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

GURALGUNTA (4D2D6O1a) MICROWATERSHED

Balichakra Hobli, Yadgir Taluk and District, Karnataka

Karnataka Watershed Development Project – II

SUJALA – III

World Bank funded Project

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.

Citation: Rajendra Hegde, Ramesh Kumar.S. C., K.V. Niranjana, S. Srinivas, B.A. Dhanorkar, R.S.Reddy and S.K. Singh (2019), "Land Resource Inventory and Socio-Economic Status of Farm Households for Watershed Planning and Development of Guralgunta (4D2D6O1a) Microwatershed, Balichakra Hobli, Yadgir Taluk & District, Karnataka", ICAR-NBSS&LUP Sujala MWS Publ.169, ICAR – NBSS & LUP, RC, Bangalore. P.115 & 29.

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PREFACE

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

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

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

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

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

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

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

Nagpur
Date: 11.03.2019

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PART-A

LAND RESOURCE INVENTORY

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EXECUTIVE SUMMARY

The land resource inventory of Guralgunta 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 580 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 570 ha (98%) in the microwatershed is covered by soils and about 10 ha by others (habitation and water bodies). The salient findings from the land resource inventory are summarized briefly below.

- *The soils belong to 14 soil series and 17 soil phases (management units) and 8 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 250 m grid interval.*
- *Land suitability for growing 26 major agricultural and horticultural crops was assessed and maps showing the degree of suitability along with constraints were generated.*
- *Entire area in the microwatershed is suitable for agriculture.*
- *About 55per cent area of the microwatershed has soils that are moderately deep to very deep (75 - >150 cm) and 43 per cent soils are shallow to moderately shallow (25-75 cm).*
- *About 41 per cent area in the microwatershed has loamy soils, 54 per cent clayey soils, 3 per cent are sandy at the surface.*
- *About 97 per cent area of the microwatershed is non gravelly (<15%) and 1 per cent gravelly (15-35%) at the surface.*
- *About 22 per cent area of the microwatershed is very low (<50 mm/m) in available water capacity, 24 per cent low (51-100 mm/m) and 52 per cent area is very high (>200 mm/m) in available water capacity.*
- *Entire area in the microwatershed has very gently sloping (1-3% slope) lands.*

- *Entire area is moderately (e2) eroded.*
- *An area of about 15 per cent soils are neutral (pH 6.5-7.3) in soil reaction, 39 per cent soils are slightly alkaline (pH 7.3-7.8), 31 per cent soils are moderately alkaline (pH 7.8 - 8.4) and 14 per cent soils are strongly alkaline (pH 8.4-9.0).*
- *The Electrical Conductivity (EC) of the soils in the entire area of the microwatershed is dominantly <2 dsm^{-1} indicating that the soils are non-saline.*
- *About 2 per cent of soils are low (<0.5%), 50 per cent of the soils are medium (0.5-0.75%) and 46 per cent soils are high (>0.75%) in organic carbon.*
- *About 83 per cent area is medium (23-57 kg/ha) and 16 per cent area is high (>57 kg/ha) in available phosphorus.*
- *About 98 per cent is medium (145-337 kg/ha) and less than 1 per cent is high (>337 kg/ha) in available potassium.*
- *Available sulphur is low (<10 ppm) in an area of about 61 per cent, 35 per cent of the soils are medium (10 -20 ppm) and high (>20 ppm) in 2 per cent area of the microwatershed.*
- *Available boron is low (<0.5 ppm) in an area of about 51 per cent, medium (0.5-1.0 ppm) in an area of 40 per cent and high (>1.0 ppm) in 8 per cent area of the microwatershed.*
- *Available iron is deficient (<4.5 ppm) in an area of about 33 per cent and sufficient (>4.5 ppm) in an area of 65 per cent.*
- *Available manganese and copper are sufficient in all the soils of the microwatershed.*
- *Available zinc is deficient (<0.6 ppm) in the entire area of the microwatershed.*
- *The land suitability for 26 major crops grown in the microwatershed were assessed and the areas that are highly suitable (S1) and moderately suitable (S2) are given below. It is however to be noted that a given soil may be suitable for various crops but what specific crop to be grown may be decided by the farmer looking to his capacity to invest on various inputs, marketing infrastructure, market price and finally the demand and supply position.*

Land suitability for various crops in the Microwatershed

Crop	***Suitability Area in ha (%)***			***Crop***	***Suitability Area in ha (%)***	
	Highly suitable (S1)	***Moderately suitable (S2)***			***Highly suitable (S1)***	***Moderately suitable (S2)***
Sorghum	*1(0.13)*	*430(73)*		*Sapota*	*-*	*15(3)*
Maize	*1(0.13)*	*124(21)*		*Pomegranate*	*-*	*322(64)*
Bajra	*1(0.13)*	*444(77)*		*Musambi*	*187(33)*	*135(24)*
Groundnut	*-*	*58(9)*		*Lime*	*187(33)*	*135(24)*
Sunflower	*-*	*308(53)*		*Amla*	*1(0.13)*	*429(74)*
Redgram	*-*	*322(55)*		*Cashew*	*-*	*1(0.13)*
Bengal gram	*187(32)*	*245(42)*		*Jackfruit*	*-*	*1(0.13)*
Cotton	*187(32)*	*244(42)*		*Jamun*	*-*	*316(54)*
Chilli	*-*	*381(66)*		*Custard apple*	*188(32)*	*242(42)*
Tomato	*1(0.13)*	*138(24)*		*Tamarind*	*-*	*316(54)*
Drumstick	*-*	*322(55)*		*Mulberry*	*-*	*1(0.13)*
Mango	*-*	*-*		*Marigold*	*-*	*446(76)*
Guava	*-*	*15(3)*		*Chrysanthemum*	*-*	*446(76)*

- *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 to crop production and conserve soil and land resource base for maintaining ecological balance and to mitigate climate change. For this, several ameliorative measures have been suggested to these problematic soils like saline/alkali, highly eroded, sandy soils etc.,*
- *Soil and water conservation treatment plan has been prepared that would help in identifying the sites to be treated and also the type of structures required.*
- *As part of the greening programme, several tree species have been suggested to be planted in marginal and submarginal lands, field bunds and also in the hillocks, mounds and ridges. 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 sitespecific database for Guralgunta 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 Guralgunta microwatershed is located in the northern part of Karnataka in Yadgir Taluk & District, Karnataka State (Fig.2.1). It comprises of Gudalagunta, Madhwara and Sambara villages. It lies between 16° 36’ and 16° 38’ North latitudes and 77° 18’ and 77° 20’ East longitudes, covering an area of about 580 ha. It is about 58 km south of Yadgir town and is bounded by Gudalagunta and Sambara on the South and Neelahalli on the west and Madhwara village on the North.

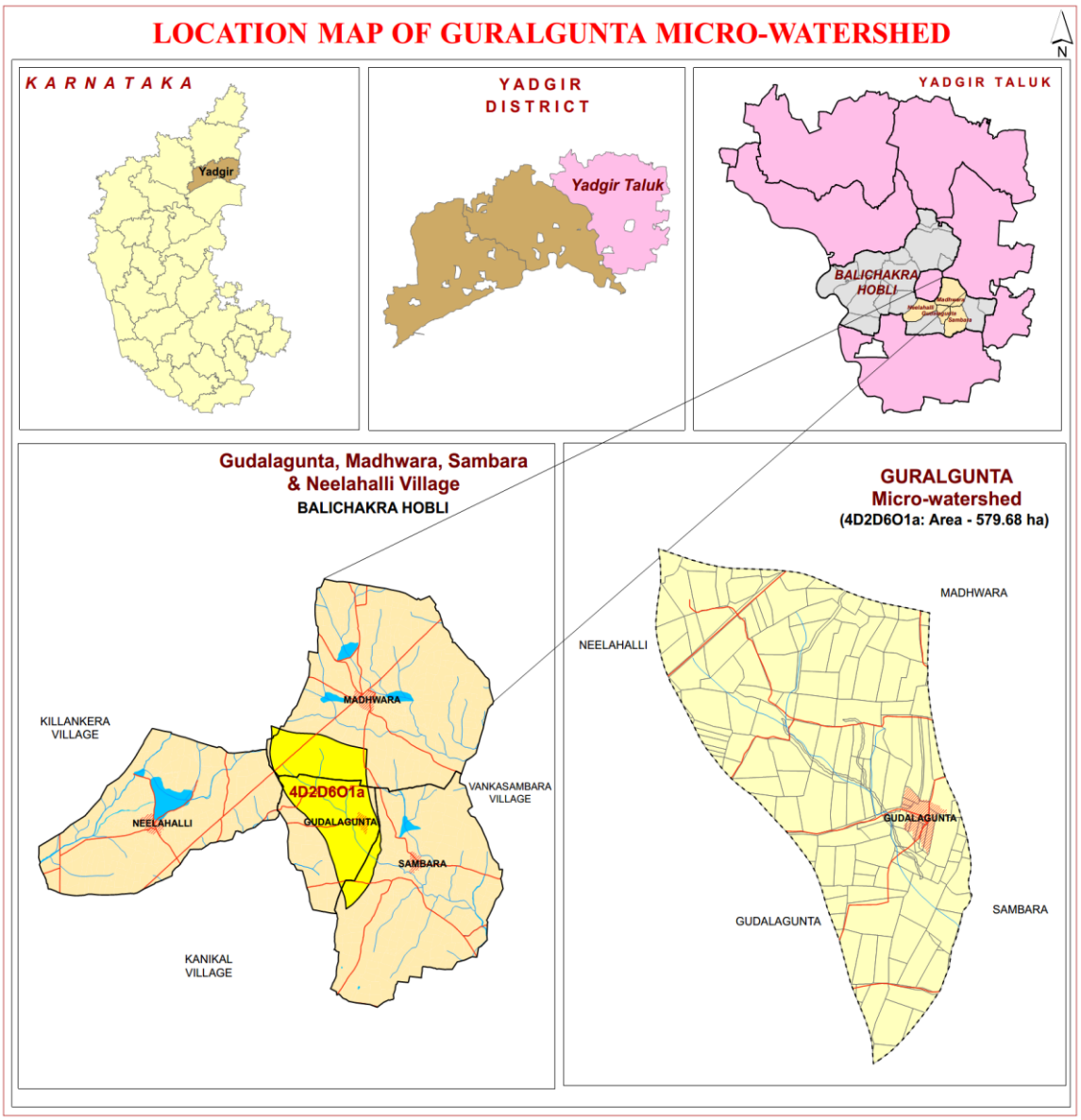


Fig.2.1 Location map of Guralgunta Microwatershed

2.2 Geology

Major rock formations observed in the microwatershed are granite gneiss and alluvial land landscapes (Figs.2.2a and b). Granite gneisses are essentially pink to gray and are coarse to medium grained. They consist primarily of quartz, feldspar, biotite and hornblende. The gray granite gneisses are highly weathered, fractured and fissured upto a depth of about 10 m. Dolerite dykes and quartz veins are common with variable width and found to occur in Guralgunta microwatershed. The most widespread and characteristic development of alluvium in the watershed region lying between the rivers Krishna and Bhima is a wide belt, the underlying formation is gneiss and alluvial soils occur over gneiss, limestone and shale. The thickness of the alluvium generally is limited to less than a meter, except in river valleys where it is very deep extending to tens of meters. Such soils are transported and represent palaeo black soils originally formed at higher elevation, but now occupying river valleys.

Fig.2.2a Granite and granite gneiss rocks

Fig. 2.2b Alluvium

2.3 Physiography

Physiographically, the area has been identified as granite gneiss and alluvial land landscapes based on geology. The area has been further subdivided into five landforms, *viz;* mounds/ridges, summits, side slopes and very gently sloping uplands, plains and valleys based on slope and its relief features. The elevation ranges from 368-386 m above MSL. The mounds and ridges are mostly covered by rock outcrops.

2.4 Drainage

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

2.5 Climate

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

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

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

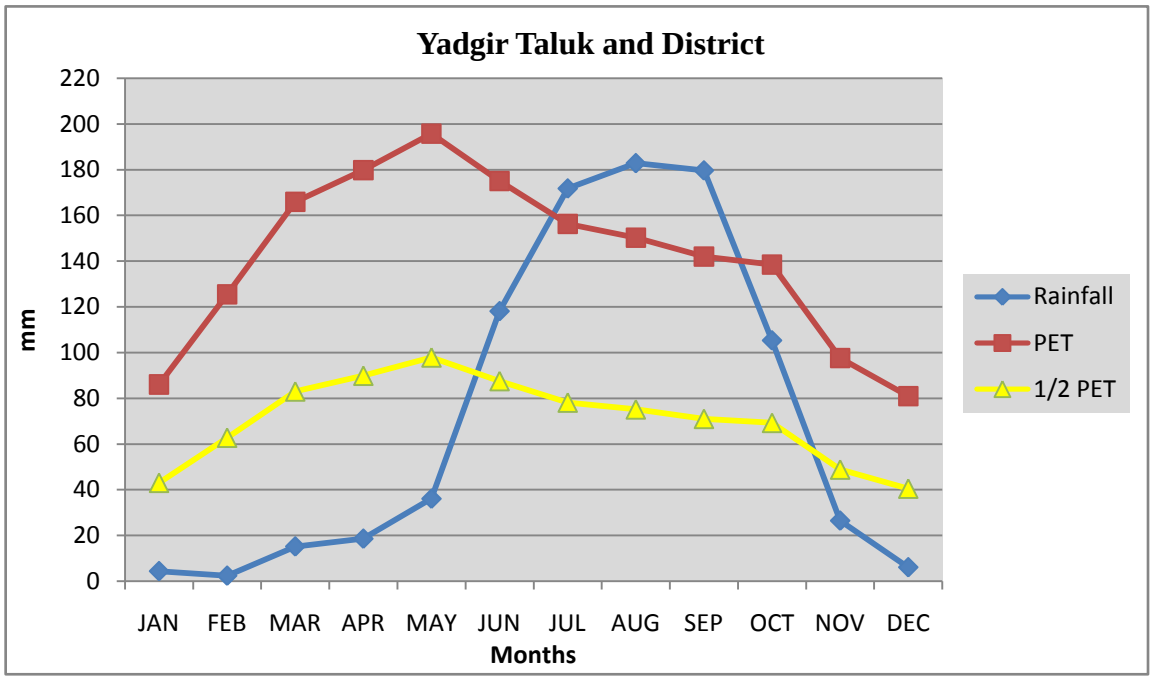


Fig 2.3 Rainfall distribution in Yadgir Taluk, Yadgir District

2.6 Natural Vegetation

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

Apart from the continuing deforestation, the presence of large population of goats, sheep and other cattle in the microwatershed is causing vegetative degradation of whatever little vegetation left in the area. The uncontrolled grazing has left no time for the regeneration of the vegetative cover. This leads to the accelerated rate of erosion on

the hill slopes resulting in the formation of deep gullies in the foot slopes that eventually result in the heavy siltation of tanks and reservoirs in the microwatershed.

2.7 Land Utilization

About 72 per cent area (Table 2.2) in Yadgir district is cultivated at present. An area of about 2 per cent is permanently under pasture, 20 per cent under current fallows and 6 per cent under non-agricultural land, and 5 per cent under currently barren. Forests occupy an area of about 7 per cent and the tree cover is in a very poor state. Most of the mounds, ridges and bouldery areas have very poor vegetative cover. Major crops grown in the area are sorghum, maize, cotton, sunflower, groundnut, red gram, mango, pomegranate, marigold and sapota. The cropping intensity is 120 per cent in the taluk. While carrying out land resource inventory, the land use/land cover particulars are collected from all the survey numbers and a current land use map of the microwatershed is prepared. The current land use map prepared shows the arable and non-arable lands, other land uses and different types of crops grown in the area. The current land use map of Guralgunta microwatershed is presented in Fig.2.4. The different crops and cropping systems adopted in the microwatershed is presented in the Figures 2.5 a & b. Simultaneously, enumeration of existing wells (bore wells) and conservation structures is made and their location in different survey numbers is marked on the cadastral map. Map showing the location of wells in Guralgunta microwatershed is presented in Fig.2.6.

Table 2.2 Land Utilization in Yadgir District

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

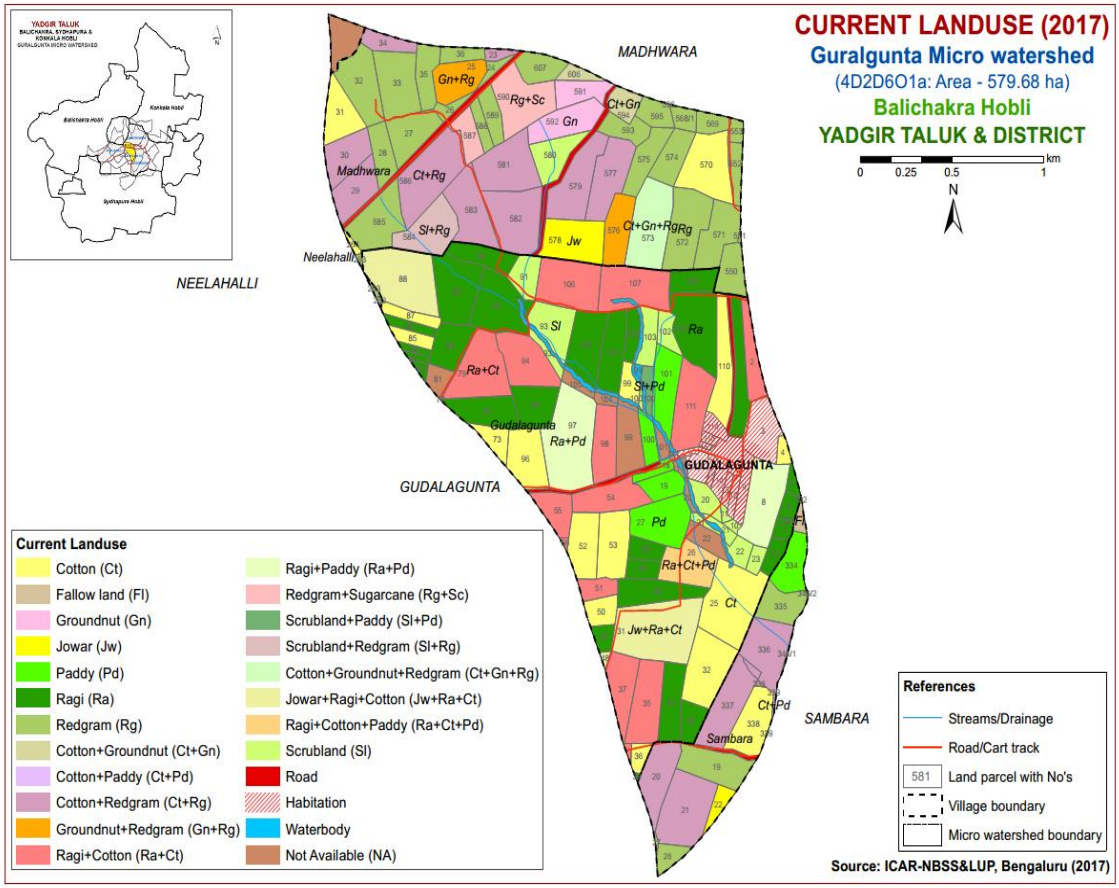


Fig.2.4 Current Land Use map of Guralgunta Microwatershed

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

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

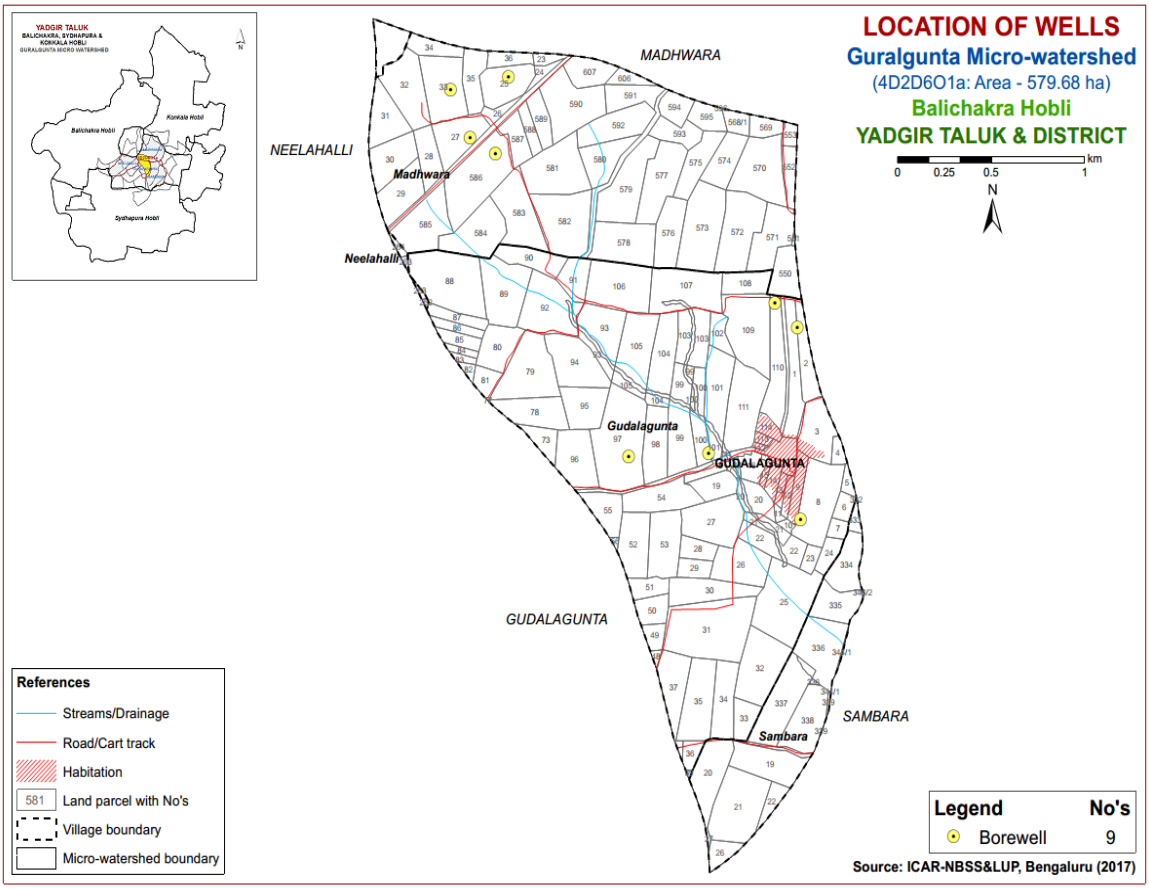


Fig.2.6 Location of Wells map of Guralgunta Microwatershed

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 Guralgunta 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 their 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 582 ha. The methodology followed for carrying out land resource inventory was as per the guidelines given in Soil Survey Manual (IARI, 1971; Soil Survey Staff, 2006; Natarajan *et al.,* 2015) which is briefly described below.

