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

SUDAPUR-1 (4D5B4J2b) MICROWATERSHED

Yadgir Taluk and District, Karnataka

Karnataka Watershed Development Project – II

SUJALA – III

World Bank funded Project

THE WORLD BANK

ICAR – NATIONAL BUREAU OF SOIL SURVEY AND LAND USE PLANNING

ICAR - NBSS & LUP

WATERSHED DEVELOPMENT DEPARTMENT
GOVT. OF KARNATAKA, BANGALORE

About ICAR - NBSS&LUP

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

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

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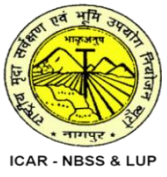

WATERSHED DEVELOPMENT DEPARTMENT, GOVT. OF KARNATAKA, BANGALORE

PREFACE

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

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

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

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

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

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

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

Nagpur
Date:11-10-2019

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PART-A

LAND RESOURCE INVENTORY

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EXECUTIVE SUMMARY

The land resource inventory of Sudapur 1 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 512 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 471 ha in the microwatershed is covered by soils, 30 ha by rock outcrops and 11 ha by others (habitation and water body). The salient findings from the land resource inventory are summarized briefly below.

- *The soils belong to 8 soil series and 15 soil phases (management units) and 5 land management units.*
- *The length of crop growing period is about 120-150 days starting from 1st week of June to 4th week of October.*
- *From the master soil map, several interpretative and thematic maps like land capability, soil depth, surface soil texture, soil gravelliness, available water capacity, soil slope and soil erosion were generated.*
- *Soil fertility status maps for macro and micronutrients were generated based on the surface soil samples collected at every 320 m grid interval.*
- *Land suitability for growing 29 major agricultural and horticultural crops was assessed and maps showing the degree of suitability along with constraints were generated.*
- *Entire area in the microwatershed is suitable for agriculture.*
- *About 29 per cent area are very shallow to shallow (<25 to 50 cm), 49 per cent area of the microwatershed has soils that are moderately shallow (50-75 cm), 9 per cent area are moderately deep (75 - 100 cm) and 5 per cent area are deep to very deep (100 to >150 cm).*
- *About 9 per cent area in the microwatershed has sandy, 24 per cent area loamy and 59 per cent clayey soils at the surface.*
- *About 41 per cent area in the microwatershed is non gravelly (<15%), 47 per cent gravelly (15-35%) and 4 per cent is very gravelly (35-60%).*

- *About 5 per cent area very high (>200 mm/m) in available water capacity, 58 per cent area low (51-100 mm/m) and 29 per cent area very low (<50 mm/m) in available water capacity.*
- *Entire area of the microwatershed is very gently sloping (1-3% slope) lands.*
- *An area of about 84 per cent area in the microwatershed is moderately (e2) eroded and 8 per cent area is severely (e3) eroded lands.*
- *Entire area of the microwatershed is neutral (pH 6.5-7.3) in soil reaction.*
- *The Electrical Conductivity (EC) of the entire soils of the microwatershed is dominantly <2 dsm^{-1} indicating that the soils are non-saline.*
- *About 2 per cent of the soils are medium (0.5-0.75%) in organic carbon and high (>0.75%) in 90 per cent area carbon.*
- *49 per cent area is high (>57 kg/ha) in available phosphorus, 27 per area is medium (23-57 kg/ha) and 15 per area is low (<23 kg/ha).*
- *Entire area of the microwatershed is medium (145-337%) in available potassium.*
- *Available sulphur is low (<10 ppm) in an area of about 42 per cent, medium (10 -20 ppm) in 45 per cent and high (>20 ppm) in 5 per cent.*
- *About 75 per cent area is low (<0.5 ppm) in available boron, 15 per cent is medium (0.5-1.0 ppm) and 3 per cent is high (>1.0 ppm).*
- *Available iron is sufficient (>4.5 ppm) in the entire area of the microwatershed.*
- *Available manganese and copper are sufficient in all the soils of the microwatershed.*
- *About 13 per cent area is deficient (<0.6 ppm) in available zinc and 79 per cent is sufficient (>0.6 ppm).*
- *The land suitability for 29 major crops grown in the microwatershed were assessed and the areas that are highly suitable (S1) and moderately suitable (S2) are given below. It is however to be noted that a given soil may be suitable for various crops but what specific crop to be grown may be decided by the farmer looking to his capacity to invest on various inputs, marketing infrastructure, market price and finally the demand and supply position.*

Land suitability for various crops in the Microwatershed

Crop	Suitability Area in ha (%)			Crop	Suitability Area in ha (%)	
	Highly suitable (S1)	Moderately suitable (S2)			Highly suitable (S1)	Moderately suitable (S2)
Sorghum	-	*324(63)*		*Guava*	-	*47(9)*
Maize	*13(2)*	*311(61)*		*Sapota*	-	*47(9)*
Bajra	*47(9)*	*277(54)*		*Pomegranate*	-	*74(14)*
Groundnut	*47(9)*	*176(34)*		*Musambi*	-	*74(14)*
Sunflower	-	*74(14)*		*Lime*	-	*74(14)*
Redgram	-	*74(14)*		*Amla*	*47(9)*	*250(49)*
Bengal gram	-	*27(5)*		*Cashew*	-	*47(9)*
Cotton	-	*101(20)*		*Jackfruit*	-	*47(9)*
Chilli	*13(2)*	*311(61)*		*Jamun*	-	-
Tomato	*13(2)*	*311(61)*		*Custard apple*	*47(9)*	*277(54)*
Brinjal	*13(2)*	*311(61)*		*Tamarind*	-	-
Onion	*13(2)*	*284(56)*		*Mulberry*	-	*47(9)*
Bhendi	*13(2)*	*311(61)*		*Marigold*	*13(2)*	*311(61)*
Drumstick	-	*47(9)*		*Chrysanthemum*	*13(2)*	*311(61)*
Mango	-	-				

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

Chapter 1

INTRODUCTION

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 Sudapur 1 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 Sudapur 1 microwatershed is located in the northern part of Karnataka in Yadgir Taluk and District, Karnataka State (Fig.2.1). It comprises parts of Dhuganura, Malyapalli, Siddhapura.B, Kolakundha and Gajarakota villages. It lies between 16^0 55' – 16^0 56' north latitudes and 77^0 18' – 77^0 20' east longitudes, covering an area of about 511.96 ha. It is about 37 km southeast of Yadgir town and is surrounded by Dhuganura and Kolakundha on the west, Malyapalli on the east and north, Siddhapura.B on the south and Gajarakota village on the southwestern side.

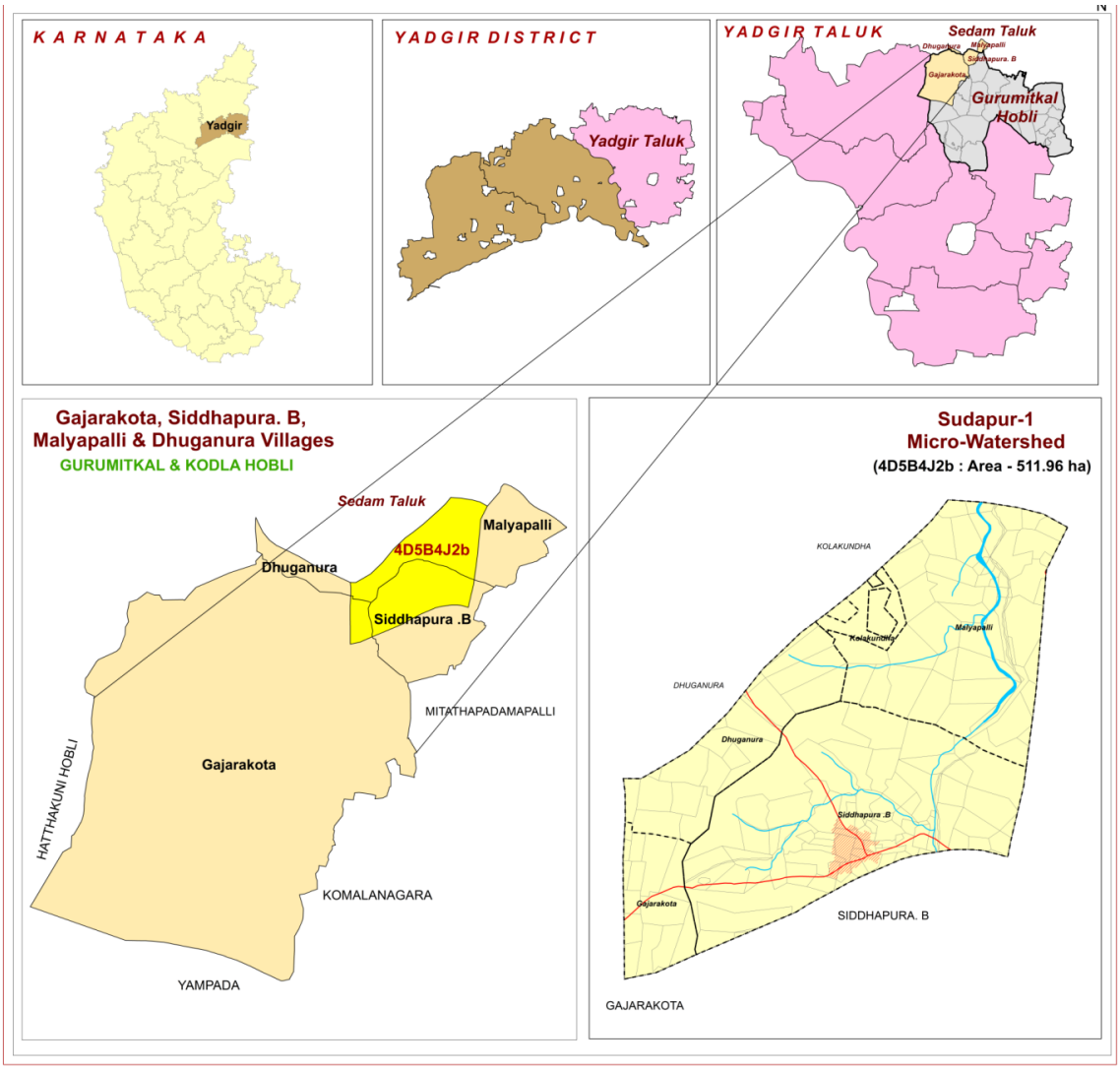

Fig.2.1 Location map of Sudapur 1 microwatershed

2.2 Geology

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

highly weathered, fractured and fissured upto a depth of about 10 m. Dolerite dykes and quartz veins are common with variable width and found to occur in Sudapur 1 microwatershed.

Fig.2.2 Granite and granite gneiss rocks formation

2.3 Physiography

Physiographically, the area has been identified as granite gneiss landscape. 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 537-603 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^{0}C and 10^{0}C respectively. During peak summer, temperature shoots up to 45^{0}C. 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 end of June to end of 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**		

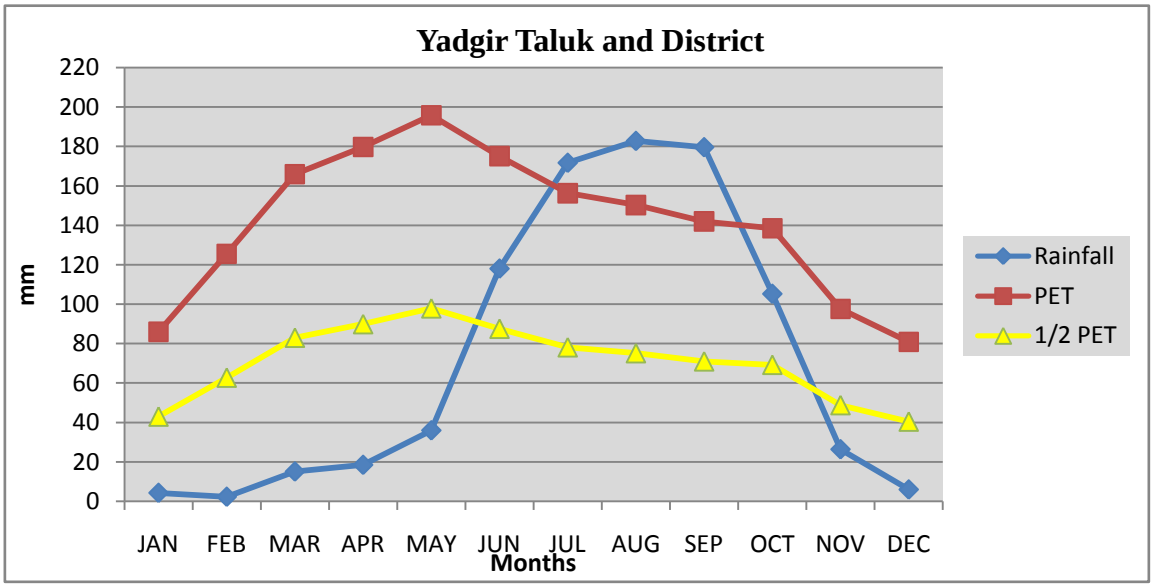

Fig 2.3 Rainfall distribution in Yadgir Taluk and District

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 (Fig 2.4).

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

Fig 2.4 Natural vegetation of Sudapur 1 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. 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 different crops and cropping systems adopted in the microwatershed is presented in Figures 2.5 a & b. The current land use map of Sudapur 1 microwatershed is presented in Fig.2.6. The occurrence and distribution of wells in Sudapur 1 microwatershed is shown in figure 2.7

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. 2.5 a. Different Crops and Cropping Systems in Sudapur 1 microwatershed

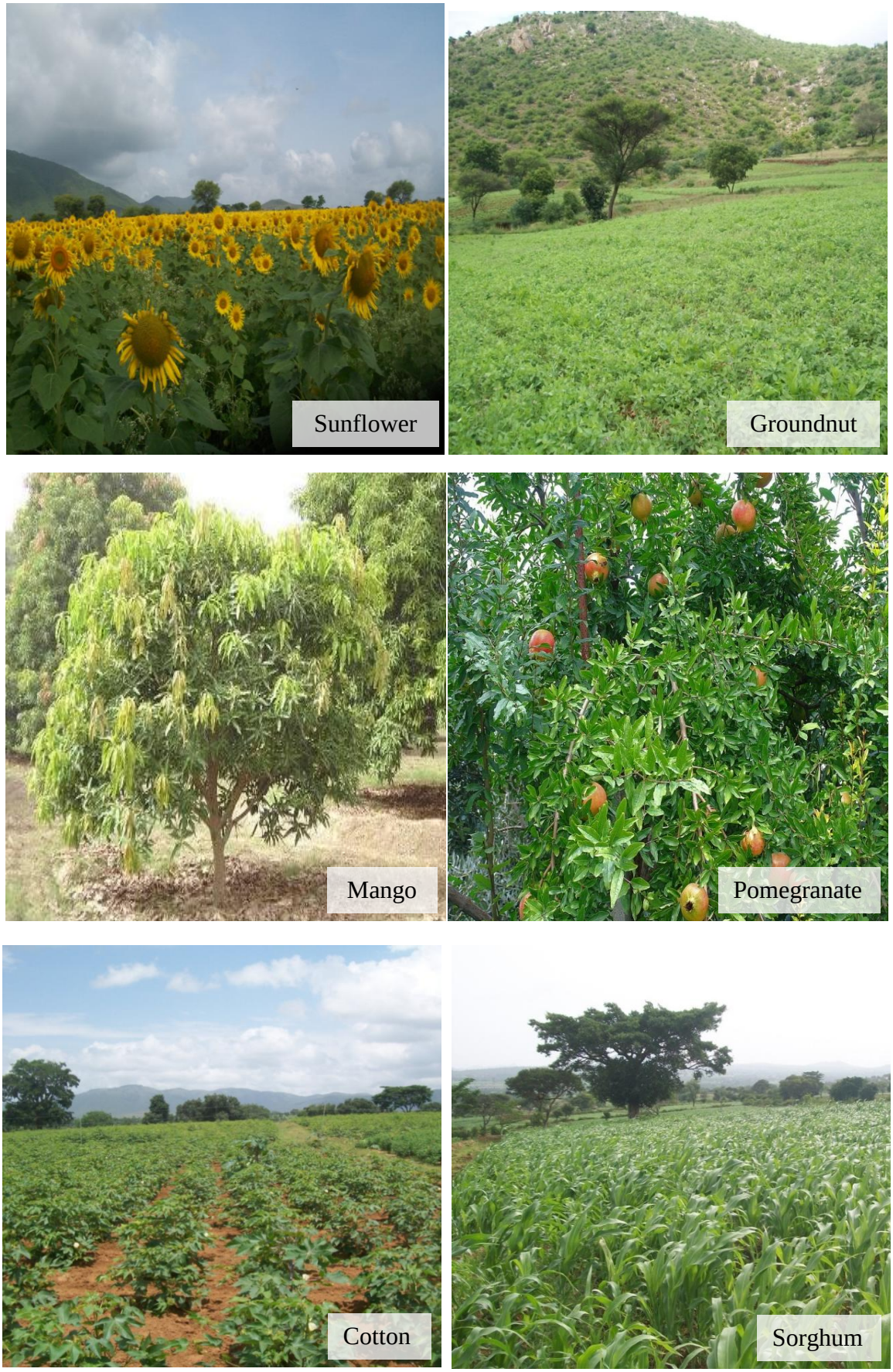

Fig. 2.5 b. Different Crops and Cropping Systems in Sudapur 1 microwatershed

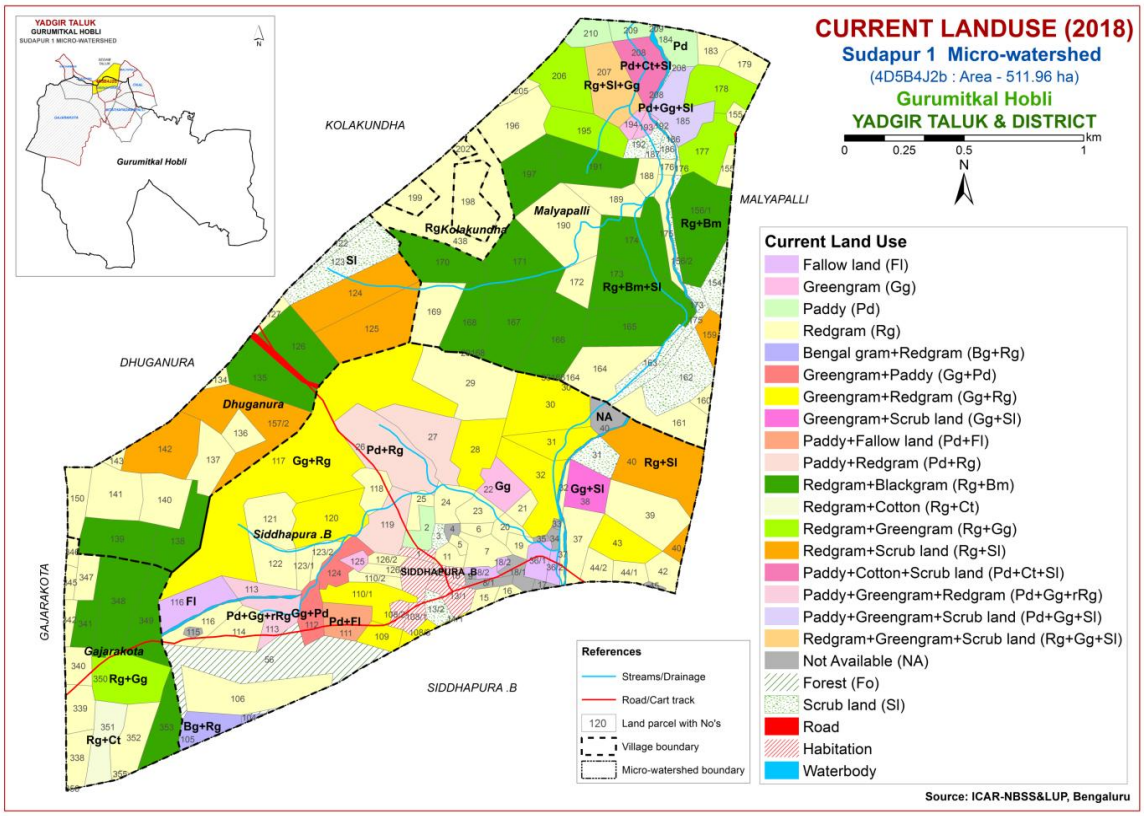

Fig.2.6 Current Land Use map of Sudapur 1 microwatershed

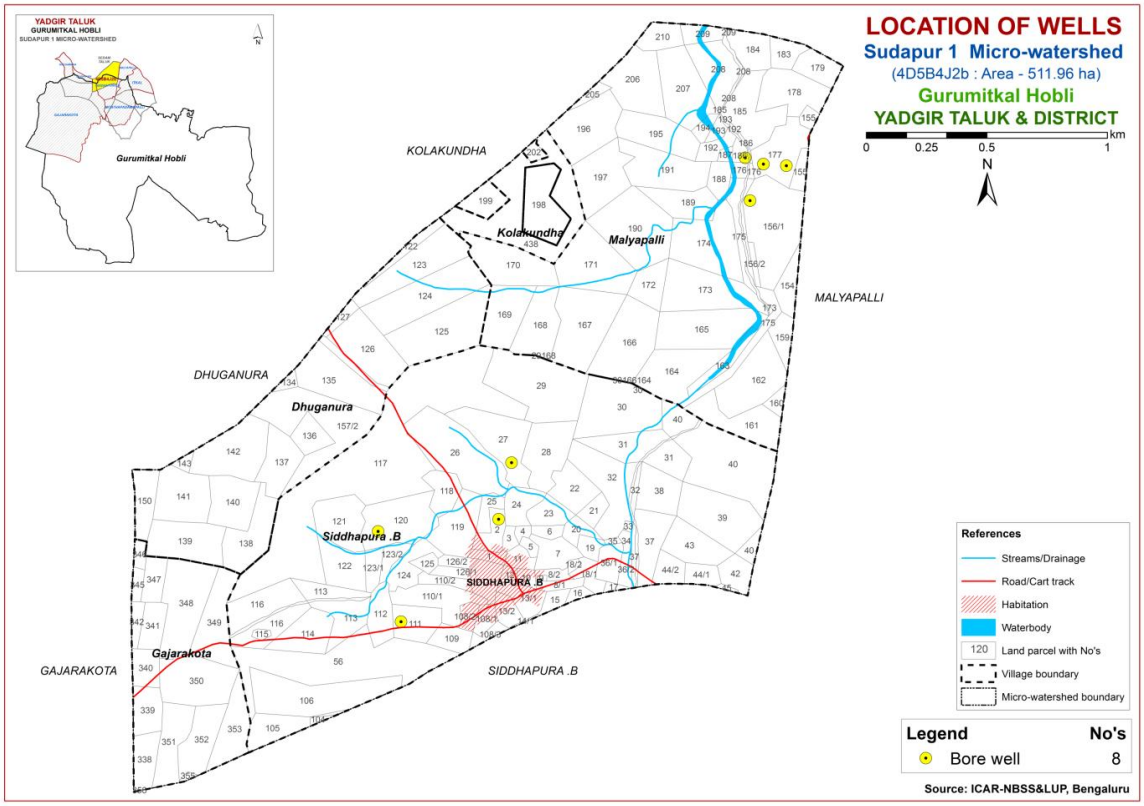

Fig. 2.7 Location of wells in Sudapur 1 microwatershed

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 Sudapur 1 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 512 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 IRS satellite imagery as base supplied by KSRSAC. The cadastral map shows field boundaries with their survey numbers, location of tanks, streams and other permanent features of the area (Fig. 3.1). Apart from the cadastral map, remote sensing data products from Cartosat-1 and LISS IV merged at the scale of 1:7920 were used in conjunction with the cadastral map to identify the landscapes, landforms and other surface features. The imagery helped in the identification and delineation of boundaries between hills, uplands and lowlands, water bodies, forest and vegetated areas, roads, habitations and other cultural features of the area (Fig. 3.2). The cadastral map was overlaid on the satellite imagery (Fig. 3.3) that helps to identify the parcel boundaries and other permanent features. Apart from cadastral maps and images, toposheets of the area (1:50,000 scale) were also used for initial traversing, identification of geology and landforms, drainage features, present land use and also for selection of transects in the microwatershed.

3.2 Image Interpretation for Physiography

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

subdivided into physiographic/image interpretation units based on image characteristics. The image interpretation legend for physiography is given below.

Image Interpretation Legend for Physiography

G- Granite Gneiss Landscape

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

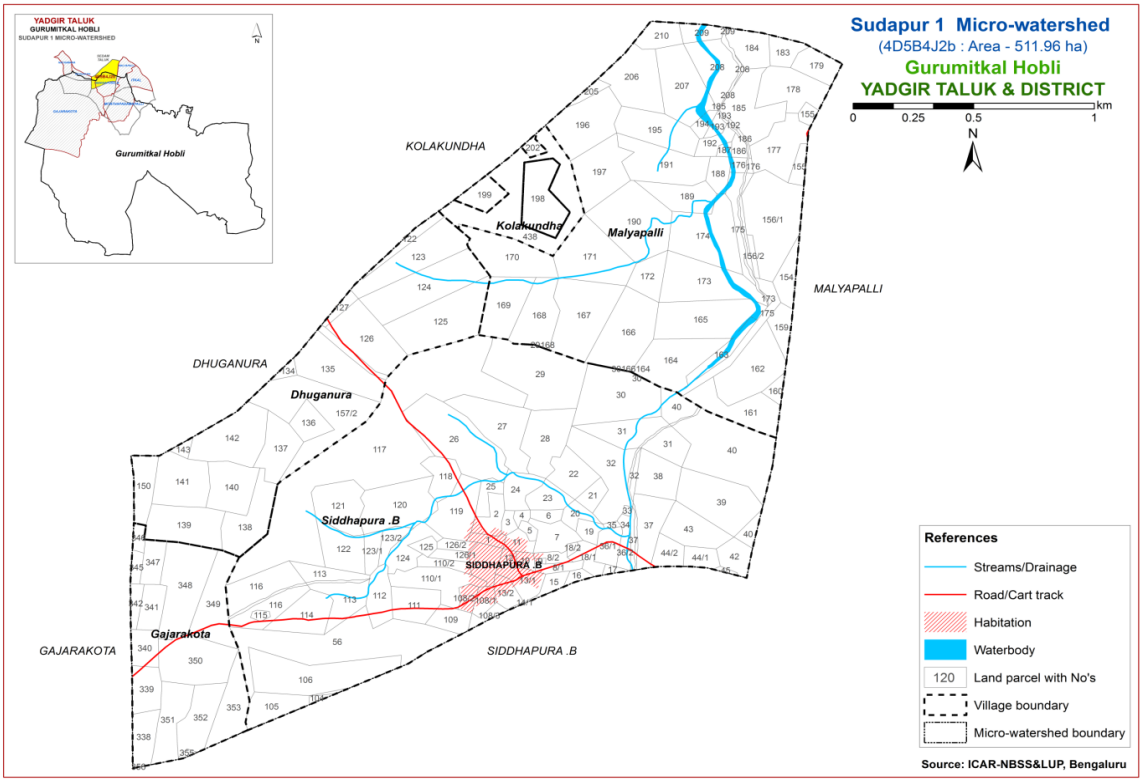

Fig 3.1 Scanned and Digitized Cadastral map of Sudapur 1 microwatershed

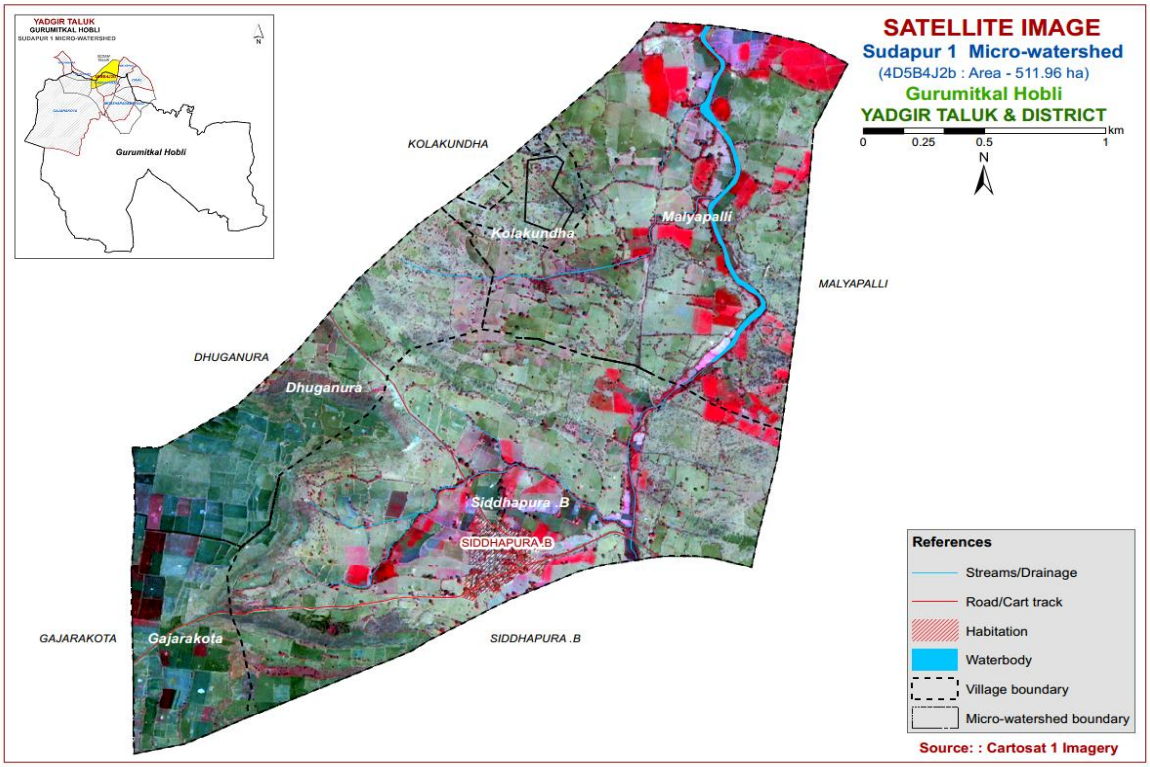

Fig.3.2 Satellite Image of Sudapur 1 microwatershed

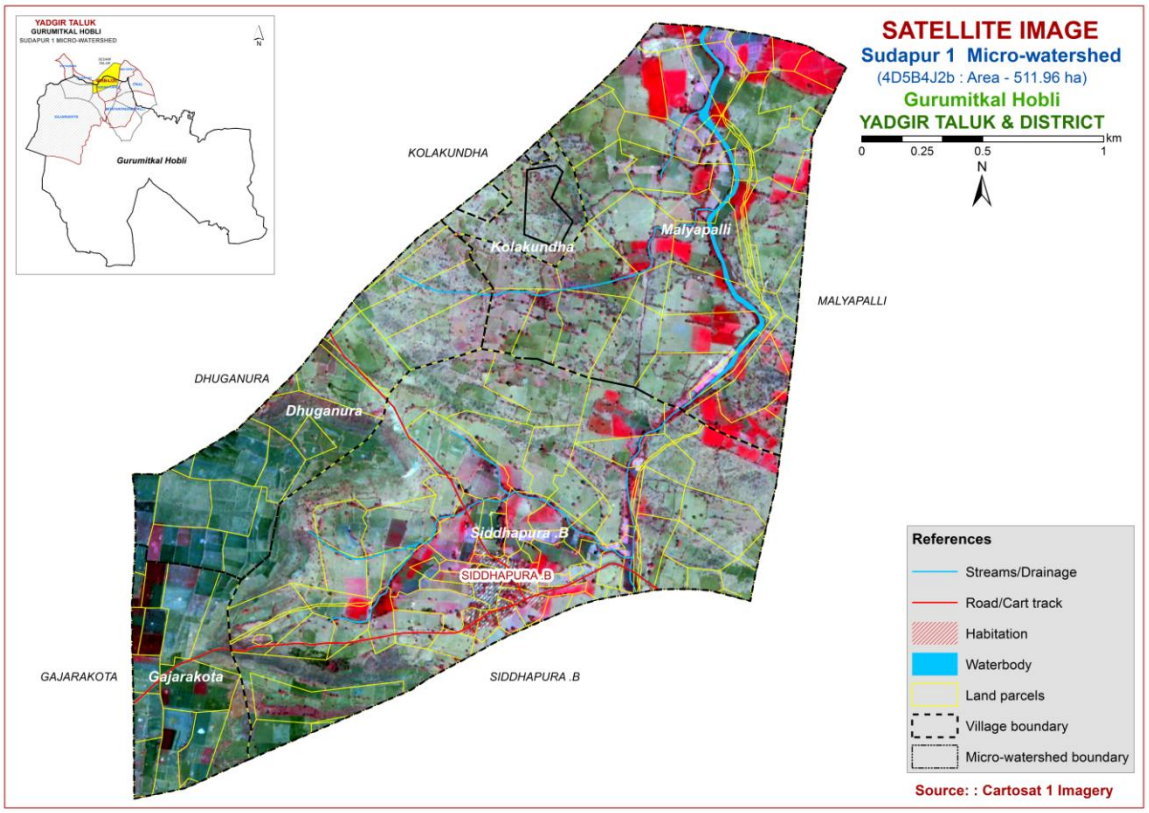

Fig.3.3 Cadastral map overlaid on IRS PAN+LISS IV merged imagery of Sudapur 1 microwatershed

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).

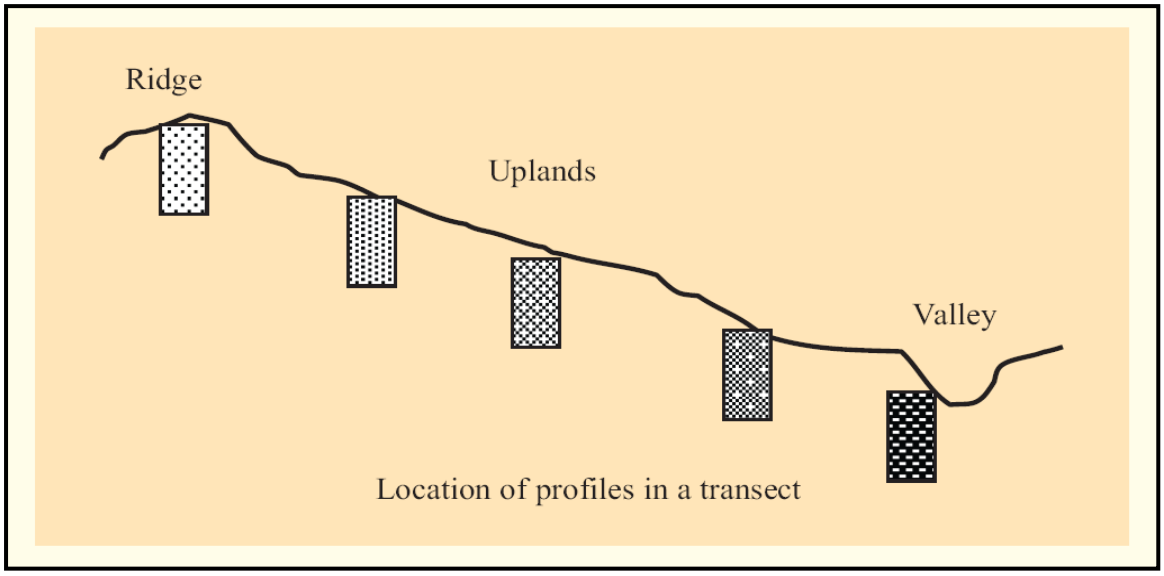

Fig: 3.4. Location of profiles in a transect

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, 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, 8 soil series were identified in the Sudapur 1 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**
1	BMN (Bhimanahalli)	>150	10YR 3/1	c	-	Ap-Bss	es
2	NGP (Nagalapur)	100-150	10YR3/2,3/1,2/1	c	-	Ap-Bss	es
3	BLC (Balichakra)	75-100	2.5YR5/3,2.5/4 5YR4/3,3/3	scl	-	Ap-Bt	-
4	YLR (Yalleri)	50-75	2.5YR 3/4,4/4 5YR3/4 7.5YR4/4	gc	15-35	Ap-Bt	-
5	JNK (Jinkera)	50-75	10YR 3/1,3/2 7.5YR3/4	scl	-	Ap-Bw	e
6	BDL (Badiyala)	25-50	7.5YR 2.5/3, 2.5/2,3/3 10YR3/4,4/3	sl	-	Ap-Bw	e
7	VNK (Vanakanahalli)	25-50	2.5YR 3/4	sc	-	Ap-Bt-Cr	-
8	BDP (Baddeppalli)	<25	7.5YR 3/2, 3/4 5YR 3/4	scl	-	Ap-Ac	es

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 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 15 mapping units representing 8 soil series occurring in the microwatershed. The soil map unit (soil legend) description is presented in Table 3.2. The soil phase map (management units) shows the distribution of 15 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 phase will have similar management needs and have to be treated accordingly.

3.5 Land Management Units

The 15 soil phases identified and mapped in the microwatershed were grouped into 5 Land Management Units (LMU's) for the purpose of preparing a Proposed Crop Plan for sustained development of the microwatershed. The database (soil phases) generated under LRI was utilized for identifying Land Management Units (LMU's) based on the management needs. One or more than one soil site characteristic having influence on the management have been chosen for identification and delineation of LMUs. For Sudapur 1 microwatershed, five soil and site characteristics, namely soil depth, soil texture, slope, erosion and gravel content have been considered for defining LMUs. The Land Management Units are expected to behave similarly for a given level of management.

3.6 Laboratory Characterization

Soil samples were collected from representative master profiles for laboratory characterization by following the methods outlined in the Laboratory Manual (Sarma *et al*, 1987). Surface soil samples collected from farmer's fields (47 samples) for fertility status (major and micronutrients) at 320 m grid interval in the year 2018 were analyzed in the laboratory (Katyal and Rattan, 2003). By linking the soil fertility data to the survey numbers through GIS, soil fertility maps were generated by using Kriging method for the microwatershed.

Table 3.2 Soil map unit description of Sudapur 1 microwatershed

*Soil map unit No.	Soil Series	Soil Phase	Mapping Unit Description	Area in ha (%)
Soils of Granite and Granite Gneiss Landscape				
	BMN	Bhimanahalli soils are very deep (>150 cm), moderately well drained, have very dark gray, calcareous cracking clay black soils occurring on very gently sloping uplands under cultivation		**19 (3.77)**
63		BMNmB2g1	Clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	19 (3.77)
	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		**8 (1.49)**
49		NGPmB2	Clay surface, slope 1-3%, moderate erosion	8 (1.49)
	BLC	Balichakra soils are moderately deep (75-100 cm), well drained, have reddish brown to dark reddish brown, sandy clay loam red soils occurring on very gently sloping uplands under cultivation		**47(9.18)**
155		BLCcB2g1	Sandy loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	34 (6.73)
38		BLCiB2	Sandy clay surface, slope 1-3%, moderate erosion	13 (2.45)

*Soil map unit No.	Soil Series	Soil Phase	Mapping Unit Description	Area in ha (%)
	YLR	Yalleri soils are moderately shallow (50-75 cm), well drained, have brown to reddish brown and dark reddish brown, gravelly, clay red soils occurring on very gently to gently sloping uplands under cultivation		**74 (14.4)**
29		YLRcB2g1	Sandy loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	47 (9.16)
31		YLRiB2	Sandy clay surface, slope 1-3%, moderate erosion	27 (5.24)
	JNK	Jinkera soils are moderately shallow (50-75 cm), well drained, have dark brown to very dark grayish brown, slightly calcareous sandy clay loam soils occurring on very gently sloping uplands under cultivation		**176 (34.41)**
22		JNKiB2	Sandy clay surface, slope 1-3%, moderate erosion	38 (7.4)
23		JNKiB2g1	Sandy clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	99 (19.41)
24		JNKiB3g1	Sandy clay surface, slope 1-3%, severe erosion, gravelly (15-35%)	39 (7.6)
	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		**107(20.97)**
2		BDLbB2	Loamy sand surface, slope 1-3%, moderate erosion	45 (8.84)
174		BDLcB2g2	Sandy loam surface, slope 1-3%, moderate erosion, very gravelly (35-60%)	20 (3.98)
5		BDLiB2	Sandy clay surface, slope 1-3%, moderate erosion	42 (8.15)
	VNK	Vanakanahalli soils are shallow (25-50 cm), well drained, have dark reddish brown, sandy clay red soils occurring on very gently to moderately sloping uplands under cultivation		**1 (0.13)**
109		VNKmB2g1	Clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	1 (0.13)
	BDP	Baddeppalli soils are very shallow (<25 cm), well drained, have dark brown to dark reddish brown, calcareous sandy clay loam soils occurring on very gently sloping uplands under cultivation		**39(7.64)**
120		BDPhB2	Sandy clay loam surface, slope 1-3%, moderate erosion	20 (3.95)
1		BDPiB2	Sandy clay surface, slope 1-3%, moderate erosion	19 (3.69)
999		Rock outcrops	Rock lands, both massive and bouldery with little or no soil	**30 (5.78)**
1000		Others	Habitation and water body	**11 (2.21)**

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

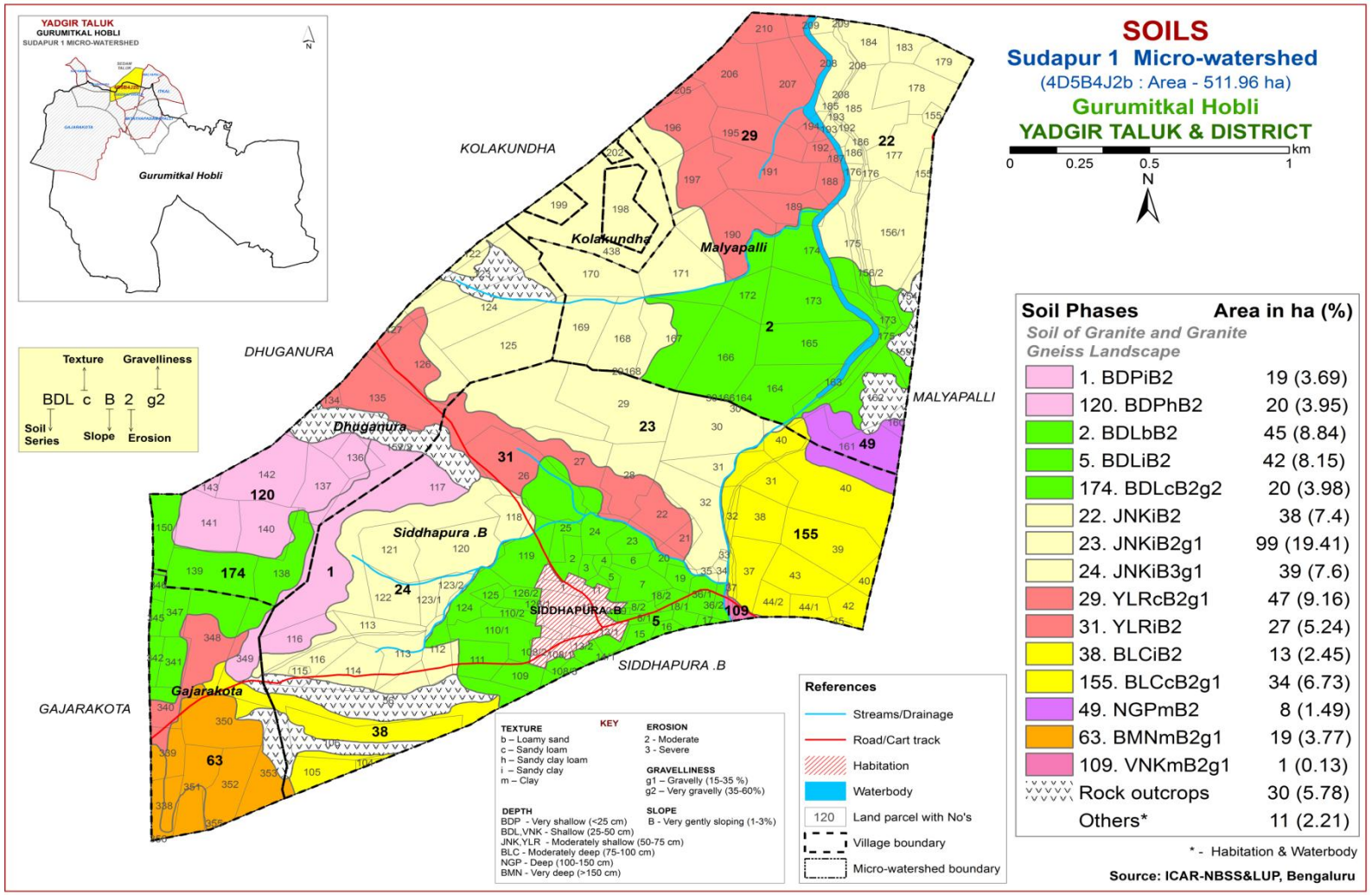

Fig 3.5 Soil phase or Management Units - Sudapur 1 microwatershed

Chapter 4

THE SOILS

Detailed information pertaining to the nature, extent and their distribution of different kinds of soils occurring in Sudapur 1 microwatershed is provided in this chapter. The microwatershed area has been identified as granite gneiss landscape based on geology. In all, 8 soil series are identified. Soil formation is the result of the combined effect of environmental and terrain factors that are reflected in soil morphology. In the granite gneiss landscape, it is by parent material, relief and climate.

