farmers, for small farmers it was Rs. 139,428.57 and semi medium farmers it was Rs. 109,583.33. The average annual expenditure is Rs. 7,982.72. For marginal farmers it was Rs. 6,505.92, for small farmers it was Rs. 6,442.18and for semi medium farmers it was Rs. 21,847.22.

Sampled households have planted 2 coconut trees in their field to cultivate horticultural crops. Households have planted 1 eucalyptus and tamarind, 49 neem and 4 banyan trees in their field and also 1 neem trees in their backyard to cultivate forest species.

Households have an average investment capacity of Rs. 1,150 for land development, Rs. 125 for irrigation facility, Rs.600 for improved crop production and Rs.225 for improved livestock management. Source of funds for additional investment is concerned; loan from bank was the source of additional investment for 7.32 per cent for land development and 2.44 per cent for improved crop production and improved livestock managemnet. Own funds was the source of additional investment for 12.2 per cent for land development, 7.32 per cent for improved crop production and 2.44 per cent for improved livestock management. Soft loan was the source of additional investment for 2.44 for irrigation facility and improved livestock management.

Regarding marketing channels, 2.50 per cent of the farmers sold their produce to agent/traders and cooperative marketing society, 70 per cent of the farmers sold their produce to local/village merchant and 17.50 per cent of the farmers sold their produce to regulated market. Further, 22.50 per cent of the households have used truck and 70 per cent of the households used tractor as a mode of transportation.

Majority of the households 67.5 per cent have shown incidence of soil and water erosion problems. The household possess, (85%) were interested towards soil testing. and 12.5 per cent of the households used LPG as a source of fuel. piped supply was the major source of drinking water for 95 per cent and 5 per cent of the households used used bore well in the micro watershed. Electricity was the major source of light for 100 per cent of the households. In the study area, 40 per cent of the households possess toilet facility. Regarding possession of PDS card, 100 per cent of the households possessed BPL card. cereals were adequate for 92.5 per cent of the households, pulses were adequate for 90 per cent, oilseeds were adequate for 17.5 per cent, vegetables were adequate for 52.5 per cent, milk were adequate for 82.5 per cent and egg were adequate for 65 per cent and meat were adequate for 32.5 per cent of the households. Cereals were inadequate for 7.5 per cent of the households, pulses were inadequate for 10 per cent, oilseed were inadequate for 82.5 per cent, vegetables were inadequate for 47.5 per cent, fruits were inadequate for 97.5 per cent, milk were inadequate for 17.50 per cent, egg were

inadequate for 32.5 per cent and meat were inadequate for 67.5 per cent of the households.

Farming constraints experienced by households in the micro watersheds were lower fertility status of the soil and wild animal menace on farm field was the constraint experienced by 90 per cent of the households, frequent incidence of pest and diseases and Lack of transport for safe transport of the Agril produce to the market (87.5%), Inadequacy of irrigation water (35 %), high cost of fertilizer and plant protection chemicals, high rate of interest on credit and Low price for the agricultural commodities (82.5%), lack of marketing facilities in the area (62.5%), inadequate extension service (15%), less rainfall (12.5%) and Source of Agri-technology information (7.5%).

Implications of the survey

- ✓ Result indicated that, there were 47.83 per cent were illiterate hence; extension methodologies such as demonstration, street play, drama, video shows will be effective in dissemination of the technologies in the micro watershed.
- ✓ The data indicate that, 45 per cent of the households possess pucca/RCC house. Hence, the development department while implementing the watershed plan should focus on agriculture to enhance the productivity of major crops in the area to increase the income of the farmers.
- ✓ Results indicated that the local institutional participation of the household members in the micro watershed is minimal hence, activities like membership campaign, awareness creation about the benefits of membership in local institutions and strengths of organized groups must be conveyed.
- ✓ Majority of the households in the watershed have experience in use of mobile phones, and television hence, these mass media can be effectively utilized for transfer of technology as well as for information dissemination.
- ✓ The farm machinery/implement possession in the micro watershed was found to be minimum the reasons may lack of knowledge or lack of financial ability which can be addressed through training on use of different farm implements, providing information on different sources of finance for purchase of farm implements.
- ✓ The possession of livestock such as crossbred cow found is less hence, farmers must be made aware of the benefits of crossbred cow in increased milk production.
- ✓ The possession of livestock such as sheep, goat and poultry was found to be low hence, farmers may be informed the role of subsidiary enterprises in enhancing the income and information on financial support for subsidiary activities.
- ✓ The data indicate that, job/work was the reason for all the migrants hence, farmers may be trained on profitable agriculture or self employment such has animal husbandry, plate making, sheep rearing, goat rearing, rabbit rearing with suitable information on sources of financial support.