3.1 Base Maps

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

3.2 Image Interpretation for Physiography

False Colour Composites (FCCs) of Cartosat-I and LISS-IV merged satellite data covering microwatershed area was visually interpreted using image interpretation elements and all the available collateral data with local knowledge. The delineated physiographic boundaries were transferred on to a cadastral map overlaid on satellite imagery. Physiographically, the area has been identified as granite and granite gneiss and alluvial landscapes. They were 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)
- **G3** **Valleys/ lowlands**
  - G31 Valleys, pink tones
  - G32 Valleys gray mixed with pink tones

DSe – Alluvial Landscape

- **DSe 1 – Summit**
  - DSe 11 –
  - DSe 12 –
- **DSe 2 – Very genetly sloping**
  - DSe 21 – Very gently sloping, dark gray tone
  - DSe 22 – Very gently sloping, medium gray tone
  - DSe 23 – Very gently sloping, yellowish grey tone
  - DSe 24 – Very gently sloping, whitish grey tone
  - DSe 25 – Very gently sloping, whitish/ eroded/ calcareous tone
  - DSe 26- Very gently sloping, medium pink
- **DSe 3 – Valley/ Lowland**
  - DSe 31 – Whitish gray/Calcareous
  - DSe 32 – Gray with pink patches
  - DSe 33 – Medium gray tone
  - DSe 34 – Lightish gray tone
  - DSe 35 – Dark gray tone

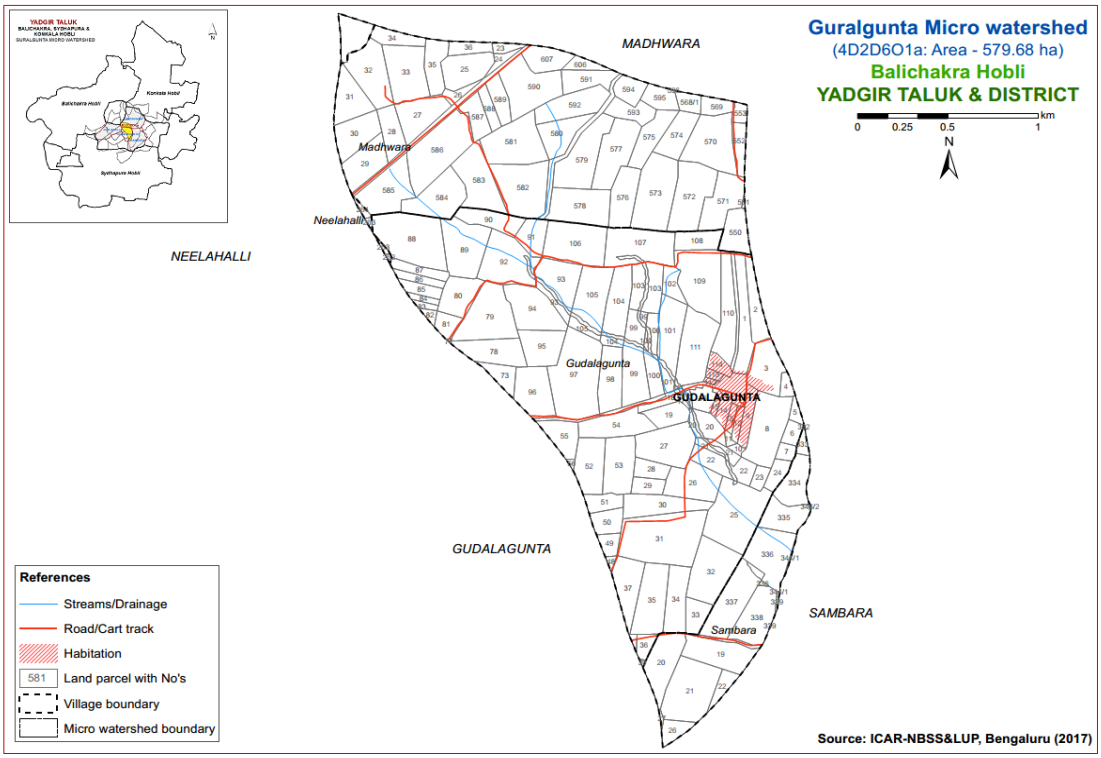


Fig 3.1 Scanned and Digitized Cadastral map of Guralgunta Microwatershed

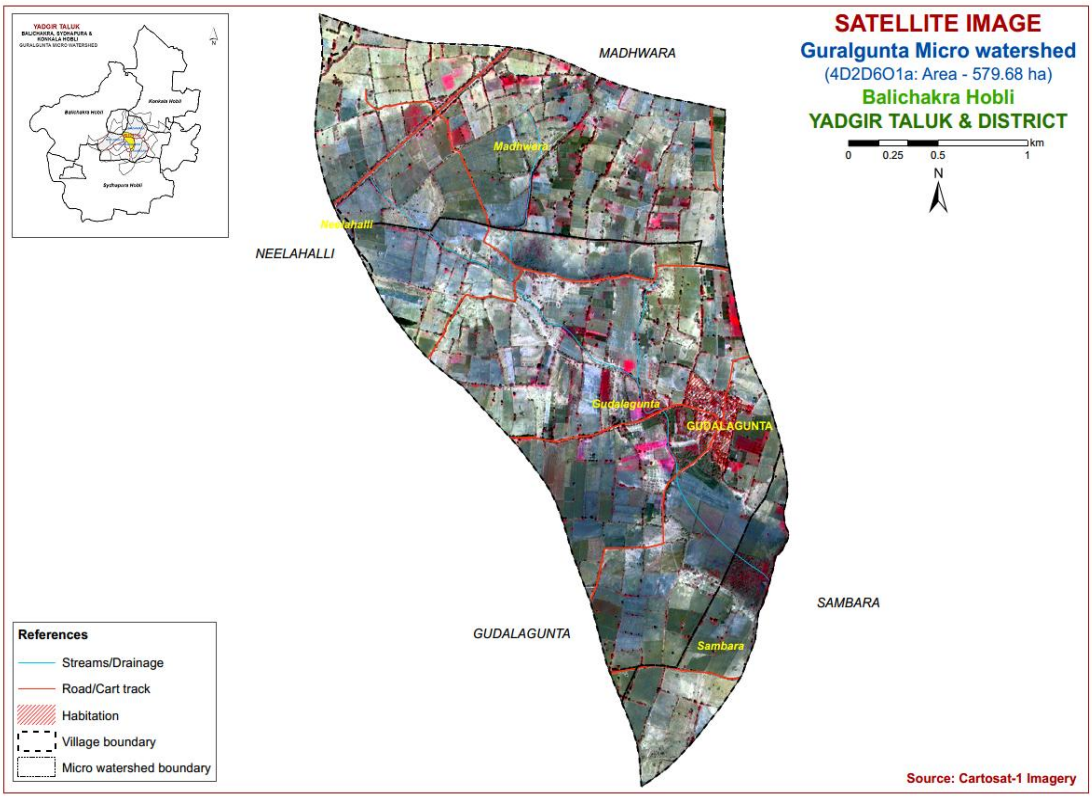


Fig.3.2 Satellite Image of Guralgunta Microwatershed

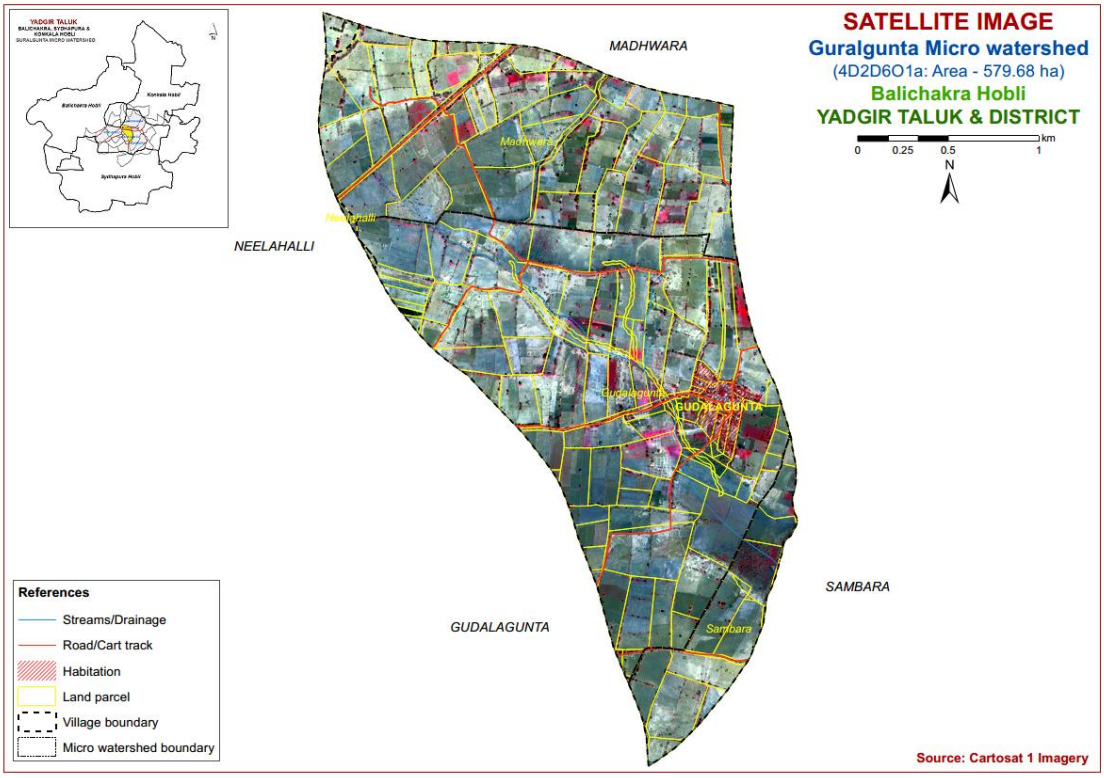


Fig. 3.3 Cadastral map overlaid on IRS PAN+LISS IV merged imagery of Guralgunta Microwatershed

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).

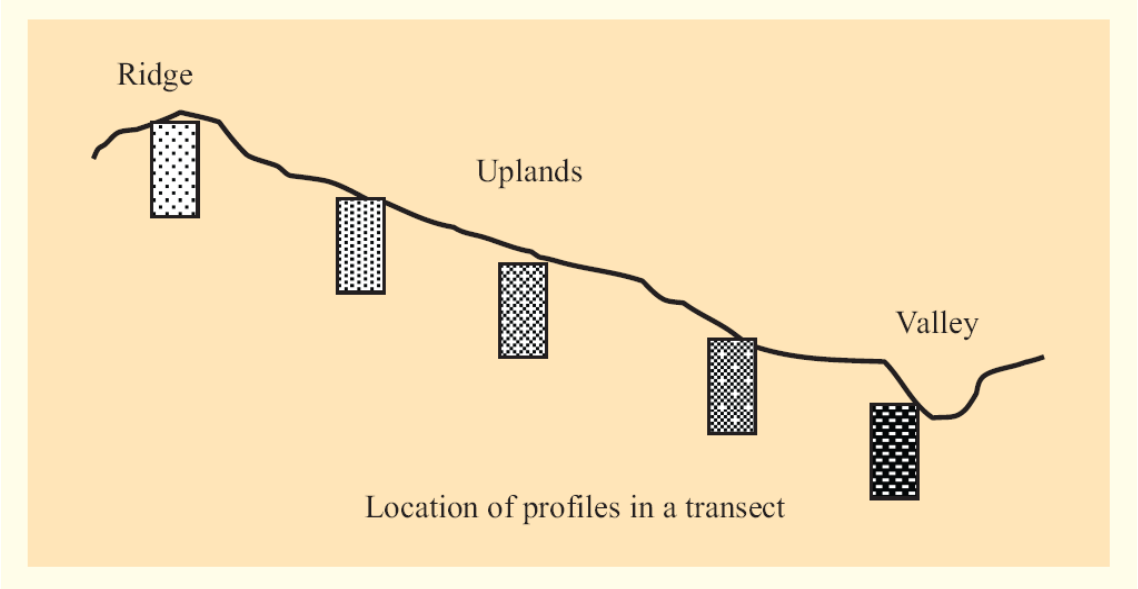


Fig: 3.4. Location of profiles in a transect

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, 14 soil series were identified in the Guralgunta microwatershed.

Table 3.1 Differentiating Characteristics used for identifying Soil Series

(Characteristics are of Series Control Section)

Sl. no.	Soil Series	Depth (cm)	Colour (moist)	Texture	Gravel (%)	Horizon sequence	Calcareous-ness
Soils of Granite and Granite Gneiss Landscape							
1	BDL (Badiyala)	25-50	7.5 YR 2.5/3, 2.5/2, 3/3, 10 YR 3/4, 4/3	sl	-	Ap-Bw	e
2	SBR (Sambara)	50-75	10 YR 7/1 7.5 YR 7/4	ls	-	Ap-Ac	-
3	HLG (Halagera)	50-75	10 YR 3/2, 4/4 7.5 YR 4/3, 4/2	scl	-	Ap-Bw	es
4	JNK (Jinkera)	50-75	10 YR 3/1, 3/2 7.5 YR 3/4	scl	-	Ap-Bw	e
5	YLR (Yalleri)	50-75	2.5 YR 3/4, 4/4 5 YR 3/4 7.5 YR 4/4	c	15-35	Ap-Bt	-
6	GWD (Gowdagera)	75-100	10 YR 3/1, 3/2, 4/2	scl	-	Ap-Bw	es
7	PGP (Poglapur)	100-150	5 YR 4/6, 3/3 7.5 YR 4/4	sc	-	Ap-Bt	-
8	YDR (Yadgir)	100-150	10 YR 4/3, 4/4 2.5 YR 4/3, 5/3	sl	-	Ap-Ac	-
9	NGP (Nagalapur)	100-150	10 YR 3/2, 3/1, 2/1	c	-	Ap-Bss	es
10	BGD (Belagundi)	100-150	10 YR 5/4, 4/4 7.5 YR 4/4	c	-	Ap-Bw	-
11	MDR (Madhwara)	>150	10 YR 3/1, 3/2,2/1,2/2	scl	-	Ap-Bw	e
12	BMN (Bhimanahalli)	>150	10 YR 3/1	c	-	Ap-Bss	es
Soils of Alluvial Landscape							
13	KDR (Kudlura)	100-150	10 YR 3/1, 3/2, 4/1,5/2	c	-	Ap-Bw	es
Low Land Soils							
14	TMK (Thumakur)	>150	10 YR 3/1, 3/2, 3/3,4/3	c	-	Ap-Bw	e

3.4 Soil Mapping

The area under each soil series was further separated into soil phases and their boundaries delineated on the cadastral map based on the variations observed in the texture of the surface soil, slope, erosion, presence of gravel, stoniness etc. A soil phase is a subdivision of soil series based mostly on surface features that affect its use and management. The soil mapping units are shown on the map (Fig.3.5) in the form of symbols. During the survey many 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 17 soil mapping units representing 14 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 soil phases mapped in the microwatershed. Each mapping unit (soil phase) delineated on the map has similar soil and site characteristics. In other words, all the farms or survey numbers included in one soil phase will have similar management needs and have to be treated accordingly.

3.5 Land Management Units (LMU's)

The 17 soil phases identified and mapped in the microwatershed were grouped into 8 Land Management Units (LMU's) for the purpose of preparing a Proposed Crop Plan for sustained development of the microwatershed. The database (soil phases) generated under LRI was utilized for identifying Land Management Units (LMU's) based on the management needs. One or more than one soil site characteristic having influence on the management have been choosen for identification and delineation of LMUs. For Guralgunta microwatershed, five soil and site characteristics, namely soil depth, soil texture, slope, erosion and gravel content have been considered for defining LMUs. The Land Management Units are expected to behave similarly for a given level of management.

3.6 Laboratory Characterization

Soil samples for each soil series were collected from representative master profiles for laboratory characterization by following the methods outlined in the Laboratory Manual (Sarma *et al*, 1987). Surface soil samples collected from farmer's fields (59 samples) for fertility status (major and micronutrients) at 250 m grid interval in the year 2017 were analyzed in the laboratory (Katyal and Rattan, 2003). By linking the soil fertility data to the survey numbers through GIS, soil fertility maps were generated by using Kriging method for the microwatershed.

Table 3.2 Soil map unit description of Guralgunta Microwatershed

Soil No*	Soil Series	Soil Phase	Mapping Unit Description	Area in Ha (%)
Soil of Granite and Granite Gneiss Landscape				
	BDL	Badiyala soils are shallow (25-50 cm), well drained, have dark brown to very dark brown and dark yellowish brown, sandy loam soils occurring on very gently to gently sloping uplands under cultivation		**66(11.24)**
2		BDLbB2	Loamy sand surface, slope 1-3%, moderate erosion	17(2.86)
4		BDLhB2	Sandy clay loam surface, slope 1-3%, moderate erosion	49(8.38)
	SBR	Sambara soils are moderately shallow (50-75 cm), well drained, have light gray to pink, loamy sand soils occurring on very gently to gently sloping uplands under cultivation		**60(10.32)**
11		SBRcB2	Sandy loam surface, slope 1-3%, moderate erosion	60(10.32)
	HLG	Halagera soils are moderately shallow (50-75 cm), moderately well drained, have dark brown to dark yellowish brown and dark grayish brown, calcareous sandy clay loam black soils occurring on very gently sloping uplands under cultivation		**1(0.22)**
16		HLGcB2	Sandy loam surface, slope 1-3%, moderate erosion	1(0.22)
	JNK	Jinkera soils are moderately shallow (50-75 cm), well drained, have dark brown to very dark grayish brown, sandy clay loam soils occurring on very gently sloping uplands under cultivation		**80(13.82)**
20		JNKcB2	Sandy loam surface, slope 1-3%, moderate erosion	66(11.43)
22		JNKiB2	Sandy clay surface, slope 1-3%, moderate erosion	14(2.39)
	YLR	Yalleri soils are moderately shallow (50-75 cm), well drained, have brown to reddish brown and dark reddish brown, clayey red soils occurring on very gently to gently sloping uplands under cultivation		**43(7.29)**
29		YLRcB2g1	Sandy loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	6(0.97)
31		YLRiB2	Sandy clay surface, slope 1-3%, moderate erosion	37(6.32)
	GWD	Gowdagera soils are moderately deep (75-100 cm), moderately well drained, have dark grayish brown to very dark grayish brown, sodic, calcareous sandy clay loam soils occurring on very gently sloping uplands under cultivation		**5(0.79)**
34		GWDcB2	Sandy loam surface, slope 1-3%, moderate erosion	5(0.79)
	PGP	Poglapur soils are moderately deep (75-100 cm), well drained, have brown to dark reddish brown and yellowish red, sandy clay red soils occurring on very gently sloping uplands under cultivation		**1(0.13)**

40		PGPcB2	Sandy loam surface, slope 1-3%, moderate erosion	1(0.13)
	YDR	Yadgir soils are deep (100-150 cm), well drained, have brown to dark yellowish brown and olive brown, sodic sandy loam soils occurring on very gently sloping uplands under cultivation		**14(2.45)**
42		YDRcB2	Sandy loam surface, slope 1-3%, moderate erosion	14(2.45)
	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		**64(11.11)**
49		NGPmB2	Clay surface, slope 1-3%, moderate erosion	64(11.11)
	BGD	Belagundi soils are deep (100-150 cm), well drained, have brown to dark yellowish brown, clayey soils occurring on very gently sloping uplands under cultivation		**0.46(0.08)**
50		BGDbB2	Loamy sand surface, slope 1-3%, moderate erosion	0.46(0.08)
	MDR	Madhwara soils are very deep (>150 cm), moderately well drained, have very dark gray to very dark brown, sandy clay loam soils occurring on nearly level to very gently sloping uplands under cultivation		**33(5.66)**
61		MDRmB2	Clay surface, slope 1-3%, moderate erosion	33(5.66)
	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		**123(21.17)**
62		BMNmB2	Clay surface, slope 1-3%, moderate erosion	123(21.17)
Soil of Alluvial Landscape				
	KDR	Kudlura soils are deep (100-150 cm), moderately well drained, have dark gray to very dark grayish brown, calcareous clayey alluvial soils occurring on nearly level to very gently sloping uplands under cultivation		**36(6.23)**
84		KDRcB2	Sandy loam surface, slope 1-3%, moderate erosion	36(6.23)
Lowland Soils				
	TMK	Thumakur soils are very deep (>150 cm), moderately well drained, have brown to very dark grayish brown, sodic, slightly calcareous clay black soils occurring on nearly level to very gently sloping lowlands under cultivation		**46(7.88)**
104		TMKiB2	Sandy clay surface, slope 1-3%, moderate erosion	46(7.88)

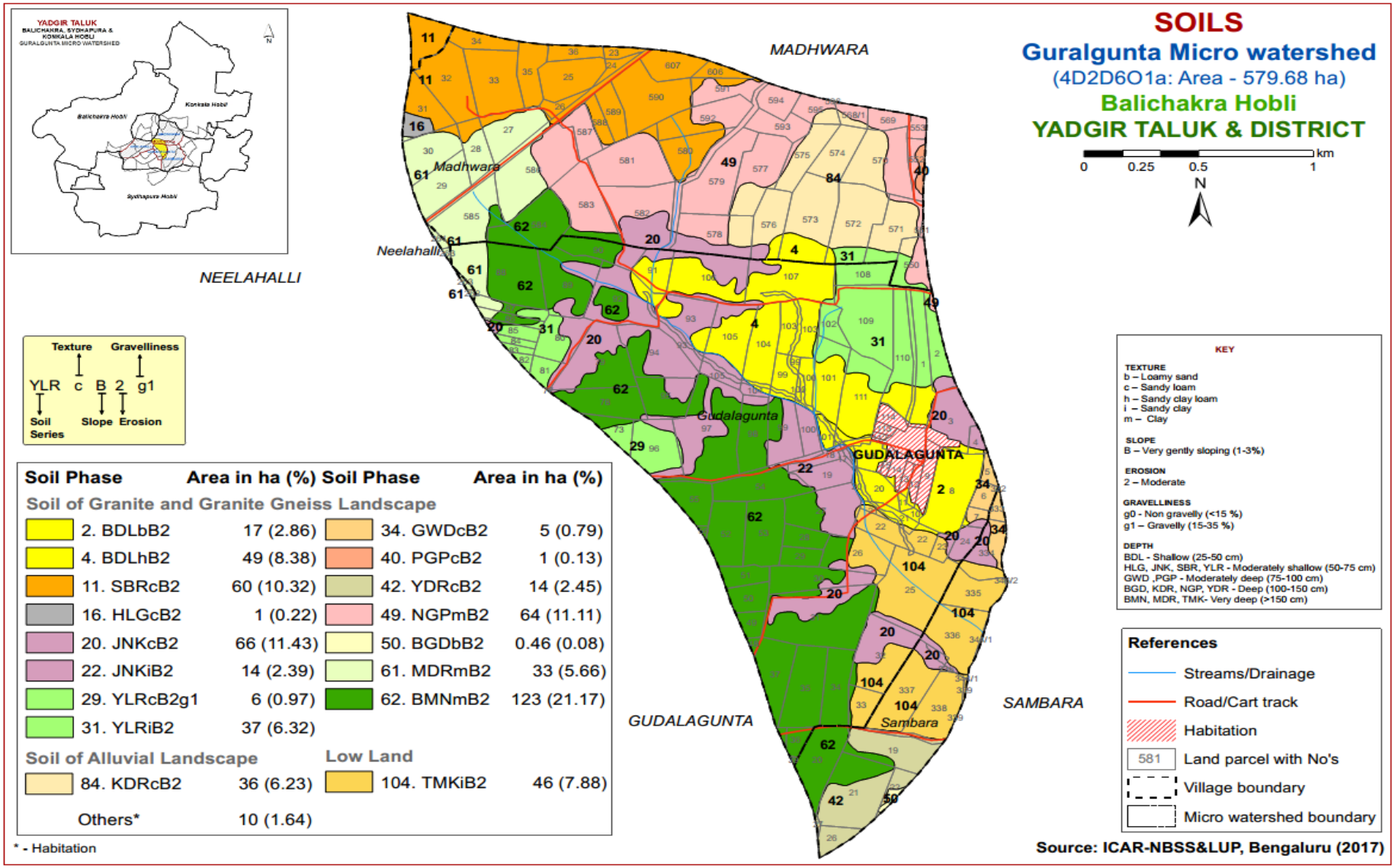


Fig 3.5 Soil Phase or Management Units - Guralgunta Microwatershed.

Chapter 4

THE SOILS

Detailed information pertaining to the nature, extent and their distribution of different kinds of soils occurring in Guralgunta microwatershed is provided in this chapter. The microwatershed area has been identified as granite gneiss and alluvial landscapes based on geology. In all, 14 soil series are identified. Soil formation is the result of the combined effect of environmental and terrain factors that are reflected in soil morphology. The soil formation is dominantly influenced by the parent material, climate, time and relief.

A brief description of each of the 14 soil series identified followed by 17 soil phases (management units) mapped are furnished below. The physical and chemical characteristics of soil series identified in Guralgunta microwatershed are given in Table 4.1. The soils in any one map unit differ from place to place in their depth, texture, slope, gravelliness, erosion or any other site characteristic that affect management. The soil phase map can be used for identifying the suitability of areas for growing specific crops or for other alternative uses and also for deciding the type of conservation structures needed. The detailed information on soil and site-characteristics like soil depth, surface soil texture, slope, erosion, gravelliness, AWC, LCC etc, with respect to each of the soil phase identified is given village/survey number wise for the microwatershed in Appendix-I.