A brief description of each of the 8 soil series identified followed by 15 soil phases (management units) mapped under each series are furnished below. The physical and chemical characteristics of soil series identified in Sudapur 1 microwatershed are given in Table 4.1 along with soil classification. The soils in any one map unit differ from place to place in their depth, texture, slope, gravelliness, erosion or any other site characteristic that affect management. The soil phase map can be used for identifying the suitability of areas for growing specific crops or for other alternative uses and also for deciding the type of conservation structures needed. The detailed information on soil and site-characteristics like soil depth, surface soil texture, slope, erosion, gravelliness, AWC, LCC etc, with respect to each of the soil phase identified is given village/survey number wise for the microwatershed in Appendix-I.

4.1 Soils of granite gneiss landscape

In this landscape, 8 soil series are identified and mapped. Of these, JNK series occupies maximum area of 176 ha (34%) followed by BDL 107 ha (21%), YLR 74 ha (14%), BLC 47 ha (9%), BDP 39 ha (8%), BMN 19 ha (4%), NGP 8 ha (1%) and VNK 1 ha (<1%). Brief description of each series identified and number of soil phases mapped is given below.

4.1.1 Bhimanahalli (BMN) Series: Bhimanahalli soils are very deep (>150 cm), moderately well drained, very dark gray, calcareous cracking clay soils. They are developed from weathered granite gneiss and occur on very gently to gently sloping uplands under cultivation. The Bhimanahalli series has been classified as a member of the fine, smectitic (calcareous), isohyperthermic family of Typic Haplusterts.

The thickness of the solum is more than 150 cm. The thickness of A horizon ranges from 6 to 13 cm. Its colour is in 10 YR hue with value 3 to 4 and chroma 1 to 2 with clay texture. The thickness of B horizon ranges from 163 to 176 cm. Its colour is in 10 YR hue with value 2 to 4 and chroma 1. Its texture is clay and is calcareous. The available water capacity is very high (>200 mm/m). Only one soil phase was identified and mapped.

Landscape and Soil Profile characteristics of Bhimanahalli (BMN) Series

4.1.2 Naglapur (NGP) Series: Naglapur soils are deep (100-150 cm), moderately well drained, have black to very dark grayish brown, calcareous cracking clay 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 (calc), 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 soil phase was identified and mapped.

Landscape and Soil Profile characteristics of Naglapur (NGP) Series

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

The thickness of the solum ranges from 80 to 100 cm. The thickness of A horizon ranges from 10 to 16 cm. Its colour is in hue 5 YR with value and chroma of 3 to 4. Its texture varies from sandy clay loam and sandy clay. The thickness of B horizon ranges from 70 to 88 cm. Its colour is in hue 2.5 YR and 5 YR with value 3 to 5 and chroma 3 to 4. Its texture is sandy clay loam to sandy clay and is slightly calcareous. The available water capacity is medium (101-150 mm/m). Two phases were identified and mapped.

Landscape and Soil Profile characteristics of Balichakra (BLC)Series

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

The thickness of the solum ranges from 50 to 74 cm. The thickness of A horizon ranges from 10 to 13 cm. Its colour is in 7.5 YR and 5 YR hue with value and chroma 2 to 4. The texture is sandy loam, loamy sand, and sandy clay loam. The thickness of B horizon ranges from 45 to 64 cm. Its colour is in 10 YR, 7.5 YR and 5 YR hue with value 2 to 4 and chroma 2 to 4. Its texture is clay with gravel content of 15-35 per cent. The available water capacity is low (51-100 mm/m). Two phases were identified and mapped.

Landscape and Soil Profile characteristics of Yalleri (YLR) Series

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

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

Landscape and Soil Profile characteristics of Jinkera (JNK) Series

4.1.6 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). Three phases have been identified and mapped.

Landscape and Soil Profile characteristics of Badiyala (BDL) Series

4.1.7 Vanakanahalli (VNK) Series: Vanakanahalli soils are shallow (25-50 cm), well drained, have dark reddish brown sandy clay red soils. They have developed from weathered granite gneiss and occur on very gently sloping uplands under cultivation. The Vanakanahalli series has been classified as a member of the clayey mixed, isohyperthermic family of (Paralittic) Haplustalfs.

The thickness of the solum ranges from 25 to 49 cm. The thickness of A horizon ranges from 7 to 16 cm. Its colour is in 2.5 YR and 5 YR with value 3 and chroma 2 to 4. The texture is sandy loam to sandy clay loam and sandy clay. The thickness of B horizon ranges from 20 to 40 cm. Its colour is in 2.5 YR and 5 YR hue with value 3 to 4 and chroma 3 to 4. Its texture is sandy clay. The available water capacity is very low (<50 mm/m). Only one phase was identified and mapped.

Landscape and Soil Profile characteristics of Vanakanahalli (VNK) Series

4.1.8 Baddeppalli (BDP) Series: Baddeppalli soils are very shallow (<25cm), well drained, have dark brown to dark reddish brown, calcareous sandy clay loam soils. They are developed from weathered granite gneiss and occur on very gently to gently sloping uplands under cultivation. The Baddepalli series has been classified as a member of the loamy, mixed, (calcareous) isohyperthermic family of Lithic Ustorthents.

The thickness of the soil is less than 25 cm. Its colour is in 7.5 YR and 5 YR hue with value 3 and chroma 2 to 4. The texture varies from sandy clay loam to sandy clay and is calcareous. The available water capacity is very low (<50 mm/m). Two phases were identified and mapped.

Landscape and Soil Profile characteristics of Baddeppalli (BDP) Series

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

Soil Series: Bhimanahalli (BMN) **Pedon:** R-3

Location: $16^0$31'82.4"N $77^0$12'70.8"E, Bheemanahalli village, Sydhapura hobli, Yadgir taluk and district

Analysis at: NBSS&LUP, Regional Centre, Bengaluru **Classification:** 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
0-8	Ap	20.34	19.94	59.72	2.68	5.03	3.75	5.25	3.64	-	c	50.19	33.49
8-40	Bss1	19.61	22.76	57.62	1.94	2.59	5.28	4.96	4.85	-	c	43.22	29.05
40-70	Bss2	21.25	17.65	61.10	3.02	5.26	3.91	5.48	3.58	-	c	44.30	30.25
70-120	Bss3	19.08	22.29	58.63	1.75	5.04	3.84	5.15	3.29	-	c	43.26	30.31
120-170	Bss4	11.11	20.44	68.45	2.04	1.93	1.70	2.83	2.61	-	c	51.33	33.51

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	8.2	-	-	0.284	0.72	4.94	-	-	1.20	0.34	-	52.70	0.88	100	0.65
8-40	8.44	-	-	0.139	0.40	7.28	-	-	0.30	0.48	-	52.06	0.90	100	0.93
40-70	8.32	-	-	0.202	0.40	6.37	-	-	0.18	0.40	-	52.52	0.86	100	0.77
70-120	9.3	-	-	0.282	0.36	6.89	-	-	0.27	0.38	-	50.97	0.87	100	0.75
120-170	8.47	-	-	0.305	0.37	8.19	-	-	0.28	0.91	-	58.19	0.85	100	1.57

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: Balichakra (BLC) **Pedon:** T1/P2

Location: $16^0$33'25.0"N $77^0$20'52.3"E, Sowrashtralli village, Sydhapura hobli, Yadgir taluk and district

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

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-8	Ap	65.46	8.38	26.16	12.51	18.72	18.82	10.44	4.96	-	scl	15.15	8.63
8-19	BA	63.48	8.16	28.36	12.80	15.84	17.21	12.49	5.14	-	scl	16.45	8.81
19-40	Bt	52.64	11.58	35.79	13.19	13.19	14.35	8.23	3.69	-	sc	21.49	10.36
40-75	BC	55.14	10.71	34.15	14.10	14.42	14.63	7.53	4.45	-	scl	17.77	8.99

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-8	6.75	-	-	0.19	0.72	0.00	12.18	3.10	0.43	0.22	15.92	16.80	0.64	95	1.31
8-19	7.23	-	-	0.12	0.68	0.84	11.37	2.50	0.23	0.18	14.28	14.77	0.52	97	1.24
19-40	7.13	-	-	0.08	0.50	0.48	13.80	2.82	0.18	0.09	16.89	17.66	0.49	96	0.51
40-75	7.07	-	-	0.07	0.35	0.84	13.00	2.90	0.17	0.10	16.16	17.55	0.51	92	0.57

Contd...

Soil Series: Yalleri (YLR) **Pedon:** R-16

Location: $16^0$32'54.3"N $77^0$22'71.2"E, Duppalli village, Sydhapura hobli, Yadgir taluk and district

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

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-5	Ap	81.69	5.44	12.87	6.10	8.65	33.88	21.57	11.50	-	sl	8.60	3.37
5-34	Bt1	38.78	6.73	54.49	3.38	9.91	12.42	8.93	4.14	-	c	25.33	15.82
34-75	Bt2	40.35	2.90	56.75	12.91	6.83	10.30	7.48	2.82	35-60	c	24.49	16.20

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}							%	%
0-5	6.91	-	-	0.069	0.70	0.00	5.29	1.37	0.28	0.03	6.96	6.90	0.54	100	0.45
5-34	7.05	-	-	0.053	0.62	0.00	16.43	3.89	0.26	0.09	20.67	21.60	0.40	96	0.42
34-75	7.25	-	-	0.058	0.59	0.00	15.22	3.46	0.25	0.14	19.06	19.90	0.35	96	0.69

Contd...

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

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

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

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

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

Contd...

Soil Series: 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: Vanakanahalli (VNK) **Pedon:** R-15

Location: $16^0$43'49.5"N $77^0$17'17.9"E, Yaleri village, Balichakra hobli, Yadgiri taluk and district

Analysis at: NBSS&LUP, Regional Centre, Bengaluru **Classification:** Clayey mixed, isohyperthermic (Paralittic) Haplustalfs

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-18	Ap	82.61	8.09	9.30	6.77	8.59	21.13	34.58	11.53	-	ls	8.85	3.53
18-61	Bt	54.51	8.73	36.77	4.93	6.18	14.15	20.75	8.49	-	sc	18.88	11.63

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	5.37	-	-	0.11	0.60	0.00	2.96	1.45	0.13	0.14	4.68	6.27	0.67	75	2.22
18-61	4.71	-	-	0.05	0.81	0.00	5.56	2.24	0.10	0.05	7.95	13.31	0.36	60	0.38

Contd...

Soil Series: Baddeppalli **(**BDP) **Pedon:** R-11

Location: $16^0$43'84.4"N $77^0$14'06.4"E, Halagera village, Yadgir hobli, Yadgir taluk and district

Analysis at: NBSS&LUP, Regional Centre, Bengaluru **Classification:** Loamy, mixed (calcareous), isohyperthermic, Lithic Ustorthents

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-16	Ap	58.67	17.02	24.31	19.03	13.74	9.62	10.57	5.71	<15	scl	16.19	8.18

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-16	8.58	-	-	0.262	1.60	7.67	-	-	0.24	0.06	-	18.10	0.74	100	0.35

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Chapter 5

INTERPRETATION FOR LAND RESOURCE MANAGEMENT

The most important soil and site characteristics that affect the land use and conservation needs of an area are land capability, soil depth, soil texture, coarse fragments, available water capacity, soil slope, soil erosion, soil reaction etc. These are interpreted from the data base generated through land resource inventory and several thematic maps are generated. These would help in identifying the areas suitable for growing crops and, soil and water conservation measures and structures needed thus helping to maintain good soil health for sustained crop production. The various 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 15 soil map units identified in the Sudapur 1 microwatershed are grouped under 3 land capability classes and 4 subclasses. Entire area in the microwatershed is suitable for agriculture (Fig. 5.1).

Good lands (Class II) cover a maximum area of about 56 per cent and are distributed in the major part of the microwatershed with minor problems of soil and erosion. Moderately good lands (Class III) cover an area of about 29 per cent and are distributed in the eastern, southern and southwestern part of the microwatershed with moderate problems of soil and erosion. Fairly good lands (Class IV) cover an area of about 8 per cent and is distributed in the southwestern part of the microwatershed with very severe problems of soil and erosion.

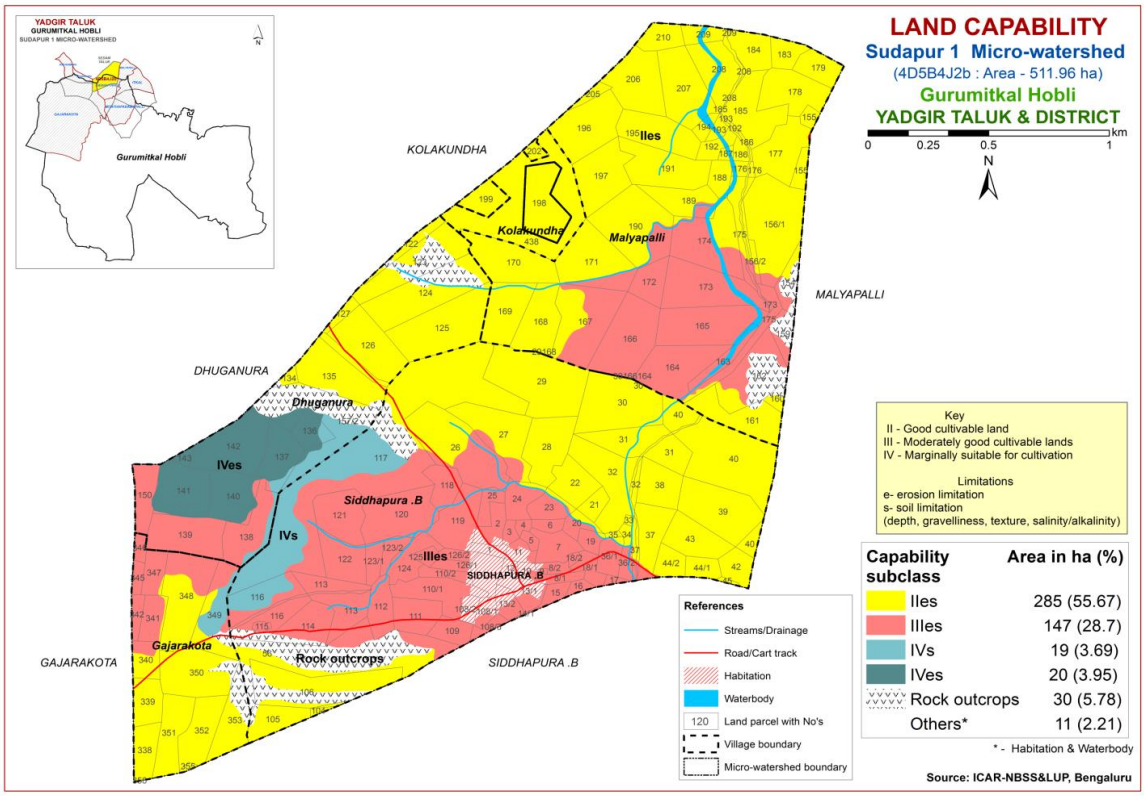


Fig. 5.1 Land Capability Classification map of Sudapur 1 microwatershed

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.

Very shallow to shallow (<25-50) soils occupy an area of about 147 ha (29%) and are distributed in the eastern, southern and southwestern part of the microwatershed. Moderately shallow (50-75 cm) soils occupy a maximum area of 250 ha (49%) and are distributed in the major part of the microwatershed. Moderately deep (75-100 cm) soils occupy an area of 47 ha (9%) and are distributed in the eastern and southwestern part of the microwatershed. Deep to very deep (100 to >150 cm) soils occupy an area of 49 ha (5%) and are distributed in the eastern and southwestern part of the microwatershed.

The most productive lands 49 ha (5%) 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. The problematic soils cover maximum area about 29 per cent where the soils are very shallow to shallow and are suitable for short duration crops.

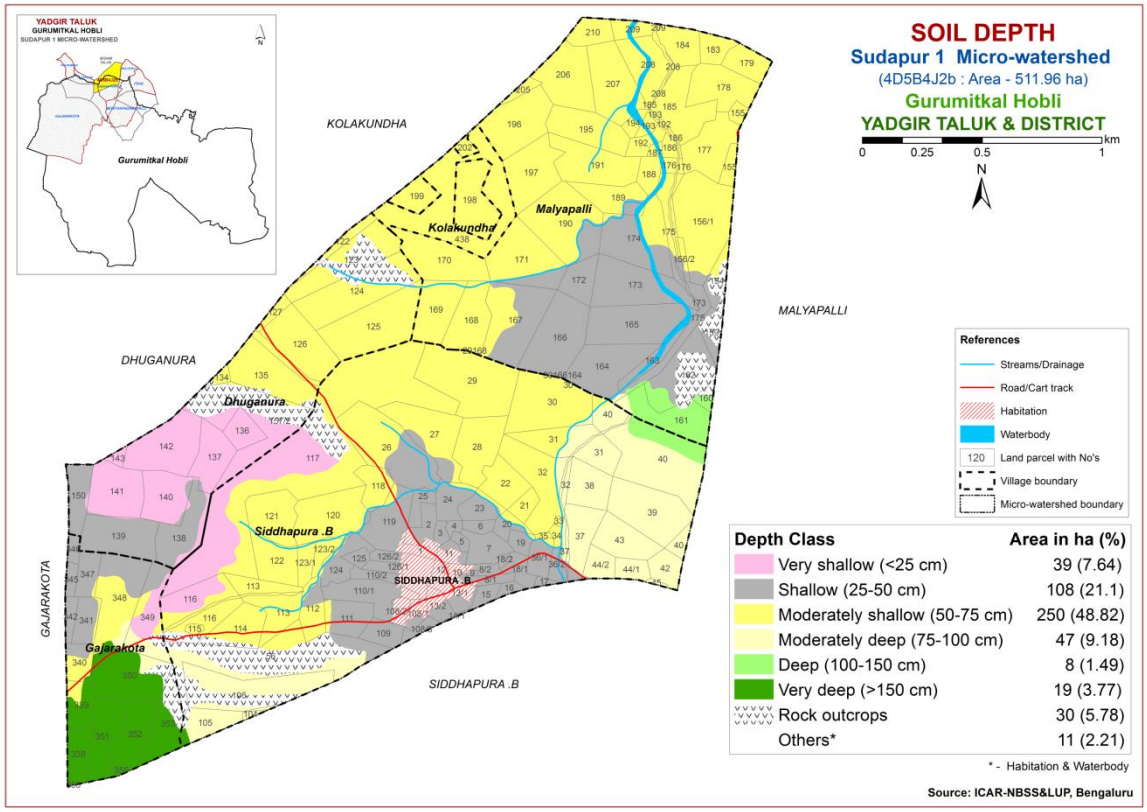


Fig. 5.2 Soil depth map of Sudapur 1 microwatershed

5.3 Surface Soil Texture

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

Maximum area of about 304 ha (59%) of the microwatershed has clayey soils at the surface and are distributed in the major part of the microwatershed. An area of 122 ha (24%) has soils that are loamy and are distributed in the western, northern, southeastern and southwestern part of the microwatershed. An area of 45 ha (9%) has soils that are sandy and are distributed in the eastern part of the microwatershed. Clayey and loamy soils have high potential for soil-water retention and availability, and nutrient retention and availability, but clayey soils have more problems of drainage, infiltration, workability and other physical

problems. The sandy soils (9%) are also productive for root and tuber crops, but these soils have the major limitations of moisture and nutrient retention capacity, hence frequent and shallow irrigation with balanced fertilizer application is to be followed in order to get better crop yields.

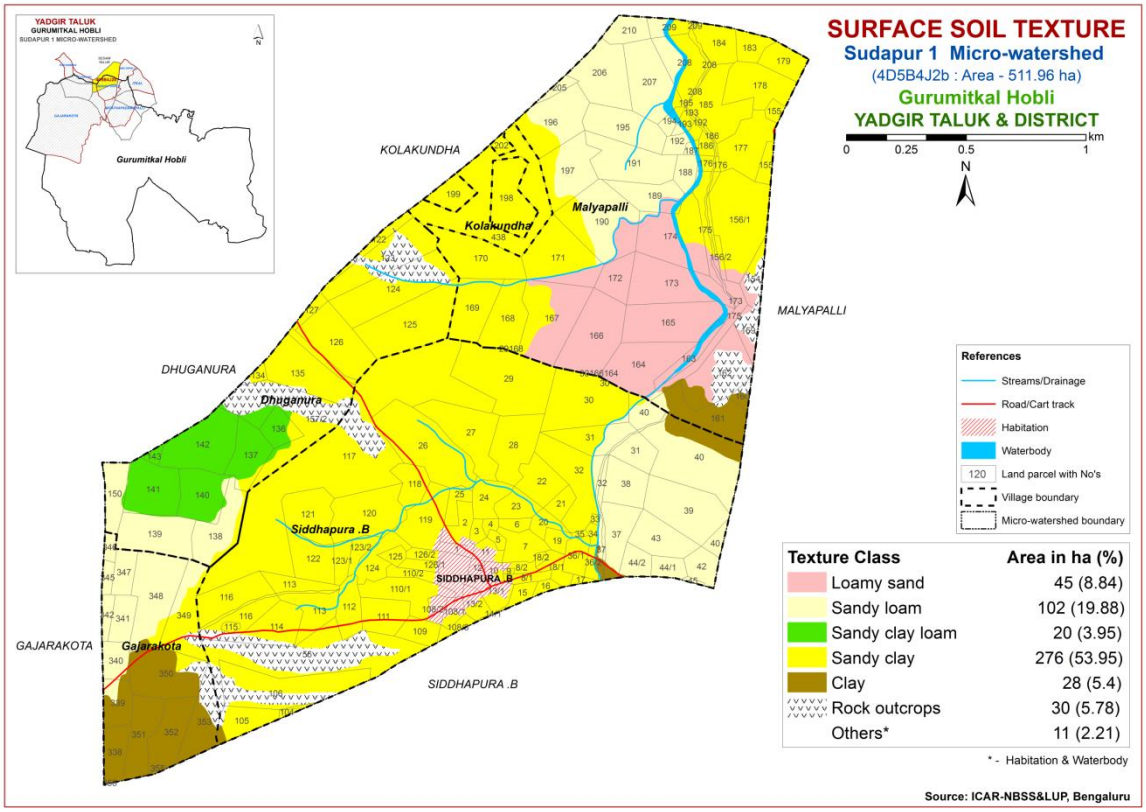


Fig. 5.3 Surface soil texture map of Sudapur 1 microwatershed

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 an area of about 211 ha (41%) and are distributed in the eastern, western, southern, southwestern and northeastern part of the microwatershed. Maximum area of about 240 ha (47%) is gravelly (15-35%) and are distributed in the major part of the microwatershed. An area of about 20 ha (4%) is very gravelly (35 - 60%) and are distributed in the southwestern part of the microwatershed.

The problem soils (51%) that are gravelly (15-35%) and very gravelly (35-60%), where only short or medium duration crops can be grown. The most productive soils (41%) that are non gravelly (<15%), where all climatically adapted long duration crops can be grown.

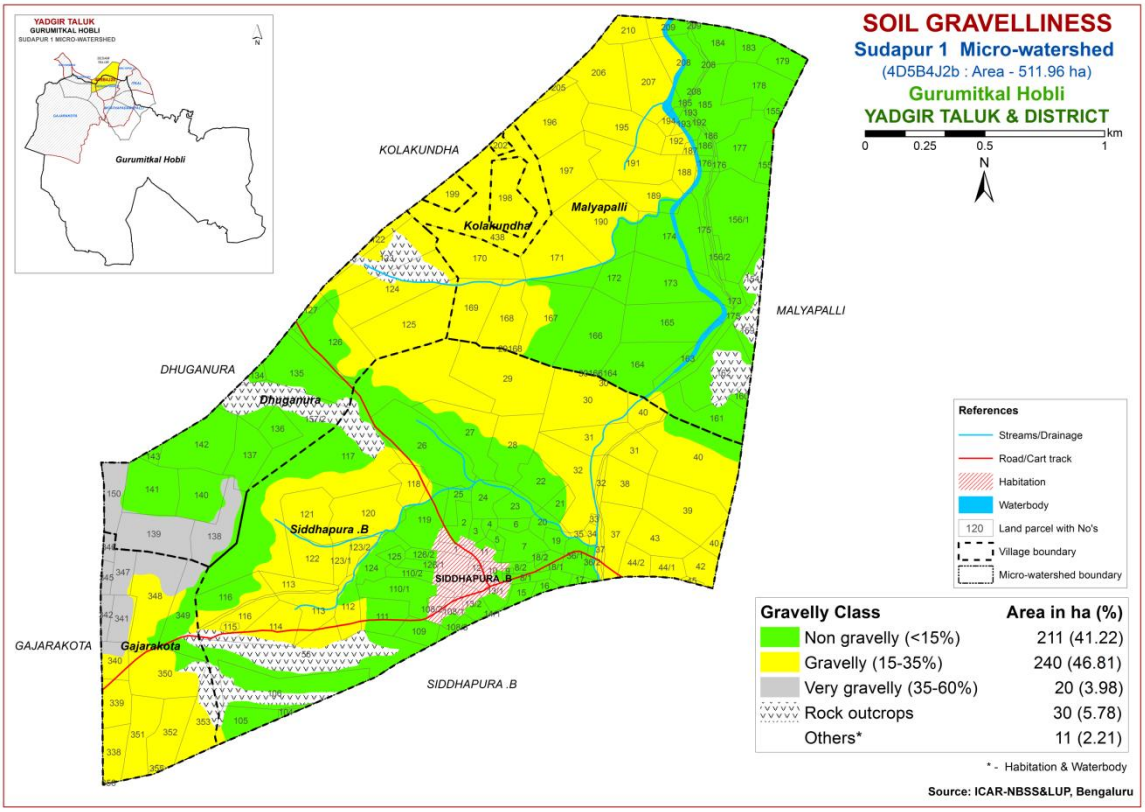


Fig. 5.4 Soil gravelliness map of Sudapur 1 microwatershed

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.

Maximum area of about 444 ha (87%) in the microwatershed have soils that are very low to low (<50 to 100 mm/m) in available water capacity and are distributed in the major part of the microwatershed. An area of about 27 ha (5%) is very high (>200 mm/m) in available water capacity and are distributed in the eastern and southwestern part of the microwatershed.

Maximum of 444 ha (87%) area in the microwatershed has soils that are problematic with regard to available water capacity. Here, only short duration crops can be grown and the probability of crop failure is very high. These areas are best put to other alternative uses. An area of 27 ha (5%) are potential areas with regard to AWC where all climatically adapted annual and perennial crops can be grown.

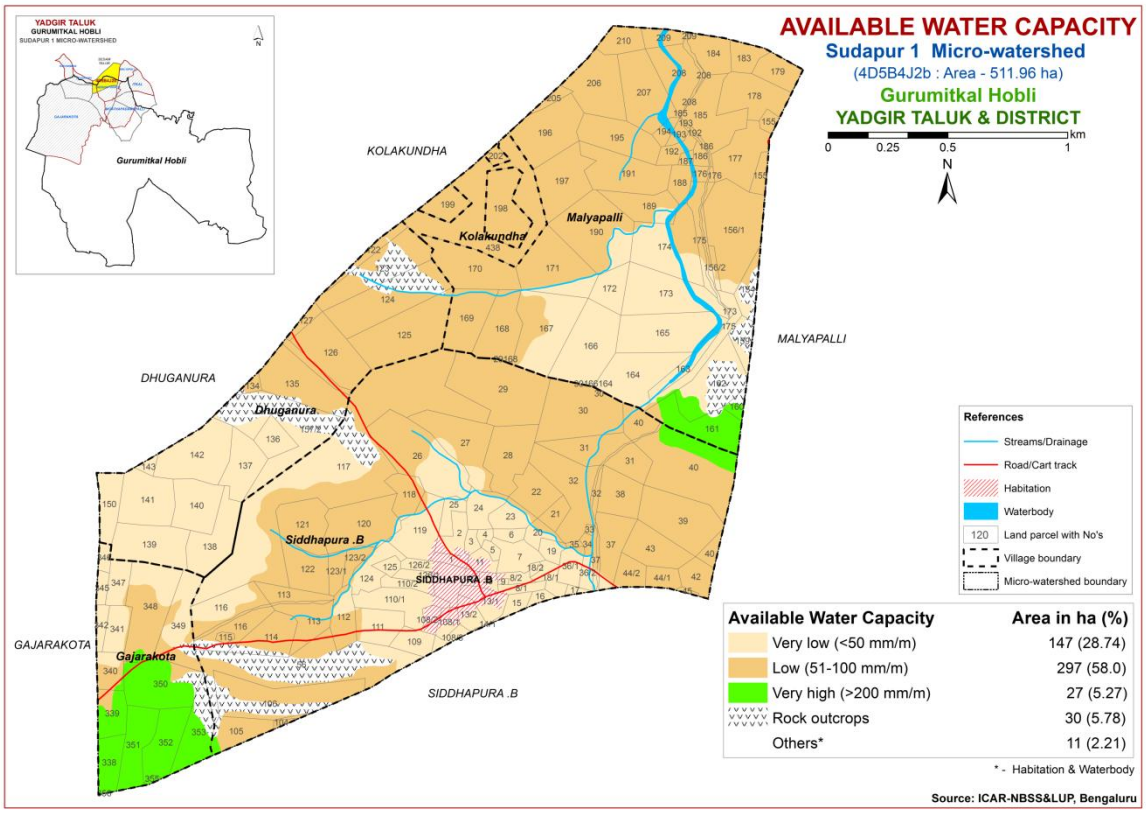


Fig. 5.5 Soil available water capacity map of Sudapur 1 microwatershed

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 two slope classes 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 has very gently sloping (1-3%) soils.

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

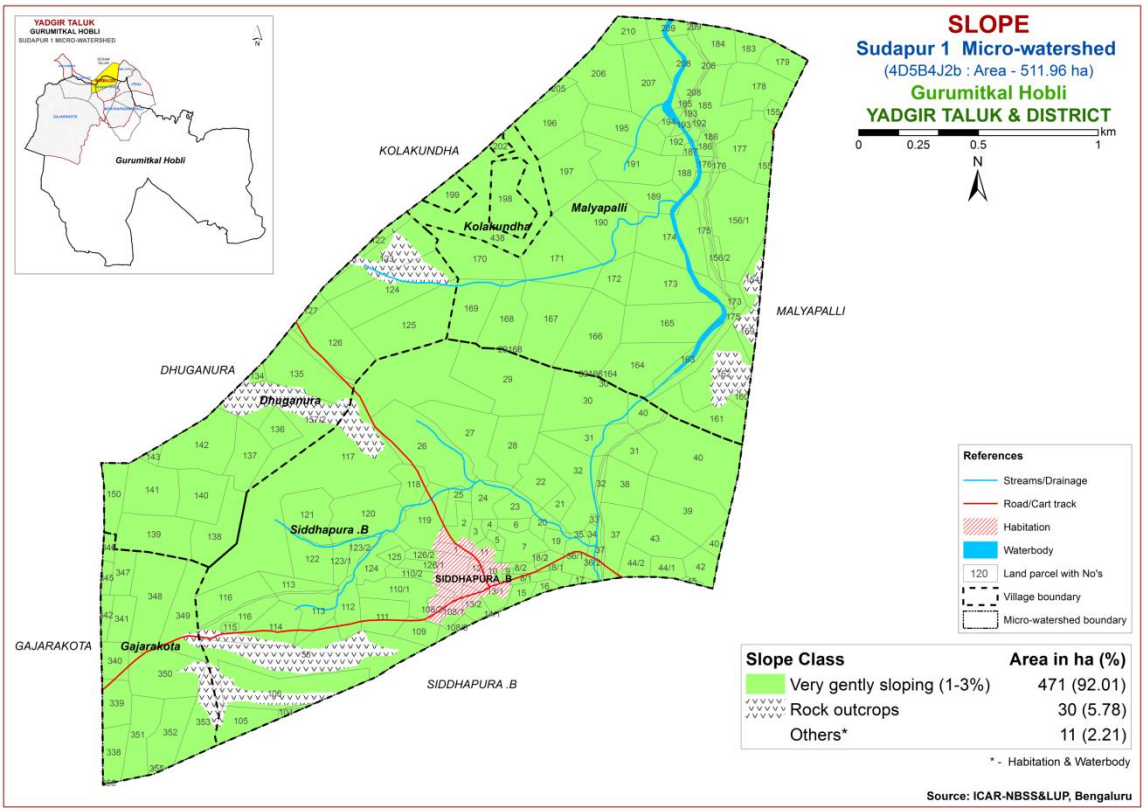


Fig. 5.6 Soil slope map of Sudapur 1 microwatershed

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 an area of 432 ha (84%) and are distributed in the major part of the microwatershed. Severely eroded (e3 class) soils cover an area of 39 ha (8%) and are distributed in the southwestern 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.

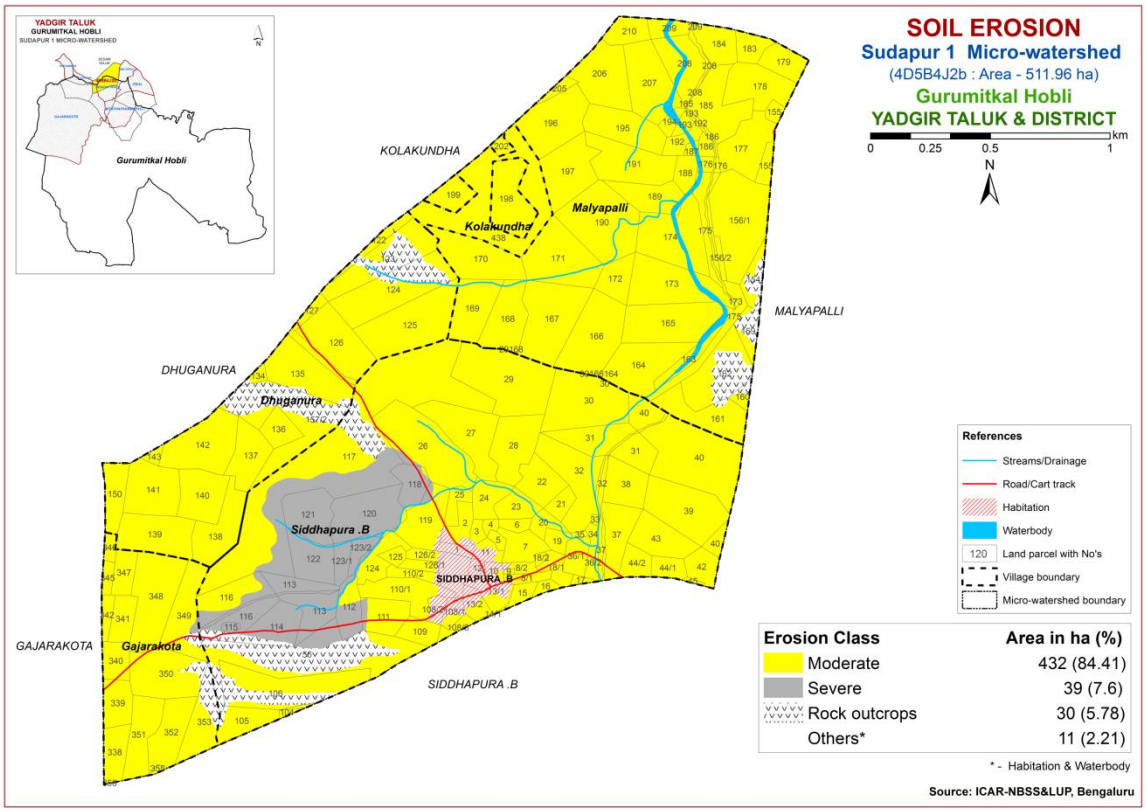


Fig. 5.7 Soil erosion map of Sudapur 1 microwatershed

Chapter 6

FERTILITY STATUS

Soil fertility plays an important role in increasing crop yield. The adoption of high yielding varieties that require high amounts of nutrients has resulted in deficiency symptoms in crops and plants due to imbalanced fertilization and poor inherent fertility status as these areas are characterised by low rainfall and high temperatures. Hence, it is necessary to know the fertility (macro and micro nutrients) status of the soils of the watersheds for assessing the kind and amount of fertilizers required for each of the crop intended to be grown. For this purpose, the surface soil samples collected from the grid points (one soil sample at every 320 m interval) all over the microwatershed through land resource inventory in the year 2018 were analysed for pH, EC, organic carbon, available phosphorus and potassium, and for micronutrients like zinc, boron, copper, iron 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 Sudapur 1 microwatershed for soil reaction (pH) shows that entire area of the microwatershed (Fig. 6.1) falls under neutral (pH 6.5-7.3).

6.2 Electrical Conductivity (EC)

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

6.3 Organic Carbon

Organic carbon content is medium (0.5-0.75 %) in an area of 8 ha (2%) and high (>0.75 %) in a maximum area of 463 ha (90%) of the microwatershed (Fig. 6.3).

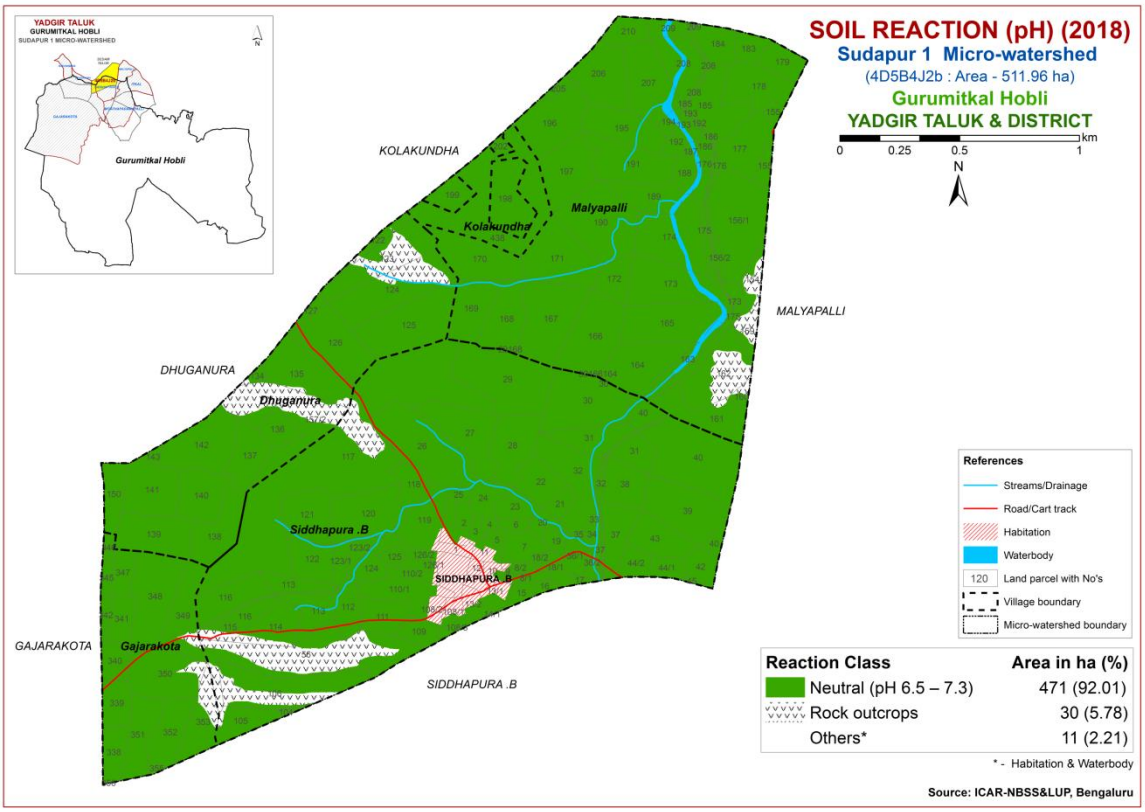


Fig.6.1 Soil reaction (pH) map of Sudapur 1 microwatershed

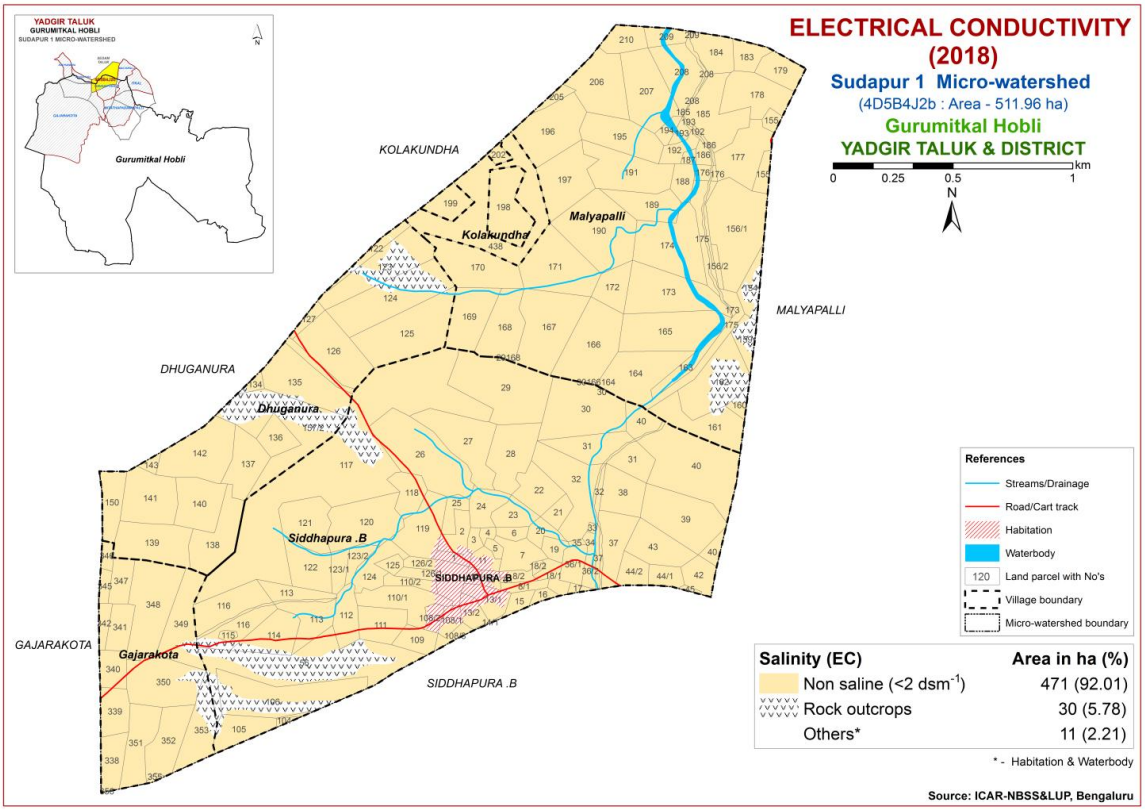


Fig.6.2 Electrical conductivity (EC) map of Sudapur 1 microwatershed

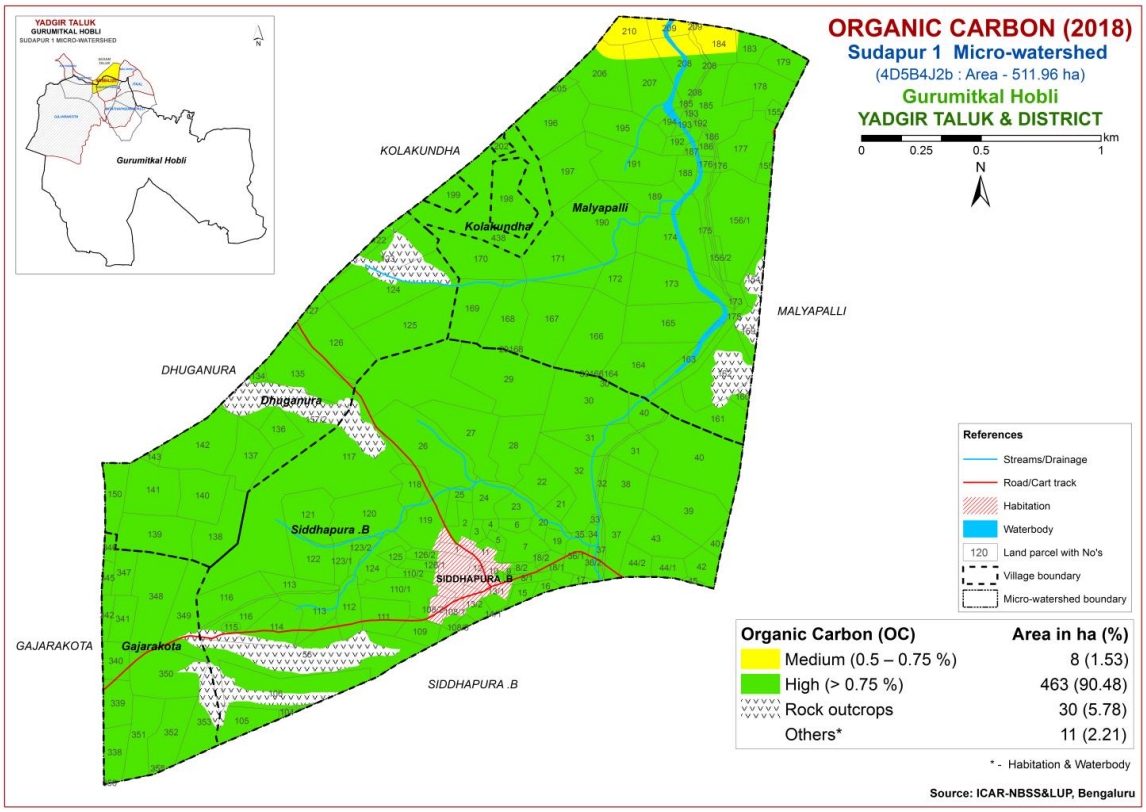


Fig.6.3 Soil organic carbon map of Sudapur 1 microwatershed

6.4 Available Phosphorus

Available phosphorus content is low (<23 kg/ha) in an area of about 77 ha (15%) and are distributed in the southwestern part of the microwatershed. Medium (23-57 kg/ha) in an area of about 140 ha (27%) and are distributed in the western, southern and northeastern part of the microwatershed. High (>57 kg/ha) in a maximum area of 253 ha (49%) and are distributed in the major part of the microwatershed (Fig. 6.4).

