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

BADAL (4D5B1R2d) MICROWATERSHED

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

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

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

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

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

ICAR-NBSS&LUP, Regional Centre, Bangalore has taken up a project sponsored by the Karnataka Watershed Development Project-II, (Sujala-III), Government of Karnataka funded by the World Bank under Component-1 Land Resource Inventry. This study was taken up to demonstrate the utility of such a database in reviewing, monitoring and evaluating all the land based watershed development programs on a scientific footing. To meet the requirements of various land use planners at grassroots level, the present study on "Land Resource Inventory and Socio-Economic Status of Farm Households for Watershed Planning and Development of Badal Microwatershed, 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: 29.04.2019

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PART-A

LAND RESOURCE INVENTORY

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EXECUTIVE SUMMARY

The land resource inventory of Badal Microwatershed was conducted using village cadastral maps and IRS satellite imagery on 1:7920 scale. The false colour composites of IRS imagery were interpreted for physiography and 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 587 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 572 ha in the microwatershed is covered by soils, 16 ha by others (water bodies). The salient findings from the land resource inventory are summarized briefly below.

- *The soils belong to 5 soil series and 6 soil phases (management units) and 4 land use class.*
- *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 250 m grid interval.*
- *Land suitability for growing 26 major agricultural and horticultural crops was assessed and maps showing the degree of suitability along with constraints were generated.*
- *Entire area in the microwatershed is suitable for agriculture.*
- *About 96 per cent area of the microwatershed has soils that are moderately deep to very deep (75 - >150 cm) and <1 per cent soils are shallow (25-50 cm).*
- *Entire area in the microwatershed has clayey soils at the surface.*
- *Entire area in the microwatershed is non gravelly (<15%).*
- *About 75 per cent area of the microwatershed is very high (>200 mm/m) in available water capacity, 21 per cent is medium (101-150 mm/m) and about one per cent area is very low (<50 mm/m) in available water capacity.*
- *Entire area in the microwatershed has very gently sloping (1-3% slope) lands.*
- *An area of about 96 per cent is moderately (e2) eroded and 1 per cent area is severely (e3) eroded.*

- *An area of about 19 per cent soils are slightly to moderately alkaline (pH 7.3-8.4) in soil reaction, 66 per cent soils are strongly alkaline (8.4 - 9.0) and 12 per cent very strongly alkaline (pH >9.0)*
- *The Electrical Conductivity (EC) of the soils in the entire area of the microwatershed is dominantly <2 dsm^{-1} indicating that the soils are non-saline.*
- *About 54 per cent of the soils are low (<0.5%) in organic carbon, 36 per cent medium (0.5-0.75%) and 8 per cent high (>0.75).*
- *About 54 per cent area is low in available phosphorus, 36 per area is medium (23-57 kg/ha) and 8 per cent is high (>57 kg/ha).*
- *About 11per cent is medium (145-337 kg/ha) in available potassium and 87 per cent is high (>337 kg/ha).*
- *Available sulphur is low (<10 ppm) in an area of about 46 per cent, medium (10 -20 ppm) in 51 per cent and high (>20 ppm) in 1 per cent area of the microwatershed.*
- *Available boron is low (<0.5 ppm) in an area of about 26 per cent, medium (0.5-1.0 ppm) in an area of 47 per cent and high (>1.0 ppm) in 24 per cent area.*
- *Available iron is sufficient (>4.5 ppm) in 24 per cent area and deficient in 74 per cent area of the microwatershed.*
- *Available manganese and copper are sufficient in all the soils of the microwatershed.*
- *Available zinc is deficient (<0.6 ppm) in an area of 96 per cent and sufficient (>0.6 ppm) in 2 per cent area of the microwatershed.*
- *The land suitability for 26 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	*332(57)*	*231(39)*	*Sapota*	-	-
Maize	-	*564(96)*	*Pomegranate*	-	*564(96)*
Bajra	-	*563(96)*	*Musambi*	*386(66)*	*178(30)*
Groundnut	-	*563(96)*	*Lime*	*386(66)*	*178(30)*
Sunflower	*278(47)*	*285(49)*	*Amla*	*332(57)*	*231(39)*
Redgram	-	*564(96)*	*Cashew*	-	-
Bengal gram	*440 (75)*	*124(21)*	*Jackfruit*	-	-
Cotton	*440(75)*	*124(21)*	*Jamun*	-	*440(75)*
Chilli	-	*456(78)*	*Custard apple*	*564(96)*	-
Tomato	-	-	*Tamarind*	-	*440(75)*
Drumstick	-	*564(96)*	*Mulberry*	-	-
Mango	-	-	*Marigold*	-	*564(96)*
Guava	-	-	*Chrysanthemum*	-	*564(96)*

- *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 to these problematic soils like saline/alkali, highly eroded, sandy soils etc.,*
- *Soil and water conservation treatment plan has been prepared that would help in identifying the sites to be treated and also the type of structures required.*
- *As part of the greening programme, several tree species have been suggested to be planted in marginal and submarginal lands, field bunds and also in the hillocks, mounds and ridges. This would help in 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

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

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

In this critical juncture, the challenge before us is not only to increase the productivity per unit area which is steadily declining and showing a fatigue syndrome, but also to prevent or at least reduce the severity of degradation. If the situation is not reversed at the earliest, then the sustainability of the already fragile crop production system and the overall ecosystem will be badly affected in the state. The continued neglect and unscientific use of the resources for a long time has led to the situation observed at present in the state. It is a known fact and established beyond doubt by many studies in the past that the cause for all kinds of degradation is the neglect and irrational use of the land resources. Hence, there is an urgent need to generate a detailed site-specific farm level database on various land resources for all the villages/watersheds in a time bound manner that would help to protect the valuable soil and land resources and also to stabilize the farm production.

Therefore, the land resource inventory required for farm level planning is the one which investigates not only the surface but also consider the other parameters which are critical for productivity *viz.*, soils, climate, water, minerals and rocks, topography, geology, hydrology, vegetation, crops, land use pattern, animal population, socio-economic conditions, infrastructure, marketing facilities and various schemes and developmental works of the government etc. From the data collected at farm level, the specific problems and potentials of the area can be identified and highlighted,

conservation measures required for the area can be planned on a scientific footing, suitability of the area for various uses can be worked out and finally viable and sustainable land use options suitable for each and every land holding can be prescribed.

The Land Resource Inventory is basically done for identifying the 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 other states.

The land resource inventory aims to provide site specific database for Badal microwatershed in Yadgir Taluk & 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 Badal microwatershed is located in the northern part of Karnataka in Yadgir Taluk & District, Karnataka State (Fig.2.1). It comprises parts of Gondedagi, Sangavara, Kondapura, Goodura and Badiyala villages. It lies between 16^0 29' and 16^0 31' North latitudes and 77^0 13' and 77^0 16' East longitudes covering an area of about 587 ha. It is about 37 km southeast of Yadgir town and is surrounded by Sangavara on the north, Kondapura on the west and east and Badiyala village on the southern side.

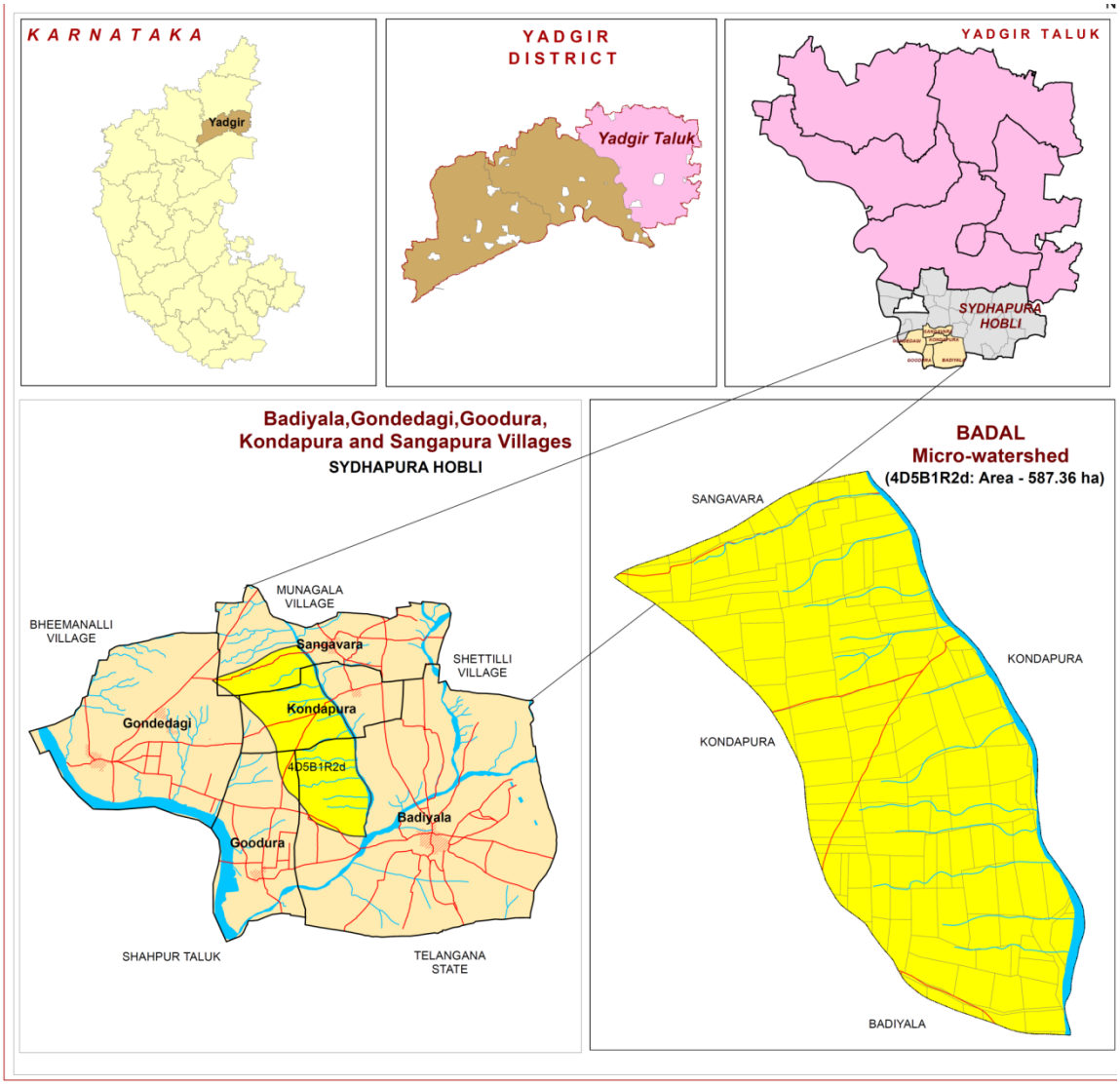


Fig.2.1 Location map of Badal Microwatershed

2.2 Geology

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

gray granite gneisses are highly weathered, fractured and fissured upto a depth of about 10 m. Dolerite dykes and quartz veins are common with variable width and found to occur in Badal microwatershed. 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.2.2a Granite and granite gneiss rocks

Fig. 2.2b Alluvium

2.3 Physiography

Physiographically, the area has been identified as granite gneiss and alluvial landscapes based on geology. The 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 344-363 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**		

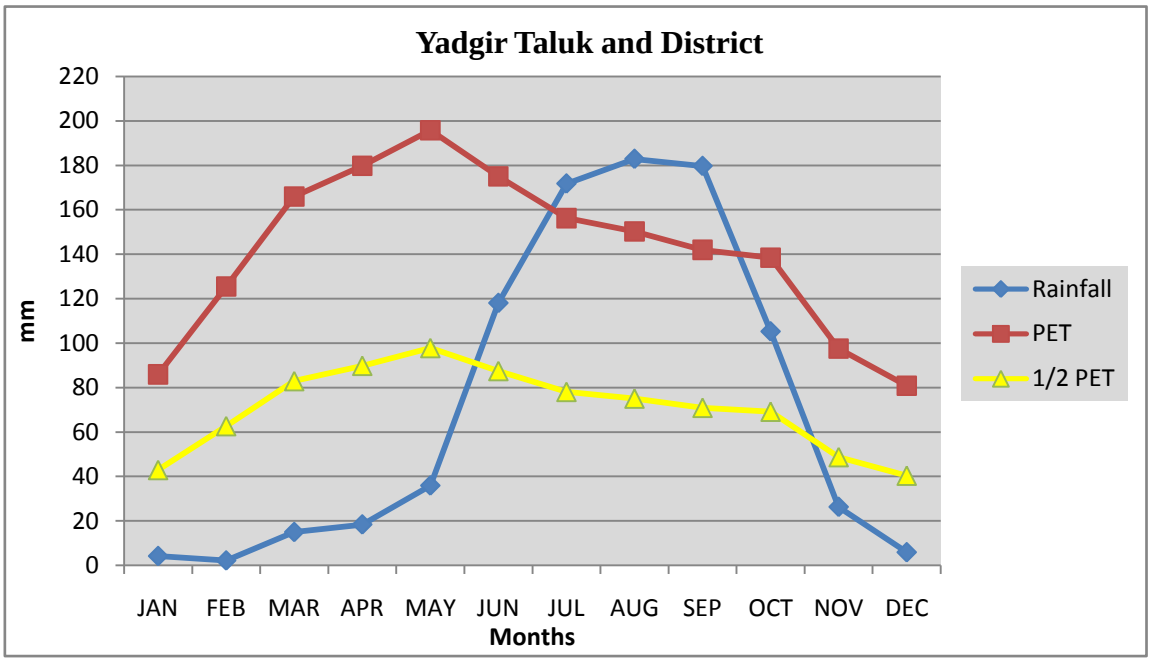


Fig 2.3 Rainfall distribution in Yadgir Taluk, Yadgir District

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, mango, pomegranate, marigold and sapota. 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 Badal microwatershed is presented in Fig.2.4. The different crops and cropping systems adopted in the microwatershed is presented in the Figures 2.5a & 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

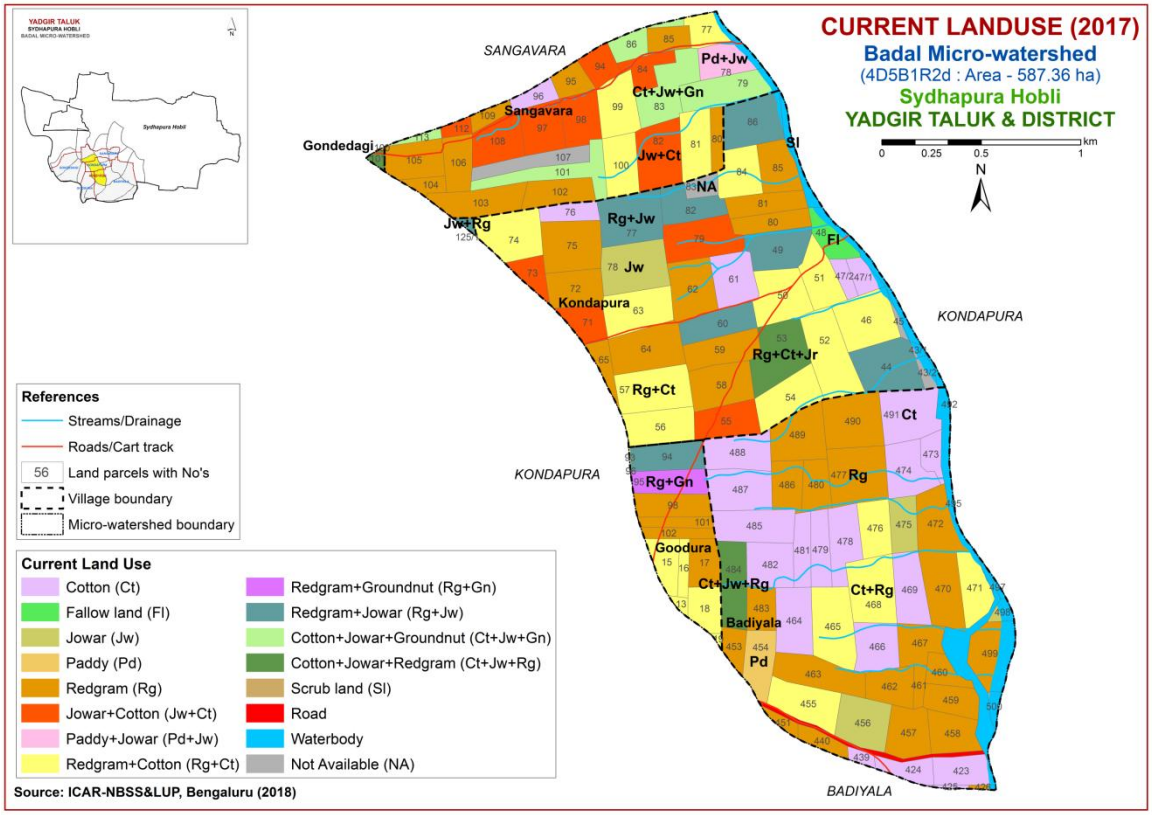


Fig.2.4 Current Land Use map of Badal Microwatershed

Fig 2.5 a. Different Crops and Cropping Systems in Badal Microwatershed

Fig 2.5 b. Different Crops and Cropping Systems in Badal Microwatershed

Chapter 3

SURVEY METHODOLOGY

The purpose of land resource inventory is to delineate similar areas (soil series and phases), which respond or expected to respond similarly to a given level of management. This was achieved in Badal microwatershed by the detailed study of all the soil characteristics (depth, texture, colour, structure, consistence, coarse fragments, porosity, soil reaction, soil horizons etc.) and site characteristics (slope 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 587 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 a 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 landscapes. 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

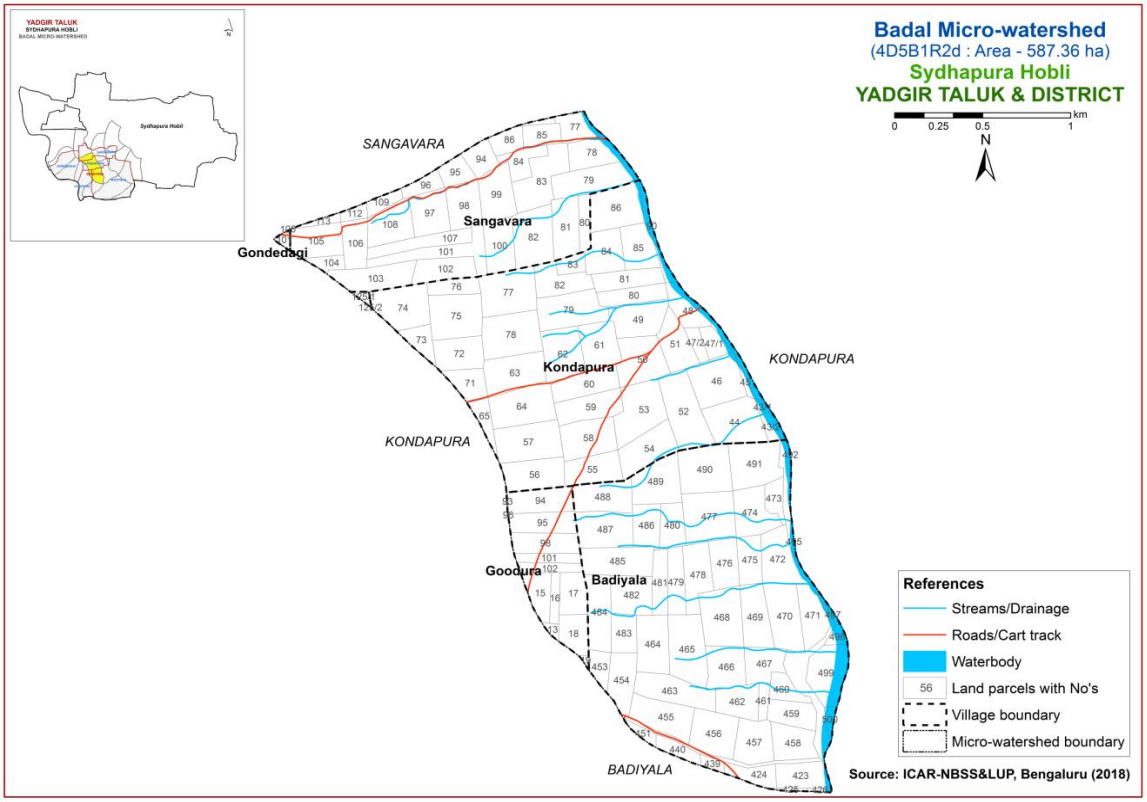


Fig 3.1 Scanned and Digitized Cadastral map of Badal Microwatershed

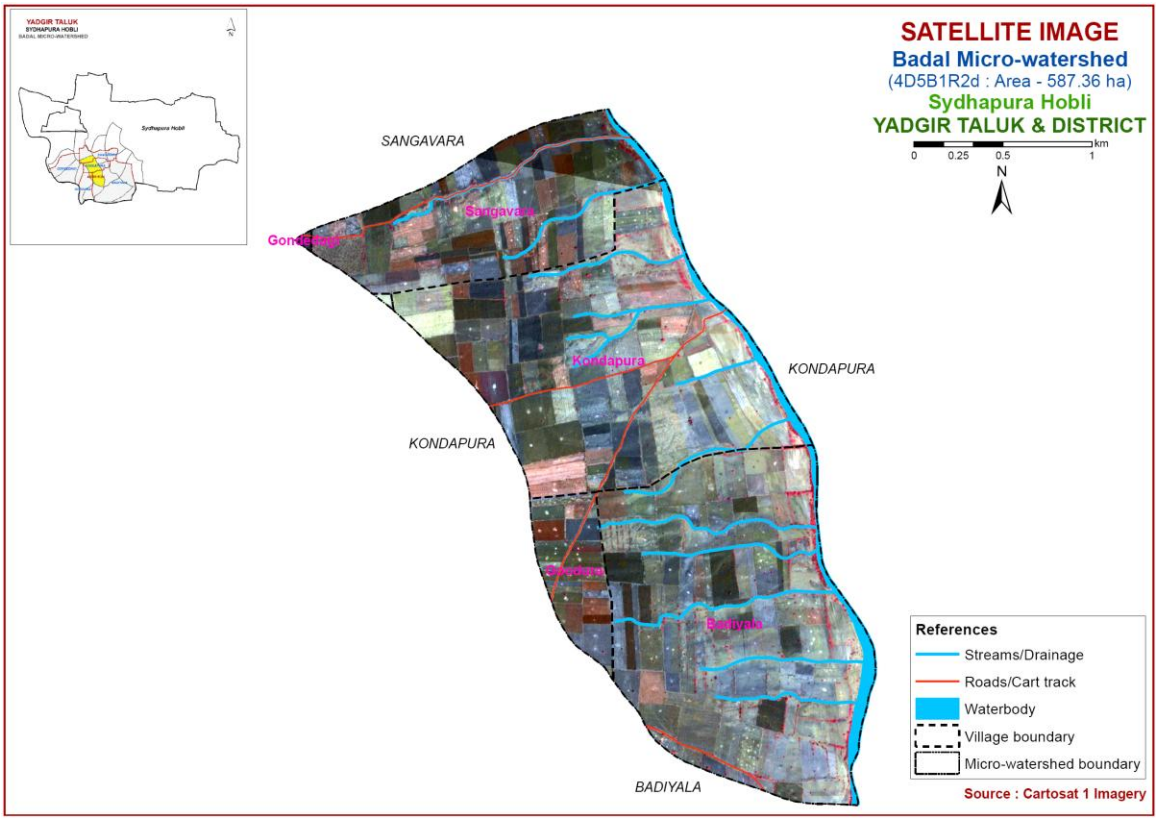


Fig.3.2 Satellite Image of Badal Microwatershed

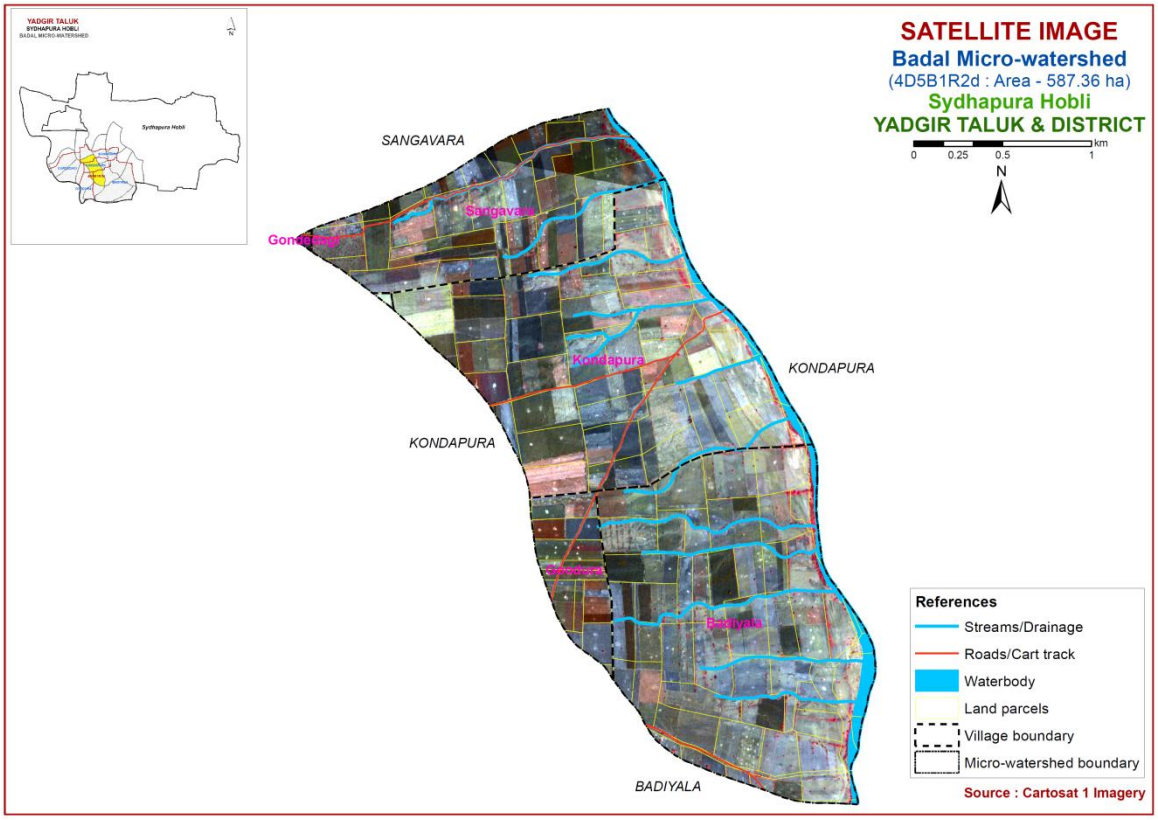


Fig.3.3 Cadastral map overlaid on IRS PAN+LISS IV merged imagery of Badal Microwatershed

3.3 Field Investigation

The field boundaries and survey numbers given on the cadastral sheet were located on the ground by following permanent features like roads, cart tracks, *nallas*, streams, tanks etc., and wherever changes were noticed, they were incorporated on the microwatershed cadastral map. Preliminary traverse of the microwatershed was carried out with the help of cadastral map, imagery and toposheets. While traversing, landforms and physiographic units identified were checked and preliminary soil legend was prepared by studying soils at few selected places. Then, intensive traversing of each physiographic unit like hills, ridges, uplands and 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).

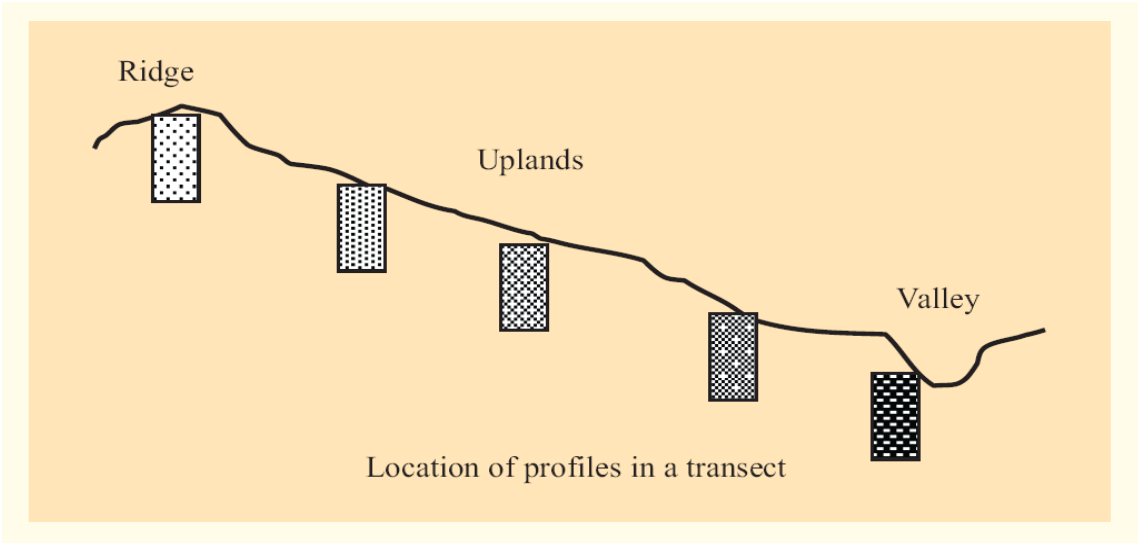


Fig: 3.4. Location of profiles in a transect

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, 5 soil series were identified in the Badal microwatershed.

Table 3.1 Differentiating Characteristics used for identifying Soil Series

(Characteristics are of Series Control Section)

Soils of Granite gneiss Landscape							
Sl. no	**Soil Series**	**Depth (cm)**	**Colour (moist)**	**Texture**	**Gravel (%)**	**Horizon sequence**	**Calcareous-ness**
Soil of Granite and Granite Gneiss Landscape							
1	BDL (Badiyala)	25-50	7.5YR 2.5/3,2.5/2,3/3 10YR 3/4,4/3	sl	-	Ap-Bw	e
2	GWD (Gowdagera)	75-100	10YR 3/1,3/2,4/2	scl	-	Ap-Bw	es
3	NGP (Naglapur)	100-150	10YR 3/2,3/1,2/1	c	-	Ap-Bss	es
4	TMK (Thumakur)	>150	10YR 3/1,3/2,3/3,4/3	c	-	Ap-Bw	e
Soils of Alluvial Landscape							
5	HGN (Hegganakera)	>150	10YR4/2,4/1,3/1,4/1	c	-	Ap-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 6 mapping units representing 5 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 6 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 6 soil phases identified and mapped in the microwatershed were grouped into 4 Land Management Units (LMU's) for the purpose of preparing a Proposed Crop Plan for sustained development of the microwatershed. The database (soil phases) generated

under LRI was utilized for identifying Land Management Units (LMU's) based on the management needs. One or more than one soil site characteristic having influence on the management have been choosen for identification and delineation of LMUs. For Badal 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 (57samples) for fertility status (major and micronutrients) at 250 m grid interval in the year 2017 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 Badal Microwatershed

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		**8 (1.34)**
6		BDLiB3	Sandy clay surface, slope 1-3%, severe erosion	8 (1.34)
	GWD	Gowdagera soils are moderately deep (75-100 cm), moderately well drained, have dark grayish brown to very dark grayish brown, calcareous sandy clay loam black soils occurring on very gently sloping uplands under cultivation		**124 (21.15)**
35		GWDiB2	Sandy clay surface, slope 1-3%, moderate erosion	124 (21.15)
	NGP	Nagalapur soils are deep (100-150 cm), moderately well drained, have very dark gray to very dark grayish brown, black calcareous cracking clay soils occurring on very gently sloping uplands under cultivation		**107 (18.3)**
48		NGPiB2	Sandy clay surface, slope 1-3%, moderate erosion	107 (18.3)
	TMK	Thumakur soils are very deep (>150 cm), moderately well drained, have brown to very dark grayish brown, slightly calcareous clay black soils occurring on nearly level to very gently sloping lowlands under cultivation		**54 (9.23)**
104		TMKiB2	Sandy clay surface, slope 1-3%, moderate erosion	54 (9.23)
Soils of Alluvial Landscape				
	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		**278 (47.35)**
93		HGNiB2	Sandy clay surface, slope 1-3%, moderate erosion	55 (9.43)
95		HGNmB2	Clay surface, slope 1-3%, moderate erosion	223 (37.92)
1000		Others	Water body	**16 (2.64)**

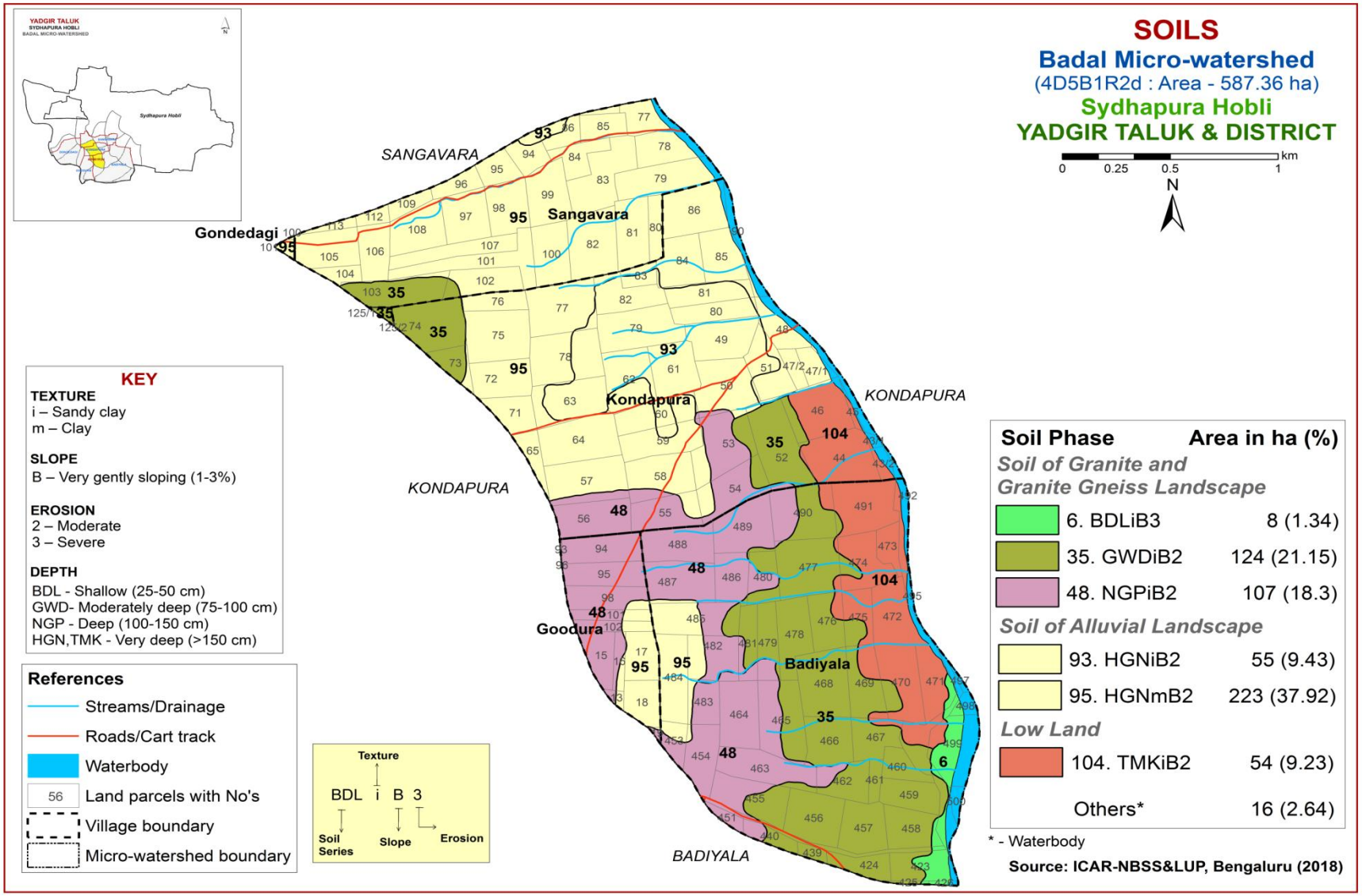


Fig 3.5 Soil Phase or Management Units - Badal Microwatershed

Chapter 4

THE SOILS

Detailed information pertaining to the nature, extent and their distribution of different kinds of soils occurring in Badal microwatershed is provided in this chapter. The microwatershed area has been identified as granite gneiss and alluvial landscapes based on geology. In all, 5 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, climate and time.

A brief description of each of the 5 soil series identified followed by 6 soil phases (management units) mapped are furnished below. The physical and chemical characteristics of soil series identified in Badal microwatershed are given in Table 4.1. 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, 4 soil series are identified and mapped. Of these, GWD series occupies maximum area of 124 ha (21%) followed by NGP 107 ha (18%), TMK 54 ha (9%) and BDL 8 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 to 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). Only one phase was identified and mapped.

Landscape and Soil Profile characteristics of Badiyala (BDL) Series

4.1.2 Gowdagera (GWD) Series: Gowdagera soils are moderately deep (75-100 cm), moderately well drained, very dark gray to dark grayish brown, calcareous sandy clay loam soils. They are developed from weathered granite gneiss and occur on very gently sloping uplands under cultivation. The Gowdagera series has been classified as a member of the fine-loamy, mixed (calcareous), isohyperthermic family of Typic Haplustepts.

The thickness of the solum ranges from 76 to 100 cm. The thickness of A horizon ranges from 8 to 16 cm. Its colour is in hue 10 YR with value 3 to 4 and chroma 2 to 4. Its texture varies from sandy loam to sandy clay loam. The thickness of B horizon ranges from 61 to 91 cm. Its colour is in hue 10 YR with value 2 to 4 and chroma 1 to 4. Its texture is sandy clay loam to sandy clay and is calcareous. The available water capacity is medium (101-150 mm/m). Only one phase was identified and mapped.

Landscape and Soil Profile characteristics of Gowdagera (GWD) Series

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

The thickness of the solum ranges from 110 to 150 cm. The thickness of A horizon ranges from 6 to 25 cm. Its colour is in 10 YR hue with value 3 to 5 and chroma 1 to 3. The texture varies from sandy loam to sandy clay and clay. The thickness of B horizon ranges from 110 to 141 cm. Its colour is in 10 YR hue with value 2 to 3 and chroma 1 to 2. Texture is clay and is calcareous. The available water capacity is very high (>200 mm/m). Only one phase was identified and mapped.

Landscape and Soil Profile characteristics of Naglapur (NGP) Series

4.1.4 Thumakur (TMK) Series: Thumakur soils are very deep (>150 cm), moderately well drained, have very dark gray to dark brown, slightly calcareous clay soils. They are developed from weathered granite gneiss and occur on nearly level to very gently sloping low lands under cultivation. The Thumakur series has been classified as a member of the fine, mixed, isohyperthermic family of Typic Haplustepts.

The thickness of the solum ranges from 150-200 cm. The thickness of A horizon ranges from 7 to 14 cm. Its colour is in 10 YR hue with value 3 to 5 and chroma 1 to 3. Texture varies from sandy loam to sandy clay and clay. The thickness of B horizon is >150 cm. Its colour is in 10 YR hue with value 3 to 5 and chroma 1 to 3. Texture varies from sandy clay to clay and is slightly calcareous. The available water capacity is very high (>200 mm/m). Only one phase was identified and mapped.

Landscape and Soil Profile characteristics of Thumakur (TMK) Series

4.2 Soils of Alluvial plains

In this landscape, only one soil series was identified and mapped. The Hegganakera (HGN) series occupies maximum area of 278 ha (47%). The brief description of the series identified and number of soil phases mapped is given below.