4.1 Soils of granite gneiss landscape

In this landscape, 12 soil series are identified and mapped. Brief description of each series identified is given below. Of these, BMN series occupies maximum area of 123 ha (21%) followed by JNK 80 ha (14%), BDL 66 ha (11%), NGP 64 ha (11%), SBR 60 ha (10%), YLR 43 ha (7%), MDR 33 ha (6%), YDR 14 ha (2%), GWD 5 ha (1%), HLG 1 ha (0.22 %), PGP 1ha (0.13%) and BGD 0.46 ha (0.10%). In low land, only one soil series is identified and mapped. TMK series occupied an area of 46 ha (8%). 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 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). Two soil phases were identified and mapped.

Landscape and Soil Profile characteristics of Jinkera (JNK) Series

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

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

Landscape and Soil Profile characteristics of Badiyala (BDL) Series

4.1.4 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, calcareous, isohyperthermic family of Typic Haplusterts.

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

Landscape and Soil Profile characteristics of Naglapur (NGP) Series

4.1.5 Sambara (SBR) Series: Sambara soils are moderately shallow (50-75 cm), somewhat excessively drained, have light grey to reddish yellow loamy sand soils. They are developed from weathered granite gneiss and occur on very gently to gently sloping uplands under cultivation. The Sambara series has been classified as a member of the sandy, mixed, isohyperthermic family of Typic Ustorthents.

The thickness of the soil ranges from 52-75 cm. Thickness of A horizon ranges from 8 to 23 cm. Its colour is in hue 10 YR and 7.5 YR with value 3 and chroma 1 to 4. The texture varies from loamy sand to sandy loam. The thickness of subsurface horizons ranges from 41 to 66 cm. Its colour is in 10 YR and 7.5 YR hue with value 3 to 5 and chroma 1 to 4. The texture is loamy sand. The available water capacity is very low (<50 mm/m). Only one soil phase was identified and mapped.

Landscape and Soil Profile characteristics of Sambara (SBR) Series

4.1.6 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 Haplustalfs.

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 soil phases were identified and mapped.

Landscape and Soil Profile characteristics of Yalleri (YLR) Series

4.1.7 Madhwara (MDR) Series: Madhwara soils are very deep (>150 cm), well drained, have black to very dark brown and very dark gray to very dark grayish brown, slightly calcareous sandy clay loam soils. They are developed from weathered granite gneiss and occur on nearly level to very gently sloping uplands under cultivation. The Madhwara series has been classified as a member of the fine-loamy, mixed, isohyperthermic family of Fluventic Haplustepts.

The thickness of the solum is more than 150 cm. The thickness of A horizon ranges from 10 to 16 cm. Its colour is in 10 YR hue with value 3 to 5 and chroma 2 to 3. Texture varies from sandy clay and clay. The thickness of B horizon is >150 cm. Its colour is in 10 YR hue with value 3 to 5 and chroma 1 to 3. Texture varies from sandy clay loam to sandy clay and is slightly 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 Madhwara (MDR) Series

4.1.8 Yadgir (YDR) Series: Yadgir soils are deep (100-150 cm), well drained, have very dark yellowish brown to light olive brown, sandy loam soils. They are developed from weathered granite gneiss and occur on very gently to gently sloping uplands under cultivation. The Yadgir series has been classified as a member of the coarse-loamy, mixed, isohyperthermic family of Typic Ustorthents.

The thickness of the soil ranges from 105 to 145 cm. The thickness of surface horizon ranges from 6 to 10 cm. Its colour is in 10 YR hue with value 4 and chroma 3. The texture is loamy sand. The thickness of subsurface horizon ranges from 95 to 130 cm. Its colour is in 10 YR and 2.5 Y hue with value 4 to 5 and chroma 3 to 4. Texture is loamy sand to sandy loam and sandy clay loam. These are sodic with ESP more than 15 per cent ranging from 1 to 89 per cent. The available water capacity is low (51-100 mm/m). Only one soil phase was identified and mapped.

Landscape and Soil Profile characteristics of Yadgir (YDR) Series

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

The thickness of the solum ranges from 76 to 100 cm. The thickness of A horizon ranges from 8 to 16 cm. Its colour is in hue 10 YR with value 3 to 4 and chroma 2 to 4. Its texture varies from sandy loam to sandy clay loam. The thickness of B horizon ranges from 61 to 91 cm. Its colour is in hue 10 YR with value 2 to 4 and chroma 1 to 4. Its texture is sandy clay loam to sandy clay and is calcareous. These are sodic with ESP more than 15 per cent ranging from 44 to 121 per cent. The available water capacity is medium (101-150 mm/m). Only one soil phase was identified and mapped.

Landscape and Soil Profile characteristics of Gowdagera (GWD) Series

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

The thickness of the solum ranges from 51 to 75 cm. The thickness of A horizon ranges from 9 to 15 cm. Its colour is in 7.5 YR and 10 YR hue with value 3 to 4 and chroma 2 to 4. The texture is loamy sand to sandy clay loam. The thickness of B horizon ranges from 44 to 66 cm. Its colour is in 10 YR and 7.5 YR hue with value 3 to 4 and chroma 2 to 3. Its texture varies from sandy clay loam to sandy clay and is calcareous. The available water capacity is low (51-100 mm/m). Only one soil phase was identified and mapped.

Landscape and Soil Profile characteristics of Halagera (HLG) Series

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

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

Landscape and Soil Profile characteristics of Poglapur (PGP) Series

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

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

Landscape and Soil Profile characteristics of Belagundi (BGD) Series

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

The thickness of the solum ranges from 150-200 cm. The thickness of A horizon ranges from 7 to 14 cm. Its colour is in 10 YR hue with value 3 to 5 and chroma 1 to 3. Texture varies from sandy loam to sandy clay and clay. The thickness of B horizon is >150 cm. Its colour is in 10 YR hue with value 3 to 5 and chroma 1 to 3. Texture varies from sandy clay to clay and is slightly calcareous. These are sodic with ESP ranging from 16 to 90 per cent. The available water capacity is very high (>200 mm/m). Only one soil phase was identified and mapped.

Landscape and Soil Profile characteristics of Thumakur (TMK) Series

4.2 Soils of Alluvial landscape

In this landscape, only one soil series was identified and mapped. Brief description of series identified is given below. KDR series occupies an area of 36 ha (6%). Brief description of series identified and number of soil phases mapped is given below.

4.2.1 Kudlura (KDR) Series: Kudlura soils are deep (100-150 cm), moderately well drained, very dark gray to grayish brown, calcareous cracking clay soils. They have developed from alluvium and occur on nearly level to very gently sloping plains under cultivation. The Kudlura series has been classified as a member of the fine, mixed (calcareous) isohyperthermic family of Fluventic Haplustepts.

The thickness of the solum ranges from 110 to 149 cm. The thickness of A horizon ranges from 6 to 22 cm. Its colour is in 10 YR hue with value 3 to 4 and chroma 1 to 2. The texture ranges from sandy loam, sandy clay loam, sandy clay and clay. The thickness of B horizon ranges from 115 to 143 cm. Its colour is in 10 YR hue with value 3 to 4 and chroma 1 to 3. Texture is sandy clay loam, sandy clay to clay and is calcareous in nature. The available water capacity is very high (>200 mm/m). Only one soil phases was identified and mapped.

Landscape and Soil Profile characteristics of Kudlura (KDR) Series

Table: 4.1 Physical and Chemical characteristics of soil series identified in Guralgunta microwatershed

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

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

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

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

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-12	6.20	-	-	0.074	1.00	0.00	2.80	0.98	0.14	0.01	3.92	4.20	0.72	93	0.20
12-28	9.04	-	-	0.253	0.80	3.20	-	-	0.16	0.69	-	16.90	0.77	100	4.09
28-52	9.41	-	-	0.364	1.10	3.60	-	-	0.16	1.39	-	11.10	0.75	100	12.52

Contd…

Soil Series: Sambara (SBR) **Pedon:** R-10

Location: $16^0$42'04.5"N $77^0$14'35.3"E, Jinatera village, Balichakra hobli, Yadgir taluk and district

Analysis at: NBSS&LUP, Regional Centre, Bengaluru **Classification:** Sandy, mixed, isohyperthermic Typic 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 coars (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-9	Ap	81.90	8.22	9.88	23.76	14.05	23.76	10.62	9.71	-	ls	9.45	2.69
9-17	C1	84.08	6.59	9.33	21.30	20.69	17.65	17.65	6.80	-	ls	7.84	2.65
17-60	C2	86.86	6.17	6.98	11.53	21.54	25.08	23.46	5.26	-	ls	5.48	2.62
60-78	C3	87.27	6.92	5.81	15.05	20.91	26.36	19.29	5.66	-	ls	5.19	2.81

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-9	8.24	-	-	0.145	0.61	0.91	-	-	0.12	0.09	-	7.50	0.76	100	1.15
9-17	8.21	-	-	0.068	0.57	0.39	-	-	0.06	0.12	-	6.70	0.72	100	1.82
17-60	8.47	-	-	0.080	0.38	0.48	-	-	0.03	0.17	-	2.70	0.39	100	6.34
60-78	8.50	-	-	0.081	0.30	0.52	-	-	0.03	0.17	-	2.70	0.46	100	6.43

Contd…

Soil Series: Halagera **(**HLG) **Pedon:** R-4

Location: $16^0$44'29.3"N $77^0$13'56.3"E, Halagera village, Yadgir hobli, Yadgir taluk and district

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

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-8	Ap	81.02	8.42	10.56	10.41	24.08	18.98	19.08	8.47	<15	ls	9.10	4.79
8-22	Bw1	61.00	11.50	27.50	8.29	9.35	21.89	14.35	7.12	<15	scl	16.91	12.28
22-53	Bw2	61.41	13.80	24.79	15.98	15.67	12.62	11.78	5.36	15-35	scl	17.08	11.26

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	8.49	-	-	0.185	0.30	2.99	-	-	0.24	0.06	-	8.80	0.83	100	0.69
8-22	8.57	-	-	0.116	0.45	4.03	-	-	0.11	0.02	-	19.50	0.71	100	0.12
22-53	8.70	-	-	0.113	0.27	7.67	-	-	0.11	0.05	-	15.50	0.63	100	0.33

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 coars (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-15	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: 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 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
0-5	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: Gowdagera (GWD) **Pedon:** R-13

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

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

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-18	Ap	79.61	13.94	6.45	14.17	17.53	23.65	17.02	7.24	-	ls	11.36	3.86
18-42	BW1	69.09	10.58	21.06	10.54	16.58	22.01	14.43	5.53	-	scl	31.62	12.30
42-81	Bw2	51.37	13.51	35.60	7.59	10.55	16.24	11.60	5.38	-	sc	67.57	26.89

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

Contd…

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

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

Analysis at: NBSS&LUP, Regional Centre, Bengaluru **Classification:** Fine, mixed, isohyperthermic 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
0-15	Ap	91.81	4.70	3.49	17.80	30.23	15.57	20.93	7.28	-	s	4.94	2.29
15-50	Bt1	46.83	4.99	48.17	11.92	16.22	8.59	6.77	3.33	10	sc	24.59	17.37
50-90	Bt2	45.81	4.73	49.46	17.10	14.09	6.45	5.16	3.01	15	sc	24.44	16.57
90-125	Bt3	58.92	5.86	35.22	28.51	10.45	10.98	5.49	3.48	15	sc	21.73	10.30

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-15	6.83	-	-	0.210	0.76	0.00	1.79	0.88	0.41	0.09	3.16	3.15	0.90	100	2.83
15-50	6.20	-	-	0.105	0.48	0.00	12.27	4.45	0.30	0.39	17.40	17.54	0.36	99	2.22
50-90	6.23	-	-	0.080	0.40	0.00	11.51	3.92	0.28	0.37	16.09	17.33	0.35	93	2.16
90-125	6.49	-	-	0.068	0.20	0.00	11.19	3.62	0.27	0.40	15.49	17.43	0.49	89	2.29

Contd…

Soil Series: Yadgir **(**YDR) **Pedon:** R-5

Location: $16^0$35'43.6"N $77^0$17'06.4"E, Kanikal village, Balichakra hobli, Yadgir taluk and district

Analysis at: NBSS&LUP, Regional Centre, Bengaluru **Classification:** Coarse-loamy, isohyperthermic Typic 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
0-14	Ap	73.39	11.31	15.30	6.76	20.27	24.87	15.66	5.83	-	sl	12.14	7.22
14-43	C1	86.59	8.77	4.64	23.19	26.92	14.11	15.22	7.16	-	ls	6.97	2.68
43-89	C2	80.41	3.75	15.84	8.06	13.47	36.73	15.71	6.43	-	sl	22.84	10.18
89-110	C3	63.55	5.40	31.05	8.10	23.05	19.00	9.87	3.53	15-35	scl	38.46	17.70

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-14	9.47	-	-	0.371	0.32	1.30	14.71	4.28	0.38	1.54	20.91	12.70	0.83	165	12.14
14-43	7.25	-	-	0.114	0.56	0.00	2.29	0.86	0.07	0.03	3.25	3.40	0.73	96	0.78
43-89	10.30	-	-	0.820	0.16	0.52	1.70	0.98	0.15	6.62	9.45	8.61	0.54	110	76.93
89-110	10.80	-	-	1.440	0.12	0.91	1.02	2.00	0.29	14.43	17.74	16.17	0.52	110	89.22

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

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

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

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

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

Contd…

Soil Series: Madhawara (MDR) **Pedon:** T_2 P_2

Location: $16^0$43'48.9"N $77^0$18'38.3"E, Yaleri village, Balichakra hobli, Yadgir taluk and district

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

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coars (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-11	Ap	58.94	20.74	20.32	5.41	7.28	13.31	20.89	12.06	-	scl	16.47	8.85
11-30	Bw1	55.52	19.32	25.16	5.00	7.19	13.12	19.69	10.52	-	scl	18.25	10.18
30-53	Bw2	53.95	19.15	26.90	4.68	7.48	12.58	19.65	9.56	-	scl	26.99	14.02
53-117	Bw3	52.68	19.51	27.81	2.84	5.47	14.72	20.82	8.83	-	scl	37.86	17.40
117-160	Bw4	49.95	17.27	32.79	2.11	5.07	14.15	20.49	8.13	-	scl	44.15	20.38

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}							%	%
0-11	8.31	-	-	0.33	0.46	2.76	-	-	0.45	0.47	-	20.57	1.01	100	2.26
11-30	9.25	-	-	0.20	0.31	4.20	-	-	0.19	1.40	-	23.98	0.95	100	5.84
30-53	9.78	-	-	0.40	0.19	5.76	-	-	0.16	1.53	-	24.53	0.91	100	6.22
53-117	9.94	-	-	0.88	0.23	4.80	-	-	0.18	9.09	-	24.31	0.87	100	37.40
117-160	9.98	-	-	0.93	0.15	3.00	-	-	0.24	11.09	-	28.27	0.86	100	39.23

Contd…

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: Kudlura (KDR) **Pedon:** T_1/P_2

Location: $16^0$34'03.1"N $77^0$14'71.7"E, Kyathanala village, Sydhapura Hobli, Yadgir taluk and district

Analysis at: NBSS&LUP, Regional Centre, Bengaluru **Classification:** Fine, mixed (calcareous) 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
0-6	Ap	49.52	14.58	35.90	5.71	7.41	14.81	15.66	5.93	-	sc	26.86	12.10
6-26	BA	50.79	13.31	35.90	7.41	9.10	15.56	13.12	5.61	-	sc	25.65	12.24
26-67	Bw1	43.49	15.97	40.54	5.86	7.38	13.56	10.85	5.86	-	c	31.22	16.48
67-115	Bw2	37.42	18.93	43.66	6.51	6.83	10.95	8.68	4.45	-	c	36.13	22.34
115-144	Bw3	39.74	18.88	41.38	8.16	7.84	10.63	8.70	4.40	-	c	35.83	20.57

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}							%	%
0-6	8.34	-	-	0.15	0.72	3.55	-	-	0.42	0.07	-	33.20	0.92	100	0.22
6-26	8.55	-	-	0.11	0.85	4.90	-	-	0.33	0.25	-	32.70	0.91	100	0.76
26-67	9.08	-	-	0.17	0.60	5.02	-	-	0.18	1.34	-	36.20	0.89	100	3.69
67-115	9.44	-	-	0.37	0.52	6.61	-	-	0.25	6.72	-	39.30	0.90	100	17.09
115-144	9.53	-	-	0.43	0.56	6.10	-	-	0.26	7.85	-	33.70	0.81	100	23.29

Contd…

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

Location: $16^0$38'01.3"N $77^0$16'49.8"E, Kilankera village, Balichakra hobli, Yadgir taluk and district

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

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very 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	62.92	15.76	21.32	5.56	9.37	21.83	18.33	7.83	-	scl	17.98	6.60
12-29	Bw1	45.91	18.53	35.56	6.08	8.18	15.41	11.43	4.82	-	sc	33.40	11.79
29-74	Bw2	48.47	16.24	35.29	5.93	9.84	16.40	11.75	4.55	-	sc	28.66	11.19
74-132	Bw3	38.25	20.59	41.16	3.21	8.23	14.64	8.97	3.21	-	c	38.85	14.72
132-158	Bw4	36.87	19.99	43.14	3.54	7.61	13.08	8.57	4.07	-	c	44.36	15.75

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

Chapter 5

INTERPRETATION FOR LAND RESOURCE MANAGEMENT

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

5.1 Land Capability Classification

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

Soil Characteristics: Depth, texture, gravelliness, calcareousness.

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

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

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

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

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

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

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

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

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

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

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

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

The land capability subclasses have been further subdivided into land capability units based on the kinds of limitations present in each subclass. Ten land capability units are 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 17 soil map units identified in the Guralgunta microwatershed are grouped under 2 land capability classes and 3 land capability subclasses. Entire area in the microwatershed is suitable for agriculture and about 10 ha (2%) is covered by others (habitation and water bodies) (Fig. 5.1).

Good cultivable lands (Class II) cover maximum area of about 87 per cent and are distributed in the major part of the microwatershed with minor problems of soil, erosion and drainage. Moderately good cultivable lands (Class III) cover an area of about 11 per cent and are distributed in the central and southeastern part of the microwatershed with moderate limitations of erosion and soil.

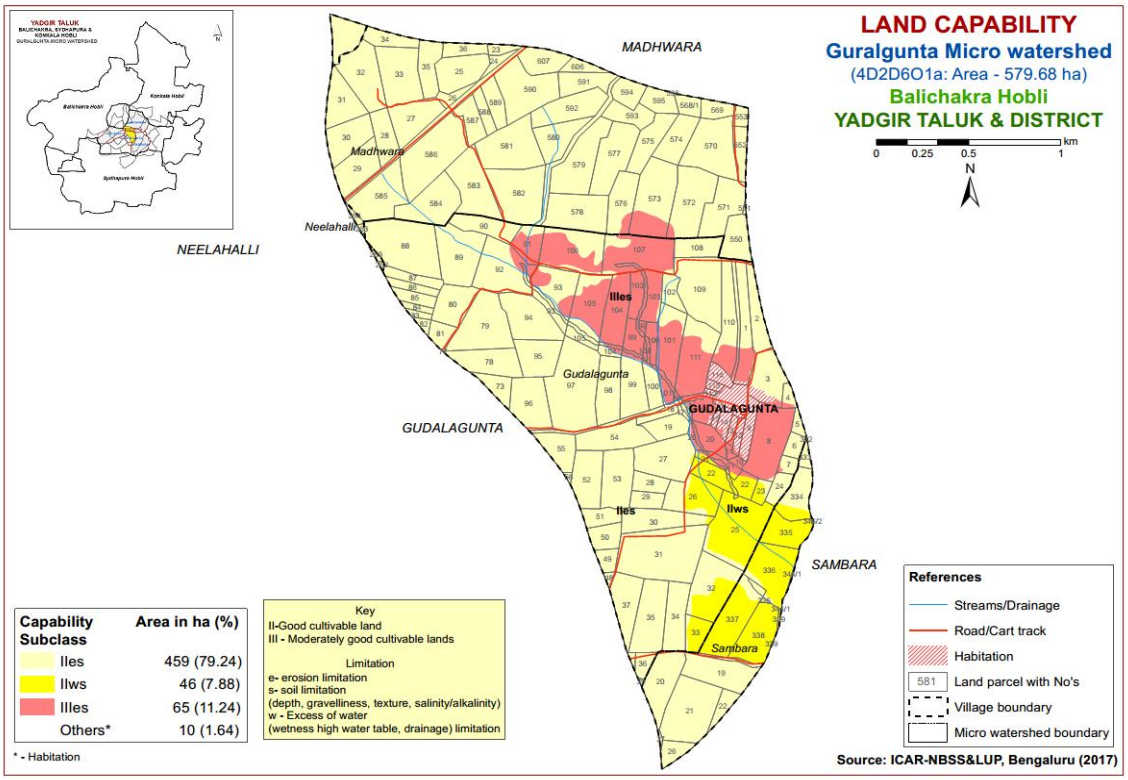


Fig. 5.1 Land Capability map of Guralgunta Microwatershed

5.2 Soil Depth

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

Shallow (25-50 cm) soils occur in an area of 65 ha (11%) and are distributed in the central and eastern part of the microwatershed. Moderately shallow (50-75 cm) soils occupy an area of about 183 ha (32%) and are distributed in the northern, central, western and eastern part of the microwatershed. Deep (100-150 cm) soils occupy an area of 115 ha (20%) and are distributed in the northern and southern part of the microwatershed. Very deep (>150 cm) soils cover maximum area of 201 ha (35%) and are distributed in the major part of the microwatershed.

The most productive lands 316 ha (55%) with respect to soil rooting depth where all climatically adapted annual and perennial crops can be grown are deep to very deep (100 to >150 cm depth) soils occurring in the major part of the microwatershed. The

problem soils (25 to 50 cm depth) cover an area of 65 ha (11%) where only short duration crops can be grown and the probability of crop failure is high.

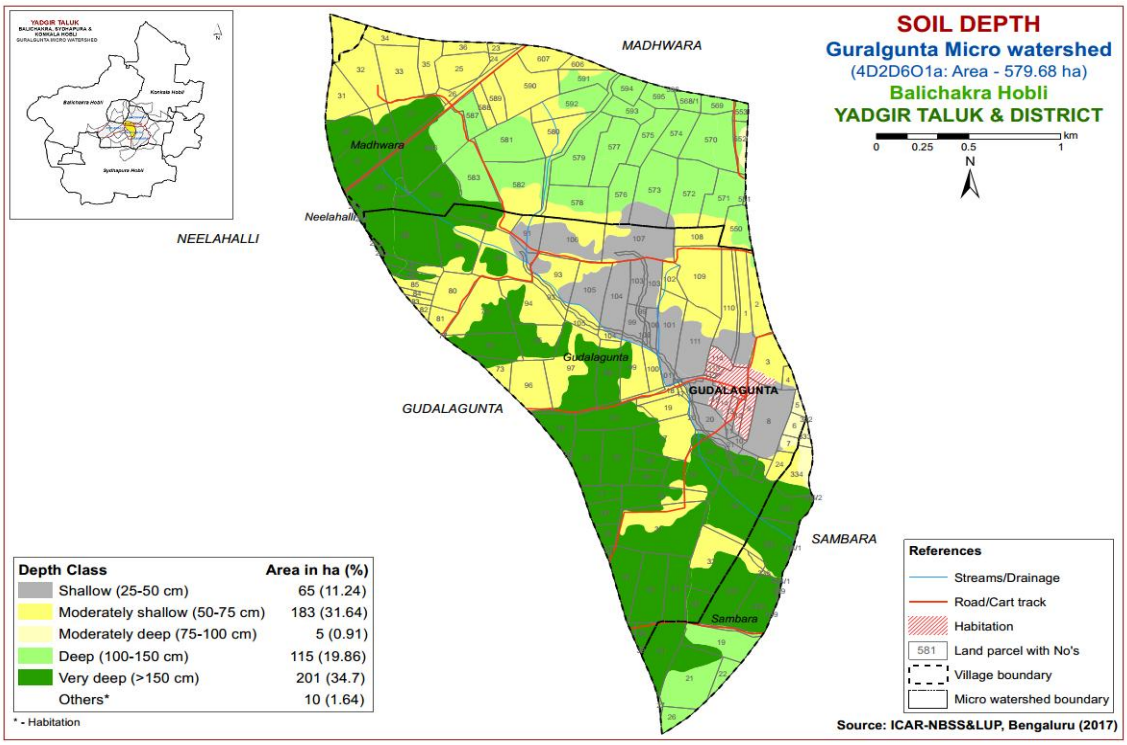


Fig. 5.2 Soil Depth map of Guralgunta Microwatershed

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.