6.5 Available Potassium

Available potassium content is medium (145-337 kg/ha) in the entire area of the microwatershed (Fig. 6.5).

6.6 Available Sulphur

An area of about 215 ha (42%) is low (<10 ppm) in available sulphur content and are distributed in the southern and southwestern part of the microwatershed. Medium (10 - 20 ppm) in a maximum area of about 232 ha (45%) and is distributed in the major part of the microwatershed. High (> 20 ppm) in an area of about 24 ha (5%) and is distributed in the northern part of the microwatershed (Fig. 6.6).

6.7 Available Boron

Available boron content is low (<0.5 ppm) in a maximum area of about 382 ha (75%) and are distributed in the major part of the microwatershed. Medium (0.5-1.0 ppm) in an area of 75 ha (15%) and are distributed in the northeastern part of the

microwatershed. High (>1.0 ppm) in an area of 14 ha (3%) and are distributed in the northeastern part of the microwatershed (Fig. 6.7).

6.8 Available Iron

Available iron content is sufficient (>4.5 ppm) in the entire microwatershed area (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).

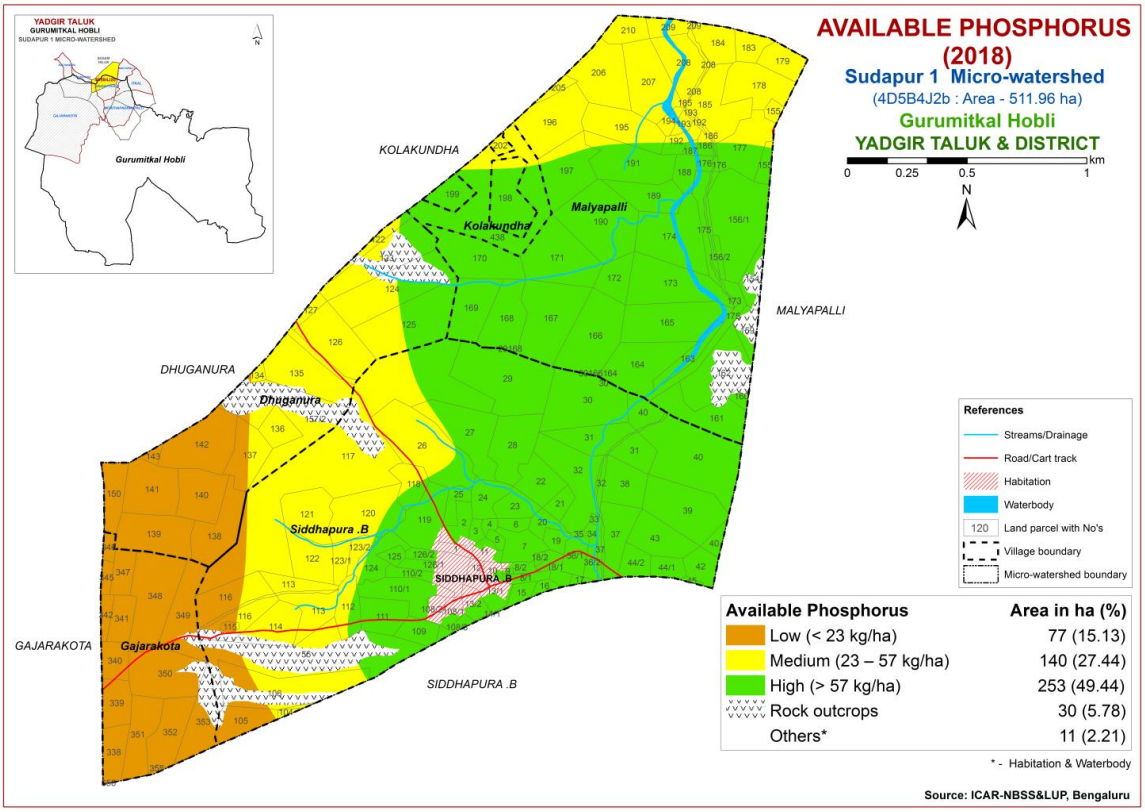


Fig.6.4 Soil available phosphorus map of Sudapur 1 microwatershed

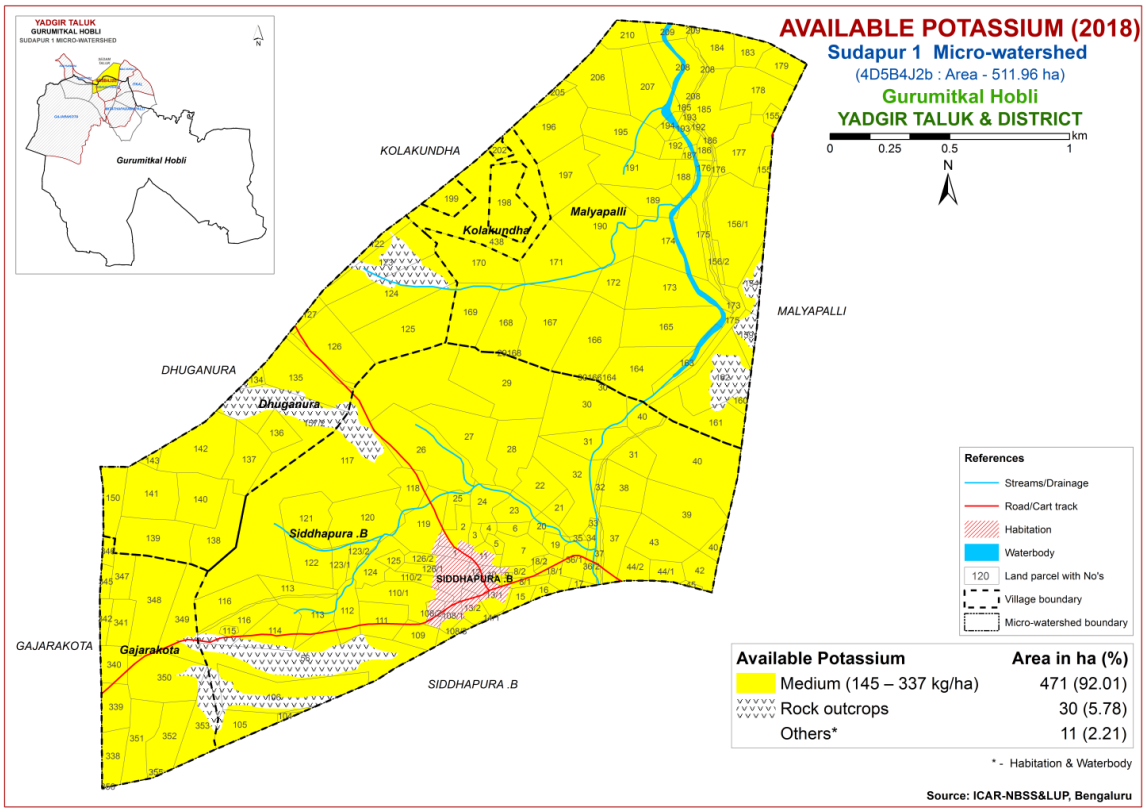


Fig.6.5 Soil available potassium map of Sudapur 1 microwatershed

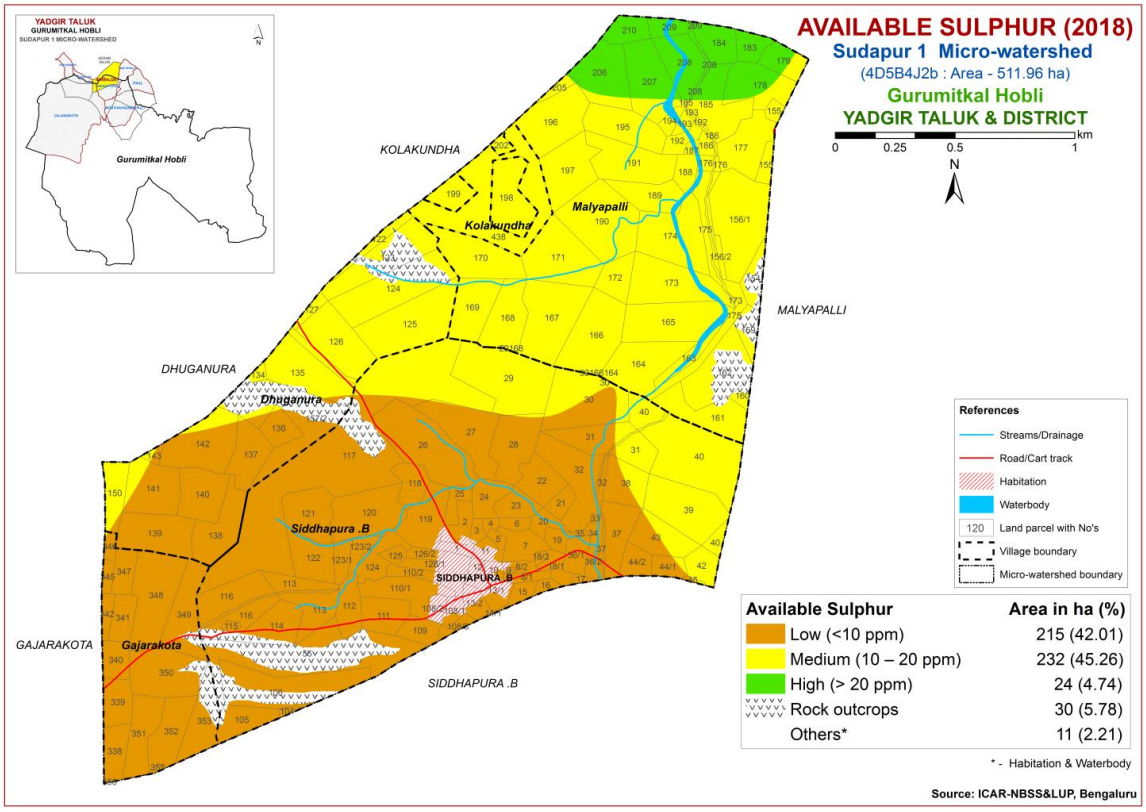


Fig.6.6 Soil available sulphur map of Sudapur 1 microwatershed

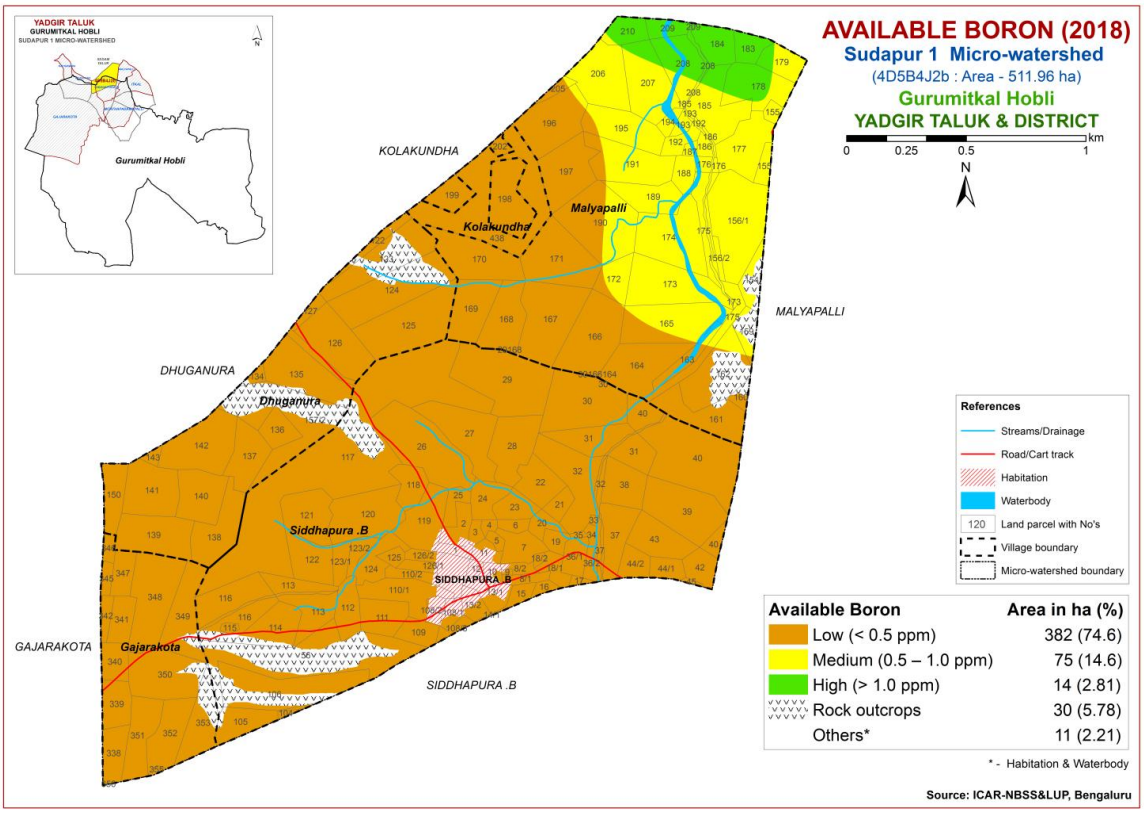


Fig.6.7 Soil available boron map of Sudapur 1 microwatershed

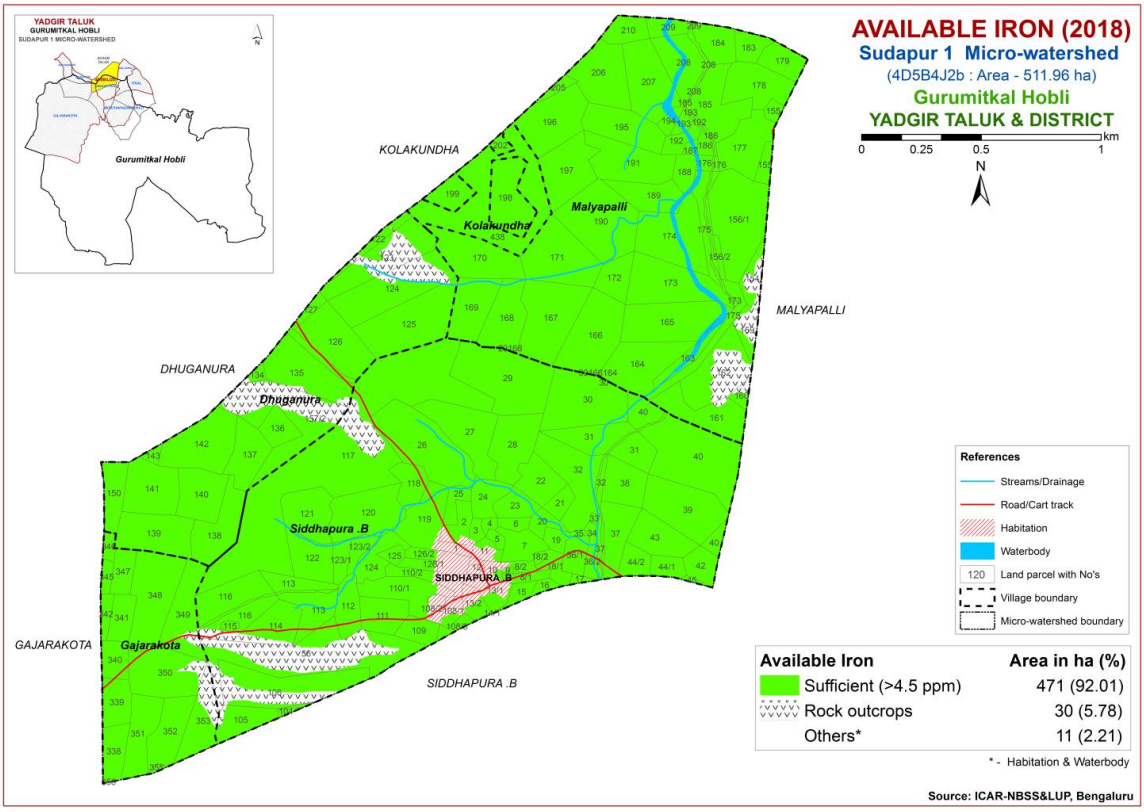


Fig.6.8 Soil available iron map of Sudapur 1 microwatershed

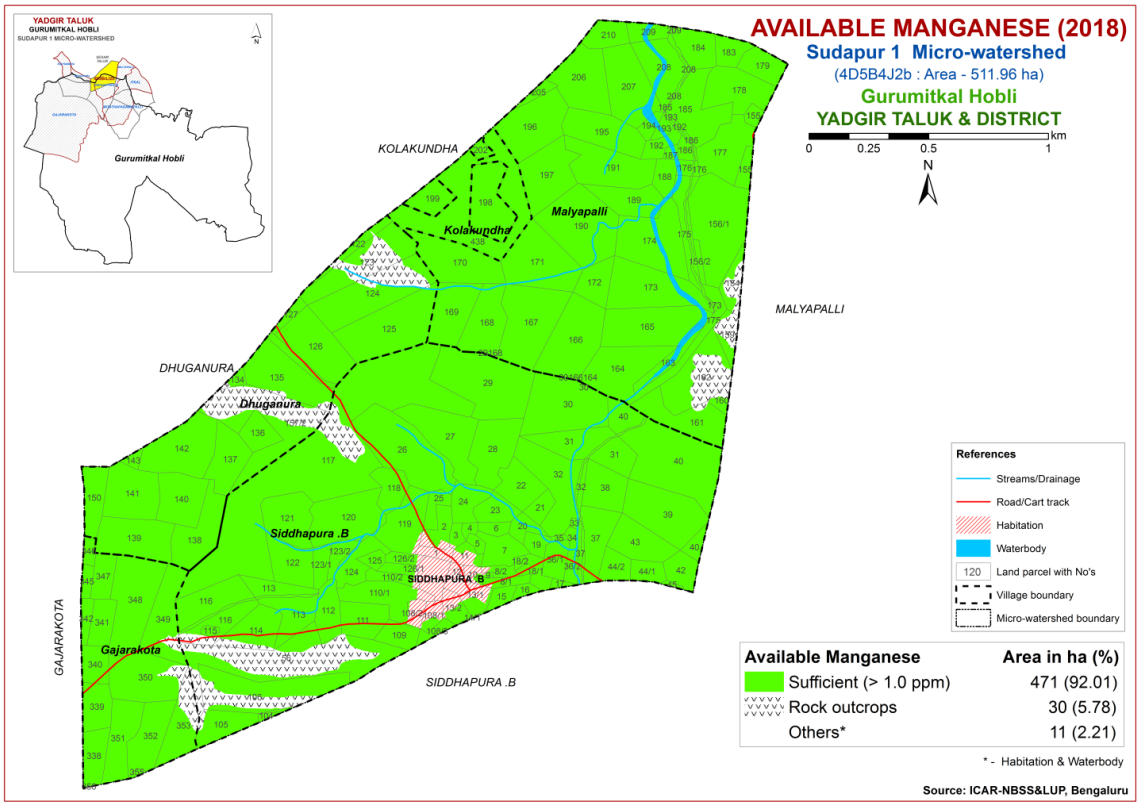


Fig.6.9 Soil available manganese map of Sudapur 1 microwatershed

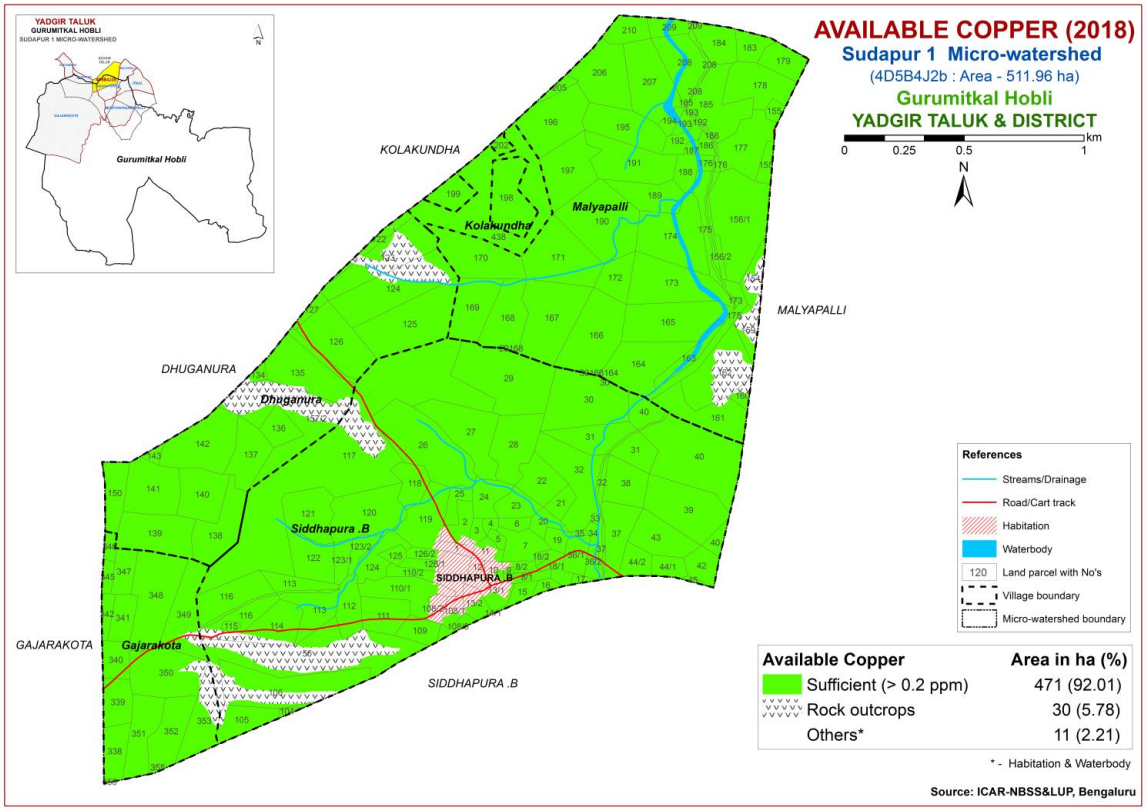


Fig.6.10 Soil available copper map of Sudapur 1 microwatershed

6.11 Available Zinc

Available zinc content is sufficient in a maximum area of 403 ha (79%) (>0.6 ppm) and are distributed in the major part of the microwatershed. Deficient in 68 ha (13%) (<0.6 ppm) and is distributed in the western, northern and southwestern part of the microwatershed (Fig 6.11).

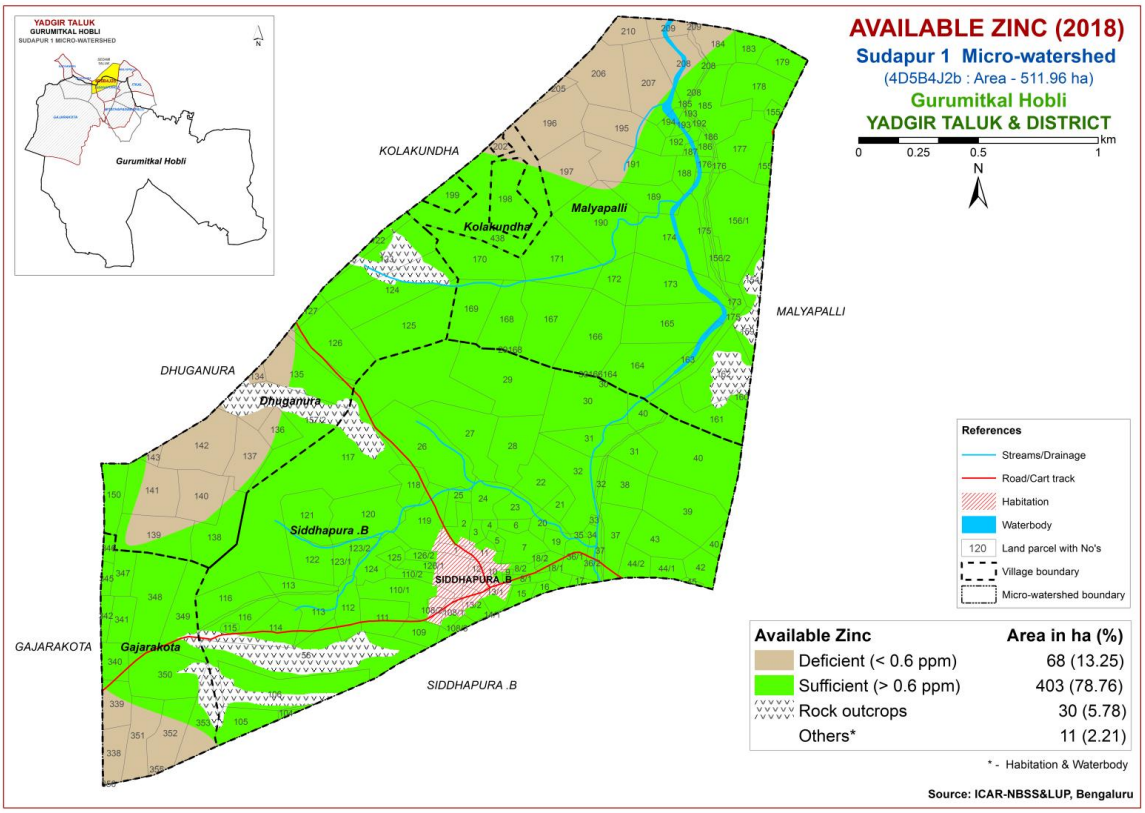


Fig.6.11 Soil available zinc map of Sudapur 1 microwatershed

Chapter 7

LAND SUITABILITY FOR MAJOR CROPS

The soil and land resource units (soil phases) of Sudapur 1 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 (Table 7.2 to 7.30) 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 (Table 7.2 – 7.30) were matched with the soil and land characteristics (Table 7.1) to arrive at the crop suitability. The tables are given at the end of the chapter. In FAO land suitability classification, two orders are recognized. Order S-Suitable and Order N-Not suitable. The orders have classes, subclasses and units. Order-S has three classes, Class S1-Highly Suitable, Class S2-Moderately Suitable and Class S3- Marginally Suitable. Order N has two classes, N1-Currently not Suitable and N2- Permanently not Suitable. There are no subclasses within the Class S1 as they will have very minor or no limitation for crop growth. Classes S2 and S3 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 and 'z' for calcareousness. These limitations are indicated as lower case letters to the class symbol. For example, moderately suitable lands with the limitations of soil depth and erosion are designated as S2re. For the microwatershed, the soil mapping units were evaluated and classified up to subclass level.

Using the above criteria, the soil map units of the microwatershed were evaluated and land suitability maps for 29 major agricultural and horticultural crops were generated. The detailed information on the kind of suitability of each of the soil phase for the crops assessed are given village/ survey number wise for the microwatershed in Appendix-III.

7.1 Land Suitability for Sorghum (*Sorghum bicolor*)

Sorghum is one of the major food crop grown in Karnataka in an area of 10.47 lakh ha in Bijapur, Gulbarga, Raichur, Bidar, Belgaum, Dharwad, Bellary, Chitradurga, Mysore and 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.

There are no highly suitable (Class S1) lands available for growing sorghum in the microwatershed. Maximum area of about 324 ha (63%) is moderately suitable (Class S2) for growing sorghum and are distributed in the major part of the microwatershed. They have minor limitations of rooting depth, texture, gravelliness and calcareousness. An area

of about 108 ha (21%) is marginally suitable (Class S3) for growing sorghum and is distributed in the eastern, southern and southwestern part of the microwatershed with moderate limitations of rooting depth and texture. Currently not suitable (Class N1) lands occur in an area of 39 ha (8%) and are distributed in the southwestern part of the microwatershed with severe limitation of rooting depth.

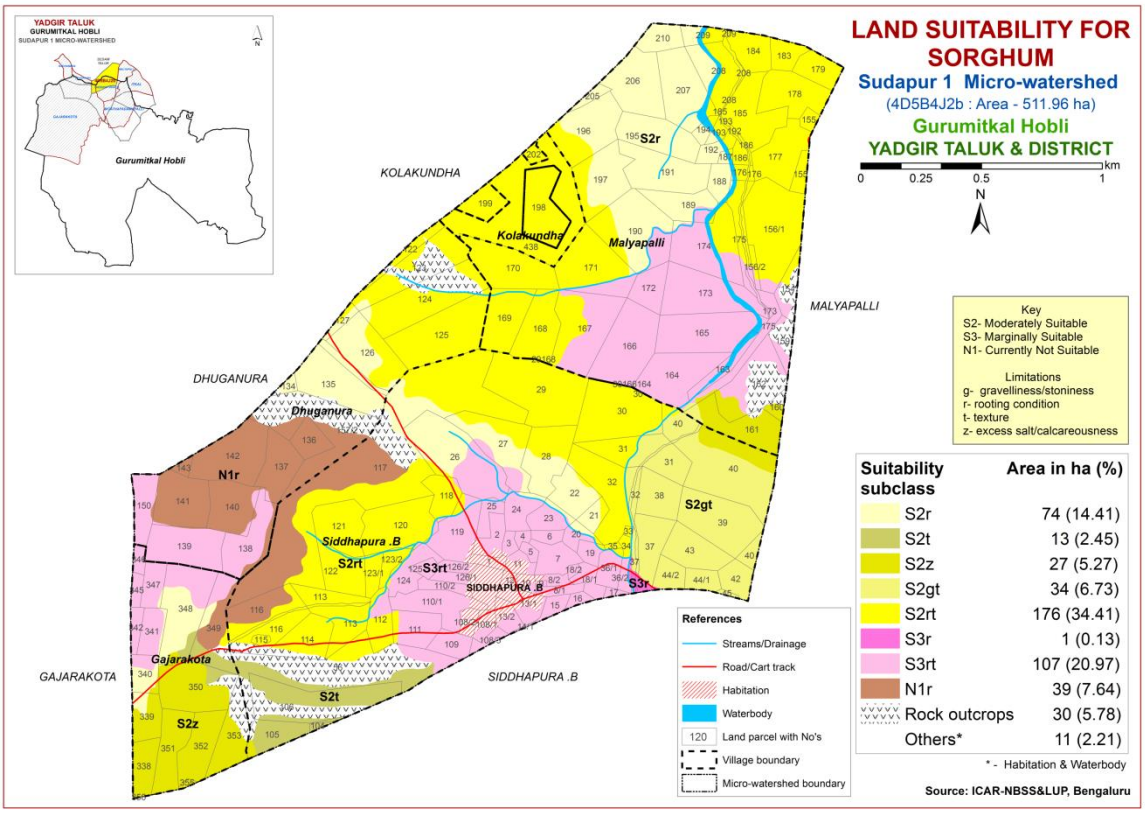


Fig. 7.1 Land suitability map of Sorghum

7.2 Land Suitability for Maize (*Zea mays*)

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

Highly suitable (Class S1) lands for growing maize occur in an area of 13 ha (2%) and are distributed in the southern part of the microwatershed. Maximum area of about 311 ha (61%) is moderately suitable (Class S2) for growing maize and are distributed in the major part of the microwatershed. They have minor limitations of rooting depth, texture, gravelliness and calcareousness. An area of about 108 ha (21%) is marginally suitable (Class S3) for growing maize and is distributed in the eastern, southern and southwestern part of the microwatershed with moderate limitations of rooting depth and texture. Currently not suitable (Class N1) lands occur in an area of 39 ha (8%) and are

distributed in the southwestern part of the microwatershed with severe limitation of rooting depth.

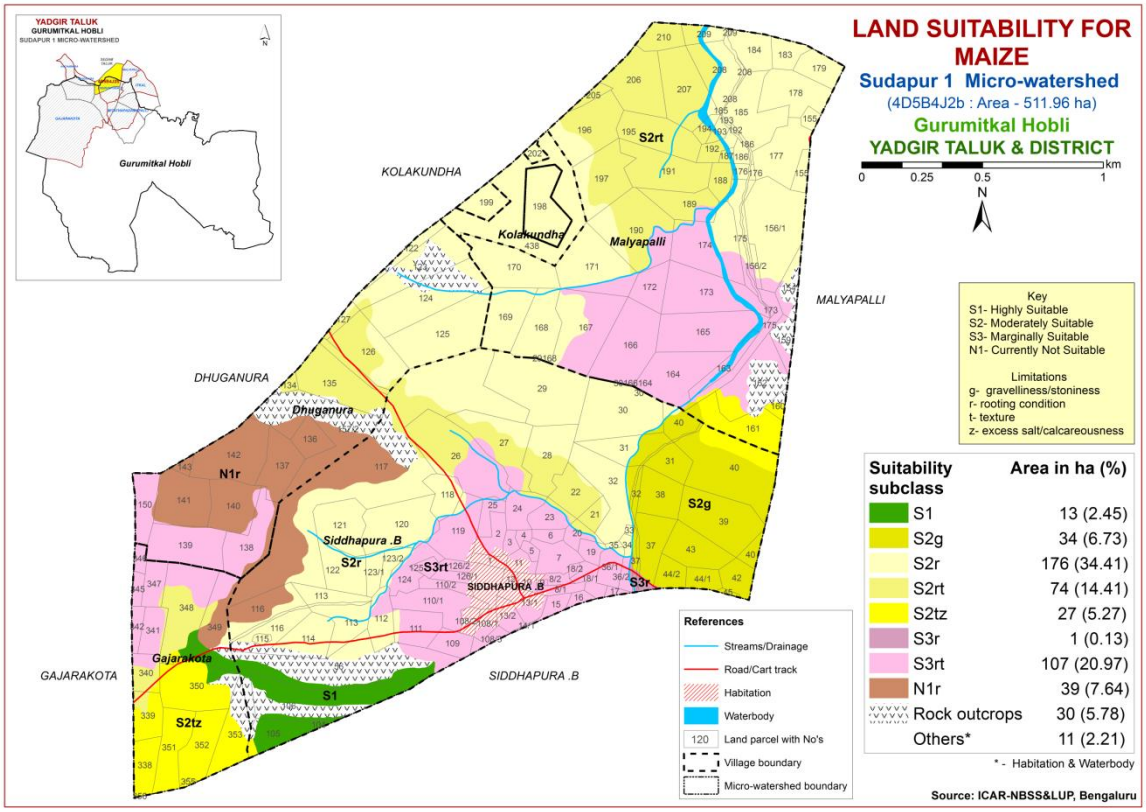


Fig. 7.2 Land suitability map of Maize

7.3 Land Suitability for Bajra (*Pennisetum glaucum)*

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

Highly suitable (Class S1) lands for growing bajra occur in an area of 47 ha (9%) and are distributed in the southeastern and southern part of the microwatershed. Maximum area of about 277 ha (54%) is moderately suitable (Class S2) for growing bajra and are distributed in the major part of the microwatershed. They have minor limitations of rooting depth, texture and calcareousness. An area of about 108 ha (21%) is marginally suitable (Class S3) for growing bajra and is distributed in the eastern, southern and southwestern part of the microwatershed with moderate limitations of rooting depth and texture. Currently not suitable (Class N1) lands occur in an area of 39 ha (8%) and are distributed in the southwestern part of the microwatershed with severe limitation of rooting depth.

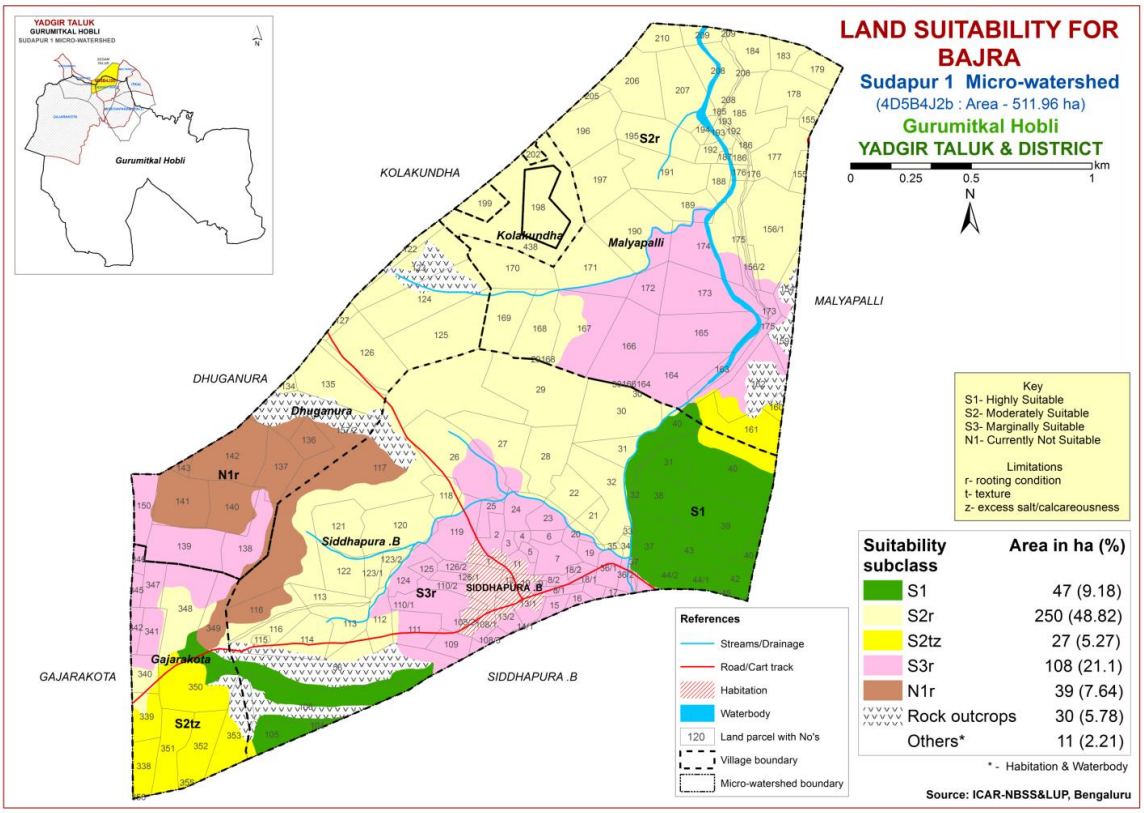


Fig. 7.3 Land suitability map of Bajra

7.4 Land Suitability for Groundnut (*Arachis hypogaea*)

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

Highly suitable (Class S1) lands for growing groundnut occur in an area of 47 ha (9%) and are distributed in the southeastern and southern part of the microwatershed. An area of about 176 ha (34%) is moderately suitable (Class S2) for growing groundnut and is distributed in the central, northern, northeastern and southern part of the microwatershed. They have minor limitation of rooting depth. Maximum area of about 208 ha (41%) is marginally suitable (Class S3) for growing groundnut and is distributed in the major part of the microwatershed with moderate limitations of rooting depth, calcareousness and texture. Currently not suitable (Class N1) lands occur in an area of 39 ha (8%) and are distributed in the southwestern part of the microwatershed with severe limitation of rooting depth.

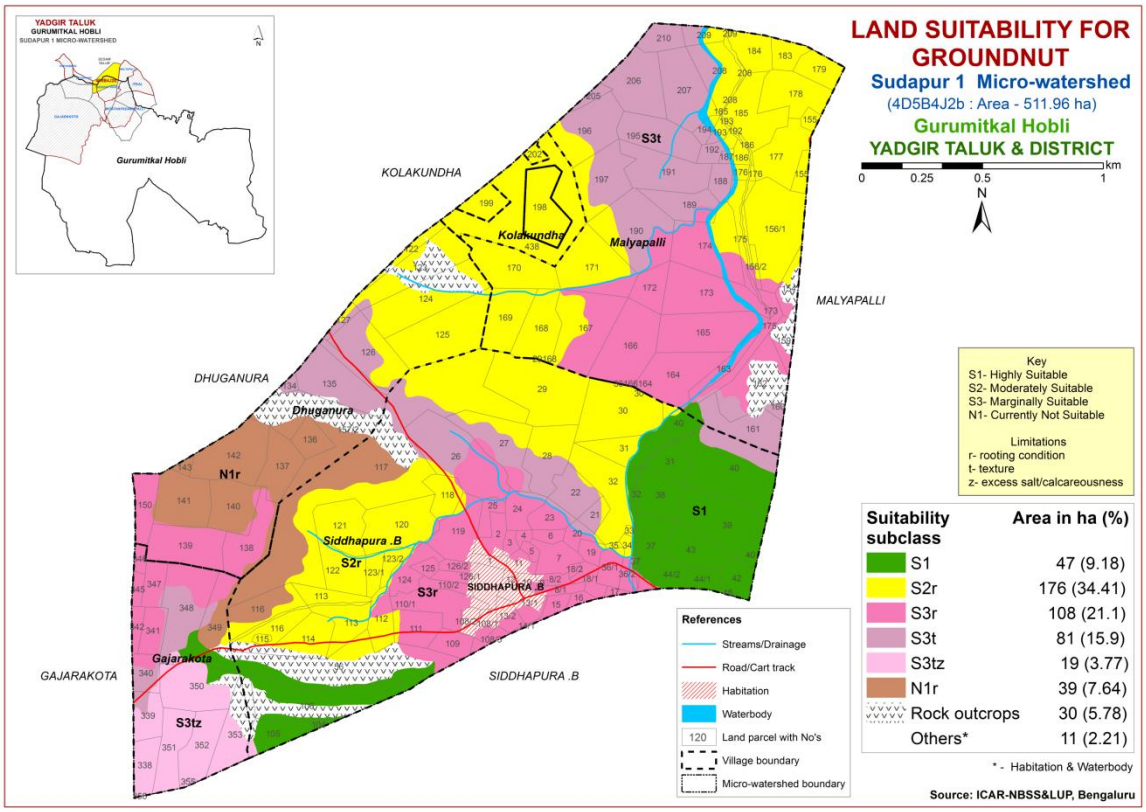


Fig. 7.4 Land suitability map of Groundnut

7.5 Land Suitability for Sunflower (*Helianthus annus*)

Sunflower is one of the most important oilseed crop grown in an area of 3.56 lakh ha in the State in all the districts. The crop requirements for growing sunflower (Table 7.6) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing sunflower was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.5.