4.2.1 Hegganakera (HGN) Series: Hegganakera soils are very deep (>150 cm), moderately well drained, very dark gray to dark grayish brown, slightly calcareous cracking clay black 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 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 Badal microwatershed

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: Gowdagera (GWD) **Pedon:** R-13

Location: $16^0$38'24.4"N $77^0$21'24.0"E, Madhawara village, Balichakara hobli, Yadgir taluk and district

Analysis at: NBSS&LUP, Regional Centre, Bengaluru **Classification:** Fine-loamy, mixed (calcareous), 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	79.61	13.94	6.45	14.17	17.53	23.65	17.02	7.24	-	ls	11.36	3.86
18-42	BW1	69.09	10.58	21.06	10.54	16.58	22.01	14.43	5.53	-	scl	31.62	12.30
42-81	Bw2	51.37	13.51	35.60	7.59	10.55	16.24	11.60	5.38	-	sc	67.57	26.89

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-18	9.89	-	-	0.74	0.66	1.20	-	-	0.18	3.63	-	8.35	1.29	100	43.51
18-42	10.82	-	-	1.60	0.27	5.76	-	-	0.19	19.23	-	15.84	0.75	100	121.42
42-81	10.83	-	-	2.30	0.27	7.80	-	-	0.40	26.71	-	26.54	0.75	100	100.67

Contd...

Soil Series: Naglapur (NGP) **Pedon:** R-8

Location: $16^0$52'84.1"N $77^0$22'99.4"E, Gurumitkal village, Gurumitkal hobli, Yadgir taluk and district

Analysis at: NBSS&LUP, Regional Centre, Bengaluru **Classification:** Very fine, smectitic (calcareous), 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
0-10	Ap	7.53	19.88	72.59	1.00	0.78	0.89	2.10	2.77	-	c	44.31	32.79
10-35	Bss1	6.55	18.76	74.68	0.80	0.92	0.80	1.72	2.30	-	c	43.09	31.62
35-60	Bss2	6.58	21.05	72.37	0.69	0.46	1.04	1.50	2.89	-	c	46.52	32.52
60-102	Bss3	7.48	19.74	72.78	1.61	1.38	0.69	1.61	2.19	-	c	51.12	35.62

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	7.42	-	-	0.24	0.84	1.30	-	-	0.84	0.15	-	67.10	0.92	100	0.22
10-35	8.52	-	-	0.291	0.64	2.86	-	-	0.17	0.29	-	65.20	0.87	100	0.45
35-60	7.89	-	-	0.134	0.62	4.55	-	-	0.15	0.20	-	65.00	0.90	100	0.30
60-102	8.68	-	-	0.213	0.54	8.32	-	-	0.17	0.15	-	64.10	0.88	100	0.24

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:** 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 coars (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

Contd...

Soil Series: Thumakuru (TMK) **Pedon:** R-10

Location: $16^0$38'01.3"N $77^0$16'49.8"E, Kilankera village, Balichakra 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 coars (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	62.92	15.76	21.32	5.56	9.37	21.83	18.33	7.83	-	scl	17.98	6.60
12-29	Bw1	45.91	18.53	35.56	6.08	8.18	15.41	11.43	4.82	-	sc	33.40	11.79
29-74	Bw2	48.47	16.24	35.29	5.93	9.84	16.40	11.75	4.55	-	sc	28.66	11.19
74-132	Bw3	38.25	20.59	41.16	3.21	8.23	14.64	8.97	3.21	-	c	38.85	14.72
132-158	Bw4	36.87	19.99	43.14	3.54	7.61	13.08	8.57	4.07	-	c	44.36	15.75

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-12	9.60	-	-	0.35	0.48	1.44	-	-	0.23	3.62	-	21.83	1.02	100	16.57
12-29	9.72	-	-	1.27	0.50	1.44	-	-	0.59	20.88	-	30.50	0.86	100	68.48
29-74	9.16	-	-	3.44	0.31	3.72	-	-	0.38	25.84	-	28.68	0.81	100	90.10
74-132	9.33	-	-	2.52	0.23	4.92	-	-	0.82	20.25	-	34.99	0.85	100	57.87
132-158	9.23	-	-	2.07	0.31	3.48	-	-	0.70	21.03	-	34.24	0.79	100	61.41

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 6 soil map units identified in Badal microwatershed are grouped under 2 land capability classes and 3 land capability subclasses. An area of 572 ha (97%) in the microwatershed is suitable for agriculture and about 16 ha (1%) is covered by others (water body) (Fig. 5.1).

Good cultivable lands (Class II) cover an area of about 96 per cent and are distributed in the major part of the microwatershed with minor problems of soil, drainage/wetness and erosion. Fairly good cultivable lands (Class IV) cover an area of about 1 per cent and are distributed in the southern and southeastern part of the microwatershed with moderate problems of soil and erosion.

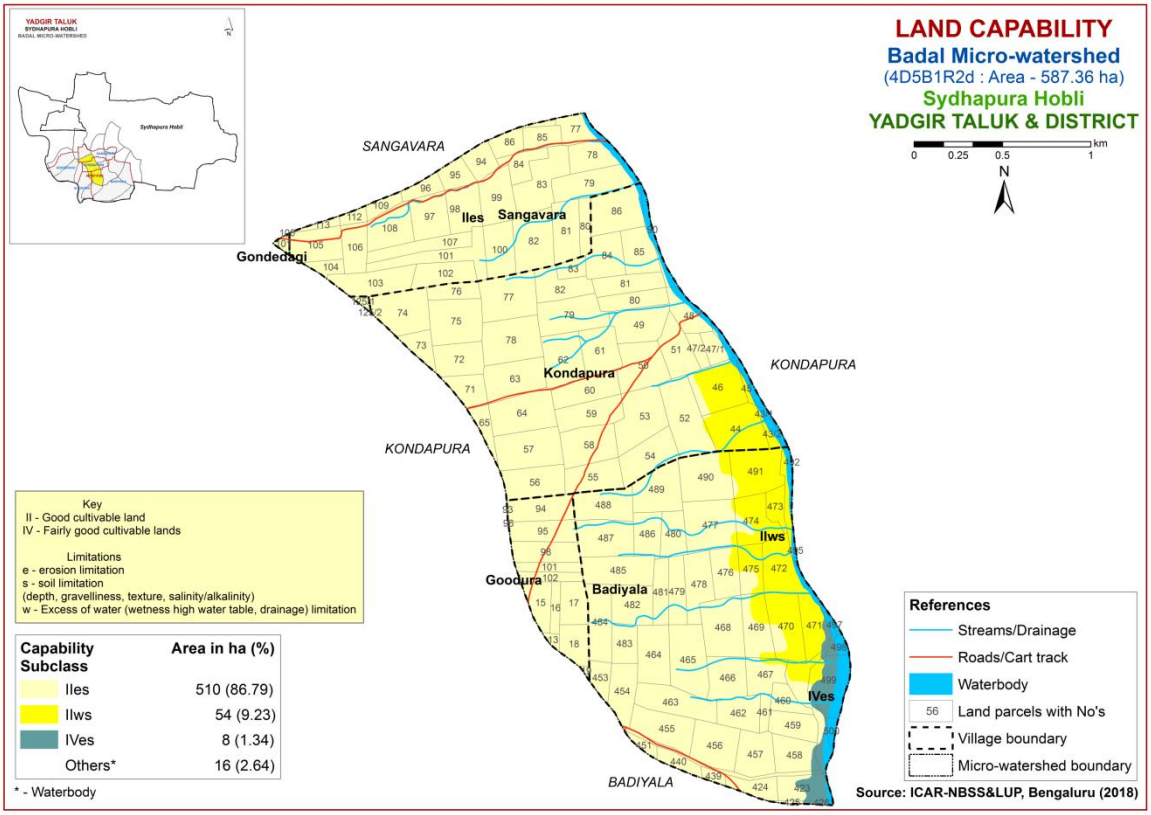


Fig. 5.1 Land Capability map of Badal Microwatershed

5.2 Soil Depth

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

Shallow (25-50 cm) soils occur in a small area of 8 ha (1%) and are distributed in the southern and southeastern part of the microwatershed. Moderately deep (75-100 cm) soils occupy an area of 124 ha (21%) and are distributed in all parts of the microwatershed. Deep (100-150 cm) soils occupy 107 ha (18%) area and are distributed in the western, central and southern part of the microwatershed. Very deep (>150 cm) soils cover maximum area of 332 ha (57%) and are distributed in all parts of the microwatershed.

The most productive lands 439 ha (75%) with respect to soil rooting depth where all climatically adapted annual and perennial crops can be grown are deep to very deep (100 to >150 cm depth) soils occurring in the major part of the microwatershed. The

problem soils occupy about only one per cent area where only short duration crops can be grown occasionally and the probability of crop failure is very high.

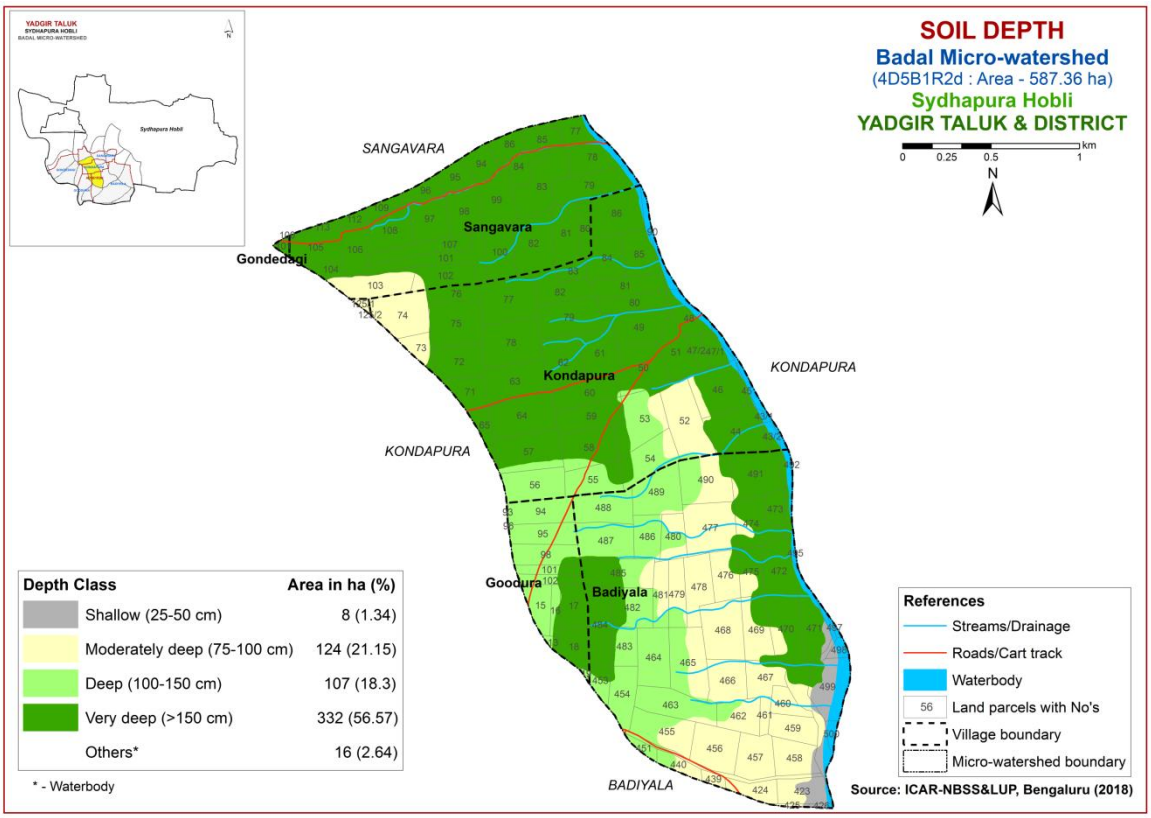


Fig. 5.2 Soil Depth map of Badal Microwatershed

5.3 Surface Soil Texture

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

Entire area of 572 ha (97%) of the microwatershed has soils that are clayey at the surface. These soils have high potential for soil-water retention and availability, and nutrient retention and availability, but have more problems of drainage, infiltration, workability and other physical problems.

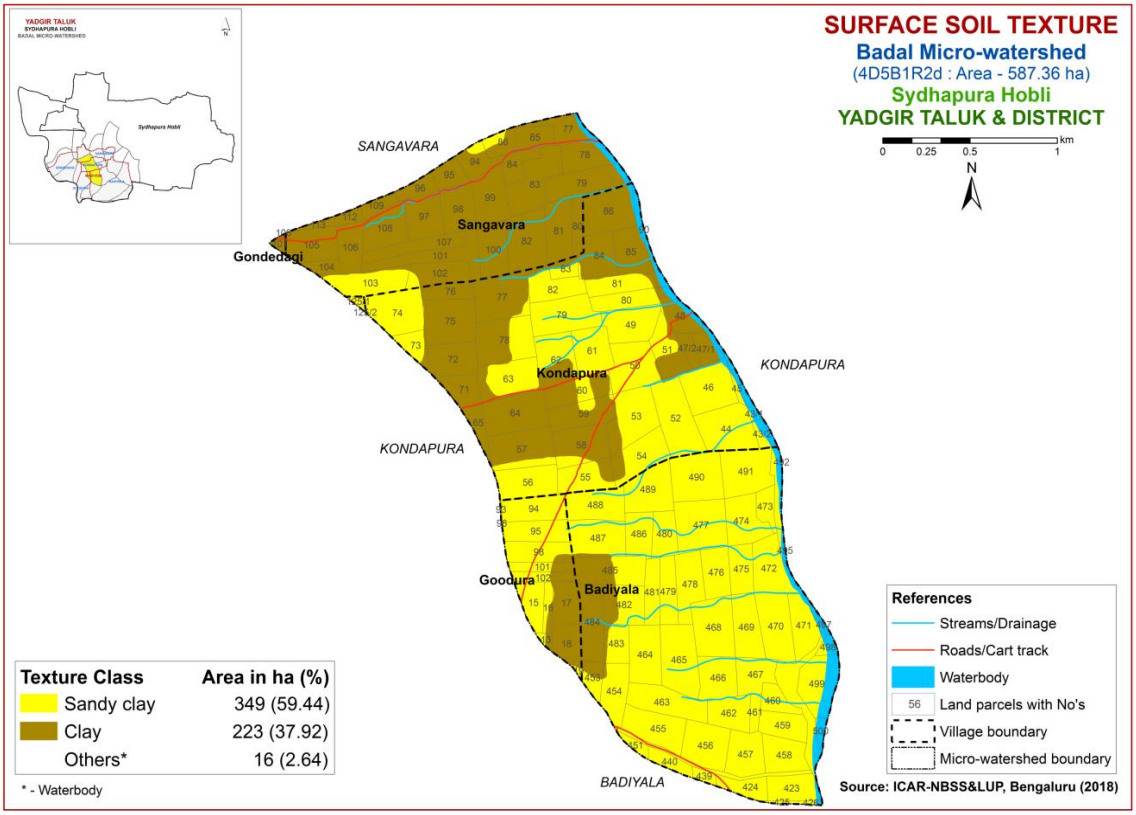


Fig. 5.3 Surface Soil Texture map of Badal Microwatershed

5.4 Soil Gravelliness

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

Non gravelly (<15%) soils cover entire 572 ha (97%) area of the microwatershed. These are the most productive soils, where all climatically adapted short and long duration crops can be grown.

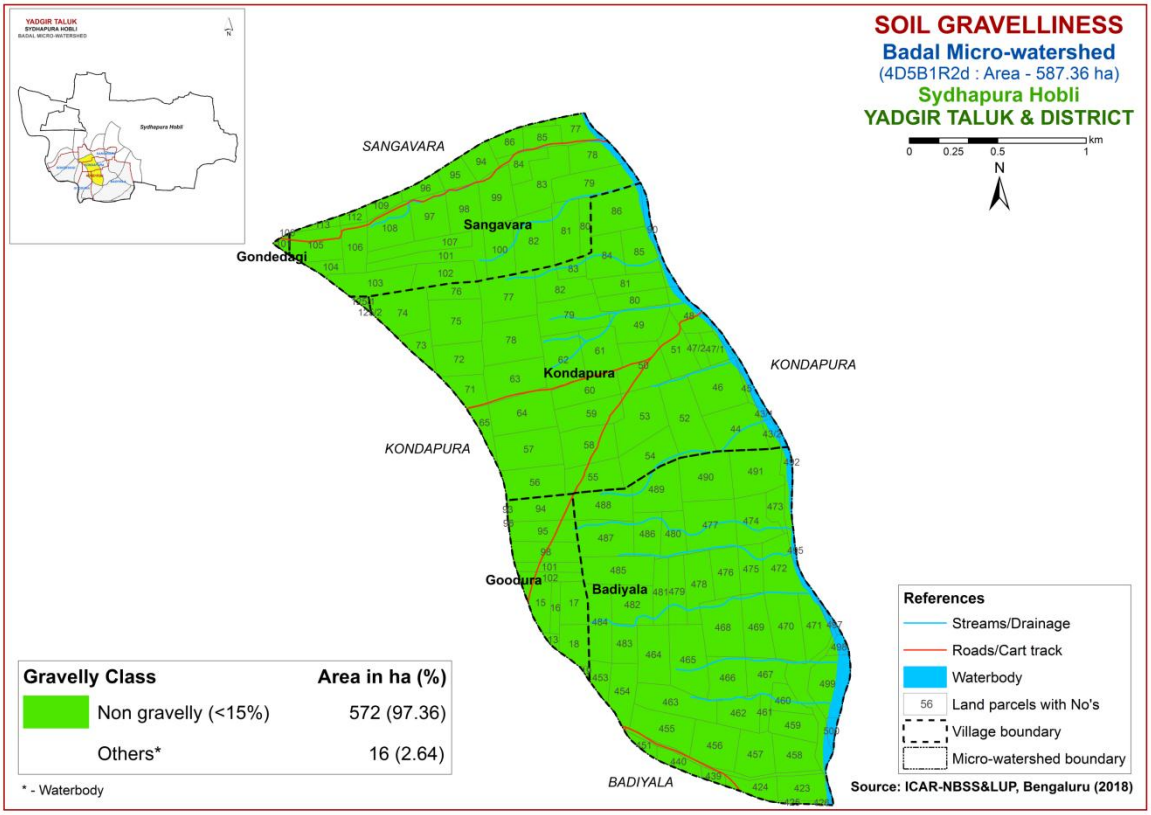


Fig. 5.4 Soil Gravelliness map of Badal Microwatershed

5.5 Available Water Capacity

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

Small area of about 8 ha (1%) in the microwatershed has soils that are very low (<50 mm/m) in available water capacity and are distributed in the southeastern and southern part of the microwatershed, An area of about 124 ha (21%) is medium (101-150 mm/m) in available water capacity and are distributed in the central, southern and northwestern part of the microwatershed. Very high (>200 mm/m) in 440 ha (75%) and are distributed in the major part of the microwatershed.

Small area of about 8 ha (1%) area 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 440 ha (75%) are potential areas with regard to AWC where all climatically adapted annual and perennial crops can be grown.

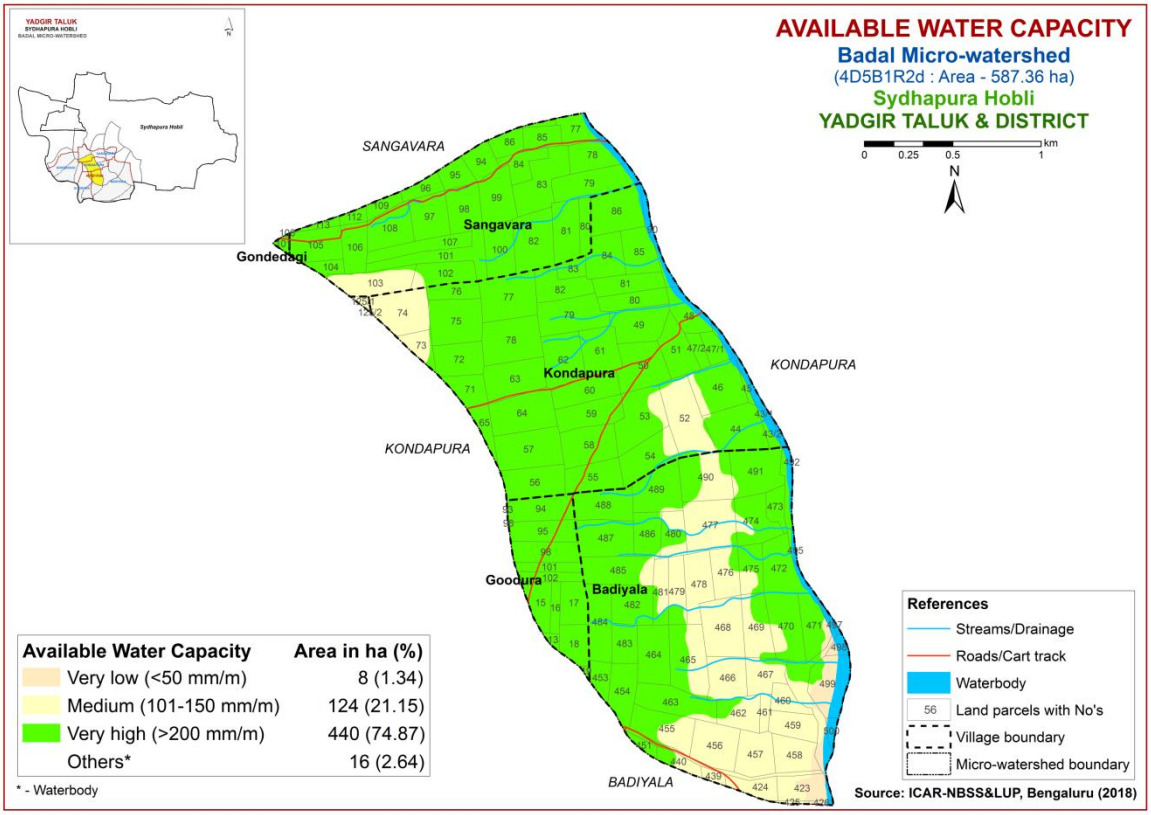


Fig. 5.5 Soil Available Water Capacity map of Badal Microwatershed

5.6 Soil Slope

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

Entire area of the microwatershed falls under very gently sloping (1-3% slope) lands and 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.

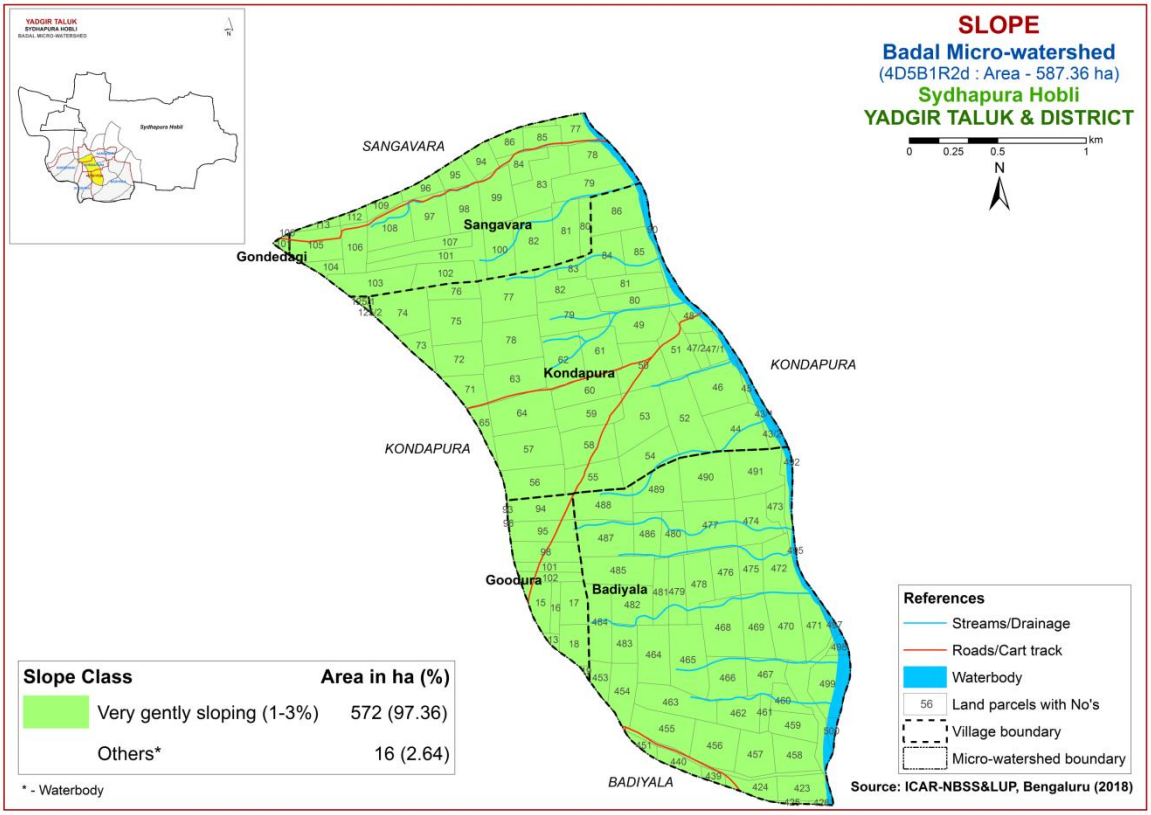


Fig. 5.6 Soil Slope map of Badal Microwatershed

5.7 Soil Erosion

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

Soils that are moderately eroded (e2 class) cover a maximum area of 564 ha (96%) and are distributed in all parts of the microwatershed. Severely eroded soils cover an area of 8 ha (1%) and are distributed in the southern and southeastern part of the microwatershed.

Entire area in the microwatershed is problematic because of moderate and severe erosion. For these areas, taking up of soil and water conservation and other land development measures are needed.

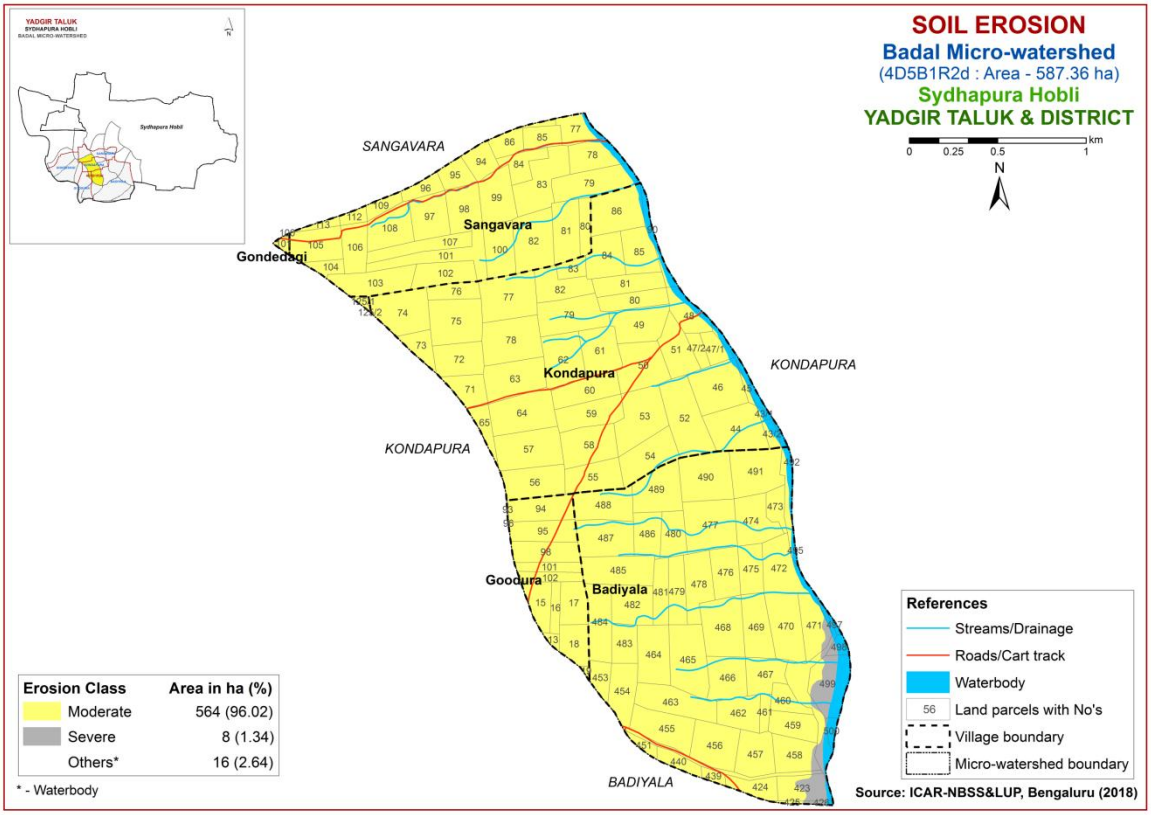


Fig. 5.7 Soil Erosion map of Badal Microwatershed

Chapter 6

FERTILITY STATUS

Soil fertility plays an important role in increasing crop yield. The adoption of high yielding varieties that require high amounts of nutrients has resulted in deficiency symptoms in crops and plants due to imbalanced fertilization and poor inherent fertility status as these areas are characterised by low rainfall and high temperatures. Hence, it is necessary to know the fertility (macro and micro nutrients) status of the soils of the watersheds for assessing the kind and amount of fertilizers required for each of the crop intended to be grown. For this purpose, the surface soil samples collected from the grid points (one soil sample at every 250 m interval) all over the microwatershed through land resource inventory in the year 2017 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 Badal microwatershed for soil reaction (pH) showed that a small area of 5 ha (1%) is slightly alkaline (pH 7.3-7.8) and are distributed in the western part of the microwatershed. An area of about 107 ha (18%) is moderately alkaline (pH 7.8-8.4) and are distributed in all parts of the microwatershed. Maximum area of 389 ha (66%) is strongly alkaline (pH 8.4-9.0) and are distributed in the major part of the microwatershed (Fig. 6.1). An area about 71 ha (12%) is very strongly alkaline (pH >9.0) and are distributed in the central, eastern and southern part of the microwatershed. Thus, all soils in the microwatershed are alkaline in reaction.

6.2 Electrical Conductivity (EC)

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

6.3 Organic Carbon

The soil organic carbon content (an index of available Nitrogen) in the soils of the microwatershed is high (>0.75) in an area of about 45 ha (8%) and are distributed in all parts of the microwatershed, medium (0.5-0.75%) covering an area of about 211 ha (36%) and are distributed in all parts of the microwatershed, whereas low (<0.5%) in an area of about 316 ha (54%) and are distributed in the major part of the microwatershed (Fig. 6.3).

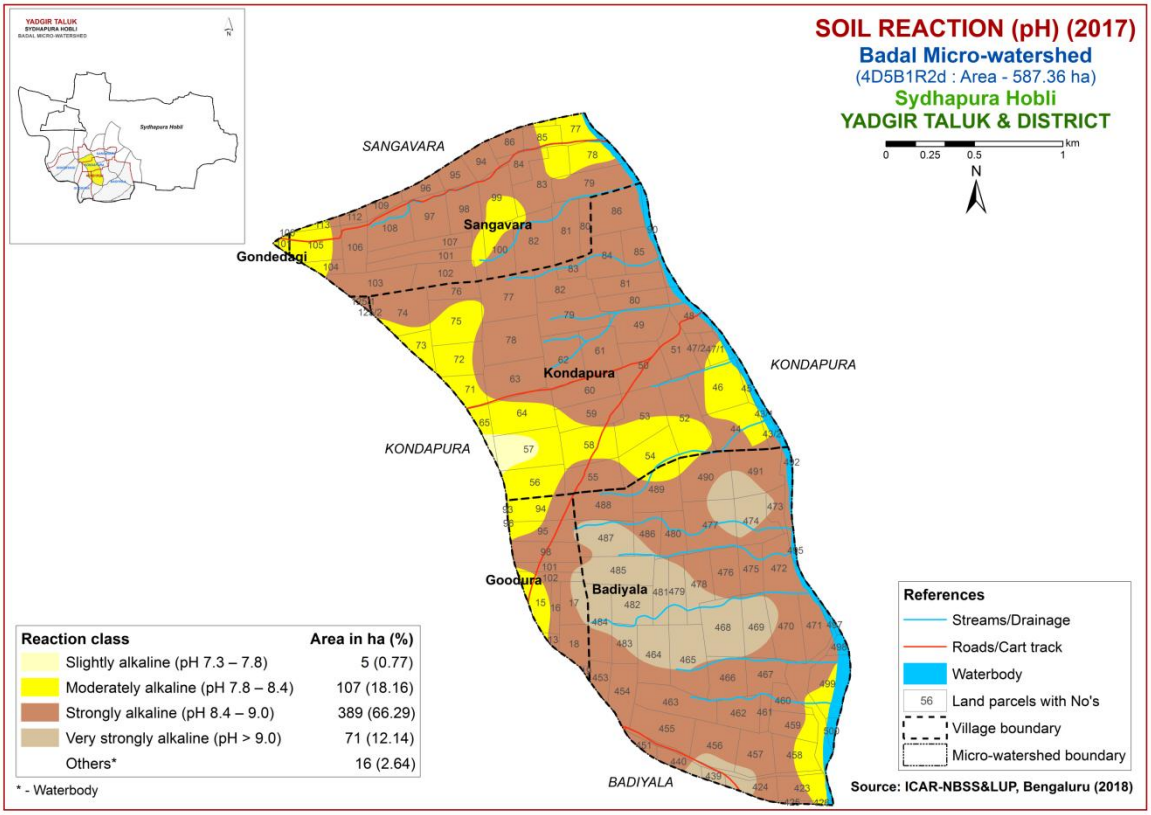


Fig.6.1 Soil Reaction (pH) map of Badal Microwatershed

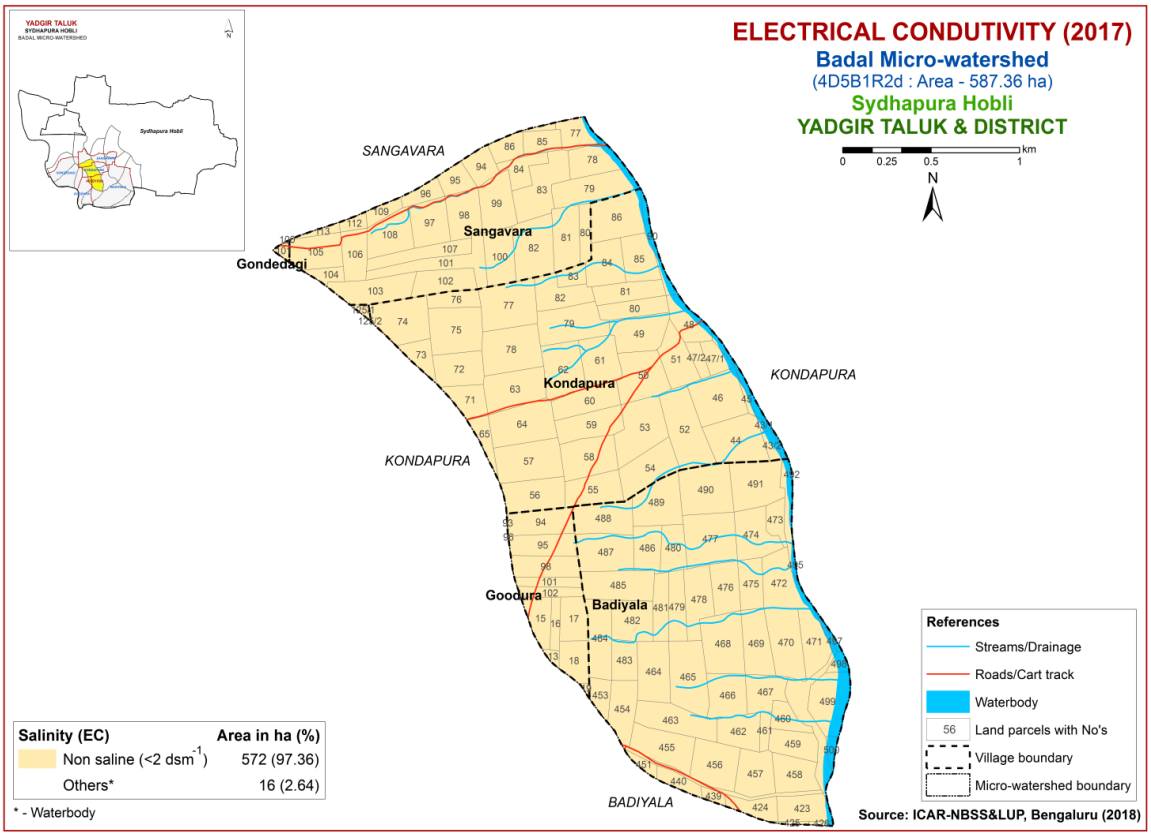


Fig.6.2 Electrical Conductivity (EC) map of Badal Microwatershed

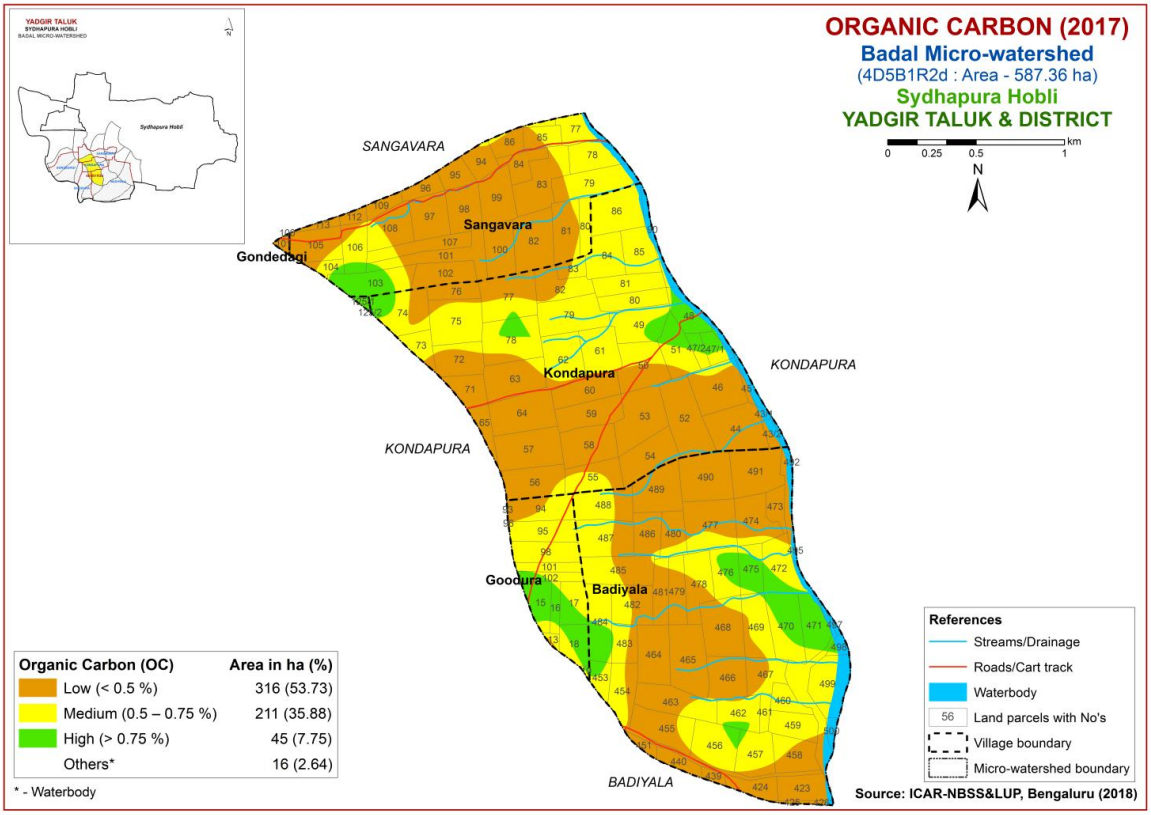


Fig.6.3 Soil Organic Carbon map of Badal Microwatershed

6.4 Available Phosphorus

Available phosphorus content is low (<23 kg/ha) in maximum area of 316 ha (54%) and are distributed in the major part of the microwatershed. Medium (23-57 kg/ha) in an area of about 211 ha (36%) and occur in all parts of the microwatershed and high (>57 kg/ha) in an area of about 45 ha (8%) and are distributed in the northwestern and southern part of the microwatershed (Fig. 6.4).