An area of about 17 ha (3%) has soils that are sandy at the surface and are distributed in the southeastern part of the microwatershed. An area of about 238 ha (41%) has soils that are loamy at the surface and are distributed in the northern, western, central, eastern and southern part of the microwatershed. Maximum area of about 316 ha (55%) has soils that are clayey at the surface and occur in the major part of the microwatershed.

The most productive lands with respect to surface soil texture are clayey and loamy soils (96%) that 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 problem soils are sandy covering 3per cent area that have moisture and nutrient constraints.

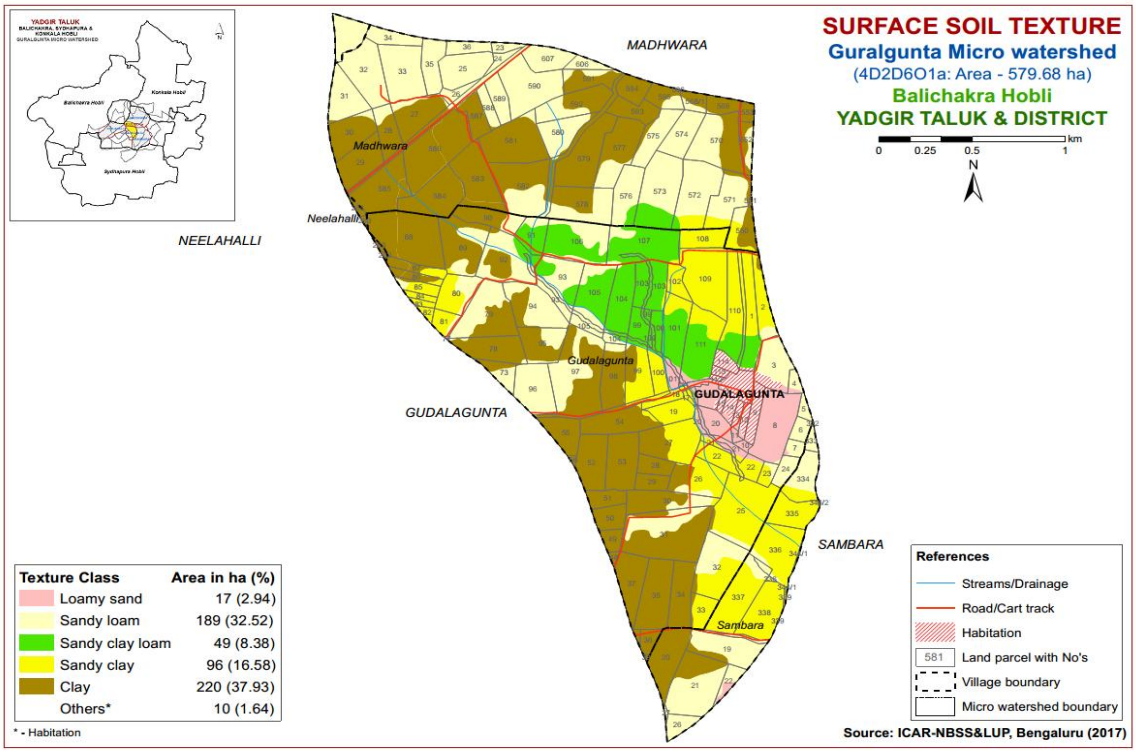


Fig. 5.3 Surface Soil Texture map of Guralgunta Microwatershed

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 are shown in Figure 5.4.

Non gravelly (<15%) soils cover almost entire area of the microwatershed. These are the most productive soils, where all climatically adapted short and long duration crops can be grown. The problem soils with 15-35 per cent gravel cover about 1 per cent and are suitable for growing medium and short duration crops.

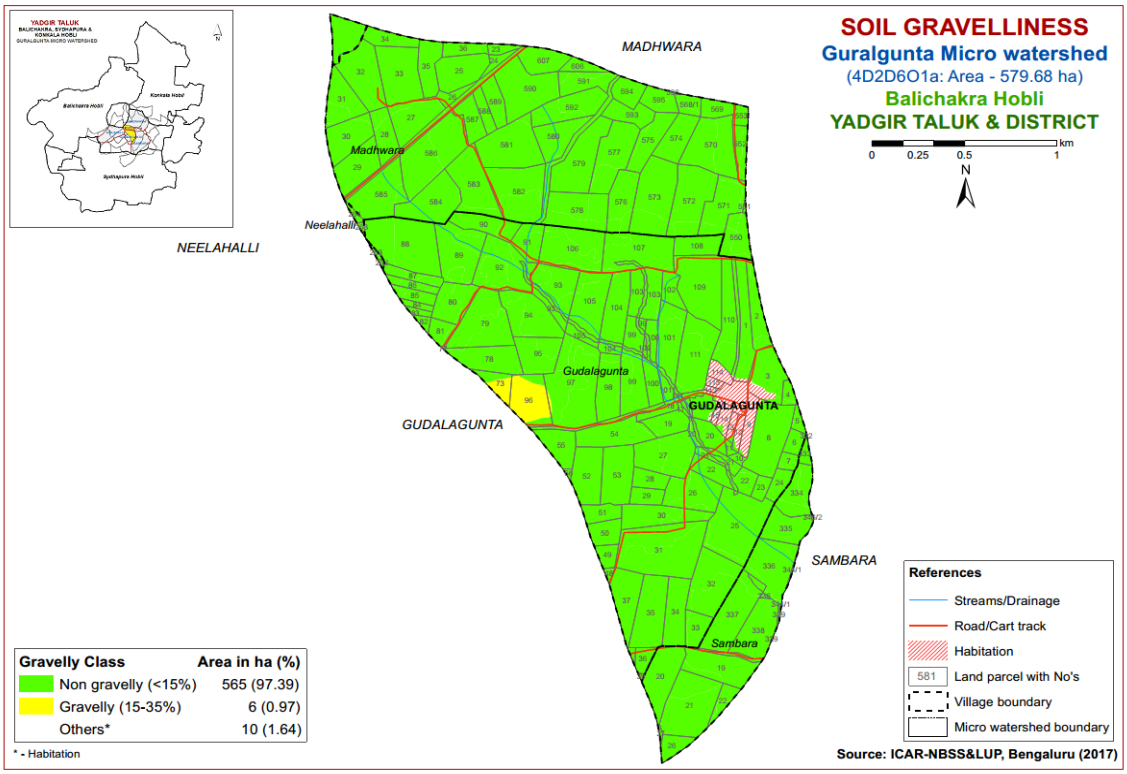


Fig. 5.4 Soil Gravelliness map of Guralgunta Microwatershed

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.

An area of about 125 ha (22%) in the microwatershed has soils that are very low (<50 mm/m) in available water capacity and are distributed in the northern, eastern and central part of the microwatershed and 139 ha (24%) area are low (51-100 mm/m) and are distributed in the western, central, eastern and southern part of the microwatershed. Maximum area of about 302 ha (52%) are very high (>200 mm/m) in available water capacity and are distributed in the all parts of the microwatershed.

About 264 ha (46%) 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 302 ha (52%) are potential areas with regard to AWC where all climatically adapted annual and perennial crops can be grown.

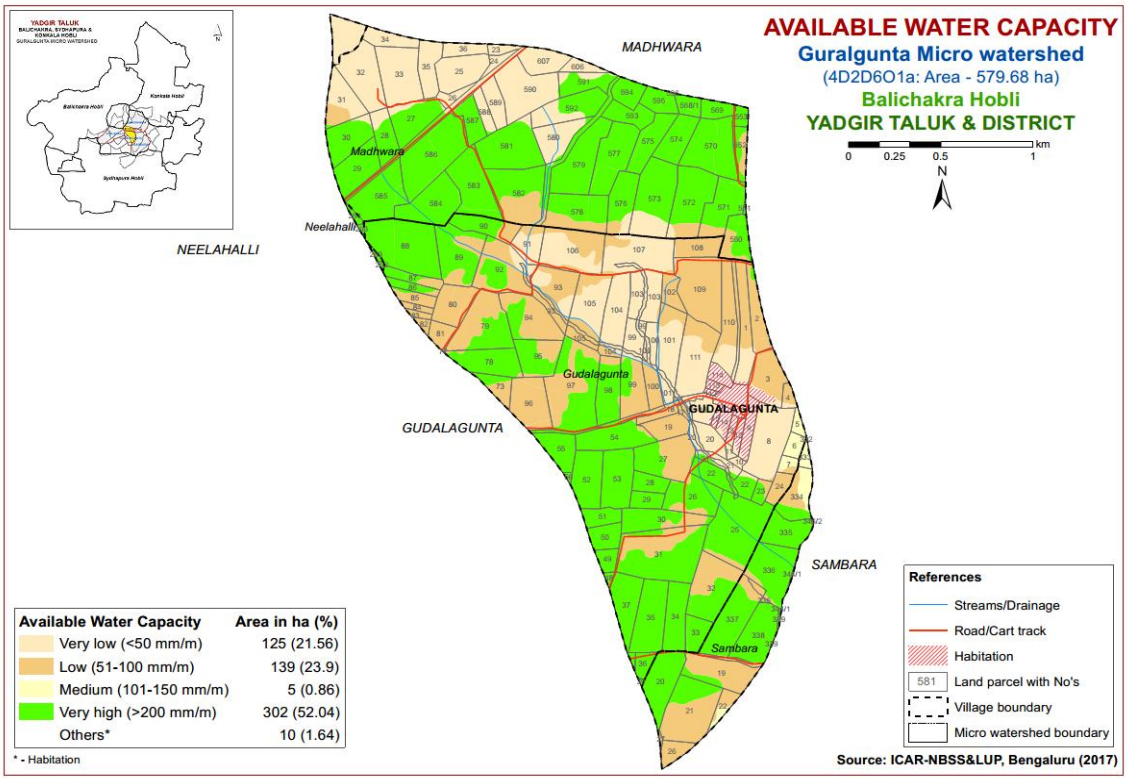


Fig. 5.5 Soil Available Water Capacity map of Guralgunta Microwatershed

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 a single slope class and a slope map was generated showing the area extent and their geographic distribution in the microwatershed (Fig. 5.6).

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

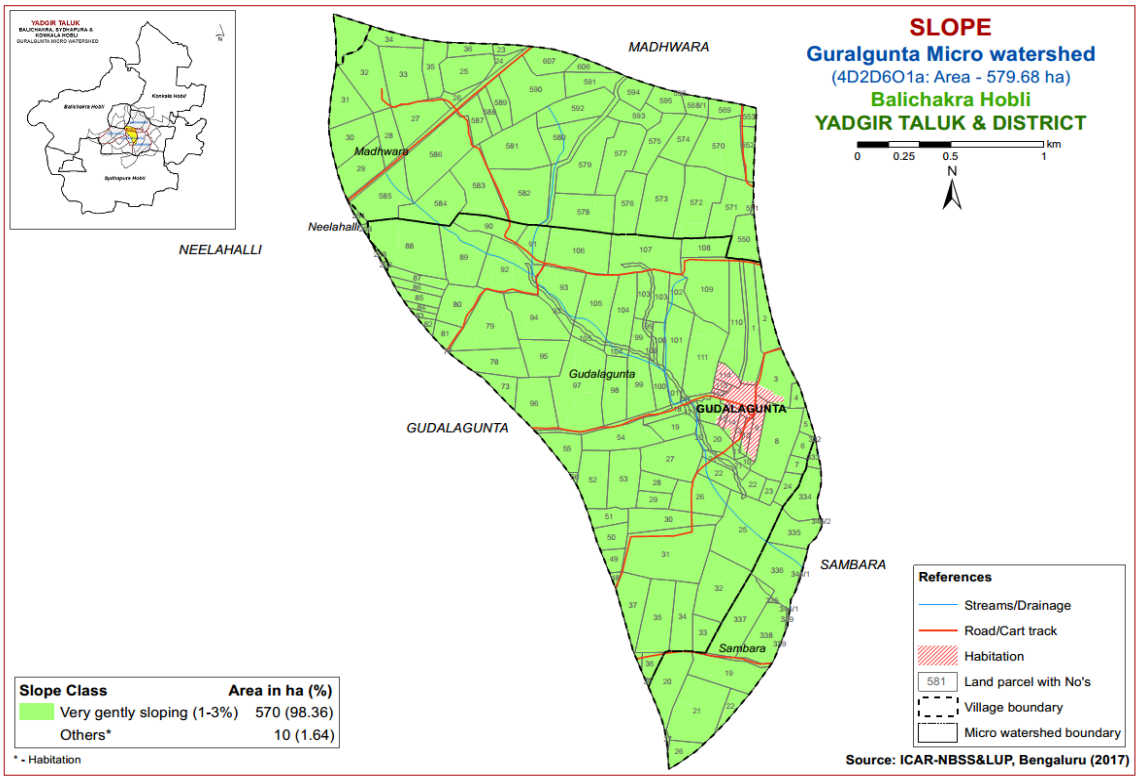


Fig. 5.6 Soil Slope map of Guralgunta Microwatershed

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 entire area of 570 ha (98%) and are distributed in all parts of the microwatershed.

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

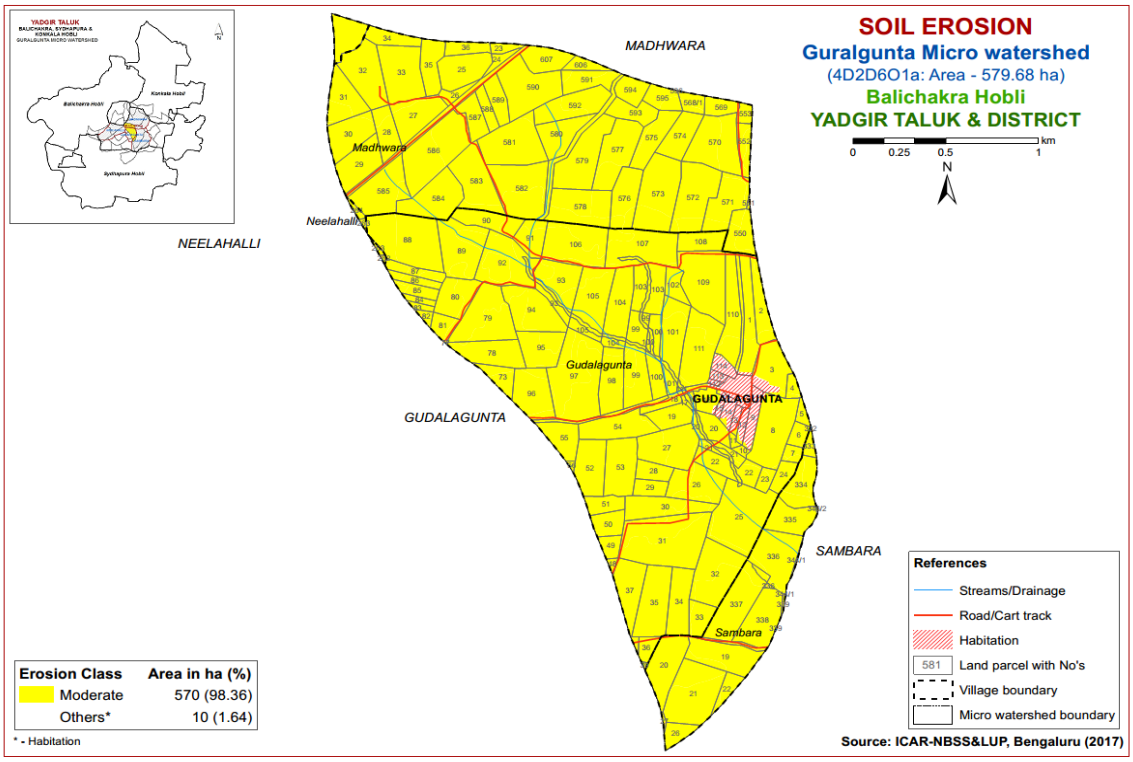


Fig. 5.7 Soil Erosion map of Guralgunta Microwatershed

Chapter 6

FERTILITY STATUS

Soil fertility plays an important role in increasing crop yield. The adoption of high yielding varieties that require high amounts of nutrients has resulted in deficiency symptoms in crops and plants due to imbalanced fertilization and poor inherent fertility status as these areas are characterised by low rainfall and high temperatures. Hence, it is necessary to know the fertility (macro and micro nutrients) status of the soils of the watersheds for assessing the kind and amount of fertilizers required for each of the crop intended to be grown. For this purpose, the surface soil samples collected from the grid points (one soil sample at every 250 m interval) all over the microwatershed through land resource inventory in the year 2017 were analysed for pH, EC, organic carbon, available phosphorus and potassium, and for micronutrients like zinc, boron, copper, iron and manganese, and secondary nutrient sulphur.

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

6.1 Soil Reaction (pH)

The soil analysis of the Guralgunta microwatershed for soil reaction (pH) showed that an area of about 87 ha (15%) is neutral (6.5-7.3) and are distributed in the southern, western and eastern part of the microwatershed. Maximum area of about 224 ha (39%) is slightly alkaline (pH 7.3-7.8) and are distributed in the western part of the microwatershed. An area of about 178 ha (31%) is moderately alkaline (pH 7.8-8.4) and are distributed in all parts of the microwatershed. Strongly alkaline (pH 8.4-9.0) soils occupy an area about 80 ha (14%) and are distributed in the northern part of the microwatershed (Fig. 6.1).

6.2 Electrical Conductivity (EC)

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

6.3 Organic Carbon

The soil organic carbon content (an index of available Nitrogen) in the soils of the microwatershed is low (<0.5%) in an area of about 12 ha (2%) and are distributed in the northern part of the microwatershed. Maximum area of about 289 ha (50%) are medium (0.5-0.75%) in organic carbon and are distributed in all parts of the microwatershed. High (>0.75) covering an area of about 268 ha (46%) and are distributed in the northern, central and southern part of the microwatershed (Fig. 6.3).

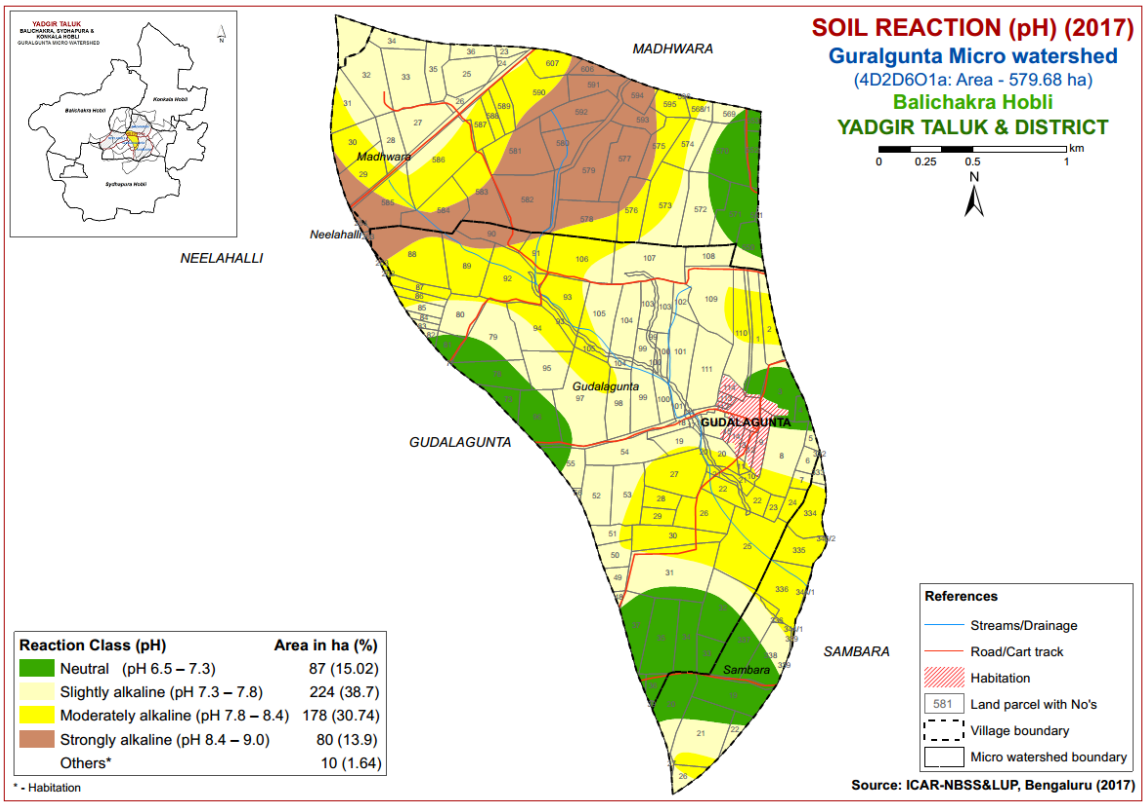


Fig.6.1 Soil Reaction (pH) map of Guralgunta Microwatershed

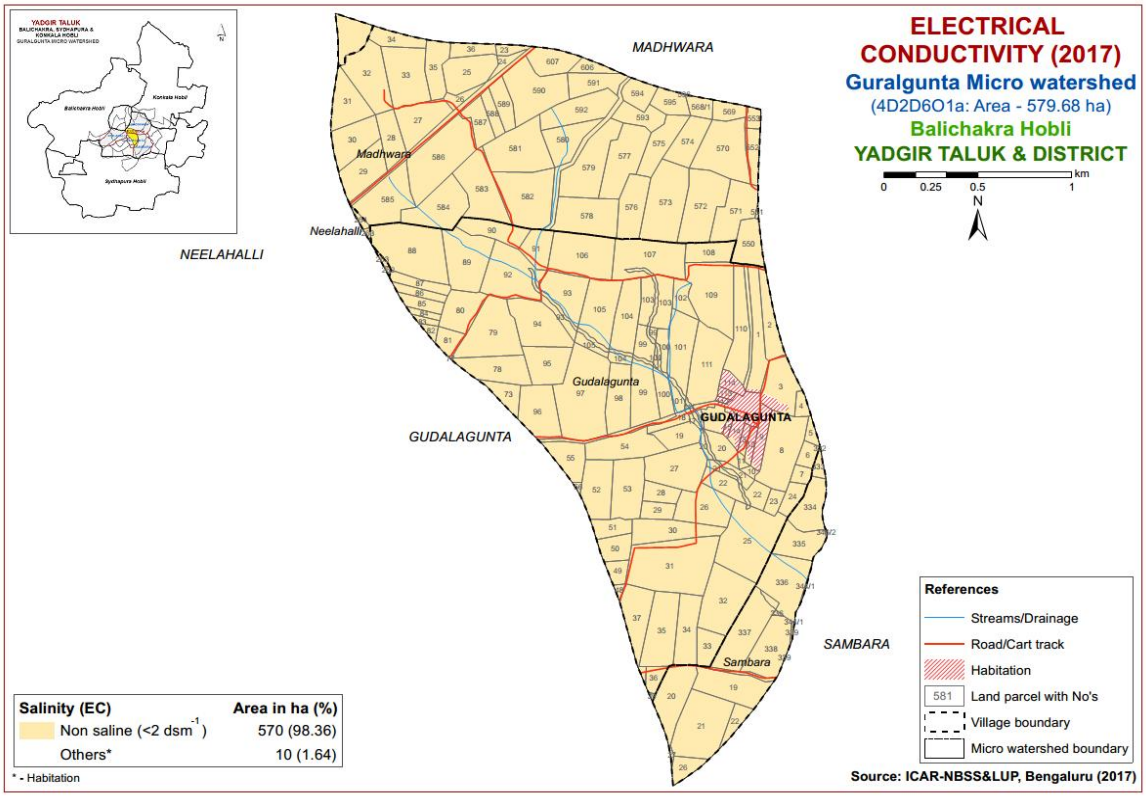


Fig.6.2 Electrical Conductivity (EC) map of Guralgunta Microwatershed

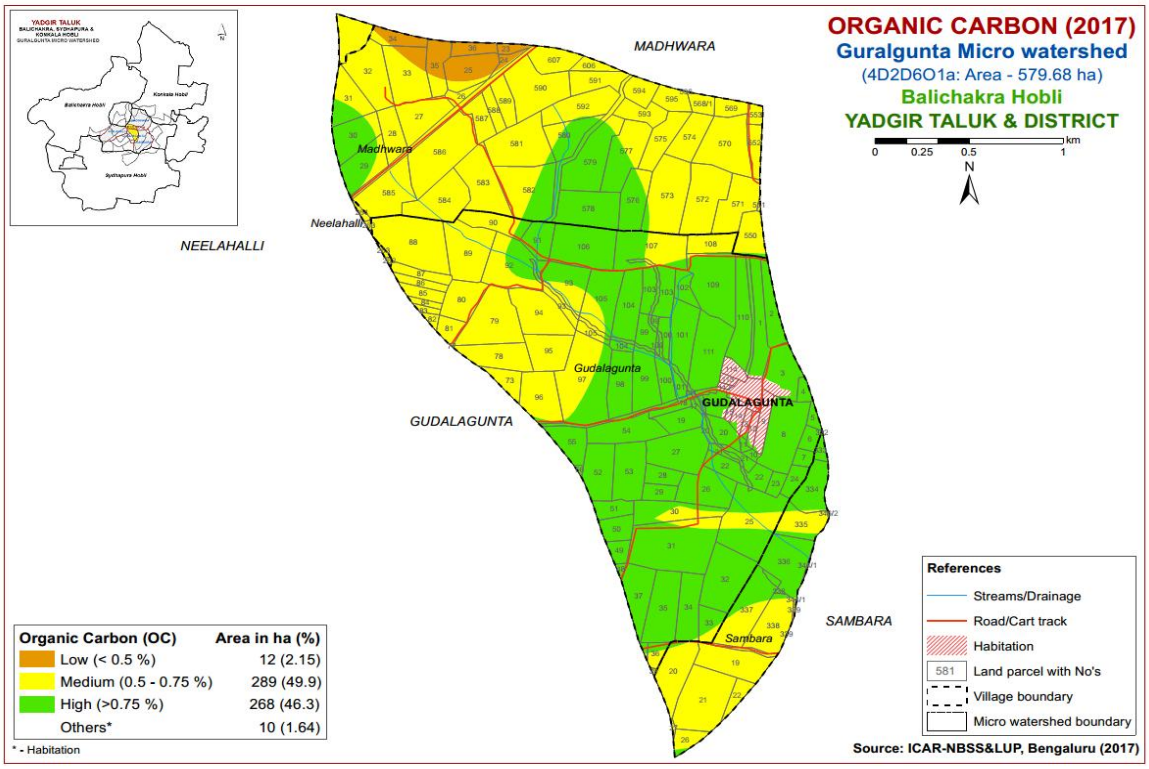


Fig.6.3 Soil Organic Carbon map of Guralgunta Microwatershed

6.4 Available Phosphorus

Available phosphorus content is low (<23 kg/ha) in an area of 1 ha (0.2%) and are distributed in the southern part of the microwatershed. Medium (23-57 kg/ha) in maximum area of about 479 ha (83%) and are distributed in all parts of the microwatershed (Fig. 6.4). An area of about 90 ha (16%) is high in available phosphorous and are distributed in the northern and eastern part of the microwatershed.