There are no highly suitable (Class S1) lands available for growing sunflower in the microwatershed. An area of about 74 ha (14%) is moderately suitable (Class S2) for sunflower and are distributed in the southeastern and southwestern part of the microwatershed. They have minor limitations of rooting depth, texture and calcareousness. Maximum area of about 250 ha (49%) is marginally suitable (Class S3) and are distributed in the major part of the microwatershed with moderate limitation of rooting depth. Currently not suitable (Class N1) lands occur in an area of about 147 ha (29%) and are distributed in the eastern, southern and southwestern part of the microwatershed with severe limitation of rooting depth.

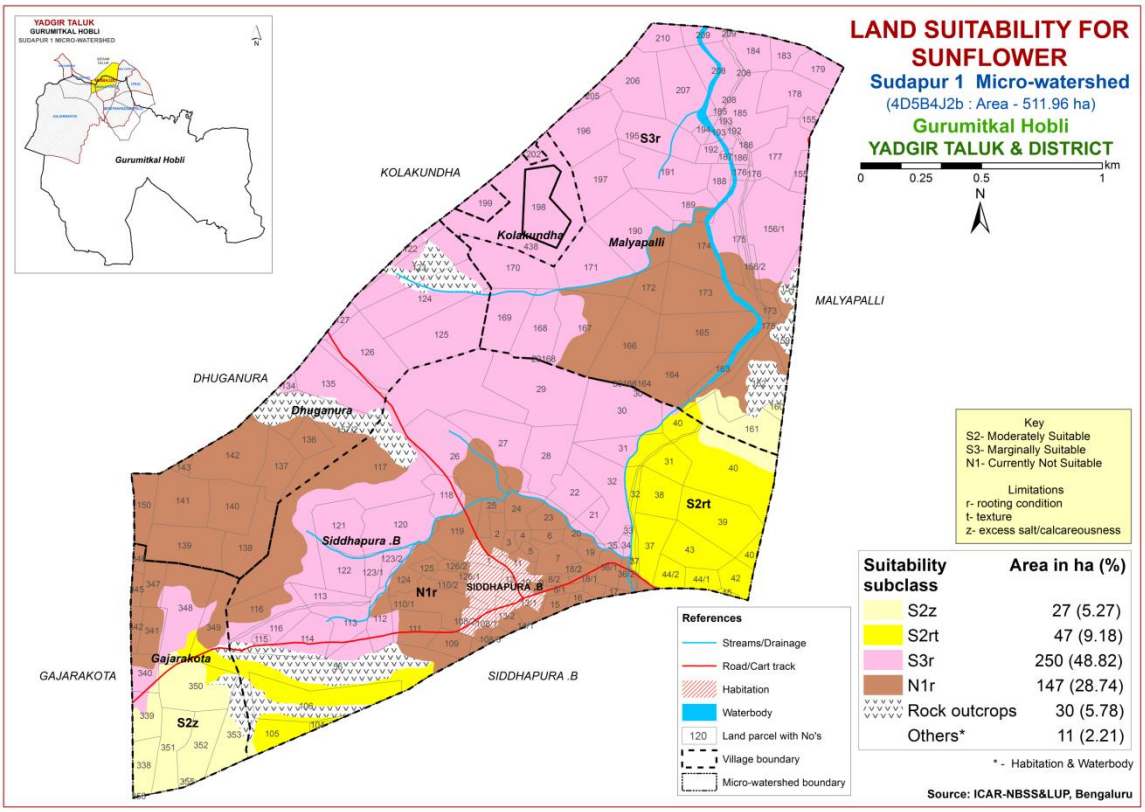


Fig. 7.5 Land suitability map of Sunflower

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

Red gram 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 red gram was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.6.

There are no highly suitable (Class S1) lands available for growing red gram in the microwatershed. An area of about 74 ha (14%) is moderately suitable (Class S2) for red gram and are distributed in the southeastern and southwestern part of the microwatershed. They have minor limitations of rooting depth, texture and calcareousness. Maximum area of about 250 ha (49%) is marginally suitable (Class S3) and are distributed in the major part of the microwatershed with moderate limitation of rooting depth. Currently not suitable (Class N1) lands occur in an area of about 147 ha (29%) and are distributed in the eastern, southern and southwestern part of the microwatershed with severe limitation of rooting depth.

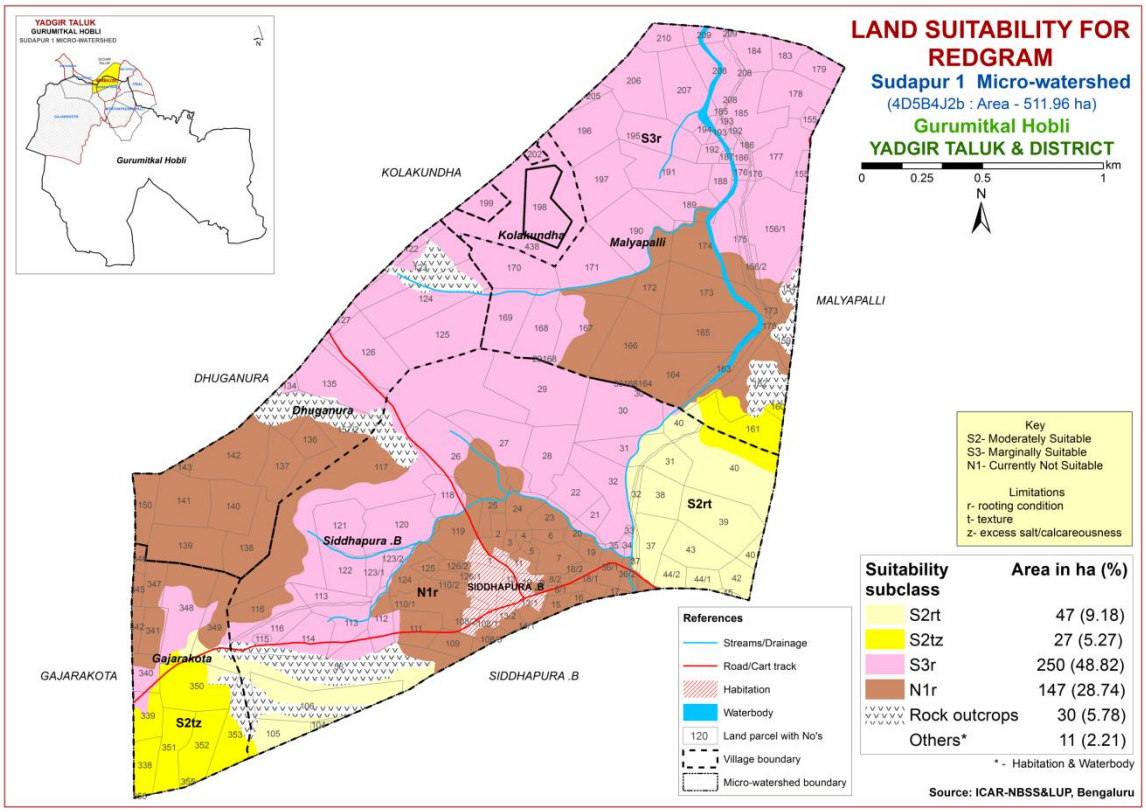


Fig. 7.6 Land suitability map of Red gram

7.7 Land Suitability for Bengalgram (*Cicer aerativum*)

Bengalgram one of is 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 bengalgram (Table 7.8) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing bengalgram was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.7.

There are no highly suitable (Class S1) lands available for growing bengalgram in the microwatershed. An area of about 27 ha (5%) is moderately suitable (Class S2) for bengalgram and are distributed in the eastern and southwestern part of the microwatershed. They have minor limitation of calcareousness. Maximum area of about 298 ha (58%) is marginally suitable (Class S3) and are distributed in the major part of the microwatershed with moderate limitations of rooting depth and texture. Currently not suitable (Class N1) lands occur in an area of about 146 ha (29%) and are distributed in the eastern, southern and southwestern part of the microwatershed with severe limitations of rooting depth and texture.

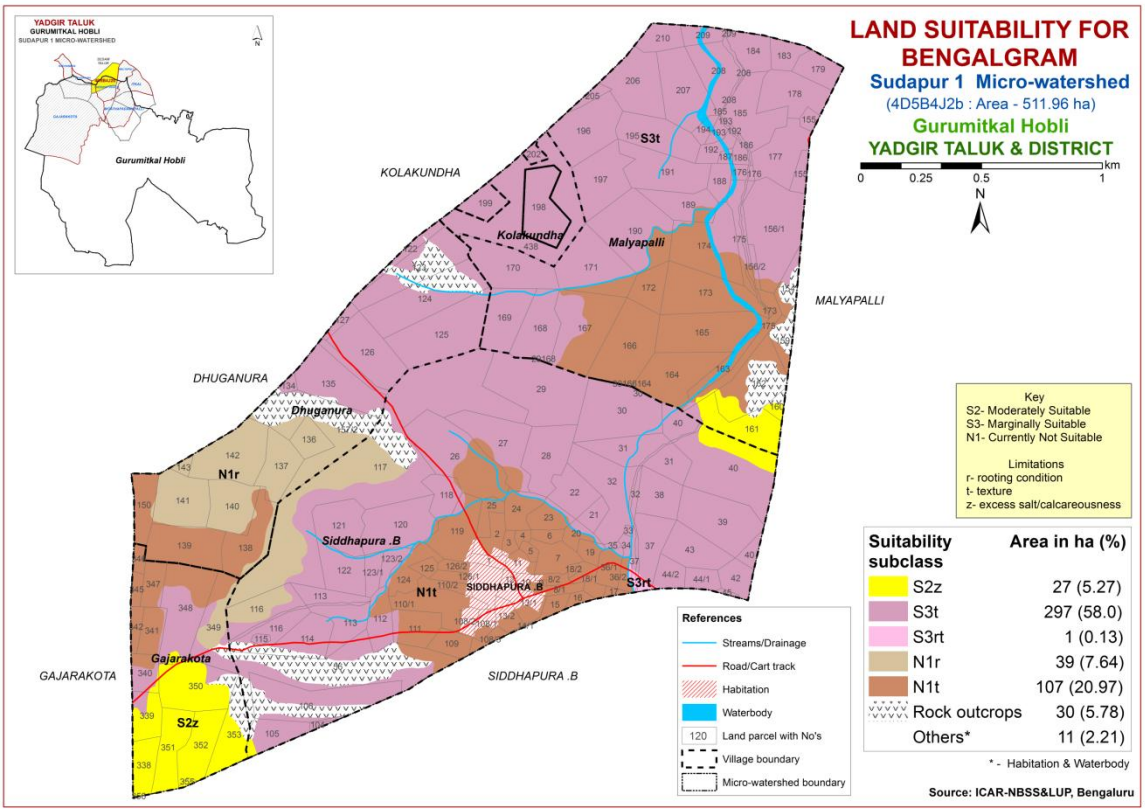


Fig. 7.7 Land suitability map of Bengalgram

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.

There are no highly suitable (Class S1) lands available for growing cotton in the microwatershed. An area of about 101 ha (20%) is moderately suitable (Class S2) for cotton and are distributed in the eastern, northern, western, central and southwestern part of the microwatershed. They have minor limitations of rooting depth and calcareousness. Maximum area of about 224 ha (44%) is marginally suitable (Class S3) and are distributed in the major part of the microwatershed with moderate limitations of rooting depth and texture. Currently not suitable (Class N1) lands occur in an area of about 146 ha (29%) and are distributed in the eastern, southern and southwestern part of the microwatershed with severe limitations of rooting depth and texture.

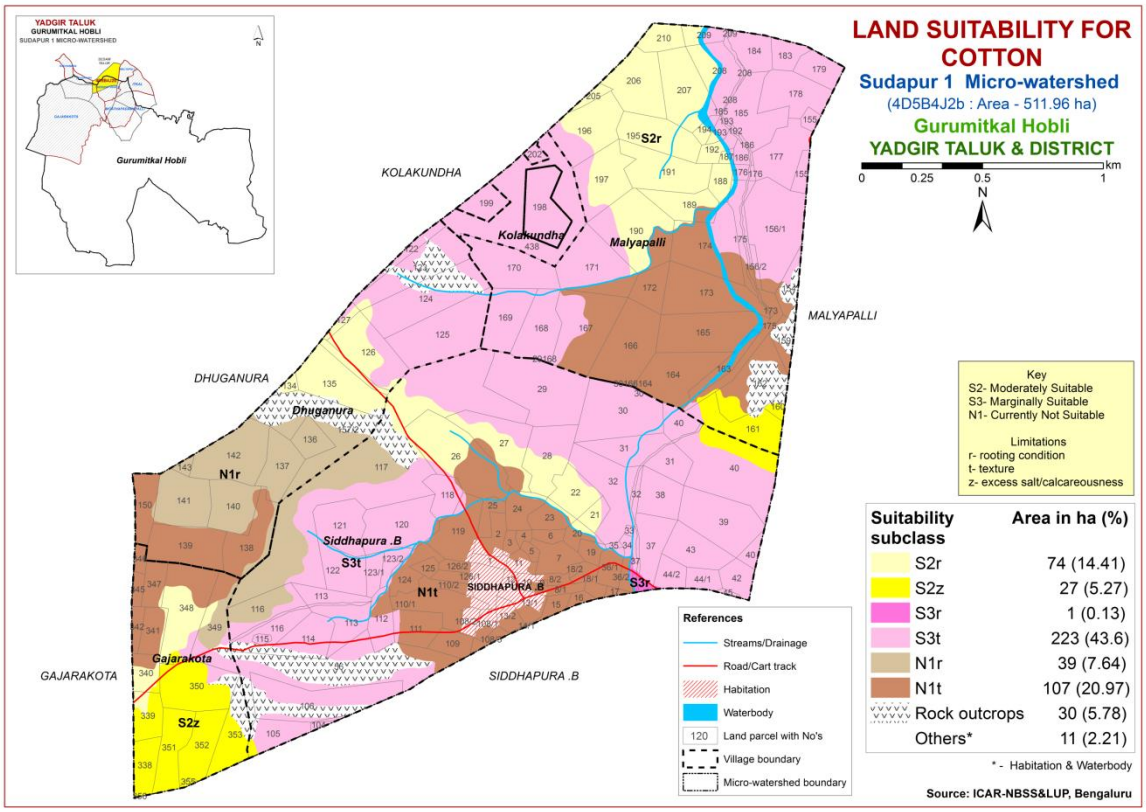


Fig. 7.8 Land suitability map of Cotton

7.9 Land Suitability for Chilli (*Capsicum annuum)*

Chilli is one of the most important spice crop grown in about 0.42 lakh ha in Karnataka state. The crop requirements for growing chilli (Table 7.10) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing chilli was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.9.

Highly suitable (Class S1) lands for growing chilli occur in an area of 13 ha (2%) and are distributed in the southwestern part of the microwatershed. Maximum area of about 311 ha (61%) is moderately suitable (Class S2) for growing chilli and is distributed in the major part of the microwatershed. They have minor limitations of rooting depth, calcareousness, gravelliness and texture. An area of about 108 ha (21%) is marginally suitable (Class S3) for growing chilli and is distributed in the eastern, southern and southwestern part of the microwatershed with moderate limitations of rooting depth and texture. Currently not suitable (Class N1) lands occur in an area of 39 ha (8%) and are distributed in the southwestern part of the microwatershed with severe limitation of rooting depth.

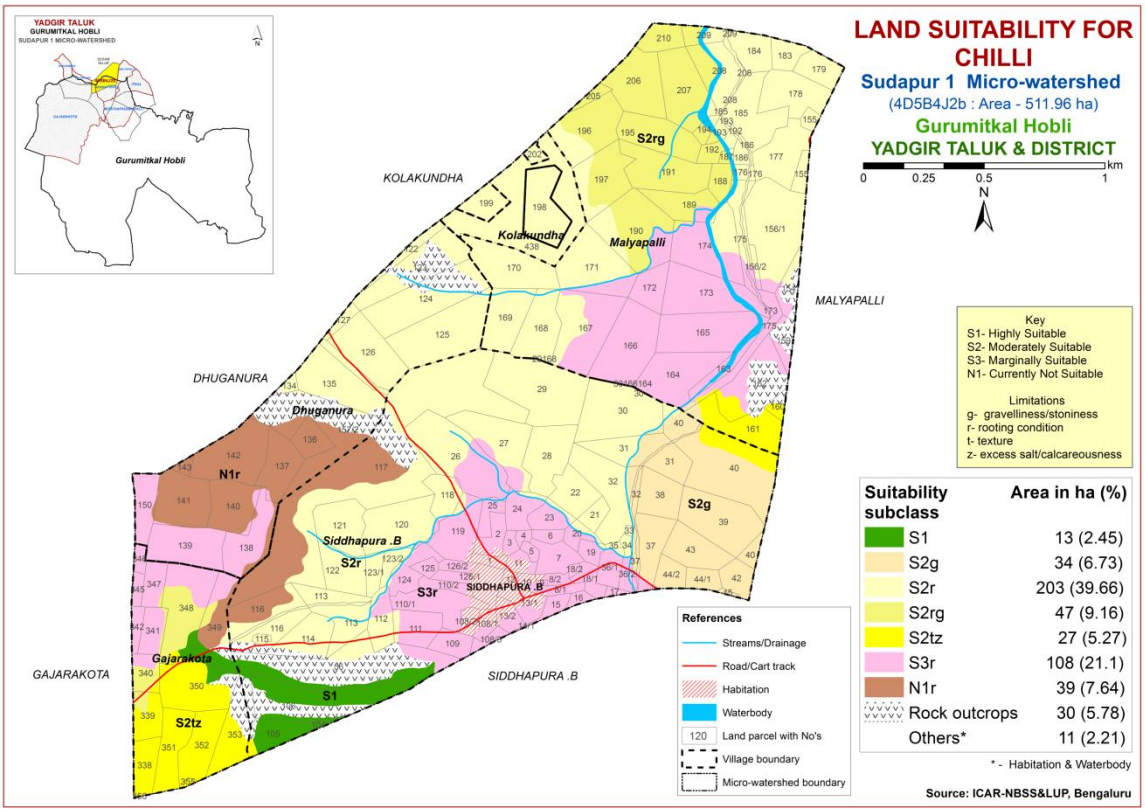


Fig 7.9 Land suitability map of Chilli

7.10 Land Suitability for Tomato *(Lycopersicon esculentum)*

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

Highly suitable (Class S1) lands for growing tomato occur in an area of 13 ha (2%) and are distributed in the southwestern part of the microwatershed. Maximum area of about 311 ha (61%) is moderately suitable (Class S2) for growing tomato and is distributed in the major part of the microwatershed. They have minor limitations of rooting depth, calcareousness, gravelliness and texture. An area of about 108 ha (21%) is marginally suitable (Class S3) for growing tomato and is distributed in the eastern, southern and southwestern part of the microwatershed with moderate limitations of rooting depth and texture. Currently not suitable (Class N1) lands occur in an area of 39 ha (8%) and are distributed in the southwestern part of the microwatershed with severe limitation of rooting depth.

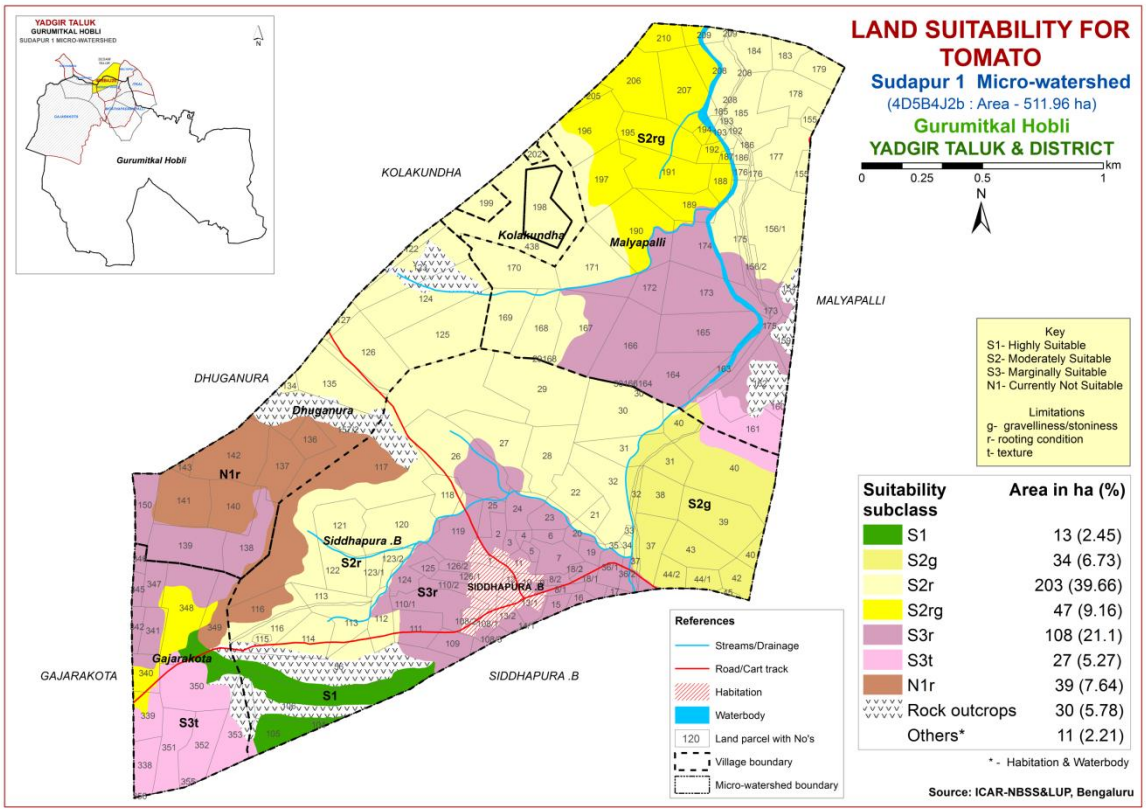


Fig 7.10 Land suitability map of Tomato

7.11 Land Suitability for Brinjal (*Solanum melongena*)

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

Highly suitable (Class S1) lands for growing brinjal occur in an area of 13 ha (2%) and are distributed in the southwestern part of the microwatershed. Maximum area of about 311 ha (61%) is moderately suitable (Class S2) for growing brinjal and is distributed in the major part of the microwatershed. They have minor limitations of rooting depth, calcareousness, gravelliness and texture. An area of about 108 ha (21%) is marginally suitable (Class S3) for growing brinjal and is distributed in the eastern, southern and southwestern part of the microwatershed with moderate limitations of rooting depth and texture. Currently not suitable (Class N1) lands occur in an area of 39 ha (8%) and are distributed in the southwestern part of the microwatershed with severe limitation of rooting depth.

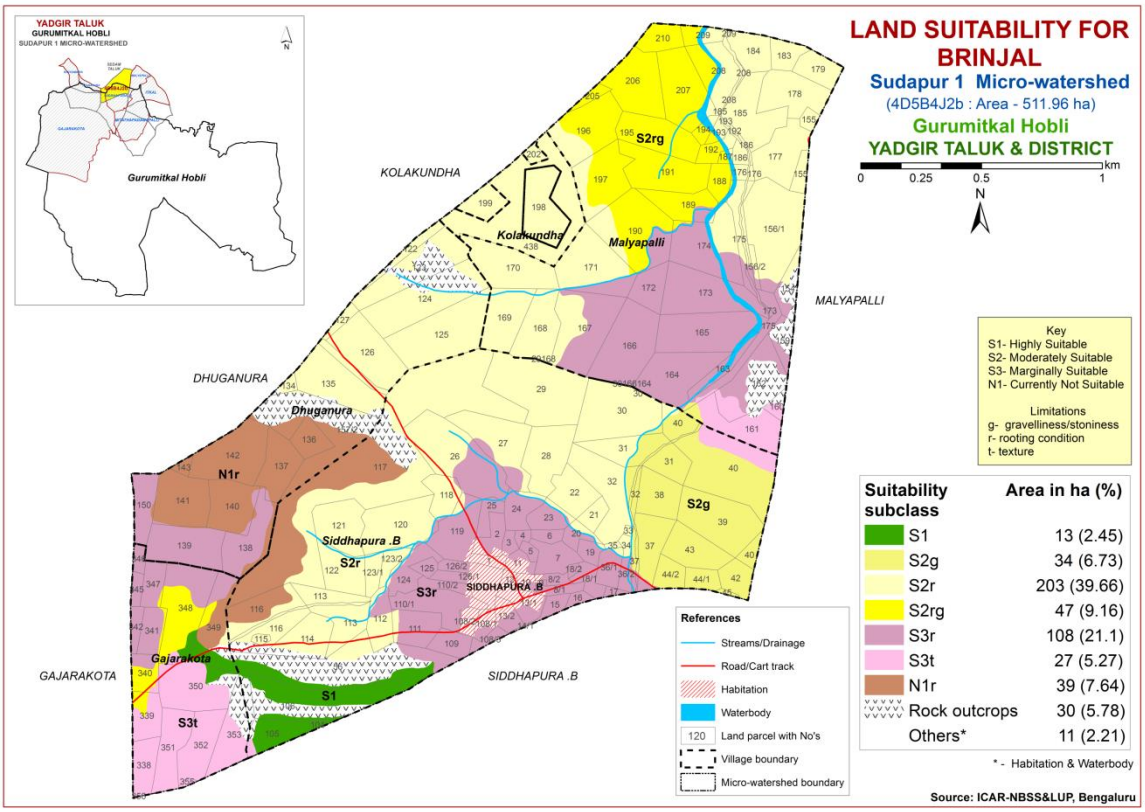


Fig 7.11 Land suitability map of Brinjal

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

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

Highly suitable (Class S1) lands for growing onion occur in an area of 13 ha (2%) and are distributed in the southwestern part of the microwatershed. Maximum area of about 284 ha (56%) is moderately suitable (Class S2) for growing onion and is distributed in the major part of the microwatershed. They have minor limitations of rooting depth and gravelliness. An area of about 135 ha (26%) is marginally suitable (Class S3) for growing onion and is distributed in the eastern, southern and southwestern part of the microwatershed with moderate limitations of rooting depth, calcareousness and texture. Currently not suitable (Class N1) lands occur in an area of 39 ha (8%) and are distributed in the southwestern part of the microwatershed with severe limitation of rooting depth.

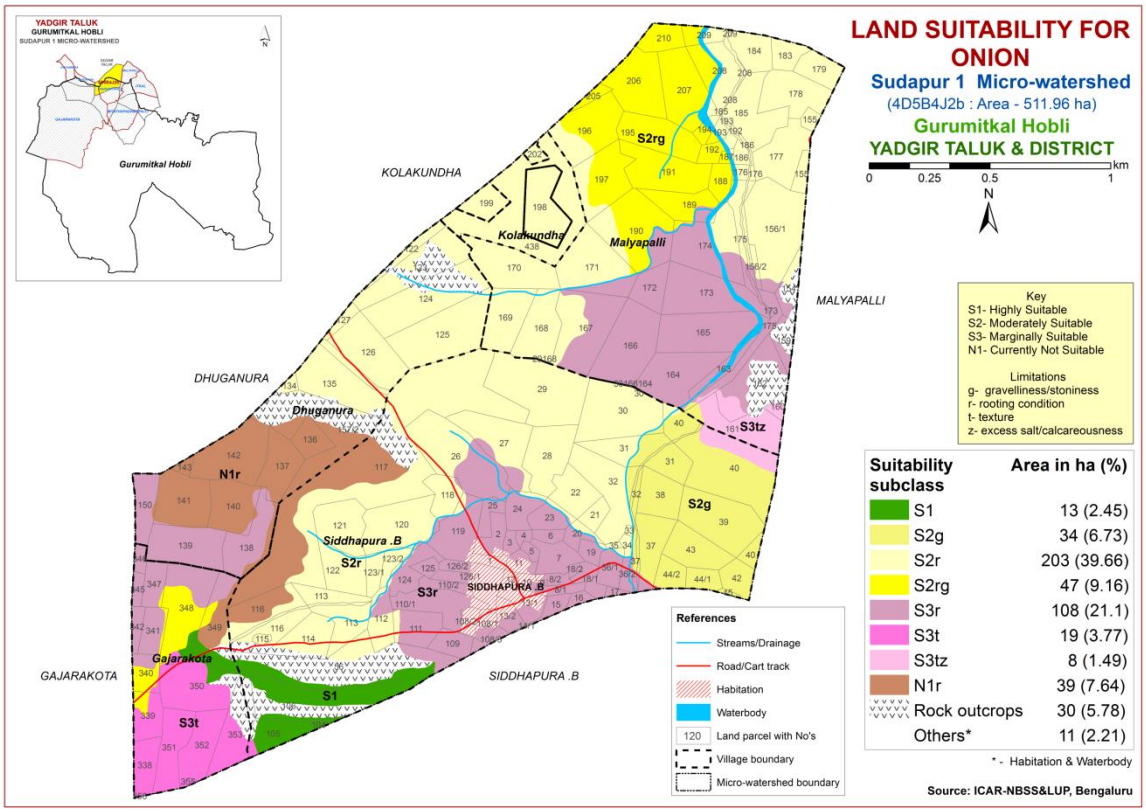


Fig 7.12 Land suitability map of Onion

7.13 Land Suitability for Bhendi (*Abelmoschus esculentus*)

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

Highly suitable (Class S1) lands for growing bhendi occur in an area of 13 ha (2%) and are distributed in the southwestern part of the microwatershed. Maximum area of about 311 ha (61%) is moderately suitable (Class S2) for growing bhendi and are distributed in the major part of the microwatershed. They have minor limitations of rooting depth, texture, gravelliness and calcareousness. An area of about 108 ha (21%) is marginally suitable (Class S3) for growing bhendi and is distributed in the eastern, southern and southwestern part of the microwatershed with moderate limitation of rooting depth. Currently not suitable (Class N1) lands occur in an area of 39 ha (8%) and are distributed in the southwestern part of the microwatershed with severe limitation of rooting depth.

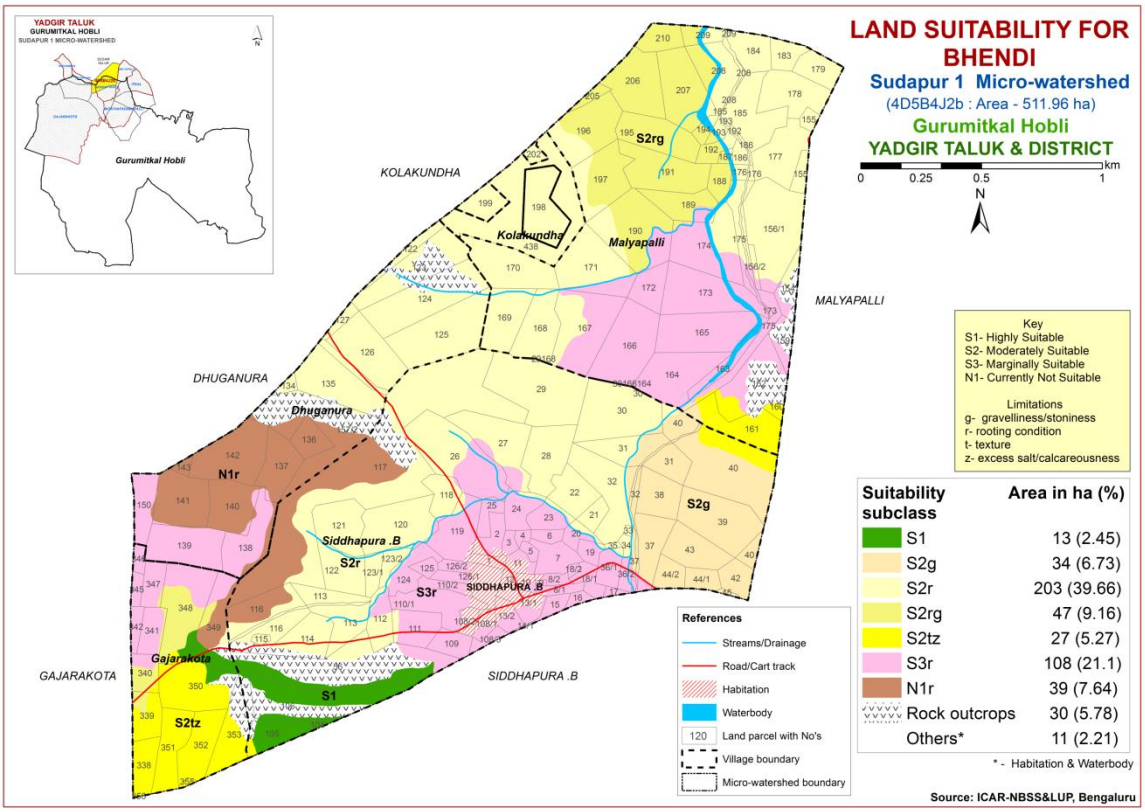


Fig 7.13 Land suitability map of Bhendi

7.14 Land Suitability for Drumstick (*Moringa oleifera*)

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

There are no highly suitable (Class S1) lands available for growing drumstick in the microwatershed. An area of about 47 ha (9%) is moderately suitable (Class S2) for drumstick and are distributed in the southeastern and southwestern part of the microwatershed. They have minor limitation of rooting depth. Maximum area of about 277 ha (54%) is marginally suitable (Class S3) and are distributed in the major part of the microwatershed with moderate limitations of rooting depth and calcareousness. Currently not suitable (Class N1) lands occur in an area of about 147 ha (29%) and are distributed in the eastern, southern and southwestern part of the microwatershed with severe limitation of rooting depth.

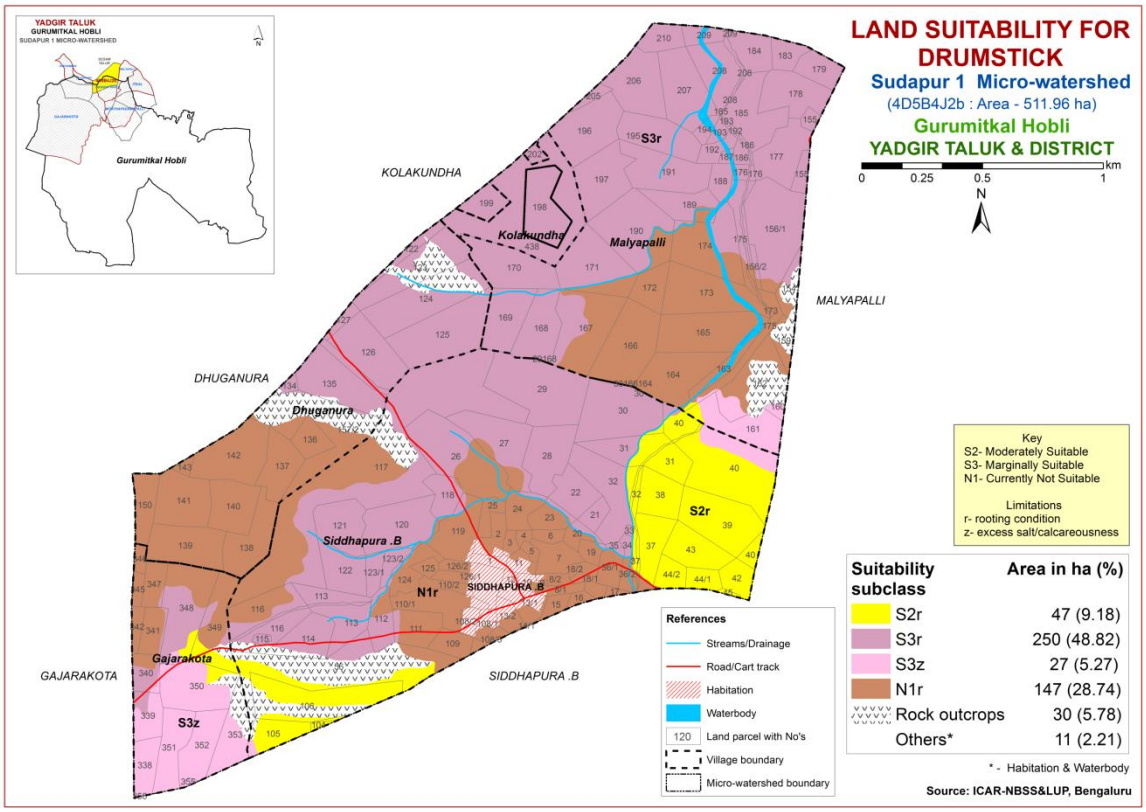


Fig 7.14 Land suitability map of Drumstick

7.15 Land Suitability for Mango (*Mangifera indica*)

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

No highly and moderately suitable (Class S1 and S2) lands are available for growing mango in the microwatershed. Marginally suitable lands (Class S3) for growing mango occupy an area of about 74 ha (14%) and occur in the southeastern and southwestern part of the microwatershed. They have moderate limitations of texture and rooting depth. Currently not suitable (Class N1) lands occur in a maximum area of 397 ha (78%) and are distributed in the major part of the microwatershed with severe limitation of rooting depth.

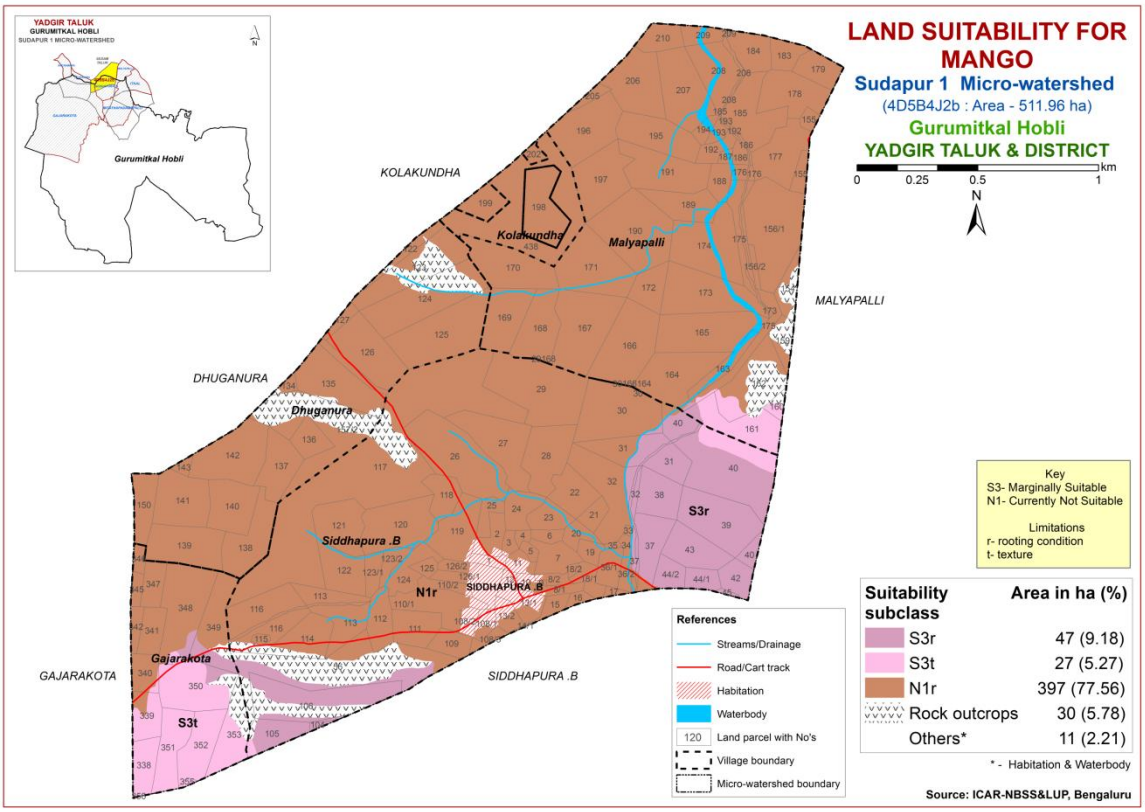


Fig. 7.15 Land suitability map of Mango

7.16 Land Suitability for Guava (*Psidium guajava*)

Guava is one of the most important fruit crop grown in an area of 0.06 lakh ha in almost all the districts of the State. The crop requirements (Table 7.17) for growing guava were matched with the soil-site characteristics (7.1) and a land suitability map for growing guava was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.16.

There are no highly suitable (Class S1) lands available for growing guava in the microwatershed. An area of about 47 ha (9%) is moderately suitable (Class S2) for guava and are distributed in the southeastern and southwestern part of the microwatershed. They have minor limitation of rooting depth. Maximum area of about 277 ha (54%) is marginally suitable (Class S3) and are distributed in the major part of the microwatershed with moderate limitations of rooting depth, texture and calcareousness. Currently not suitable (Class N1) lands occur in an area of about 147 ha (29%) and are distributed in the eastern, southern and southwestern part of the microwatershed with severe limitation of rooting depth.

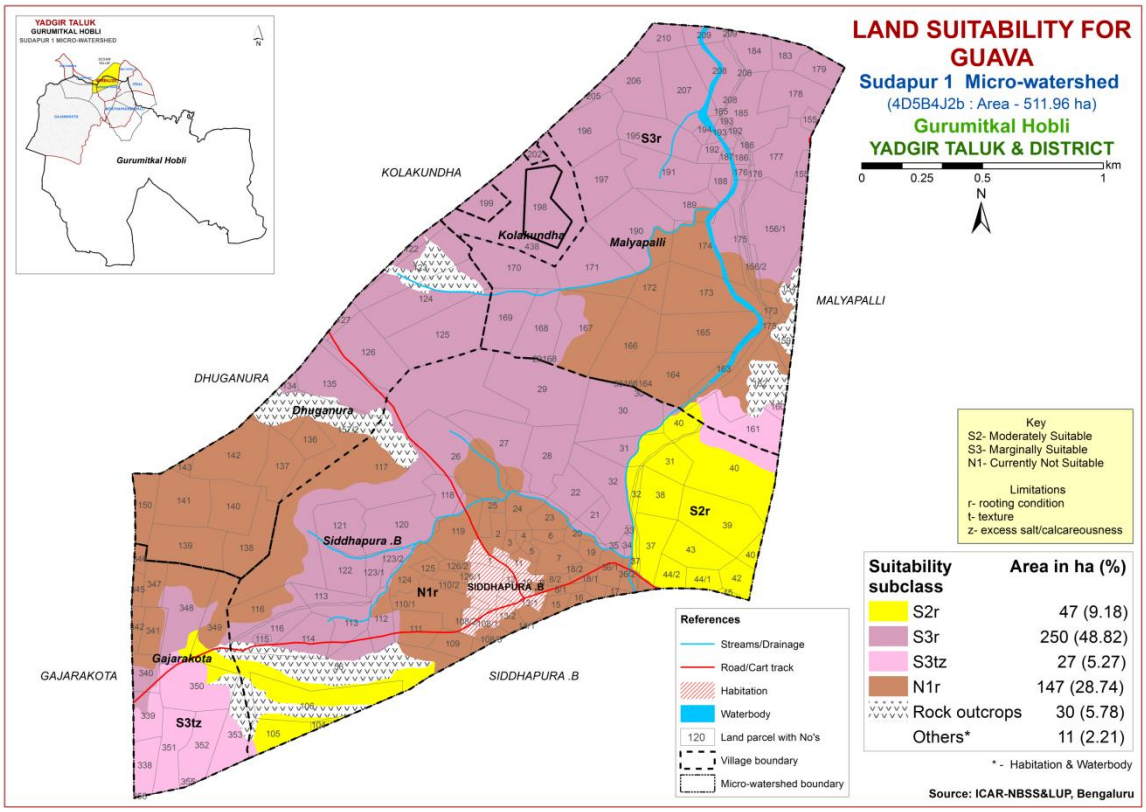


Fig. 7.16 Land suitability map of Guava

7.17 Land Suitability for Sapota (*Manilkara zapota*)

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

There are no highly suitable (Class S1) lands available for growing sapota in the microwatershed. An area of about 47 ha (9%) is moderately suitable (Class S2) for sapota and are distributed in the southeastern and southwestern part of the microwatershed. They have minor limitation of rooting depth. Maximum area of about 277 ha (54%) is marginally suitable (Class S3) and are distributed in the major part of the microwatershed with moderate limitations of rooting depth and texture. Currently not suitable (Class N1) lands occur in an area of about 147 ha (29%) and are distributed in the eastern, southern and southwestern part of the microwatershed with severe limitation of rooting depth.