6.5 Available Potassium

Available potassium content is medium (145-337 kg/ha) in an area of about 61 ha (10%) and are distributed in the northeastern, eastern and southeastern part of the microwatershed (Fig. 6.5). High (>337 kg/ha) in maximum area of 511 ha (87%) and are distributed in the major part of the microwatershed.

6.6 Available Sulphur

An area of about 268 ha (46%) is low (<10 ppm) in available sulphur content and are distributed in the northwestern, central, western and eastern part of the microwatershed. Medium (10-20 ppm) in maximum area of about 297 ha (51%) and is distributed in the major part of the microwatershed (Fig. 6.6) and high in small area of 6 ha (1%) and is distributed in the northwestern part of the microwatershed.

6.7 Available Boron

Available boron content is medium (0.5-1.0 ppm) in a maximum area of 276 ha (47%) and are distributed in the major part of the microwatershed. An area of about 153 ha (26%) is low (<0.5 ppm) in available boron and are distributed in the northwestern, western, central, northern and southern part of the microwatershed. High in (>10 ppm) 143 ha (24%) and are distributed in all parts of the microwatershed (Fig. 6.7).

6.8 Available Iron

Available iron content is sufficient (>4.5 ppm) in an area of 138 ha (24%) and are distributed in the northern, central, eastern and western part of the microwatershed and deficient in a maximum area of 434 ha (74%) and are distributed in the major part of the microwatershed (Fig 6.8).

6.9 Available Manganese

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

6.10 Available Copper

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

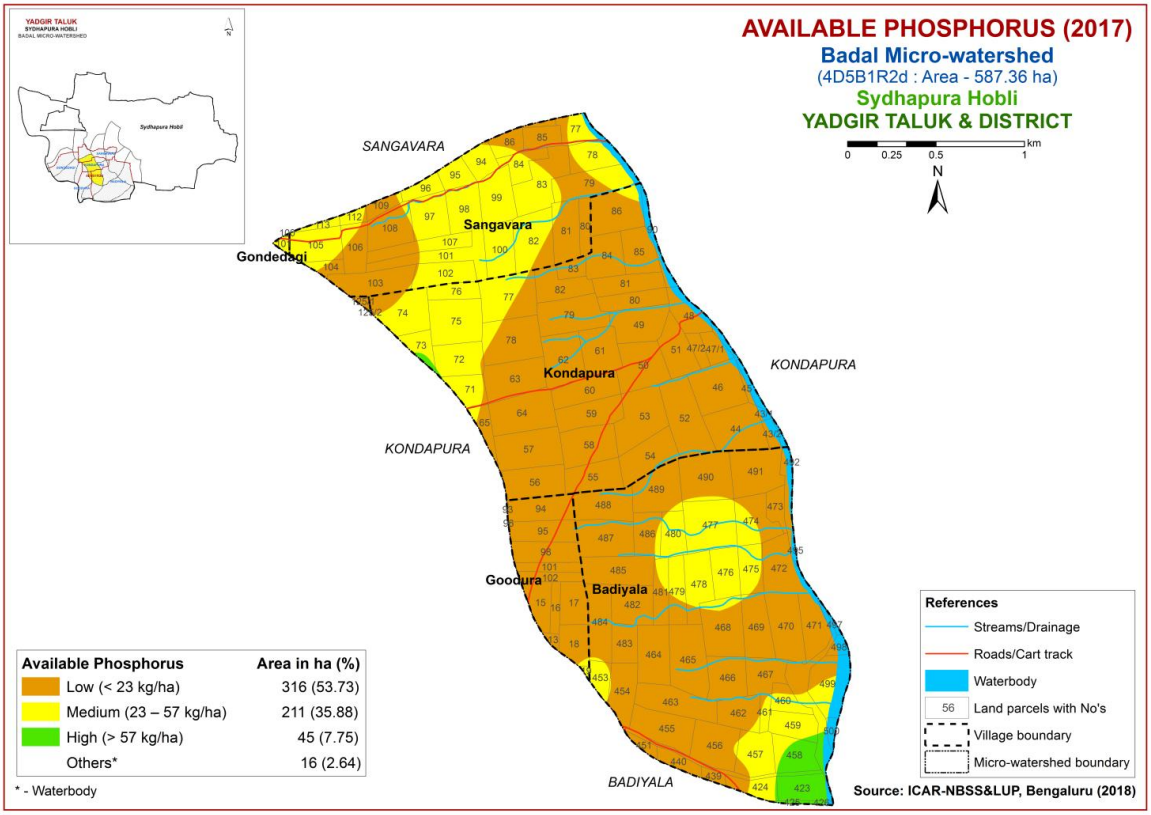


Fig.6.4 Soil Available Phosphorus map of Badal Microwatershed

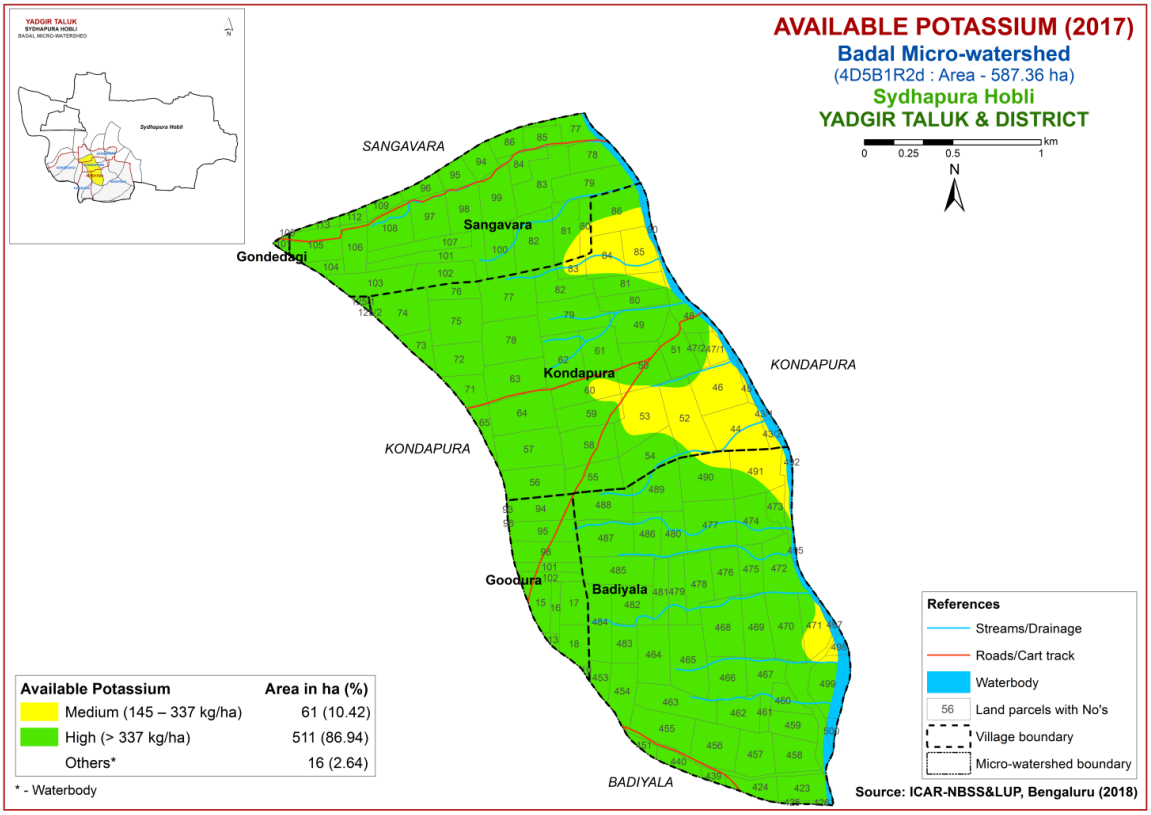


Fig.6.5 Soil Available Potassium map of Badal Microwatershed

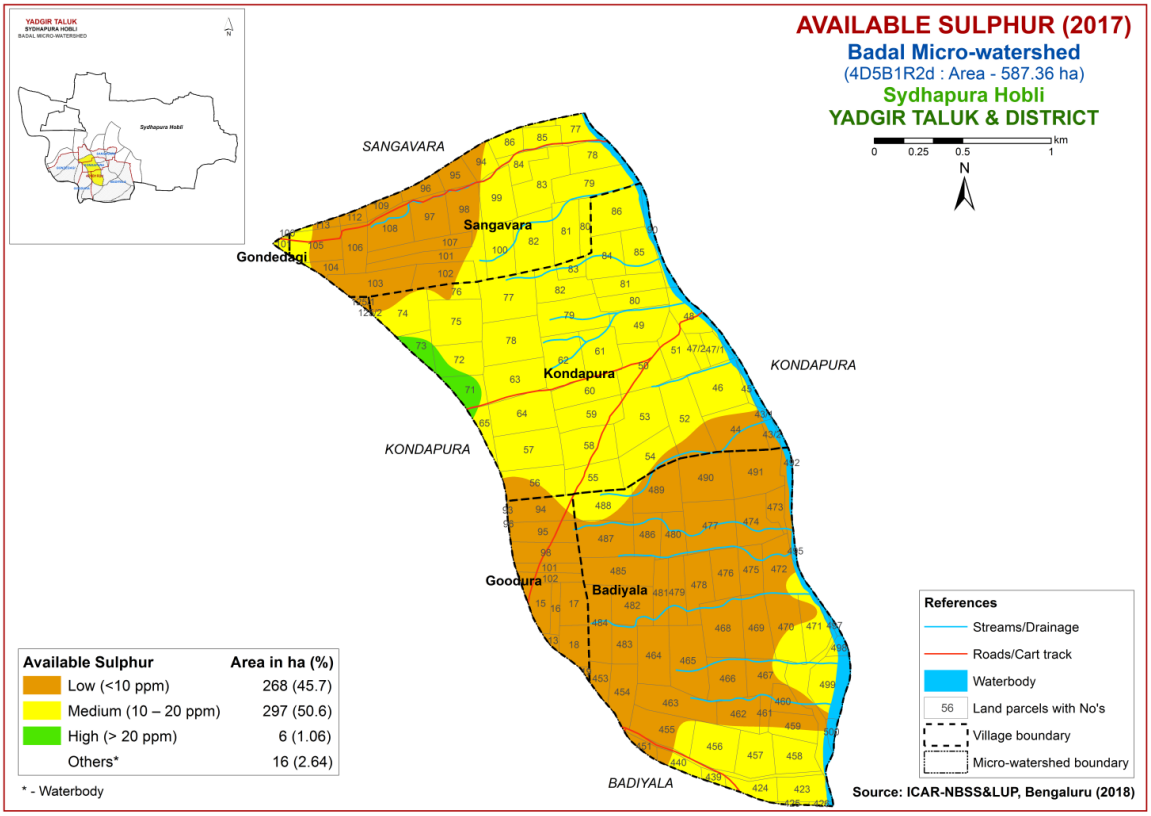


Fig.6.6 Soil Available Sulphur map of Badal Microwatershed

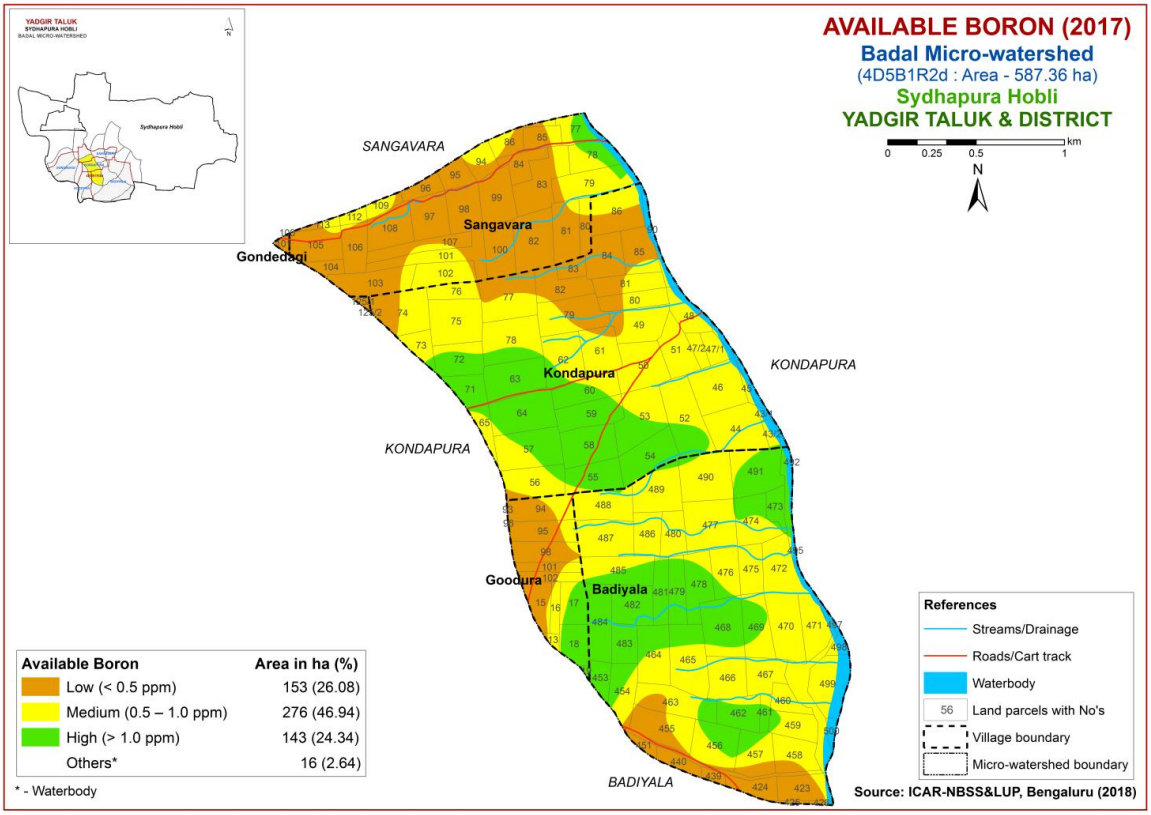


Fig.6.7 Soil Available Boron map of Badal Microwatershed

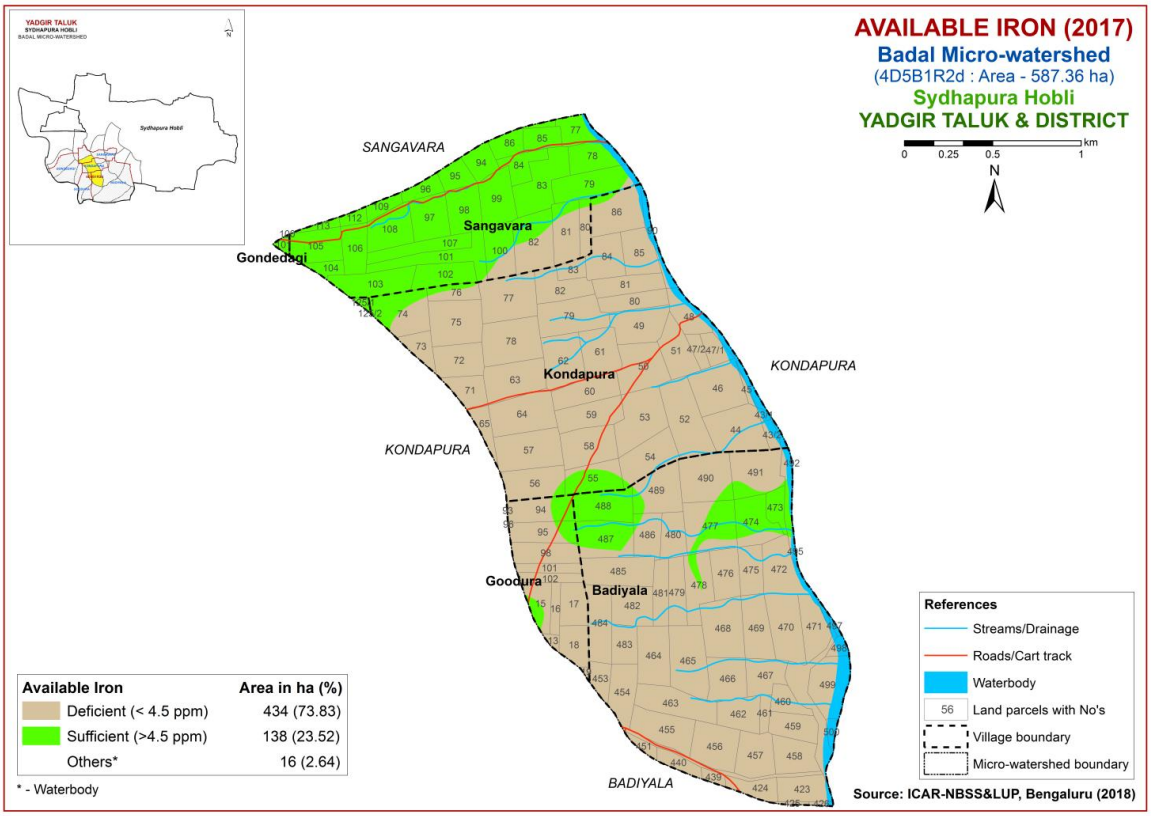


Fig.6.8 Soil Available Iron map of Badal Microwatershed

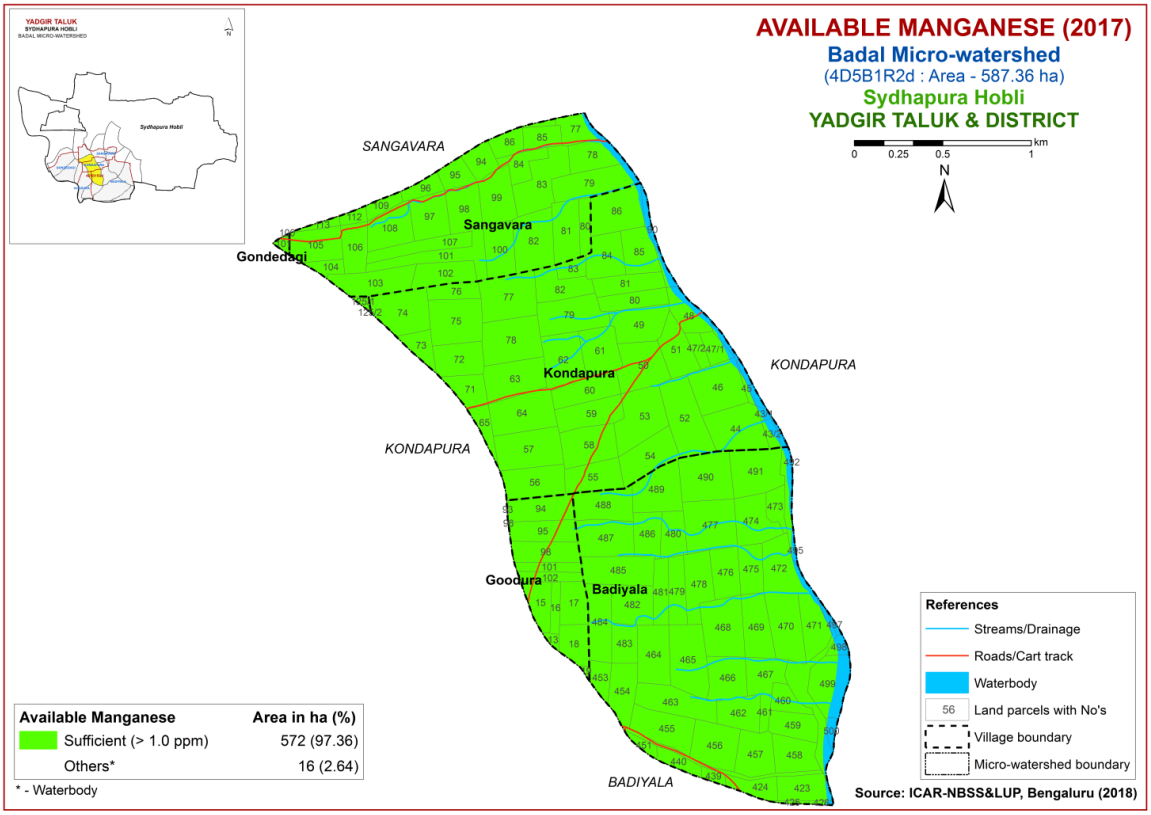


Fig.6.9 Soil Available Manganese map of Badal Microwatershed

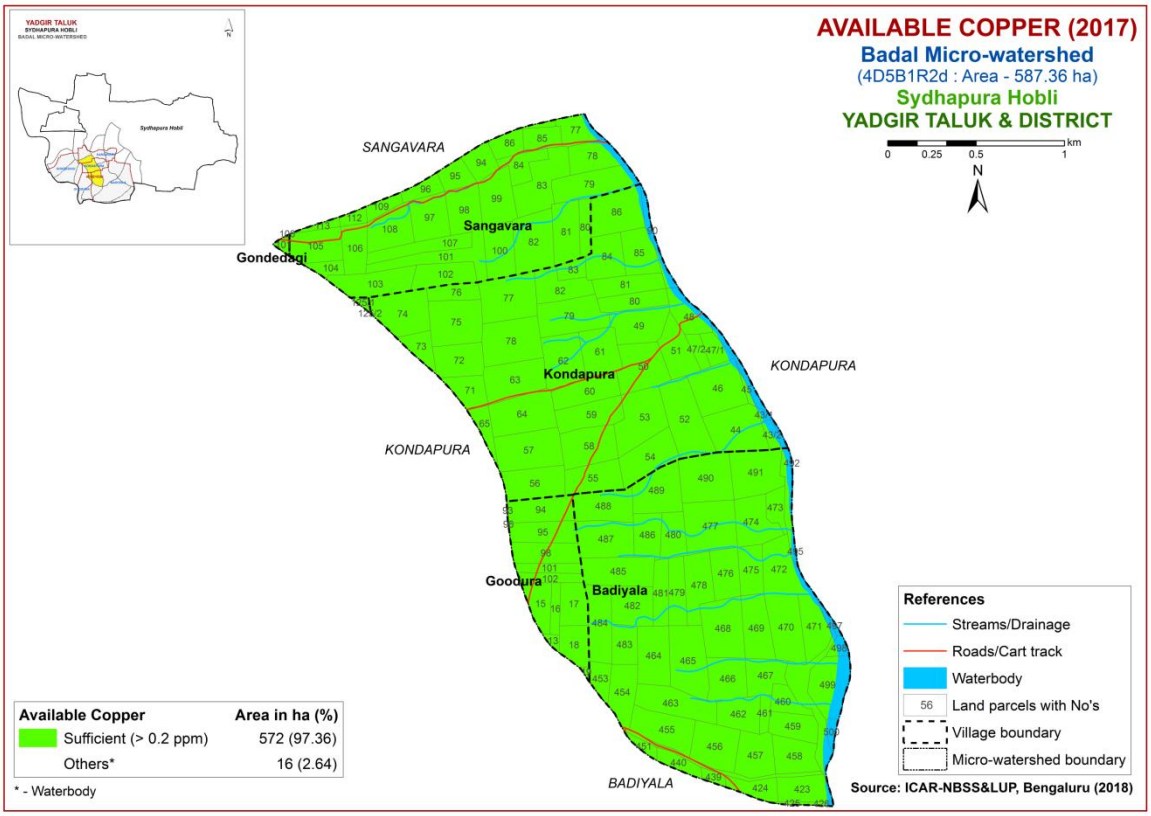


Fig.6.10 Soil Available Copper map of Badal Microwatershed

6.11 Available Zinc

Available zinc content is deficient (<0.6 ppm) in maximum area of 561 ha (96%) and is distributed in the major part of the microwatershed. Small area of 11 ha (2%) is distributed in the eastern and southern part of the microwatershed (Fig 6.11).

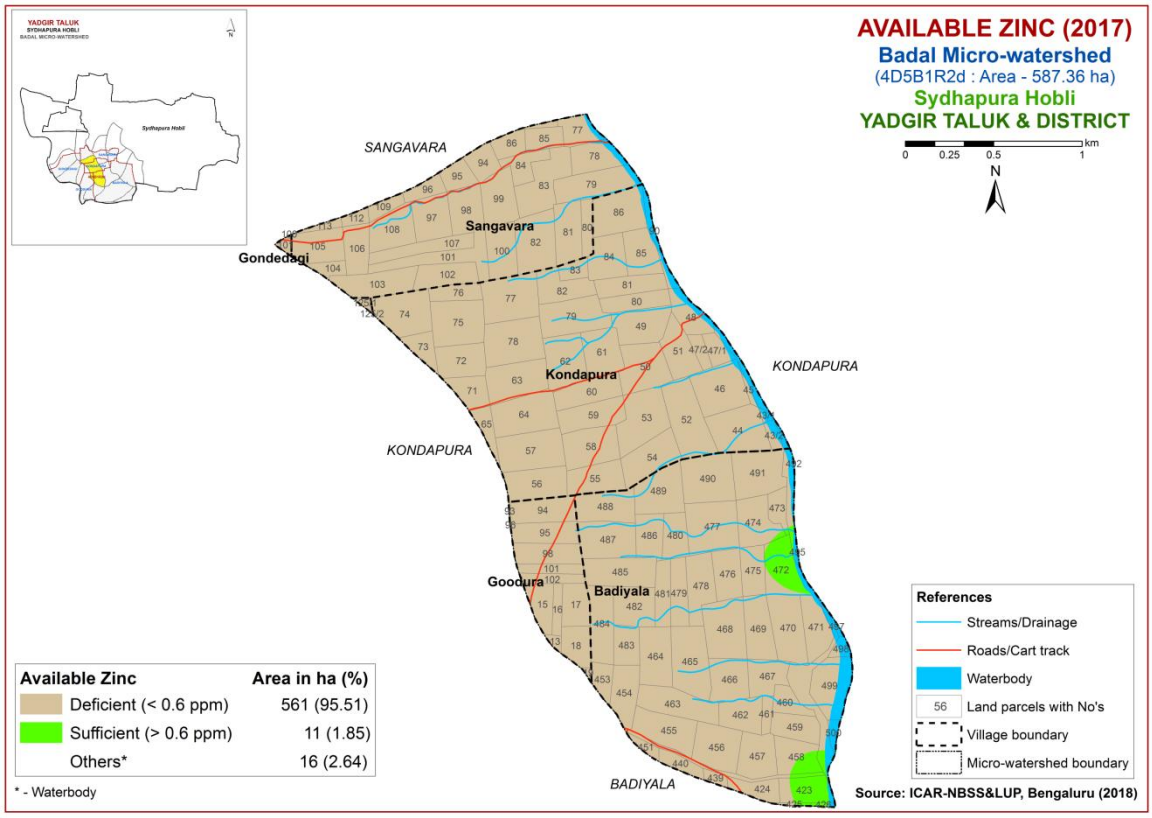


Fig.6.11 Soil Available Zinc map of Badal Microwatershed

Chapter 7

LAND SUITABILITY FOR MAJOR CROPS

The soil and land resource units (soil phases) of Badal microwatershed were assessed for their suitability for growing food, fodder, fibre and other horticulture crops by following the procedure as outlined in FAO, 1976 and 1983. Crop requirements were developed for each of the crop from the available research data and also by referring to Naidu *et. al.* (2006) and Natarajan *et. al* (2015). The crop requirements were matched with the soil and land characteristics (Table 7.1) to arrive at the crop suitability. In FAO land suitability classification, two orders are recognized. Order S-Suitable and Order N-Not suitable. The orders have classes, subclasses and units. Order-S has three classes, Class S1-Highly Suitable, Class S2-Moderately Suitable and Class S3- Marginally Suitable. Order N has two classes, N1-Currently not Suitable and N2- Permanently not Suitable. There are no subclasses within the Class S1 as they will have very minor or no limitations for crop growth. Classes S2, S3, 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 26 major agricultural and horticultural crops were generated. The detailed information on the kind of suitability of each of the soil phase for the crops assessed are given village/ survey number wise for the microwatershed in Appendix-III.

7.1 Land Suitability for Sorghum (*Sorghum bicolor*)

Sorghum is one of the major crops grown in Karnataka in an area of 10.47 lakh ha in Bijapur, Gulbarga, Raichur, Bidar, Belgaum, Dharwad, Bellary, Chitradurga, Mysore and 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 332 ha (57%) and are distributed in the major part of the microwatershed. An area of about 231 ha (39%) is moderately suitable (Class S2) for growing sorghum and are distributed in all parts of the microwatershed. They have minor limitations of calcareousness and drainage. An area of about 8 ha (1%) is marginally suitable (Class S3)

Table 7.1 Soil-Site Characteristics of Badal Microwatershed

Soil Map Units	Climate (P) (mm)	Growing period (Days)	Drainage Class	Soil depth (cm)	Soil texture		Gravelliness		AWC (mm/m)	Slope (%)	Erosion	pH	EC (dSm^{-1})	ESP (%)	CEC [Cmol (p^{+})kg^{-1}]	BS (%)
					Sur-face	Sub-surface	Surface (%)	Sub-surface (%)								
BDLiB3	866	150	WD	25-50	sc	sl	-	-	<50	1-3	severe	6.20	0.07	0.20	4.20	93
GWDiB2	866	150	WD	50-75	sc	scl	-	-	51-100	1-3	moderate	9.89	0.74	43.51	8.35	100
NGPiB2	866	150	WD	50-75	sc	scl	-	-	51-100	1-3	moderate	7.42	0.24	0.22	67.10	100
HGNiB2	866	150	WD	50-75	sc	scl	-	-	51-100	1-3	moderate	8.77	1.33	14.38	36.23	100
HGNmB2	866	150	WD	50-75	c	scl	-	-	51-100	1-3	moderate	8.77	1.33	14.38	36.23	100
TMKiB2	866	150	WD	50-75	sc	scl	-	-	51-100	1-3	moderate	9.60	0.35	16.57	21.83	100

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

for growing sorghum and is distributed in the southeastern and southern part of the microwatershed with moderate limitation rooting depth.

Table 7.2 Crop suitability criteria for Sorghum

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

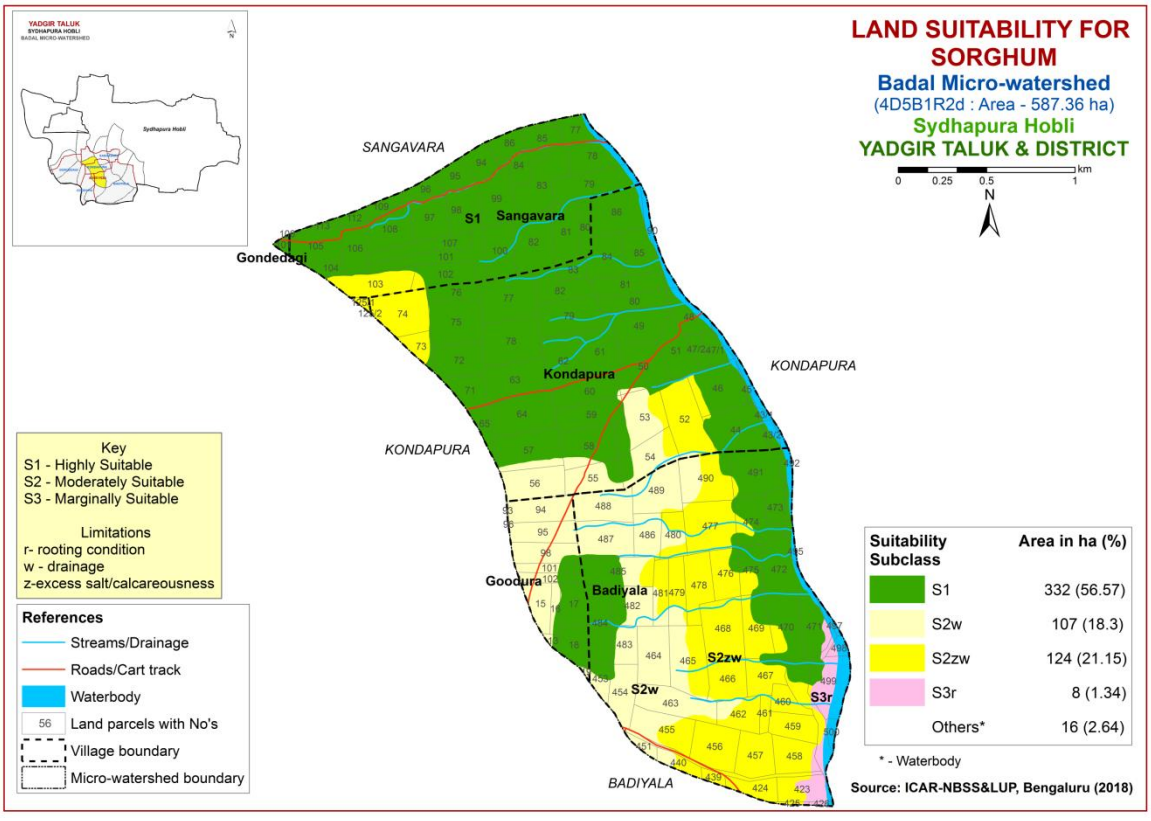


Fig. 7.1 Land Suitability map of Sorghum

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.

There are no highly suitable (Class S1) lands available for growing maize in the microwatershed. Moderately suitable (Class S2) lands occur in a maximum area of 564 ha (96%) and are distributed in the major part of the microwatershed with minor limitations of texture, drainage and calcareousness. Marginally suitable lands (Class S3) for growing maize occupy an area of about 8 ha (1%) and occur in the southern and southeastern part of the microwatershed. They have moderate limitations of rooting depth and texture.

Table 7.3 Crop suitability criteria for Maize

Crop requirement		Rating			
Soil–site characteristics	**Unit**	**Highly suitable(S1)**	**Moderately suitable(S2)**	**Marginally suitable(S3)**	**Not suitable(N)**
Slope	%	<3	3.5	5-8	
LGP	Days	>100	100-80	60-80	
Soil drainage	Class	Well drained	Mod. to imperfectly	Poorly/excessively	V. poorly
Soil reaction	pH	5.5-7.5	7.6-8.5	8.6-9.0	
Surface soil texture	Class	l, cl, scl, sil	sl, sicl, sic	c(s-s), ls	s,fragmental
Soil depth	cm	>75	50-75	25-50	<25
Gravel content	% vol.	<15	15-35	35-50	>50
Salinity (EC)	dSm^{-1}	<1.0	1.0-2.0	2.0-4.0	
Sodicity (ESP)	%	<10	10-15	>15	

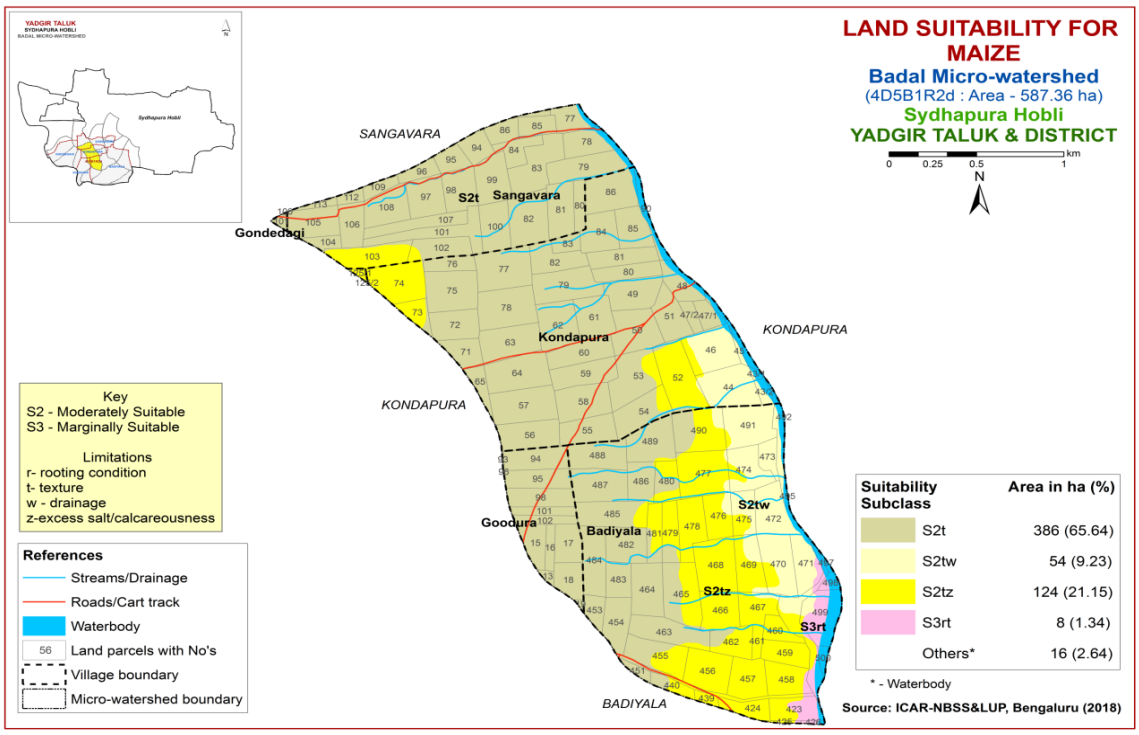


Fig. 7.2 Land Suitability map of Maize

7.3 Land Suitability for Bajra (*Pennisetum glaucum)*

Bajra is one of the 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.

Table 7.4 Crop suitability criteria for Bajra

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

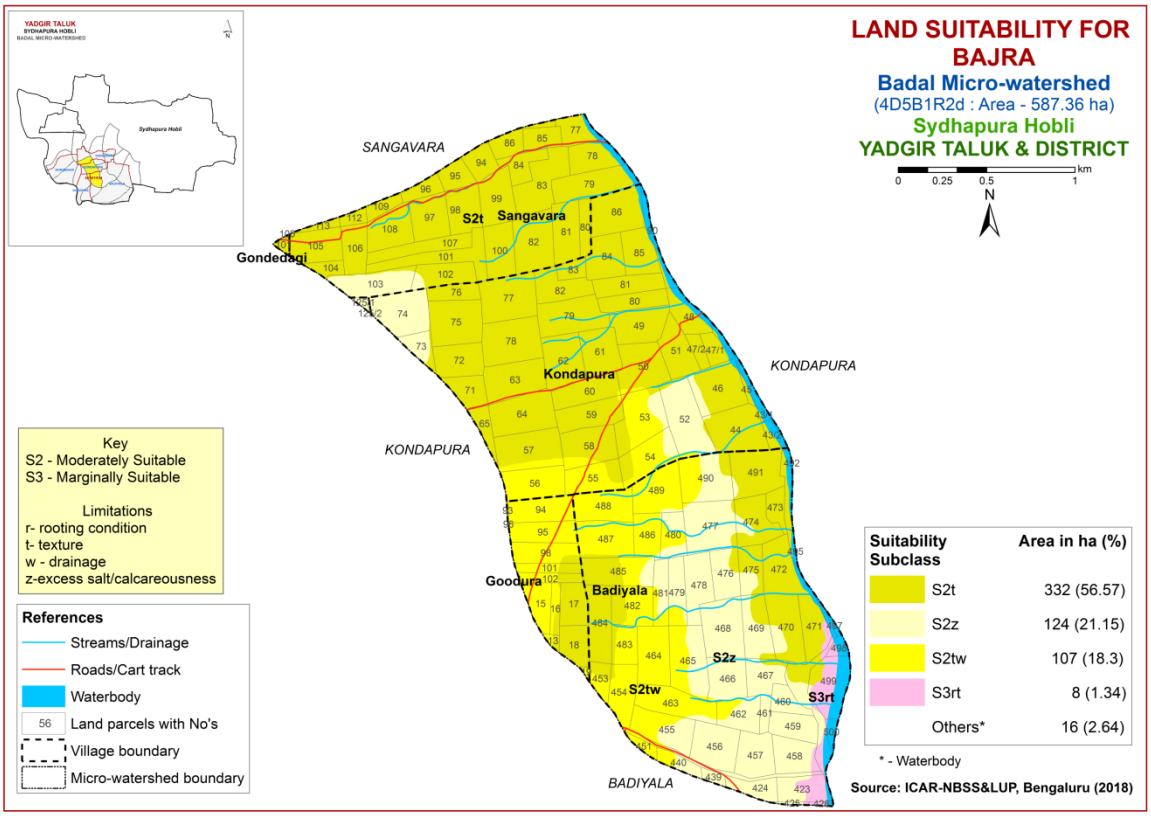


Fig. 7.3 Land Suitability map of Bajra

There are no highly (Class S1) suitable lands available for growing bajra in the microwatershed. Major area of about 563 ha (96%) is moderately suitable (Class S2) for growing bajra and are distributed in the major part of the microwatershed. They have minor limitations of texture, drainage and calcareousness. Marginally suitable lands (Class S3) occupy small area of about 8 ha (1%) and distributed in the southeastern and southern part of the microwatershed. They have moderate limitations of rooting depth and texture.