6.5 Available Potassium

Medium (145-337 kg/ha) in maximum area of about 566 ha (98%) and are distributed in all parts of the microwatershed (Fig. 6.5). High (>337 kg/ha) in an area of 3 ha (0.6%) and are distributed in the eastern part of the microwatershed.

6.6 Available Sulphur

Maximum area of about 353 ha (61%) is low (<10 ppm) in available sulphur content and are distributed in all parts of the microwatershed. Medium (10-20 ppm) in an area of about 204 ha (35%) and are distributed in the northern, northeastern and eastern part of the microwatershed (Fig. 6.6). A very small area of about 12 ha (2%) is high (>20 ppm) in available sulphur content and are distributed in the southern part of the microwatershed.

6.7 Available Boron

Maximum area of about 296 ha (51%) is low (<0.5 ppm) in available boron content and are distributed in all parts of the microwatershed. Medium (0.5-1.0 ppm) in

an area of 229 ha (40%) and are distributed in the northern, central, eastern, western and southern part of the microwatershed. Small area of about 44 ha (8%) is high (>1.0 ppm) in available boron and are distributed in the central and eastern part of the microwatershed (Fig. 6.7).

6.8 Available Iron

Available iron content is deficient (<4.5 ppm) in an area of about 190 ha (33%) and are distributed in the northern, western and central part of the microwatershed. Sufficient (>4.5 ppm) in the maximum area of 379 ha (65%) and are distributed in the major part of the microwatershed (Fig .6.8).