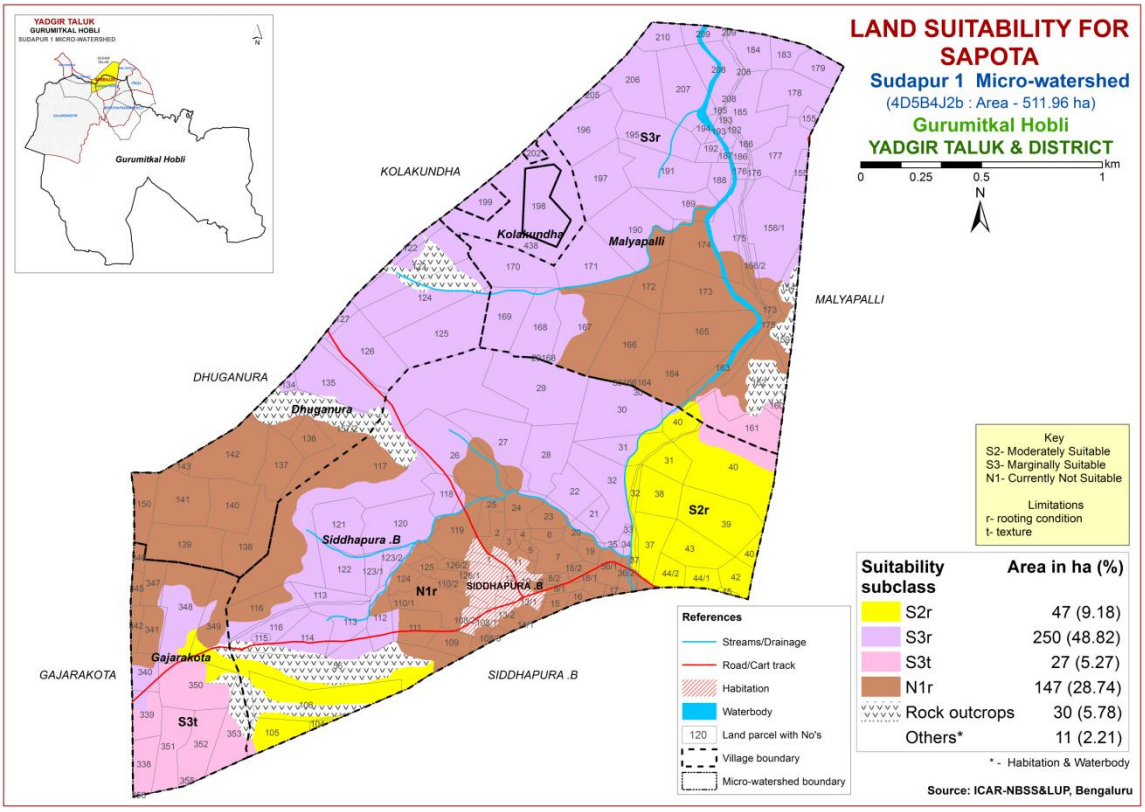


Fig. 7.17 Land suitability map of Sapota

7.18 Land Suitability for Pomegranate (*Punica granatum*)

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

There are no highly suitable (Class S1) lands available for growing pomegranate in the microwatershed. An area of about 74 ha (14%) is moderately suitable (Class S2) for pomegranate and are distributed in the southeastern and southwestern part of the microwatershed. They have minor limitations of rooting depth, texture and calcareousness. Maximum area of about 250 ha (49%) is marginally suitable (Class S3) and are distributed in the major part of the microwatershed with moderate limitation of rooting depth. Currently not suitable (Class N1) lands occur in an area of about 147 ha (29%) and are distributed in the eastern, southern and southwestern part of the microwatershed with severe limitation of rooting depth.

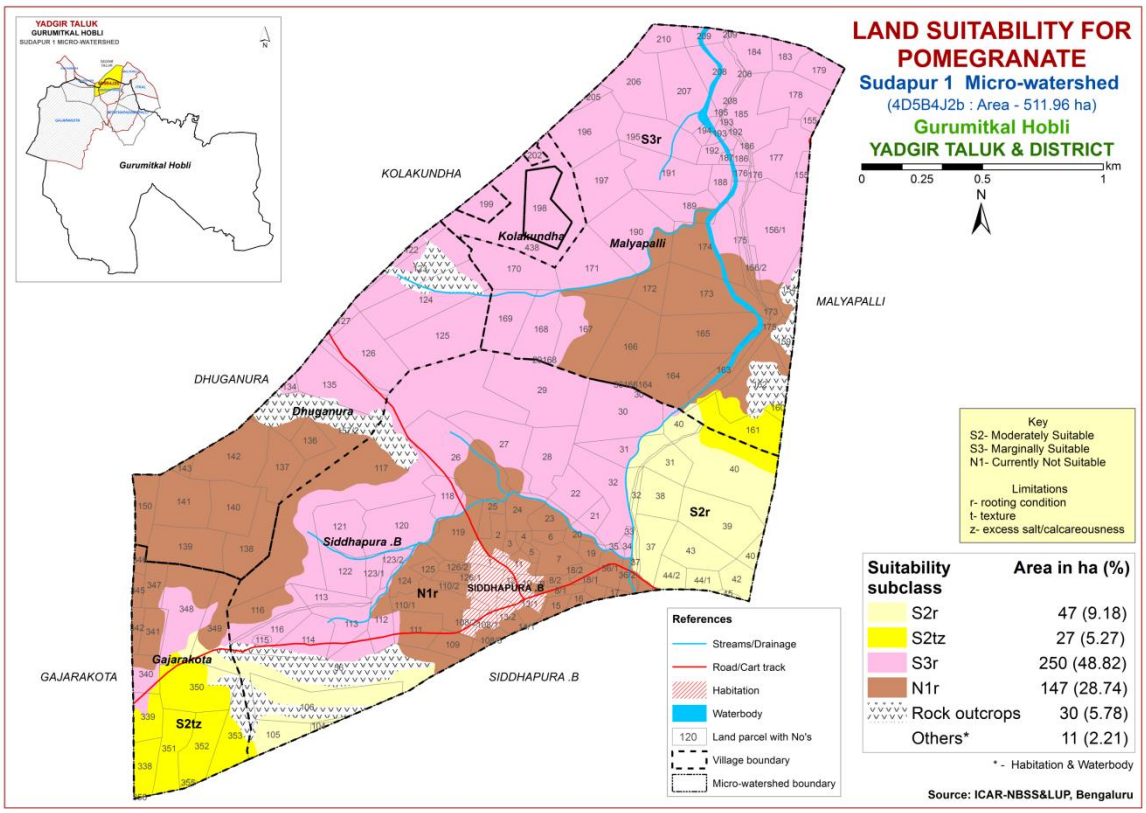


Fig 7.18 Land suitability map of Pomegranate

7.19 Land Suitability for Musambi (*Citrus limetta*)

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

There are no highly suitable (Class S1) lands available for growing musambi in the microwatershed. An area of about 74 ha (14%) is moderately suitable (Class S2) for musambi and are distributed in the southeastern and southwestern part of the microwatershed. They have minor limitations of rooting depth and calcareousness. Maximum area of about 250 ha (49%) is marginally suitable (Class S3) and are distributed in the major part of the microwatershed with moderate limitation of rooting depth. Currently not suitable (Class N1) lands occur in an area of about 147 ha (29%) and are distributed in the eastern, southern and southwestern part of the microwatershed with severe limitation of rooting depth.

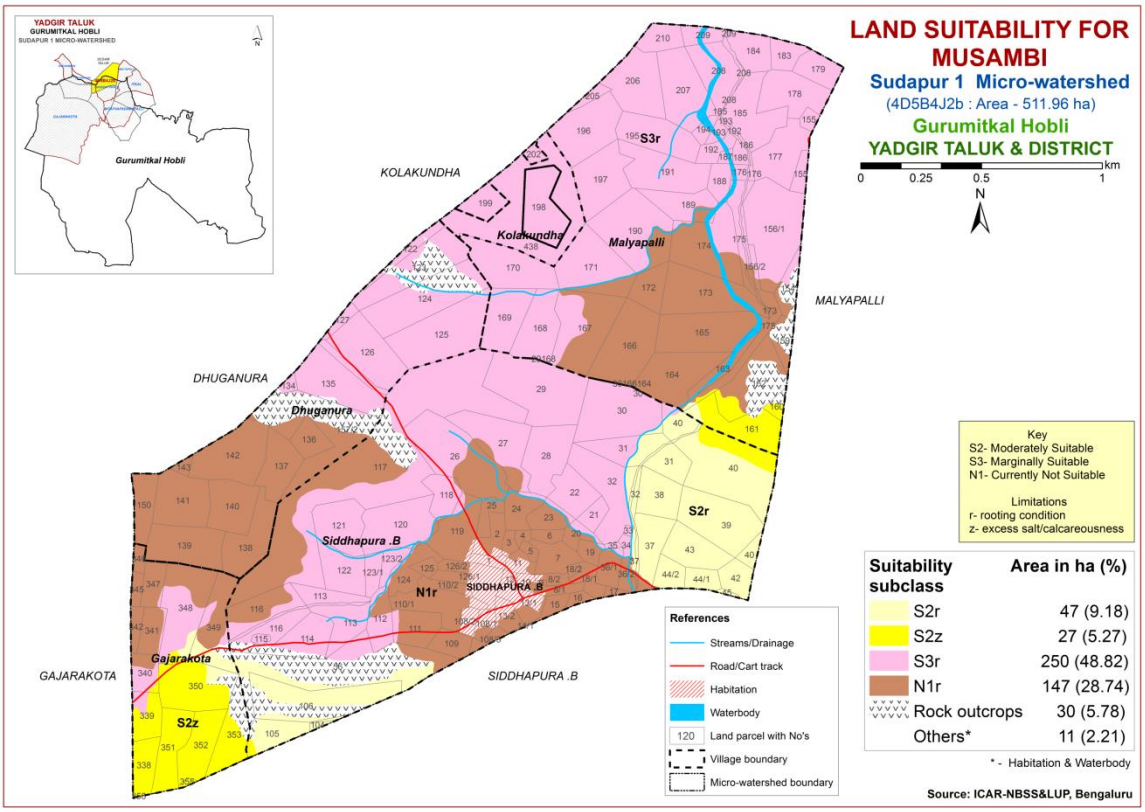


Fig. 7.19 Land suitability map of Musambi

7.20 Land Suitability for Lime (*Citrus sp*)

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

There are no highly suitable (Class S1) lands available for growing lime in the microwatershed. An area of about 74 ha (14%) is moderately suitable (Class S2) for lime and are distributed in the southeastern and southwestern part of the microwatershed. They have minor limitations of rooting depth and calcareousness. Maximum area of about 250 ha (49%) is marginally suitable (Class S3) and are distributed in the major part of the microwatershed with moderate limitation of rooting depth. Currently not suitable (Class N1) lands occur in an area of about 147 ha (29%) and are distributed in the eastern, southern and southwestern part of the microwatershed with severe limitation of rooting depth.

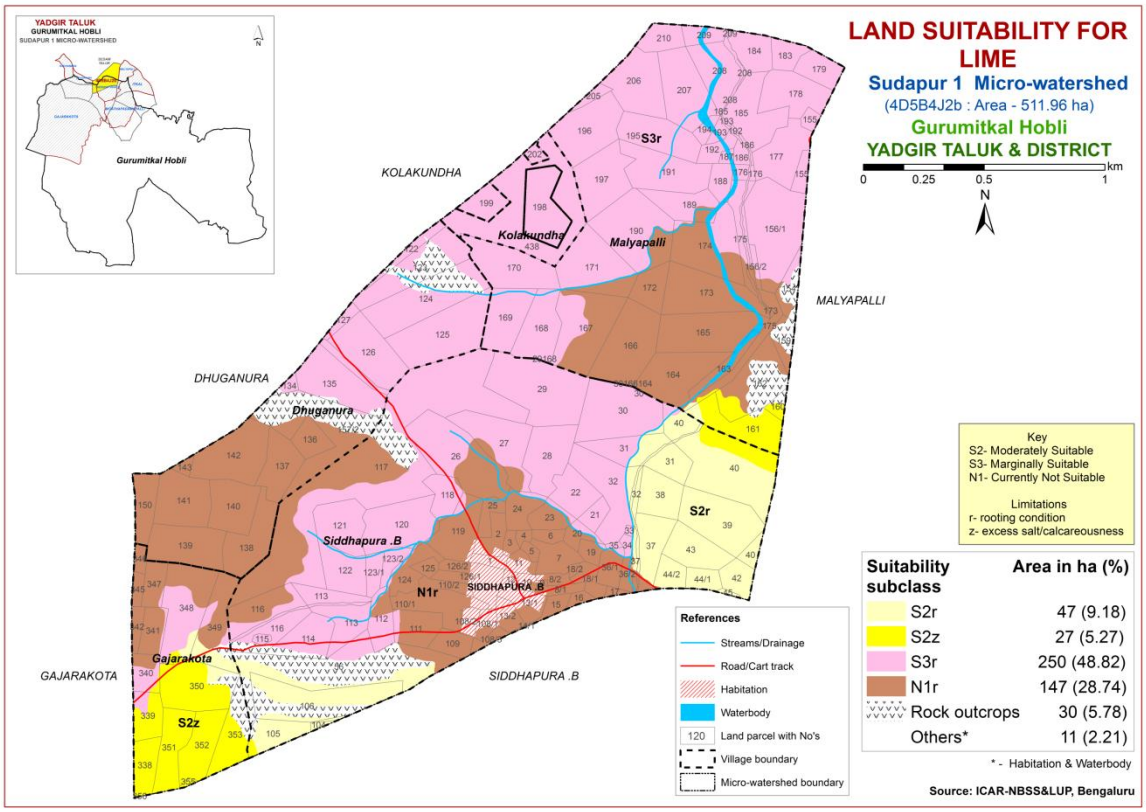


Fig. 7.20 Land suitability map of Lime

7.21 Land Suitability for Amla (*Phyllanthus emblica*)

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

Highly suitable (Class S1) lands for growing amla occur in an area of 47 ha (9%) and are distributed in the southeastern and southern part of the microwatershed. Maximum area of about 250 ha (49%) is moderately suitable (Class S2) for growing amla and are distributed in the major part of the microwatershed. They have minor limitation of rooting depth. An area of about 135 ha (26%) is marginally suitable (Class S3) for growing amla and is distributed in the eastern, southern and southwestern part of the microwatershed with moderate limitations of rooting depth, calcareousness and texture. Currently not suitable (Class N1) lands occur in an area of 39 ha (8%) and are distributed in the southwestern part of the microwatershed with severe limitation of rooting depth.

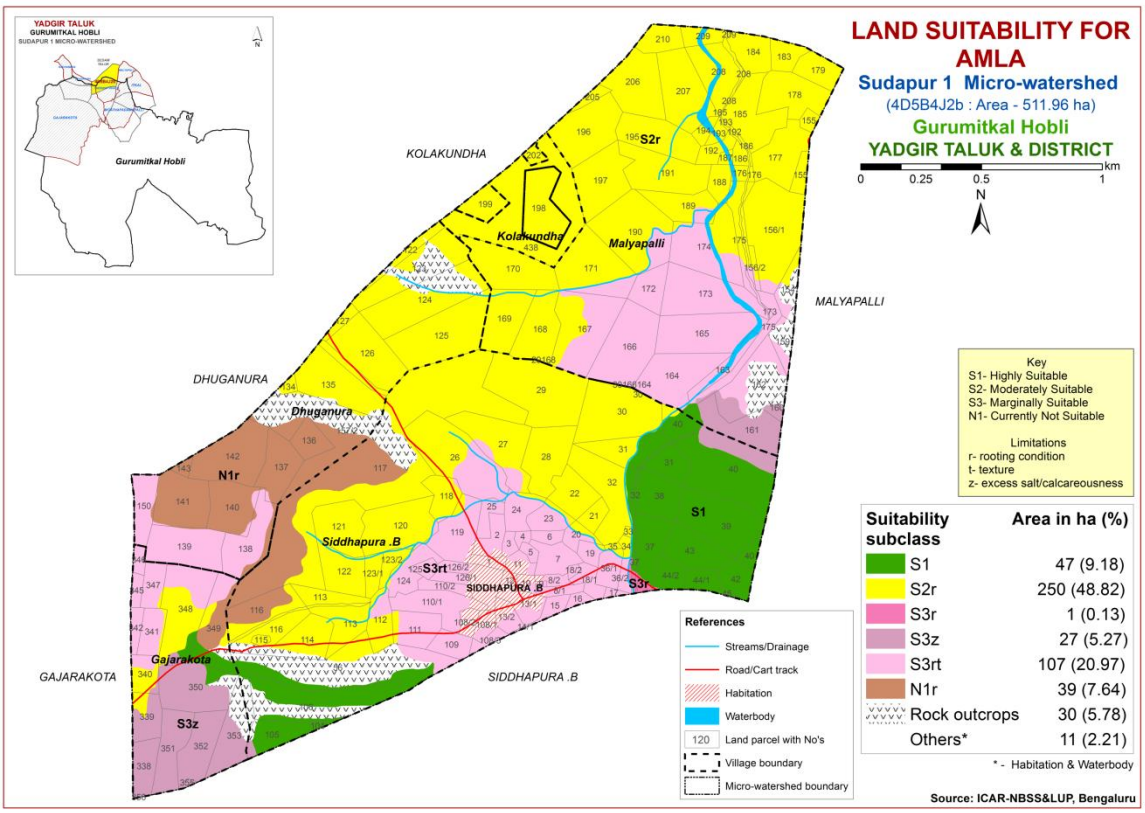


Fig. 7.21 Land suitability map of Amla

7.22 Land Suitability for Cashew (*Anacardium occidentale)*

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

There are no highly suitable (Class S1) lands available for growing cashew in the microwatershed. An area of about 47 ha (9%) is moderately suitable (Class S2) for cashew and are distributed in the southeastern and southwestern part of the microwatershed. They have minor limitation of nutrient availability. Marginally suitable lands (Class S3) for growing cashew occupy an area of about 74 ha (14%) and occur in the northeastern, western, central and southwestern part of the microwatershed. They have moderate limitation of rooting depth. Currently not suitable (Class N1) lands occur in a maximum area of 351 ha (68%) and are distributed in the major part of the microwatershed with severe limitations of rooting depth, texture and nutrient availability.

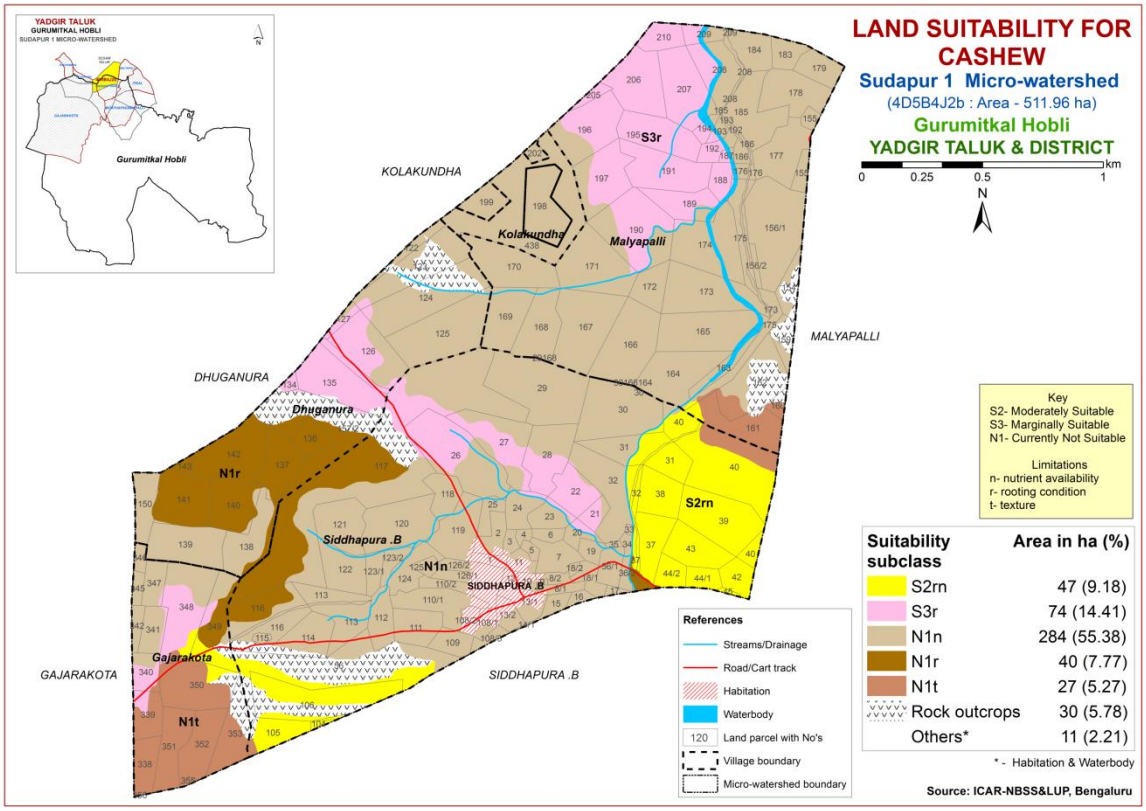


Fig. 7.22 Land suitability map of Cashew

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

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

There are no highly suitable (Class S1) lands available for growing jackfruit in the microwatershed. An area of about 47 ha (9%) is moderately suitable (Class S2) for jackfruit and are distributed in the southeastern and southwestern part of the microwatershed. They have minor limitation of rooting depth. Maximum area of about 277 ha (54%) is marginally suitable (Class S3) and are distributed in the major part of the microwatershed with moderate limitations of rooting depth and texture. Currently not suitable (Class N1) lands occur in an area of about 147 ha (29%) and are distributed in the eastern, southern and southwestern part of the microwatershed with severe limitation of rooting depth.

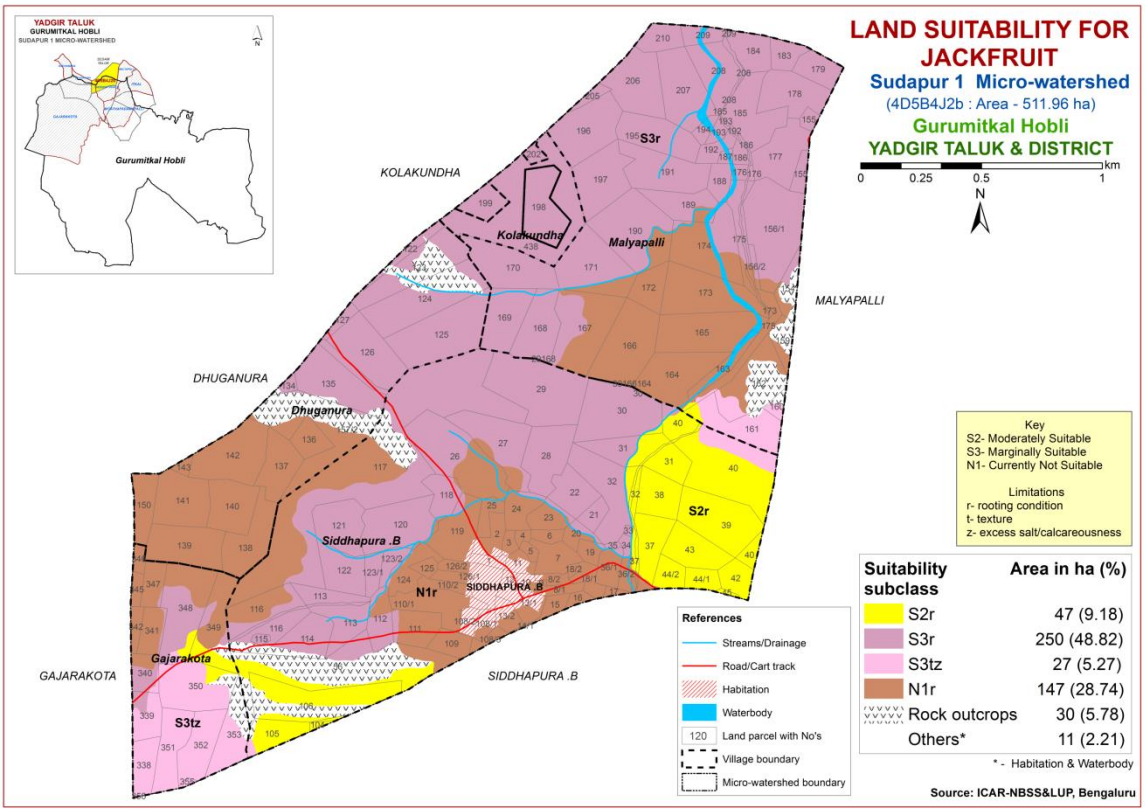


Fig. 7.23 Land suitability map of Jackfruit

7.24 Land Suitability for Jamun (*Syzygium cumini*)

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

No highly and moderately suitable (Class S1 and S2) lands are available for growing jamun in the microwatershed. Marginally suitable lands (Class S3) for growing jamun occupy a maximum area of about 324 ha (63%) and occur in the major part of the microwatershed. They have moderate limitations of calcareousness and rooting depth. Currently not suitable (Class N1) lands occur in an area of about 147 ha (29%) and are distributed in the eastern, southern and southwestern part of the microwatershed with severe limitation of rooting depth.

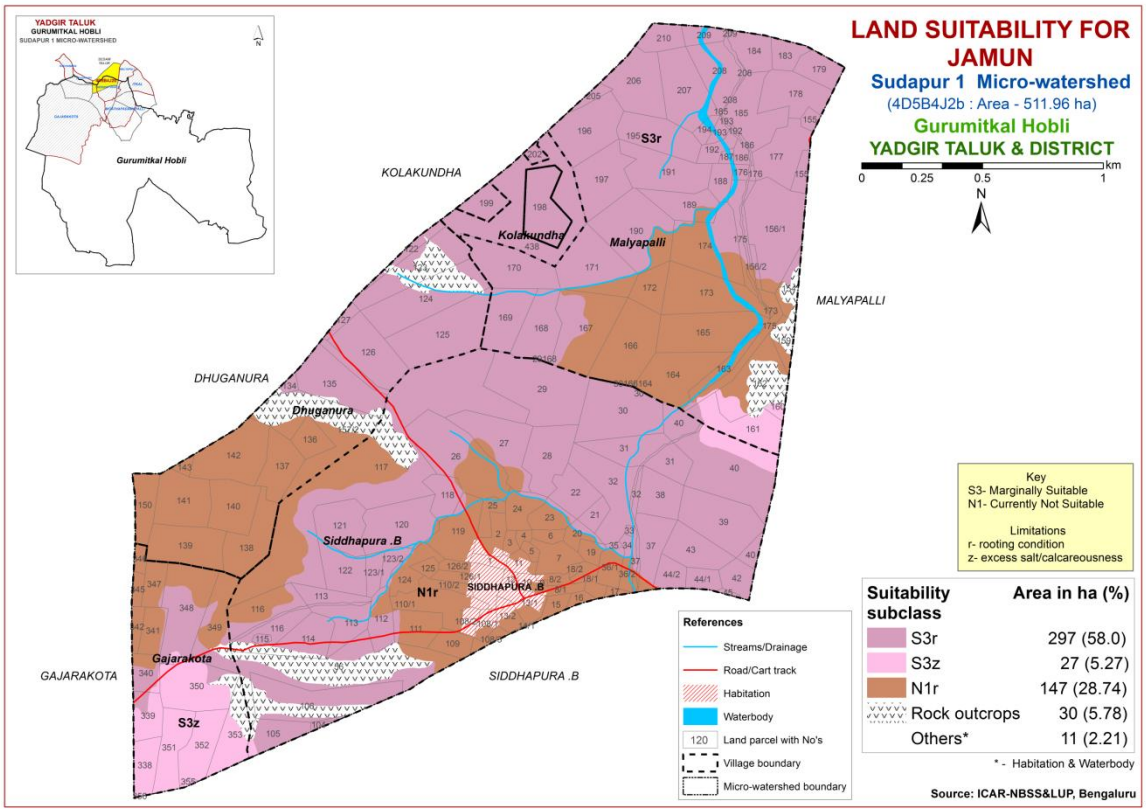


Fig. 7.24 Land suitability map of Jamun

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

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

Highly suitable (Class S1) lands for growing custard apple occur in an area of 47 ha (9%) and are distributed in the southeastern and southern part of the microwatershed. Maximum area of about 277 ha (54%) is moderately suitable (Class S2) for growing custard apple and are distributed in the major part of the microwatershed. They have minor limitations of rooting depth and calcareousness. An area of about 108 ha (21%) is marginally suitable (Class S3) for growing custard apple and is distributed in the eastern, southern and southwestern part of the microwatershed with moderate limitations of rooting depth and texture. Currently not suitable (Class N1) lands occur in an area of 39 ha (8%) and are distributed in the southwestern part of the microwatershed with severe limitation of rooting depth.

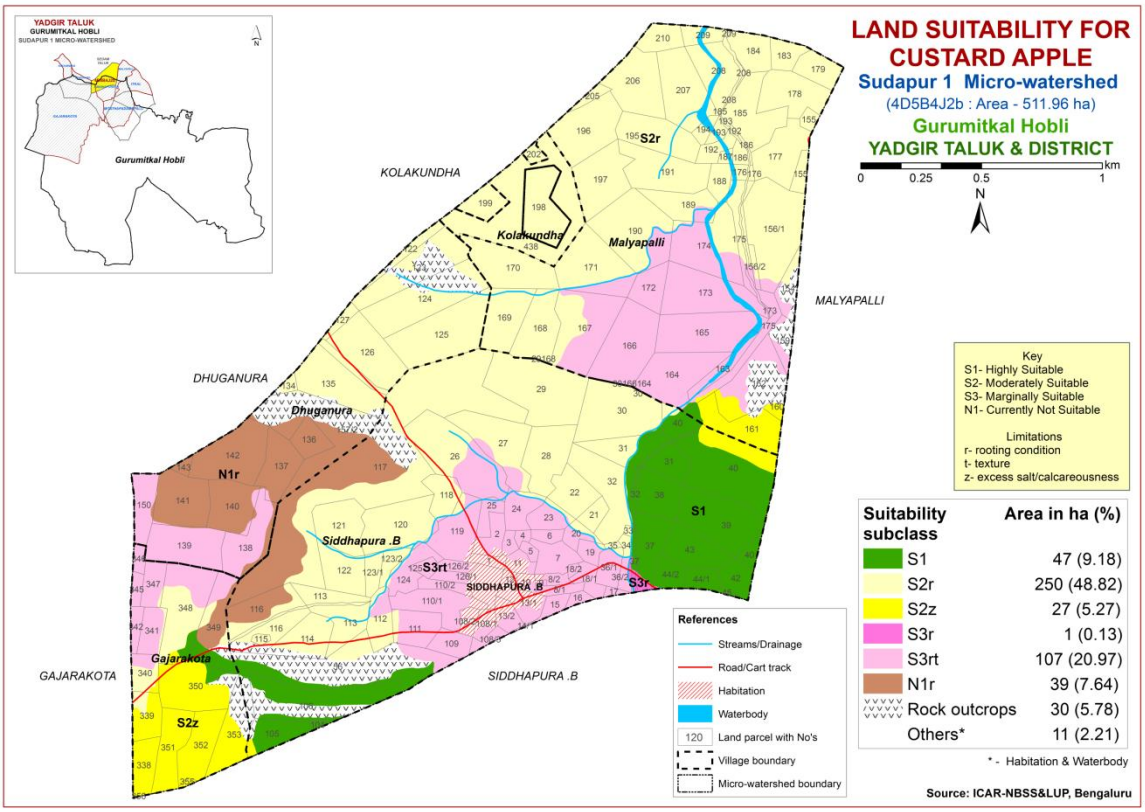


Fig. 7.25 Land suitability map of Custard Apple

7.26 Land Suitability for Tamarind (*Tamarindus indica*)

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

No highly and moderately suitable (Class S1 and S2) lands are available for growing tamarind in the microwatershed. Marginally suitable lands (Class S3) for growing tamarind occupy an area of about 74 ha (14%) and occur in the southeastern and southwestern part of the microwatershed. They have moderate limitations of calcareousness and rooting depth. Currently not suitable (Class N1) lands occur in a maximum area of 397 ha (78%) and are distributed in the major part of the microwatershed with severe limitation of rooting depth.

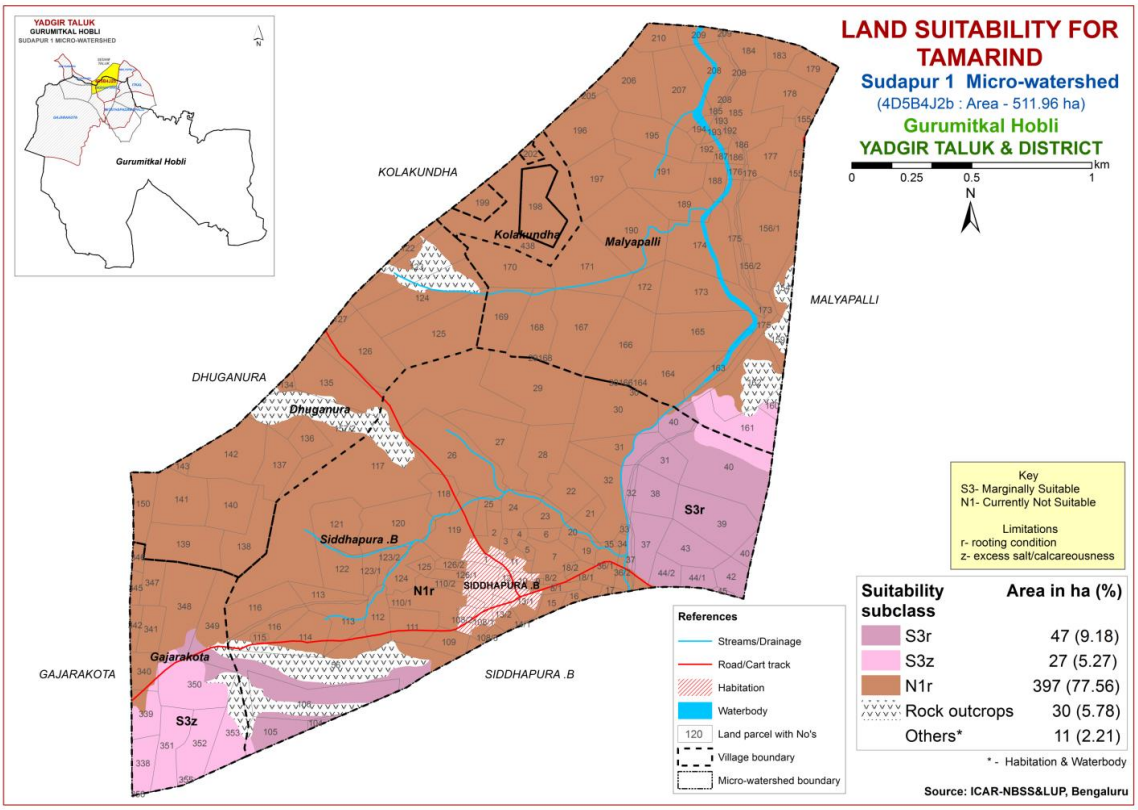


Fig. 7.26 Land suitability map of Tamarind

7.27 Land Suitability for Mulberry (*Morus nigra*)

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

There are no highly suitable (Class S1) lands available for growing mulberry in the microwatershed. An area of about 47 ha (9%) is moderately suitable (Class S2) for mulberry and are distributed in the southeastern and southwestern part of the microwatershed. They have minor limitation of rooting depth. Maximum area of about 277 ha (54%) is marginally suitable (Class S3) and are distributed in the major part of the microwatershed with moderate limitations of rooting depth and texture. Currently not suitable (Class N1) lands occur in an area of about 147 ha (29%) and are distributed in the eastern, southern and southwestern part of the microwatershed with severe limitation of rooting depth.

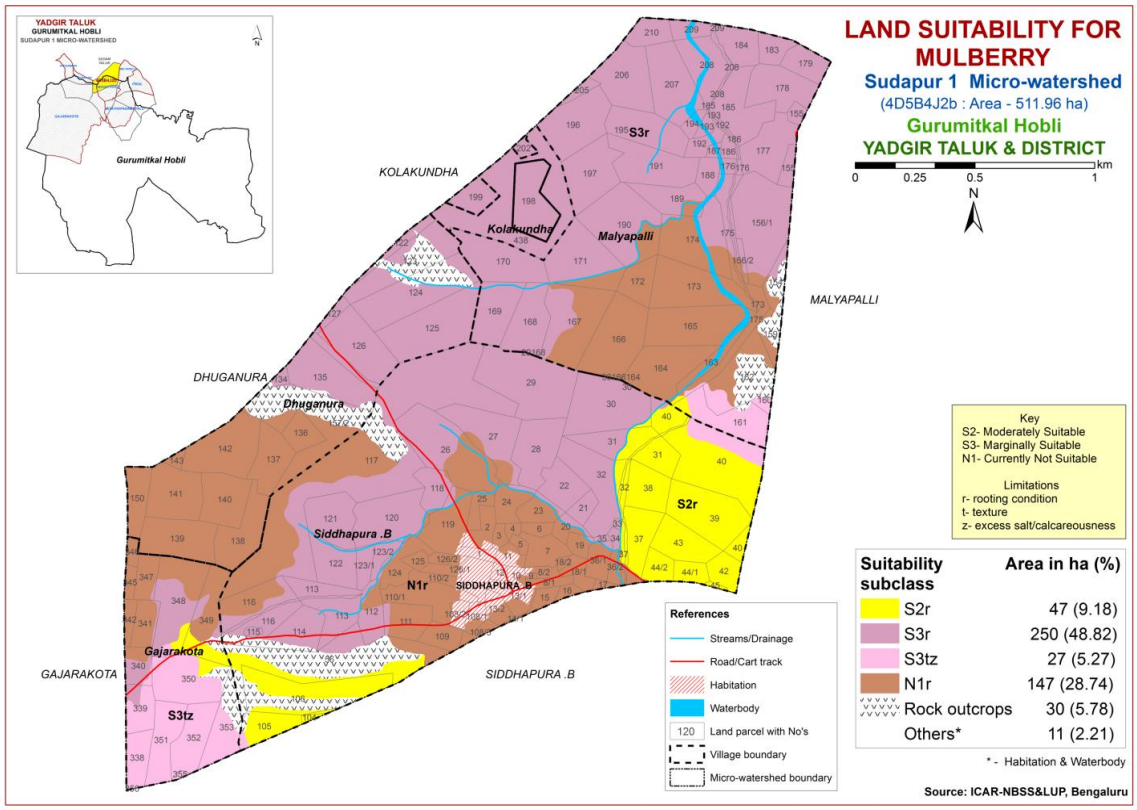


Fig 7.27 Land suitability map of Mulberry

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

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

Highly suitable (Class S1) lands for growing marigold occur in an area of 13 ha (2%) and are distributed in the southwestern part of the microwatershed. Maximum area of about 311 ha (61%) is moderately suitable (Class S2) for growing marigold and are distributed in the major part of the microwatershed. They have minor limitations of rooting depth, texture, gravelliness and calcareousness. An area of about 108 ha (21%) is marginally suitable (Class S3) for growing marigold and is distributed in the eastern, southern and southwestern part of the microwatershed with moderate limitation of rooting depth. Currently not suitable (Class N1) lands occur in an area of 39 ha (8%) and are distributed in the southwestern part of the microwatershed with severe limitation of rooting depth.

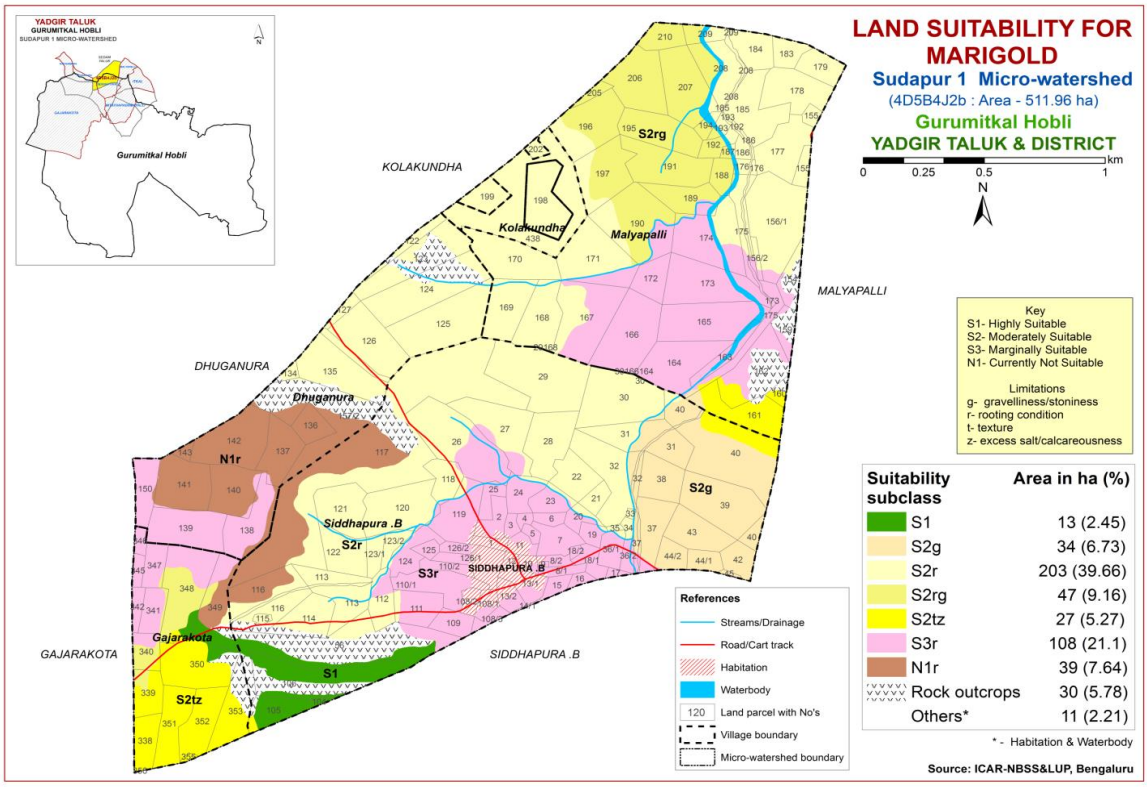


Fig. 7.28 Land suitability map of Marigold

7.29 Land Suitability for Chrysanthemum (*Dendranthema grandiflora*)

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

Highly suitable (Class S1) lands for growing chrysanthemum occur in an area of 13 ha (2%) and are distributed in the southwestern part of the microwatershed. Maximum area of about 311 ha (61%) is moderately suitable (Class S2) for growing chrysanthemum and are distributed in the major part of the microwatershed. They have minor limitations of rooting depth, texture, gravelliness and calcareousness. An area of about 108 ha (21%) is marginally suitable (Class S3) for growing chrysanthemum and is distributed in the eastern, southern and southwestern part of the microwatershed with moderate limitation of rooting depth. Currently not suitable (Class N1) lands occur in an area of 39 ha (8%) and are distributed in the southwestern part of the microwatershed with severe limitation of rooting depth.