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.

There are no highly suitable (Class S1) lands available for growing Groundnut in the microwatershed. Maximum area of about 563 ha (96%) is moderately suitable (Class S2) for groundnut and are distributed in the major part of the microwatershed. They have minor limitations of calcareousness, drainage and texture. Marginally suitable lands (Class S3) for growing groundnut occupy a very small area of about 8 ha (1%) and are distributed in the southern and southeastern part of the microwatershed. They have moderate limitations of texture and rooting depth.

Table 7.5 Crop suitability criteria for Groundnut

Crop requirement		**Rating**			
Soil–site characteristics	**Unit**	**Highly suitable(S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable(N)**
Slope	%	<3	3-5	5-10	>10
LGP	Days	100-125	90-105	75-90	
Soil drainage	Class	Well drained	Mod. Well drained	Imperfectly drained	Poorly drained
Soil reaction	pH	6.0-8.0	8.1-8.5,5.5-5.9	>8.5,<5.5	
Surface soil texture	Class	l, cl,sil, sc,sicl	sc, sic, c,	s,ls,sl,c(>60%)	s,fragmental
Soil depth	Cm	>75	50-75	25-50	<25
Gravel content	% vol.	<35	35-50	>50	
$CaCO_3$ in root zone	%	high	Medium	low	
Salinity (EC)	dSm^{-1}	<2.0	2.0-4.0	4.0-8.0	
Sodicity (ESP)	%	<5	5-10	>10	

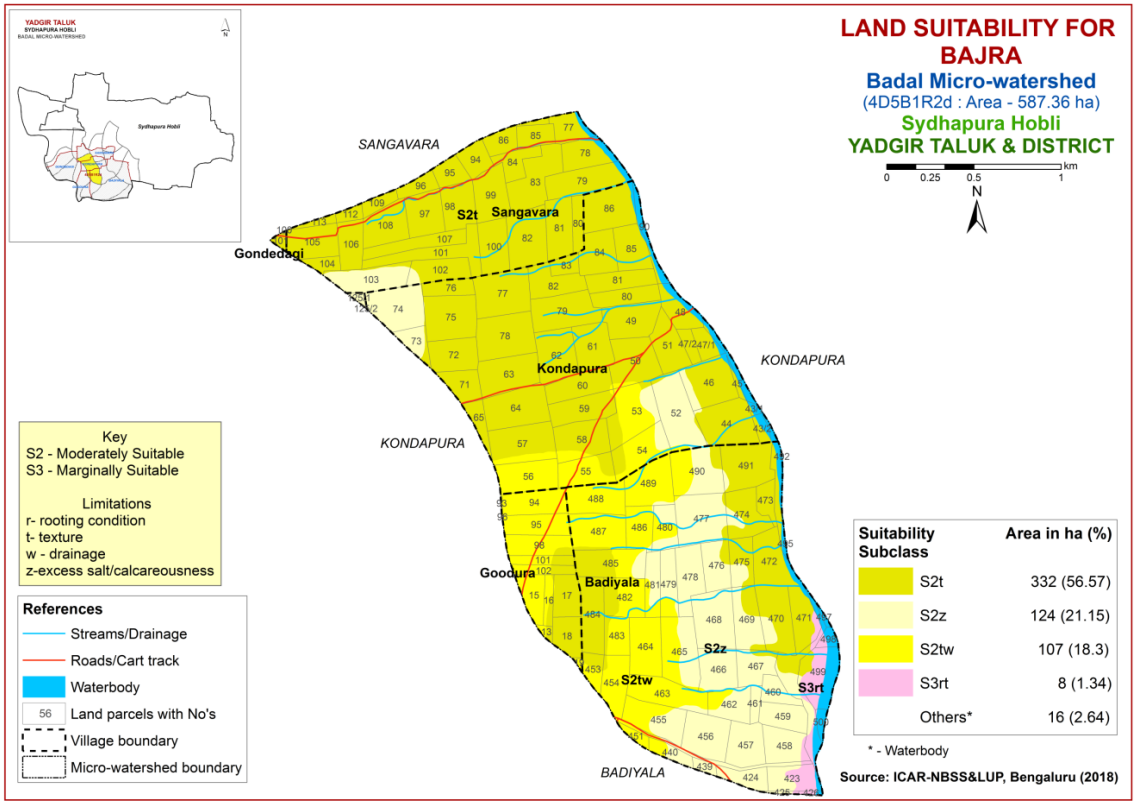


Fig. 7.4 Land Suitability map of Groundnut

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.

Table 7.6 Crop suitability criteria for Sunflower

Crop requirement		Rating			
Soil–site characteristics	**Unit**	**Highly suitable(S1)**	**Moderately suitable (S2)**	**Marginally suitable(S3)**	**Not suitable(N)**
Slope	%	<3	3-5	5-10	>10
LGP	Days	>90	80-90	70-80	<70
Soil drainage	Class	Well drained	Mod. well drained	Imperfectly drained	Poorly drained
Soil reaction	pH	6.5-8.0	8.1-8.55.5-6.4	8.6-9.0;4.5-5.4	>9.0<4.5
Surface soil texture	Class	l, cl, sil, sc	scl, sic, c,	c (>60%), sl	ls, s
Soil depth	Cm	>100	75-100	50-75	<50
Gravel content	% vol.	<15	15-35	35-60	>60
Salinity (EC)	dS m^{-1}	<1.0	1.0-2.0	>2.0	
Sodicity (ESP)	%	<10	10-15	>15	

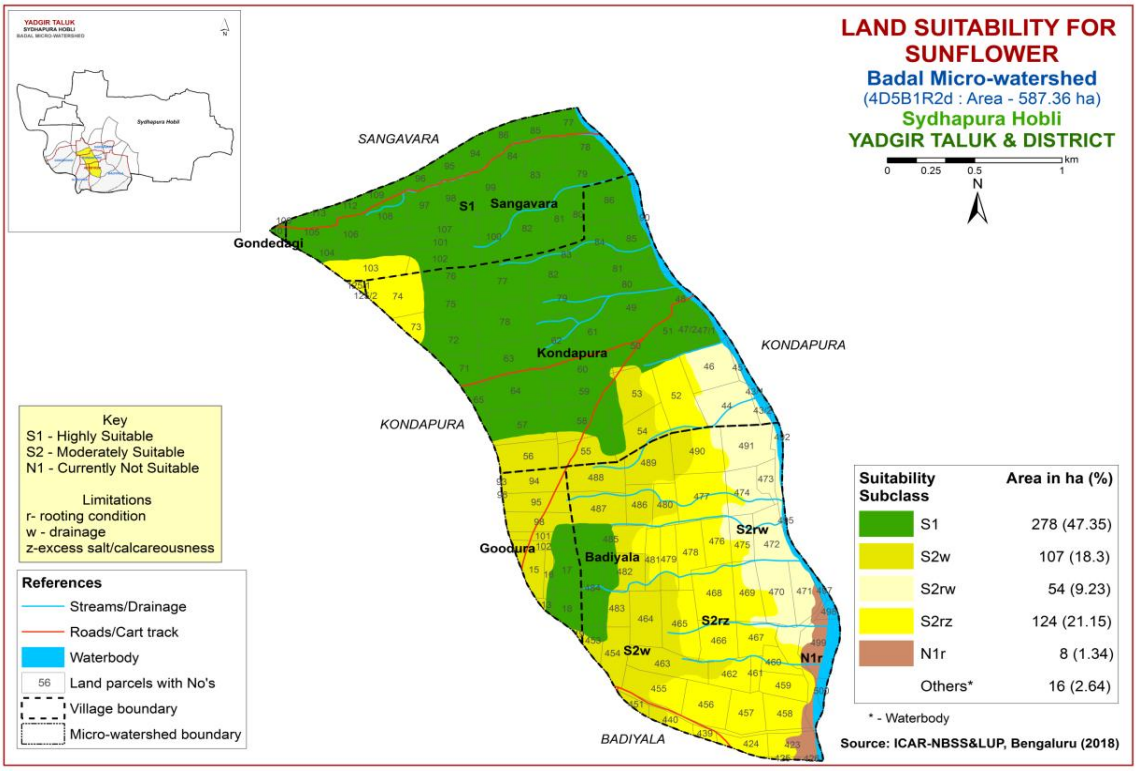


Fig. 7.5 Land Suitability map of Sunflower

Highly suitable (Class S1) lands for growing sunflower occupy an area of 278 ha (47%) and are distributed in the northeastern, northern, central and western part of the microwatershed. Maximum area of about 285 ha (49%) is moderately suitable (Class S2) for sunflower and are distributed in the part of the microwatershed. They have minor limitations of rooting depth, calcareousness and drainage. An area of about 8 ha (1%) is not suitable (Class N1) and is distributed in the southeastern and southern part of the microwatershed with severe limitation of rooting depth.

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.

No highly suitable (Class S1) lands are available for growing redgram in the microwatershed. Maximum area of about 564 ha (96%) is moderately suitable (Class S2) for growing redgram 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) for growing redgram occupy a small area of about 8 ha (1%) and occur in the southern and southeastern part of the microwatershed. They have moderate limitations of rooting depth and texture.

Table 7.7 Land suitability criteria for Red gram

Crop requirement		Rating			
Soil –site characteristics	**Unit**	**Highly suitable(S1)**	**Moderately suitable(S2)**	**Marginally suitable(S3)**	**Not suitable(N)**
Slope	%	<3	3-5	5-10	>10
LGP	Days	>210	180-210	150-180	<150
Soil drainage	Class	Well drained	Mod. well drained	Imperfectly drained	Poorly drained
Soil reaction	pH	6.5-7.5	5.0-6.5,7.6-8.0	8.0-9.0	>9.0
Sub Surface soil texture	Class	l,scl,sil cl, sl	sicl, sic, c(m)	ls	
Soil depth	cm	>100	75-100	50-75	<50
Gravel content	% vol.	<15	15-35	3-60	>60
Salinity (EC)	ds m^{-1}	<1.0	1.0-2.0	>2.0	
Sodicity (ESP)	%	<10	10-15	>15	

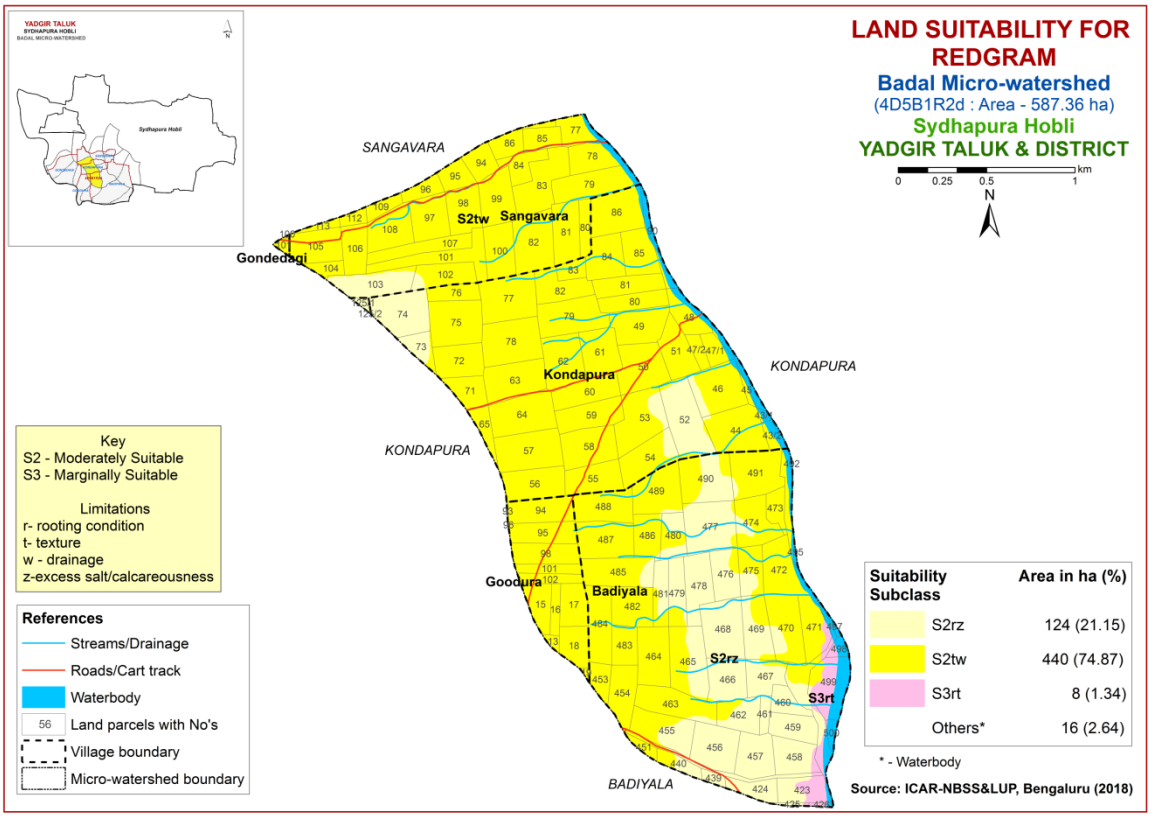


Fig. 7.6 Land Suitability map of Redgram

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 maximum area of 440 ha (75%) and are distributed in the major part of the microwatershed. An area of about 124 ha (21%) is moderately suitable (Class S2) for growing Bengal gram and are distributed in the northwestern, central and southern part of the microwatershed. They have minor limitations of drainage and calcareousness,. Marginally suitable lands (Class S3) occupy a small area of about 8 ha (1%) and are distributed in the southern and southeastern part of the microwatershed. They have moderate limitation of rooting depth.

Table 7.8 Crop suitability criteria for Bengal gram

Crop requirement		Rating			
Soil –site characteristics	**Unit**	**Highly suitable(S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable(N)**
Slope	%	<3	3-5	5-10	>10
LGP	Days	>100	90-100	70-90	<70
Soil drainage	class	Well drained	Mod. to well drained; imperfectly drained	Poorly drained; excessively drained	Very Poorly drained
Soil reaction	pH	6.0-7.5	5.5-5.7, 7.6-8.0	8.1-9.0;4.5-5.4	>9.0
Surface soil texture	Class	l, scl, sil,cl,	sicl, sic, c	sl, c>60%	
Soil depth	Cm	>75	51-75	25-50	<25
Gravel content	% vol.	<15	15-35	>35	
Salinity (ECe)	dsm^{-1}	<1.0	1.0-2.0	>2.0	
Sodicity (ESP)	%	<10	10-15	>15	

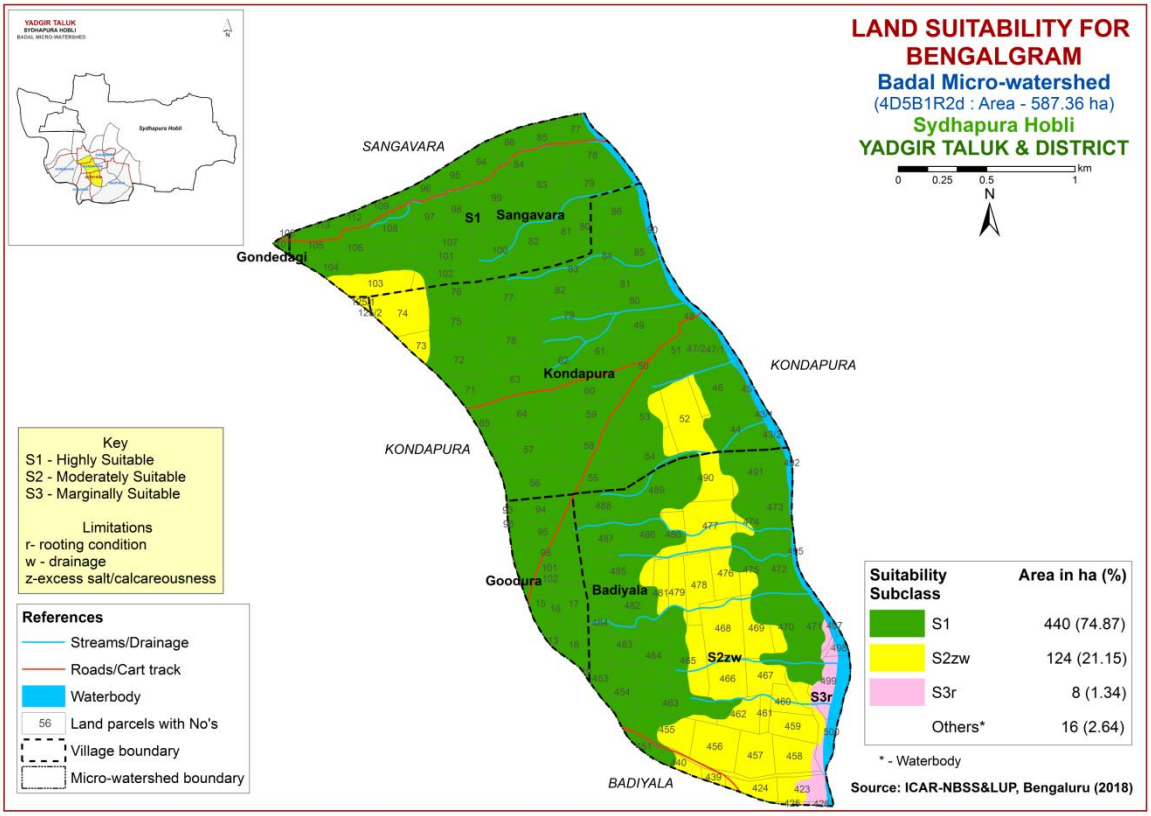


Fig. 7.7 Land Suitability map of Bengal gram

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.

Table 7.9 Crop suitability criteria for Cotton

Crop requirement		Rating			
Soil–site characteristics	**Unit**	**Highly suitable(S1)**	**Moderately suitable(S2)**	**Marginally suitable(S3)**	**Not suitable (N)**
Slope	%	1-2	2-3	3-5	>5
LGP	Days	180-240	120-180	<120	
Soil drainage	class	Well to moderately well	imperfectly drained	Poor somewhat excessive	Stagnant/ excessive
Soil reaction	pH	6.5-7.5	7.6-8.0	8.1-9.0	>9.0 >6.5
Surface soil texture	Class	sic, c	sicl, cl	si, sil, sc, scl, l	sl, s,ls
Soil depth	Cm	100-150	60-100	30-60	<30
Gravel content	% vol.	<5	5-10	10-15	15-35
$CaCO_3$ in root zone	%	<3	3-5	5-10	10-20
Salinity (EC)	dSm^{-1}	2-4	4.0-8.0	8.0-12	>12
Sodicity (ESP)	%	5-10	10-20	20-30	>30

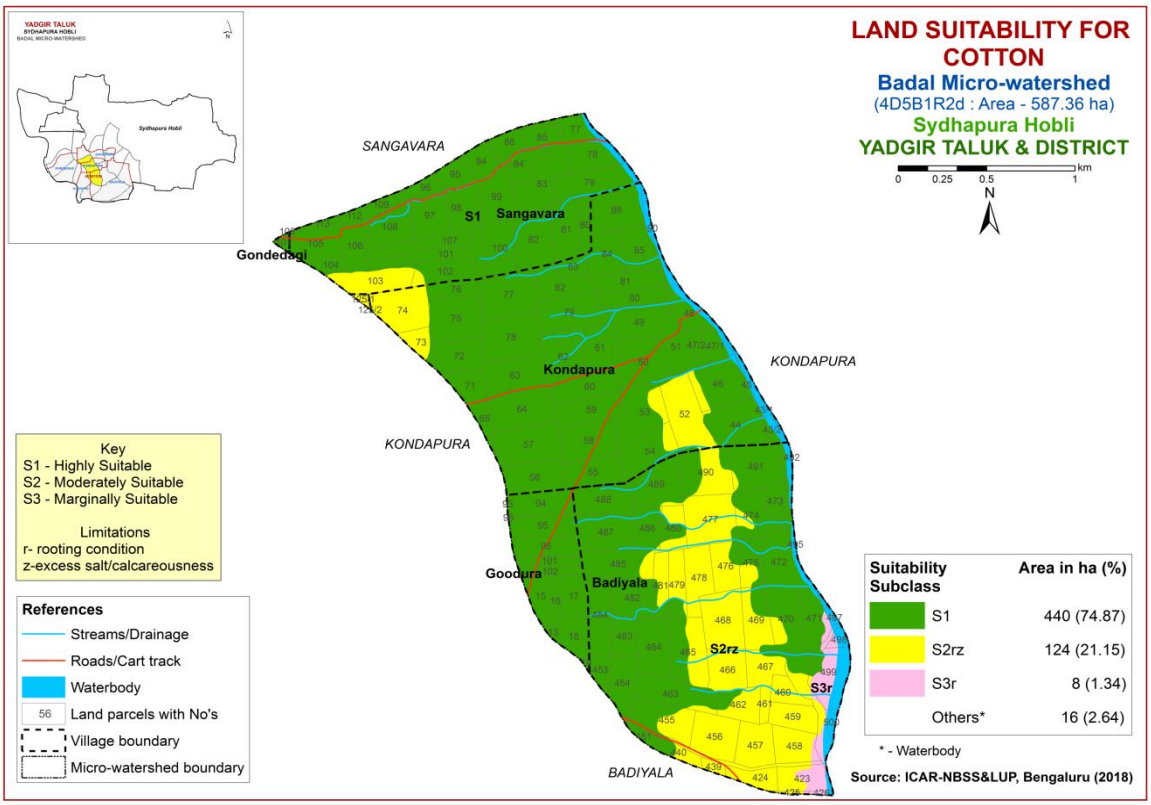


Fig. 7.8 Land Suitability map of Cotton

Highly suitable (Class S1) lands for growing cotton crop occur in maximum area of 440 ha (75%) and are distributed in the major part of the microwatershed. Moderately suitable (Class S2) lands are found to occur in an area of about 124 ha (21%). The soils have minor limitations of rooting depth and calcareousness. They are distributed in the northwestern, central and southern part of the microwatershed. Marginally suitable (Class S3) lands for cotton are found to occur in a small area of about 8 ha (1%) with moderate limitation of rooting depth and are distributed in the southern and southeastern part the microwatershed.

7.9 Land Suitability for Chilli (*Capsicum annuum)*

Chilli is one of the most important fruit and 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.

There are no highly (Class S1) suitable lands available for growing chilli crop in the microwatershed. Maximum area of about 456 ha (78%) is moderately suitable (Class S2) for growing chilli and are distributed in the major part of the microwatershed. They have minor limitations of texture, drainage and calcareousness. Marginally suitable lands (Class S3) occupy an area of about 115 ha (20%) and are distributed in the central, western, southwestern, southeastern and southern part of the microwatershed. They have moderate limitations of rooting depth, drainage and texture.

Table 7.10 Crop suitability criteria for Chilli

Crop requirement		**Rating**			
Soil –site characteristics	**Unit**	**Highly suitable(S1)**	**Moderately suitable(S2)**	**Marginally suitable (S3)**	**Not suitable(N)**
Mean temp. in growing season	^{0}c	20-30	30-35, 13-15	35-40, 10-12	>40,<10
Slope	%	<3	3-5	5-10	>10
LGP	Days	>150	120-150	90-120	<90
Soil drainage	class	Well drained	Moderately drained	Imp./ poor drained/excessively	V.poorly drained
Soil reaction	pH	6.5-7.8, 6.0-7.0	7.8-8.4	8.4-9.0, 5.0-5.9	>9.0
Surface soil texture	Class	scl, cl, sil	sl,sc,sic,c(m/k	C(ss), ls, s	
Soil depth	cm	>75	50-75	25-50	<25
Gravel content	%vol.	<15	15-35	35-60	>60
Salinity (ECe)	dsm^{-1}	<1.0	1.0-2.0	2.0-4.0	<4
Sodicity (ESP)	%	<5	5-10	10-15	

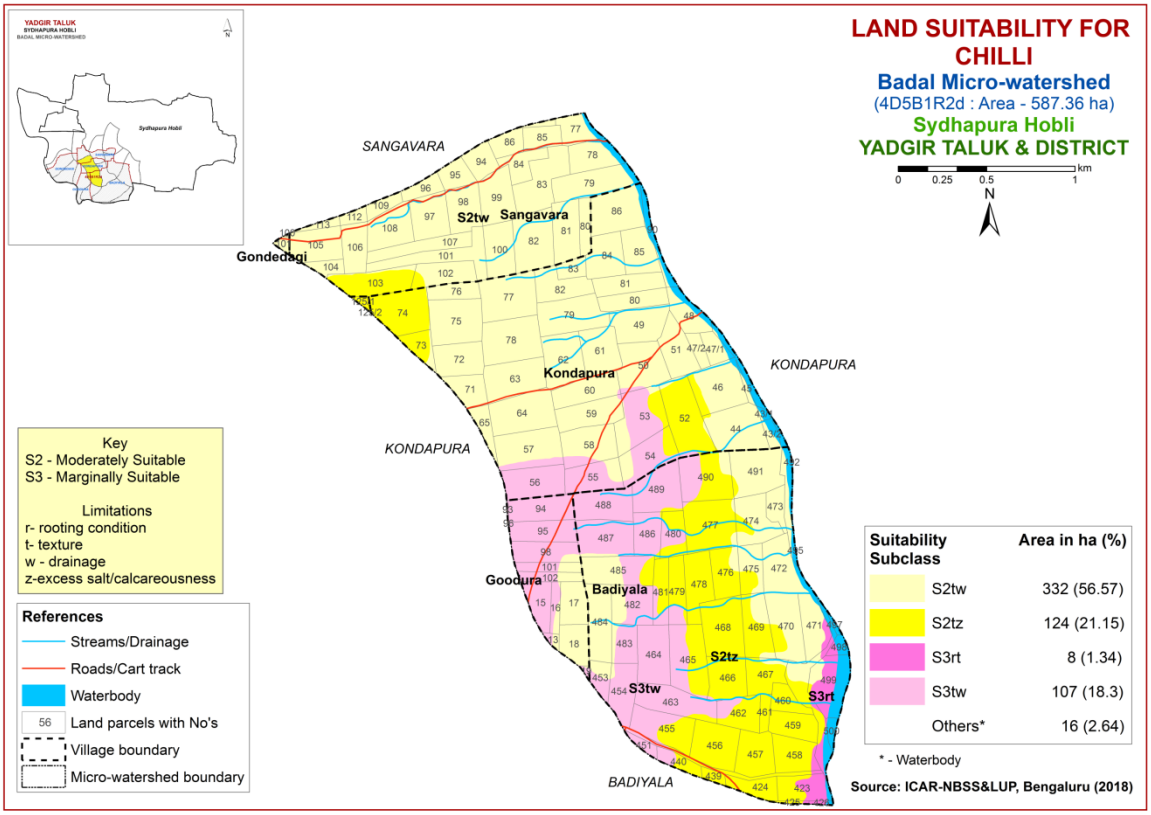


Fig 7.9 Land Suitability map of Chilli

7.10 Land Suitability for Tomato (*Lycopersicon esculentum*)

Tomato is one of the most important fruit 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.

Table 7.11 Crop suitability criteria for Tomato

Crop requirement			Rating			
Soil –site characteristics		Unit	Highly suitable(S1)	Moderately suitable(S2)	Marginally suitable(S3)	Not suitable(N)
Climate	Temperature in growing season	^{0}c	25-28	29-32 , 20-24	15-19 33-36	<15, >36
Soil moisture	Growing period	Days	>150	120-150	90-120	
Soil aeration	Soil drainage	class	Well drained	Moderately well drained	Poorly drained	V. poorly drained
Nutrient availability	Texture	Class	l, sl, cl, scl	sic,sicl,sc,c(m/k)	c (ss), ls	s
	pH	1:2.5	6.0-7.3	5.5-6.0 7.3-8.4	8.4-9.0	>9.0
	$CaCO_3$ in root zone	%	Non calcareous	Slightly calcareous	Strongly calcareous	
Roting conditions	Soil depth	cm	>75	50-75	25-50	<25
	Gravel content	%vol.	<15	15-35	>35	
Soil toxicity	Salinity	ds/m	Non saline	slight	strongly	
	Sodicity(ESP)	%	<10	10-15	>15	-
Erosion	Slope	%	1-3	3-5	5-10	>10

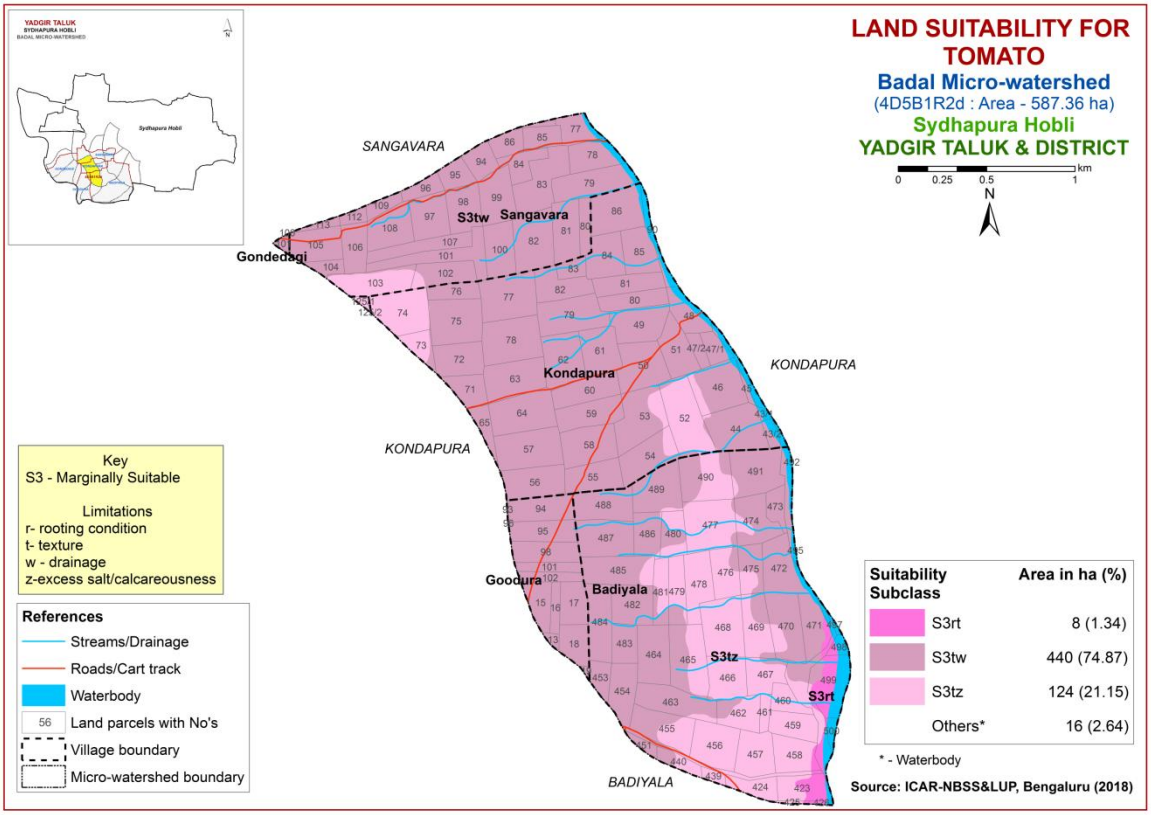


Fig 7.10 Land Suitability map of Tomato

There are no highly (Class S1) and moderately suitable (Class S2) lands available for growing tomato in the microwatershed. Entire area of 572 ha (97%) are marginally suitable for tomato (Class S3). They have moderate limitations of rooting depth, drainage, calcareousness and texture.

7.11 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 7.12) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing drumstick was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.11.

There are no highly (Class S1) suitable lands available for growing drumstick in the microwatershed. An area of about 564 ha (96%) 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. Small area of about 8 ha (1%) is not suitable (Class N1) for growing drumstick and are distributed in the southeastern and southern part of the microwatershed. They have severe limitations of rooting depth and texture.

Table 7.12 Crop suitability criteria for Drumstick

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

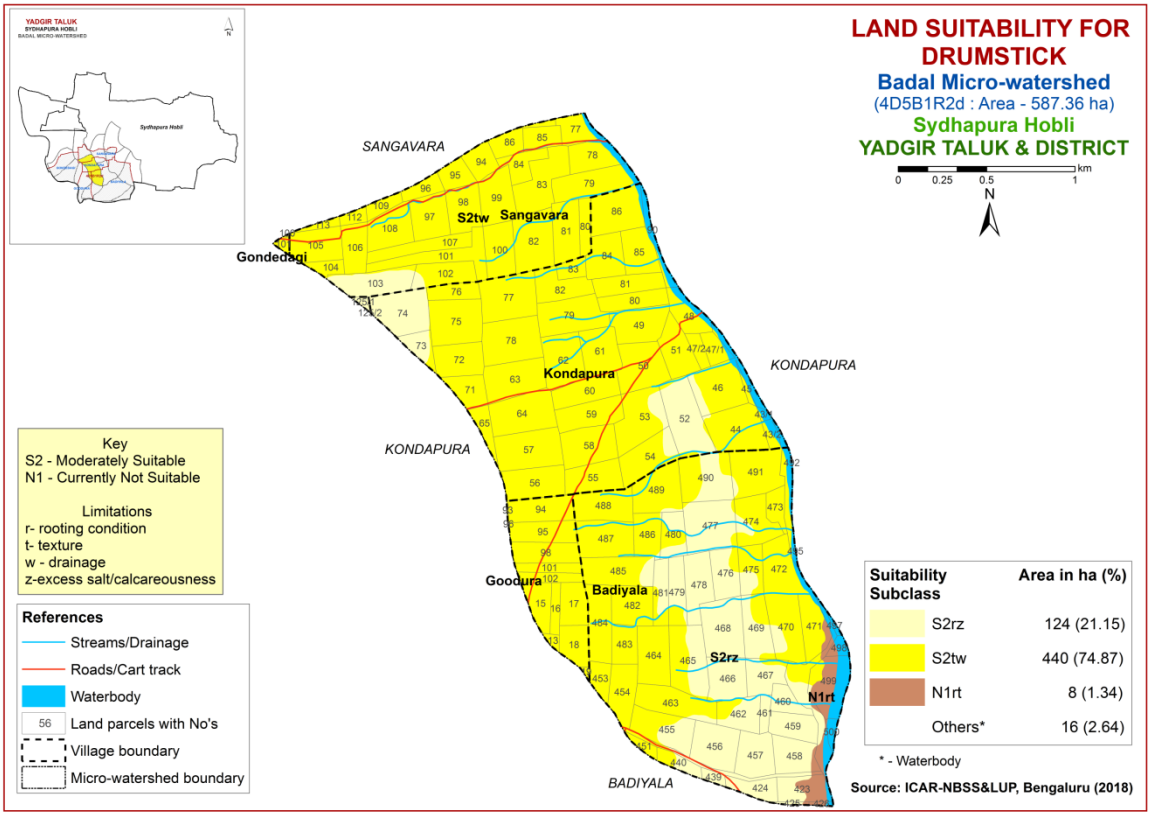


Fig 7.11 Land Suitability map of Drumstick

7.12 Land suitability for 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 7.13) 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 7.12.

There are no highly suitable (Class S1) and moderately suitable (Class S2) lands available for growing mango in the microwatershed. Maximum area of 564 ha (96%) is marginally suitable (Class S3) for growing mango with moderate limitations of drainage, texture, calcareousness and rooting depth and are distributed in the major part of the microwatershed. Small area of about 8 ha (1%) is not suitable (Class N1) for growing

mango and are distributed in the southern and southeastern part of the microwatershed with severe limitation of rooting depth.

Table 7.13 Crop suitability criteria for Mango

Crop requirement			Rating			
Soil-site characteristics		**Unit**	**Highly suitable(S1)**	**Moderately suitable(S2)**	**Marginally suitable(S3)**	**Not suitable(N)**
Climate	Temp. in growing season	^{0}C	28-32	24-27 33-35	36-40	20-24
	Min. temp. before flowering	^{0}C	10-15	15-22	>22	
Soil moisture	Growing period	Days	>180	150-180	120-150	<120
Soil aeration	Soil drainage	Class	Well drained	Mod. To imperfectly drained	Poor drained	Very poorly drained
	Water table	M	>3	2.50-3.0	2.5-1.5	<1.5
Nutrient availability	Texture	Class	sc, l, sil, cl	sl, sc, sic, l, c	c (<60%)	c >60%),
	pH	1:2.5	5.5-7.5	7.6-8.5 5.0-5.4	8.6-9.0 4.0-4.9	>9.0<4.0
	OC	%	High	medium	low	
	$CaCO_3$ in root zone	%	Non calcareous	<5	5-10	>10
Rooting conditions	Soil depth	cm	>200	125-200	75-125	<75
	Gravel content	%vol	Non gravelly	<15	15-35	>35
Soil toxicity	Salinity	dS/m	Non saline	<2.0	2.0-3.0	>3.0
	Sodicity	%	Non sodic	<10	10-15	>15
Erosion	Slope	%	<3	3-5	5-10	

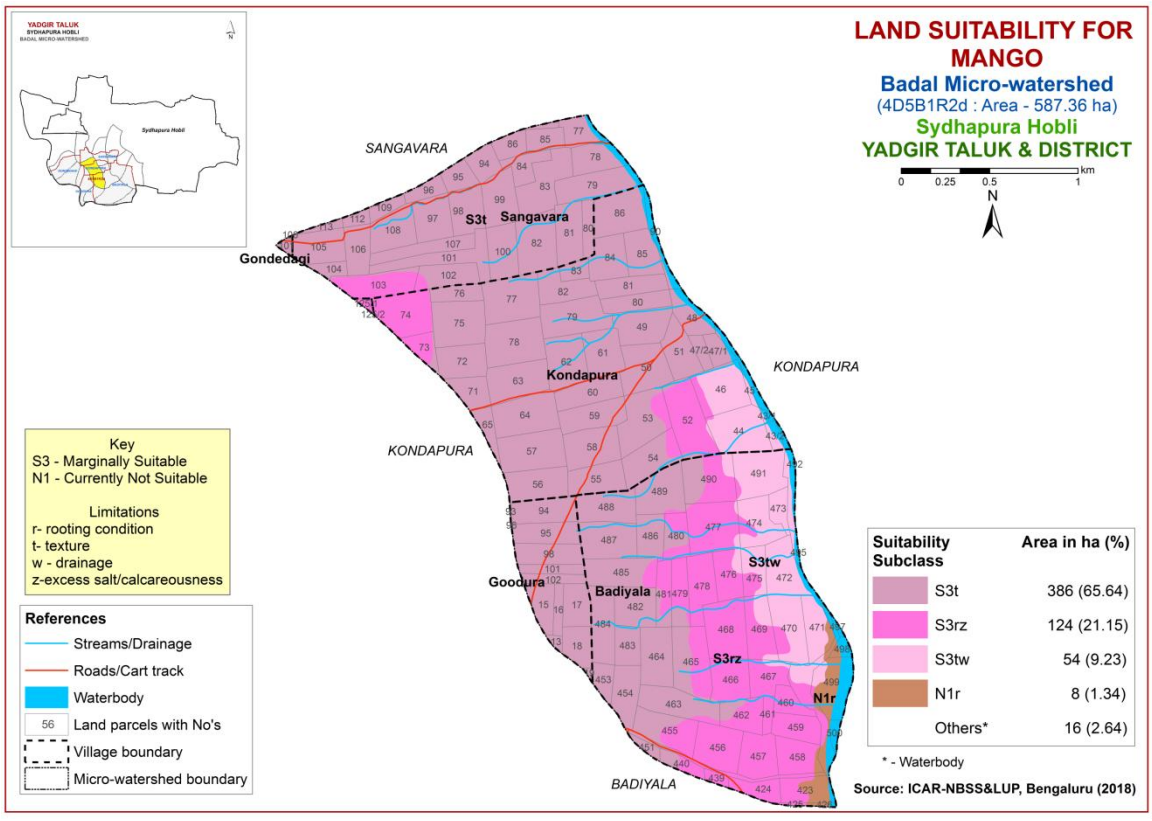


Fig. 7.12 Land Suitability map of Mango

7.13 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 7.14) 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 7.13.