6.9 Available Manganese

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

6.10 Available Copper

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

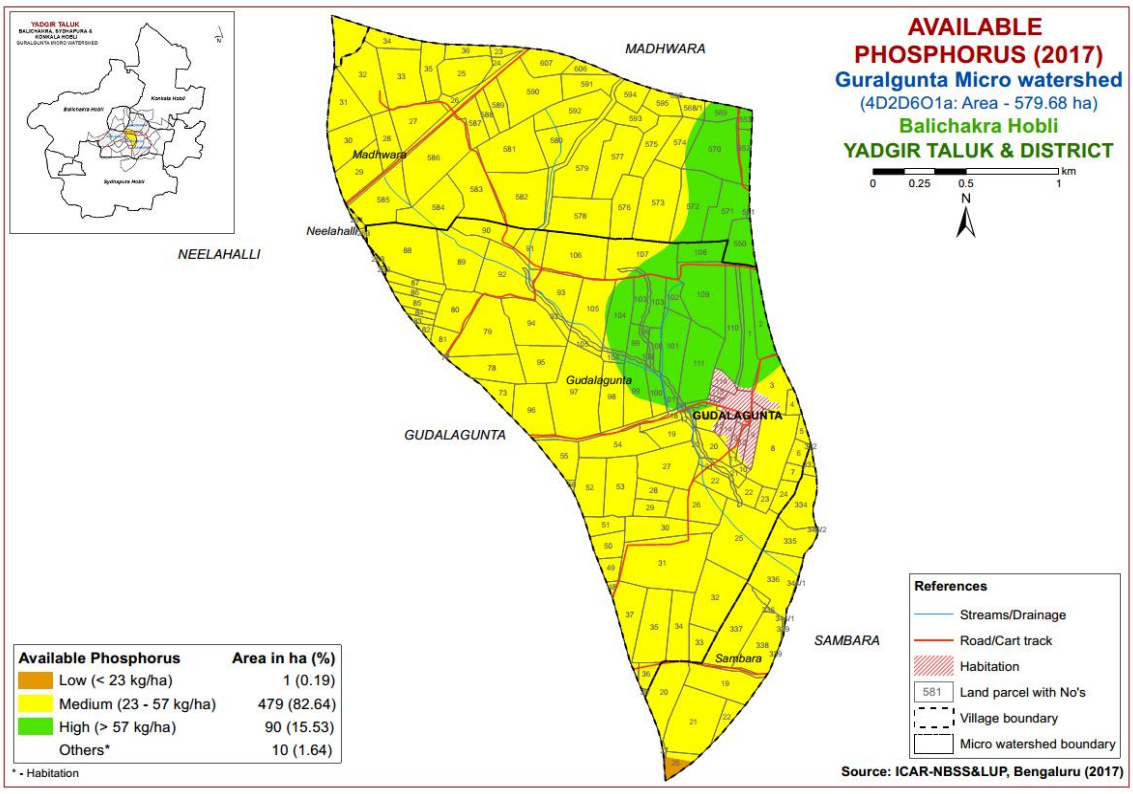


Fig. 6.4 Soil Available Phosphorus map of Guralgunta Microwatershed

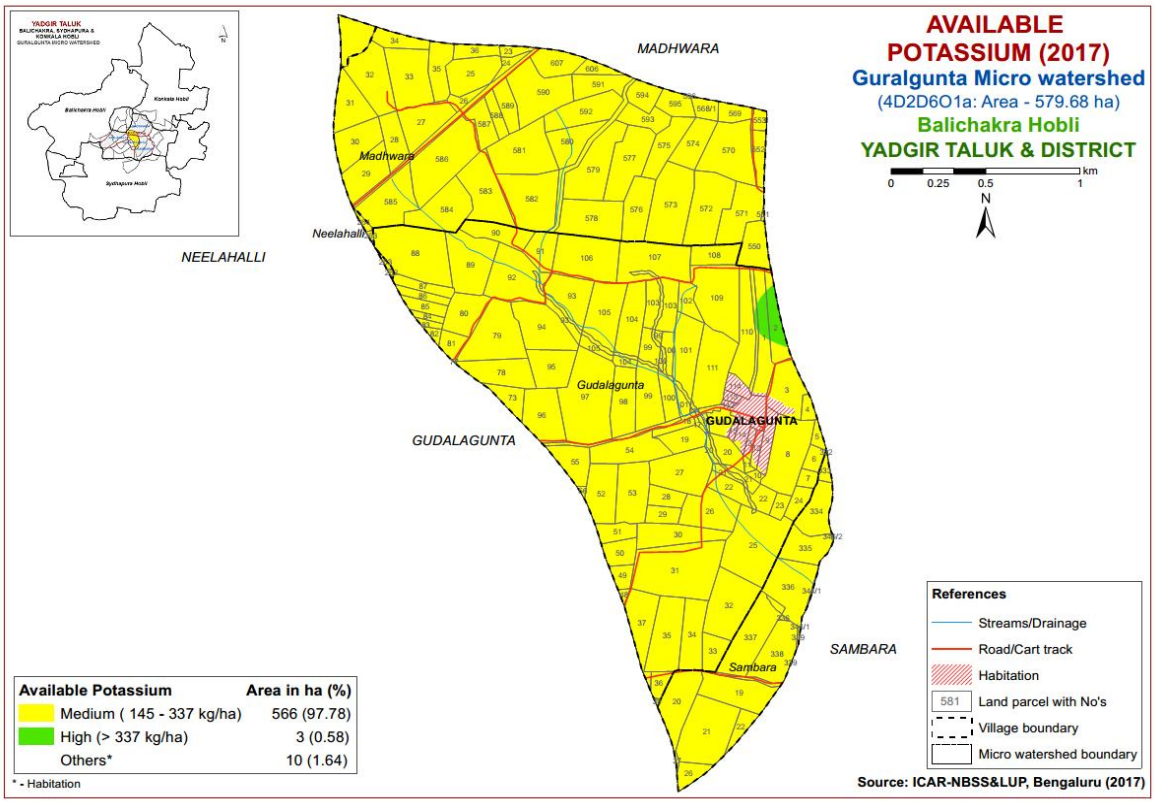


Fig.6.5 Soil Available Potassium map of Guralgunta Microwatershed

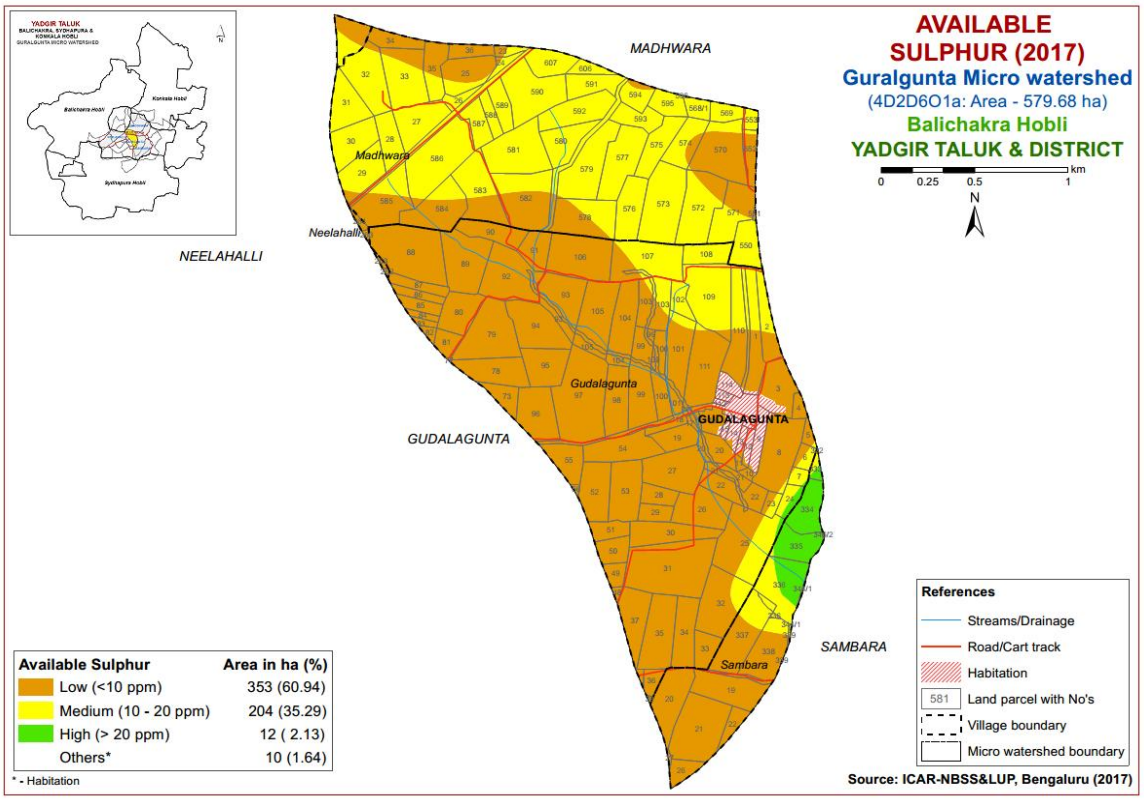


Fig.6.6 Soil Available Sulphur map of Guralgunta Microwatershed

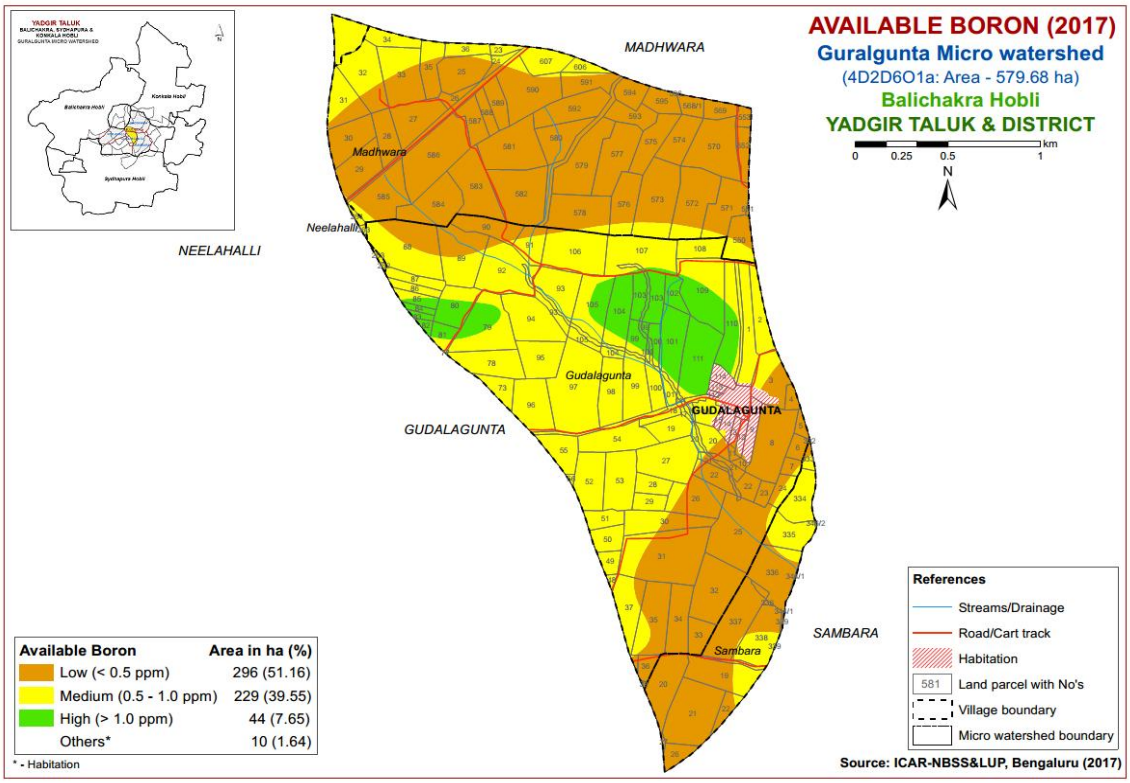


Fig.6.7 Soil Available Boron map of Guralgunta Microwatershed

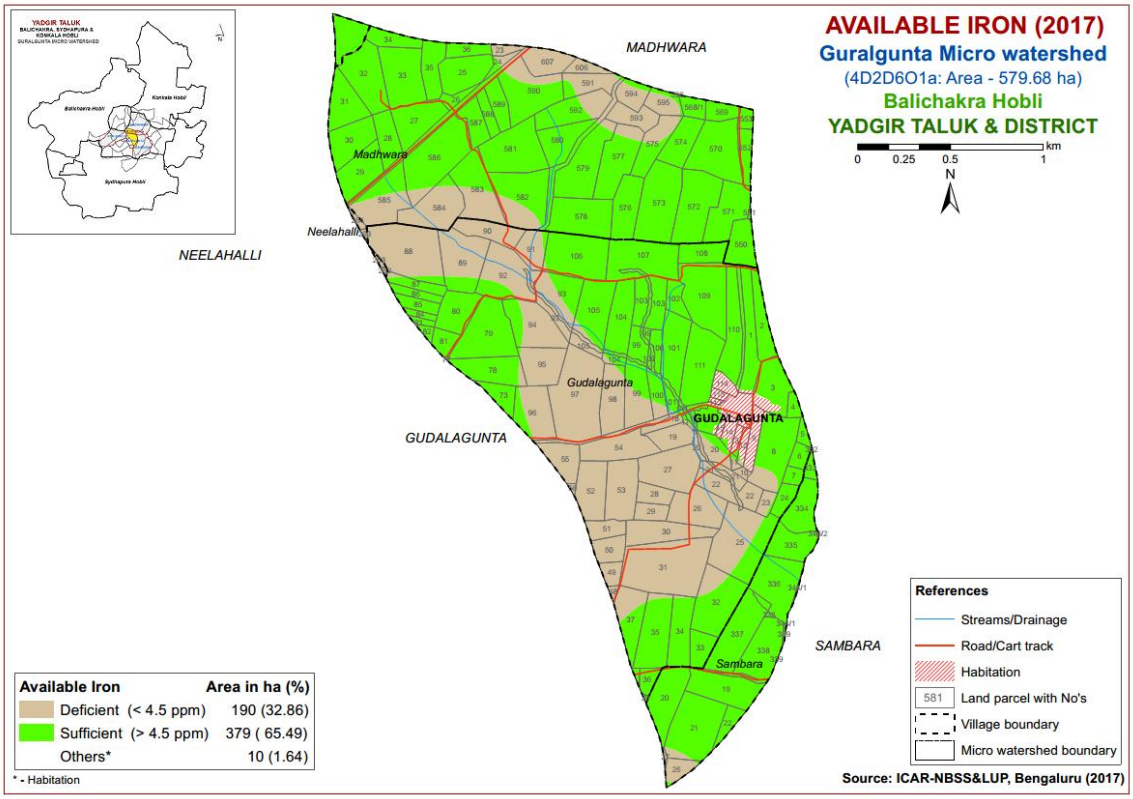


Fig.6.8 Soil Available Iron map of Guralgunta Microwatershed

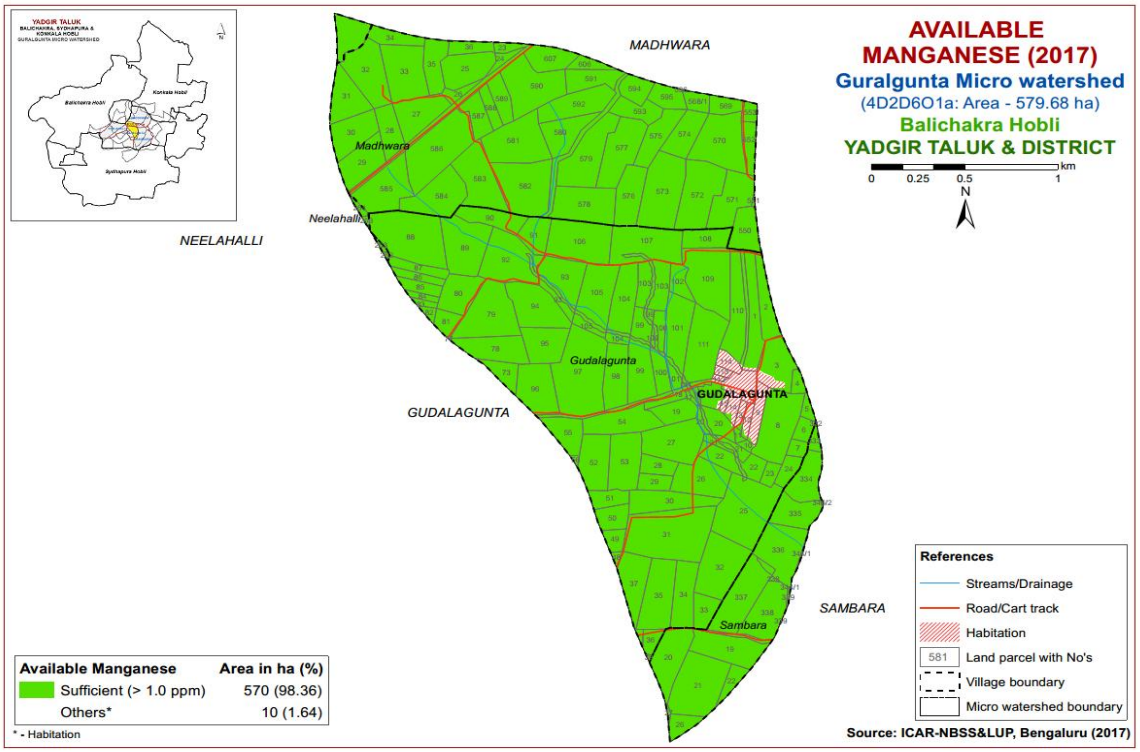


Fig.6.9 Soil Available Manganese map of Guralgunta Microwatershed

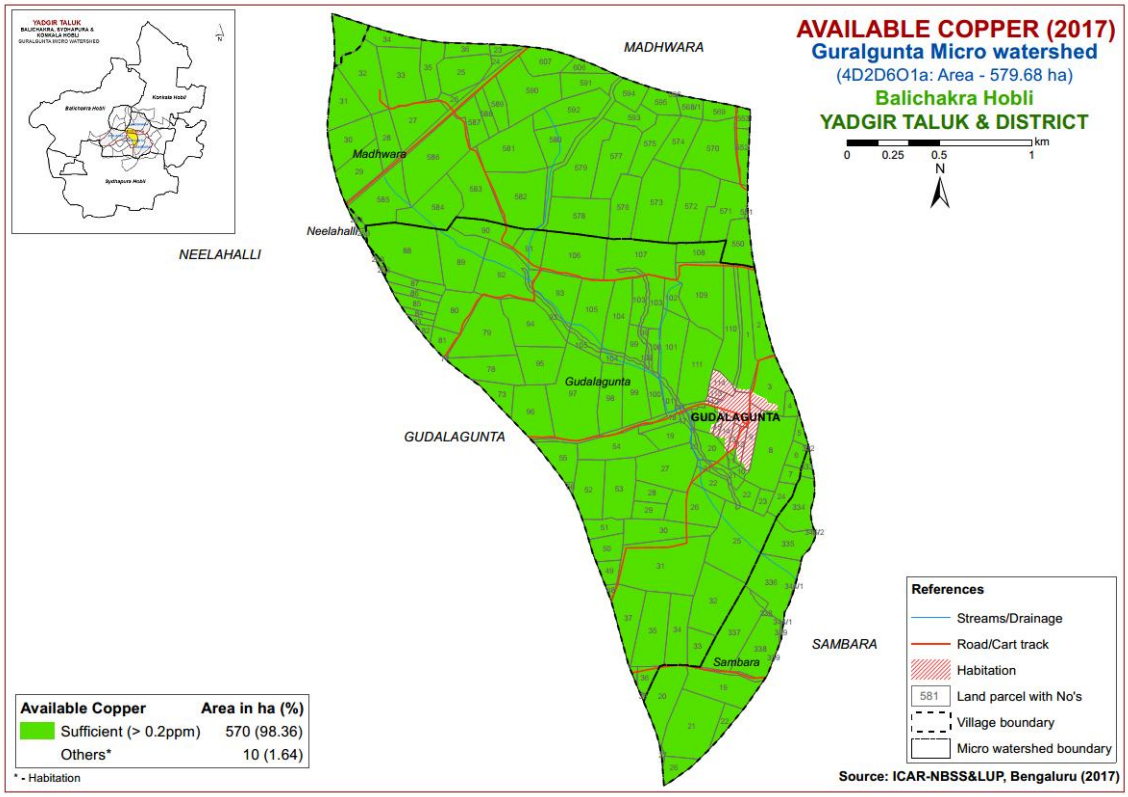


Fig.6.10 Soil Available Copper map of Guralgunta Microwatershed

6.11 Available Zinc

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

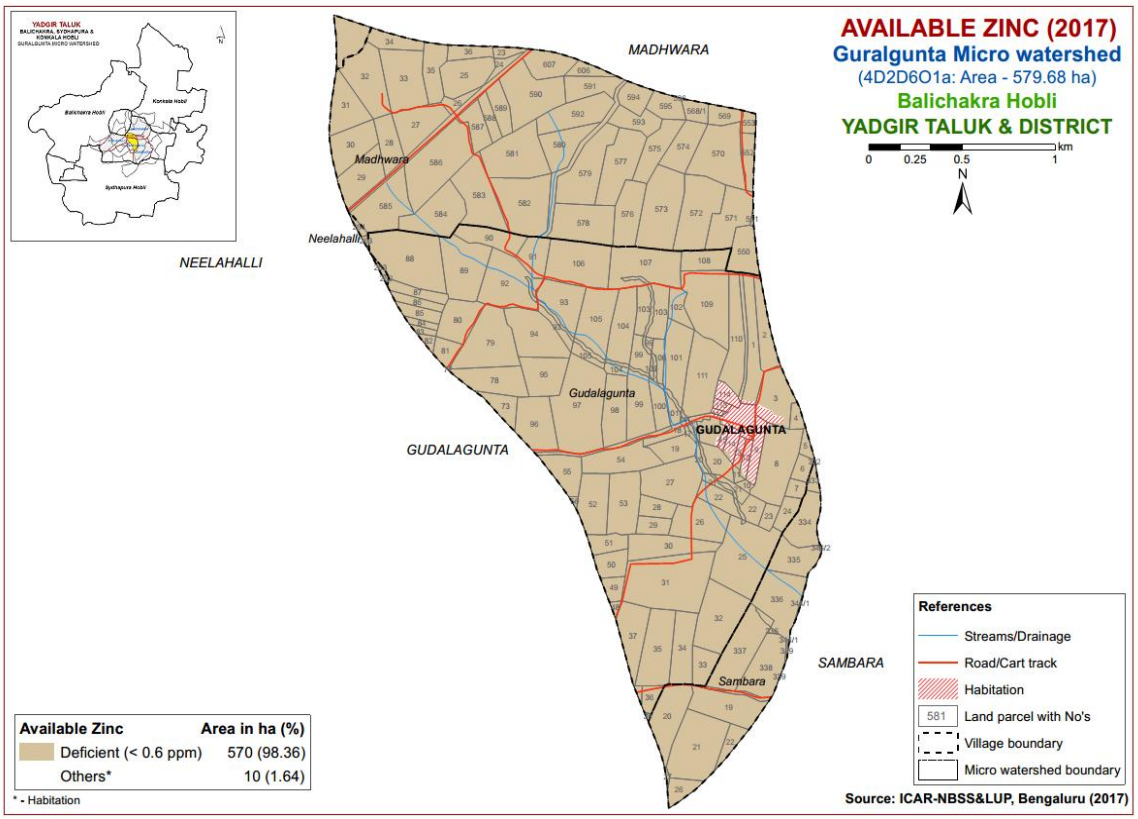


Fig.6.11 Soil Available Zinc map of Guralgunta Microwatershed

Chapter 7

LAND SUITABILITY FOR MAJOR CROPS

The soil and land resource units (soil phases) of Guralgunta microwatershed were assessed for their suitability for growing food, fodder, fibre and other horticulture crops by following the procedure as outlined in FAO, 1976 and 1983. Crop requirements were developed for each of the crop from the available research data and also by referring to Naidu *et. al.* (2006) and Natarajan *et. al* (2015). The crop requirements were matched with the soil and land characteristics (Table 7.1) to arrive at the crop suitability. In FAO land suitability classification, two orders are recognized. Order S-Suitable and Order N-Not suitable. The orders have classes, subclasses and units. Order-S has three classes, Class S1-Highly Suitable, Class S2-Moderately Suitable and Class S3- Marginally Suitable. Order N has two classes, N1-Currently not Suitable and N2- Permanently not Suitable. There are no subclasses within the Class S1 as they will have very minor or no limitations for crop growth. Classes S2, S3 and N1 are divided into subclasses based on the kinds of limitations encountered. The limitations that affect crop production are 'c' for erratic rainfall and its distribution and length of growing period (LGP), 'e' for erosion hazard, 'r' for rooting condition, 't' for lighter or heavy texture, 'g' for gravelliness or stoniness, 'n' for nutrient availability,'l' for topography, 'm' for moisture availability, 'w' for drainage, 's' for sodicity and 'z' for calcareousness. These limitations are indicated as lower case letters to the Class symbol. For example, moderately suitable lands with the limitations of soil depth and erosion are designated as S2re. For the microwatershed, the soil mapping units were evaluated and classified up to subclass level.

Using the above criteria, the soil map units of the microwatershed were evaluated and land suitability maps for 26 major annual and perennial crops were generated. The detailed information on the kind of suitability of each of the soil phase for the crops assessed are given village/ survey number wise for the microwatershed in Appendix-III.

7.1 Land Suitability for Sorghum (*Sorghum bicolor*)

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

An area of about 1ha (0.13%) is highly suitable (Class S1) for growing Sorghum in the microwatershed. Maximum area of about 430 ha (73%) is moderately suitable (Class S2) for growing sorghum and are distributed in the major part of the microwatershed. They have minor limitations of calcareousness, drainage, gravelliness and rooting depth. An area of about 139 ha (23%) is marginally suitable (Class S3) for growing sorghum and are distributed in the northern, central and southern part of the microwatershed with major limitations of rooting depth, texture and calcareousness.

Table 7.2 Crop suitability criteria for Sorghum.

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

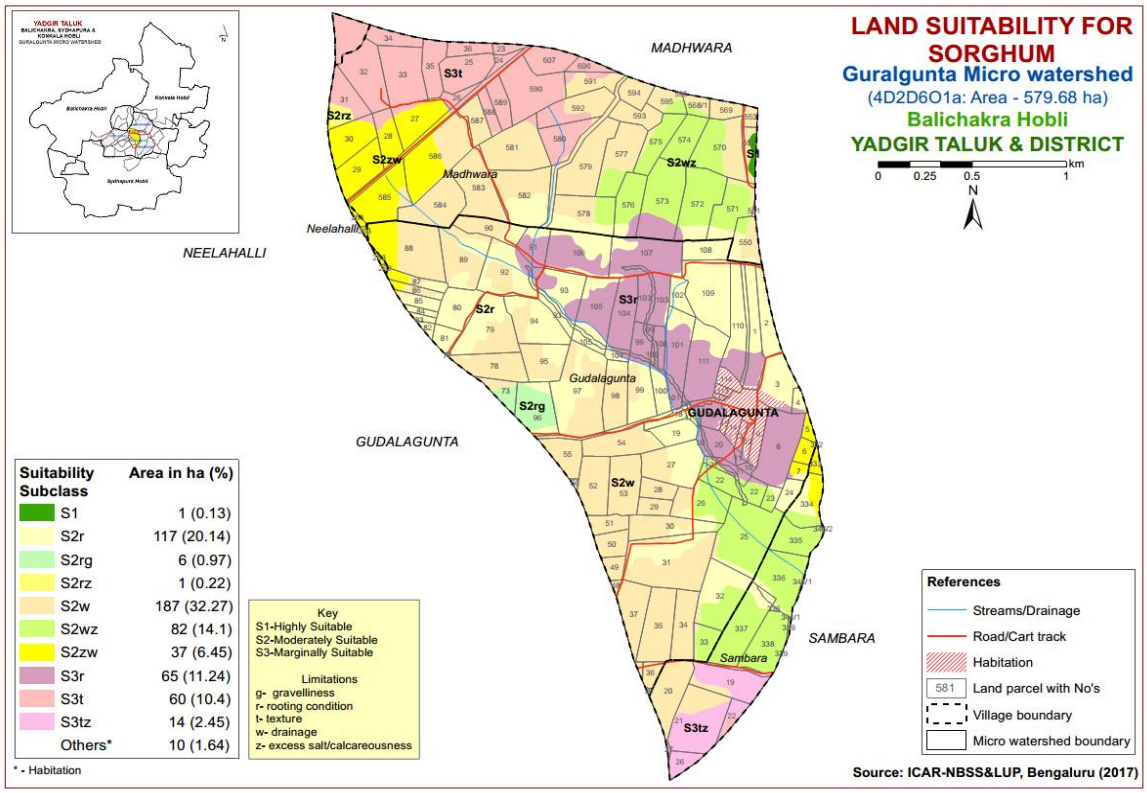


Fig. 7.1 Land Suitability map of Sorghum

Table 7.1 Soil-Site Characteristics of Shathalli-2 Microwatershed

Soil Map Units	Climate (P) (mm)	Growing period (Days)	Drainage Class	Soil depth (cm)	Soil texture		Gravelliness		AWC (mm/m)	Slope (%)	Erosion	pH	EC (dSm^{-1})	ESP (%)	CEC [Cmol (p^{+})kg^{-1}]	BS (%)
					Sur-face	Sub-surface	Surface (%)	Sub-surface (%)								
BDLbB2	866	150	WD	25-50	ls	sl	-	-	<50	1-3	moderate	6.20	0.07	0.20	4.20	93
BDLhB2	866	150	WD	25-50	scl	sl	-	-	<50	1-3	moderate	6.20	0.07	0.20	4.20	93
SBRcB2	866	150	Sed	50-75	sl	ls	-	-	<50	1-3	moderate	8.24	0.15	1.15	7.50	100
HLGcB2	866	150	WD	50-75	sl	scl	-	-	51-100	1-3	moderate	8.49	0.19	0.69	8.80	100
JNKcB2	866	150	WD	50-75	sl	scl	-	-	51-100	1-3	moderate	8.42	0.15	0.18	14.50	100
JNKiB2	866	150	WD	50-75	sc	scl	-	-	51-100	1-3	moderate	8.42	0.15	0.18	14.50	100
YLRcB2g1	866	150	WD	50-75	sl	c	15-35	15-35	51-100	1-3	moderate	6.91	0.07	0.45	6.90	100
YLRiB2	866	150	WD	50-75	sc	c	-	15-35	51-100	1-3	moderate	6.91	0.07	0.45	6.90	100
GWDcB2	866	150	MWD	75-100	sl	scl	-	-	101-150	1-3	moderate	9.89	0.74	43.51	8.35	100
PGPcB2	866	150	WD	100-150	sl	sc	-	-	101-150	1-3	moderate	6.83	0.21	2.83	3.15	100
YDRcB2	866	150	WD	100-150	sl	sl	-	-	51-100	1-3	moderate	9.47	0.37	12.14	12.70	165
NGPmB2	866	150	MWD	100-150	c	c	-	-	>200	1-3	moderate	7.42	0.24	0.22	67.10	100
BGDbB2	866	150	MWD	100-150	ls	c	-	-	>200	1-3	moderate	7.85	0.25	0.26	65.90	100
MDRmB2	866	150	WD	>150	c	scl	-	-	>200	1-3	moderate	8.31	0.33	2.26	20.57	100
BMNmB2	866	150	MWD	>150	c	c	-	-	>200	1-3	moderate	8.20	0.28	0.65	52.70	100
KDRcB2	866	150	MWD	100-150	sl	sc-c	-	-	>200	1-3	moderate	8.34	0.15	0.22	33.20	100
TMKiB2	866	150	MWD	>150	sc	sc-c	-	-	>200	1-3	moderate	9.60	0.35	16.57	21.83	100

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

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 cover an area of about 1 ha (0.13%) and distributed in the northern part. An area of about 124 ha (21%) is moderately suitable (Class S2) for growing maize and are distributed in the central, eastern and southern part of the microwatershed with minor limitations of texture, gravelliness, calcareousness and rooting depth. Marginally suitable lands (Class S3) for growing maize occupy an entire area of 446 ha (76%) and occur in all parts of the microwatershed. They have major limitations of texture, rooting depth, drainage and calcareousness.

Table 7.3 Crop suitability criteria for Maize

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

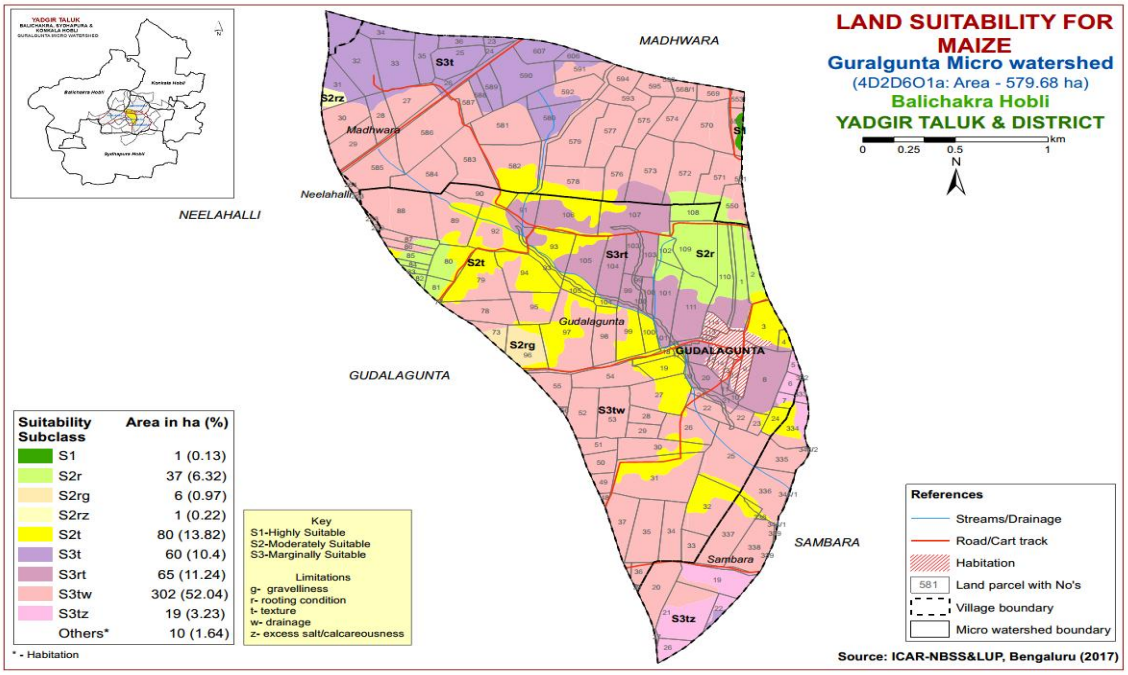


Fig. 7.2 Land Suitability map of Maize

7.3 Land Suitability for Bajra (*Pennisetum glaucum)*

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

Table 7.4 Crop suitability criteria for Bajra

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

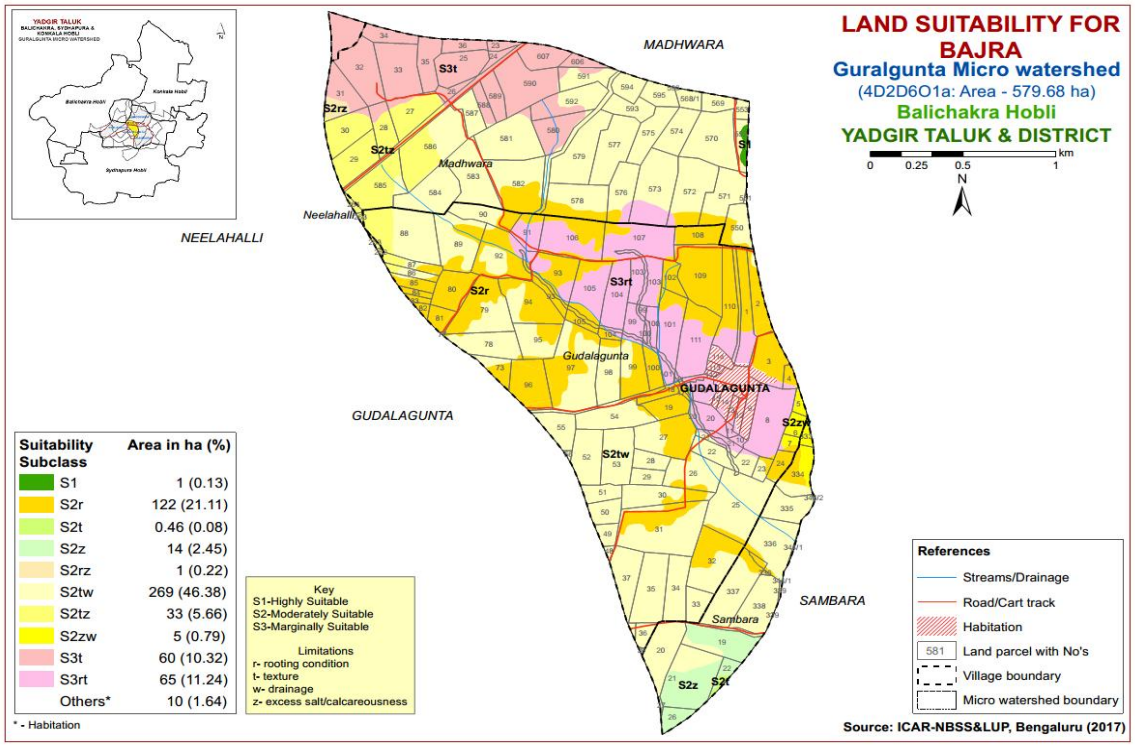


Fig. 7.3 Land Suitability map of Bajra

A very less area of about 1 ha (0.13%) is highly suitable (Class S1) for growing bajra in the microwatershed. Maximum area of about 444 ha (77%) is moderately suitable

(Class S2) for growing bajra and are distributed in the major part of the microwatershed. They have minor limitations of texture, drainage, calcareousness and rooting depth. An area of about 125 ha (22%) is marginally suitable (Class S3) for growing Bajra and is distributed in the northern, central and southeastern part of the microwatershed with major limitations of rooting depth and texture.

7.4 Land Suitability for Groundnut (*Arachis hypogaea*)

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

No highly suitable (Class S1) lands are available for growing Groundnut in the microwatershed. An area of about 58 ha (9%) is moderately suitable (Class S2) for groundnut and are distributed in the western, southern and eastern part of the microwatershed with minor limitations of rooting depth, texture and calcareousness. Marginally suitable lands (Class S3) for growing groundnut occupy maximum area of about 512 ha (88%) and are distributed in the major part of the microwatershed. They have major limitations of texture, drainage, calcareousness and rooting depth.

Table 7.5 Crop suitability criteria for Groundnut

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

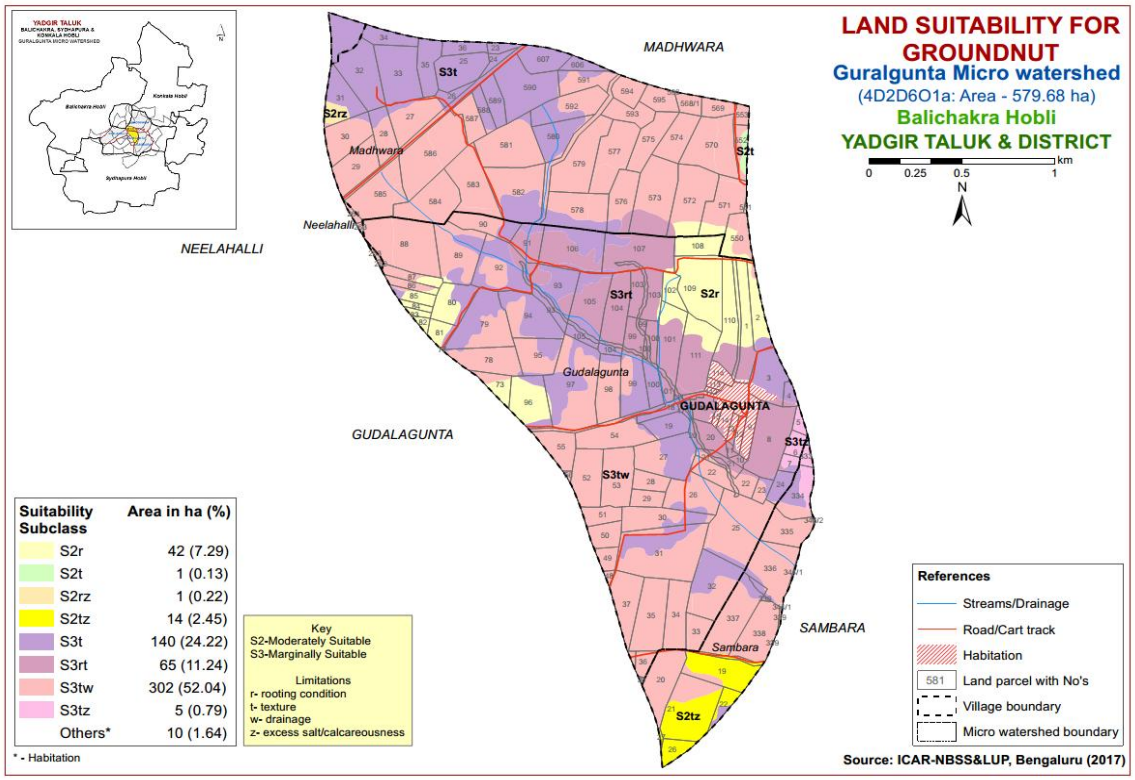


Fig. 7.4 Land Suitability map of Groundnut

7.5 Land Suitability for Sunflower (*Helianthus annus*)

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

Table 7.6 Crop suitability criteria for Sunflower

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

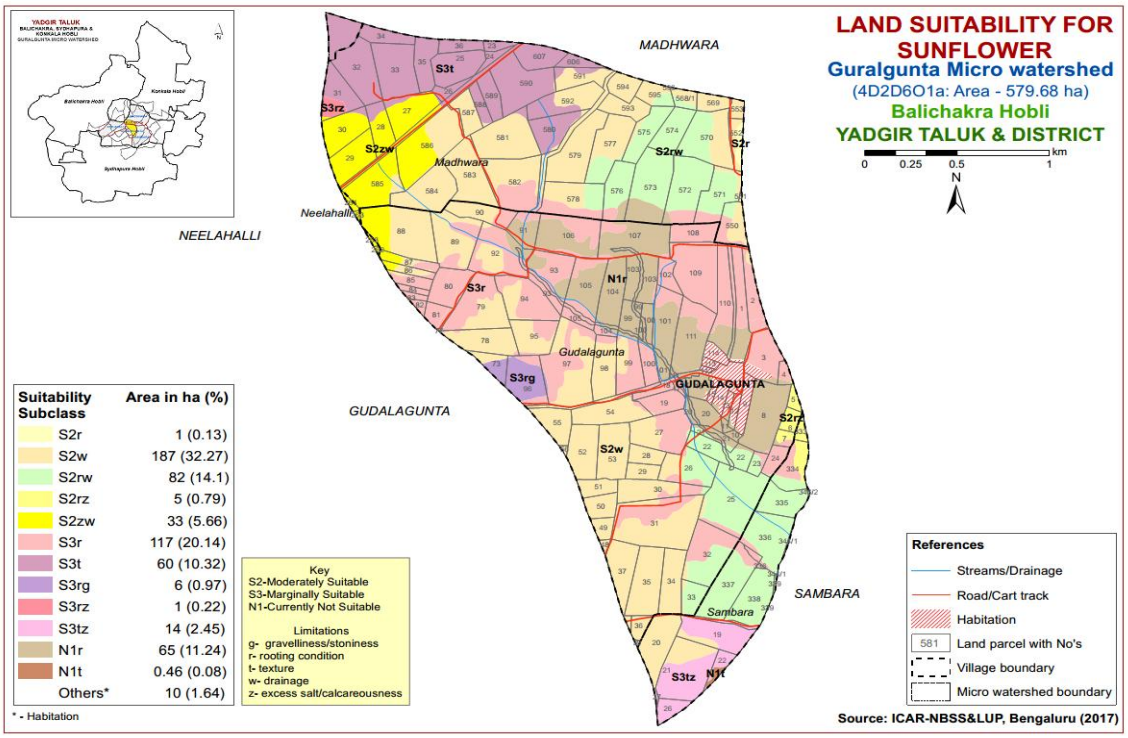


Fig. 7.5 Land Suitability map of Sunflower

No highly suitable (Class S1) lands available for growing sunflower in the microwatershed. Maximum area of about 308 ha (53%) is moderately suitable (Class S2) for sunflower and are distributed in the major part of the microwatershed with minor limitations of drainage, calcareousness and rooting depth. An area of about 198 ha (33%) is marginally suitable (Class S3) for sunflower and are distributed in the northern, central, western, southern and eastern part of the microwatershed. They have major limitations of rooting depth, texture, gravelliness and calcareousness. An area of about 65 ha (11%) is not suitable (Class N1) for sunflower and are distributed in the central and eastern part of the microwatershed with severe limitation of rooting depth and texture.