- ✓ The results indicate that there was a change in quality of life due to migration hence, the developmental departments should take actions to arrest migration and to improve the quality of the life in rural areas.
- ✓ Households possess 32.43 ha (95.25 %) of dry land and 1.62 ha (4.75 %) of irrigated land hence, the availability of the dry land agricultural technologies such as short duration crops, high yielding drought resistance crop varieties, drip irrigation technology and subsidy information will be helpful for the farmers to enhance the productivity of land and as well as farmers income.
- ✓ Few of the bore well and open well in micro watershed found non functional hence, farmers may be trained on possibility of bore well rejuvenation.
- ✓ Bore well and open was source of irrigation for 2.5 per cent of the households. Hence, in order to increase the area under irrigation as well as to increase the water use efficiency farmers may trained on drip irrigation and provides the information on subsidy for drip irrigation equipment's along with the information on different agencies which provides the financial assistance for drip irrigation.
- ✓ Farmers have grown horticulture species, 2 coconut trees in their field and forest species have planted 1 eucalyptus and tamarind, 49 neem and 4 banyan trees in their field and also 1 neem trees in their backyard. Hence, production technologies related to these crops can be made available to the farmers for better adoption.
- ✓ The cropping intensity in the micro watershed was found to be (97.36 %) hence; care must be taken by the implementing agency to bring uncultivated land into cultivation through suitable measures.
- ✓ Many of the household members have borrowed loan from cooperative banks which has higher rate of interest hence, farmers may be sensitized on the different sources of credit with lesser interest rate such SHGs etc.
- ✓ The results indicated the non availability of both green and dry fodder throughout the year hence, fodder development activities can be taken up in the micro watershed. The average annual gross income was Rs. 87,545.45 for marginal farmers, for small farmers it was Rs. 139,428.57 and semi medium farmers it was Rs. 109,583.33.
- ✓ Agriculture was found to be the major source of income for households hence; the development activities should focus on productivity enhancement, marketing arrangements and agricultural technology dissemination to have a direct impact on the farmers.
- ✓ The cultivation of forest species is found minimal hence; information and production technology related to agro-forestry and integrated farming system.
- ✓ The data indicated that, 85 per cent of the households have interest in soil testing hence, farmers must be provided with the information on various institutions which are involved in soil testing for the benefit of the farmers.

- ✓ Except summer ploughing the adoption of other soil and water conservation structures is minimum hence, the farmers in the micro watershed should be sensitized on the use of different conservation structures for soil water conservation.
- ✓ Cereals and pulses found be adequate for per cent of the households respectively hence, farm households and the farm women must be trained on importance of balanced nutrition and role of vegetable, milk, egg, meat in balanced diet.
- ✓ Lower fertility status of the soil and wild animal menace on farm field was the constraint experienced by 90 per cent of the households, frequent incidence of pest and diseases and Lack of transport for safe transport of the Agril produce to the market (87.5%), Inadequacy of irrigation water (35 %), high cost of fertilizer and plant protection chemicals, high rate of interest on credit and Low price for the agricultural commodities (82.5%), lack of marketing facilities in the area (62.5%), inadequate extension service (15%), less rainfall (12.5%) and Source of Agri-technology information (7.5%) were the major farming constraints experienced hence, these constraints must be addressed immediately for the welfare of the farmers. Awareness to be created among the farmers to approach nearest KVKs/RSKs and other developmental departments for technical and for subsidized inputs and utilize the well established regulated markets, approaching the contract firms, direct markets to avoid the involvement of middlemen.