No highly (Class S1) and moderately suitable (Class S2) lands available for growing guava in the microwatershed. Marginally suitable (Class S3) lands cover maximum area of about 564 ha (96%) and are distributed in the major part of the microwatershed. They have moderate limitations of texture, calcareousness and drainage. Very small area of about 8 ha (1%) is not suitable (N) for growing guava and occur in the southeastern and southern part of the microwatershed with severe limitations of rooting depth and texture.

Table 7.14 Crop suitability criteria for Guava

Crop requirement			**Rating**			
Soil –site characteristics		**Unit**	**Highly suitable(S1)**	**Moderately suitable (S2)**	**Marginally suitable(S3)**	**Not suitable(N)**
Climate	Temperature in growing season	^{0}C	28-32	33-36 24-27	37-42 20-23	
Soil moisture	Growing period	Days	>150	120-150	90-120	<90
Soil aeration	Soil drainage	Class	Well drained	Mod. to imperfectly	poor	Very poor
Nutrient availability	Texture	Class	scl, l, cl, sil	sl,sicl,sic.,sc,c	c (<60%)	c (>60%)
	pH	1:2.5	6.0-7.5	7.6-8.0:5.0-5.9	8.1-8.5:4.5-4	>8.5:<4.5
	$CaCO_3$ in root zone	%	Non calcareous	<10	10-15	>15
Rooting conditions	Soil depth	Cm	>100	75-100	50-75	<50
	Gravelcontent	%vol.	<15	15-35	>35	
Soil toxicity	Salinity	dS/m	<2.0	2.0-4.0	4.0-6.0	
	Sodicity	%	Non sodic	10-15	15-25	>25
Erosion	Slope	%	<3	3-5	5-10	>10

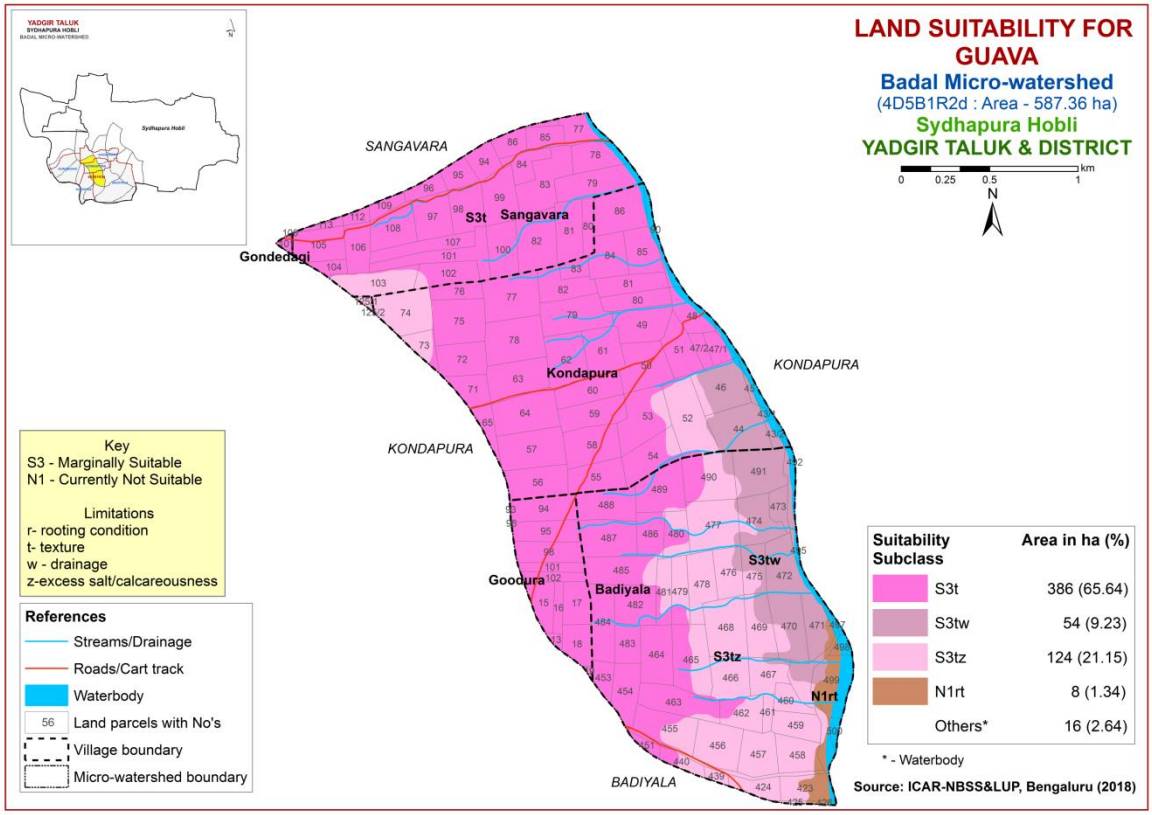


Fig. 7.13 Land Suitability map of Guava

7.14 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 7.15) for growing sapota were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing sapota was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.14.

No highly (Class S1) and moderately suitable (Class S2) lands available for growing sapota in the microwatershed. Maximum area of about 564 ha (96%) is marginally suitable (Class S3) for growing sapota and are distributed in the major part of the microwatershed. They have moderate limitations of texture, calcareousness and drainage. Very small area of about 8 ha (1%) is not suitable (Class N1) for growing sapota and occur in the southeastern and southern part of the microwatershed with severe limitation of rooting depth.

Table 7.15 Crop suitability criteria for Sapota

Crop requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable(S1)**	**Moderately suitable(S2)**	**Marginally suitable(S3)**	**Not suitable(N)**
Climate	Temperature in growing season	^{0} C	28-32	33-36 24-27	37-42 20-23	>42 <18
Soil moisture	Growing period	Days	>150	120-150	90-120	<120
Soil aeration	Soil drainage	Class	Well drained	Moderately well drained	Imperfectly drained	Poorly drained
Nutrient availability	Texture	Class	scl, l, cl, sil	sl, sicl, sc	c (<60%)	ls,s,c(>60%)
	pH	1:2.5	6.0-7.5	7.6-8.0,5.0-5.9	8.1-9.0,4.5-4.9	>9.0,<4.5
	$CaCO_3$ in root zone	%	Non calcareous	<10	10-15	>15
Rooting conditions	Soil depth	cm	>150	75-150	50-75	<50
	Gravel content	%vol.	Nongravelly	<15	15-35	<35
Soil toxicity	Salinity	dS/m	Non saline	Up to 1.0	1.0-2.0	2.0-4.0
	Sodicity	%	Non sodic	10-15	15-25	>25
Erosion	Slope	%	<3	3-5	5-10	>10

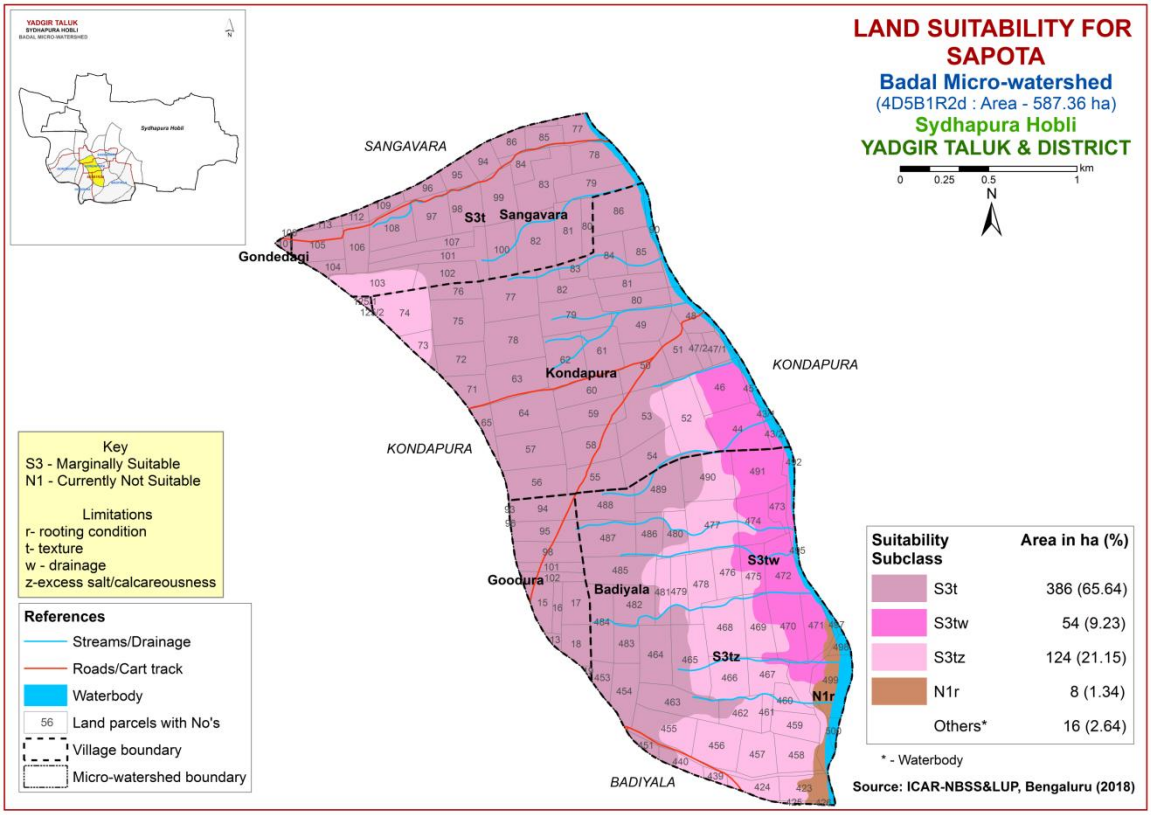


Fig. 7.14 Land Suitability map of Sapota

7.15 Land Suitability for Pomegranate (*Punica granatum*)

Pomegranate is one of the 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 7.16) 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 is given in Figure 7.15.

Table 7.16 Crop suitability criteria for Pomegranate

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

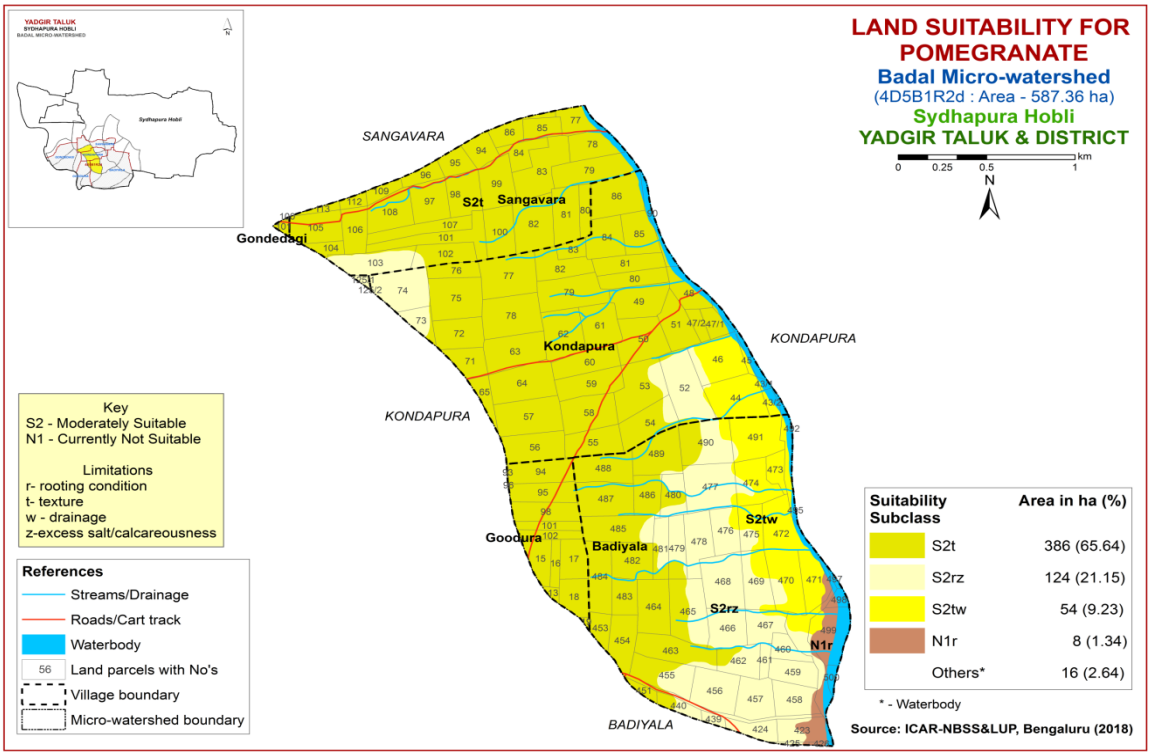


Fig 7.15 Land Suitability map of Pomegranate

No highly (Class S1) suitable lands available for growing pomegranate in the microwatershed. Maximum area of about 564 ha (96%) is moderately suitable (Class S2) for growing pomegranate and is distributed in the major part of the microwatershed. They have minor limitations of rooting depth, texture, calcareousness and drainage. Very small area of about 8 ha (1%) is not suitable (Class N1) for growing pomegranate and is distributed in the southeastern and southern part of the microwatershed with severe limitation of rooting depth.

7.16 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 7.17) 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 7.16.

Highly suitable (Class S1) lands for growing Musambi occur in maximum area of 386 ha (66%) and are distributed in the major part of the microwatershed. An area of about 178 ha (30%) is moderately suitable (Class S2) for growing Musambi and are distributed in the northwestern, central, eastern and southern part of the microwatershed. They have minor limitations of drainage, calcareousness and rooting depth. Very small area of about 8 ha (1%) is not suitable (Class N1) and is distributed in the southeastern and southern part of the microwatershed with severe limitation of rooting depth.

Table 7.17 Crop suitability criteria for Musambi

Crop requirement			**Rating**			
Soil –site characteristics		**Unit**	**Highly suitable(S1)**	**Moderately suitable (S2)**	**Marginally suitable(S3)**	**Not suitable(N)**
Soil aeration	Soil drainage	Class	Well drained	Mod. to imperfectly drained	poorly	Very poorly
Nutrient availability	Texture	Class	scl,l,sicl, cl,s	sc, sc, c	c (>70%)	s, ls
	pH	1:2.5	6.0-7.5	5.5-6.47.6-8.0	4.0-5.4,8.1-8.5	<4.0,>8.5
Rooting conditions	Soil depth	cm	>150	100-150	50-100	<50
	Gravel content	%vol.	Non gravelly	15-35	35-55	>55
Erosion	Slope	%	<3	3-5	5-10	

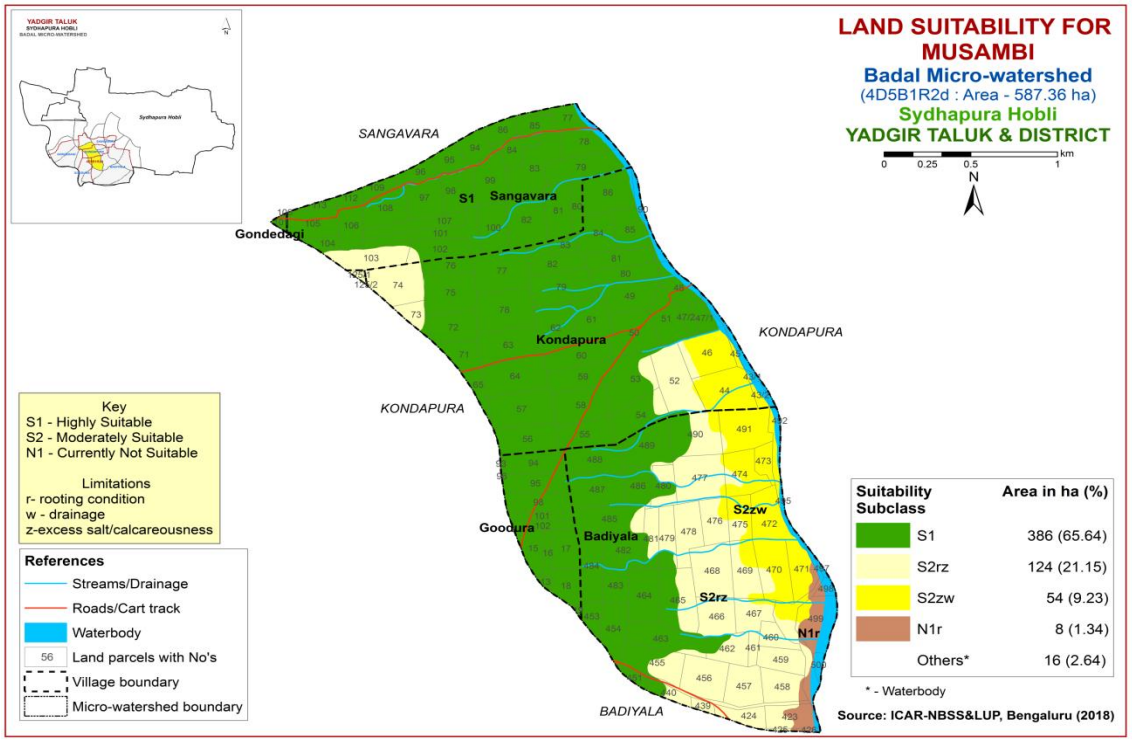


Fig. 7.16 Land Suitability map of Musambi

7.17 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 7.18) 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. 17.

Table 7.18 Crop suitability criteria for Lime

Crop requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable(S1)**	**Moderately suitable(S2)**	**Marginally suitable(S3)**	**Not suitable(N)**
Climate	Temperature in growing season	^{0}C	28-30	31-35 24-27	36-40 20-23	>40 <20
Soil moisture	Growing period	Days	240-265	180-240	150-180	<150
Soil aeration	Soil drainage	Class	Well drained	Mod. to imperf.drained	poorly	Very poorly
Nutrient availability	Texture	Class	scl,l,sicl,cl, s	sc, sc, c	c (>70%)	s, ls
	pH	1:2.5	6.0-7.5	5.5-6.47.6-8.0	4.0-5.4,8.1-8.5	<4.0,>8.5
	$CaCO_3$ in root zone	%	Non 34calcareous	Upto 5	5-10	>10
Rooting conditions	Soil depth	cm	>150	100-150	50-100	<50
	Gravel content	%vol.	Nongravelly	15-35	35-55	>55
Soil toxicity	Salinity	dS/m	Non saline	Upto 1.0	1.0-2.5	>2.5
	Sodicity	%	Non sodic	5-10	10-15	>15
Erosion	Slope	%	<3	3-5	5-10	

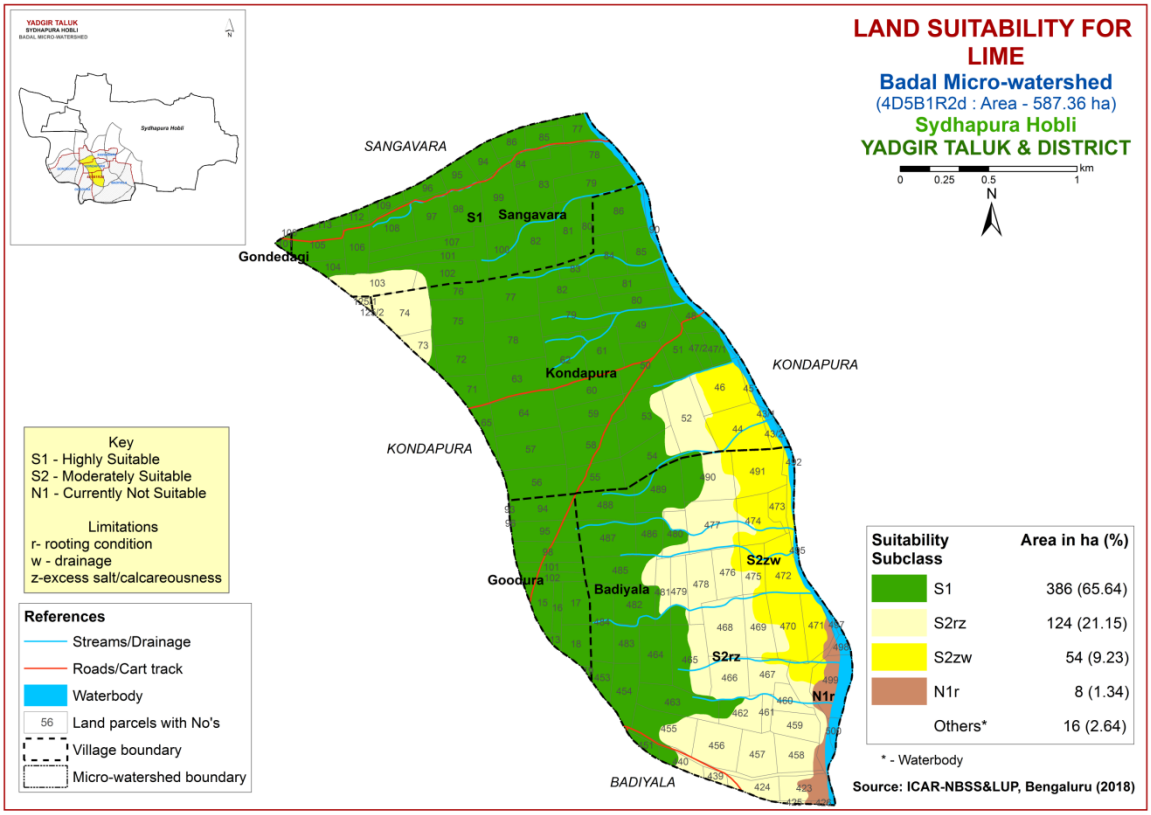


Fig. 7.17 Land Suitability map of Lime

Highly suitable (Class S1) lands for growing Lime occur in maximum area of 386 ha (66%) and are distributed in the major part of the microwatershed. An area of about 178 ha (30%) is moderately suitable (Class S2) for growing lime and are distributed in the northwestern, central, eastern and southern part of the microwatershed. They have minor limitations of drainage, calcareousness, gravelliness and rooting depth. Very small area of about 8 ha (1%) is not suitable (Class N1) and is distributed in the southeastern and southern part of the microwatershed with severe limitation of rooting depth.

7.18 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 7.19) 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 7.18.

Highly suitable (Class S1) lands for growing Amla occur in maximum area of 332 ha (57%) and are distributed in the major part of the microwatershed. An area of about 231 ha (39%) has soils that are moderately suitable (Class S2) for growing Amla with minor limitations of drainage, texture and calcareousness and are distributed in the major part of the microwatershed. Very small area of 8 ha (1%) is marginally suitable (Class S3) for growing amla with moderate limitations of rooting depth and texture and is distributed in the southeastern and southern part of the microwatershed.

Table 7.19 Land suitability criteria for Amla

Crop requirement			Rating			
Soil –site characteristics		Unit	Highly suitable(S1)	Moderately suitable(S2)	Marginally suitable(S3)	Not suitable(N)
Soil aeration	Soil drainage	Class	Well drained	Mod.well drained	Poorly drained	V. Poorly drained
Nutrient availability	Texture	Class	scl,cl,sc,c(red)	c (black)	ls, sl	-
	pH	1:2.5	5.5-7.3	5.0-5.5	7.8-8.4	>8.4
Rooting conditions	Soil depth	Cm	>75	50-75	25-50	<25
	Gravel content	%vol.	<15-35	35-60	60-80	
Erosion	Slope	%	0-3	3-5	5-10	>10

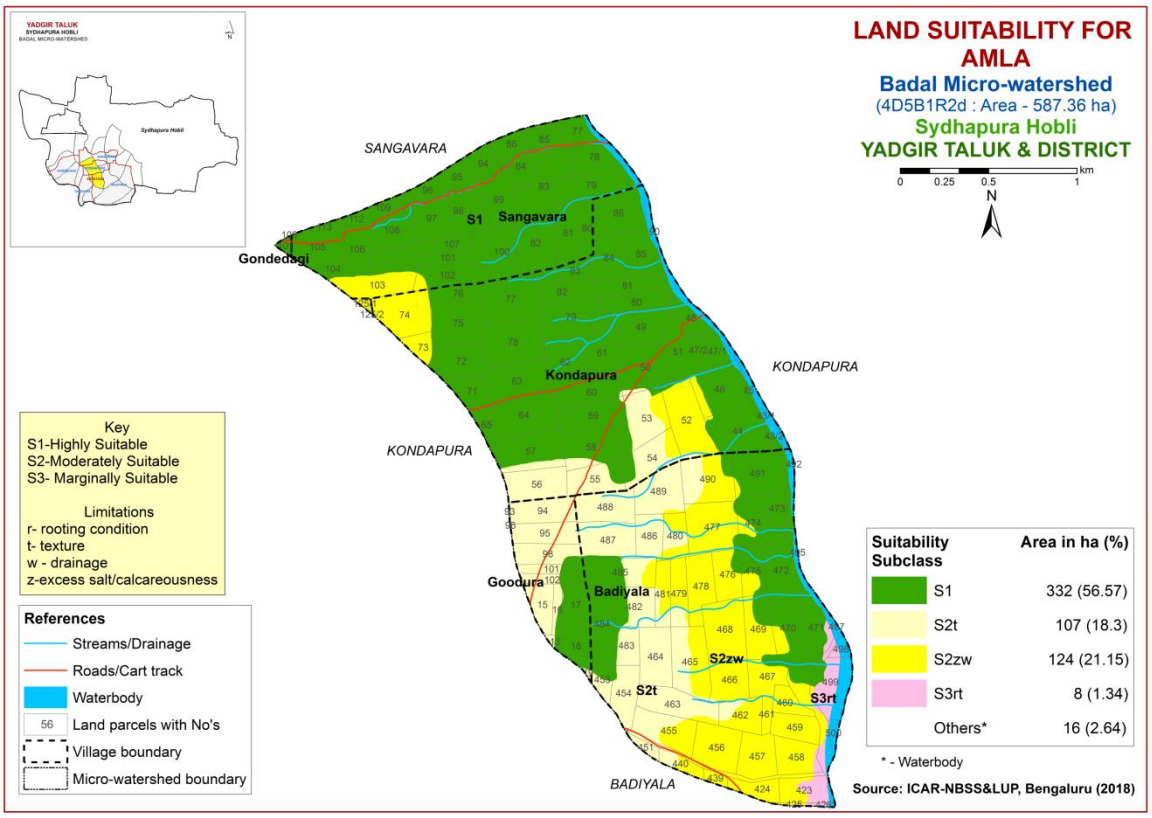


Fig. 7.18 Land Suitability map of Amla

7.19 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 7.20) 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 7.19.

Entire area of the microwatershed is not suitable (Class N1) for cultivation of cashew which occupies an area of 572 ha (97%) with severe limitations of rooting depth, texture and calcareousness.

Table 7.20 Land suitability criteria for Cashew

Crop requirement			Rating			
Soil –site characteristics		Unit	Highly suitable(S1)	Moderately suitable(S2)	Marginally suitable(S3)	Not suitable(N)
Soil aeration	Soil drainage	Class	Well drained	Mod. well drained	Poorly drained	V.Poorly drainage
Nutrient availability	Texture	Class	sc,c (red), scl, cl,	-	ls, sl	c (black)
	pH	1:2.5	5.5-6.5	5.0-5.5,6.5-7.3	7.3-7.8	>7.8
Rooting conditions	Soil depth	Cm	>100	75-100	50-75	<50
	Gravel content	% vol.	<15	15-35	35-60	>60
Erosion	Slope	%	0-3	3-10	>10	

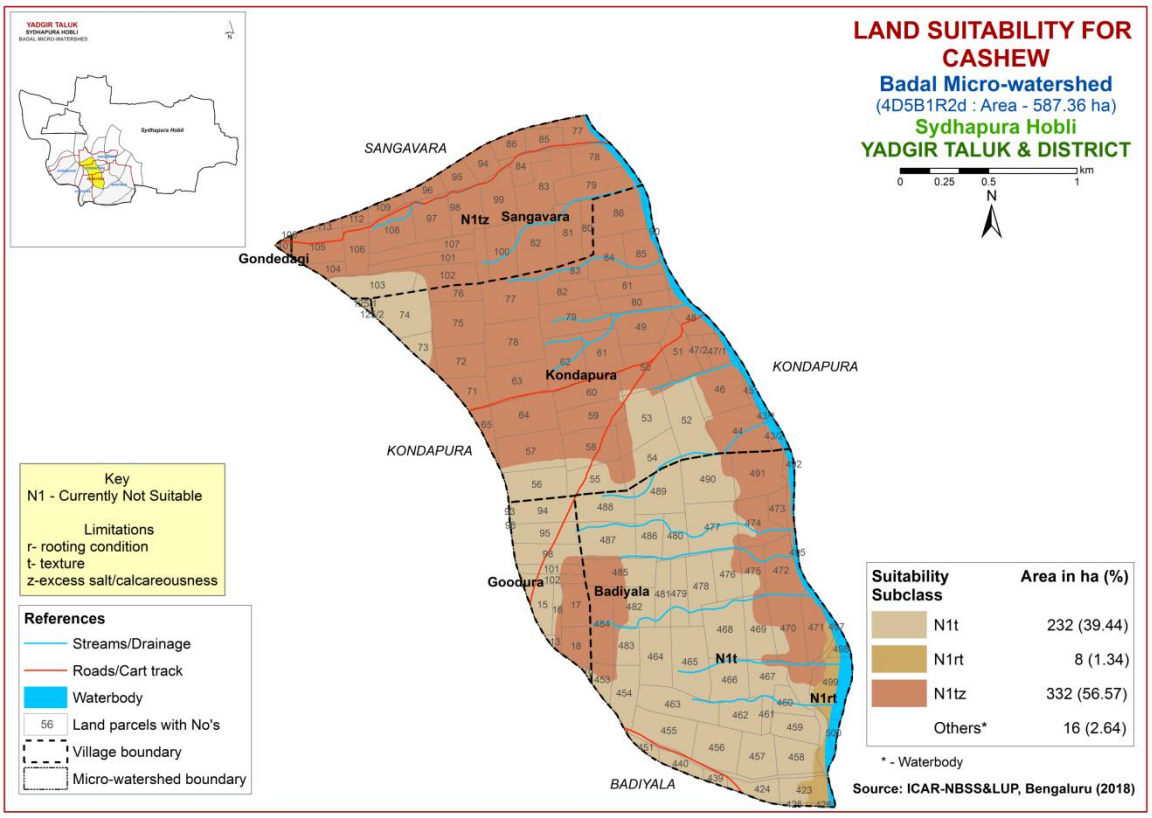


Fig. 7.19 Land Suitability map of Cashew

7. 20 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 7.21) 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 7.20.

No highly suitable (Class S1) and moderately suitable (Class S2) lands are available for growing Jackfruit in the microwatershed. Marginally suitable (Class S3) lands occupy maximum area of about 564 ha (96%) and are distributed in the major part of the microwatershed. They have moderate limitations of drainage, texture and calcareousness. Very small area of about 8 ha (1%) is not suitable (Class N1) and is

distributed in the southeastern and southern part of the microwatershed with severe limitations of rooting depth and texture.

Table 7.21 Land suitability criteria for Jackfruit

Crop requirement			Rating			
Soil –site characteristics		Unit	Highly suitable(S1)	Moderately suitable(S2)	Marginally suitable(S3)	Not suitable(N)
Soil aeration	Soil drainage	class	well	Mod. well	Poorly	V. Poorly
Nutrient availability	Texture	Class	scl,cl,sc,c(red)	-	sl,ls,c(black)	-
	pH	1:2.5	5.5-7.3	5.0-5.5,7.3-7.8	7.8-8.4	>8.4
Rooting conditions	Soil depth	cm	>100	75-100	50-75	<50
	Gravel content	% vol.	<15	15-35	35-60	>60
Erosion	Slope	%	0-3	3-5	>5	-

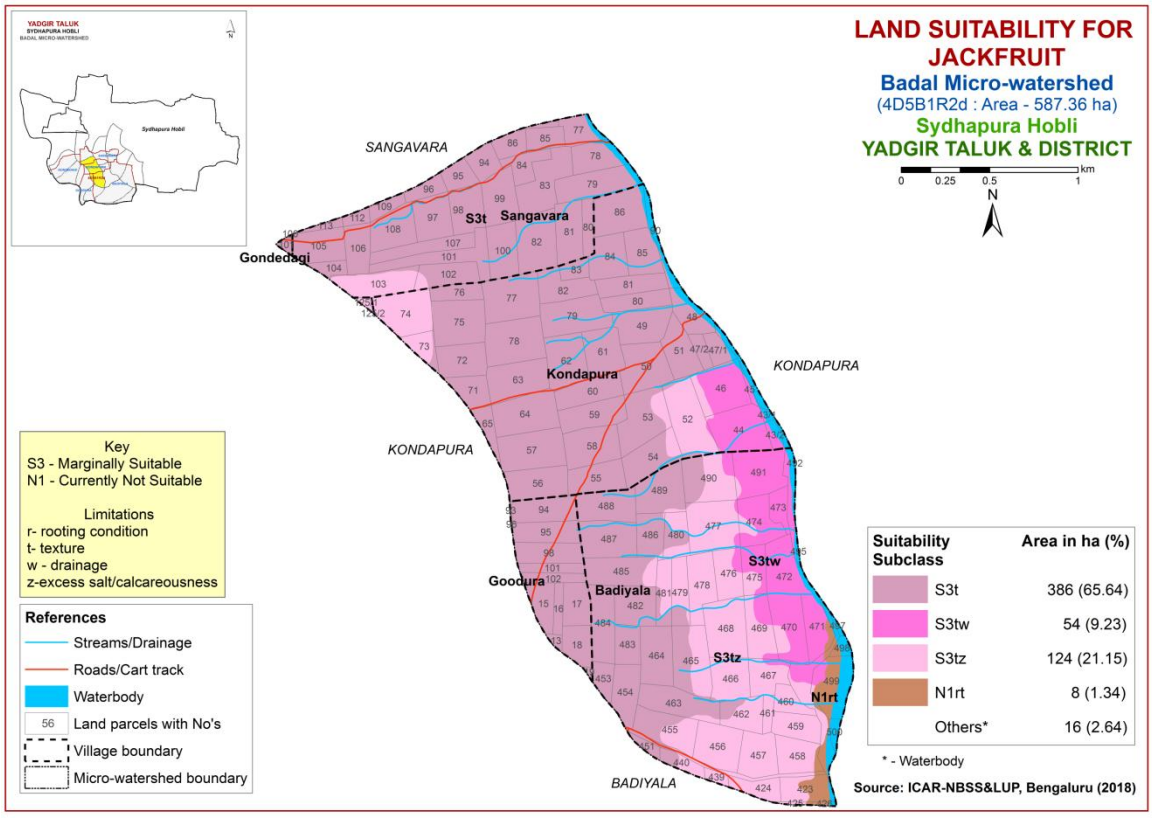


Fig. 7.20 Land Suitability map of Jackfruit

7.21 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 22) 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 7.21.

No highly suitable (Class S1) lands available for growing Jamun in the microwatershed. Maximum area of about 440 ha (75%) is moderately suitable (Class S2) for growing Jamun and are distributed in the major part of the microwatershed. They have

minor limitations of texture and drainage. An area of about 124 ha (21%) is marginally suitable (Class S3) for growing Jamun and is distributed in the northwestern, central and southern part of the microwatershed. They have moderate limitations of calcareousness and rooting depth. Very small area of about 8 ha (1%) is not suitable (N) and is distributed in the southeastern and southern part of the microwatershed with severe limitations of rooting depth and texture.

Table 7.22 Land suitability criteria for Jamun

Crop requirement			Rating			
Soil –site characteristics		Unit	Highly suitable(S1)	Moderately suitable(S2)	Marginally suitable(S3)	Not suitable (N)
Soil aeration	Soil drainage	Class	Well	Mod. well	Poorly	V.Poorly
Nutrient availability	Texture	Class	scl,cl,sc,c(red)	sl, c (black)	ls	-
	pH	1:2.5	6.0-7.8	5.0-6.0	7.8-8.4	>8.4
Rooting conditions	Soil depth	cm	>150	100-150	50-100	<50
	Gravel content	% vol.	<15	15-35	35-60	>60
Erosion	Slope	%	0-3	3-5	5-10	>10

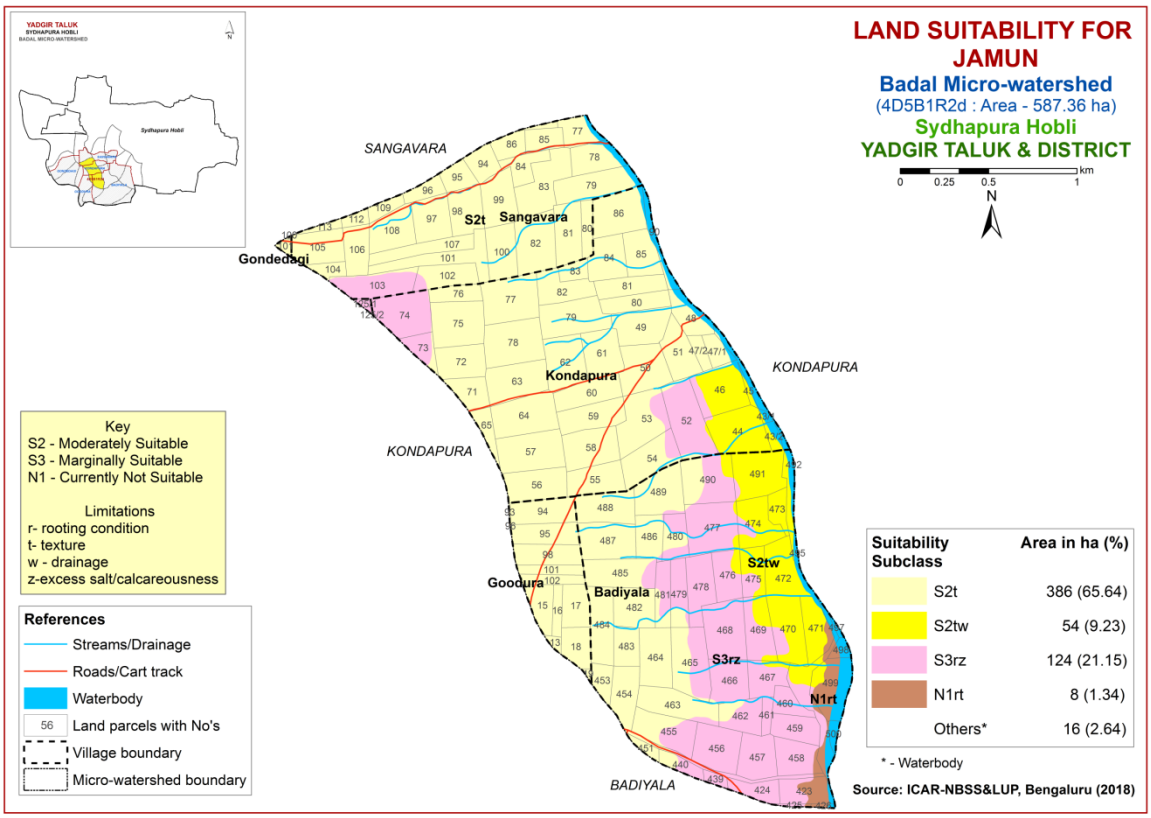


Fig. 7.21 Land Suitability map of Jamun

7.22 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 (Table7.23) 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 7.22.