7.6 Land suitability criteria for Redgram (*Cajanus Cajan)*

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

No highly suitable (Class S1) lands available for growing redgram in the microwatershed. Maximum area of about 322 ha (55%) is moderately suitable (Class S2) for growing redgram and are distributed in the major part of the microwatershed with minor limitations texture, rooting depth, calcareousness and drainage. An area of about 249 ha (42%) is marginally suitable (Class S3) for redgram and are distributed in the northern, central, western and eastern part of the microwatershed. They have major limitations of rooting depth, gravelliness, texture, calcareousness and drainage.

Table 7.7 Land suitability criteria for Redgram

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

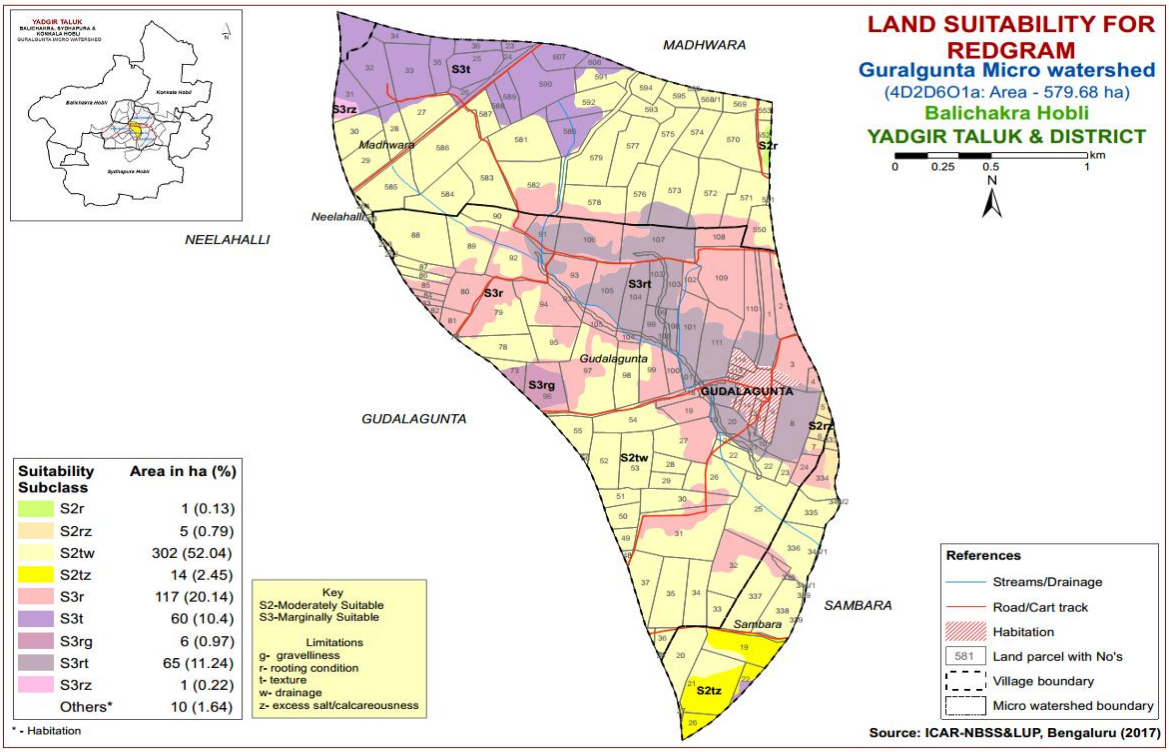


Fig. 7.6 Land Suitability map of Redgram

7.7 Land Suitability for Bengalgram (*Cicer aerativum*)

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

Table 7.8 Crop suitability criteria for Bengalgram

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

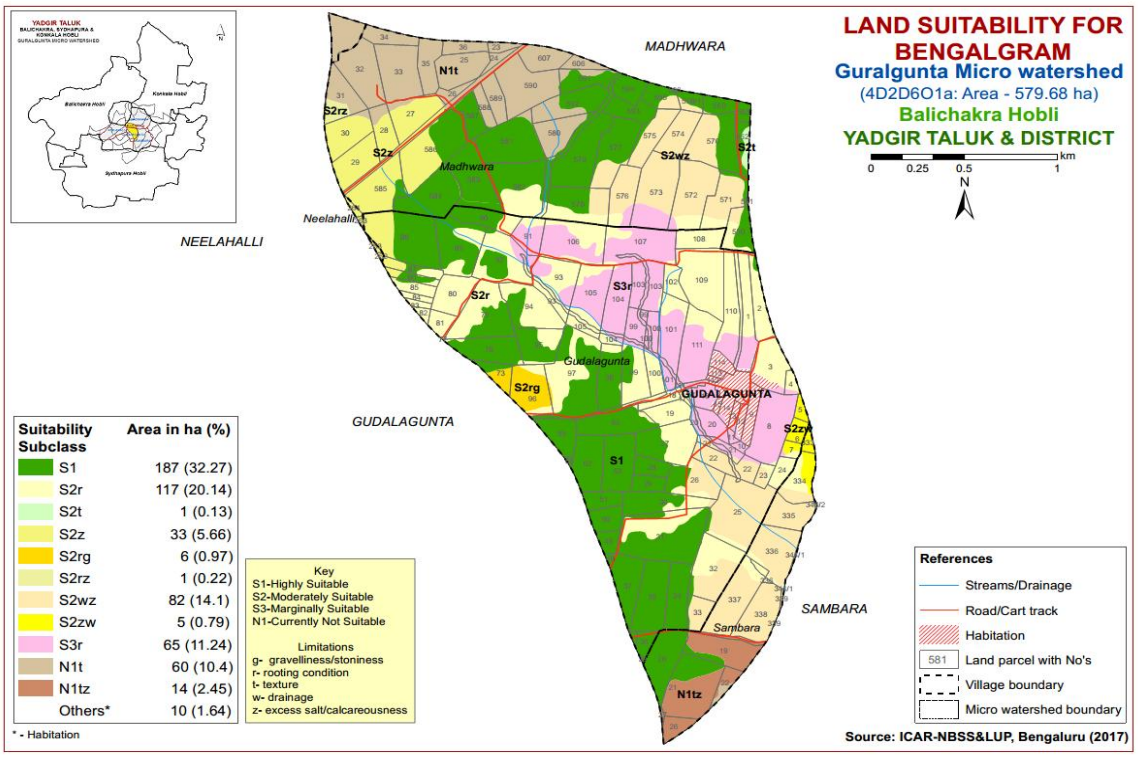


Fig. 7.7 Land Suitability map of Bengalgram

Highly suitable (Class S1) lands available for growing Bengal gram cover an area of about 187 ha (32%) and are distributed in the northern, western, northeastern and southern part of the microwatershed. Maximum area of about 245 ha (42%) is moderately suitable (Class S2) for growing Bengal gram and are distributed in all parts of the microwatershed with minor limitations of drainage, calcareousness, texture, gravelliness and rooting depth. Marginally suitable lands (Class S3) occupy an area of about 65 ha (11%) and are distributed in the central and eastern part of the microwatershed. They have major limitations of rooting depth. An area of about 74 ha (13%) is not suitable

(Class N1) for Bengal gram and are distributed in the northern and southern part of the microwatershed with severe limitations of calcareousness and texture.

7.8 Land Suitability for Cotton (*Gossypium hirsutum*)

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

Highly suitable (Class S1) lands are available for growing cotton in an area of 187 ha (32%) and are distributed in the northern, western, northeastern and southern part of the microwatershed. Maximum area of about 244 ha (42%) is moderately suitable (Class S2) for growing cotton and are distributed in all parts of the microwatershed with minor limitations of drainage, calcareousness, gravelliness and rooting depth. Marginally suitable lands (Class S3) occupy an area of about 65 ha (11%) and are distributed in the central and eastern part of the microwatershed. They have major limitation of rooting depth. An area of about 74 ha (13%) is not suitable (Class N1) for cotton and are distributed in the northern and southern part of the microwatershed with severe limitations of calcareousness and texture.

Table 7.9 Crop suitability criteria for Cotton

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

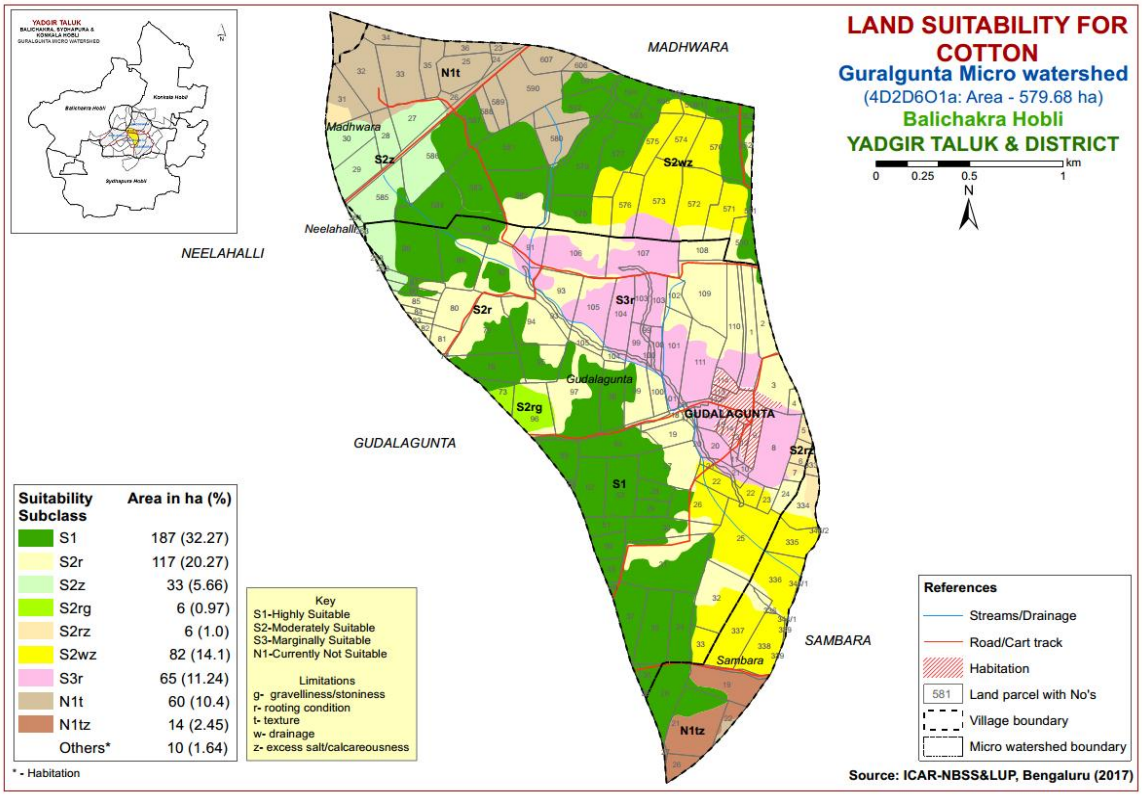


Fig. 7.8 Land Suitability map of Cotton

7.9 Land Suitability for Chilli (*Capsicum annuum)*

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

No highly (Class S1) suitable lands available for growing chilli in the microwatershed. Maximum area of about 381 ha (66%) is moderately suitable (Class S2) for growing chilli and are distributed in all parts of the microwatershed with minor limitations of drainage, texture, gravelliness, calcareousness and rooting depth. Marginally suitable lands (Class S3) occupy an area of about 189 ha (33%) and are distributed in the northern, central and southeastren part of the microwatershed. They have major limitations of texture, rooting depth and drainage.

Table 7.10 Crop suitability criteria for Chilli

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

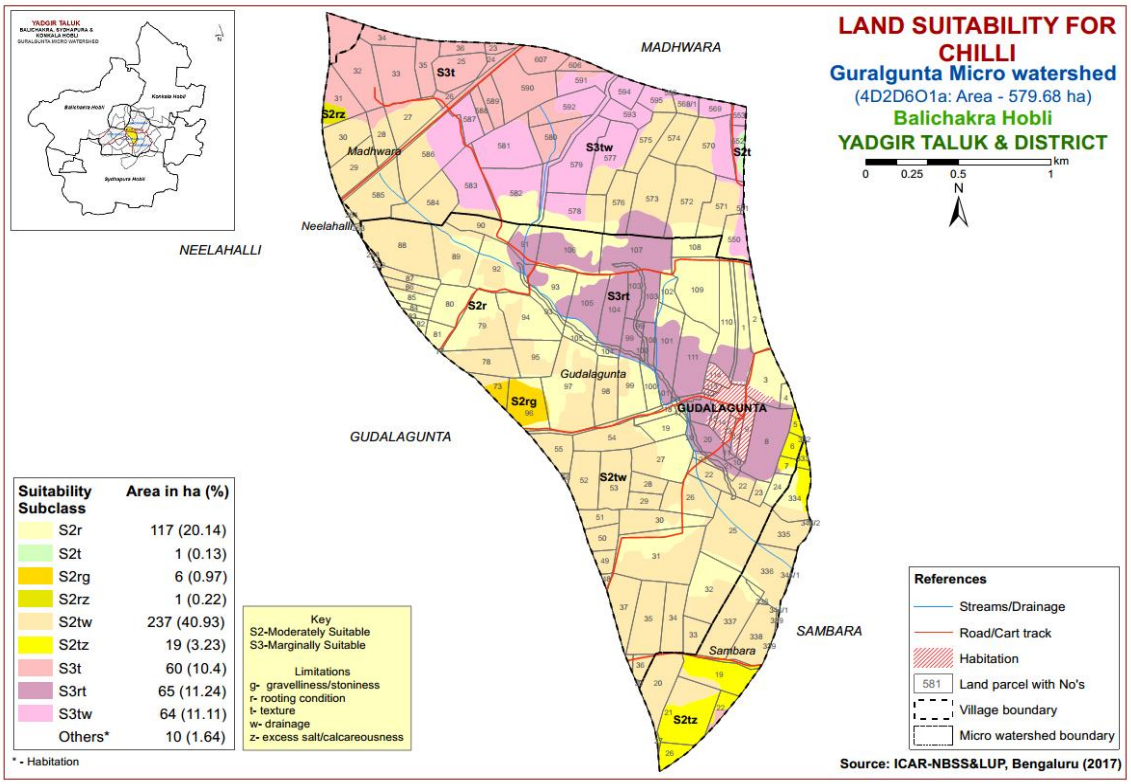


Fig 7.9 Land Suitability map of Chilli

7.10 Land Suitability for Tomato *(Lycopersicon esculentum)*

Tomato is one of the most important 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.

Table 7.11 Crop suitability criteria for Tomato

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

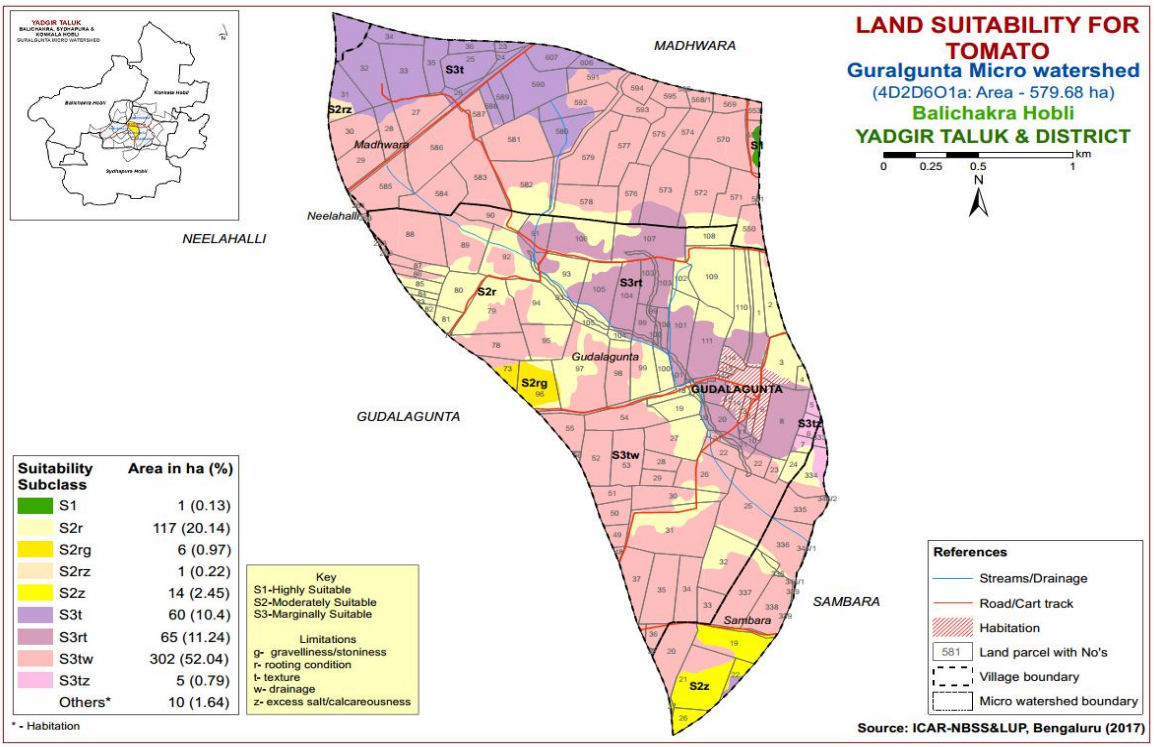


Fig 7.10 Land Suitability map of Tomato

Highly suitable (Class S1) lands are available for growing tomato in an area of 1 ha (0.13%) and are distributed in the northeastern part of the microwatershed. An area of about 138 ha (23%) is moderately suitable (Class S2) for growing tomato and are

distributed in the central, eastern and southern part of the microwatershed. They have minor limitations of rooting depth, gravelliness and calcareousness. Marginally suitable lands (Class S3) occupy major area of about 432 ha (74%) and are distributed in all parts of the microwatershed. They have moderate limitations of texture, rooting depth, calcareousness and drainage.

7.11 Land Suitability for Drumstick (*Moringa oleifera*)

Drumstick is one of the most important vegetable crop grown in about 2403 ha in the state. The crop requirements for growing drumstick (Table 7.12) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing drumstick was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.11.

Table 7.12 Crop suitability criteria for Drumstick

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

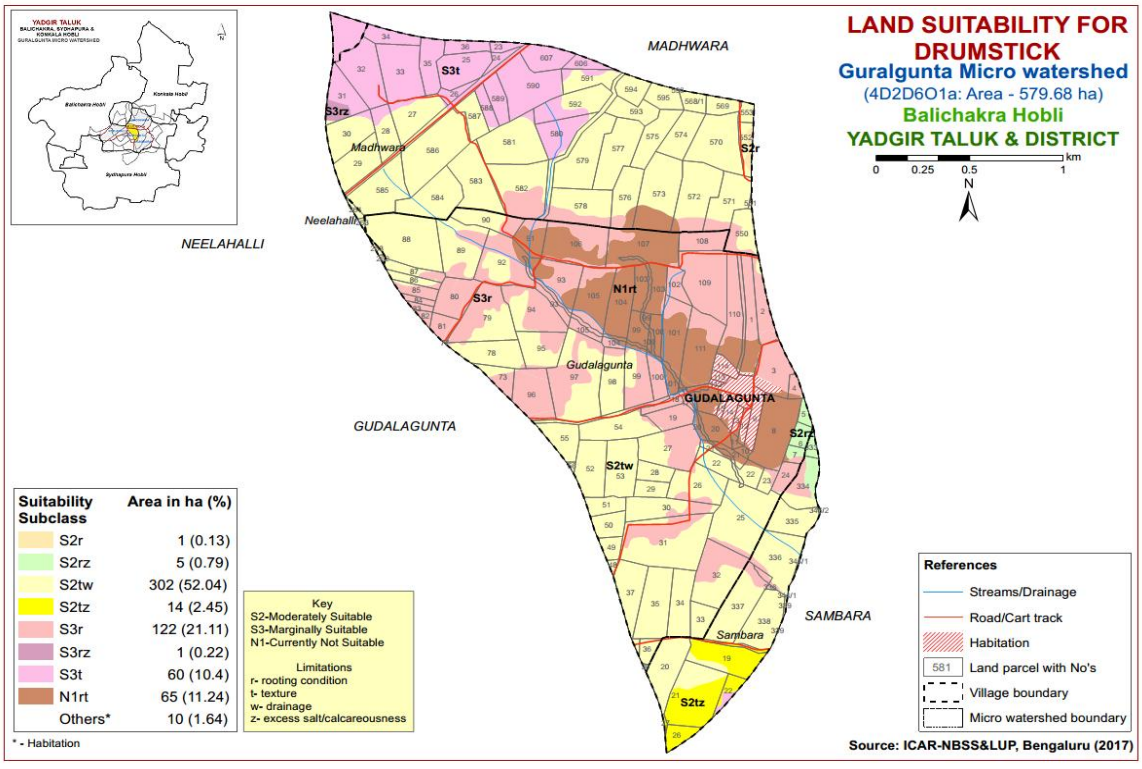


Fig 7.11 Land Suitability map of Drumstick

There are no highly (Class S1) suitable lands available for growing drumstick in the microwatershed. Major area of about 322 ha (55%) is moderately suitable (Class S2) for drumstick and is distributed in the major part of the microwatershed. They have minor limitations of texture, rooting depth, calcareousness and drainage. An area of about 183 ha (32%) is marginally suitable (Class S3) for growing drumstick and are distributed in the northern, central, western, southern and eastern part of the microwatershed. They have moderate limitations of rooting depth, calcareousness and texture. An area of about 65 ha (11%) is not suitable (Class N1) for growing drumstick and are distributed in the central and south-eastern part of the microwatershed. They have severe limitations of rooting depth and texture.

7.12 Land suitability for Mango (*Mangifera indica*)

Mango is one of the most important fruit crop grown in an area of 1.73 lakh ha in almost all the districts of the State. The crop requirements (Table 7.13) for growing mango were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing mango was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed is given in Figure 7.12.

No highly suitable (Class S1) and moderately suitable (Class S2) lands are available for growing mango in the microwatershed. Maximum area of 323 ha (56%) is marginally suitable (Class S3) for growing mango with moderate limitations of drainage, texture, rooting depth and calcareousness and are distributed in the major part of the microwatershed. An area of about 248 ha (43%) is not suitable (Class N1) for growing mango and occur in the northern, northwestern, central and southeastern part of the microwatershed with severe limitations of rooting depth and calcareousness.