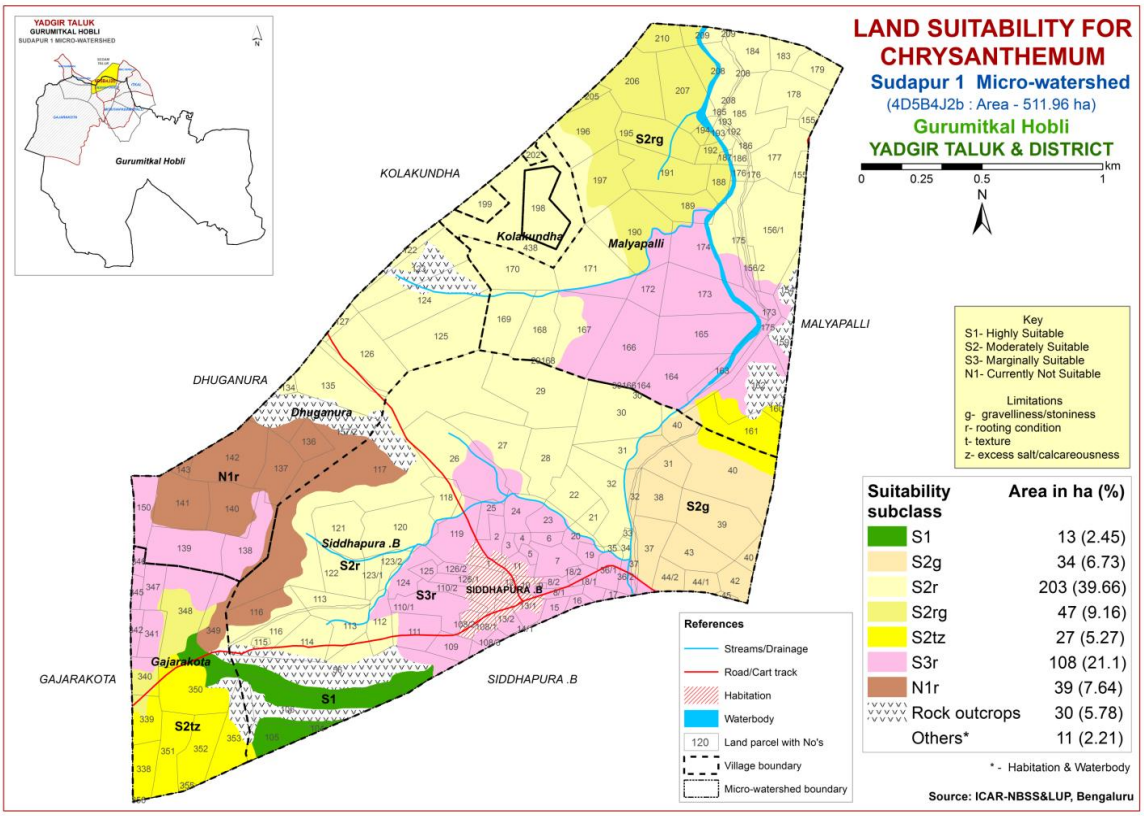


Fig. 7.29 Land suitability map of Chrysanthemum

Table 7.1 Soil-Site Characteristics of Sudapur 1 Microwatershed

Soil Map Units	Climate (P) (mm)	Growing period (Days)	Drain-age Class	Soil depth (cm)	Soil texture		Gravelliness		AWC (mm/m)	Slope (%)	Erosion	pH	EC (dSm^{-1})	ESP (%)	CEC [Cmol (p^{+})kg^{-1}]	BS (%)
					Sur-face	Sub-surface	Surface (%)	Sub-surface (%)								
BLCcB2g1	866	150	W	75-100	sl	scl	15-35	<15	51-100	1-3	Moderate	6.75	0.19	1.31	16.80	95
BLCiB2	866	150	W	75-100	sc	scl	<15	<15	51-100	1-3	Moderate	6.75	0.19	1.31	16.80	95
BMNmB2g1	866	150	MW	>150	c	c	15-35	<15	>200	1-3	Moderate	8.2	0.284	0.65	52.70	100
NGPmB2	866	150	MW	100-150	c	c	<15	<15	>200	1-3	Moderate	7.42	0.24	0.22	67.10	100
YLRcB2g1	866	150	W	50-75	sl	c	15-35	<15	51-100	1-3	Moderate	6.91	0.069	0.45	6.90	100
YLRiB2	866	150	W	50-75	sc	c	<15	<15	51-100	1-3	Moderate	6.91	0.069	0.45	6.90	100
JNKiB2	866	150	W	50-75	sc	scl	<15	15-35	51-100	1-3	Moderate	8.42	0.148	0.18	14.50	100
JNKiB2g1	866	150	W	50-75	sc	scl	15-35	<15	51-100	1-3	Moderate	8.42	0.148	0.18	14.50	100
JNKiB3g1	866	150	W	50-75	sc	scl	15-35	<15	51-100	1-3	Severe	8.42	0.148	0.18	14.50	100
BDPhB2	866	150	W	<25	scl	scl	<15	<15	<50	1-3	Moderate	8.58	0.262	0.35	18.10	100
BDPiB2	866	150	W	<25	sc	scl	<15	10-15	<50	1-3	Moderate	8.58	0.262	0.35	18.10	100
BDLbB2	866	150	W	25-50	ls	sl	<15	<15	<50	1-3	Moderate	6.20	0.074	0.20	4.20	93
BDLcB2g2	866	150	W	25-50	sl	sl	15-35	<15	<50	1-3	Moderate	6.20	0.074	0.20	4.20	93
BDLiB2	866	150	W	25-50	sc	sl	<15	<15	<50	1-3	Moderate	6.20	0.074	0.20	4.20	93
VNKmB2g1	866	150	W	25-50	c	sc	15-35	10-25	<50	1-3	Moderate	5.37	0.11	2.22	6.27	75

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

Table 7.2 Land suitability criteria for Sorghum

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

Table 7.3 Land suitability criteria for Maize

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

Table 7.4 Land suitability criteria for Bajra

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

Table 7.5 Land suitability criteria for Groundnut

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

Table 7.6 Land suitability criteria for Sunflower

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

Table 7.7 Land suitability criteria for Redgram

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

Table 7.8 Land suitability criteria for Bengal gram

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

Table 7.9 Land suitability criteria for Cotton

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

Table 7.10 Land suitability criteria for Chilli

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

Table 7.11 Land suitability criteria for Tomato

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

Table 7.12 Land suitability criteria for Brinjal

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

Table 7.13 Land suitability criteria for Onion

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

Table 7.14 Land suitability criteria for Bhendi

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

Table 7.15 Land suitability criteria for Drumstick

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

Table 7.16 Land suitability criteria for Mango

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

Table 7.17 Land suitability criteria for Guava

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

Table 7.18 Land suitability criteria for Sapota

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

Table 7.19 Land suitability criteria for Pomegranate

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

Table 7.20 Land suitability criteria for Musambi

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

Table 7.21 Land suitability criteria for Lime

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

Table 7.22 Land suitability criteria for Amla

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

Table 7.23 Land suitability criteria for Cashew

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

Table 7.24 Land suitability criteria for Jackfruit

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

Table 7.25 Land suitability criteria for Jamun

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

Table 7.26 Land suitability criteria for Custard apple

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

Table 7.27 Land suitability criteria for Tamarind

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

Table 7.28 Land suitability criteria for Mulberry

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

Table 7.29 Land suitability criteria for Marigold

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

Table 7.30 Land suitability criteria for Chrysanthemum

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

7.30 Land Management Units (LMUs)

The 15 soil map units identified in Sudapur 1 microwatershed have been grouped into 5 Land Management Units (LMU's) for the purpose of preparing a Proposed Crop Plan. Land Management Units are grouped based on the similarities in respect of the type of soil, the depth of the soil, the surface soil texture, gravel content, AWC, slope, erosion etc. and a Land Management Units map (Fig. 7.30) has been generated. These Land Management Units are expected to behave similarly for a given level of management.

The 15 map units that have been grouped into 5 Land Management Units along with brief description of soil and site characteristics are given below.

LMU	Soil map units	Soil and site characteristics
1	155.BLCcB2g1 38.BLCiB2	Moderately deep (75-100cm), 1-3% slopes, non-gravelly to gravelly (15-35 %), moderate erosion
2	63.BMNmB2g1 49.NGPmB2	Deep to very deep (100 to >150cm), 1-3 % slopes, non-gravelly to gravelly (15-35 %), moderate erosion
3	29.YLRcB2g1 31.YLRiB2	Moderately shallow (50-75cm), 1-3% slopes, non-gravelly to gravelly (15-35 %), moderate erosion
4	22.JNKiB2 23.JNKiB2g1 24.JNKiB3g1	Moderately shallow (50-75cm), 1-3% slopes, non-gravelly to gravelly (15-35 %), moderate to severe erosion
5	120.BDPhB2 1.BDPiB2 2.BDLbB2 174.BDLcB2g2 5.BDLiB2 109.VNKmB2g1	Shallow to very shallow (<25 to 50cm), 1-3% slopes, non-gravelly to very gravelly (15-30 %), moderate erosion

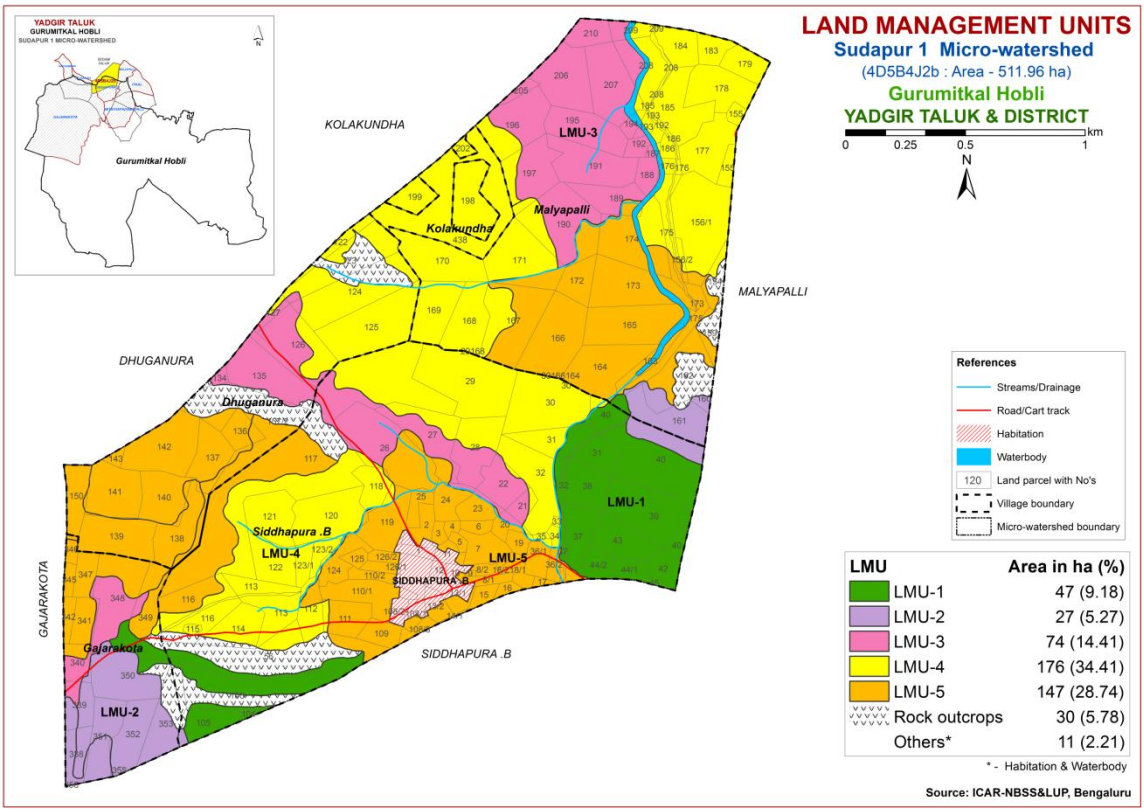


Fig. 7.3 Land Management Units Map-Sudapur 1 microwatershed

7.31 Proposed crop plan for Sudapur 1 microwatershed.

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

Table 7.31 Proposed crop plan for Sudapur 1 microwatershed

LMU	Soil Map Units	Survey Number	Soil Characteristics	Field Crops/ Commercial crops	Horticulture Crops (Rainfed/Irrigated)	Suitable Interventions
1	155.BLCcB2g1 38.BLCiB2 (Moderately deep, sandy clay loam soils)	**Siddhapura.B:**31,37,38,39,40,42,43,44/1,44/2,45,104,105,106	Moderately deep (75-100cm), 1-3% slopes, non-gravelly to gravelly (15-35 %), moderate erosion	Sunflower, Sorghum, Maize, Groundnut, Red gram, Bajra	**Fruit crops:** Mango, Musambi, Sapota, Tamarind, Pomegranate, Amla, Custard apple, Guava, Jackfruit, Jamun, Lime **Vegetables:** Tomato, Onion**,** Bhendi, Chilli, Brinjal, Drumstick, Coriander **Flowers:** Marigold, Chrysanthemum	Application of FYM, biofertilizers and micronutrients, drip irrigation, mulching, suitable soil and water conservation practices
2	63.BMNmB2g1 49.NGPmB2 (Deep to very deep, black calcareous clay soils)	**Gajarakota:**338,339,350,351,352,353, 355,356 **Malyapalli :**160,161	Deep to very deep (100 to >150cm), 1-3 % slopes, non-gravelly to gravelly (15-35 %), moderate erosion	Maize, Sorghum, Sunflower, Cotton, Red gram, Bengalgram, Bajra	**Fruit crops:** Lime, Musambi, Custard apple, Pomegranate **Vegetables:** Chilli, Bhendi **Flowers:** Marigold, Chrysanthemum	Application of FYM, biofertilizers and micronutrients, drip irrigation, mulching, suitable soil and water conservation practices
3	29.YLRcB2g1 31.YLRiB2 (Moderately shallow, red clay soils)	**Dhuganura:**126,127,134,135 **Gajarakota :**340,348 **Malyapalli:**187,188,189,190,191,192,194,195,196,197,205,206,207,209,210	Moderately shallow (50-75cm), 1-3% slopes, non-gravelly to gravelly (15-35	Maize, Sorghum, Cotton, Bajra	**Fruit crops:** Amla, Custard apple **Vegetables:** Tomato, Onion**,** Bhendi, Chilli, Brinjal **Flowers:** Marigold,	Drip irrigation, mulching, suitable soil and water conservation practices

LMU	Soil Map Units	Survey Number	Soil Characteristics	Field Crops/ Commercial crops	Horticulture Crops (Rainfed/Irrigated)	Suitable Interventions
		Siddhapura.B:21,22,26,27,135	%), moderate erosion		Chrysanthemum	(Crescent Bunding with Catch Pit etc)
4	22.JNKiB2 23.JNKiB2g1 24.JNKiB3g1 (Moderately shallow, sandy clay loam soils)	**Dhuganura:**122,123,124,125 **Kolakundha:**438 **Malyapalli:**155,156/1,156/2,168,169,170,171,176,177,178,179,183,184,185,186,193,198,199,202,208 **Siddhapura.B:**28,29,30,32,33,34,35,112,113,114,115,116,118,120,121,122,123/1,123/2,164,166,168	Moderately shallow (50-75cm), 1-3% slopes, non-gravelly to gravelly (15-35 %), moderate to severe erosion	Maize, Sorghum Groundnut, Bajra	**Fruit crops:** Amla, Custard apple **Vegetables:** Tomato, Chilli, Brinjal, Bhendi, Onion **Flowers:** Marigold, Chrysanthemum	Application of FYM, biofertilizers and micronutrients, drip irrigation, mulching, suitable soil and water conservation practices
5	120.BDPhB2 1.BDPiB2 2.BDLbB2 174.BDLcB2g2 5.BDLiB2 109.VNKmB2g1 (Shallow to very shallow soils)	**Dhuganura:**136,137,138,139,140,141,142,143,150 **Gajarakota:**341,342,345,346,347,349 **Malyapalli:**163,164,165,166,167,172,173,174,175 **Siddhapura.B:**2,3,4,5,6,7,8/1,8/2,9,13/2,14/1,15,16,17,18/1,18/2,19,20,23,24,25,36/1,36/2,108/3,109,110/1,110/2,111,117,119,124,125,126/1,126/2,138,157/2	Shallow to very shallow (<25 to 50cm), 1-3% slopes, non-gravelly to very gravelly (15-30 %), moderate erosion	-	**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 Sudapur 1 microwatershed

- The soil phases identified in the microwatershed belonged to the soil series of JNK 176 ha (34%), BDL 107 ha (21%), YLR 74 ha (14%), BLC 47 ha (9%), BDP 39 ha (8%), BMN 19 ha (4%), NGP 8 ha (1%) and VNK 1 ha (<1%).
- As per land capability classification entire area of the microwatershed falls under arable land category (Class II, III & IV). The major limitations identified in the arable lands were soil and erosion.
- On the basis of soil reaction, entire area of the microwatershed is under neutral (pH 6.5-7.3).

❖ **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

No acid soils are occurring in the microwatershed

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

Liming materials:

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

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

Alkaline soils

No alkaline soils are occurring in the microwatershed

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

Neutral soils

Neutral soils cover an entire area in the microwatershed.

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

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

Soil Degradation

Soil erosion is one of the major factor affecting the soil health in the microwatershed. Out of total 512 ha area in the microwatershed, an area of about 432 ha is suffering from moderate and 39 ha 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-Dry land 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 Sudapur 1 microwatershed.
- **Organic Carbon:** The OC content (an index of available Nitrogen) is medium (0.5-0.75%) in about 8 ha (2%) area and high (>0.75%) in 463 ha (90%). The areas that are medium in OC needs to be further improved by applying farmyard manure and rotating crops with cereals and legumes or mixed cropping.
- **Promoting Green Manuring:** Growing of green manuring crops costs Rs. 1250/ha (green manuring seeds) and about Rs. 2000/ha towards cultivation that totals to Rs. 3250/- per ha. On the other hand, application of organic manure @ 10 tons/ha costs Rs. 5000/ha. The practice needs to be continued for 2-3 years or more. Nitrogen fertilizer needs to be supplemented by 25% in addition to the recommended level where OC in 8 ha is 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 77 ha (15%) area, medium (23-57 kg/ha) in 140 ha (27%) area and high (>57 kg/ha) in an area of 253 ha (49%) of the microwatershed. In low and medium areas, for all the crops 25% additional P needs to be applied.
- **Available Potassium:** Available potassium is medium (145-337 kg/ha) in the entire area of the microwatershed. For all the crops 25% additional potassium needs to be applied.
- **Available Sulphur:** Available sulphur is a very critical nutrient for oilseed crops. It is high (>20 ppm) in 24 ha (5%), medium (10 - 20 ppm) in 232 ha (45%) and low (<10 ppm) in 215 ha (42%). 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:** Available boron is low (<0.5ppm) in 382 ha (75%) area, medium (0.5-1.0 ppm) in 75 ha (15%) area and high (>1.0ppm) in an area of 14 ha (3%) of the microwatershed. For low and medium areas, application of sodium borate @ 10 kg/ha as soil application or 0.2 % borax as foliar spray is recommended.
- **Available Iron:** All the soils in the microwatershed are sufficient (>4.5 ppm) in available iron.
- **Available Manganese:** All the soils in the microwatershed are sufficient (>1.0 ppm) in available manganese.

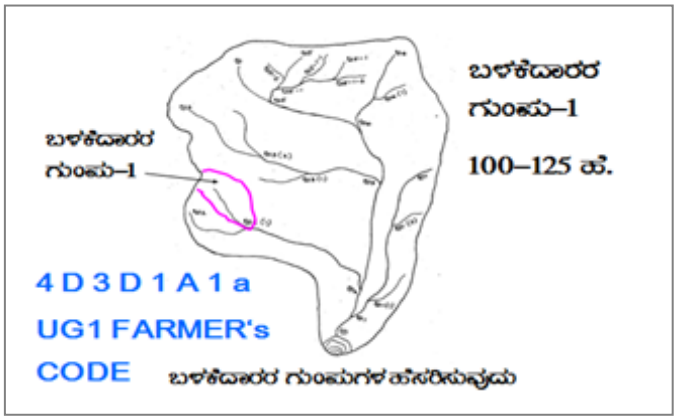
- **Available Copper:** All the soils in the microwatershed are sufficient (>0.2 ppm) in available copper.
- **Available Zinc:** An area of about 68 ha (13%) is deficient (<0.6 ppm) and 403 ha (79%) is sufficient in available zinc content. Application of zinc sulphate @25 kg/ha is recommended for deficient areas.
- **Soil Alkalinity:** No area in the microwatershed has soils that are alkaline. The alkaline areas if present need application of gypsum and wherever calcium is in excess, iron pyrites and element sulphur can be recommended. Management practices like treating repeatedly with good quality water to drain out the excess salts and provision of subsurface drainage and growing of salt tolerant crops like Casuarina, Acacia, Neem, Ber etc, are recommended.
- **Land Suitability for Various Crops:** Areas that are highly, moderately and marginally suitable 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, rooting depth, texture and calcareousness 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 Sudapur 1 microwatershed, the land resource inventory database generated under Sujala-III project has been transformed as information through series of interpretative (thematic) maps using soil phase map as a base. The various thematic maps (1:7920 scale) generated were

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



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

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

Steps for Survey and Preparation of Treatment Plan

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

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

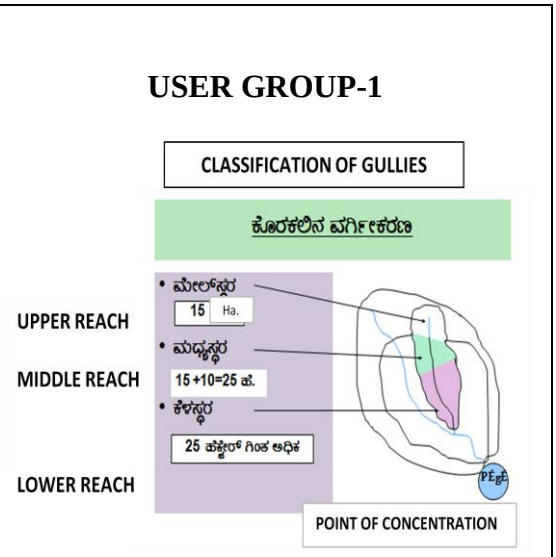
9.1 Treatment Plan

The treatment plan recommended for arable lands is briefly described below

9.1.1 Arable Land Treatment

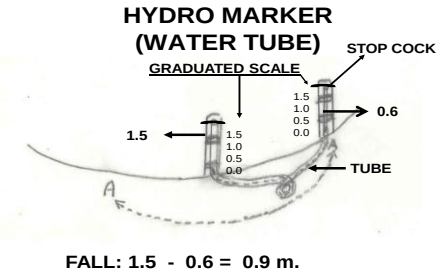
A. BUNDING

Steps for Survey and Preparation of Treatment Plan	
• 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.

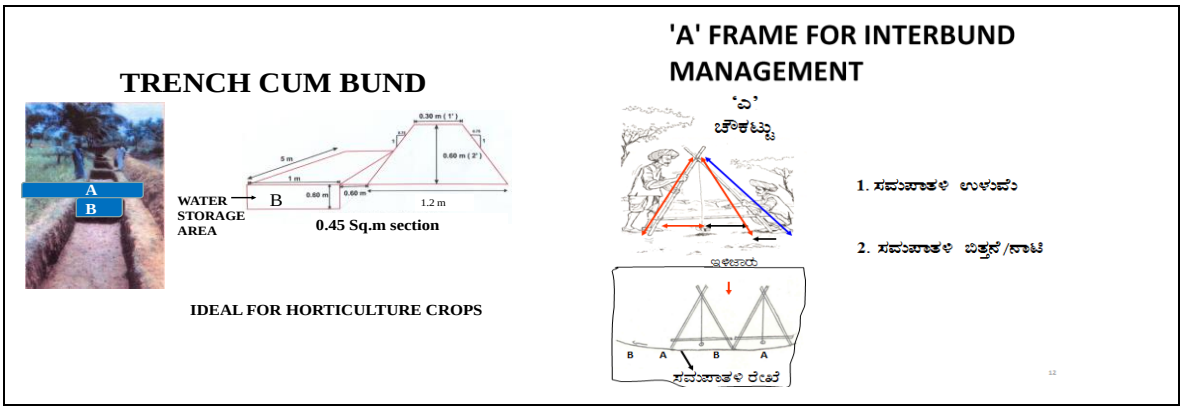
Recommended Bund Section

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 soils	
0.45	2	0.75	01:01	0.92		
0.45	2.4	0.75	1.3:1	1.07	Shallow black soils	
0.6	3.1	0.7	1.78:1	1.29	Medium black soils	
0.5	3	0.85	1.47:1	1.49		

Formation of Trench cum Bund

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

Details of Borrow Pit dimensions are given below:



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

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

B. Water Ways

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

C. Farm Ponds

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

D. Diversion Channel

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

9.1.2 Non-Arable Land Treatment

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

9.1.3 Treatment of Natural Water Course/ Drainage Lines

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

9.2 Recommended Soil and Water Conservation Measures

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

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

A map (Fig. 9.1) showing soil and water conservation plan with different kinds of structures recommended has been prepared which shows the spatial distribution and extent of area. An area of about 161 ha (31%) needs trench cum bunding and a maximum area of about 311 ha (61%) 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.

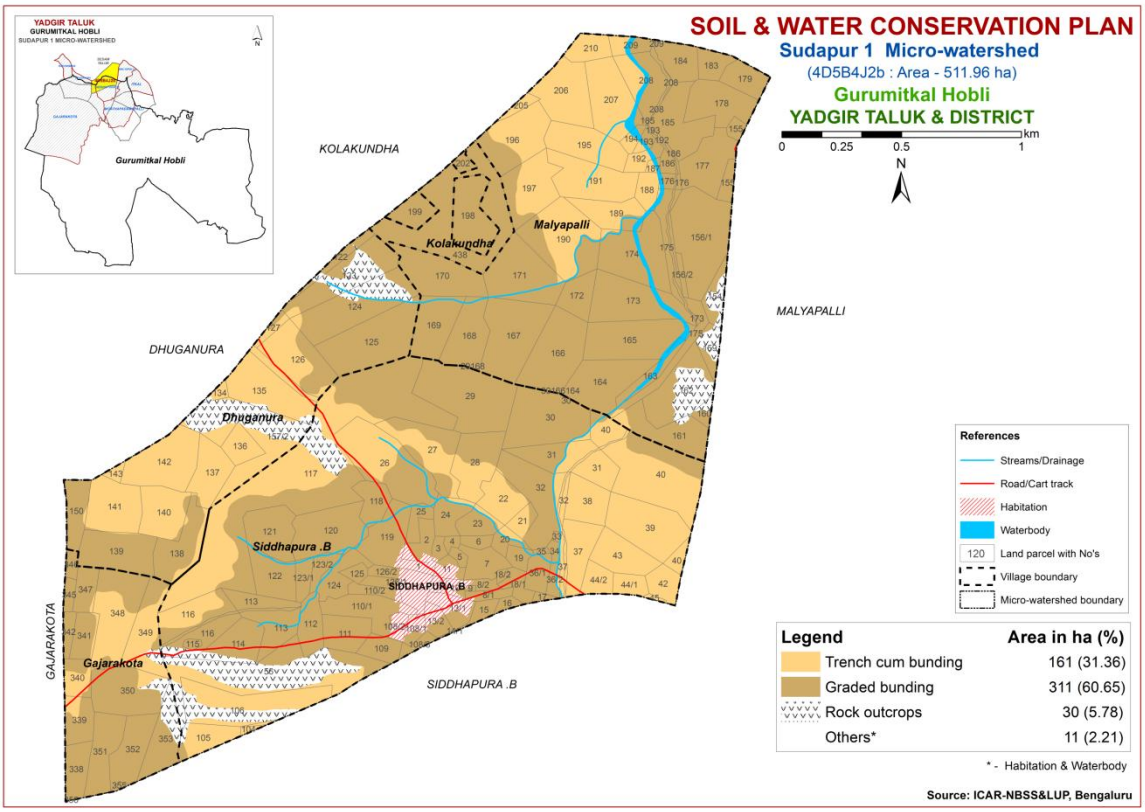


Fig. 9.1 Soil and water conservation plan map of Sudapur 1 microwatershed

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

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

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

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Appendix I

Sudapur-1 (4D5B4J2b) Microwatershed

Soil Phase Information

Village	Survey Number	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	WELLS	Land Capability	Conservation Plan
Gajarakota	338	2.2	BMNmB2g1	LMU-2	Very deep (>150 cm)	Clay	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Gajarakota	339	2.31	BMNmB2g1	LMU-2	Very deep (>150 cm)	Clay	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Gajarakota	340	1.77	YLRcB2g1	LMU-3	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Trench cum bunding
Gajarakota	341	1.85	BDLcB2g2	LMU-5	Shallow (25-50 cm)	Sandy loam	Very gravelly (35-60%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Blackgram (Rg+Bm)	Not Available	IIIes	Graded bunding
Gajarakota	342	0.8	BDLcB2g2	LMU-5	Shallow (25-50 cm)	Sandy loam	Very gravelly (35-60%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIIes	Graded bunding
Gajarakota	345	0.62	BDLcB2g2	LMU-5	Shallow (25-50 cm)	Sandy loam	Very gravelly (35-60%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIIes	Graded bunding
Gajarakota	346	0.57	BDLcB2g2	LMU-5	Shallow (25-50 cm)	Sandy loam	Very gravelly (35-60%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIIes	Graded bunding
Gajarakota	347	1.64	BDLcB2g2	LMU-5	Shallow (25-50 cm)	Sandy loam	Very gravelly (35-60%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIIes	Graded bunding
Gajarakota	348	6.55	YLRcB2g1	LMU-3	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Blackgram (Rg+Bm)	Not Available	IIes	Trench cum bunding
Gajarakota	349	4.64	BDPiB2	LMU-5	Very shallow (<25 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Blackgram (Rg+Bm)	Not Available	IVes	Trench cum bunding
Gajarakota	350	5.81	BMNmB2g1	LMU-2	Very deep (>150 cm)	Clay	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Greengram (Rg+Gg)	Not Available	IIes	Graded bunding
Gajarakota	351	3.67	BMNmB2g1	LMU-2	Very deep (>150 cm)	Clay	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Cotton (Rg+Ct)	Not Available	IIes	Graded bunding
Gajarakota	352	3.68	BMNmB2g1	LMU-2	Very deep (>150 cm)	Clay	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Gajarakota	353	3.62	BMNmB2g1	LMU-2	Very deep (>150 cm)	Clay	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Blackgram (Rg+Bm)	Not Available	IIes	Graded bunding
Gajarakota	355	0.16	BMNmB2g1	LMU-2	Very deep (>150 cm)	Clay	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Gajarakota	356	0.02	BMNmB2g1	LMU-2	Very deep (>150 cm)	Clay	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kolakundha	438_GRASS_FIELD	10.66	JNKiB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Malyapalli	STREAM	1.18	JNKiB2	LMU-4	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Waterbody	Not Available	IIes	Graded bunding
Malyapalli	154	1.7	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Scrub land (Sl)	Not Available	Rock outcrops	Rock outcrops
Malyapalli	155	1.38	JNKiB2	LMU-4	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Malyapalli	156/1	8.26	JNKiB2	LMU-4	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Blackgram (Rg+Bm)	Not Available	IIes	Graded bunding
Malyapalli	156/2	0.42	JNKiB2	LMU-4	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Blackgram (Rg+Bm)	Not Available	IIes	Graded bunding

Village	Survey Number	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	WELLS	Land Capability	Conservation Plan
Malyapalli	159	1.46	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Redgram+Scrub land (Rg+Sl)	Not Available	Rock outcrops	Rock outcrops
Malyapalli	160	0.62	NGPmB2	LMU-2	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Malyapalli	161	4.33	NGPmB2	LMU-2	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Malyapalli	162	5.68	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Scrub land (Sl)	Not Available	Rock outcrops	Rock outcrops
Malyapalli	163	1.53	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Scrub land (Sl)	Not Available	IIIes	Graded bunding
Malyapalli	164	5.38	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIIes	Graded bunding
Malyapalli	165	6.43	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Blackgram (Rg+Bm)	Not Available	IIIes	Graded bunding
Malyapalli	166	6.51	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Blackgram (Rg+Bm)	Not Available	IIIes	Graded bunding
Malyapalli	167	7.11	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Blackgram (Rg+Bm)	Not Available	IIIes	Graded bunding
Malyapalli	168	4.17	JNKiB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Blackgram (Rg+Bm)	Not Available	IIes	Graded bunding
Malyapalli	169	4.15	JNKiB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Malyapalli	170	5.32	JNKiB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Blackgram (Rg+Bm)	Not Available	IIes	Graded bunding
Malyapalli	171	6.32	JNKiB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Blackgram (Rg+Bm)	Not Available	IIes	Graded bunding
Malyapalli	172	2.17	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIIes	Graded bunding
Malyapalli	173	6.22	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Blackgram (Rg+Bm)	Not Available	IIIes	Graded bunding
Malyapalli	174	6.49	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Blackgram (Rg+Bm)	Not Available	IIIes	Graded bunding
Malyapalli	175	4.28	BDLbB2	LMU-5	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Scrub land (Sl)	Not Available	IIIes	Graded bunding
Malyapalli	176	0.56	JNKiB2	LMU-4	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Malyapalli	177	4.19	JNKiB2	LMU-4	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Greengram (Rg+Gg)	Not Available	IIes	Graded bunding
Malyapalli	178	4.18	JNKiB2	LMU-4	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Greengram (Rg+Gg)	Not Available	IIes	Graded bunding
Malyapalli	179	2.02	JNKiB2	LMU-4	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Malyapalli	183	1.49	JNKiB2	LMU-4	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Malyapalli	184	2.37	JNKiB2	LMU-4	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIes	Graded bunding
Malyapalli	185	4.59	JNKiB2	LMU-4	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy+Greengram+Scrub land (Pd+Gg+Sl)	Not Available	IIes	Graded bunding

Village	Survey Number	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	WELLS	Land Capability	Conservation Plan
Malyapalli	186	0.64	JNKiB2	LMU-4	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Scrub land (Sl)	Not Available	IIes	Graded bunding
Malyapalli	187	0.32	YLRcB2g1	LMU-3	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Scrub land (Sl)	Not Available	IIes	Trench cum bunding
Malyapalli	188	1.31	YLRcB2g1	LMU-3	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Trench cum bunding
Malyapalli	189	3.05	YLRcB2g1	LMU-3	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Trench cum bunding
Malyapalli	190	7.64	YLRcB2g1	LMU-3	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Trench cum bunding
Malyapalli	191	5.25	YLRcB2g1	LMU-3	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Blackgram (Rg+Bm)	Not Available	IIes	Trench cum bunding
Malyapalli	192	1.17	YLRcB2g1	LMU-3	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Scrub land (Sl)	Not Available	IIes	Trench cum bunding
Malyapalli	193	0.57	JNKiB2	LMU-4	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Greengram (Gg)	Not Available	IIes	Graded bunding
Malyapalli	194	0.66	YLRcB2g1	LMU-3	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Greengram (Gg)	Not Available	IIes	Trench cum bunding
Malyapalli	195	4.3	YLRcB2g1	LMU-3	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Greengram (Rg+Gg)	Not Available	IIes	Trench cum bunding
Malyapalli	196	5.51	YLRcB2g1	LMU-3	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Trench cum bunding
Malyapalli	197	4.92	YLRcB2g1	LMU-3	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Blackgram (Rg+Bm)	Not Available	IIes	Trench cum bunding
Malyapalli	198	4.59	JNKiB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Malyapalli	199	1.86	JNKiB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Malyapalli	202	0.53	JNKiB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Malyapalli	205	0.59	YLRcB2g1	LMU-3	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Trench cum bunding
Malyapalli	206	5.08	YLRcB2g1	LMU-3	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Greengram (Rg+Gg)	Not Available	IIes	Trench cum bunding
Malyapalli	207	5.51	YLRcB2g1	LMU-3	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Greengram+Scrub land (Rg+Gg+Sl)	Not Available	IIes	Trench cum bunding
Malyapalli	208	3.78	JNKiB2	LMU-4	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy+Cotton+Scrub land (Pd+Ct+Sl)	Not Available	IIes	Graded bunding
Malyapalli	209	1.26	YLRcB2g1	LMU-3	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIes	Trench cum bunding
Malyapalli	210	1.82	YLRcB2g1	LMU-3	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIes	Trench cum bunding
Dhugan ura	122	1.1	JNKiB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Scrub land (Sl)	Not Available	IIes	Graded bunding
Dhugan ura	123	5.75	JNKiB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Scrub land (Sl)	Not Available	IIes	Graded bunding
Dhugan ura	124	7.28	JNKiB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Scrub land (Rg+Sl)	Not Available	IIes	Graded bunding

Village	Survey Number	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	WELLS	Land Capability	Conservation Plan
Dhugan ura	125	7.59	JNKiB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Scrub land (Rg+Sl)	Not Available	IIes	Graded bunding
Dhugan ura	126	5.27	YLRiB2	LMU-3	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Blackgram (Rg+Bm)	Not Available	IIes	Trench cum bunding
Dhugan ura	127	0.64	YLRiB2	LMU-3	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Trench cum bunding
Dhugan ura	134	0.45	YLRiB2	LMU-3	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Trench cum bunding
Dhugan ura	135	5.57	YLRiB2	LMU-3	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Blackgram (Rg+Bm)	Not Available	IIes	Trench cum bunding
Dhugan ura	136	1.78	BDPhB2	LMU-5	Very shallow (<25 cm)	Sandy clay loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IVes	Trench cum bunding
Dhugan ura	137	3.41	BDPhB2	LMU-5	Very shallow (<25 cm)	Sandy clay loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IVes	Trench cum bunding
Dhugan ura	138	4.36	BDLcB2g2	LMU-5	Shallow (25-50 cm)	Sandy loam	Very gravelly (35-60%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Blackgram (Rg+Bm)	Not Available	IIIes	Graded bunding
Dhugan ura	139	5	BDLcB2g2	LMU-5	Shallow (25-50 cm)	Sandy loam	Very gravelly (35-60%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Blackgram (Rg+Bm)	Not Available	IIIes	Graded bunding
Dhugan ura	140	3.93	BDPhB2	LMU-5	Very shallow (<25 cm)	Sandy clay loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IVes	Trench cum bunding
Dhugan ura	141	4.7	BDPhB2	LMU-5	Very shallow (<25 cm)	Sandy clay loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IVes	Trench cum bunding
Dhugan ura	142	5.9	BDPhB2	LMU-5	Very shallow (<25 cm)	Sandy clay loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Scrub land (Rg+Sl)	Not Available	IVes	Trench cum bunding
Dhugan ura	143	0.41	BDPhB2	LMU-5	Very shallow (<25 cm)	Sandy clay loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IVes	Trench cum bunding
Dhugan ura	150	2.43	BDLcB2g2	LMU-5	Shallow (25-50 cm)	Sandy loam	Very gravelly (35-60%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIIes	Graded bunding
Dhugan ura	157/2	8.69	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Redgram+Scrub land (Rg+Sl)	Not Available	Rock outcrops	Rock outcrops

Appendix II

Sudapur-1 (4D5B4J2b) Microwatershed

Soil Fertility Information

Village	Survey Number	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Gajara kota	338	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Gajara kota	339	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Gajara kota	340	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Gajara kota	341	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Gajara kota	342	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Gajara kota	345	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Gajara kota	346	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Gajara kota	347	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Gajara kota	348	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Gajara kota	349	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Gajara kota	350	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Gajara kota	351	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Gajara kota	352	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Gajara kota	353	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Gajara kota	355	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Gajara kota	356	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kolakundha	438_GRASS_FIELD	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Malyapalli	STREAM	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Malyapalli	154	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops
Malyapalli	155	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Malyapalli	156/1	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Malyapalli	156/2	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)

Village	Survey Number	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Malyapalli	159	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops
Malyapalli	160	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Malyapalli	161	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Malyapalli	162	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Rock outcrops	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Malyapalli	163	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Malyapalli	164	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Malyapalli	165	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Malyapalli	166	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Malyapalli	167	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Malyapalli	168	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Malyapalli	169	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Malyapalli	170	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Malyapalli	171	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Malyapalli	172	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Malyapalli	173	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Malyapalli	174	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Malyapalli	175	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Malyapalli	176	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Malyapalli	177	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Malyapalli	178	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	High (> 20 ppm)	High (> 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Malyapalli	179	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Malyapalli	183	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	High (> 20 ppm)	High (> 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Malyapalli	184	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	High (> 20 ppm)	High (> 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Malyapalli	185	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)

Village	Survey Number	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Malyapalli	186	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Malyapalli	187	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Malyapalli	188	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Malyapalli	189	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Malyapalli	190	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Malyapalli	191	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Malyapalli	192	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Malyapalli	193	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Malyapalli	194	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Malyapalli	195	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Malyapalli	196	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Malyapalli	197	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Malyapalli	198	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Malyapalli	199	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Malyapalli	202	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Malyapalli	205	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Malyapalli	206	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Malyapalli	207	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Malyapalli	208	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	High (> 20 ppm)	High (> 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Malyapalli	209	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	High (> 20 ppm)	High (> 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Malyapalli	210	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	High (> 20 ppm)	High (> 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhuganura	122	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Dhuganura	123	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	Rock outcrops	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Dhuganura	124	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)

Village	Survey Number	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Dhuganura	125	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Dhuganura	126	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Dhuganura	127	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Dhuganura	134	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhuganura	135	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Dhuganura	136	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Dhuganura	137	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhuganura	138	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Dhuganura	139	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Dhuganura	140	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhuganura	141	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhuganura	142	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhuganura	143	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhuganura	150	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Dhuganura	157/2	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops

Appendix III

Sudapur-1 (4D5B4J2b) Microwatershed

Soil Suitability Information

Village	Survey Number	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	Bengalgram	Sunflower	Redgram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Onion	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Brinjal	Bhendi	Drumstick	Mulberry
Gajarakota	338	S3t	S2tz	S3t	S2z	S3tz	S2z	S3z	S2z	S2z	S2z	S2tz	S3z	S3tz	S2z	N1t	S3z	S2z	S3tz	S3t	S2tz	S3t	S2tz	S2tz	S2tz	S2tz	S3t	S2tz	S3z	S3tz
Gajarakota	339	S3t	S2tz	S3t	S2z	S3tz	S2z	S3z	S2z	S2z	S2z	S2tz	S3z	S3tz	S2z	N1t	S3z	S2z	S3tz	S3t	S2tz	S3t	S2tz	S2tz	S2tz	S2tz	S3t	S2tz	S3z	S3tz
Gajarakota	340	N1r	S2rt	S3r	S2r	S3r	S2r	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S3t	S2rg	S2rg	S2rg	S2rg	S2rg	S3r	S2r	S2rg	S2rg	S3r	S3r
Gajarakota	341	N1r	S3rt	N1r	S3rt	N1r	N1t	N1r	N1r	N1t	N1r	N1r	S3rt	N1r	S3rt	N1n	N1r	N1r	S3r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Gajarakota	342	N1r	S3rt	N1r	S3rt	N1r	N1t	N1r	N1r	N1t	N1r	N1r	S3rt	N1r	S3rt	N1n	N1r	N1r	S3r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Gajarakota	345	N1r	S3rt	N1r	S3rt	N1r	N1t	N1r	N1r	N1t	N1r	N1r	S3rt	N1r	S3rt	N1n	N1r	N1r	S3r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Gajarakota	346	N1r	S3rt	N1r	S3rt	N1r	N1t	N1r	N1r	N1t	N1r	N1r	S3rt	N1r	S3rt	N1n	N1r	N1r	S3r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Gajarakota	347	N1r	S3rt	N1r	S3rt	N1r	N1t	N1r	N1r	N1t	N1r	N1r	S3rt	N1r	S3rt	N1n	N1r	N1r	S3r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Gajarakota	348	N1r	S2rt	S3r	S2r	S3r	S2r	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S3t	S2rg	S2rg	S2rg	S2rg	S2rg	S3r	S2r	S2rg	S2rg	S3r	S3r
Gajarakota	349	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r
Gajarakota	350	S3t	S2tz	S3t	S2z	S3tz	S2z	S3z	S2z	S2z	S2z	S2tz	S3z	S3tz	S2z	N1t	S3z	S2z	S3tz	S3t	S2tz	S3t	S2tz	S2tz	S2tz	S2tz	S3t	S2tz	S3z	S3tz
Gajarakota	351	S3t	S2tz	S3t	S2z	S3tz	S2z	S3z	S2z	S2z	S2z	S2tz	S3z	S3tz	S2z	N1t	S3z	S2z	S3tz	S3t	S2tz	S3t	S2tz	S2tz	S2tz	S2tz	S3t	S2tz	S3z	S3tz
Gajarakota	352	S3t	S2tz	S3t	S2z	S3tz	S2z	S3z	S2z	S2z	S2z	S2tz	S3z	S3tz	S2z	N1t	S3z	S2z	S3tz	S3t	S2tz	S3t	S2tz	S2tz	S2tz	S2tz	S3t	S2tz	S3z	S3tz
Gajarakota	353	S3t	S2tz	S3t	S2z	S3tz	S2z	S3z	S2z	S2z	S2z	S2tz	S3z	S3tz	S2z	N1t	S3z	S2z	S3tz	S3t	S2tz	S3t	S2tz	S2tz	S2tz	S2tz	S3t	S2tz	S3z	S3tz
Gajarakota	355	S3t	S2tz	S3t	S2z	S3tz	S2z	S3z	S2z	S2z	S2z	S2tz	S3z	S3tz	S2z	N1t	S3z	S2z	S3tz	S3t	S2tz	S3t	S2tz	S2tz	S2tz	S2tz	S3t	S2tz	S3z	S3tz
Gajarakota	356	S3t	S2tz	S3t	S2z	S3tz	S2z	S3z	S2z	S2z	S2z	S2tz	S3z	S3tz	S2z	N1t	S3z	S2z	S3tz	S3t	S2tz	S3t	S2tz	S2tz	S2tz	S2tz	S3t	S2tz	S3z	S3tz
Kolakundha	438_GRASS_FIELD	N1r	S2r	S3r	S2rt	S3r	S3t	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	N1n	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Malyapalli	STREAM	N1r	S2r	S3r	S2rt	S3r	S3t	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	N1n	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Malyapalli	154	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops
Malyapalli	155	N1r	S2r	S3r	S2rt	S3r	S3t	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	N1n	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Malyapalli	156/1	N1r	S2r	S3r	S2rt	S3r	S3t	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	N1n	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r

Village	Survey Number	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	Bengalgram	Sunflower	Redgram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Onion	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Brinjal	Bhendi	Drumstick	Mulberry
Malyapalli	156/2	N1r	S2r	S3r	S2rt	S3r	S3t	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	N1n	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Malyapalli	159	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops
Malyapalli	160	S3t	S2tz	S3t	S2z	S3tz	S2z	S3z	S2z	S2z	S2z	S2tz	S3z	S3tz	S2z	N1t	S3z	S2z	S3t	S3tz	S2tz	S3t	S2tz	S2tz	S2tz	S2tz	S3t	S2tz	S3z	S3tz
Malyapalli	161	S3t	S2tz	S3t	S2z	S3tz	S2z	S3z	S2z	S2z	S2z	S2tz	S3z	S3tz	S2z	N1t	S3z	S2z	S3t	S3tz	S2tz	S3t	S2tz	S2tz	S2tz	S2tz	S3t	S2tz	S3z	S3tz
Malyapalli	162	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops
Malyapalli	163	N1r	S3rt	N1r	S3rt	N1r	N1t	N1r	N1r	N1t	N1r	N1r	S3rt	N1r	S3rt	N1n	N1r	N1r	S3r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Malyapalli	164	N1r	S3rt	N1r	S3rt	N1r	N1t	N1r	N1r	N1t	N1r	N1r	S3rt	N1r	S3rt	N1n	N1r	N1r	S3r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Malyapalli	165	N1r	S3rt	N1r	S3rt	N1r	N1t	N1r	N1r	N1t	N1r	N1r	S3rt	N1r	S3rt	N1n	N1r	N1r	S3r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Malyapalli	166	N1r	S3rt	N1r	S3rt	N1r	N1t	N1r	N1r	N1t	N1r	N1r	S3rt	N1r	S3rt	N1n	N1r	N1r	S3r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Malyapalli	167	N1r	S3rt	N1r	S3rt	N1r	N1t	N1r	N1r	N1t	N1r	N1r	S3rt	N1r	S3rt	N1n	N1r	N1r	S3r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Malyapalli	168	N1r	S2r	S3r	S2rt	S3r	S3t	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	N1n	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Malyapalli	169	N1r	S2r	S3r	S2rt	S3r	S3t	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	N1n	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Malyapalli	170	N1r	S2r	S3r	S2rt	S3r	S3t	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	N1n	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Malyapalli	171	N1r	S2r	S3r	S2rt	S3r	S3t	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	N1n	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Malyapalli	172	N1r	S3rt	N1r	S3rt	N1r	N1t	N1r	N1r	N1t	N1r	N1r	S3rt	N1r	S3rt	N1n	N1r	N1r	S3r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Malyapalli	173	N1r	S3rt	N1r	S3rt	N1r	N1t	N1r	N1r	N1t	N1r	N1r	S3rt	N1r	S3rt	N1n	N1r	N1r	S3r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Malyapalli	174	N1r	S3rt	N1r	S3rt	N1r	N1t	N1r	N1r	N1t	N1r	N1r	S3rt	N1r	S3rt	N1n	N1r	N1r	S3r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Malyapalli	175	N1r	S3rt	N1r	S3rt	N1r	N1t	N1r	N1r	N1t	N1r	N1r	S3rt	N1r	S3rt	N1n	N1r	N1r	S3r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Malyapalli	176	N1r	S2r	S3r	S2rt	S3r	S3t	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	N1n	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Malyapalli	177	N1r	S2r	S3r	S2rt	S3r	S3t	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	N1n	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Malyapalli	178	N1r	S2r	S3r	S2rt	S3r	S3t	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	N1n	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Malyapalli	179	N1r	S2r	S3r	S2rt	S3r	S3t	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	N1n	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Malyapalli	183	N1r	S2r	S3r	S2rt	S3r	S3t	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	N1n	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Malyapalli	184	N1r	S2r	S3r	S2rt	S3r	S3t	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	N1n	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r

Village	Survey Number	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	Bengalgram	Sunflower	Redgram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Onion	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Brinjal	Bhendi	Drumstick	Mulberry
Malyapalli	185	N1r	S2r	S3r	S2rt	S3r	S3t	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	N1n	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Malyapalli	186	N1r	S2r	S3r	S2rt	S3r	S3t	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	N1n	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Malyapalli	187	N1r	S2rt	S3r	S2r	S3r	S2r	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S3t	S2rg	S2rg	S2rg	S2rg	S2rg	S3r	S2r	S2rg	S2rg	S3r	S3r
Malyapalli	188	N1r	S2rt	S3r	S2r	S3r	S2r	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S3t	S2rg	S2rg	S2rg	S2rg	S2rg	S3r	S2r	S2rg	S2rg	S3r	S3r
Malyapalli	189	N1r	S2rt	S3r	S2r	S3r	S2r	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S3t	S2rg	S2rg	S2rg	S2rg	S2rg	S3r	S2r	S2rg	S2rg	S3r	S3r
Malyapalli	190	N1r	S2rt	S3r	S2r	S3r	S2r	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S3t	S2rg	S2rg	S2rg	S2rg	S2rg	S3r	S2r	S2rg	S2rg	S3r	S3r
Malyapalli	191	N1r	S2rt	S3r	S2r	S3r	S2r	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S3t	S2rg	S2rg	S2rg	S2rg	S2rg	S3r	S2r	S2rg	S2rg	S3r	S3r
Malyapalli	192	N1r	S2rt	S3r	S2r	S3r	S2r	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S3t	S2rg	S2rg	S2rg	S2rg	S2rg	S3r	S2r	S2rg	S2rg	S3r	S3r
Malyapalli	193	N1r	S2r	S3r	S2rt	S3r	S3t	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	N1n	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Malyapalli	194	N1r	S2rt	S3r	S2r	S3r	S2r	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S3t	S2rg	S2rg	S2rg	S2rg	S2rg	S3r	S2r	S2rg	S2rg	S3r	S3r
Malyapalli	195	N1r	S2rt	S3r	S2r	S3r	S2r	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S3t	S2rg	S2rg	S2rg	S2rg	S2rg	S3r	S2r	S2rg	S2rg	S3r	S3r
Malyapalli	196	N1r	S2rt	S3r	S2r	S3r	S2r	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S3t	S2rg	S2rg	S2rg	S2rg	S2rg	S3r	S2r	S2rg	S2rg	S3r	S3r
Malyapalli	197	N1r	S2rt	S3r	S2r	S3r	S2r	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S3t	S2rg	S2rg	S2rg	S2rg	S2rg	S3r	S2r	S2rg	S2rg	S3r	S3r
Malyapalli	198	N1r	S2r	S3r	S2rt	S3r	S3t	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	N1n	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Malyapalli	199	N1r	S2r	S3r	S2rt	S3r	S3t	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	N1n	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Malyapalli	202	N1r	S2r	S3r	S2rt	S3r	S3t	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	N1n	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Malyapalli	205	N1r	S2rt	S3r	S2r	S3r	S2r	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S3t	S2rg	S2rg	S2rg	S2rg	S2rg	S3r	S2r	S2rg	S2rg	S3r	S3r
Malyapalli	206	N1r	S2rt	S3r	S2r	S3r	S2r	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S3t	S2rg	S2rg	S2rg	S2rg	S2rg	S3r	S2r	S2rg	S2rg	S3r	S3r
Malyapalli	207	N1r	S2rt	S3r	S2r	S3r	S2r	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S3t	S2rg	S2rg	S2rg	S2rg	S2rg	S3r	S2r	S2rg	S2rg	S3r	S3r
Malyapalli	208	N1r	S2r	S3r	S2rt	S3r	S3t	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	N1n	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Malyapalli	209	N1r	S2rt	S3r	S2r	S3r	S2r	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S3t	S2rg	S2rg	S2rg	S2rg	S2rg	S3r	S2r	S2rg	S2rg	S3r	S3r
Malyapalli	210	N1r	S2rt	S3r	S2r	S3r	S2r	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S3t	S2rg	S2rg	S2rg	S2rg	S2rg	S3r	S2r	S2rg	S2rg	S3r	S3r
Dhuganura	122	N1r	S2r	S3r	S2rt	S3r	S3t	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	N1n	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Dhuganura	123	N1r	S2r	S3r	S2rt	S3r	S3t	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	N1n	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Dhuganura	124	N1r	S2r	S3r	S2rt	S3r	S3t	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	N1n	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Dhuganura	125	N1r	S2r	S3r	S2rt	S3r	S3t	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	N1n	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r

Village	Survey Number	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	Bengalgram	Sunflower	Redgram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Onion	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Brinjal	Bhendi	Drumstick	Mulberry
Dhuganura	126	N1r	S2rt	S3r	S2r	S3r	S2r	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S3t	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Dhuganura	127	N1r	S2rt	S3r	S2r	S3r	S2r	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S3t	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Dhuganura	134	N1r	S2rt	S3r	S2r	S3r	S2r	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S3t	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Dhuganura	135	N1r	S2rt	S3r	S2r	S3r	S2r	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S3t	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Dhuganura	136	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r
Dhuganura	137	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r
Dhuganura	138	N1r	S3rt	N1r	S3rt	N1r	N1t	N1r	N1r	N1t	N1r	N1r	S3rt	N1r	S3rt	N1n	N1r	N1r	S3r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Dhuganura	139	N1r	S3rt	N1r	S3rt	N1r	N1t	N1r	N1r	N1t	N1r	N1r	S3rt	N1r	S3rt	N1n	N1r	N1r	S3r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Dhuganura	140	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r
Dhuganura	141	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r
Dhuganura	142	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r
Dhuganura	143	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r
Dhuganura	150	N1r	S3rt	N1r	S3rt	N1r	N1t	N1r	N1r	N1t	N1r	N1r	S3rt	N1r	S3rt	N1n	N1r	N1r	S3r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Dhuganura	157/2	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops

PART-B

SOCIO-ECONOMIC STATUS OF FARM HOUSEHOLDS

CONTENTS

LIST OF TABLES

Chapter 1

SALIENT FINDINGS OF THE SURVEY

- *The data indicated that there were 98 (53.85%) men and 84 (46.15%) women among the sampled households.*
- *The average family size of landless farmers' was 3.4, marginal farmers' was 5, small farmers' was 6.71, semi medium farmers' was 6.71 and medium farmers' was 5.5.*
- *The data indicated that, 28 (15.38%) people were in 0-15 years of age, 79 (43.41%) were in 16-35 years of age, 60 (32.97%) were in 36-60 years of age and 15 (8.24%) were above 61 years of age.*
- *The results indicated that Sudapur-1 had 56.59 per cent illiterates, 14.84 per cent of them had primary school education, 7.69 per cent of them had middle school education, 8.24 per cent of them had high school education, 3.85 per cent of them had PUC education, 3.30 per cent of them had degree education and 1.65 per cent did masters.*
- *The results indicate that, 90.91 per cent of households were practicing agriculture, 15.15 per cent of the households were agricultural labourers and 3.03 per cent of them were housewives.*
- *The results indicate that agriculture was the major occupation for 60.99 per cent of the household members, 4.40 per cent were agricultural laborers, 2.75 per cent were general labourers, 0.55 per cent were in government service, 2.75 per cent were in private service, 21.43 per cent were students, 3.30 per cent were housewives and 3.85 per cent were children.*
- *The results show that 100 per cent of the population in the micro watershed has not participated in any local institutions.*
- *The results indicate that 6.06 per cent of the households possess thatched house, 72.73 per cent of the households possess katcha house and 21.21 per cent of them possess pucca house.*
- *The results show that 60.61 per cent of the households possess TV, 3.03 per cent of the households possess DVD/VCD player, 3.03 per cent of the households possess mixer/grinder, 6.06 per cent of the households possess refrigerator, 33.33 per cent of the households possess motor cycle, 6.06 per cent of them own car/four wheeler, 3.03 per cent had landline phone and computer/laptop and 93.94 per cent of the households possess mobile phones.*
- *The results show that the average value of television was Rs. 7,200, DVD/VCD player was Rs. 3,000, mixer/grinder was Rs.2,500, refrigerator was Rs. 12,500, motor cycle was Rs. 33,181, car/four wheeler was Rs. 66,666, landline was Rs. 2,000, computer/laptop was Rs. 25,000 and mobile phone was Rs. 1,833.*
- *About 21.21 per cent of the households possess bullock cart, 27.27 per cent of the households possess plough, 15.15 per cent of them possess seed/fertilizer drill, 6.06 per cent of them were in tractor, 60.61 per cent of them possess sprayer, 12.12 per*

cent of them possess sprinkler, 3.03 per cent of them thresher and 57.58 per cent of them possess weeder.

- *The results show that the average value of bullock cart was Rs. 8,142, plough was Rs.2,000, seed/fertilizer drill was Rs. 2,800, tractor was Rs.600,000, the average value of sprayer was Rs. 3,535, sprinkler was Rs. 10,000, the average value of weeder was Rs.63 and thresher was Rs. 15,000.*
- *The results indicate that, 30.30 per cent of the households possess bullocks, 24.24 per cent of the households possess local cow, 21.21 per cent of them possess buffalo, 3.03 per cent of them possess sheep and 18.18 per cent of them possess goat and poultry birds.*
- *The results indicate that, average own labour men available in the micro watershed was 2.14, average own labour (women) available was 1.86, average hired labour (men) available was 8.89 and average hired labour (women) available was 8.61.*
- *The results indicate that, 84.85 per cent of the households opined that the hired labour was adequate.*
- *The results indicate that, households of the Sudapur-1 micro-watershed possess 27.11 ha (75.62%) of dry land and 8.74 ha (24.38%) of irrigated land. Marginal farmers possess 6.61 ha (94.23%) of dry land and 0.40 ha (5.77%) of irrigated land. Small farmers possess 7.30 ha (81.85%) of dry land and 1.62 ha (18.15%) of irrigated land. Semi medium farmers possess 8.61 ha (65.31%) of dry land and 4.75 ha (34.69%) of irrigated land. Medium farmers possess 4.59 ha (68.17%) of dry land and 2.14 ha (31.84%) of irrigated land.*
- *The results indicate that, the average value of dry land was Rs. 527,336.52 and average value of irrigated land was Rs. 732,190.83. In case of marginal famers, the average land value was Rs. 1,118,604.66 for dry land and Rs. 1,976,000 for irrigated land. In case of small famers, the average land value was Rs. 424,445.68 for dry land and Rs. 802,750 for irrigated land. In case of semi medium famers, the average land value was Rs. 359,990.60 for dry land and Rs. 765,044.25 for irrigated land. In case of medium farmers, the average land value was Rs. 527,336.52 for dry land and Rs. 373,534.97 for irrigated land.*
- *The results indicate that, there were 7 functioning bore wells in the micro watershed.*
- *The results indicate that, bore well was the major irrigation source in the micro water shed for 21.21 per cent of the farmers.*
- *The results indicate that, the depth of bore well was found to be 11.87 meters.*
- *The results indicate that, marginal, small and semi medium farmers had an irrigated area of 0.40 ha, 1.21 ha and 4.57 ha respectively.*
- *The results indicate that, farmers have grown cotton (1.21 ha), greengram (7.56 ha), groundut (1.21 ha), paddy (1.62 ha), redgram (21.77 ha) and sorghum (3.36 ha). Marginal farmers have grown redgram and greengram. Small farmers had grown cotton, greengram and redgram. Semi medium farmers had grown cotton,*

greengram, groundnut, paddy, redgram and sorghum. Medium farmers had grown redgram and sorghum.

- *The results indicate that, the cropping intensity in Sudapur-1 micro-watershed was found to be 68.82 per cent.*
- *The results indicate that, 66.67 per cent of the households have bank account.*
- *The results indicate that, 69.70 per cent of the households have availed credit from different sources.*
- *The results indicate that, the total cost of cultivation for greengram was Rs. 29295.51. The gross income realized by the farmers was Rs. 55618.78. The net income from Greengram cultivation was Rs. 26323.27, thus the benefit cost ratio was found to be 1:1.9.*
- *The total cost of cultivation for Paddy was Rs. 55852.80. The gross income realized by the farmers was Rs. 96968.08. The net income from Paddy cultivation was Rs. 41115.28. Thus the benefit cost ratio was found to be 1:1.74.*
- *The total cost of cultivation for groundnut was Rs. 36908.45. The gross income realized by the farmers was Rs. 70395. The net income from groundnut cultivation was Rs. 33486.55. Thus the benefit cost ratio was found to be 1:1.91.*
- *The total cost of cultivation for cotton was Rs. 41889.19. The gross income realized by the farmers was Rs. 108680. The net income from cotton cultivation was Rs. 66790.81. Thus the benefit cost ratio was found to be 1:2.59.*
- *The total cost of cultivation for red gram was Rs. 28899.40. The gross income realized by the farmers was Rs. 62070.22. The net income from red gram cultivation was Rs. 33170.83. Thus the benefit cost ratio was found to be 1:2.15.*
- *The total cost of cultivation for sorghum was Rs. 20454.68. The gross income realized by the farmers was Rs. 34086. The net income from sorghum cultivation was Rs. 13631.32. Thus the benefit cost ratio was found to be 1:1.67.*
- *The results indicate that, 39.39 per cent of the households opined that dry fodder was adequate and 3.03 per cent of the households opined that green fodder was adequate.*
- *The results indicate that the annual gross income was Rs. 118,000 for landless farmers, for marginal farmers it was Rs. 116,060.83, for small farmers it was Rs. 165,514.29, for semi medium farmers it was Rs. 194,208.57 and for medium farmers it was Rs. 286,250.*
- *The results indicate that the average annual expenditure is Rs. 15,952.30. For landless households it was Rs. 9,920, for marginal farmers it was Rs. 8,336.17, for small farmers it was Rs. 14,204.08, for semi medium farmers it was Rs. 21,605.44 and for medium farmers it was Rs. 63,062.50.*
- *The results indicate that, sampled households have grown 1 coconut tree, 121 custard apple, 1 guava and 6 mango trees in the field. Also, 2 guava and 1 lemon tree in the backyard.*

- *The results indicate that, households have planted 98 neem trees, 3 tamarind trees, 1 teak and 1 acacia tree in their field and 4 neem trees in their backyard.*
- *The results indicated that, households have an average investment capacity of Rs. 11,666.67 for land development, Rs. 27,272.73 for irrigation facility and Rs. 757.58 for improved crop production.*
- *The results indicated that government subsidy was the source of additional investment for 3.03 per cent for land development and 3.03 per cent for irrigation facility. Loan from bank was the source of additional investment for 12.12 per cent for land development, for 18.18 per cent for irrigation facility and for 6.06 per cent for improved crop production. Own funds was the source of additional investment for 12.12 per cent for land development and 6.06 per cent for irrigation facility. Soft loan was the source of additional investment for 3.03 per cent for improved crop production.*
- *The results indicated that, cotton was sold to the extent of 100 per cent, greengram was sold to the extent of 92.67 per cent, groundnut was sold to the extent of 93.33 per cent, paddy was sold to the extent of 100 per cent, redgram was sold to the extent of 84.69 per cent and sorghum was sold to the extent of 100 per cent.*
- *The results indicated that, about 100 per cent of the farmers sold their produce to local/village merchants.*
- *The results indicated that, 100 per cent of the households have used tractor as a mode of transportation for their agricultural produce.*
- *The results indicated that, 69.70 per cent of the households have experienced soil and water erosion problems in the farm.*
- *The results indicated that, 84.85 per cent have shown interest in soil test.*
- *The results indicated that, 81.82 per cent of the households used firewood and 18.18 per cent used LPG as a source of fuel.*
- *The results indicated that, piped supply was the major source of drinking water for 100 per cent of the households in the micro watershed.*
- *Electricity was the major source of light for 100 per cent of the households in micro watershed.*
- *The results indicated that, 60.61 per cent of the households possess sanitary toilet.*
- *The results indicated that, 100 per cent of the sampled households possessed BPL card.*
- *The results indicated that, 78.79 per cent of the households participated in NREGA programme.*
- *The results indicated that, cereals were adequate for 100 per cent of the households, pulses were adequate for 100 per cent, oilseeds were adequate for 21.21 per cent, vegetables were adequate for 87.88 per cent, milk was adequate for 96.97 per cent and eggs were adequate for 18.18 per cent.*

- *The results indicated that, oilseeds were inadequate for 84.85 per cent, vegetables were inadequate for 12.12 per cent, fruits were inadequate for 100 per cent, eggs were inadequate for 81.82 per cent and meat was inadequate for 100 per cent of the households.*
- *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 (84.85%), inadequacy of irrigation water (27.27%), high cost of fertilizers and plant protection chemicals (81.82%), high rate of interest on credit (78.79%), low price for the agricultural commodities (78.79%), lack of marketing facilities in the area (75.76%), inadequate extension services (9.09%), lack of transport for the safe transport of agricultural produce to the market (30.30%) and source of agri technology information (3.03%).*

Chapter 2

INTRODUCTION

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

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

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

Scope and importance of survey

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

Chapter 3

METHODOLOGY

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

Description of the study area

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 agglomerations 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%.

Description of the micro watershed

Sudapur-1 micro-watershed in Duganur sub-watershed (Yadgir taluk and district) is located in between $16^0$56’11’’ to 16^0 55’9.728” North latitudes and 77^0 19’56.238’’ to 77^0 18’24.694’’ East longitudes, covering an area of about 253.47 ha, bounded by Gajarakota and Siddapura.B villages.

Methodology followed in assessing socio-economic status of households

In order to assess the socio-economic condition of the farmers in the watershed a comprehensive questionnaire was prepared. Major components such as demographic conditions, migration details, food consumption and family expenditure pattern, material possession, land holding, land use management, cropping pattern, cost of cultivation of crops, livestock management. The statistical components such as frequency and percentage were used to analyse the data. About 33 households located in the micro-watershed were interviewed for the survey.

SALIENT FEATURES OF THE SURVEY

Households sampled for socio-economic survey: The data on households sampled for socio economic survey in Sudapur-1 micro-watershed is presented in Table 1 and it indicated that 33 farmers were sampled in Sudapur-1 micro-watershed among them 5 (15.15%) were landless, 12 (36.36%) were marginal farmers, 7 (21.21%) were small farmers, 7 (21.21%) were semi medium farmers and 2 (6.06%) were medium farmers.

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

Sl.No.	Particulars	LL (5)		MF (12)		SF (7)		SMF (7)		MDF (2)		All (33)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Farmers	5	15.15	12	36.36	7	21.21	7	21.21	2	6.06	33	100.00

Population characteristics: The population characteristics of households sampled for socio-economic survey in Sudapur-1 micro-watershed is presented in Table 2. The data indicated that there were 98 (53.85%) men and 84 (46.15%) women among the sampled households. The average family size of landless farmers' was 3.4, marginal farmers' was 5, small farmers' was 6.71, semi medium farmers' was 6.71 and medium farmers' was 5.5.

Table 2: Population characteristics of Sudapur-1 micro-watershed

Sl.No.	Particulars	LL (17)		MF (59)		SF (48)		SMF (47)		MDF (11)		All (182)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Men	9	52.94	31	52.54	28	58.33	22	46.81	8	72.73	98	53.85
2	Women	8	47.06	28	47.46	20	41.67	25	53.19	3	27.27	84	46.15
Total		17	100.00	59	100.00	48	100.00	47	100.00	11	100.00	182	100.00
Average		3.4		5		6.71		6.71		5.5		5.5	

Age wise classification of population: The age wise classification of household members in Sudapur-1 micro-watershed is presented in Table 3. The data indicated that, 28 (15.38%) people were in 0-15 years of age, 79 (43.41%) were in 16-35 years of age, 60 (32.97%) were in 36-60 years of age and 15 (8.24%) were above 61 years of age.

Table 3: Age wise classification of household members in Sudapur-1 micro-watershed

Sl.No.	Particulars	LL (17)		MF (59)		SF (48)		SMF (47)		MDF (11)		All (182)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	0-15 years of age	3	17.65	7	11.86	10	20.83	8	17.02	0	0.00	28	15.38
2	16-35 years of age	7	41.18	26	44.07	20	41.67	23	48.94	3	27.27	79	43.41
3	36-60 years of age	6	35.29	21	35.59	14	29.17	12	25.53	7	63.64	60	32.97
4	> 61 years	1	5.88	5	8.47	4	8.33	4	8.51	1	9.09	15	8.24
Total		17	100.00	59	100.00	48	100.00	47	100.00	11	100.00	182	100.00

Education level of household members: Education level of household members in Sudapur-1 micro-watershed is presented in Table 4. The results indicated that Sudapur-1 had 56.59 per cent illiterates, 14.84 per cent of them had primary school education, 7.69

per cent of them had middle school education, 8.24 per cent of them had high school education, 3.85 per cent of them had PUC education, 3.30 per cent of them had degree education and 1.65 per cent did masters.

Table 4. Education level of household members in Sudapur-1 micro-watershed

Sl.No.	Particulars	LL (17)		MF (59)		SF (48)		SMF (47)		MDF (11)		All (182)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Illiterate	8	47.06	37	62.71	29	60.42	28	59.57	1	9.09	103	56.59
2	Primary School	3	17.65	7	11.86	9	18.75	6	12.77	2	18.18	27	14.84
3	Middle School	4	23.53	1	1.69	2	4.17	3	6.38	4	36.36	14	7.69
4	High School	0	0.00	6	10.17	4	8.33	5	10.64	0	0.00	15	8.24
5	PUC	1	5.88	4	6.78	0	0.00	0	0.00	2	18.18	7	3.85
6	Degree	1	5.88	2	3.39	0	0.00	1	2.13	2	18.18	6	3.30
7	Masters	0	0.00	0	0.00	1	2.08	2	4.26	0	0.00	3	1.65
8	Others	0	0.00	2	3.39	3	6.25	2	4.26	0	0.00	7	3.85
Total		17	100.00	59	100.00	48	100.00	47	100.00	11	100.00	182	100.00

Occupation of household heads: The data regarding the occupation of the household heads in Sudapur-1 micro-watershed is presented in Table 5. The results indicate that, 90.91 per cent of households were practicing agriculture, 15.15 per cent of the households were agricultural labourers and 3.03 per cent of them were housewives.

Table 5: Occupation of household heads in Sudapur-1 micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (7)		SMF (7)		MDF (2)		All (33)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Agriculture	0	0.00	13	108.33	7	100.00	7	100.00	3	150.00	30	90.91
2	Agricultural Labour	4	80.00	1	8.33	0	0.00	0	0.00	0	0.00	5	15.15
3	Housewife	1	20.00	0	0.00	0	0.00	0	0.00	0	0.00	1	3.03
Total		5	100.00	14	100.00	7	100.00	7	100.00	3	100.00	36	100.00

Table 6: Occupation of family members in Sudapur-1 micro-watershed

Sl. No.	Particulars	LL (17)		MF (59)		SF (48)		SMF(47)		MDF(11)		All (182)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Agriculture	0	0.00	40	67.80	32	66.67	30	63.83	9	81.82	111	60.99
2	Agricultural Labour	6	35.29	2	3.39	0	0.00	0	0.00	0	0.00	8	4.40
3	General Labour	5	29.41	0	0.00	0	0.00	0	0.00	0	0.00	5	2.75
4	Government Service	0	0.00	1	1.69	0	0.00	0	0.00	0	0.00	1	0.55
5	Private Service	1	5.88	2	3.39	0	0.00	2	4.26	0	0.00	5	2.75
6	Student	3	17.65	11	18.64	13	27.08	10	21.28	2	18.18	39	21.43
7	Housewife	2	11.76	1	1.69	0	0.00	3	6.38	0	0.00	6	3.30
8	Children	0	0.00	2	3.39	3	6.25	2	4.26	0	0.00	7	3.85
Total		17	100.00	59	100.00	48	100.00	47	100.00	11	100.00	182	100.00

Occupation of the household members: The data regarding the occupation of the household members in Sudapur-1 micro-watershed is presented in Table 6. The results indicate that agriculture was the major occupation for 60.99 per cent of the household members, 4.40 per cent were agricultural laborers, 2.75 per cent were general labourers,

0.55 per cent were in government service, 2.75 per cent were in private service, 21.43 per cent were students, 3.30 per cent were housewives and 3.85 per cent were children.

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

Table 7. Institutional Participation of household members in Sudapur-1 micro-watershed

Sl.No.	Particulars	LL (17)		MF (59)		SF (48)		SMF (47)		MDF (11)		All (182)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	No Participation	17	100.00	59	100.00	48	100.00	47	100.00	11	100.00	182	100.00
Total		17	100.00	59	100.00	48	100.00	47	100.00	11	100.00	182	100.00

Type of house owned: The data regarding the type of house owned by the households in Sudapur-1 micro-watershed is presented in Table 8. The results indicate that 6.06 per cent of the households possess thatched house, 72.73 per cent of the households possess katcha house and 21.21 per cent of them possess pucca house.

Table 8. Type of house owned by households in Sudapur-1 micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (7)		SMF (7)		MDF (2)		All (33)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Thatched	1	20.00	1	8.33	0	0.00	0	0.00	0	0.00	2	6.06
2	Katcha	4	80.00	7	58.33	6	85.71	7	100.00	0	0.00	24	72.73
3	Pucca/RCC	0	0.00	4	33.33	1	14.29	0	0.00	2	100.00	7	21.21
Total		5	100.00	12	100.00	7	100.00	7	100.00	2	100.00	33	100.00

Table 9. Durable Assets owned by households in Sudapur-1 micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (7)		SMF (7)		MDF (2)		All (33)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Television	4	80.00	7	58.33	4	57.14	3	42.86	2	100.00	20	60.61
2	DVD/VCD Player	0	0.00	1	8.33	0	0.00	0	0.00	0	0.00	1	3.03
3	Mixer/Grinder	0	0.00	1	8.33	0	0.00	0	0.00	0	0.00	1	3.03
4	Refrigerator	0	0.00	2	16.67	0	0.00	0	0.00	0	0.00	2	6.06
5	Motor Cycle	1	20.00	3	25.00	1	14.29	5	71.43	1	50.00	11	33.33
6	Car/Four Wheeler	0	0.00	1	8.33	0	0.00	1	14.29	0	0.00	2	6.06
7	Landline Phone	0	0.00	0	0.00	1	14.29	0	0.00	0	0.00	1	3.03
8	Mobile Phone	4	80.00	12	100.00	6	85.71	7	100.00	2	100.00	31	93.94
9	Computer/Laptop	0	0.00	0	0.00	0	0.00	1	14.29	0	0.00	1	3.03
10	Blank	1	20.00	0	0.00	0	0.00	0	0.00	0	0.00	1	3.03

Durable Assets owned by the households: The data regarding the Durable Assets owned by the households in Sudapur-1 micro-watershed is presented in Table 9. The results show that 60.61 per cent of the households possess TV, 3.03 per cent of the households possess DVD/VCD player, 3.03 per cent of the households possess mixer/grinder, 6.06 per cent of the households possess refrigerator, 33.33 per cent of the households possess motor cycle, 6.06 per cent of them own car/four wheeler, 3.03 per

cent had landline phone and computer/laptop and 93.94 per cent of the households possess mobile phones.

Average value of durable assets: The data regarding the average value of durable assets owned by the households in Sudapur-1 micro-watershed is presented in Table 10. The results show that the average value of television was Rs. 7,200, DVD/VCD player was Rs. 3,000, mixer/grinder was Rs. 2,500, refrigerator was Rs. 12,500, motor cycle was Rs. 33,181, car/four wheeler was Rs. 66,666, landline was Rs. 2,000, computer/laptop was Rs. 25,000 and mobile phone was Rs. 1,833.

Table 10. Average value of durable assets owned by households in Sudapur-1 micro-watershed

Average value (Rs.)

Sl.No.	Particulars	LL (5)	MF (12)	SF (7)	SMF (7)	MDF (2)	All (33)
1	Television	5,875.00	7,214.00	7,000.00	8,333.00	8,500.00	7,200.00
2	DVD/VCD Player	0.00	3,000.00	0.00	0.00	0.00	3,000.00
3	Mixer/Grinder	0.00	2,500.00	0.00	0.00	0.00	2,500.00
4	Refrigerator	0.00	12,500.00	0.00	0.00	0.00	12,500.00
5	Motor Cycle	60,000.00	38,333.00	25,000.00	26,000.00	35,000.00	33,181.00
6	Car/Four Wheeler	0.00	150,000.00	0.00	25,000.00	0.00	66,666.00
7	Landline Phone	0.00	0.00	2,000.00	0.00	0.00	2,000.00
8	Mobile Phone	2,000.00	1,846.00	2,000.00	1,454.00	3,000.00	1,833.00
9	Computer/Laptop	0.00	0.00	0.00	25,000.00	0.00	25,000.00

Farm Implements owned: The data regarding the farm implements owned by the households in Sudapur-1 micro-watershed is presented in Table 11. About 21.21 per cent of the households possess bullock cart, 27.27 per cent of the households possess plough, 15.15 per cent of them possess seed/fertilizer drill, 6.06 per cent of them were in tractor, 60.61 per cent of them possess sprayer, 12.12 per cent of them possess sprinkler, 3.03 per cent of them thresher and 57.58 per cent of them possess weeder.

Table 11. Farm Implements owned by households in Sudapur-1 micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (7)		SMF (7)		MDF (2)		All (33)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Bullock Cart	0	0	0	0	3	42.86	3	42.86	1	50	7	21.21
2	Plough	0	0	2	16.67	2	28.57	4	57.14	1	50	9	27.27
3	Seed/Fertilizer Drill	0	0	2	16.67	0	0	2	28.57	1	50	5	15.15
4	Tractor	0	0	0	0	0	0	2	28.57	0	0	2	6.06
5	Sprayer	0	0	8	66.67	5	71.43	6	85.71	1	50	20	60.61
6	Sprinkler	0	0	2	16.67	1	14.29	1	14.29	0	0	4	12.12
7	Weeder	0	0	7	58.33	5	71.43	5	71.43	2	100	19	57.58
8	Thresher	0	0	0	0	0	0	1	14.29	0	0	1	3.03
9	Blank	5	100	2	16.67	1	14.29	1	14.29	0	0	9	27.27

Average value of farm implements: The data regarding the average value of farm Implements owned by the households in Sudapur-1 micro-watershed is presented in Table 12. The results show that the average value of bullock cart was Rs. 8,142, plough was Rs. 2,000, seed/fertilizer drill was Rs. 2,800, tractor was Rs. 600,000, the average value of

sprayer was Rs. 3,535, sprinkler was Rs. 10,000, the average value of weeder was Rs.63 and thresher was Rs. 15,000.

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

Sl.No.	Particulars	LL (5)	MF (12)	SF (7)	SMF (7)	MDF (2)	All (33)
1	Bullock Cart	0.00	0.00	1,666.00	12,333.00	15,000.00	8,142.00
2	Plough	0.00	2,250.00	1,000.00	1,875.00	4,000.00	2,000.00
3	Seed/Fertilizer Drill	0.00	2,750.00	0.00	2,500.00	3,500.00	2,800.00
4	Tractor	0.00	0.00	0.00	600,000.00	0.00	600,000.00
5	Sprayer	0.00	3,325.00	4,000.00	3,600.00	2,500.00	3,535.00
6	Sprinkler	0.00	10,000.00	10,000.00	10,000.00	0.00	10,000.00
7	Weeder	0.00	100.00	83.00	38.00	40.00	63.00
8	Thresher	0.00	0.00	0.00	15,000.00	0.00	15,000.00

Livestock possession by the households: The data regarding the Livestock possession by the households in Sudapur-1 micro-watershed is presented in Table 13. The results indicate that, 30.30 per cent of the households possess bullocks, 24.24 per cent of the households possess local cow, 21.21 per cent of them possess buffalo, 3.03 per cent of them possess sheep and 18.18 per cent of them possess goat and poultry birds.

Table 13. Livestock possession by households in Sudapur-1 micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (7)		SMF (7)		MDF (2)		All (33)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Bullock	0	0.00	2	16.67	3	42.86	4	57.14	1	50.00	10	30.30
2	Local cow	1	20.00	2	16.67	1	14.29	4	57.14	0	0.00	8	24.24
3	Buffalo	1	20.00	2	16.67	0	0.00	3	42.86	1	50.00	7	21.21
4	Sheep	0	0.00	0	0.00	0	0.00	1	14.29	0	0.00	1	3.03
5	Goat	0	0.00	1	8.33	2	28.57	3	42.86	0	0.00	6	18.18
6	Poultry birds	0	0.00	3	25.00	1	14.29	2	28.57	0	0.00	6	18.18
7	blank	4	80.00	7	58.33	3	42.86	2	28.57	1	50.00	17	51.52

Average Labour availability: The data regarding the average labour availability in Sudapur-1 micro-watershed is presented in Table 14. The results indicate that, average own labour men available in the micro watershed was 2.14, average own labour (women) available was 1.86, average hired labour (men) available was 8.89 and average hired labour (women) available was 8.61.

In case of marginal farmers, average own labour men available was 1.58, average own labour (women) was 1.58, average hired labour (men) was 8.42 and average hired labour (women) available was 8.83. In case of small farmers, average own labour men available was 2.86, average own labour (women) was 2.14, average hired labour (men) was 7.43 and average hired labour (women) available was 6.71. In case of semi medium farmers, average own labour men available was 2.29, average own labour (women) was 2.14, average hired labour (men) was 9.43 and average hired labour (women) available was 9. In case of medium farmers, average own labour men available was 4, average own

labour (women) was 1, average hired labour (men) was 10 and average hired labour (women) available was 10.

Table 14. Average Labour availability in Sudapur-1 micro-watershed

Sl.No.	Particulars	LL (5)	MF (12)	SF (7)	SMF (7)	MDF (2)	All (33)
		N	N	N	N	N	N
1	Hired labour Female	15.00	8.83	6.71	9.00	10.00	8.61
2	Own Labour Female	2.00	1.58	2.14	2.14	1.00	1.86
3	Own labour Male	1.00	1.58	2.86	2.29	4.00	2.14
4	Hired labour Male	20.00	8.42	7.43	9.43	10.00	8.89

Adequacy of Hired Labour: The data regarding the adequacy of hired labour in Sudapur-1 micro-watershed is presented in Table 15. The results indicate that, 84.85 per cent of the households opined that the hired labour was adequate.

Table 15. Adequacy of Hired Labour in Sudapur-1 micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (7)		SMF (7)		MDF (2)		All (33)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Adequate	1	20.00	12	100.00	7	100.00	7	100.00	1	50.00	28	84.85

Distribution of land (ha): The data regarding the distribution of land (ha) in Sudapur-1 micro-watershed is presented in Table 16. The results indicate that, households of the Sudapur-1 micro-watershed possess 27.11 ha (75.62%) of dry land and 8.74 ha (24.38%) of irrigated land. Marginal farmers possess 6.61 ha (94.23%) of dry land and 0.40 ha (5.77%) of irrigated land. Small farmers possess 7.30 ha (81.85%) of dry land and 1.62 ha (18.15%) of irrigated land. Semi medium farmers possess 8.61 ha (65.31%) of dry land and 4.75 ha (34.69%) of irrigated land. Medium farmers possess 4.59 ha (68.17%) of dry land and 2.14 ha (31.84%) of irrigated land.

Table 16. Distribution of land (Ha) in Sudapur-1 micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (7)		SMF (7)		MDF (2)		All (33)	
		ha	%	ha	%	ha	%	ha	%	ha	%	ha	%
1	Dry	0	0	6.61	94.23	7.30	81.85	8.61	65.31	4.59	68.17	27.11	75.62
2	Irrigated	0	0	0.40	5.77	1.62	18.15	4.57	34.69	2.14	31.83	8.74	24.38
Total		0	100	7.02	100	8.92	100	13.18	100	6.73	100	35.84	100

Average land value (Rs./ha): The data regarding the average land value (Rs./ha) in Sudapur-1 micro-watershed is presented in Table 17. The results indicate that, the average value of dry land was Rs. 527,336.52 and average value of irrigated land was Rs. 732,190.83. In case of marginal famers, the average land value was Rs. 1,118,604.66 for dry land and Rs. 1,976,000 for irrigated land. In case of small famers, the average land value was Rs. 424,445.68 for dry land and Rs. 802,750 for irrigated land. In case of semi medium famers, the average land value was Rs. 359,990.60 for dry land and Rs. 765,044.25 for irrigated land. In case of medium farmers, the average land value was Rs. 527,336.52 for dry land and Rs. 373,534.97 for irrigated land.

Table 17. Average land value (Rs./ha) in Sudapur-1 micro-watershed

Sl.No.	Particulars	LL (5)	MF (12)	SF (7)	SMF (7)	MDF (2)	All (33)
1	Dry	0.00	1,118,604.66	424,445.68	359,990.60	152,603.71	527,336.52
2	Irrigated	0.00	1,976,000.00	802,750.00	765,044.25	373,534.97	732,190.83

Status of bore wells: The data regarding the status of bore wells in Sudapur-1 micro-watershed is presented in Table 18. The results indicate that, there were 7 functioning bore wells in the micro watershed.

Table 18. Status of bore wells in Sudapur-1 micro-watershed

Sl.No.	Particulars	LL (5)	MF (12)	SF (7)	SMF (7)	MDF (2)	All (33)
		N	N	N	N	N	N
1	Functioning	0	1	2	4	0	7

Source of irrigation: The data regarding the source of irrigation in Sudapur-1 micro-watershed is presented in Table 19. The results indicate that, bore well was the major irrigation source in the micro water shed for 21.21 per cent of the farmers.