Highly suitable (Class S1) lands for growing custard apple occur in maximum area of 564 ha (96%) and is distributed in the major part of the microwatershed. Very small area of about 8 ha (1%) is marginally suitable (Class S3) for growing custard apple and is distributed in the southeastern and southern part of the microwatershed with moderate limitation of rooting depth.

Table 7.23 Land suitability criteria for Custard apple

Crop requirement			Rating			
Soil –site characteristics		Unit	Highly suitable (S1)	Moderately suitable(S2)	Marginally suitable(S3)	Not suitable(N)
Soil aeration	Soil drainage	Class	Well drained	Mod. well drained	Poorly drained	V. Poorly drained
Nutrient availability	Texture	Class	scl, cl, sc, c (red), c (black)	-	sl, ls	-
	pH	1:2.5	6.0-7.3	7.3-8.4	5.0-5.5,8.4-9.0	>9.0
Rooting conditions	Soil depth	Cm	>75	50-75	25-50	<25
	Gravel content	% vol.	<15-35	35-60	60-80	-
Erosion	Slope	%	0-3	3-5	>5	

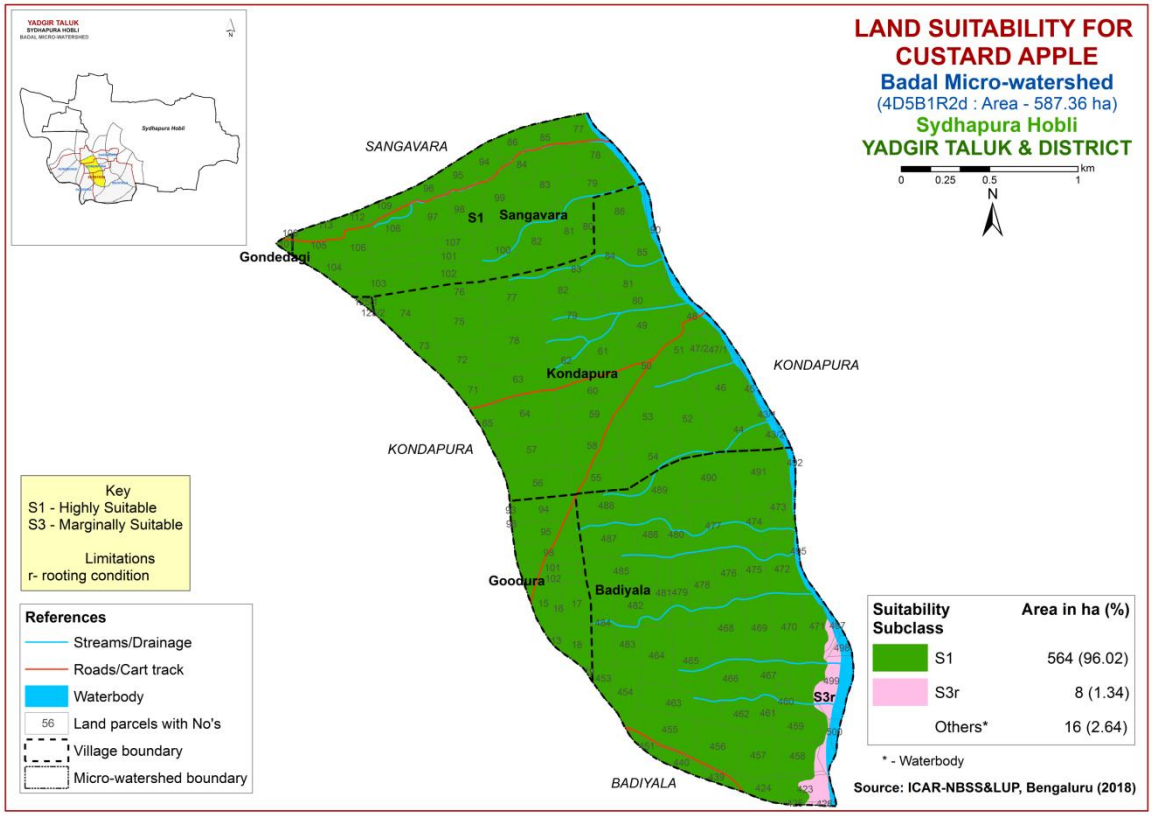


Fig. 7.22 Land Suitability map of Custard Apple

7.23 Land Suitability for 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 7.24) 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 Fig. 7.23.

Table 7.24 Land suitability criteria for Tamarind

Crop requirement			Rating			
Soil –site characteristics		Unit	Highly suitable(S1)	Moderately suitable(S2)	Marginally suitable(S3)	Not suitable(N)
Soil aeration	Soil drainage	Class	Well drained	Mod.well drained	Poorly drained	V.Poorly drained
Nutrient availability	Texture	Class	scl,cl,sc,c(red)	sl, c (black)	ls	-
	pH	1:2.5	6.0-7.3	5.0-6.0,7.3-7.8	7.8-8.4	>8.4
Rooting conditions	Soil depth	Cm	>150	100-150	75-100	<50
	Gravel content	% vol.	<15	15-35	35-60	60-80
Erosion	Slope	%	0-3	3-5	5-10	>10

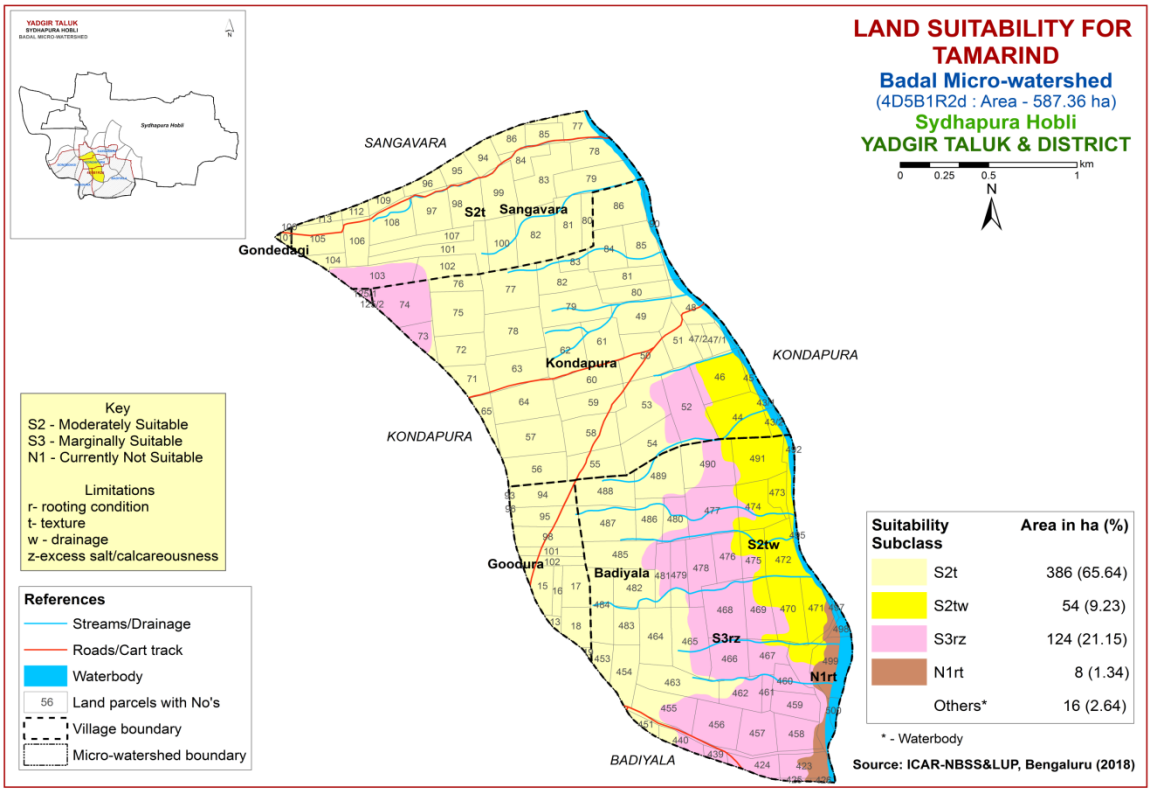


Fig. 7.23 Land Suitability map of Tamarind

No highly suitable (Class S1) lands available for growing Tamarind in the microwatershed. Maximum area of about 440 ha (75%) is moderately suitable (Class S2) for growing Tamarind and are distributed in the major part of the microwatershed. They have minor limitations of texture and drainage. Marginally suitable (Class S3) lands for

growing Tamarind occupy an area of about 124 ha (21%) and are distributed in the northwestern, central and southern part of the microwatershed. They have moderate limitations of rooting depth and calcareousness. Very small area of about 8 ha (1%) is not suitable (Class N1) for growing Tamarind and occur in the southeastern and southern part of the microwatershed with severe limitations of rooting depth and texture.

7.24 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 7.25) 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 7.24.

Table 7.25 Crop suitability criteria for Mulberry

Crop requirement			Rating			
Soil –site characteristics		Unit	Highly suitable(S1)	Moderately Suitable(S2)	Marginally suitable(S3)	Not suitable(N)
Soil aeration	Soil drainage	Class	Well drained	Moderately well drained	Poorly drained	V. Poorly drained
Nutrient availability	Texture	Class	sc, cl, scl	c (red)	c(black), sl, ls	-
	pH	1:2.5	5.5-7.3	5.0-5.5,7.8-8.4	8.4-9.0	>9.0
Rooting conditions	Soil depth	cm	>100	75-100	50-75	<50
	Gravel content	%vol.	0-35	35-60	60-80	>80
Erosion	Slope	%	0-3	3-5	5-10	>10

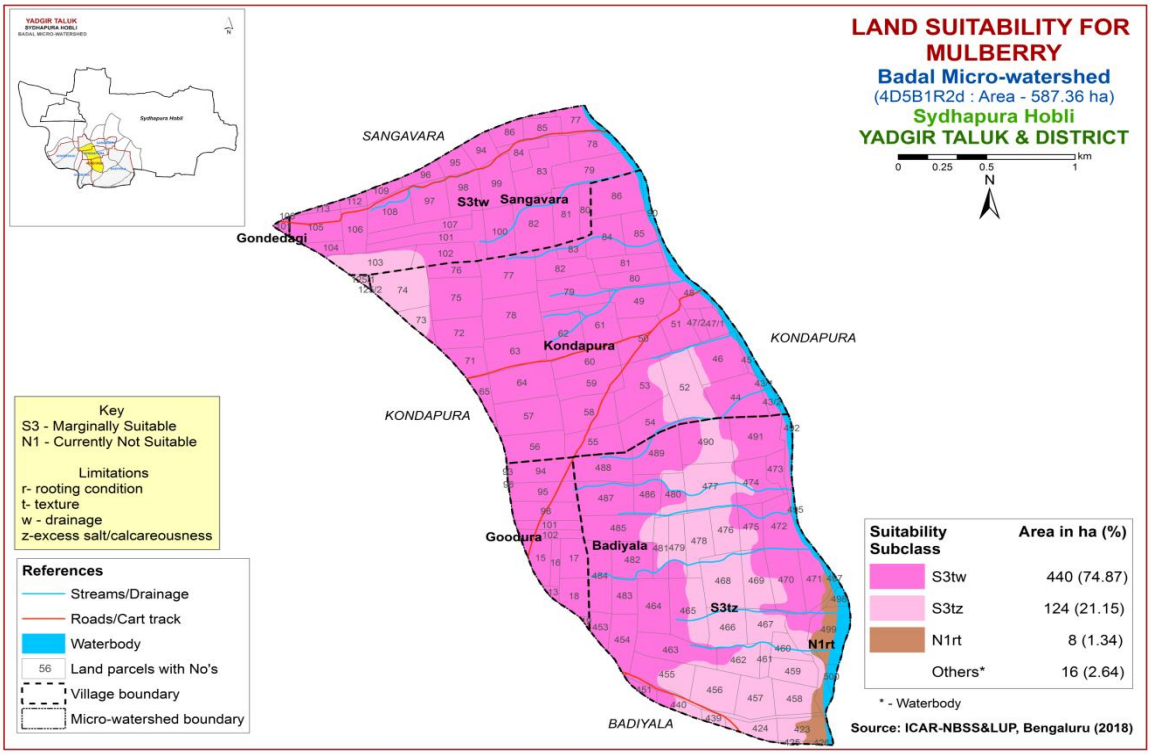


Fig 7.24 Land Suitability map of Mulberry

No highly (Class S1) and moderately (Class S2) suitable lands available for growing mulberry in the microwatershed. Major area of about 564 ha (96%) is marginally suitable (Class S3) for growing mulberry and are distributed in the major part of the microwatershed. They have moderate limitations of texture, drainage and calcareousness. Not suitable lands (Class N1) occupy very small area of about 8 ha (1%) and distributed in the southeastern and southern part of the microwatershed. They have severe limitations of rooting depth and texture.

7.25 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 7.26) 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 7.25.

No highly suitable (Class S1) lands available for growing Marigold in the microwatershed. Maximum area of about 564 ha (96%) is moderately suitable (Class S2) for growing Marigold and are distributed in the major part of the microwatershed. They have minor limitations of texture, drainage and calcareousness. Marginally suitable (Class S3) lands for growing Marigold occupy a very small area of about 8 ha (1%) and are distributed in the southeastern and southern part of the microwatershed. They have moderate limitations of texture and rooting depth.

Table 7.26 Land suitability criteria for Marigold

Crop requirement			**Rating**			
Soil –site characteristics		**Unit**	**Highly suitable(S1)**	**Moderately suitable(S2)**	**Marginally suitable(S3)**	**Not suitable(N)**
Climate	Temperature in growing season		18-23	17-15 24-35	35-40 10-14	>40 <10
Soil aeration	Soil drainage	Class	Well drained	Moderately well drained	Imperfectly drained	Poorly drained
Nutrient availability	Texture	Class	l,sl,scl,cl, sil	sicl,sc,sic,c	c	ls, s
	pH	1:2.5	7.0-7.5	5.5-5.9,7.6-8.5	<5,>8.5	-
	$CaCO_3$ in root zone	%	Non calcareous	Slightly calcareous	Strongly calcareous	-
Rooting conditions	Soil depth	cm	>75	50-75	25-50	<25
	Gravel content	%vol.	<15	15-35	>35	-
Soil toxicity	Salinity	ds/m	Non saline	Slightly	Strongly	-
	Sodicity(ESP)	%	<10	10-15	>15	-
Erosion	Slope	%	1-3	3-5	5-10	-

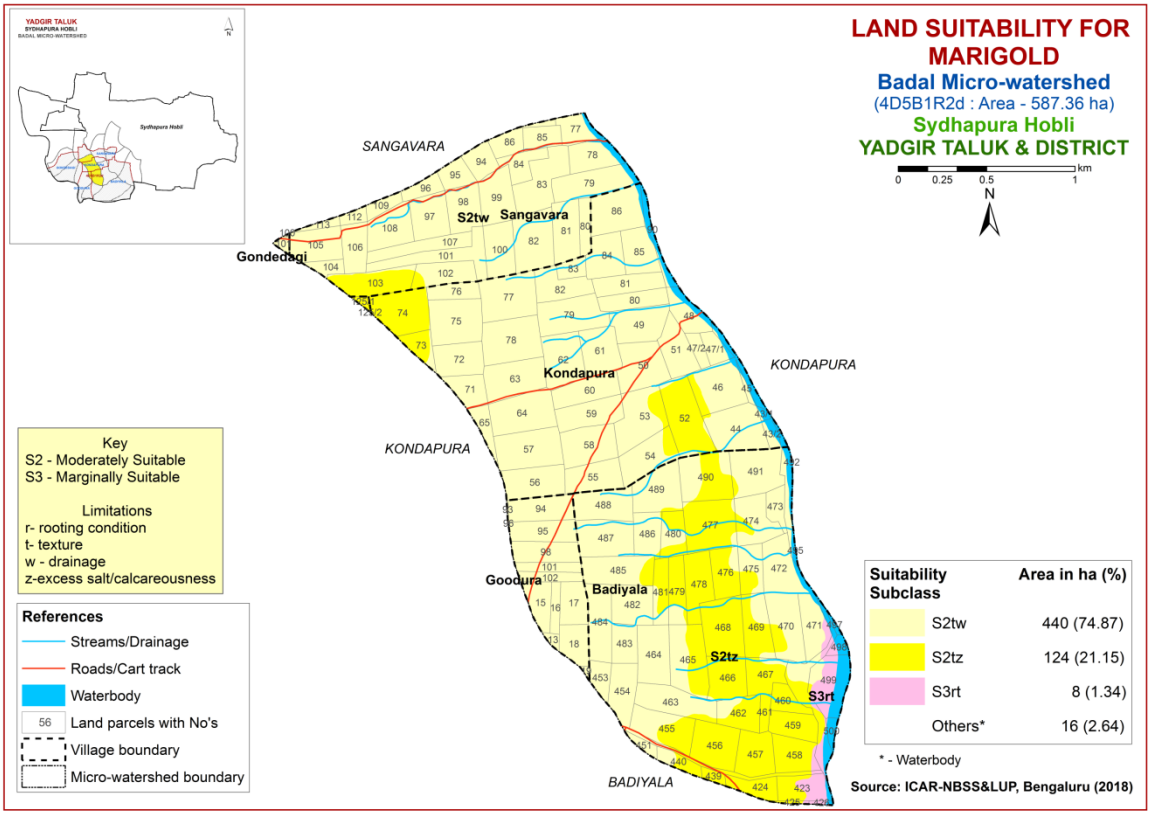


Fig. 7.25 Land Suitability map of Marigold

7.26 Land Suitability for Chrysanthemum (*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 7.27) for growing chrysanthemum were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing chrysanthemum was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.26.

No highly suitable (Class S1) lands available for growing Chrysanthemum in the microwatershed. Maximum area of about 564 ha (96%) is moderately suitable (Class S2) for growing Chrysanthemum and are distributed in the major part of the microwatershed. They have minor limitations of texture, calcareousness and drainage. Marginally suitable (Class S3) lands for growing Chrysanthemum occupy very small area of about 8 ha (1%) and are distributed in the southeastern and southern part of the microwatershed. They have moderate limitations of rooting depth and texture.

Table 7.27 Land suitability criteria for Chrysanthemum

Crop requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable(S1)**	**Moderately suitable(S2)**	**Marginally suitable(S3)**	**Not suitable(N)**
Climate	Temperature in growing season		18-23	17-15 24-35	35-40 10-14	>40 <10
Soil aeration	Soil drainage	Class	Well drained	Moderately well drained	Imperfectly drained	Poorly drained
Nutrient availability	Texture	Class	l ,sl,scl,cl, sil	sicl,sc,sic,c	c	ls, s
	pH	1:2.5	7.0-7.5	5.5-5.9,7.6-8.5	<5,>8.5	
	$CaCO_3$ in root zone	%	Non calcareous	Slightly calcareous	Strongly calcareous	
Rooting conditions	Soil depth	Cm	>75	50-75	25-50	<25
	Gravel content	%vol.	<15	15-35	>35	
Soil toxicity	Salinity	ds/m	Non saline	slightly	strongly	
	Sodicity(ESP)	%	<10	10-15	>15	-
Erosion	Slope	%	1-3	3-5	5-10	

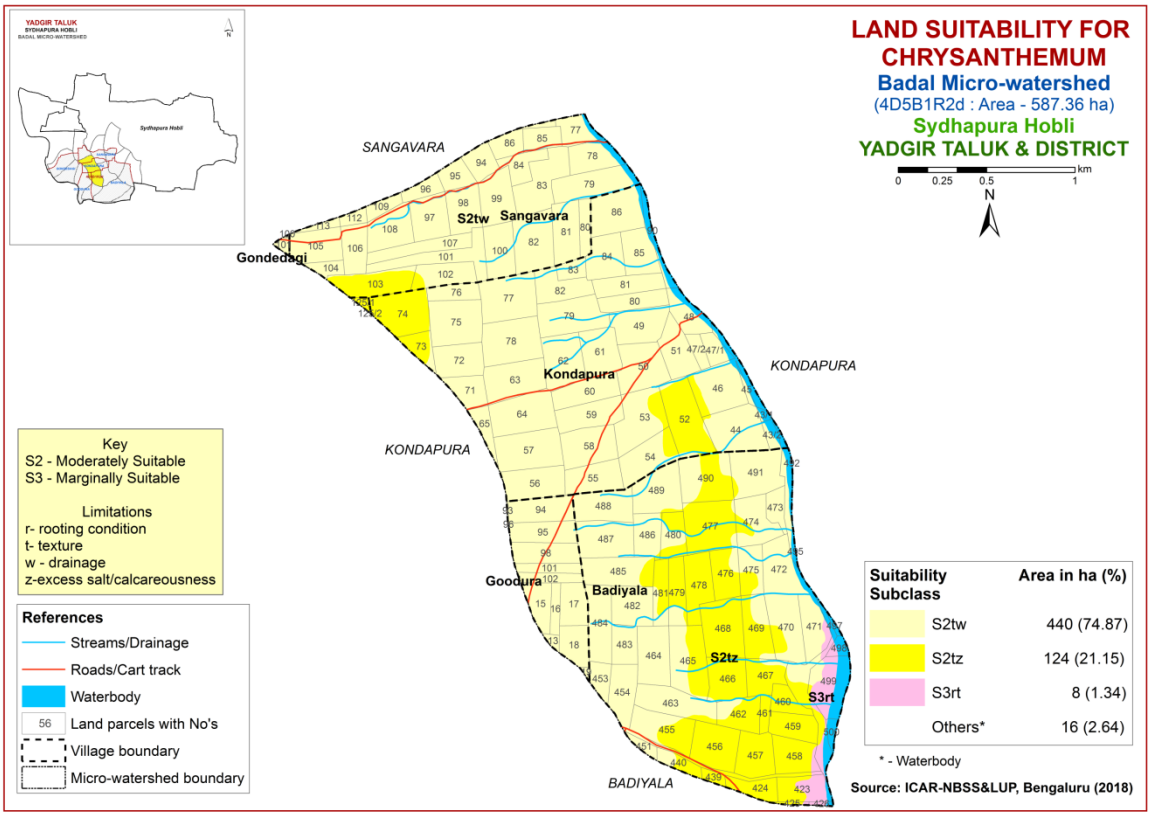


Fig. 7.26 Land Suitability map of Chrysanthemum

7.27 Land Management Units (LMUs)

The 6 soil map units identified in Badal microwatershed have been grouped into 4 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. 7.28) has been generated. These Land Management Units are expected to behave similarly for a given level of management.

The 6 map units that have been grouped into 4 Land Management Units along with brief description of soil and site characteristics are given below.

LMU NO.	Soil map units	Soil and site characteristics
1	104. TMKiB2	Very deep, lowland black clay soils, 1-3% slopes, non gravelly, moderate erosion
2	93. HGNiB2 95. HGNmB2 35. GWDiB2	Moderately deep to very deep, black calcareous sandy clay to clay soils, 1-3% slopes, non gravelly, moderate erosion
3	48. NGPiB2	Deep black loamy sand soils, 1-3% slopes, non gravelly, moderate erosion
4	6. BDLiB3	Shallow, black sandy clay soils, 1-3% slopes, non gravelly, severe erosion

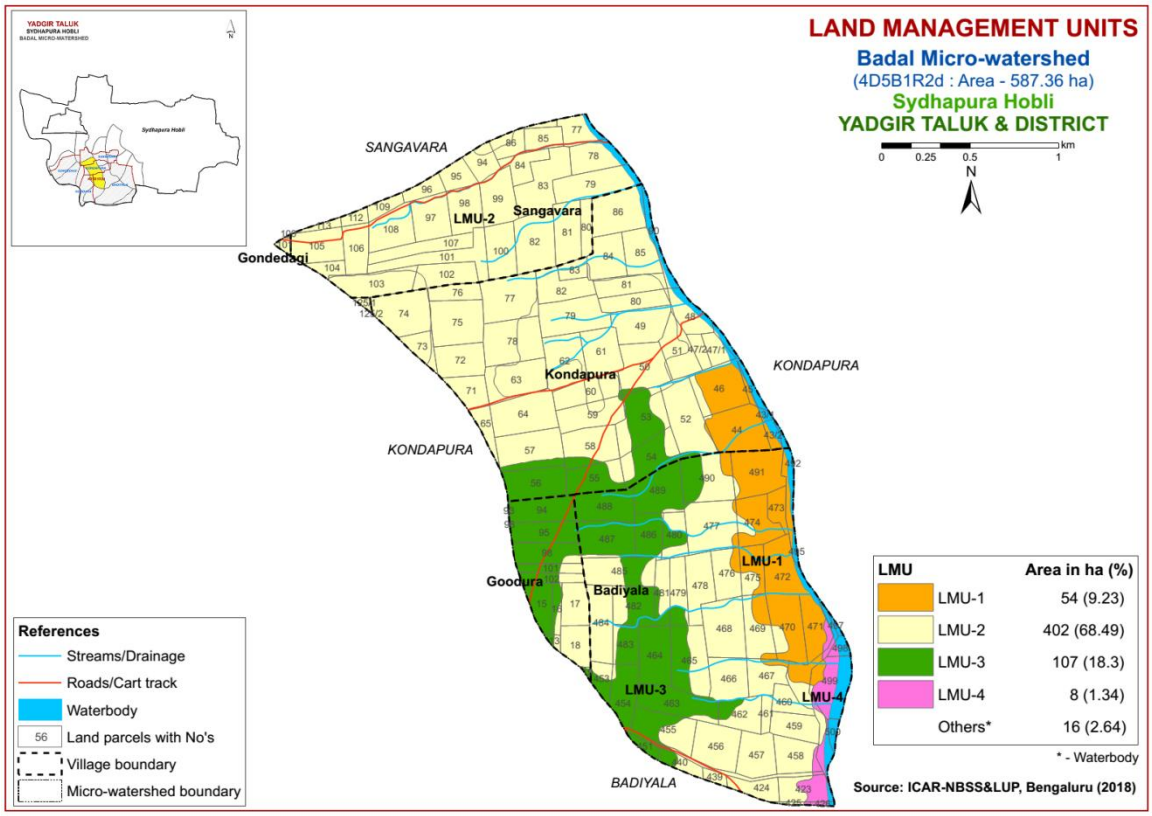


Fig. 7.28 Land Management Units Map- Badal Microwatershed

7.28 Proposed Crop Plan for Badal Microwatershed

After assessing the land suitability for the 26 crops, the Proposed Crop Plan has been prepared for the 4 identified LMUs by considering only the highly (Class S1) and moderately (Class S2) suitable lands for each of the 26 crops. The resultant proposed crop plan is presented below in Table 7.29.

Table 7.28 Proposed Crop Plan for Badal Microwatershed

LMU No	Mapping Units	Survey Number	Soil Characteristics	Field Crops	Horticulture Crops	Suitable Interventions
1	104. TMKiB2	**Badiyala:** 470,471,472,473, 474,475, 491 **Kondapura:** 43/2,44,45,46	Very deep, lowland black clay soils, 1-3% slopes, non gravelly, moderate erosion	Sunflower, Cotton, Bengal gram, Bajra	**Fruit crops:** Lime, Musambi, Amla, Jamun **Vegetables:** Drumstick, Chilli, Coriander **Flowers:** Marigold, Chrysanthemum	Application of FYM, Biofertilizers and micronutrients, suitable soil and water conservation practices
2	93. HGNiB2 95. HGNmB2 35. GWDiB2	**Badiyala:**423,424,425,439,440,456,457,458,459,460,461,462,465,466,467,468,469, 476,477,478,479,480,481,484, 485,490 **Gondedagi:** 100,101,125/1, 125/2 **Goodura:** 13,17,18 **Kondapura:**47/1,47/2,48,49,50,51,52,57,58,59,60,61,62,63,64,65,71,72,73,74,75,76, 77,78,79,80,81,82,83,84,85,86 **Sangavara:**77,78,79,80,81,82,83,84,85,86,94,95,96,97,98,99,100,101,102,103,104,105,106,107,108, 109,112,113	Moderately deep to very deep, black calcareous sandy clay to clay soils, 1-3% slopes, non gravelly, moderate erosion	Sunflower, Sorghum, Maize, Cotton, Bengal gram, Safflower, Linseed, Bajra	**Fruit crops:** Pomegranate, Lime, Musambi, Amla, Custard apple, Tamarind, Jamun **Vegetables:** Drumstick, Chilli, Coriander **Flowers:** Marigold, Chrysanthemum	Application of FYM, Biofertilizers and micronutrients, drip irrigation, Mulching, suitable soil and water conservation practices
3	48. NGPiB2	**Badiyala:**451,453,454,455,463,464,482,483, 486,487,488,489 **Goodura:** 15,16,19,93,94,95,96,98,101,102 **Kondapura:** 53,54,55,56	Deep black loamy sand soils, 1-3% slopes, non gravelly, moderate erosion	Bajra, Safflower, Linseed, Coriander, Bengal gram	**Fruit crops:** Amla, Jamun, Custard apple, Tamarind **Vegetables:** Drumstick	Application of FYM, Biofertilizers and micronutrients, drip irrigation, mulching, suitable soil and water conservation practices
4	6. BDLiB3	**Badiyala:** 426,499	Shallow black sandy clay soils, 1-3% slopes, non gravelly, severe erosion	Bengal gram, Linseed, Safflower, Coriander	**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 Badal Microwatershed

- The soil phases identified in the microwatershed belonged to the soil series of HGN 278 ha (47%), GWD 124 ha (21%), NGP 107 ha (18%), TMK 54 ha (9%) and BDL 8 ha (1%).
- As per land capability classification entire area of the microwatershed falls under arable land category (Class II & IV). The major limitations identified in the arable lands were soil and erosion.
- On the basis of soil reaction, about 112 ha (19%) area is slightly to moderately alkaline (pH 7.3-8.4) and 460 ha (78%) is strongly to very strongly alkaline (pH 8.4 - >9.0).

❖ **Soil Health Management**

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

Acid soils

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 moderately alkaline soils)

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

Neutral soils

1. Regular addition of organic manure, green manuring, green leaf manuring, crop residue incorporation and mulching needs to be taken up to improve the soil organic matter status.
2. Application of biofertilizers, (Azospirullum, 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 587 ha area in the microwatershed, an area of about 572 ha is suffering from moderate to severe erosion. These areas need immediate soil and water conservation and, other land development and land husbandry practices for restoring soil health.

Dissemination of Information and Communication of Benefits

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

Inputs for Net Planning (Saturation Plan) and Interventions needed

Net planning (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 Badal microwatershed.

- **Organic Carbon:** The OC content (an index of available Nitrogen) is high in (>0.75%) in about 45 ha (8%), medium (0.5-0.75%) in 211 ha (36%) area and low (<0.5%) in 316 ha (54%). 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 527 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 is low (<23 kg/ha) in an area of 316 ha (54%) and medium (23-57 kg/ha) in 211 ha (36%) of the microwatershed. In 45 ha (8%) area, the available phosphorus is high (>57 kg/ha). For all the crops 25% additional P needs to be applied where available P is low and medium.
- **Available Potassium:** Available potassium is medium (145-337 kg/ha) in an area of 61 ha (10%) of the microwatershed and maximum area of about 511 ha (87%) is high (>337 kg/ha) in available potassium. 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 in small area of 6 ha (1%), medium in 297 ha (51%) and low in 268 ha (46%). 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 143 ha (24%) is high in available boron, 276 ha (47%) is medium and 153 ha (26%) is low. For areas of low and medium, application of sodium tetra borate @ 10 kg/ha as soil application or 0.2 % borax as foliar spray is recommended.
- **Available Iron:** An area of about 138 ha (24%) is under sufficient and 434 ha (74%) is deficient in available iron in the microwatershed. For deficient areas, application of iron sulphate @ 25 ka/ha is recommended.
- **Available Zinc:** Maximum area of about 561 ha is deficient in available zinc content. Application of zinc sulphate @25 kg/ha is to be recommended for these areas. Small area of 11 ha (2%) is sufficient in available zinc content.
- **Soil Alkalinity:** Entire microwatershed has soils that are slightly to very strongly alkaline. These areas need application of gypsum and wherever calcium is in excess, iron pyrites and element sulphur can be recommended. Management practices like treating repeatedly with good quality water to drain out the excess salts and provision of subsurface drainage and growing of salt tolerant crops like Casuarina, Acasia, Neem, Ber etc, are recommended.

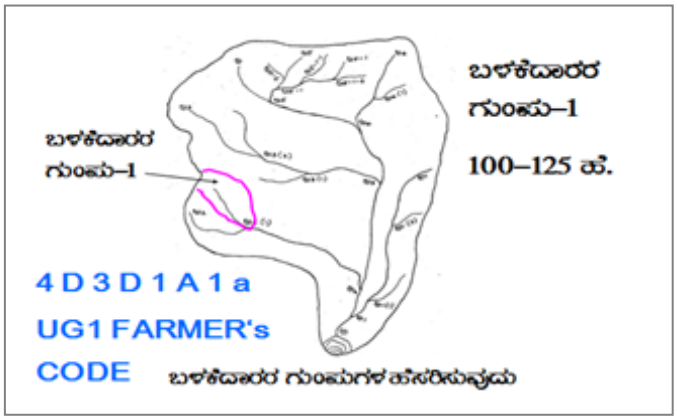
Land Suitability for various crops: Areas that are highly, moderately and marginally suitable and not suitable for growing various crops are indicated. Along with the suitability, various constraints that are limiting the productivity are also indicated. For example, in case of cotton, gravel content,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

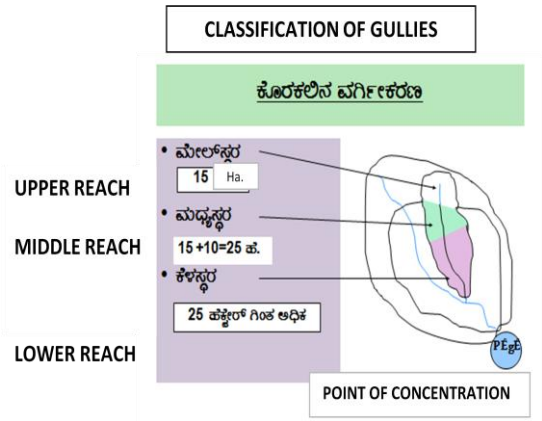
- Naming of user groups and farmers
- Identification of arable and non arable lands
- Identification of drainage lines and gullies
- Identification of non treatable areas
- Identification of priority areas in the arable lands
- Treatment plan for arable lands
- Location of water harvesting and recharge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

9.1 Treatment Plan

The treatment plan recommended for arable lands is briefly described below

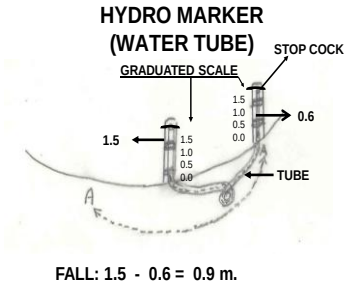
9.1.1 Arable Land Treatment

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.



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.

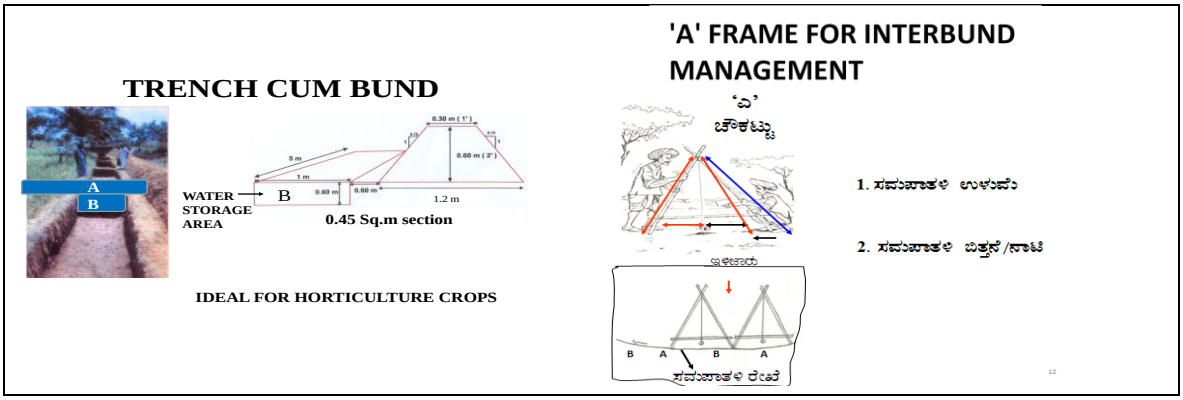
Recommended Bund Section

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 are formed in the field.

9.1.3 Treatment of Natural Water Course/ Drainage Lines

a) The cadastral map has to be updated as regards the network of drainage lines (gullies/ *nalas/ hallas*) and existing structures are marked to the scale and storage capacity of the existing water bodies are documented.
b) The drainage line will be demarcated into Upper Reach, Middle Reach and Lower Reach.
c) Considering the Catchment, *Nala* bed and bank conditions, suitable structures are decided.
d) Number of storage structures (Check dam/ *Nala* bund/ Percolation tank) will be decided considering the commitments and available runoff from water budgeting and quality of water in the wells and site suitability.
e) Detailed 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. Entire area of about 572 ha (97%) 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.

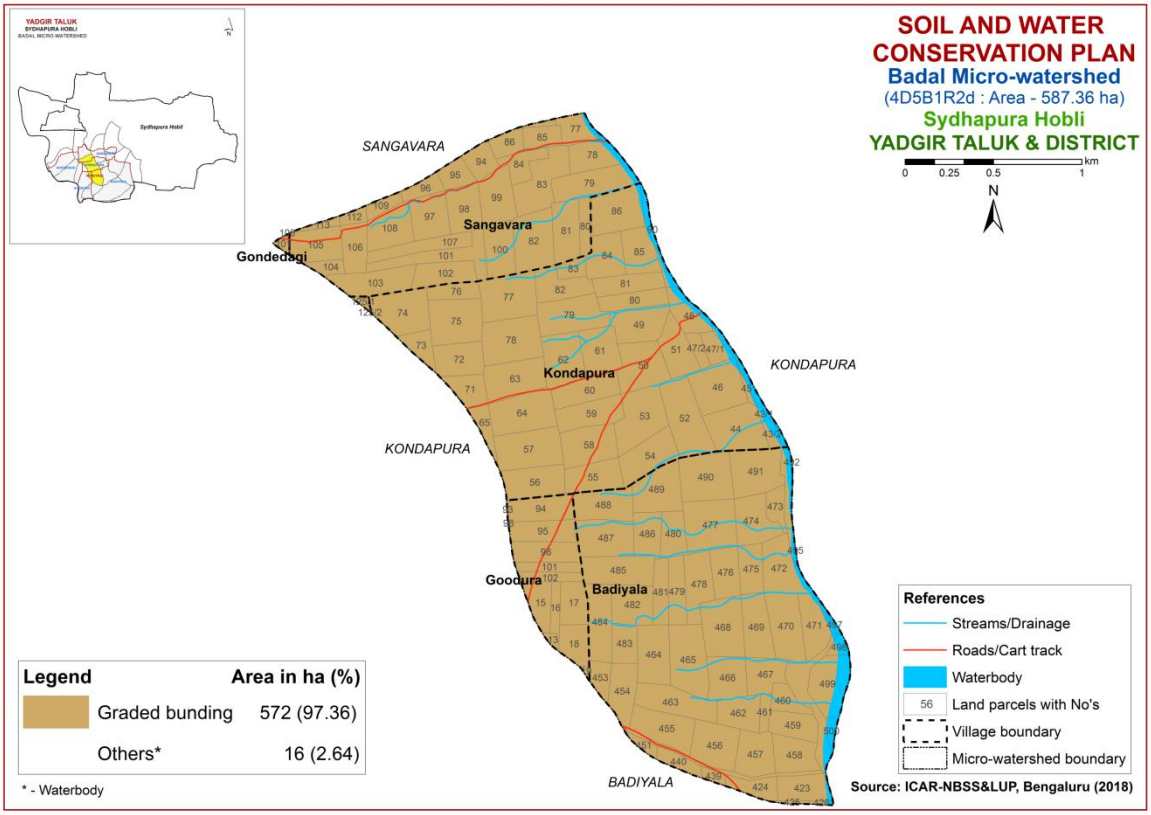


Fig. 9.1 Soil and Water Conservation Plan map of Badal Microwatershed

9.3 Greening of Microwatershed

As part of the greening programme in the watersheds, it is envisaged to plant a variety of horticultural and other tree plants that are edible, economical and produce lot of biomass which helps to restore the ecological balance in the watersheds. The lands that are suitable for greening programme are non-arable lands (land capability classes V, VI VII and VIII) and also the lands that are not suitable or marginally suitable 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 dug out soil on the lower side of the slope in order to harness the flowing water and facilitate weathering of soil in the pit. Exposure of soil in the pit also prevents spread of pests and diseases due to scorching sun rays. The pits should be filled with mixture of soil and organic manure during the second week of April and keep ready with sufficiently tall seedlings produced either in poly bags or in root trainer nurseries so that planting can be done during the 2nd or 3rd week of April depending on the rainfall.

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

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

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Appendix I

Badal 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
Goodura	13	0.56	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Cotton (Rg+Ct)	Not Available	IIes	Graded bunding
Goodura	15	3.37	NGPiB2	LMU-3	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Cotton (Rg+Ct)	Not Available	IIes	Graded bunding
Goodura	16	1.52	NGPiB2	LMU-3	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Cotton (Rg+Ct)	Not Available	IIes	Graded bunding
Goodura	17	3.71	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Goodura	18	3.47	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Cotton (Rg+Ct)	Not Available	IIes	Graded bunding
Goodura	19	0.23	NGPiB2	LMU-3	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Cotton (Rg+Ct)	Not Available	IIes	Graded bunding
Goodura	93	0.08	NGPiB2	LMU-3	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Cotton (Rg+Ct)	Not Available	IIes	Graded bunding
Goodura	94	4.98	NGPiB2	LMU-3	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Jowar (Rg+Jw)	Not Available	IIes	Graded bunding
Goodura	95	4.5	NGPiB2	LMU-3	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Groundnut (Rg+Gn)	Not Available	IIes	Graded bunding
Goodura	96	0	NGPiB2	LMU-3	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Cotton (Rg+Ct)	Not Available	IIes	Graded bunding
Goodura	98	4.45	NGPiB2	LMU-3	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Goodura	101	2.02	NGPiB2	LMU-3	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Goodura	102	2.01	NGPiB2	LMU-3	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kondapura	43/1	0.38	Waterbody	Others	Others	Others	Others	Others	Others	Others	Waterbody	Not Available	Others	Others
Kondapura	43/2	1.13	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIws	Graded bunding
Kondapura	44	7.47	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Jowar (Rg+Jw)	Not Available	IIws	Graded bunding
Kondapura	45	0.49	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIws	Graded bunding
Kondapura	46	7.32	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Cotton (Rg+Ct)	Not Available	IIws	Graded bunding
Kondapura	47/1	2.04	HGNmB2	LMU-2	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
Kondapura	47/2	1.44	HGNmB2	LMU-2	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
Kondapura	48	3.81	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Fallow land (Fl)	Not Available	IIes	Graded bunding
Kondapura	49	5.73	HGNiB2	LMU-2	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Jowar (Rg+Jw)	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
Kondapura	50	6.73	HGNiB2	LMU-2	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Cotton (Rg+Ct)	Not Available	IIes	Graded bunding
Kondapura	51	4.94	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Cotton (Rg+Ct)	Not Available	IIes	Graded bunding
Kondapura	52	8.51	GWDiB2	LMU-2	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Cotton (Rg+Ct)	Not Available	IIes	Graded bunding
Kondapura	53	7.77	NGPiB2	LMU-3	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton+Jowar+Redgram (Ct+Jw+Rg)	Not Available	IIes	Graded bunding
Kondapura	54	6.09	NGPiB2	LMU-3	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Cotton (Rg+Ct)	Not Available	IIes	Graded bunding
Kondapura	55	5.13	NGPiB2	LMU-3	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar+Cotton (Jw+Ct)	Not Available	IIes	Graded bunding
Kondapura	56	5.9	NGPiB2	LMU-3	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Cotton (Rg+Ct)	Not Available	IIes	Graded bunding
Kondapura	57	7.71	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Cotton (Rg+Ct)	Not Available	IIes	Graded bunding
Kondapura	58	6.39	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kondapura	59	5.32	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kondapura	60	4.97	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Jowar (Rg+Jw)	Not Available	IIes	Graded bunding
Kondapura	61	5.39	HGNiB2	LMU-2	Very deep (>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
Kondapura	62	6.38	HGNiB2	LMU-2	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kondapura	63	6.75	HGNiB2	LMU-2	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Cotton (Rg+Ct)	Not Available	IIes	Graded bunding
Kondapura	64	7.54	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kondapura	65	2.1	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kondapura	71	3.35	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar+Cotton (Jw+Ct)	Not Available	IIes	Graded bunding
Kondapura	72	5	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kondapura	73	2.52	GWDiB2	LMU-2	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar+Cotton (Jw+Ct)	Not Available	IIes	Graded bunding
Kondapura	74	7.05	GWDiB2	LMU-2	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Cotton (Rg+Ct)	Not Available	IIes	Graded bunding
Kondapura	75	7.39	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kondapura	76	2.63	HGNmB2	LMU-2	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
Kondapura	77	7.74	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Jowar (Rg+Jw)	Not Available	IIes	Graded bunding
Kondapura	78	7.96	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar (Jw)	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
Kondapura	79	7.16	HGNiB2	LMU-2	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar+Cotton (Jw+Ct)	Not Available	IIes	Graded bunding
Kondapura	80	3.6	HGNiB2	LMU-2	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kondapura	81	4.04	HGNiB2	LMU-2	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kondapura	82	4.58	HGNiB2	LMU-2	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Jowar (Rg+Jw)	Not Available	IIes	Graded bunding
Kondapura	83	1.66	HGNiB2	LMU-2	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIes	Graded bunding
Kondapura	84	4.87	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Cotton (Rg+Ct)	Not Available	IIes	Graded bunding
Kondapura	85	4.65	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kondapura	86	6.91	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Jowar (Rg+Jw)	Not Available	IIes	Graded bunding
Kondapura	90	0	Waterbody	Others	Others	Others	Others	Others	Others	Others	Waterbody	Not Available	Others	Others
Sangavara	77	3.1	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Cotton (Rg+Ct)	Not Available	IIes	Graded bunding
Sangavara	78	4.43	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy+Jowar (Pd+Jw)	Not Available	IIes	Graded bunding
Sangavara	79	6.63	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton+Jowar+Groundnut (Ct+Jw+Gn)	Not Available	IIes	Graded bunding
Sangavara	80	2.08	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Sangavara	81	5.15	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Cotton (Rg+Ct)	Not Available	IIes	Graded bunding
Sangavara	82	7.19	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar+Cotton (Jw+Ct)	Not Available	IIes	Graded bunding
Sangavara	83	7.06	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton+Jowar+Groundnut (Ct+Jw+Gn)	Not Available	IIes	Graded bunding
Sangavara	84	2.96	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar+Cotton (Jw+Ct)	Not Available	IIes	Graded bunding
Sangavara	85	2.66	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Sangavara	86	2.88	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton+Jowar+Groundnut (Ct+Jw+Gn)	Not Available	IIes	Graded bunding
Sangavara	94	2.82	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar+Cotton (Jw+Ct)	Not Available	IIes	Graded bunding
Sangavara	95	2.55	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Sangavara	96	2.04	HGNmB2	LMU-2	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
Sangavara	97	5.07	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar+Cotton (Jw+Ct)	Not Available	IIes	Graded bunding
Sangavara	98	4.74	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar+Cotton (Jw+Ct)	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
Sangavara	99	5.49	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Cotton (Rg+Ct)	Not Available	IIes	Graded bunding
Sangavara	100	5.03	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Cotton (Rg+Ct)	Not Available	IIes	Graded bunding
Sangavara	101	5.95	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton+Jowar+Groundnut (Ct+Jw+Gn)	Not Available	IIes	Graded bunding
Sangavara	102	4.47	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Sangavara	103	5.95	GWDiB2	LMU-2	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Sangavara	104	1.51	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Sangavara	105	5.26	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Sangavara	106	3.91	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Sangavara	107	4.27	HGNmB2	LMU-2	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
Sangavara	108	5.31	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar+Cotton (Jw+Ct)	Not Available	IIes	Graded bunding
Sangavara	109	1.6	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Sangavara	112	1.11	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar+Cotton (Jw+Ct)	Not Available	IIes	Graded bunding
Sangavara	113	0.85	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton+Jowar+Groundnut (Ct+Jw+Gn)	Not Available	IIes	Graded bunding
Gondedagi	100	0.04	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Gondedagi	101	0.57	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton+Jowar+Redgram (Ct+Jw+Rg)	Not Available	IIes	Graded bunding
Gondedagi	125/1	0.47	GWDiB2	LMU-2	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Jowar (Rg+Jw)	Not Available	IIes	Graded bunding
Gondedagi	125/2	0.01	GWDiB2	LMU-2	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Cotton (Rg+Ct)	Not Available	IIes	Graded bunding
Badiyala	423	4.19	GWDiB2	LMU-2	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Badiyala	424	2.82	GWDiB2	LMU-2	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Badiyala	425	0.31	GWDiB2	LMU-2	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Badiyala	426	0.3	BDLiB3	LMU-4	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Severe	Redgram (Rg)	Not Available	IVes	Graded bunding
Badiyala	439	0.89	GWDiB2	LMU-2	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Badiyala	440	2.01	GWDiB2	LMU-2	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Badiyala	451	1	NGPiB2	LMU-3	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (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
Badiyala	453	2.14	NGPiB2	LMU-3	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Badiyala	454	4.7	NGPiB2	LMU-3	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIes	Graded bunding
Badiyala	455	6.28	NGPiB2	LMU-3	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Cotton (Rg+Ct)	Not Available	IIes	Graded bunding
Badiyala	456	6.22	GWDiB2	LMU-2	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar (Jw)	Not Available	IIes	Graded bunding
Badiyala	457	5.13	GWDiB2	LMU-2	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Badiyala	458	4.65	GWDiB2	LMU-2	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Badiyala	459	3.9	GWDiB2	LMU-2	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Badiyala	460	2.48	GWDiB2	LMU-2	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Badiyala	461	1.2	GWDiB2	LMU-2	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Badiyala	462	4.26	GWDiB2	LMU-2	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Badiyala	463	6.47	NGPiB2	LMU-3	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Badiyala	464	6.05	NGPiB2	LMU-3	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
Badiyala	465	7.99	GWDiB2	LMU-2	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Cotton (Rg+Ct)	Not Available	IIes	Graded bunding
Badiyala	466	5.19	GWDiB2	LMU-2	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Badiyala	467	4.16	GWDiB2	LMU-2	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Badiyala	468	7.47	GWDiB2	LMU-2	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Cotton (Rg+Ct)	Not Available	IIes	Graded bunding
Badiyala	469	5.53	GWDiB2	LMU-2	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Badiyala	470	6.94	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIws	Graded bunding
Badiyala	471	4.68	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Cotton (Rg+Ct)	Not Available	IIws	Graded bunding
Badiyala	472	6.21	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIws	Graded bunding
Badiyala	473	2.11	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIws	Graded bunding
Badiyala	474	5.59	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIws	Graded bunding
Badiyala	475	3.74	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar (Jw)	Not Available	IIws	Graded bunding
Badiyala	476	4.34	GWDiB2	LMU-2	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Cotton (Rg+Ct)	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
Badiyala	477	8.13	GWDiB2	LMU-2	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Badiyala	478	5.34	GWDiB2	LMU-2	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Badiyala	479	3.72	GWDiB2	LMU-2	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Badiyala	480	3.52	GWDiB2	LMU-2	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Badiyala	481	3.23	GWDiB2	LMU-2	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Badiyala	482	5.24	NGPiB2	LMU-3	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
Badiyala	483	3.24	NGPiB2	LMU-3	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Badiyala	484	5.84	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton+Jowar+Redgram (Ct+Jw+Rg)	Not Available	IIes	Graded bunding
Badiyala	485	6.53	HGNmB2	LMU-2	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
Badiyala	486	3.87	NGPiB2	LMU-3	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Badiyala	487	6.52	NGPiB2	LMU-3	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
Badiyala	488	5.7	NGPiB2	LMU-3	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
Badiyala	489	6.54	NGPiB2	LMU-3	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Badiyala	490	7.74	GWDiB2	LMU-2	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Badiyala	491	7.15	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIws	Graded bunding
Badiyala	492	0	Waterbody	Others	Others	Others	Others	Others	Others	Others	Waterbody	Not Available	Others	Others
Badiyala	495	0.01	Waterbody	Others	Others	Others	Others	Others	Others	Others	Waterbody	Not Available	Others	Others
Badiyala	497	0.28	Waterbody	Others	Others	Others	Others	Others	Others	Others	Waterbody	Not Available	Others	Others
Badiyala	498	0.98	Waterbody	Others	Others	Others	Others	Others	Others	Others	Waterbody	Not Available	Others	Others
Badiyala	499	6.47	BDLiB3	LMU-4	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Severe	Redgram (Rg)	Not Available	IVes	Graded bunding
Badiyala	500	0.8	Waterbody	Others	Others	Others	Others	Others	Others	Others	Waterbody	Not Available	Others	Others

Appendix II

Badal 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
Goodura	13	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 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)
Goodura	15	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 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)
Goodura	16	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 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)
Goodura	17	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	High (> 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Goodura	18	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	High (> 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Goodura	19	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	High (> 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Goodura	93	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 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)
Goodura	94	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 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)
Goodura	95	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 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)
Goodura	96	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 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)
Goodura	98	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 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)
Goodura	101	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 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)
Goodura	102	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 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)
Kondapura	43/1	Waterbody	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Kondapura	43/2	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 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)
Kondapura	44	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 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)
Kondapura	45	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 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)
Kondapura	46	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 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)
Kondapura	47/1	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 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)
Kondapura	47/2	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kondapura	48	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kondapura	49	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kondapura	50	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)

Village	Survey No.	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Kondapura	51	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kondapura	52	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 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)
Kondapura	53	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	High (> 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kondapura	54	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	High (> 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kondapura	55	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	High (> 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kondapura	56	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kondapura	57	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	High (> 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kondapura	58	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	High (> 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kondapura	59	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	High (> 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kondapura	60	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	High (> 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kondapura	61	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kondapura	62	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kondapura	63	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	High (> 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kondapura	64	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	High (> 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kondapura	65	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kondapura	71	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Non saline (<2 dsm)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	High (> 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kondapura	72	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Non saline (<2 dsm)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	High (> 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kondapura	73	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Non saline (<2 dsm)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kondapura	74	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kondapura	75	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Non saline (<2 dsm)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kondapura	76	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kondapura	77	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kondapura	78	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kondapura	79	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	High (> 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)

Village	Survey No.	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Kondapura	80	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kondapura	81	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kondapura	82	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	High (> 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)
Kondapura	83	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 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)
Kondapura	84	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 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)
Kondapura	85	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 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)
Kondapura	86	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	High (> 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)
Kondapura	90	Waterbody	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Sangavara	77	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Non saline (<2 dsm)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	High (> 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Sangavara	78	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Non saline (<2 dsm)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Sangavara	79	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Sangavara	80	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	High (> 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)
Sangavara	81	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	High (> 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)
Sangavara	82	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Medium (23 – 57 kg/ha)	High (> 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)
Sangavara	83	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Medium (23 – 57 kg/ha)	High (> 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)
Sangavara	84	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Medium (23 – 57 kg/ha)	High (> 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)
Sangavara	85	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	High (> 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)
Sangavara	86	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	High (> 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)
Sangavara	94	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Medium (23 – 57 kg/ha)	High (> 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)
Sangavara	95	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	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)
Sangavara	96	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	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)
Sangavara	97	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	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)
Sangavara	98	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	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)
Sangavara	99	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Medium (23 – 57 kg/ha)	High (> 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)
Sangavara	100	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Medium (23 – 57 kg/ha)	High (> 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)

Village	Survey No.	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Sangavara	101	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	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)
Sangavara	102	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Medium (23 – 57 kg/ha)	High (> 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)
Sangavara	103	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 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)
Sangavara	104	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 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)
Sangavara	105	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Non saline (<2 dsm)	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)
Sangavara	106	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 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)
Sangavara	107	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	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)
Sangavara	108	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 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)
Sangavara	109	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	High (> 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)
Sangavara	112	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Medium (23 – 57 kg/ha)	High (> 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)
Sangavara	113	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Non saline (<2 dsm)	Medium (23 – 57 kg/ha)	High (> 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)
Gondedagi	100	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Non saline (<2 dsm)	Medium (23 – 57 kg/ha)	High (> 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)
Gondedagi	101	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Non saline (<2 dsm)	Medium (23 – 57 kg/ha)	High (> 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)
Gondedagi	125/ 1	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 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)
Gondedagi	125/ 2	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 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)
Badiyala	423	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	High (> 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Badiyala	424	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Medium (23 – 57 kg/ha)	High (> 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)
Badiyala	425	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	High (> 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Badiyala	426	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Non saline (<2 dsm)	High (> 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Badiyala	439	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	High (> 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)
Badiyala	440	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	High (> 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)
Badiyala	451	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 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)
Badiyala	453	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	High (> 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Badiyala	454	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 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)

Village	Survey No.	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Badiyala	455	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 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)
Badiyala	456	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Badiyala	457	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Badiyala	458	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	High (> 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Badiyala	459	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	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)
Badiyala	460	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	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)
Badiyala	461	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	High (> 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Badiyala	462	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	High (> 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Badiyala	463	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 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)
Badiyala	464	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 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)
Badiyala	465	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 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)
Badiyala	466	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 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)
Badiyala	467	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 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)
Badiyala	468	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	High (> 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Badiyala	469	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 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)
Badiyala	470	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 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)
Badiyala	471	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 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)
Badiyala	472	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Badiyala	473	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	High (> 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Badiyala	474	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	High (> 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)
Badiyala	475	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	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)
Badiyala	476	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	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)
Badiyala	477	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Medium (23 – 57 kg/ha)	High (> 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)
Badiyala	478	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	High (> 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
Badiyala	479	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	High (> 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Badiyala	480	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	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)
Badiyala	481	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	High (> 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Badiyala	482	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	High (> 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Badiyala	483	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	High (> 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Badiyala	484	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	High (> 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Badiyala	485	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 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)
Badiyala	486	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 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)
Badiyala	487	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	High (> 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)
Badiyala	488	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Badiyala	489	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 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)
Badiyala	490	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 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)
Badiyala	491	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	High (> 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Badiyala	492	Waterbody	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Badiyala	495	Waterbody	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Badiyala	497	Waterbody	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Badiyala	498	Waterbody	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Badiyala	499	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Non saline (<2 dsm)	Waterbody	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Badiyala	500	Waterbody	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others

Appendix III

Badal Microwatershed

Soil Suitability Information

Village	Survey No	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	Bengalgram	Sunflower	Redgram	Amla	Jackfruit	Custard apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Drum stick	Mulberry
Goodura	13	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Goodura	15	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Goodura	16	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Goodura	17	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Goodura	18	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Goodura	19	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Goodura	93	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Goodura	94	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Goodura	95	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Goodura	96	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Goodura	98	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Goodura	101	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Goodura	102	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Kondapura	43/1	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
Kondapura	43/2	S3tw	S2tw	S3tw	S1	S3tw	S1	S2tw	S2zw	S1	S2rw	S2tw	S1	S3tw	S1	N1tz	S2tw	S2zw	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw
Kondapura	44	S3tw	S2tw	S3tw	S1	S3tw	S1	S2tw	S2zw	S1	S2rw	S2tw	S1	S3tw	S1	N1tz	S2tw	S2zw	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw
Kondapura	45	S3tw	S2tw	S3tw	S1	S3tw	S1	S2tw	S2zw	S1	S2rw	S2tw	S1	S3tw	S1	N1tz	S2tw	S2zw	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw
Kondapura	46	S3tw	S2tw	S3tw	S1	S3tw	S1	S2tw	S2zw	S1	S2rw	S2tw	S1	S3tw	S1	N1tz	S2tw	S2zw	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw
Kondapura	47/1	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Kondapura	47/2	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Kondapura	48	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Kondapura	49	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Kondapura	50	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Kondapura	51	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Kondapura	52	S3rz	S2tz	S3tz	S2zw	S3tz	S2rz	S3rz	S2rz	S2zw	S2rz	S2rz	S2zw	S3tz	S1	N1t	S3rz	S2rz	S3tz	S2tz	S3tz	S2tz	S2tz	S2rz	S2z	S2rz	S3tz
Kondapura	53	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Kondapura	54	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Kondapura	55	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Kondapura	56	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Kondapura	57	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Kondapura	58	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Kondapura	59	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Kondapura	60	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Kondapura	61	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Kondapura	62	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Kondapura	63	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Kondapura	64	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Kondapura	65	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Kondapura	71	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Kondapura	72	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw

Village	Survey No	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	Bengalgram	Sunflower	Redgram	Amla	Jackfruit	Custard apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Drum stick	Mulberry
Kondapura	73	S3rz	S2tz	S3tz	S2zw	S3tz	S2rz	S3rz	S2rz	S2zw	S2rz	S2rz	S2zw	S3tz	S1	N1t	S3rz	S2rz	S3tz	S2tz	S3tz	S2tz	S2tz	S2rz	S2z	S2rz	S3tz
Kondapura	74	S3rz	S2tz	S3tz	S2zw	S3tz	S2rz	S3rz	S2rz	S2zw	S2rz	S2rz	S2zw	S3tz	S1	N1t	S3rz	S2rz	S3tz	S2tz	S3tz	S2tz	S2tz	S2rz	S2z	S2rz	S3tz
Kondapura	75	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Kondapura	76	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Kondapura	77	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Kondapura	78	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Kondapura	79	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Kondapura	80	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Kondapura	81	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Kondapura	82	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Kondapura	83	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Kondapura	84	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Kondapura	85	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Kondapura	86	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Kondapura	90	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Sangavara	77	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Sangavara	78	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Sangavara	79	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Sangavara	80	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Sangavara	81	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Sangavara	82	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Sangavara	83	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Sangavara	84	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Sangavara	85	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Sangavara	86	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Sangavara	94	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Sangavara	95	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Sangavara	96	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Sangavara	97	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Sangavara	98	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Sangavara	99	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Sangavara	100	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Sangavara	101	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Sangavara	102	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Sangavara	103	S3rz	S2tz	S3tz	S2zw	S3tz	S2rz	S3rz	S2rz	S2zw	S2rz	S2rz	S2zw	S3tz	S1	N1t	S3rz	S2rz	S3tz	S2tz	S3tz	S2tz	S2tz	S2rz	S2z	S2rz	S3tz
Sangavara	104	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Sangavara	105	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Sangavara	106	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Sangavara	107	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Sangavara	108	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Sangavara	109	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Sangavara	112	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Sangavara	113	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Gondedagi	100	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw

Village	Survey No	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	Bengalgram	Sunflower	Redgram	Amla	Jackfruit	Custard apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Drum stick	Mulberry
Gondedagi	101	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Gondedagi	125/1	S3rz	S2tz	S3tz	S2zw	S3tz	S2rz	S3rz	S2rz	S2zw	S2rz	S2rz	S2zw	S3tz	S1	N1t	S3rz	S2rz	S3tz	S2tz	S3tz	S2tz	S2tz	S2rz	S2z	S2rz	S3tz
Gondedagi	125/2	S3rz	S2tz	S3tz	S2zw	S3tz	S2rz	S3rz	S2rz	S2zw	S2rz	S2rz	S2zw	S3tz	S1	N1t	S3rz	S2rz	S3tz	S2tz	S3tz	S2tz	S2tz	S2rz	S2z	S2rz	S3tz
Badiyala	423	S3rz	S2tz	S3tz	S2zw	S3tz	S2rz	S3rz	S2rz	S2zw	S2rz	S2rz	S2zw	S3tz	S1	N1t	S3rz	S2rz	S3tz	S2tz	S3tz	S2tz	S2tz	S2rz	S2z	S2rz	S3tz
Badiyala	424	S3rz	S2tz	S3tz	S2zw	S3tz	S2rz	S3rz	S2rz	S2zw	S2rz	S2rz	S2zw	S3tz	S1	N1t	S3rz	S2rz	S3tz	S2tz	S3tz	S2tz	S2tz	S2rz	S2z	S2rz	S3tz
Badiyala	425	S3rz	S2tz	S3tz	S2zw	S3tz	S2rz	S3rz	S2rz	S2zw	S2rz	S2rz	S2zw	S3tz	S1	N1t	S3rz	S2rz	S3tz	S2tz	S3tz	S2tz	S2tz	S2rz	S2z	S2rz	S3tz
Badiyala	426	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	N1rt	N1rt
Badiyala	439	S3rz	S2tz	S3tz	S2zw	S3tz	S2rz	S3rz	S2rz	S2zw	S2rz	S2rz	S2zw	S3tz	S1	N1t	S3rz	S2rz	S3tz	S2tz	S3tz	S2tz	S2tz	S2rz	S2z	S2rz	S3tz
Badiyala	440	S3rz	S2tz	S3tz	S2zw	S3tz	S2rz	S3rz	S2rz	S2zw	S2rz	S2rz	S2zw	S3tz	S1	N1t	S3rz	S2rz	S3tz	S2tz	S3tz	S2tz	S2tz	S2rz	S2z	S2rz	S3tz
Badiyala	451	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Badiyala	453	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Badiyala	454	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Badiyala	455	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Badiyala	456	S3rz	S2tz	S3tz	S2zw	S3tz	S2rz	S3rz	S2rz	S2zw	S2rz	S2rz	S2zw	S3tz	S1	N1t	S3rz	S2rz	S3tz	S2tz	S3tz	S2tz	S2tz	S2rz	S2z	S2rz	S3tz
Badiyala	457	S3rz	S2tz	S3tz	S2zw	S3tz	S2rz	S3rz	S2rz	S2zw	S2rz	S2rz	S2zw	S3tz	S1	N1t	S3rz	S2rz	S3tz	S2tz	S3tz	S2tz	S2tz	S2rz	S2z	S2rz	S3tz
Badiyala	458	S3rz	S2tz	S3tz	S2zw	S3tz	S2rz	S3rz	S2rz	S2zw	S2rz	S2rz	S2zw	S3tz	S1	N1t	S3rz	S2rz	S3tz	S2tz	S3tz	S2tz	S2tz	S2rz	S2z	S2rz	S3tz
Badiyala	459	S3rz	S2tz	S3tz	S2zw	S3tz	S2rz	S3rz	S2rz	S2zw	S2rz	S2rz	S2zw	S3tz	S1	N1t	S3rz	S2rz	S3tz	S2tz	S3tz	S2tz	S2tz	S2rz	S2z	S2rz	S3tz
Badiyala	460	S3rz	S2tz	S3tz	S2zw	S3tz	S2rz	S3rz	S2rz	S2zw	S2rz	S2rz	S2zw	S3tz	S1	N1t	S3rz	S2rz	S3tz	S2tz	S3tz	S2tz	S2tz	S2rz	S2z	S2rz	S3tz
Badiyala	461	S3rz	S2tz	S3tz	S2zw	S3tz	S2rz	S3rz	S2rz	S2zw	S2rz	S2rz	S2zw	S3tz	S1	N1t	S3rz	S2rz	S3tz	S2tz	S3tz	S2tz	S2tz	S2rz	S2z	S2rz	S3tz
Badiyala	462	S3rz	S2tz	S3tz	S2zw	S3tz	S2rz	S3rz	S2rz	S2zw	S2rz	S2rz	S2zw	S3tz	S1	N1t	S3rz	S2rz	S3tz	S2tz	S3tz	S2tz	S2tz	S2rz	S2z	S2rz	S3tz
Badiyala	463	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Badiyala	464	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Badiyala	465	S3rz	S2tz	S3tz	S2zw	S3tz	S2rz	S3rz	S2rz	S2zw	S2rz	S2rz	S2zw	S3tz	S1	N1t	S3rz	S2rz	S3tz	S2tz	S3tz	S2tz	S2tz	S2rz	S2z	S2rz	S3tz
Badiyala	466	S3rz	S2tz	S3tz	S2zw	S3tz	S2rz	S3rz	S2rz	S2zw	S2rz	S2rz	S2zw	S3tz	S1	N1t	S3rz	S2rz	S3tz	S2tz	S3tz	S2tz	S2tz	S2rz	S2z	S2rz	S3tz
Badiyala	467	S3rz	S2tz	S3tz	S2zw	S3tz	S2rz	S3rz	S2rz	S2zw	S2rz	S2rz	S2zw	S3tz	S1	N1t	S3rz	S2rz	S3tz	S2tz	S3tz	S2tz	S2tz	S2rz	S2z	S2rz	S3tz
Badiyala	468	S3rz	S2tz	S3tz	S2zw	S3tz	S2rz	S3rz	S2rz	S2zw	S2rz	S2rz	S2zw	S3tz	S1	N1t	S3rz	S2rz	S3tz	S2tz	S3tz	S2tz	S2tz	S2rz	S2z	S2rz	S3tz
Badiyala	469	S3rz	S2tz	S3tz	S2zw	S3tz	S2rz	S3rz	S2rz	S2zw	S2rz	S2rz	S2zw	S3tz	S1	N1t	S3rz	S2rz	S3tz	S2tz	S3tz	S2tz	S2tz	S2rz	S2z	S2rz	S3tz
Badiyala	470	S3tw	S2tw	S3tw	S1	S3tw	S1	S2tw	S2zw	S1	S2rw	S2tw	S1	S3tw	S1	N1tz	S2tw	S2zw	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw
Badiyala	471	S3tw	S2tw	S3tw	S1	S3tw	S1	S2tw	S2zw	S1	S2rw	S2tw	S1	S3tw	S1	N1tz	S2tw	S2zw	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw
Badiyala	472	S3tw	S2tw	S3tw	S1	S3tw	S1	S2tw	S2zw	S1	S2rw	S2tw	S1	S3tw	S1	N1tz	S2tw	S2zw	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw
Badiyala	473	S3tw	S2tw	S3tw	S1	S3tw	S1	S2tw	S2zw	S1	S2rw	S2tw	S1	S3tw	S1	N1tz	S2tw	S2zw	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw
Badiyala	474	S3tw	S2tw	S3tw	S1	S3tw	S1	S2tw	S2zw	S1	S2rw	S2tw	S1	S3tw	S1	N1tz	S2tw	S2zw	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw
Badiyala	475	S3tw	S2tw	S3tw	S1	S3tw	S1	S2tw	S2zw	S1	S2rw	S2tw	S1	S3tw	S1	N1tz	S2tw	S2zw	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw
Badiyala	476	S3rz	S2tz	S3tz	S2zw	S3tz	S2rz	S3rz	S2rz	S2zw	S2rz	S2rz	S2zw	S3tz	S1	N1t	S3rz	S2rz	S3tz	S2tz	S3tz	S2tz	S2tz	S2rz	S2z	S2rz	S3tz
Badiyala	477	S3rz	S2tz	S3tz	S2zw	S3tz	S2rz	S3rz	S2rz	S2zw	S2rz	S2rz	S2zw	S3tz	S1	N1t	S3rz	S2rz	S3tz	S2tz	S3tz	S2tz	S2tz	S2rz	S2z	S2rz	S3tz
Badiyala	478	S3rz	S2tz	S3tz	S2zw	S3tz	S2rz	S3rz	S2rz	S2zw	S2rz	S2rz	S2zw	S3tz	S1	N1t	S3rz	S2rz	S3tz	S2tz	S3tz	S2tz	S2tz	S2rz	S2z	S2rz	S3tz
Badiyala	479	S3rz	S2tz	S3tz	S2zw	S3tz	S2rz	S3rz	S2rz	S2zw	S2rz	S2rz	S2zw	S3tz	S1	N1t	S3rz	S2rz	S3tz	S2tz	S3tz	S2tz	S2tz	S2rz	S2z	S2rz	S3tz
Badiyala	480	S3rz	S2tz	S3tz	S2zw	S3tz	S2rz	S3rz	S2rz	S2zw	S2rz	S2rz	S2zw	S3tz	S1	N1t	S3rz	S2rz	S3tz	S2tz	S3tz	S2tz	S2tz	S2rz	S2z	S2rz	S3tz
Badiyala	481	S3rz	S2tz	S3tz	S2zw	S3tz	S2rz	S3rz	S2rz	S2zw	S2rz	S2rz	S2zw	S3tz	S1	N1t	S3rz	S2rz	S3tz	S2tz	S3tz	S2tz	S2tz	S2rz	S2z	S2rz	S3tz
Badiyala	482	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Badiyala	483	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Badiyala	484	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Badiyala	485	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2tw	S1	S3t	S1	N1tz	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2t	S2tw	S3tw
Badiyala	486	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw

Village	Survey No	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	Bengalgram	Sunflower	Redgram	Amla	Jackfruit	Custard apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Drum stick	Mulberry
Badiyala	487	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Badiyala	488	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Badiyala	489	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Badiyala	490	S3rz	S2tz	S3tz	S2zw	S3tz	S2rz	S3rz	S2rz	S2zw	S2rz	S2rz	S2zw	S3tz	S1	N1t	S3rz	S2rz	S3tz	S2tz	S3tz	S2tz	S2tz	S2rz	S2z	S2rz	S3tz
Badiyala	491	S3tw	S2tw	S3tw	S1	S3tw	S1	S2tw	S2zw	S1	S2rw	S2tw	S1	S3tw	S1	N1tz	S2tw	S2zw	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw
Badiyala	492	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Badiyala	495	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Badiyala	497	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Badiyala	498	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Badiyala	499	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	N1rt	N1rt
Badiyala	500	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others

PART-B

SOCIO-ECONOMIC STATUS OF FARM HOUSEHOLDS

CONTENT SHEET

LIST OF TABLES

Chapter 1

FINDINGS OF THE SOCIO-ECONOMIC SURVEY

- *The survey was conducted in Badal is located at North latitude 16^0 31' 39.345" and 16^0 29' 32.556" and East longitude 77^0 15' 51.422" and 77^0 14' 3.803" covering an area of about 587.10 ha coming under Kondapura, Badiyala and Sangavara villages of Yadagiri taluk.*
- *Socio-economic analysis of Badal micro watersheds of Mungal sub-watershed, Yadgir taluk & District indicated that, out of the total sample of 33 total respondents, 11 (33.33 %) were marginal, 13 (39.39%)were small and 5 (15.15 %) were Semi medium farmers.*
- *The population characteristics of households indicated that, there were 68 (55.74%) men and 54 (44.26 %) were women.*
- *Majority of the respondents (40.16%) were in the age group of 16-35 years.*
- *Education level of the sample households indicated that, there were 46.72 per cent illiterates, 50.01 per cent pre university education and 4.92 per cent attained graduation.*
- *About, 78.79 per cent of household heads practicing agriculture and 9.09 per cent of the household heads were engaged as agricultural labourers.*
- *Agriculture was the major occupation for 60.66 per cent of the household members.*
- *In the study area, 90.91 per cent of the households possess katcha house.*
- *The durable assets owned by the households showed that, 84.85 per cent possess TV, 42.42 per cent possess mixer grinder, 66.67 per cent possess mobile phones and 9.09 per cent possess motor cycles.*
- *Farm implements owned by the households indicated that, 42.42 per cent of the households possess plough, 6.06 per cent possess tractor, 33.33 per cent possess bullock cart and 9.09 per cent possess sprayer.*
- *Regarding livestock possession by the households, 6.06 per cent possess local cow.*
- *The average labour availability in the study area showed that, own men and women labour availability in the micro watershed was 14.79 each, while the hired labour (men) availability was 1.72.*
- *Out of the total land holding of the sample respondents 100.00 per cent (38.39 ha) of the area is under dry condition.*
- *The major crops grown by sample farmers are and cropping intensity was recorded as 99.22 per cent.*
- *Out of the sample households 6.06 percent possessed bank account.*
- *About 6.06 per cent of the respondents borrowed credit from various sources.*
- *The per hectare cost of cultivation for Cotton, Redgram and Sorghum of Rs.50497.60, 40293.72 and 54888.46 with benefit cost ratio of 1:1.30, 1: 1.30 and 1: 1.30 respectively.*

- *Further, 81.82 per cent of the households opined that dry fodder was adequate and 9.09 per cent of the households have opined that the green fodder was adequate.*
- *The average annual gross income of the farmers was Rs. 109253.03 in micro-watershed, of which Rs. 61828.79 comes from agriculture.*
- *Sampled households have grown 51 forestry trees together in the fields and back yards.*
- *Regarding marketing channels, 87.88 per cent of the households have sold agricultural produce to the local/village merchants.*
- *Further, 87.88 per cent of the households have used tractor for the transport of agriculture commodity.*
- *Majority of the farmers (87.88%) have experienced soil and water erosion problems in the watershed and 84.85 per cent of the households were interested towards soil testing.*
- *Fire was the major source of fuel for domestic use for 93.94 per cent of the households and 3.03 per cent households has LPG connection.*
- *Piped supply was the major source for drinking water for 12.12 per cent of the households.*
- *Electricity was the major source of light for 100.00 per cent of the households.*
- *In the study area, 100.00 per cent of the households possess toilet facility.*
- *Regarding possession of PDS card, 100.00 per cent of the households possessed.*
- *Households opined that, the requirement of cereals (100.00%), pulses (81.82%) and oilseeds (24.24%) are adequate for consumption.*
- *Farming constraints experienced by households in the micro watersheds were lower fertility status of the soil (90.91%) wild animal menace on farm field (87.88%), frequent incidence of pest and diseases (78.79%), inadequacy of irrigation water (12.12%), high cost of fertilizers and plant protection chemicals (81.82%), high rate of interest on credit (45.45%), low price for the agricultural commodities (66.67%), lack of marketing facilities in the area (57.58%), inadequate extension services (3.03%) and lack of transport for safe transport of the agricultural produce to the market (39.39%).*

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, labor 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 and

The study was conducted in Badal micro-watershed (Mungal sub-watershed, Yadgir taluk & District) is located at North latitude 16^0 31’ 39.345” and 16^0 29’ 32.556” and East longitude 77^0 15’ 51.422” and 77^0 14’ 3.803”covering an area of about 587.10 ha bounded by under Kondapura, Badiyala and Sangavara Villages.

3. Selection of the respondents for the study

The micro-watershed is marked with 320 square meters grids. One farmer from every alternate grid in the micro-watershed was selected for the study and interviewed for socio-economic data. Totally 33 households were interviewed for the survey.

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

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

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

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

5. Development of interview schedule and data collection

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

6. Tools used to analyze the data

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

Abbreviations used in the report

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

Chapter 4

FINDINGS OF THE SURVEY

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

Households sampled for socio-economic survey: The data on households sampled for socio economic survey in Badal Micro watershed is presented in Table 1 and it indicated that 33 farmers were sampled in Badal micro-watershed among households surveyed 11 (33.33%) were marginal, 13 (39.39%) were small and 5 (15.15 %) were semi medium, farmers. 4 landless farmers were also interviewed for the survey.

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

Sl.No.	Particulars	LL (4)		MF (11)		SF (13)		SMF (5)		All (33)	
		N	%	N	%	N	%	N	%	N	%
1	Farmers	4	12.1	11	33.3	13	39.4	5	15.2	33	100

Population characteristics: The population characteristics of households sampled for socio-economic survey in Badal Micro watershed is presented in Table 2. The data indicated that, there were 68 (55.74%) men and 54 (44.26%) were women.

Table 2. Population characteristics in Badal micro-watershed

Sl.No.	Particulars	LL (1)		MF (44)		SF (59)		SMF (18)		All (122)	
		N	%	N	%	N	%	N	%	N	%
1	Men	1	100	23	52	31	53	13	72.2	68	55.7
2	Women	0	0	21	48	28	47	5	27.8	54	44.3
Total		1	100	44	100	59	100	18	100	122	100

Age wise classification of population: The age wise classification of household members in Badal Micro watershed is presented in Table 3. The indicated that, 24 (19.67%) of population were 0-15 years of age, 49 (40.16%) were 16-35 years of age, 39(31.97%) were 36-60 years of age and 10 (8.20 %) were above 61 years of age.