Table 19. Source of irrigation in Sudapur-1 micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (7)		SMF (7)		MDF (2)		All (33)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Bore Well	0	0.00	1	8.33	2	28.57	4	57.14	0	0.00	7	21.21

Depth of water (Avg in meters): The data regarding the depth of water in Sudapur-1 micro-watershed is presented in Table 20. The results indicate that, the depth of bore well was found to be 11.87 meters.

Table 20. Depth of water (Avg in meters) in Sudapur-1 micro-watershed

Sl.No.	Particulars	LL (5)	MF (12)	SF (7)	SMF (7)	MDF (2)	All (33)
1	Bore Well	0.00	5.46	16.55	30.04	0.00	11.87

Irrigated Area (ha): The data regarding the irrigated area (ha) in Sudapur-1 micro-watershed is presented in Table 21. The results indicate that, marginal, small and semi medium farmers had an irrigated area of 0.40 ha, 1.21 ha and 4.57 ha respectively.

Table 21. Irrigated Area (ha) in Sudapur-1 micro-watershed

Sl.No.	Particulars	LL (5)	MF (12)	SF (7)	SMF (7)	MDF (2)	All (33)
1	Kharif	0.00	0.40	1.21	4.57	0.00	6.19
Total		0.00	0.40	1.21	4.57	0.00	6.19

Cropping pattern: The data regarding the cropping pattern in Sudapur-1 micro-watershed is presented in Table 22. The results indicate that, farmers have grown cotton (1.21 ha), greengram (7.56 ha), groundut (1.21 ha), paddy (1.62 ha), redgram (21.77 ha) and sorghum (3.36 ha). Marginal farmers have grown redgram and greengram. Small farmers had grown cotton, greengram and redgram. Semi medium farmers had grown cotton, greengram, groundnut, paddy, redgram and sorghum. Medium farmers had grown redgram and sorghum.

Table 22. Cropping pattern in Sudapur-1 micro-watershed (Area in ha)

Sl.No.	Particulars	LL (5)	MF (12)	SF (7)	SMF (7)	MDF (2)	All (33)
1	Kharif - Cotton	0	0	0.4	0.81	0	1.21
2	Kharif - Greengram	0	2.07	2.43	3.06	0	7.56
3	Kharif - Groundnut	0	0	0	1.21	0	1.21
4	Kharif - Paddy	0	0	0.4	1.21	0	1.62
5	Kharif - Red gram (togari)	0	6	5.67	5.67	4.43	21.77
6	Kharif - Sorghum	0	0	0	0.81	2.02	2.83
7	Rabi - Sorghum	0	0	0	0.53	0	0.53
Total		0	8.06	8.91	13.31	6.46	36.74

Cropping intensity: The data regarding the cropping intensity in Sudapur-1 micro-watershed is presented in Table 23. The results indicate that, the cropping intensity in Sudapur-1 micro-watershed was found to be 68.82 per cent.

Table 23. Cropping intensity (%) in Sudapur-1 micro-watershed

Sl.No.	Particulars	LL (5)	MF (12)	SF (7)	SMF (7)	MDF (2)	All (33)
1	Cropping Intensity	0.00	101.12	70.88	61.82	57.07	68.82

Possession of Bank account and savings: The data regarding the possession of bank account and saving in Sudapur-1 micro-watershed is presented in Table 24. The results indicate that, 66.67 per cent of the households have bank account.

Table 24. Possession of Bank account and savings in Sudapur-1 micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (7)		SMF (7)		MDF (2)		All (33)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Account	0	0.00	8	66.67	7	100.00	6	85.71	1	50.00	22	66.67

Borrowing status: The data regarding the borrowing status in Sudapur-1 micro-watershed is presented in Table 25. The results indicate that, 69.70 per cent of the households have availed credit from different sources.

Table 25. Borrowing status in Sudapur-1 micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (7)		SMF (7)		MDF (2)		All (33)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Credit Availed	0	0.00	8	66.67	8	114.29	6	85.71	1	50.00	23	69.70

Cost of Cultivation of Green gram: The data regarding the cost of cultivation of green gram in Sudapur-1 micro-watershed is presented in Table 26. The results indicate that, the total cost of cultivation for green gram was Rs. 29295.51. The gross income realized by the farmers was Rs. 55618.78. The net income from Green gram cultivation was Rs. 26323.27, thus the benefit cost ratio was found to be 1:1.9.

Table 26. Cost of Cultivation of Green gram in Sudapur-1 micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	33.58	5627.01	19.21
2	Bullock		Pairs/day	5.01	2503.00	8.54
3	Tractor		Hours	2.18	1634.95	5.58
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	9.10	1012.30	3.46
6	Seed Inter Crop		Kgs.	0.00	0.00	0.00
7	FYM		Quintal	21.61	2840.50	9.70
8	Fertilizer + micronutrients		Quintal	2.45	2525.56	8.62
9	Pesticides (PPC)		Kgs/liters	1.68	1684.83	5.75
10	Irrigation		Number	2.16	0.00	0.00
11	Repairs			0.00	0.00	0.00
12	Msc. Charges (Marketing costs etc)			0.00	0.00	0.00
13	Depreciation charges			0.00	212.10	0.72
14	Land revenue and Taxes			0.00	4.94	0.02
II	**Cost B1**					
16	Interest on working capital				967.58	3.30
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				19012.75	64.90
III	**Cost B2**					
18	Rental Value of Land				493.33	1.68
19	**Cost B2 = (Cost B1 + Rental value)**				19506.09	66.58
IV	**Cost C1**					
20	Family Human Labour			35.10	7126.20	24.33
21	**Cost C1 = (Cost B2 + Family Labour)**				26632.28	90.91
V	**Cost C2**					
22	Risk Premium				0.00	0.00
23	**Cost C2 = (Cost C1 + Risk Premium)**				26632.28	90.91
VI	**Cost C3**					
24	Managerial Cost				2663.23	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				29295.51	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		10.93	55618.78	
		b) Main Crop Sales Price (Rs.)			5090.00	
b.	Gross Income (Rs.)				55618.78	
c.	Net Income (Rs.)				26323.27	
d.	Cost per Quintal (Rs./q.)				2681.00	
e.	Benefit Cost Ratio (BC Ratio)				1:1.9	

Cost of cultivation of Paddy: The data regarding the cost of cultivation of Paddy in Sudapur-1 micro-watershed is presented in Table 27. The results indicate that, the total cost of cultivation for Paddy was Rs. 55852.80. The gross income realized by the farmers was Rs. 96968.08. The net income from Paddy cultivation was Rs. 41115.28. Thus the benefit cost ratio was found to be 1:1.74.

Table 27. Cost of Cultivation of Paddy in Sudapur-1 micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	43.23	6771.92	12.12
2	Bullock		Pairs/day	7.41	3705.00	6.63
3	Tractor		Hours	3.71	2778.75	4.98
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	55.58	3499.17	6.26
6	Seed Inter Crop		Kgs.	0.00	0.00	0.00
7	FYM		Quintal	41.17	4940.00	8.84
8	Fertilizer + micronutrients		Quintal	4.12	2964.00	5.31
9	Pesticides (PPC)		Kgs/liters	2.06	2058.33	3.69
10	Irrigation		Number	17.29	0.00	0.00
12	Msc. Charges (Marketing costs etc)			0.00	0.00	0.00
13	Depreciation charges			0.00	6002.92	10.75
14	Land revenue and Taxes			0.00	4.67	0.01
II	**Cost B1**					
16	Interest on working capital				1615.38	2.89
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				34340.14	61.48
III	**Cost B2**					
18	Rental Value of Land				688.89	1.23
19	**Cost B2 = (Cost B1 + Rental value)**				35029.02	62.72
IV	**Cost C1**					
20	Family Human Labour			75.34	15746.25	28.19
21	**Cost C1 = (Cost B2 + Family Labour)**				50775.27	90.91
V	**Cost C2**					
22	Risk Premium				0.00	0.00
23	**Cost C2 = (Cost C1 + Risk Premium)**				50775.27	90.91
VI	**Cost C3**					
24	Managerial Cost				5077.53	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				55852.80	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		37.46	84288.75	
		b) Main Crop Sales Price (Rs.)			2250.00	
	By Product	e) Main Product (q)		172.90	12679.33	
		f) Main Crop Sales Price (Rs.)			73.33	
b.	Gross Income (Rs.)				96968.08	
c.	Net Income (Rs.)				41115.28	
d.	Cost per Quintal (Rs./q.)				1490.93	
e.	Benefit Cost Ratio (BC Ratio)				1:1.74	

Cost of Cultivation of Groundnut: The data regarding the cost of cultivation of groundnut in Sudapur-1 micro-watershed is presented in Table 28. The results indicate that, the total cost of cultivation for groundnut was Rs. 36908.45. The gross income realized by the farmers was Rs. 70395. The net income from groundnut cultivation was Rs. 33486.55. Thus the benefit cost ratio was found to be 1:1.91.

Table 28. Cost of Cultivation of Groundnut in Sudapur-1 micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	9.06	1440.83	3.90
2	Bullock		Pairs/day	4.12	2058.33	5.58
3	Tractor		Hours	1.65	1235.00	3.35
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	49.40	4940.00	13.38
6	Seed Inter Crop		Kgs.	0.00	0.00	0.00
7	FYM		Quintal	24.70	3458.00	9.37
8	Fertilizer + micronutrients		Quintal	1.65	1976.00	5.35
9	Pesticides (PPC)		Kgs /liters	0.82	823.33	2.23
10	Irrigation		Number	0.00	0.00	0.00
13	Depreciation charges			0.00	10248.85	27.77
14	Land revenue and Taxes			0.00	4.94	0.01
II	**Cost B1**					
16	Interest on working capital				1343.68	3.64
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				27528.97	74.59
III	**Cost B2**					
18	Rental Value of Land				466.67	1.26
19	**Cost B2 = (Cost B1 + Rental value)**				27995.64	75.85
IV	**Cost C1**					
20	Family Human Labour			27.17	5557.50	15.06
21	**Cost C1 = (Cost B2 + Family Labour)**				33553.14	90.91
V	**Cost C2**					
22	Risk Premium				0.00	0.00
23	**Cost C2 = (Cost C1 + Risk Premium)**				33553.14	90.91
VI	**Cost C3**					
24	Managerial Cost				3355.31	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				36908.45	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		12.35	67925.00	
		b) Main Crop Sales Price (Rs.)			5500.00	
	By Product	e) Main Product (q)		2.47	2470.00	
		f) Main Crop Sales Price (Rs.)			1000.00	
b.	Gross Income (Rs.)				70395.00	
c.	Net Income (Rs.)				33486.55	
d.	Cost per Quintal (Rs./q.)				2988.54	
e.	Benefit Cost Ratio (BC Ratio)				1:1.91	

Cost of Cultivation of cotton: The data regarding the cost of cultivation of cotton in Sudapur-1 micro-watershed is presented in Table 29. The results indicate that, the total cost of cultivation for cotton was Rs. 41889.19. The gross income realized by the farmers was Rs. 108680. The net income from cotton cultivation was Rs. 66790.81. Thus the benefit cost ratio was found to be 1:2.59.

Table 29. Cost of Cultivation of cotton in Sudapur-1 micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	82.75	13152.75	31.40
2	Bullock		Pairs/day	6.18	3087.50	7.37
3	Tractor		Hours	3.09	2315.63	5.53
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	2.47	1296.75	3.10
6	Seed Inter Crop		Kgs.	0.00	0.00	0.00
7	FYM		Quintal	0.00	0.00	0.00
8	Fertilizer + micronutrients		Quintal	4.32	4693.00	11.20
9	Pesticides (PPC)		Kgs /liters	2.47	2470.00	5.90
10	Irrigation		Number	0.00	0.00	0.00
11	Repairs			0.00	0.00	0.00
12	Msc. Charges (Marketing costs etc)			0.00	0.00	0.00
13	Depreciation charges			0.00	198.83	0.47
14	Land revenue and Taxes			0.00	3.71	0.01
II	**Cost B1**					
16	Interest on working capital				1015.17	2.42
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				28233.34	67.40
III	**Cost B2**					
18	Rental Value of Land				400.00	0.95
19	**Cost B2 = (Cost B1 + Rental value)**				28633.34	68.35
IV	**Cost C1**					
20	Family Human Labour			45.69	9447.75	22.55
21	**Cost C1 = (Cost B2 + Family Labour)**				38081.09	90.91
V	**Cost C2**					
22	Risk Premium				0.00	0.00
23	**Cost C2 = (Cost C1 + Risk Premium)**				38081.09	90.91
VI	**Cost C3**					
24	Managerial Cost				3808.11	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				41889.19	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		24.70	108680.00	
		b) Main Crop Sales Price (Rs.)			4400.00	
b.	Gross Income (Rs.)				108680.00	
c.	Net Income (Rs.)				66790.81	
d.	Cost per Quintal (Rs./q.)				1695.92	
e.	Benefit Cost Ratio (BC Ratio)				1:2.59	

Cost of cultivation of Red gram: The data regarding the cost of cultivation of red gram in Sudapur-1 micro-watershed is presented in Table 30. The results indicate that, the total cost of cultivation for red gram was Rs. 28899.40. The gross income realized by the farmers was Rs. 62070.22. The net income from red gram cultivation was Rs. 33170.83. Thus the benefit cost ratio was found to be 1:2.15.

Table 30. Cost of Cultivation of red gram in Sudapur-1 micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	39.54	6549.51	22.66
2	Bullock		Pairs/day	3.52	1755.93	6.08
3	Tractor		Hours	3.68	2757.32	9.54
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	8.67	839.89	2.91
6	Seed Inter Crop		Kgs.	0.00	0.00	0.00
7	FYM		Quintal	24.39	3385.14	11.71
8	Fertilizer + micronutrients		Quintal	2.77	2325.46	8.05
9	Pesticides (PPC)		Kgs/liters	1.19	1190.80	4.12
10	Irrigation		Number	0.00	0.00	0.00
11	Repairs			0.00	0.00	0.00
12	Msc. Charges (Marketing costs etc)			0.00	0.00	0.00
13	Depreciation charges			0.00	621.04	2.15
14	Land revenue and Taxes			0.00	5.02	0.02
II	**Cost B1**					
16	Interest on working capital				928.96	3.21
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				20359.08	70.45
III	**Cost B2**					
18	Rental Value of Land				669.84	2.32
19	**Cost B2 = (Cost B1 + Rental value)**				21028.92	72.77
IV	**Cost C1**					
20	Family Human Labour			25.28	5243.26	18.14
21	**Cost C1 = (Cost B2 + Family Labour)**				26272.18	90.91
V	**Cost C2**					
22	Risk Premium				0.00	0.00
23	**Cost C2 = (Cost C1 + Risk Premium)**				26272.18	90.91
VI	**Cost C3**					
24	Managerial Cost				2627.22	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				28899.40	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		14.91	62070.22	
		b) Main Crop Sales Price (Rs.)			4161.90	
b.	Gross Income (Rs.)				62070.22	
c.	Net Income (Rs.)				33170.83	
d.	Cost per Quintal (Rs./q.)				1937.75	
e.	Benefit Cost Ratio (BC Ratio)				1:2.15	

Cost of cultivation of Sorghum: The data regarding the cost of cultivation of sorghum in Sudapur-1 micro-watershed is presented in Table 31. The results indicate that, the total cost of cultivation for sorghum was Rs. 20454.68. The gross income realized by the farmers was Rs. 34086. The net income from sorghum cultivation was Rs. 13631.32. Thus the benefit cost ratio was found to be 1:1.67.

Table 31. Cost of Cultivation of sorghum in Sudapur-1 micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	35.07	5668.65	27.71
2	Bullock		Pairs/day	3.46	1729.00	8.45
3	Tractor		Hours	3.70	2778.75	13.58
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	9.88	611.33	2.99
6	Seed Inter Crop		Kgs.	0.00	0.00	0.00
7	FYM		Quintal	0.00	0.00	0.00
8	Fertilizer + micronutrients		Quintal	1.11	1333.80	6.52
9	Pesticides (PPC)		Kgs/liters	0.86	864.50	4.23
10	Irrigation		Number	0.00	0.00	0.00
12	Msc. Charges (Marketing costs etc)			0.00	0.00	0.00
13	Depreciation charges			0.00	162.28	0.79
14	Land revenue and Taxes			0.00	4.53	0.02
II	**Cost B1**					
16	Interest on working capital				337.16	1.65
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				13489.99	65.95
III	**Cost B2**					
18	Rental Value of Land				900.00	4.40
19	**Cost B2 = (Cost B1 + Rental value)**				14389.99	70.35
IV	**Cost C1**					
20	Family Human Labour			19.14	4205.18	20.56
21	**Cost C1 = (Cost B2 + Family Labour)**				18595.16	90.91
V	**Cost C2**					
22	Risk Premium				0.00	0.00
23	**Cost C2 = (Cost C1 + Risk Premium)**				18595.16	90.91
VI	**Cost C3**					
24	Managerial Cost				1859.52	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				20454.68	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		14.82	34086.00	
		b) Main Crop Sales Price (Rs.)			2300.00	
b.	Gross Income (Rs.)				34086.00	
c.	Net Income (Rs.)				13631.32	
d.	Cost per Quintal (Rs./q.)				1380.21	
e.	Benefit Cost Ratio (BC Ratio)				1:1.67	

Adequacy of fodder: The data regarding the adequacy of fodder in Sudapur-1 micro-watershed is presented in Table 32. The results indicate that, 39.39 per cent of the households opined that dry fodder was adequate and 3.03 per cent of the households opined that green fodder was adequate.

Table 32. Adequacy of fodder in Sudapur-1 micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (7)		SMF (7)		MDF (2)		All (33)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Adequate-Dry Fodder	0	0.00	5	41.67	3	42.86	5	71.43	0	0.00	13	39.39
2	Adequate-Green Fodder	0	0.00	1	8.33	0	0.00	0	0.00	0	0.00	1	3.03

Annual gross income: The data regarding the annual gross income in Sudapur-1 micro-watershed is presented in Table 33. The results indicate that the annual gross income was Rs. 118,000 for landless farmers, for marginal farmers it was Rs. 116,060.83, for small farmers it was Rs. 165,514.29, for semi medium farmers it was Rs. 194,208.57 and for medium farmers it was Rs. 286,250.

Table 33. Annual gross income in Sudapur-1 micro-watershed

(Avg value in Rs.)

Sl.No.	Particulars	LL (5)	MF (12)	SF (7)	SMF (7)	MDF (2)	All (33)
1	Service/salary	0.00	0.00	0.00	20,000.00	0.00	4,242.42
2	Business	0.00	15,833.33	0.00	0.00	0.00	5,757.58
3	Wage	118,000.00	58,333.33	87,857.14	56,428.57	80,000.00	74,545.45
4	Agriculture	0.00	38,654.17	67,657.14	103,185.71	206,250.00	62,795.45
5	Dairy Farm	0.00	3,240.00	0.00	13,165.71	0.00	3,970.91
7	Goat Farming	0.00	0.00	10,000.00	1,428.57	0.00	2,424.24
Income(Rs.)		118,000.00	116,060.83	165,514.29	194,208.57	286,250.00	153,736.06

Average annual expenditure: The data regarding the average annual expenditure in Sudapur-1 micro-watershed is presented in Table 34. The results indicate that the average annual expenditure is Rs. 15,952.30. For landless households it was Rs.9,920, for marginal farmers it was Rs. 8,336.17, for small farmers it was Rs. 14,204.08, for semi medium farmers it was Rs. 21,605.44 and for medium farmers it was Rs. 63,062.50.

Table 34. Average annual expenditure in Sudapur-1 micro-watershed

(Avg value in Rs.)

Sl.No.	Particulars	LL (5)	MF (12)	SF (7)	SMF (7)	MDF (2)	All (33)
1	Service/salary	0.00	0.00	0.00	50,000.00	0.00	1,515.15
2	Business	0.00	45,000.00	0.00	0.00	0.00	2,727.27
3	Wage	49,600.00	30,409.09	45,000.00	32,000.00	31,500.00	34,924.24
4	Agriculture	0.00	18,958.33	34,428.57	49,571.43	94,625.00	30,446.97
5	Dairy Farm	0.00	5,666.67	0.00	16,666.67	0.00	2,030.30
6	Goat Farming	0.00	0.00	20,000.00	3,000.00	0.00	696.97
Total		49,600.00	100,034.09	99,428.57	151,238.10	126,125.00	526,425.76
Average		9,920.00	8,336.17	14,204.08	21,605.44	63,062.50	15,952.30

Horticulture species grown: The data regarding horticulture species grown in Sudapur-1 micro-watershed is presented in Table 35. The results indicate that, sampled households

have grown 1 coconut tree, 121 custard apple, 1 guava and 6 mango trees in the field. Also, 2 guava and 1 lemon tree in the backyard.

Table 35. Horticulture species grown in Sudapur-1 micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (7)		SMF (7)		MDF (2)		All (33)	
		F	B	F	B	F	B	F	B	F	B	F	B
1	Coconut	0	0	1	0	0	0	0	0	0	0	1	0
2	Custard apple	0	0	44	0	22	0	50	0	5	0	121	0
3	Guava	0	0	0	0	0	0	0	1	1	1	1	2
4	Lemon	0	0	0	1	0	0	0	0	0	0	0	1
5	Mango	0	0	2	0	1	0	3	0	0	0	6	0

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

Forest species grown: The data regarding forest species grown in Sudapur-1 micro-watershed is presented in Table 36. The results indicate that, households have planted 98 neem trees, 3 tamarind trees, 1 teak and 1 acacia tree in their field and 4 neem trees in their backyard.

Table 36: Forest species grown in Sudapur-1 micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (7)		SMF (7)		MDF (2)		All (33)	
		F	B	F	B	F	B	F	B	F	B	F	B
1	Teak	0	0	1	0	0	0	0	0	0	0	1	0
2	Neem	0	0	34	2	26	0	14	2	24	0	98	4
3	Tamarind	0	0	0	0	1	0	2	0	0	0	3	0
4	Acacia	0	0	0	0	0	0	0	0	1	0	1	0

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

Average Additional investment capacity: The data regarding average additional investment capacity in Sudapur-1 micro-watershed is presented in Table 37. The results indicated that, households have an average investment capacity of Rs. 11,666.67 for land development, Rs. 27,272.73 for irrigation facility and Rs. 757.58 for improved crop production.

Table 37: Source of funds for additional investment capacity in Sudapur-1 micro-watershed

Sl.No.	Particulars	MF (12)	SF (7)	SMF (7)	MDF (2)	All (33)
		Rs.	Rs.	Rs.	Rs.	Rs.
1	Land development	5,454.55	23,571.43	22,857.14	0	11,666.67
2	Irrigation facility	18,181.82	71,428.57	28,571.43	0	27,272.73
3	Improved crop production	909.09	0	1,428.57	2,500	757.58

Source of additional investment: The data regarding source of funds for additional investment in Sudapur-1 micro-watershed is presented in Table 38. The results indicated that government subsidy was the source of additional investment for 3.03 per cent for land development and 3.03 per cent for irrigation facility. Loan from bank was the source of additional investment for 12.12 per cent for land development, for 18.18 per cent for irrigation facility and for 6.06 per cent for improved crop production. Own funds was the

source of additional investment for 12.12 per cent for land development and 6.06 per cent for irrigation facility. Soft loan was the source of additional investment for 3.03 per cent for improved crop production.

Table 38: Source of funds for additional investment capacity in Sudapur-1 micro-watershed

Sl.No	Item	Land development		Irrigation facility		Improved crop production	
		N	%	N	%	N	%
1	Government subsidy	1	3.03	1	3.03	0	0.0
2	Loan from bank	4	12.12	6	18.18	2	6.06
3	Own funds	4	12.12	2	6.06	0	0.0
4	Soft loan	0	0.0	0	0.0	1	3.03

Marketing of the agricultural produce: The data regarding marketing of the agricultural produce in Sudapur-1 micro-watershed is presented in Table 39. The results indicated that, cotton was sold to the extent of 100 per cent, greengram was sold to the extent of 92.67 per cent, groundnut was sold to the extent of 93.33 per cent, paddy was sold to the extent of 100 per cent, redgram was sold to the extent of 84.69 per cent and sorghum was sold to the extent of 100 per cent.

Table 39. Marketing of the agricultural produce in Sudapur-1 micro-watershed

Sl.No	Crops	Output obtained (q)	Output retained (q)	Output sold (q)	Output sold (%)	Avg. Price obtained (Rs/q)
1	Cotton	30.0	0.0	30.0	100.0	4400.0
2	Greengram	75.0	5.5	69.5	92.67	5090.0
3	Groundnut	15.0	1.0	14.0	93.33	5500.0
4	Paddy	58.0	0.0	58.0	100.0	2250.0
5	Redgram	294.0	45.0	249.0	84.69	4161.9
6	Sorghum	22.0	0.0	22.0	100.0	1500.0

Marketing Channels used for sale of agricultural produce: The data regarding marketing channels used for sale of agricultural produce in Sudapur-1 micro-watershed is presented in Table 40. The results indicated that, about 100 per cent of the farmers sold their produce to local/village merchants.

Table 40. Marketing Channels used for sale of agricultural produce in Sudapur-1 micro-watershed

Sl.No.	Particulars	MF (12)		SF (7)		SMF (7)		MDF (2)		All (33)	
		N	%	N	%	N	%	N	%	N	%
1	Local/village Merchant	12	100.00	7	100.00	7	100.00	2	100.00	33	100.00

Mode of transport of agricultural produce: The data regarding mode of transport of agricultural produce in Sudapur-1 micro-watershed is presented in Table 41. The results indicated that, 100 per cent of the households have used tractor as a mode of transportation for their agricultural produce.

Table 41. Mode of transport of agricultural produce in Sudapur-1 micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (7)		SMF (7)		MDF (2)		All (33)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Tractor	0	0.00	12	100.00	7	100.00	7	100.00	2	100.00	33	100.00

Incidence of soil and water erosion problems: The data regarding incidence of soil and water erosion problems in Sudapur-1 micro-watershed is presented in Table 42. The results indicated that, 69.70 per cent of the households have experienced soil and water erosion problems in the farm.

Table 42. Incidence of soil and water erosion problems in Sudapur-1 micro-watershed

Sl.No.	Particulars	MF (12)		SF (7)		SMF(7)		MDF (2)		All (33)	
		N	%	N	%	N	%	N	%	N	%
1	Soil and water erosion problems in the farm	10	83.33	5	71.43	6	85.71	2	100.00	23	69.70

Interest shown towards soil testing: The data regarding Interest shown towards soil testing in Sudapur-1 micro-watershed is presented in Table 43. The results indicated that, 84.85 per cent have shown interest in soil test.

Table 43. Interest shown towards soil testing in Sudapur-1 micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (7)		SMF (7)		MDF (2)		All (33)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Interest in soil test	0	0.00	12	100.00	7	100.00	7	100.00	2	100.00	28	84.85

Usage pattern of fuel for domestic use: The data regarding usage pattern of fuel for domestic use in Sudapur-1 micro-watershed is presented in Table 44. The results indicated that, 81.82 per cent of the households used firewood and 18.18 per cent used LPG as a source of fuel.

Table 44. Usage pattern of fuel for domestic use in Sudapur-1 micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (7)		SMF (7)		MDF (2)		All (33)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Fire Wood	3	60.00	11	91.67	6	85.71	7	100.00	0	0.00	27	81.82
2	LPG	2	40.00	1	8.33	1	14.29	0	0.00	2	100.00	6	18.18

Source of drinking water: The data regarding source of drinking water in Sudapur-1 micro-watershed is presented in Table 45. The results indicated that, piped supply was the major source of drinking water for 100 per cent of the households in the micro watershed.

Table 45. Source of drinking water in Sudapur-1 micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (7)		SMF (7)		MDF (2)		All (33)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Piped supply	5	100.00	12	100.00	7	100.00	7	100.00	2	100.00	33	100.00

Source of light: The data regarding source of light in Sudapur-1 micro-watershed is presented in Table 46. The results indicated that, Electricity was the major source of light for 100 per cent of the households in micro watershed.

Table 46. Source of light in Sudapur-1 micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (7)		SMF (7)		MDF (2)		All (33)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Electricity	5	100.00	12	100.00	7	100.00	7	100.00	2	100.00	33	100.00

Existence of Sanitary toilet facility: The data regarding existence of sanitary toilet facility in Sudapur-1 micro-watershed is presented in Table 47. The results indicated that, 60.61 per cent of the households possess sanitary toilet.

Table 47. Existence of Sanitary toilet facility in Sudapur-1 micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (7)		SMF (7)		MDF (2)		All (33)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Sanitary toilet facility	5	100.00	6	50.00	3	42.86	5	71.43	1	50.00	20	60.61

Possession of PDS card: The data regarding possession of PDS card in Sudapur-1 micro-watershed is presented in Table 48. The results indicated that, 100 per cent of the sampled households possessed BPL card.

Table 48. Possession of PDS card in Sudapur-1 micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (7)		SMF (7)		MDF (2)		All (33)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	BPL	5	100.00	12	100.00	7	100.00	7	100.00	2	100.00	33	100.00

Participation in NREGA program: The data regarding participation in NREGA programme in Sudapur-1 micro-watershed is presented in Table 49. The results indicated that, 78.79 per cent of the households participated in NREGA programme.

Table 49. Participation in NREGA programme in Sudapur-1 micro-watershed

Sl. No.	Particulars	LL (5)		MF (12)		SF (7)		SMF (7)		MDF (2)		All (33)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Participation in NREGA programme	5	100	10	83.33	5	71.43	4	57.14	2	100	26	78.79

Adequacy of food items: The data regarding adequacy of food items in Sudapur-1 micro-watershed is presented in Table 50. The results indicated that, cereals were adequate for 100 per cent of the households, pulses were adequate for 100 per cent, oilseeds were adequate for 21.21 per cent, vegetables were adequate for 87.88 per cent, milk was adequate for 96.97 per cent and eggs were adequate for 18.18 per cent.

Table 50. Adequacy of food items in Sudapur-1 micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (7)		SMF (7)		MDF (2)		All (33)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Cereals	5	100.00	12	100.00	7	100.00	7	100.00	2	100.00	33	100.00
2	Pulses	5	100.00	12	100.00	7	100.00	7	100.00	2	100.00	33	100.00
3	Oilseed	0	0.00	5	41.67	2	28.57	0	0.00	0	0.00	7	21.21
4	Vegetables	4	80.00	10	83.33	6	85.71	7	100.00	2	100.00	29	87.88
5	Milk	5	100.00	12	100.00	7	100.00	6	85.71	2	100.00	32	96.97
6	Egg	0	0.00	4	33.33	2	28.57	0	0.00	0	0.00	6	18.18

Response on Inadequacy of food items: The data regarding inadequacy of food items in Sudapur-1 micro-watershed is presented in Table 51. The results indicated that, oilseeds were inadequate for 84.85 per cent, vegetables were inadequate for 12.12 per cent, fruits were inadequate for 100 per cent, eggs were inadequate for 81.82 per cent and meat was inadequate for 100 per cent of the households.

Table 51. Response on Inadequacy of food items in Sudapur-1 micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (7)		SMF (7)		MDF (2)		All (33)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Oilseed	5	100.00	7	58.33	5	71.43	9	128.57	2	100.00	28	84.85
2	Vegetables	0	0.00	2	16.67	1	14.29	1	14.29	0	0.00	4	12.12
3	Fruits	5	100.00	12	100.00	7	100.00	7	100.00	2	100.00	33	100.00
4	Egg	5	100.00	8	66.67	5	71.43	7	100.00	2	100.00	27	81.82
5	Meat	5	100.00	12	100.00	7	100.00	7	100.00	2	100.00	33	100.00

Farming constraints: The data regarding farming constraints experienced by households in Sudapur-1 micro-watershed is presented in Table 52. 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 (84.85%), inadequacy of irrigation water (27.27%), high cost of fertilizers and plant protection chemicals (81.82%), high rate of interest on credit (78.79%), low price for the agricultural commodities (78.79%), lack of marketing facilities in the area (75.76%), inadequate extension services (9.09%), lack of transport for the safe transport of agricultural produce to the market (30.30%) and source of agri technology information (3.03%).

Table 52. Farming constraints Experienced in Sudapur-1 micro-watershed

Sl. No.	Particulars	MF (12)		SF (7)		SMF (7)		MDF (2)		All (33)	
		N	%	N	%	N	%	N	%	N	%
1	Lower fertility status of the soil	13	108.33	7	100	7	100	2	100	30	90.91
2	Wild animal menace on farm field	12	100	7	100	7	100	2	100	29	87.88
3	Frequent incidence of pest and diseases	11	91.67	7	100	7	100	2	100	28	84.85
4	Inadequacy of irrigation water	2	16.67	1	14.29	4	57.14	1	50	9	27.27
5	High cost of Fertilizers and plant protection chemicals	12	100	7	100	5	71.43	2	100	27	81.82
6	High rate of interest on credit	10	83.33	7	100	6	85.71	2	100	26	78.79
7	Low price for the agricultural commodities	12	100	5	71.43	6	85.71	2	100	26	78.79
8	Lack of marketing facilities in the area	11	91.67	6	85.71	5	71.43	2	100	25	75.76
9	Inadequate extension services	2	16.67	0	0	1	14.29	0	0	3	9.09
10	Lack of transport for safe transport of the Agril produce to the market.	4	33.33	2	28.57	3	42.86	0	0	10	30.30
11	Source of Agri-technology information(Newspaper/TV/Mobile)	0	0	0	0	1	14.29	0	0	1	3.03

Chapter 5

SUMMARY

In order to assess the socio-economic condition of the farmers in the watershed a comprehensive questionnaire was prepared. Major components such as demographic conditions, migration details, food consumption and family expenditure pattern, material possession, land holding, land use management, cropping pattern, cost of cultivation of crops, livestock management. The statistical components such as frequency and percentage were used to analyze the data. About 33 households located in the micro watershed were interviewed for the survey.

The data indicated that there were 98 (53.85%) men and 84 (46.15%) women among the sampled households. The average family size of landless farmers' was 3.4, marginal farmers' was 5, small farmers' was 6.71, semi medium farmers' was 6.71 and medium farmers' was 5.5.

The data indicated that, 28 (15.38%) people were in 0-15 years of age, 79 (43.41%) were in 16-35 years of age, 60 (32.97%) were in 36-60 years of age and 15 (8.24%) were above 61 years of age.

The results indicated that Sudapur-1 had 56.59 per cent illiterates, 14.84 per cent of them had primary school education, 7.69 per cent of them had middle school education, 8.24 per cent of them had high school education, 3.85 per cent of them had PUC education, 3.30 per cent of them had degree education and 1.65 per cent did masters.

The results indicate that, 90.91 per cent of households were practicing agriculture, 15.15 per cent of the households were agricultural labourers and 3.03 per cent of them were housewives. The results indicate that agriculture was the major occupation for 60.99 per cent of the household members, 4.40 per cent were agricultural laborers, 2.75 per cent were general labourers, 0.55 per cent were in government service, 2.75 per cent were in private service, 21.43 per cent were students, 3.30 per cent were housewives and 3.85 per cent were children.

The results show that 100 per cent of the population in the micro watershed has not participated in any local institutions.

The results indicate that 6.06 per cent of the households possess thatched house, 72.73 per cent of the households possess katcha house and 21.21 per cent of them possess pucca house.

The results show that 60.61 per cent of the households possess TV, 3.03 per cent of the households possess DVD/VCD player, 3.03 per cent of the households possess mixer/grinder, 6.06 per cent of the households possess refrigerator, 33.33 per cent of the households possess motor cycle, 6.06 per cent of them own car/four wheeler, 3.03 per cent had landline phone and computer/laptop and 93.94 per cent of the households

possess mobile phones. The results show that the average value of television was Rs. 7,200, DVD/VCD player was Rs. 3,000, mixer/grinder was Rs.2,500, refrigerator was Rs. 12,500, motor cycle was Rs. 33,181, car/four wheeler was Rs. 66,666, landline was Rs. 2,000, computer/laptop was Rs. 25,000 and mobile phone was Rs. 1,833.

About 21.21 per cent of the households possess bullock cart, 27.27 per cent of the households possess plough, 15.15 per cent of them possess seed/fertilizer drill, 6.06 per cent of them were in tractor, 60.61 per cent of them possess sprayer, 12.12 per cent of them possess sprinkler, 3.03 per cent of them thresher and 57.58 per cent of them possess weeder. The results show that the average value of bullock cart was Rs. 8,142, plough was Rs.2,000, seed/fertilizer drill was Rs. 2,800, tractor was Rs.600,000, the average value of sprayer was Rs. 3,535, sprinkler was Rs. 10,000, the average value of weeder was Rs.63 and thresher was Rs. 15,000.

The results indicate that, 30.30 per cent of the households possess bullocks, 24.24 per cent of the households possess local cow, 21.21 per cent of them possess buffalo, 3.03 per cent of them possess sheep and 18.18 per cent of them possess goat and poultry birds.

The results indicate that, average own labour men available in the micro watershed was 2.14, average own labour (women) available was 1.86, average hired labour (men) available was 8.89 and average hired labour (women) available was 8.61. The results indicate that, 84.85 per cent of the households opined that the hired labour was adequate.

The results indicate that, households of the Sudapur-1 micro-watershed possess 27.11 ha (75.62%) of dry land and 8.74 ha (24.38%) of irrigated land. Marginal farmers possess 6.61 ha (94.23%) of dry land and 0.40 ha (5.77%) of irrigated land. Small farmers possess 7.30 ha (81.85%) of dry land and 1.62 ha (18.15%) of irrigated land. Semi medium farmers possess 8.61 ha (65.31%) of dry land and 4.75 ha (34.69%) of irrigated land. Medium farmers possess 4.59 ha (68.17%) of dry land and 2.14 ha (31.84%) of irrigated land.

The results indicate that, the average value of dry land was Rs. 527,336.52 and average value of irrigated land was Rs. 732,190.83. In case of marginal famers, the average land value was Rs. 1,118,604.66 for dry land and Rs. 1,976,000 for irrigated land. In case of small famers, the average land value was Rs. 424,445.68 for dry land and Rs. 802,750 for irrigated land. In case of semi medium famers, the average land value was Rs. 359,990.60 for dry land and Rs. 765,044.25 for irrigated land. In case of medium farmers, the average land value was Rs. 527,336.52 for dry land and Rs. 373,534.97 for irrigated land.

The results indicate that, there were 7 functioning bore wells in the micro watershed. The results indicate that, bore well was the major irrigation source in the micro water shed for 21.21 per cent of the farmers. The results indicate that, the depth of

bore well was found to be 11.87 meters. The results indicate that, marginal, small and semi medium farmers had an irrigated area of 0.40 ha, 1.21 ha and 4.57 ha respectively.

The results indicate that, farmers have grown cotton (1.21 ha), greengram (7.56 ha), groundut (1.21 ha), paddy (1.62 ha), redgram (21.77 ha) and sorghum (3.36 ha). Marginal farmers have grown redgram and greengram. Small farmers had grown cotton, greengram and redgram. Semi medium farmers had grown cotton, greengram, groundnut, paddy, redgram and sorghum. Medium farmers had grown redgram and sorghum. The results indicate that, the cropping intensity in Sudapur-1 micro-watershed was found to be 68.82 per cent.

The results indicate that, 66.67 per cent of the households have bank account. The results indicate that, 69.70 per cent of the households have availed credit from different sources.

The results indicate that, the total cost of cultivation for greengram was Rs. 29295.51. The gross income realized by the farmers was Rs. 55618.78. The net income from Greengram cultivation was Rs. 26323.27, thus the benefit cost ratio was found to be 1:1.9. The total cost of cultivation for Paddy was Rs. 55852.80. The gross income realized by the farmers was Rs. 96968.08. The net income from Paddy cultivation was Rs. 41115.28. Thus the benefit cost ratio was found to be 1:1.74. The total cost of cultivation for groundnut was Rs. 36908.45. The gross income realized by the farmers was Rs. 70395. The net income from groundnut cultivation was Rs. 33486.55. Thus the benefit cost ratio was found to be 1:1.91. The total cost of cultivation for cotton was Rs. 41889.19. The gross income realized by the farmers was Rs. 108680. The net income from cotton cultivation was Rs. 66790.81. Thus the benefit cost ratio was found to be 1:2.59. The total cost of cultivation for red gram was Rs. 28899.40. The gross income realized by the farmers was Rs. 62070.22. The net income from red gram cultivation was Rs. 33170.83. Thus the benefit cost ratio was found to be 1:2.15. The total cost of cultivation for sorghum was Rs. 20454.68. The gross income realized by the farmers was Rs. 34086. The net income from sorghum cultivation was Rs. 13631.32. Thus the benefit cost ratio was found to be 1:1.67.

The results indicate that, 39.39 per cent of the households opined that dry fodder was adequate and 3.03 per cent of the households opined that green fodder was adequate.

The results indicate that the annual gross income was Rs. 118,000 for landless farmers, for marginal farmers it was Rs. 116,060.83, for small farmers it was Rs. 165,514.29, for semi medium farmers it was Rs. 194,208.57 and for medium farmers it was Rs. 286,250.

The results indicate that the average annual expenditure is Rs. 15,952.30. For landless households it was Rs.9,920, for marginal farmers it was Rs. 8,336.17, for small

farmers it was Rs. 14,204.08, for semi medium farmers it was Rs. 21,605.44 and for medium farmers it was Rs. 63,062.50.

The results indicate that, sampled households have grown 1 coconut tree, 121 custard apple, 1 guava and 6 mango trees in the field. Also, 2 guava and 1 lemon tree in the backyard. The results indicate that, households have planted 98 neem trees, 3 tamarind trees, 1 teak and 1 acacia tree in their field and 4 neem trees in their backyard.

The results indicated that, households have an average investment capacity of Rs. 11,666.67 for land development, Rs. 27,272.73 for irrigation facility and Rs. 757.58 for improved crop production. The results indicated that government subsidy was the source of additional investment for 3.03 per cent for land development and 3.03 per cent for irrigation facility. Loan from bank was the source of additional investment for 12.12 per cent for land development, for 18.18 per cent for irrigation facility and for 6.06 per cent for improved crop production. Own funds was the source of additional investment for 12.12 per cent for land development and 6.06 per cent for irrigation facility. Soft loan was the source of additional investment for 3.03 per cent for improved crop production.

The results indicated that, cotton was sold to the extent of 100 per cent, greengram was sold to the extent of 92.67 per cent, groundnut was sold to the extent of 93.33 per cent, paddy was sold to the extent of 100 per cent, redgram was sold to the extent of 84.69 per cent and sorghum was sold to the extent of 100 per cent.

The results indicated that, about 100 per cent of the farmers sold their produce to local/village merchants. The results indicated that, 100 per cent of the households have used tractor as a mode of transportation for their agricultural produce.

The results indicated that, 69.70 per cent of the households have experienced soil and water erosion problems in the farm. The results indicated that, 84.85 per cent have shown interest in soil test.

The results indicated that, 81.82 per cent of the households used firewood and 18.18 per cent used LPG as a source of fuel. The results indicated that, piped supply was the major source of drinking water for 100 per cent of the households in the micro watershed. Electricity was the major source of light for 100 per cent of the households in micro watershed.

The results indicated that, 60.61 per cent of the households possess sanitary toilet. The results indicated that, 100 per cent of the sampled households possessed BPL card. The results indicated that, 78.79 per cent of the households participated in NREGA programme.

The results indicated that, cereals were adequate for 100 per cent of the households, pulses were adequate for 100 per cent, oilseeds were adequate for 21.21 per

cent, vegetables were adequate for 87.88 per cent, milk was adequate for 96.97 per cent and eggs were adequate for 18.18 per cent.

The results indicated that, oilseeds were inadequate for 84.85 per cent, vegetables were inadequate for 12.12 per cent, fruits were inadequate for 100 per cent, eggs were inadequate for 81.82 per cent and meat was inadequate for 100 per cent of the households.

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 (84.85%), inadequacy of irrigation water (27.27%), high cost of fertilizers and plant protection chemicals (81.82%), high rate of interest on credit (78.79%), low price for the agricultural commodities (78.79%), lack of marketing facilities in the area (75.76%), inadequate extension services (9.09%), lack of transport for the safe transport of agricultural produce to the market (30.30%) and source of agri technology information (3.03%).