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

Sl.No.	Particulars	LL (1)		MF (44)		SF (59)		SMF (18)		All (122)	
		N	%	N	%	N	%	N	%	N	%
1	0-15 years of age	0	0	8	18.2	16	27.1	0	0	24	19.67
2	16-35 years of age	0	0	19	43.2	22	37.3	8	44.44	49	40.16
3	36-60 years of age	1	100	13	29.6	16	27.1	9	50	39	31.97
4	> 61 years	0	0	4	9.09	5	8.47	1	5.56	10	8.2
Total		1	100	44	100	59	100	18	100	122	100

Education level of household members: Education level of household members in Badal Micro watershed is presented in Table 4. The results indicated that, there were 46.72 per cent of illiterates, 0.00 per cent of functional literate, 13.11 per cent of them had primary school education, 9.02 per cent middle school education, and 9.84 per cent high school education, 9.02 per cent of them had PUC education, 1.64 per cent of them had Diploma, 4.92 per cent attained graduation, and 0.82 them had other education.

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

Sl.No.	Particulars	LL (1)		MF (44)		SF (59)		SMF (18)		All (122)	
		N	%	N	%	N	%	N	%	N	%
1	Illiterate	1	100	20	45.5	29	49.2	7	38.9	57	46.7
2	Primary School	0	0	8	18.2	8	13.6	0	0	16	13.1
3	Middle School	0	0	0	0	10	17	1	5.56	11	9.02
4	High School	0	0	5	11.4	6	10.2	1	5.56	12	9.84
5	PUC	0	0	6	13.6	0	0	5	27.8	11	9.02
6	Diploma	0	0	1	2.27	1	1.69	0	0	2	1.64
7	ITI	0	0	2	4.55	3	5.08	1	5.56	6	4.92
8	Degree	0	0	1	2.27	2	3.39	3	16.7	6	4.92
9	Others	0	0	1	2.27	0	0	0	0	1	0.82
Total		1	100	44	100	59	100	18	100	122	100

Occupation of head of households: The data regarding the occupation of the household heads in Badal Micro watershed is presented in Table 5. The results indicate that, 78.79 per cent of households heads were practicing agriculture, 9.09 per cent of the household heads were agricultural Labour and housewife (3.03%).

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

Sl.No.	Particulars	LL (4)		MF (11)		SF (13)		SMF (5)		All (33)	
		N	%	N	%	N	%	N	%	N	%
1	Agriculture	0	0	11	100	10	76.92	5	100	26	78.79
2	Agricultural Labour	0	0	1	9.1	2	15.38	0	0	3	9.09
3	Housewife	0	0	0	0	1	7.69	0	0	1	3.03
Total		0	100	12	100	13	100	5	100	30	100

Occupation of the members of the household: The data regarding the occupation of the household members in Badal Micro watershed is presented in Table 6. The results indicate that, agriculture was the major occupation for 60.66 per cent of the household members, 3.28 per cent were agricultural labour, 27.87 per cent were working in pursuing education, 4.92 per cent were involved as housewife, and 0.82 per cent were childrens.

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

Sl.No.	Particulars	LL (1)		MF (44)		SF (59)		SMF (18)		All (122)	
		N	%	N	%	N	%	N	%	N	%
1	Agriculture	0	0	28	63.6	33	55.93	13	72.22	74	60.7

2	Agricultural Labour	1	100	1	2.27	2	3.39	0	0	4	3.28
3	Private Service	0	0	0	0	1	1.69	1	5.56	2	1.64
4	Student	0	0	12	27.3	19	32.2	3	16.67	34	27.9
5	Others	0	0	0	0	1	1.69	0	0	1	0.82
6	Housewife	0	0	2	4.55	3	5.08	1	5.56	6	4.92
7	Children	0	0	1	2.27	0	0	0	0	1	0.82
Total		1	100	44	100	59	100	18	100	122	100

Institutional Participation of household members: The data regarding the institutional participation of the household members in Badal Micro watershed is presented in Table 7. The results show that, out of the total family members in the households 0.82 per cent of them were participating in raitha sangha, and rest were not participating in any of the institutions.

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

Sl.No.	Particulars	LL (1)		MF (44)		SF (59)		SMF (18)		All (122)	
		N	%	N	%	N	%	N	%	N	%
1	Raitha Sangha	0	0	0	0	1	1.69	0	0	1	0.82
2	No Participation	1	100	44	100	58	98.3	18	100	121	99.2
Total		1	100	44	100	59	100	18	100	122	100

Type of house owned: The data regarding the type of house owned by the households in Badal Micro watershed is presented in Table 8. The results indicate that, 90.91 per cent of the households possess katcha house.

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

Sl.No.	Particulars	LL (4)		MF (11)		SF (13)		SMF (5)		All (33)	
		N	%	N	%	N	%	N	%	N	%
1	Katcha	1	25	11	100	13	100	5	100	30	90.91
Total		1	100	11	100	13	100	5	100	30	100

Durable assets owned by the households: The data regarding the Durable Assets owned by the households in Badal Micro watershed is presented in Table 9. The result shows that, 84.85 per cent possess TV, 42.42 per cent possess mixer grinder, 9.09 per cent possess motor cycle, 3.03 per cent possess Landline Phone and 66.67 per cent possess mobile phones.

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

Sl.No.	Particulars	LL (4)		MF (11)		SF (13)		SMF (5)		All (33)	
		N	%	N	%	N	%	N	%	N	%
1	Television	1	25	9	82	13	100	5	100	28	84.85
2	Mixer/Grinder	0	0	3	27	9	69.2	2	40	14	42.42
3	Motor Cycle	0	0	1	9.1	0	0	2	40	3	9.09
4	Landline Phone	0	0	0	0	0	0	1	20	1	3.03

5	Mobile Phone	0	0	10	91	10	76.9	2	40	22	66.67
6	Blank	0	0	1	9.1	0	0	0	0	1	3.03

Average value of durable assets: The data regarding the average value of durable assets owned by the households in Badal Micro watershed is presented in Table 10. The result shows that, the average value of television was Rs.7357.00, mixer grinder was Rs.2178.00, motor cycle was Rs. 50000.00, Landline Phone was Rs. 2500.00 and mobile phone was Rs.2914.00.

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

Average Value (Rs.)

Sl.No.	Particulars	LL (4)	MF (11)	SF (13)	SMF (5)	All (33)
1	Television	5000	7666	7615	6600	7357
2	Mixer/Grinder	0	1833	1944	3750	2178
3	Motor Cycle	0	50000	0	50000	50000
4	Landline Phone	0	0	0	2500	2500
5	Mobile Phone	0	2750	3357	1833	2914

Farm implements owned: The data regarding the farm implements owned by the households in Badal Micro watershed is presented in Table 11. About 33.33 per cent of the households possess Bullock Cart, 42.42 per cent possess plough and 9.09 per cent possess Sprayer and 6.06 per cent possess tractor.

Table 11. Farm implements owned in Badal micro-watershed

Sl.No.	Particulars	LL (4)		MF (11)		SF (13)		SMF (5)		All (33)	
		N	%	N	%	N	%	N	%	N	%
1	Bullock Cart	0	0	5	45.5	6	46.15	0	0	11	33.33
2	Plough	0	0	5	45.5	7	53.85	2	40	14	42.42
3	Tractor	0	0	0	0	0	0	2	40	2	6.06
4	Sprayer	0	0	1	9.09	1	7.69	1	20	3	9.09
5	Blank	1	25	6	54.6	6	46.15	2	40	15	45.45

Average value of farm implements: The data regarding the average value of farm Implements owned by the households in Badal Micro watershed is presented in Table 12. The results show that the average value of plough was Rs.4396.00, bullock Cart was Rs.22454.00, seed/fertilizer drill was Rs.2666.00 and tractor Rs. 102500.

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

Average Value (Rs.)

Sl.No.	Particulars	LL (4)	MF (11)	SF (13)	SMF (5)	All (33)
1	Bullock Cart	0	21400	23333	0	22454
2	Plough	0	2640	3335	12500	4396
3	Tractor	0	0	0	102500	102500
4	Sprayer	0	2000	1000	5000	2666

Livestock possession by the households: The data regarding the Livestock possession by the households in Badal Micro watershed is presented in Table 13. The results indicate that, 24.24 per cent of the households possess bullocks and 6.06 per cent possess local cow.

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

Sl.No.	Particulars	LL (4)		MF (11)		SF (13)		SMF (5)		All (33)	
		N	%	N	%	N	%	N	%	N	%
1	Bullock	0	0	2	18	5	38.46	1	20	8	24.24
2	Local cow	0	0	1	9.1	1	7.69	0	0	2	6.06
9	blank	1	25	8	73	8	61.54	4	80	21	63.64

Average Labour availability: The data regarding the average labour availability in Badal Micro watershed is presented in Table 14. The indicated that, own labour men available in the micro watershed was 13.45, women available in the micro watershed was 1.34, hired labour (men) available was 1.72 and hired labour (women) available was 12.41.

Table 14. Average labour availability in Badal micro-watershed

Sl.No.	Particulars	LL (4)	MF (11)	SF (13)	SMF (5)	All (33)
		N	N	N	N	N
1	Hired labour Female	0	10	13.46	21	13.45
2	Own Labour Female	0	1.36	1.46	1	1.34
3	Own labour Male	0	1.55	1.77	2	1.72
4	Hired labour Male	0	9.09	12.31	20	12.41

Adequacy of hired labour: The data regarding the adequacy of hired labour in Badal Micro watershed is presented in Table 15. The results indicate that, 87.88 per cent of the household opined that hired labour was adequate.

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

Sl.No.	Particulars	LL (4)		MF (11)		SF (13)		SMF (5)		All (33)	
		N	%	N	%	N	%	N	%	N	%
1	Adequate	0	0	11	100	13	100	5	100	29	87.9

Distribution of land (ha): The data regarding the distribution of land (ha) in Badal Micro watershed is presented in Table 16. The results indicate that, 38.39 ha (100.00%) of dry land.

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

Sl.No.	Particulars	LL (4)		MF (11)		SF (13)		SMF (5)		All (33)	
		N	%	N	%	N	%	N	%	N	%
1	Dry	0	0	7.32	100	18.64	100	12.43	100	38.39	100
Total		0	100	7.32	100	18.64	100	12.43	100	38.39	100

Average value of land (ha): The data regarding the average land value (Rs./ha) in Badal Micro watershed is presented in Table 17. The results show that the average value of dry land was Rs.518163.61.

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

Sl.No.	Particulars	LL (4)	MF (11)	SF (13)	SMF (5)	All (33)
		N	N	N	N	N
1	Dry	0	1065597	466543.6	273372.4	518163.6

Cropping pattern: The data regarding the cropping pattern in Badal Micro watershed is presented in Table 18. The results indicate that, farmers have grown Kharif - Cotton (14.35 ha), Kharif – Sorghum (0.45 ha) and Kharif - Red gram (togari) (23.02 ha).

Table 18. Cropping pattern in Badal micro-watershed

Sl.No.	Particulars	LL (4)	MF (11)	SF (13)	SMF (5)	All (33)
1	Kharif - Red gram (togari)	0	2.23	10.53	10.27	23.02
2	Kharif - Cotton	0	4.65	7.68	2.02	14.35
3	Kharif - Sorghum	0	0.45	0	0	0.45
Total	0	0	7.32	18.21	12.3	37.82

Cropping intensity: The data regarding the cropping intensity in Badal Micro watershed is presented in Table 19. The results indicate that, the cropping intensity was 99.22 per cent.

Table 19. Cropping intensity (%) in Badal micro-watershed

Sl.No.	Particulars	LL (4)	MF (11)	SF (13)	SMF (5)	All (33)
1	Cropping Intensity	0	100	99.16	98.86	99.22

Possession of bank account and savings: The data regarding the possession of bank account and saving in Badal micro-watershed is presented in Table 20. The results indicate that, 6.06 cent of the households posses bank account.

Table 20. Possession of Bank account and savings in Badal micro-watershed

Sl.No.	Particulars	LL (4)		MF (11)		SF (13)		SMF (5)		All (33)	
		N	%	N	%	N	%	N	%	N	%
1	Account	0	0	1	9.09	0	0	1	20	2	6.06

Borrowing status: The data regarding the borrowing status in Badal micro-watershed is presented in Table 21. The results indicate that, 6.06 percent of the sample farmers have borrowed credit from different sources.

Table 21. Borrowing status in Badal micro-watershed

Sl.No.	Particulars	LL (4)		MF (11)		SF (13)		SMF (5)		All (33)	
		N	%	N	%	N	%	N	%	N	%
1	Credit Availed	0	0	1	9.09	0	0	1	20	2	6.06

Cost of Cultivation of Cotton: The data regarding the cost of cultivation (Rs/ha) of Cotton in Badal micro watershed is presented in Table 22.a. The results indicate that, the total cost of cultivation (Rs/ha) for Cotton was Rs. 50497.60. The gross income realized by the farmers was Rs. 63695.25. The net income from Cotton cultivation was Rs.13197.65, thus the benefit cost ratio was found to be 1:1.30.

Table 22(a). Cost of Cultivation of Cotton in Badal micro-watershed

Sl. No	Particulars		Units	Phy Units	Value (Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	72.56	11936.14	23.64
2	Bullock		Pairs/day	3.17	1582.73	3.13
3	Tractor		Hours	7.74	7744.3	15.34
4	Machinery		Hours	0.48	475	0.94
5	Seed Main Crop (Establishment and Maintenence)		Kgs (Rs.)	6.94	7419.12	14.69
6	Seed Inter Crop		Kgs.	0	0	0
7	FYM		Quintal	1.79	2507.05	4.96
8	Fertilizer + micronutrients		Quintal	4.92	4569.67	9.05
9	Pesticides (PPC)		Kgs/liters	2.35	3253.98	6.44
10	Irrigation		Number	0	0	0
11	Repairs			0	0	0
12	Msc. Charges (Marketing costs etc)			0	0	0
13	Depreciation charges			0	226.01	0.45
14	Land revenue and Taxes			0	4.88	0.01
II	**Cost B1**					
16	Interest on working capital				2129.98	4.22
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				41848.84	82.87
III	**Cost B2**					
18	Rental Value of Land				466.67	0.92
19	**Cost B2 = (Cost B1 + Rental value)**				42315.51	83.8
IV	**Cost C1**					
20	Family Human Labour			17.57	3591.4	7.11
21	**Cost C1 = (Cost B2 + Family Labour)**				45906.91	90.91
V	**Cost C2**					
22	Risk Premium				0	0
23	**Cost C2 = (Cost C1 + Risk Premium)**				45906.91	90.91
VI	**Cost C3**					
24	Managerial Cost				4590.69	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				50497.6	100
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		15.71	63695.25	
		b) Main Crop Sales Price (Rs.)			4055.38	
b.	Gross Income (Rs.)				63695.25	
c.	Net Income (Rs.)				13197.65	
d.	Cost per Quintal (Rs./q.)				3215.11	
e.	Benefit Cost Ratio (BC Ratio)				1:1.3	

Cost of Cultivation of Redgram: The data regarding the cost of cultivation (Rs/ha) of Redgram in Badal micro watershed is presented in Table 22.b. The results indicate that, the total cost of cultivation (Rs/ha) for Redgram was Rs. 40293.72. The gross income realized by the farmers was Rs. 53147.52. The net income from Redgram cultivation was Rs.12853.80, thus the benefit cost ratio was found to be 1:1.30.

Table 22(b). Cost of Cultivation of Redgram in Badal micro-watershed

Sl.No	Particulars	Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**				
1	Hired Human Labour	Man days	61.39	10036.7	24.91
2	Bullock	Pairs/day	1.22	607.59	1.51
3	Tractor	Hours	10.55	10548.31	26.18
4	Machinery	Hours	0.22	219.56	0.54
5	Seed Main Crop (Establishment and Maintenence)	Kgs (Rs.)	13.16	1956.99	4.86
6	Seed Inter Crop	Kgs.	0	0	0
7	FYM	Quintal	2	2892.53	7.18
8	Fertilizer + micronutrients	Quintal	3.24	2932.1	7.28
9	Pesticides (PPC)	Kgs / liters	1.67	2155.05	5.35
10	Irrigation	Number	0	0	0
11	Repairs		0	0	0
12	Msc. Charges (Marketing costs etc)		0	0	0
13	Depreciation charges		0	465.56	1.16
14	Land revenue and Taxes		0	4.83	0.01
II	**Cost B1**				
16	Interest on working capital			1192.4	2.96
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**			33011.62	81.93
III	**Cost B2**				
18	Rental Value of Land			451.11	1.12
19	**Cost B2 = (Cost B1 + Rental value)**			33462.73	83.05
IV	**Cost C1**				
20	Family Human Labour		14.82	3167.93	7.86
21	**Cost C1 = (Cost B2 + Family Labour)**			36630.65	90.91
V	**Cost C2**				
22	Risk Premium			0	0
23	**Cost C2 = (Cost C1 + Risk Premium)**			36630.65	90.91
VI	**Cost C3**				
24	Managerial Cost			3663.07	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**			40293.72	100
VII	**Economics of the Crop**				
a.	Main Product	a) Main Product (q)	7.2	53147.52	
b.	Gross Income (Rs.)			53147.52	
c.	Net Income (Rs.)			12853.8	
d.	Cost per Quintal (Rs./q.)			5600.19	
e.	Benefit Cost Ratio (BC Ratio)			1:1.3	

Cost of Cultivation of Sorghum: The data regarding the cost of cultivation (Rs/ha) of Sorghum in Badal micro watershed is presented in Table 22.c. The results indicate, the total cost of cultivation (Rs/ha) for Sorghum was Rs.54888.46. The gross income realized by the farmers was Rs. 70731.82. The net income from Sorghum cultivation was Rs. 15843.36, thus the benefit cost ratio was found to be 1:1.30.

Table 22(c). Cost of Cultivation of Sorghum in Badal micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	87.57	14483.18	26.39
2	Bullock		Pairs/day	4.49	2245.45	4.09
3	Tractor		Hours	6.74	6736.36	12.27
4	Machinery		Hours	0	0	0
5	Seed Main Crop (Establishment and Maintenence)		Kgs (Rs.)	22.45	2694.55	4.91
6	Seed Inter Crop		Kgs.	0	0	0
7	FYM		Quintal	0	0	0
8	Fertilizer + micronutrients		Quintal	8.98	8083.64	14.73
9	Pesticides (PPC)		Kgs / liters	4.49	6287.27	11.45
10	Irrigation		Number	0	0	0
11	Repairs			0	0	0
12	Msc. Charges (Marketing costs etc)			0	0	0
13	Depreciation charges			0	0.04	0
14	Land revenue and Taxes			0	4.94	0.01
II	**Cost B1**					
16	Interest on working capital				2047.85	3.73
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				42583.29	77.58
III	**Cost B2**					
18	Rental Value of Land				466.67	0.85
19	**Cost B2 = (Cost B1 + Rental value)**				43049.96	78.43
IV	**Cost C1**					
20	Family Human Labour			33.68	6848.64	12.48
21	**Cost C1 = (Cost B2 + Family Labour)**				49898.6	90.91
V	**Cost C2**					
22	Risk Premium				0	0
23	**Cost C2 = (Cost C1 + Risk Premium)**				49898.6	90.91
VI	**Cost C3**					
24	Managerial Cost				4989.86	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				54888.46	100
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		15.72	70731.82	
		b) Main Crop Sales Price (Rs.)			4500	
b.	Gross Income (Rs.)				70731.82	
c.	Net Income (Rs.)				15843.36	
d.	Cost per Quintal (Rs./q.)				3492.04	
e.	Benefit Cost Ratio (BC Ratio)				1:1.3	

Adequacy of fodder: The data regarding the adequacy of fodder in Badal Micro watershed is presented in Table 23. The results indicate that, 81.82 per cent of the households opined that dry fodder was adequate With respect to green fodder availability, 9.09 percent of them opined it was sufficient.

Table 23. Adequacy of fodder in Badal micro-watershed

Sl.No.	Particulars	LL (4)		MF (11)		SF (13)		SMF (5)		All (33)	
		N	%	N	%	N	%	N	%	N	%
1	Adequate-Dry Fodder	0	0	10	90.91	12	92.31	5	100	27	81.82
2	Adequate-Green Fodder	0	0	1	9.09	2	15.38	0	0	3	9.09

Average annual gross income: The data regarding the annual gross income in Badal Micro watershed is presented in Table 24. The results indicate that, the farmers have annual gross income of Rs. 109253.03 in micro-watershed, of which Rs. 61828.79 is from agriculture itself.

Table 24. Average annual gross income in Badal micro-watershed

Sl.No.	Particulars	LL (4)	MF (11)	SF (13)	SMF (5)	All (33)
		Rs.	Rs.	Rs.	Rs.	Rs.
1	Business	0	0	16923.1	65000	16515.2
2	Wage	0	34545.5	48461.5	2000	30909.1
3	Agriculture	0	42200	83742.3	97500	61828.8
Income(Rs.)		0	76745.5	149127	164500	109253

Average annual Expenditure: The data regarding the average annual expenditure in Badal Micro watershed is presented in Table 25. The results indicate that, the farmers have annual gross expenditure of Rs. 191034.97 in micro-watershed, of which Rs. 24575.76 is from agriculture itself.

Table 25. Average annual Expenditure in Badal micro-watershed

Sl.No.	Particulars	LL (4)	MF (11)	SF (13)	SMF (5)	All (33)
		Rs.	Rs.	Rs.	Rs.	Rs.
1	Business	0	0	7500	87500	5757.58
2	Agriculture	0	18727.3	27307.7	50000	24575.8
Total		0	18727.3	34807.7	137500	191035

Table 26. Forest species grown in Badal micro-watershed

Sl.No.	Particulars	LL (4)		MF (11)		SF (13)		SMF (5)		All (33)	
		F	B	F	B	F	B	F	B	F	B
1	Neem	0	0	15	0	16	0	11	0	42	0
2	Tamarind	0	0	1	0	4	0	0	0	5	0
3	Pongamia	0	0	0	0	0	0	2	0	2	0
4	Banyan	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 Badal Micro watershed is presented in Table 26. The results indicate that, households have planted 42 neem trees, 5 tamarind trees, 2 pongamia trees and 2 banyan trees together in both field and backyard.

Marketing of agricultural produce: The data regarding marketing of the agricultural produce in Badal Micro watershed is presented in Table 27. The results indicated that, 100 percent of output of Cotton was sold in the market with average price of Rs. 4055.38; 97.92 percent of output of Redgram was sold in the market with average price of Rs. 7386.67 and 100.00 percent of output of Sorghum was sold in the market with average price of Rs. 4500.00.

Table 27. Marketing of agricultural produce in Badal micro-watershed

Sl.No	Crops	Output obtained (q)	Output retained (q)	Output sold (q)	Output sold (%)	Avg. Price obtained (Rs/q)
1	Cotton	201	0	201	100	4055
2	Redgram	144	3	141	98	7387
3	Sorghum	7	0	7	100	4500

Marketing channels used for sale of agricultural produce: The data regarding marketing channels used for sale of agricultural produce in Badal Micro watershed is presented in Table 28. The results indicated that, 87.88 cent of the households have sold agricultural produce to the local/village merchants.

Table 28. Marketing channels used for sale of agricultural produce in Badal micro-watershed

Sl.No.	Particulars	LL (4)		MF (11)		SF (13)		SMF (5)		All (33)	
		N	%	N	%	N	%	N	%	N	%
1	Local/village Merchant	0	0	11	100	13	100	5	100	29	87.88

Mode of transport of agricultural produce: The data regarding mode of transport of agricultural produce in Badal Micro watershed is presented in Table 29. The results indicated that, 87.88 cent of the households have used tractor.

Table 29. Mode of transport of agricultural produce in Badal micro-watershed

Sl.No.	Particulars	LL (4)		MF (11)		SF (13)		SMF (5)		All (33)	
		N	%	N	%	N	%	N	%	N	%
1	Tractor	0	0	11	100	13	100	5	100	29	87.88

Incidence of soil and water erosion problems: The data regarding incidence of incidence of soil and water erosion problems in Badal Micro watershed is presented in Table 30. The results indicate that, 87.88 per cent of the households have experienced soil and water erosion problems.

Table 30. Incidence of soil and water erosion problems in Badal micro-watershed

Sl.No.	Particulars	LL (4)		MF (11)		SF (13)		SMF (5)		All (33)	
		N	%	N	%	N	%	N	%	N	%
1	Soil and water erosion problems in the farm	0	0	11	100	13	100	5	100	29	87.88

Interest towards soil testing: The data regarding Interest shown towards soil testing in Badal Micro watershed is presented in Table 31. The results indicated that, 84.85 per cent of the households were interested towards soil testing.

Table 31. Interest regarding soil testing in Badal micro-watershed

Sl.No.	Particulars	LL (4)		MF (11)		SF (13)		SMF (5)		All (33)	
		N	%	N	%	N	%	N	%	N	%
1	Interest in soil test	0	0	10	91	13	100	5	100	28	84.85

Usage pattern of fuel for domestic use: The data on usage pattern of fuel for domestic use in Badal Micro watershed is presented in Table 32. The results indicated that, firewood was the major source of fuel for domestic use for 93.94 per cent of the households followed by LPG (3.03%).

Table 32. Usage pattern of fuel for domestic use in Badal micro-watershed

Sl.No.	Particulars	LL (4)		MF (11)		SF (13)		SMF (5)		All (33)	
		N	%	N	%	N	%	N	%	N	%
1	Fire Wood	4	100	10	90.9	12	92.3	5	100	31	93.94
2	LPG	0	0	0	0	1	7.69	0	0	1	3.03

Source of drinking water: The data on source of drinking water in Badal Micro watershed is presented in Table 33. The results indicated that, bore well supply of water was the major source for drinking water for (81.82%) per cent of the households followed by piped waters supply (12.12 %) and open ell water for (3.03%).

Table 33. Source of drinking water in Badal micro-watershed

Sl.No.	Particulars	LL (4)		MF (11)		SF (13)		SMF (5)		All (33)	
		N	%	N	%	N	%	N	%	N	%
1	Piped supply	0	0	1	9.09	2	15.38	1	20	4	12.12
2	Bore Well	4	100	9	81.8	10	76.92	4	80	27	81.82
3	Open well	0	0	0	0	1	7.69	0	0	1	3.03

Source of light: The data on source of light in Badal Micro watershed is presented in Table 34. The results indicated that, electricity was the major source of light for 100.00 per cent of the households.

Table 34. Source of light in Badal micro-watershed

Sl.No.	Particulars	LL (4)		MF (11)		SF (13)		SMF (5)		All (33)	
		N	%	N	%	N	%	N	%	N	%
1	Electricity	4	100	11	100	13	100	5	100	33	100

Existence of sanitary toilet facility: The data on availability of toilet facility in Badal Micro watershed is presented in Table 35. The results indicated that, 100.00 per cent of the households possess toilets.

Table 35. Existence of sanitary toilet facility in Badal micro-watershed

Sl.No.	Particulars	LL (4)		MF (11)		SF (13)		SMF (5)		All (33)	
		N	%	N	%	N	%	N	%	N	%
1	Sanitary toilet facility	4	100	11	100	13	100	5	100	33	100

Possession of PDS card: The data regarding possession of PDS card in Badal Micro watershed is presented in Table 36. The results indicated that, 100.00per cent of the households possessed BPL card.

Table 36. Possession of PDS card in Badal micro-watershed

Sl.No.	Particulars	LL (4)		MF (11)		SF (13)		SMF (5)		All (33)	
		N	%	N	%	N	%	N	%	N	%
1	BPL	4	100	11	100	13	100	5	100	33	100

Participation in NREGA programme: The data regarding Participation in NREGA programme in Badal Micro watershed is presented in Table 37. The results indicated that, only 3.03 percent of the participate have participated in NREGA programme.

Table 37. Participation in NREGA programme in Badal micro-watershed

Sl.No.	Particulars	LL (4)		MF (11)		SF (13)		SMF (5)		All (33)	
		N	%	N	%	N	%	N	%	N	%
1	Participation in NREGA programme	0	0	0	0	0	0	1	20	1	3.03

Adequacy of food items: The data regarding adequacy of food items in Badal Micro watershed is presented in Table 38. The results indicated that, the extent of adequacy of food items for cereals, pulses, Oilseeds and vegetables were 100.00, 81.82, 24.24, 33.33 per cent respectively, similarly for milk (48.48%) and Egg (12.12%).

Table 38. Adequacy of food items in Badal micro-watershed

Sl.No.	Particulars	LL (4)		MF (11)		SF (13)		SMF (5)		All (33)	
		N	%	N	%	N	%	N	%	N	%
1	Cereals	4	100	11	100	13	100	5	100	33	100
2	Pulses	2	50	10	90.9	10	76.92	5	100	27	81.82
3	Oilseed	1	25	4	36.4	3	23.08	0	0	8	24.24
4	Vegetables	2	50	2	18.2	3	23.08	4	80	11	33.33
5	Milk	0	0	7	63.6	7	53.85	2	40	16	48.48
6	Egg	0	0	1	9.09	1	7.69	2	40	4	12.12

Table 39. Inadequacy of food items in Badal micro-watershed

Sl.No.	Particulars	LL (4)		MF (11)		SF (13)		SMF (5)		All (33)	
		N	%	N	%	N	%	N	%	N	%
1	Pulses	2	50	1	9.09	2	15.38	0	0	5	15.15
2	Oilseed	2	50	5	45.5	10	76.92	5	100	22	66.67
3	Vegetables	2	50	9	81.8	10	76.92	1	20	22	66.67
4	Fruits	4	100	11	100	13	100	5	100	33	100
5	Milk	4	100	3	27.3	5	38.46	3	60	15	45.45
6	Egg	4	100	10	90.9	12	92.31	3	60	29	87.88
7	Meat	4	100	11	100	12	92.31	5	100	32	96.97

Inadequacy of food items: The data regarding in adequacy of food items in Badal Micro watershed is presented in Table 39. The results indicated that, the extent of in adequacy of food items for pulses, Oilseeds and vegetables were 15.15, 66.67, 66.67 and 96.97 per

cent respectively, similarly for fruits (100.00%), milk (45.45%), egg (87.88%) and meat (96.97%).

Response on market surplus of food items: The data regarding adequacy of food items in Badal Micro watershed is presented in Table 40. The results indicated that, the extent of adequacy of food items for pulses and Oilseeds were 3.03, 6.06, per cent respectively.

Table 40. Response on market surplus of food items in Badal micro-watershed

Sl. No.	**Particulars**	**LL** (4)		**MF** (11)		**SF** (13)		**All (33)**	
		N	**%**	**N**	**%**	**N**	**%**	**N**	**%**
1	Pulses	0	0	0	0	1	7.69	1	3.03
2	Oilseed	0	0	2	18.2	0	0	2	6.06

Farming constraints: The data regarding farming constraints experienced by households in Badal Micro watershed is presented in Table 41. The results indicated that, lower fertility status of the soil was the constraint experienced by (90.91 %) per cent of the households, wild animal menace on farm field (87.88%), frequent incidence of pest and diseases (78.79%), inadequacy of irrigation water (12.12%), high cost of fertilizers and plant protection chesmicals (81.82%), high rate of interest on credit (45.45%), low price for the agricultural commodities (66.67 %), lack of marketing facilities in the area (57.58%), inadequate extension services (3.03 %) and lack of transport for safe transport of the agricultural produce to the market (39.39%).

Table 41. Farming constraints experienced in Badal micro-watershed

SN	**Particulars**	**LL** (4)		**MF** (11)		**SF** (13)		**SMF** (5)		**All (33)**	
		N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
1	Lower fertility status of the soil	0	0	11	100	14	107.69	5	100	30	90.91
2	Wild animal menace on farm field	0	0	11	100	13	100	5	100	29	87.88
3	Frequent incidence of pest and diseases	0	0	11	100	10	76.92	5	100	26	78.79
4	Inadequacy of irrigation water	0	0	2	18.18	1	7.69	1	20	4	12.12
5	High cost of Fertilizers and plant protection chemicals	0	0	11	100	11	84.62	5	100	27	81.82
6	High rate of interest on credit	0	0	8	72.73	6	46.15	1	20	15	45.45
7	Low price for the agricultural commodities	0	0	9	81.82	9	69.23	4	80	22	66.67
8	Lack of marketing facilities in the area	0	0	8	72.73	7	53.85	4	80	19	57.58
9	Inadequate extension services	0	0	0	0	1	7.69	0	0	1	3.03
10	Lack of transport for safe transport of the Agril produce to the market.	0	0	5	45.45	4	30.77	4	80	13	39.39

Chapter 5

SUMMARY AND IMPLICATIONS

In order to assess the socio-economic condition of the farmers in the watershed 33 households located in the micro watershed were interviewed for the survey. The study was conducted in Badal micro-watershed (Mungal sub-watershed, Yadgir taluk & District) is located at North latitude 16^0 31' 39.345" and 16^0 29' 32.556" and East longitude 77^0 15' 51.422" and 77^0 14' 3.803"covering an area of about 587.10 ha bounded by under Kondapura, Badiyala and Sangavara Villages.

Socio-economic analysis indicated that, out of the total sample of 33 respondents, -11 (33.33%) were marginal, 13(39.39%) were small and 5 (15.15%) were semi medium, farmers. The population characteristics of households indicated that, there were 68 (55.74%) men and 54 (44.26%) were women. Majority of the respondents (40.16%) were in the age group of 35-60 years. Education level of the sample households indicated that, majority there were 46.72 per cent illiterates and only 4.92 per cent attained graduation. About, 78.79 per cent of household heads practicing agriculture and 9.09 per cent of the household heads were engaged as agricultural labourers. Agriculture was the major occupation for 60.66 per cent of the household members.

In the study area, 90.91 per cent of the households possess katcha house. The durable assets owned by the households showed that, 84.85 per cent possess TV, 42.42 per cent possess mixer grinder and 66.67 per cent possess mobile phones. Farm implements owned by the households indicated that, 42.42 per cent of the households possess plough and only 9.09 per cent sprayer. Regarding livestock possession by the households and 6.06 per cent possess local cow respectively.

The average labour availability in the study area showed that**,** own men and women labour availability in the micro watershed was 14.79 each, while the hired labour (men) availability was 1.72.

Out of the total land holding of the sample respondents (38.39 ha), 100.00 per cent of the area is under dry condition Cotton, cropping intensity was recorded as 99.22 per cent.

The sample households possessed 6.06 per cent bank account. About 6.06 per cent of the respondents borrowed credit from various sources. Among the credit borrowed by households.

The per hectare cost of cultivation for Cotton, Redgram and Sorghum of Rs.50497.60, 40293.72 and 54888.46 with benefit cost ratio of 1:1.30, 1: 1.30 and 1: 1.30, respectively.

Further, 81.82 per cent of the households opined that dry fodder was adequate and 9.09 per cent of the households have opined that the green fodder was adequate.

The average annual gross income of the farmers was Rs. 109253.03 in micro-watershed, of which Rs. 61828.79 comes from agriculture.

Regarding marketing channels, 87.88 per cent of the households have sold agricultural produce to the local/village merchants, Further, 87.88 per cent of the households have used tractor for the transport of agriculture commodity.

Majority of the farmers (87.88 %) have experienced soil and water erosion problems in the watershed and 84.85 per cent of the households were interested towards soil testing.

Firewood connection was the major source of fuel for domestic use for 93.94 per cent of the households and 3.03 per cent households has LPG. Piped supply was the major source for drinking water for 12.12 per cent of the households. Electricity was the major source of light for 100.00 per cent of the households. In the study area, 100.00 per cent of the households possess toilet facility. Regarding possession of PDS card, 100.00 per cent of the households possessed BPL card and Cereals (100.00%), pulses (81.82%), oilseeds (24.24%) were adequate for consumption.

Farming constraints experienced by households in the micro watersheds were lower fertility status of the soil (90.91%) wild animal menace on farm field (87.88%), frequent incidence of pest and diseases (78.79%), inadequacy of irrigation water (12.12%), high cost of fertilizers and plant protection chemicals (81.82%), high rate of interest on credit (45.45%), low price for the agricultural commodities (66.67%), lack of marketing facilities in the area (57.58%), inadequate extension services (3.03%) and lack of transport for safe transport of the agricultural produce to the market (39.39%).

Implications of the survey

- ✓ Result indicated that, there were 46.72 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, 90.91 per cent of the households possess katcha house. Hence, the development department while implementing the watershed plan should focus on agriculture to enhance the productivity of major crops in the area to increase the income of the farmers.
- ✓ Results indicated that the local institutional participation of the household members in the micro watershed is minimal hence, activities like membership campaign, awareness creation about the benefits of membership in local institutions and strengths of organized groups must be conveyed.

- ✓ Majority of the households in the watershed have experience in use of mobile phones, and television hence, these mass media can be effectively utilized for transfer of technology as well as for information dissemination.
- ✓ The farm machinery/implement possession in the micro watershed was found to be minimum the reasons may lack of knowledge or lack of financial ability which can be addressed through training on use of different farm implements, providing information on different sources of finance for purchase of farm implements.
- ✓ The possession of livestock such as crossbred cow found is less hence, farmers must be made aware of the benefits of crossbred cow in increased milk production.
- ✓ The possession of livestock such as sheep, goat and poultry was found to be low hence, farmers may be informed the role of subsidiary enterprises in enhancing the income and information on financial support for subsidiary activities.
- ✓ The data indicate that, job/work was the reason for all the migrants hence, farmers may be trained on profitable agriculture or self employment such has animal husbandry, plate making, sheep rearing, goat rearing, rabbit rearing with suitable information on sources of financial support.
- ✓ The results indicate that there was a change in quality of life due to migration hence, the developmental departments should take actions to arrest migration and to improve the quality of the life in rural areas.
- ✓ Households possess 38.39ha (100.00 %) of dry land and the availability of the dryland agricultural technologies such as short duration crops, high yielding drought resistance crop varieties, drip irrigation technology and subsidy information will be helpful for the farmers to enhance the productivity of land and as well as farmers income.
- ✓ Few of the bore well in micro watershed found non functional hence, farmers may be trained on possibility of bore well rejuvenation.
- ✓ Bore well was major source of irrigation for 0.00 per cent of the households. hence, in order to increase the area under irrigation as well as to increase the water use efficiency farmers may trained on drip irrigation and provide the information on subsidy for drip irrigation equipment's along with the information on different agencies which provides the financial assistance for drip irrigation.
- ✓ The cropping intensity in the micro watershed was found to be (99.22 %) hence, care must be taken by the implementing agency to bring uncultivated land into cultivation through suitable measures.
- ✓ Many of the household members have borrowed loan from cooperative banks which has higher rate of interest hence, farmers may be sensitized on the different sources of credit with lesser interest rate such SHGs etc.
- ✓ The results indicated the non availability of both green and dry fodder throughout the year hence, fodder development activities can be taken up in the micro watershed.
- ✓ The average annual gross income of the households Rs.61828.79 from agriculture, Rs.16515.15 from business and Rs. 30909.09 from wages and. Agriculture was found to

be the major source of income for households hence; the development activities should focus on productivity enhancement, marketing arrangements and agricultural technology dissemination to have a direct impact on the farmers.

- ✓ The cultivation of forest species is found minimal hence, information and production technology related to agro-forestry and integrated farming system.
- ✓ The data indicated that, 87.88 per cent of the households have experienced soil and water erosion problems. Hence, those farmers who reported the soil and water erosion problems may be given attention while implementation of the watershed development plan.
- ✓ The data indicated that, 84.85 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 (90.91%), wild animal menace on farm field (87.88%), frequent incidence of pest and diseases (78.79%), high cost of fertilizers and plant protection chemicals (81.82%), high rate of interest on credit (45.45%), low price for the agricultural commodities (66.67%), lack of marketing facilities in the area (57.58%), inadequate extension services (3.03%), lack of transport for safe transport of the agricultural produce to the market (39.39%) 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.