Table 7.13 Crop suitability criteria for Mango

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

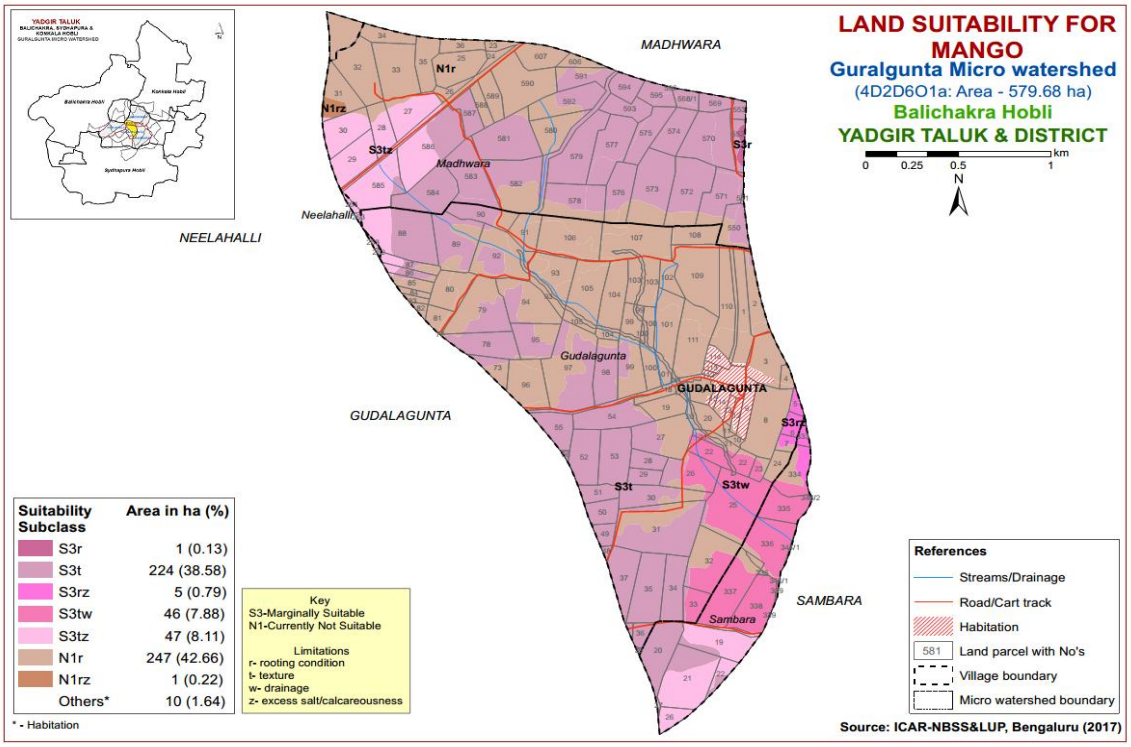


Fig. 7.12 Land Suitability map of Mango

7.13 Land suitability for Guava (*Psidium guajava*)

Guava is one of the most important fruit crop grown in an area of 0.06 lakh ha in almost all the districts of the State. The crop requirements (Table 7.14) for growing guava were matched with the soil-site characteristics (7.1) and a land suitability map for growing guava was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.13.

Table 7.14 Crop suitability criteria for Guava

Crop requirement			Rating			
Soil –site characteristics		Unit	Highly suitable(S1)	Moderately suitable (S2)	Marginally suitable(S3)	Not suitable(N)
Climate	Temperature in growing season	^{0}C	28-32	33-36 24-27	37-42 20-23	
Soil moisture	Growing period	Days	>150	120-150	90-120	<90
Soil aeration	Soil drainage	Class	Well drained	Mod. to imperfectly	poor	Very poor
Nutrient availability	Texture	Class	scl,l,cl, sil	sl,sicl,sic.,sc,c	c (<60%)	c (>60%)
	pH	1:2.5	6.0-7.5	7.6-8.0:5.0-5.9	8.1-8.5:4.5-4.9	>8.5:<4.5
	$CaCO_3$ in root zone	%	Non calcareous	<10	10-15	>15
Rooting conditions	Soil depth	Cm	>100	75-100	50-75	<50
	Gravel content	% vol.	<15	15-35	>35	
Soil toxicity	Salinity	dS/m	<2.0	2.0-4.0	4.0-6.0	
	Sodicity	%	Non sodic	10-15	15-25	>25
Erosion	Slope	%	<3	3-5	5-10	>10

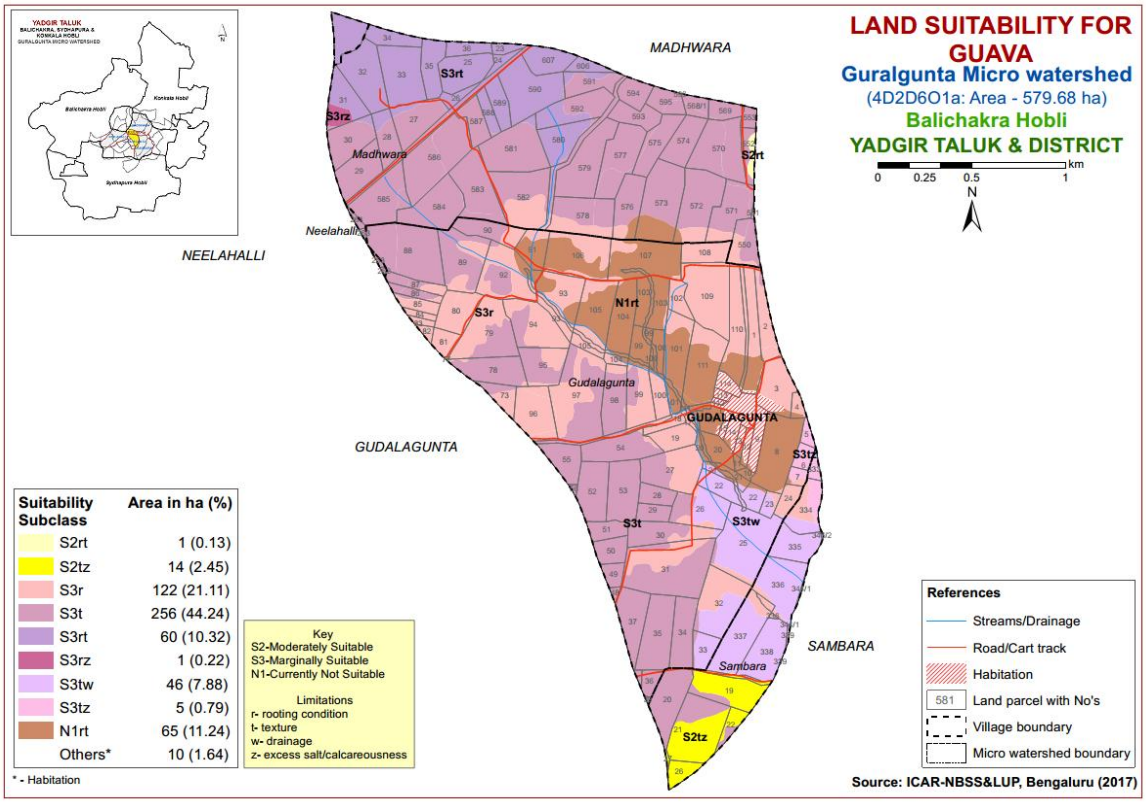


Fig. 7.13 Land Suitability map of Guava

No highly suitable (Class S1) lands are available for growing guava in the microwatershed. An area of about 15 ha (3%) is moderately suitable (Class S2) with minor limitations of texture, calcareousness and rooting depth and are distributed in the southern part of the microwatershed. Maximum area of 490 ha (85%) is marginally suitable (Class S3) for growing guava with moderate limitations of drainage, texture, calcareousness and rooting depth and are distributed in the major part of the microwatershed. An area of about 65 ha (7%) is not suitable (Class N1) for growing guava and occur in the central and western part of the microwatershed with severe limitations of rooting depth and texture.

7.14 Land suitability for Sapota (*Manilkara zapota*)

Sapota is one of the most important fruit crop grown in an area of 29373 ha in almost all the districts of the State. The crop requirements (Table 7.15) for growing sapota were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing sapota was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.14.

No highly suitable (Class S1) lands are available for growing Sapota in the microwatershed. An area of about 15 ha (3%) is moderately suitable (Class S2) with minor limitations of texture, calcareousness and rooting depth and are distributed in the southern part of the microwatershed. Maximum area of about 490 ha (85%) is marginally suitable (Class S3) for growing sapota and are distributed in the major part of the

microwatershed. They have moderate limitations of rooting depth, texture, calcareousness and drainage. An area of about 65 ha (11%) is not suitable (Class N1) for growing sapota and occur in the central and western part of the microwatershed with severe limitation of rooting depth.

Table 7.15 Crop suitability criteria for Sapota

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

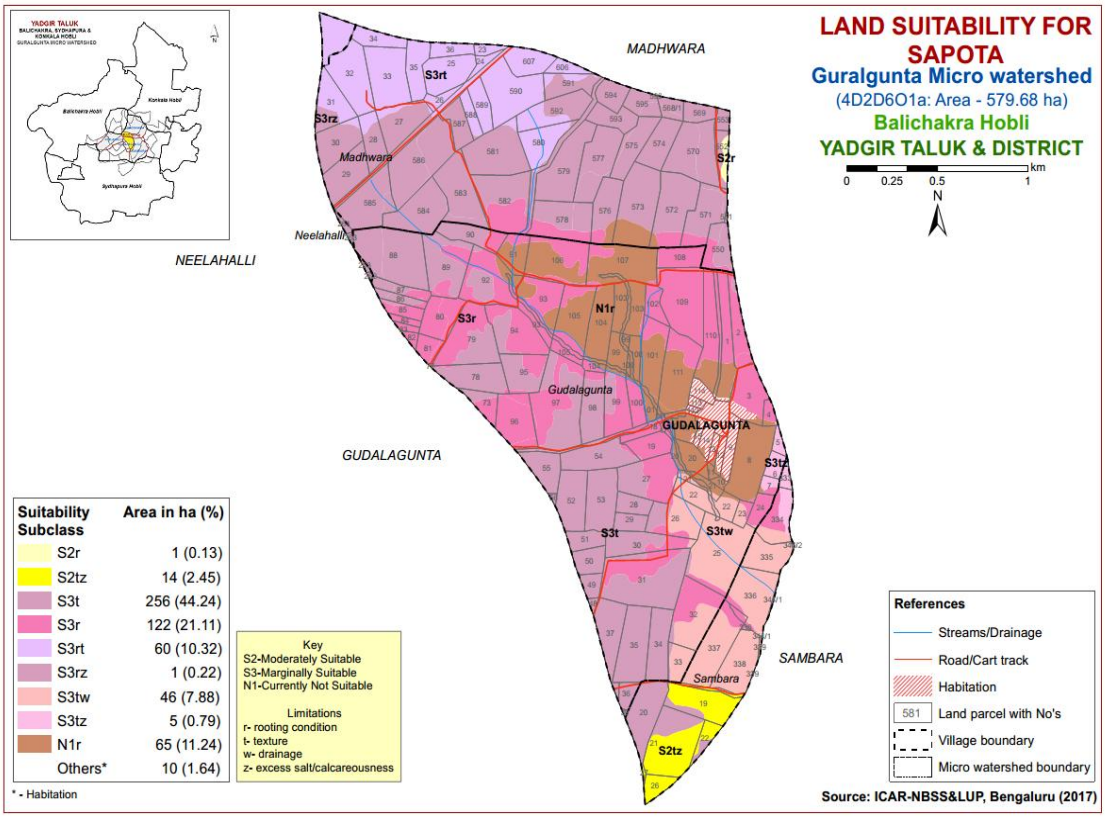


Fig. 7.14 Land Suitability map of Sapota

7.15 Land Suitability for Pomegranate (*Punica granatum*)

Pomegranate is one of the most important fruit crop commercially grown in about 18488 ha in Karnataka, mainly in Bijapur, Bagalkot, Koppal, Gadag and Chitradurga districts. The crop requirements for growing pomegranate (Table 7.16) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing pomegranate was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.15.

No highly (Class S1) suitable lands available for growing pomegranate in the microwatershed. Major area of about 322 ha (64%) is moderately suitable (Class S2) for growing pomegranate and is distributed in all parts of the microwatershed. They have minor limitations of texture, rooting depth, calcareousness and drainage. An area of about 183 ha (32%) is marginally suitable (Class S3) for growing pomegranate and are distributed in the northern, northwestern, central and eastern part of the microwatershed. They have moderate limitations of rooting depth, calcareousness and texture. About 65 ha (11%) of area is not suitable (Class N1) for growing pomegranate and are distributed in the central and western part of the microwatershed with severe limitation of rooting depth.

Table 7.16 Crop suitability criteria for Pomegranate

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

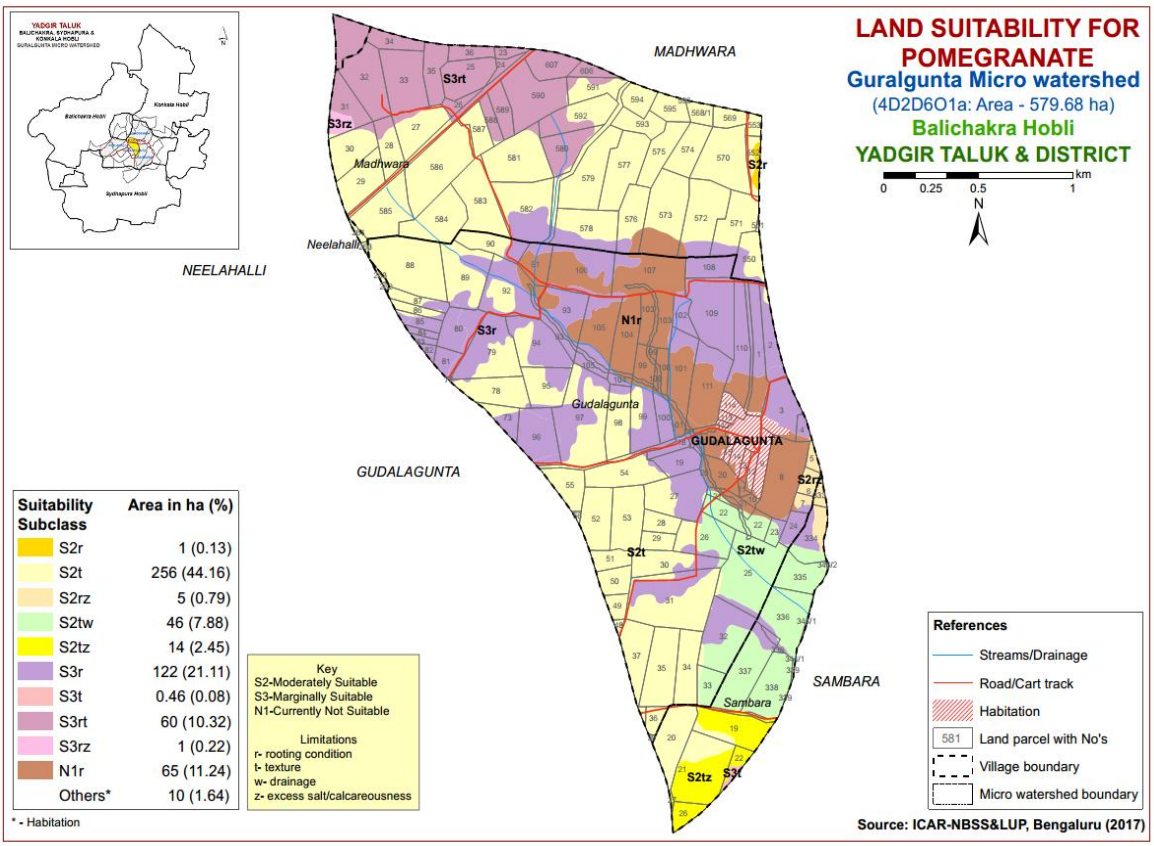


Fig 7.15 Land Suitability map of Pomegranate

7.16 Land Suitability for Musambi (*Citrus limetta*)

Musambi is one of the important fruit crop grown in an area of 3446 ha in almost all the districts of the State. The crop requirements for growing musambi (Table 7.17) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing musambi was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.16.

Table 7.17 Crop suitability criteria for Musambi

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

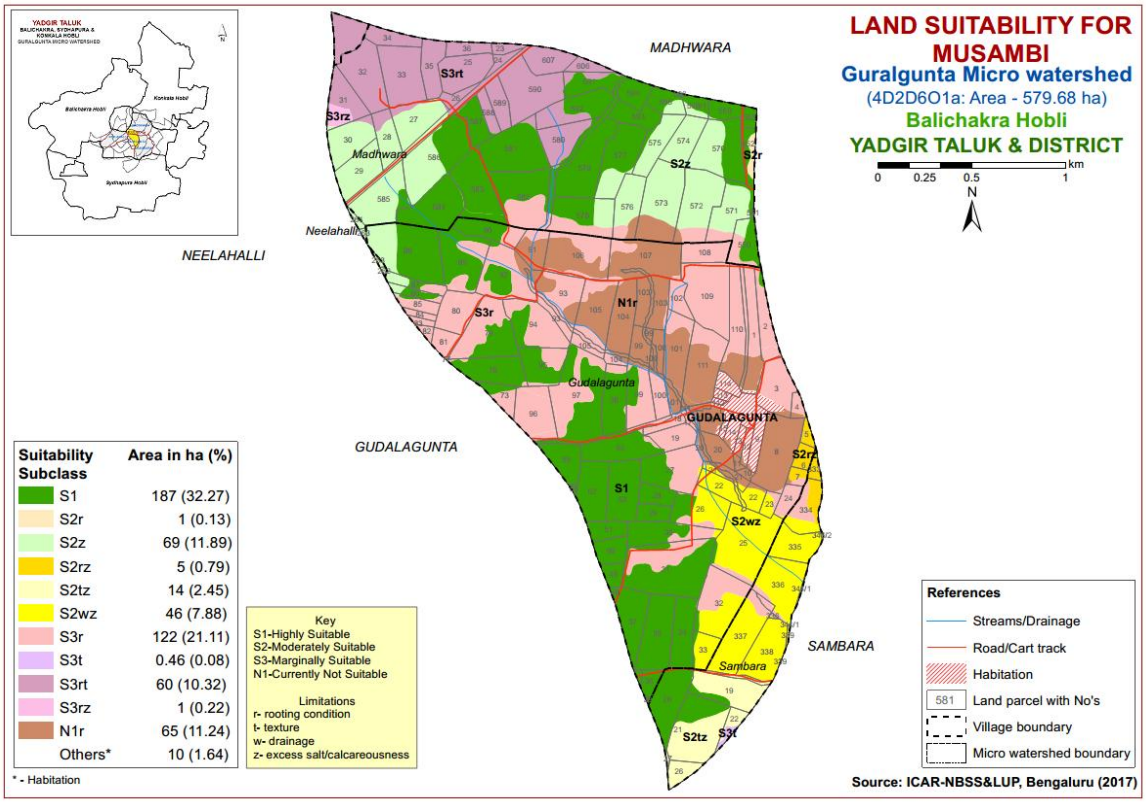


Fig. 7.16 Land Suitability map of Musambi

Highly suitable (Class S1) lands of about 187 ha (33%) is available for growing Musambi and are distributed in the northern, western and southern part of the microwatershed. An area of about 135 ha (24%) is moderately suitable (Class S2) for growing Musambi and are distributed in the southern part of the microwatershed. They have minor limitations of drainage, texture, rooting depth and calcareousness. Marginally suitable (Class S3) lands occupy a maximum area of about 183 ha (31%) and are distributed in the northern, central, western and eastern part of the microwatershed. They have moderate limitations of rooting depth, texture and calcareousness. An area of about 65 ha (11%) is not suitable (Class N1) for growing musambi and are distributed in the central and eastern part of the microwatershed with severe limitation of rooting depth.

7.17 Land Suitability for Lime (*Citrus sp*)

Lime is one of the most important fruit crop grown in an area of 0.11 lakh ha in almost all the districts of the State. The crop requirements for growing lime (Table 7.18) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing lime was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7. 17.

Table 7.18 Crop suitability criteria for Lime

Crop requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable(S1)**	**Moderately suitable(S2)**	**Marginally suitable(S3)**	**Not suitable(N)**
Climate	Temperature in growing season	^{0}C	28-30	31-35 24-27	36-40 20-23	>40 <20
Soil moisture	Growing period	Days	240-265	180-240	150-180	<150
Soil aeration	Soil drainage	Class	Well drained	Mod. to imperf drained	poorly	Very poorly
Nutrient availability	Texture	Class	scl,l,sicl,cl,s	sc, sc, c	c(>70%)	s, ls
	pH	1:2.5	6.0-7.5	5.5-6.4,7.6-8.0	4.0-5.4,8.1-8.5	<4.0,>8.5
	$CaCO_3$ in root zone	%	Non - calcareous	Upto 5	5-10	>10
Rooting conditions	Soil depth	Cm	>150	100-150	50-100	<50
	Gravel content	% vol.	Non gravelly	15-35	35-55	>55
Soil toxicity	Salinity	dS/m	Non saline	Upto 1.0	1.0-2.5	>2.5
	Sodicity	%	Non sodic	5-10	10-15	>15
Erosion	Slope	%	<3	3-5	5-10	

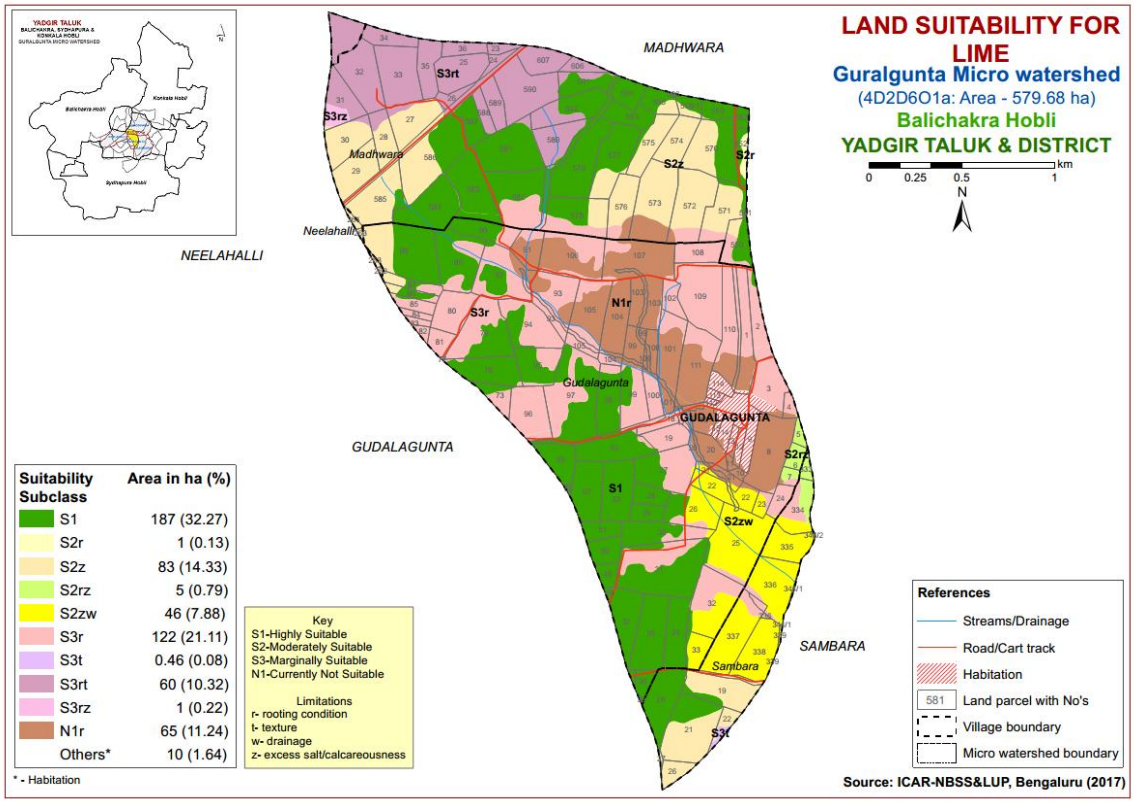


Fig. 7.17 Land Suitability map of Lime

Highly suitable (Class S1) lands of about 187 ha (33%) is available for growing Lime and are distributed in the northern, western and southern part of the microwatershed. An area of about 135 ha (24%) is moderately suitable (Class S2) for growing lime and are distributed in all parts of the microwatershed. They have minor

limitations of drainage and calcareousness. Marginally suitable (Class S3) lands occupy an area of about 183 ha (32%) and are distributed in the northern and southern part of the microwatershed. They have moderate limitations of rooting depth, calcareousness and texture. An area of about 65 ha (11%) is not suitable (Class N1) and are distributed in the central and western part of the microwatershed with severe limitation of rooting depth.

7.18 Land Suitability for Amla (*Phyllanthus emblica*)

Amla is one of the medicinal fruit crop grown in almost all the districts of the State. The crop requirements for growing amla (Table 7.19) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing amla was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.18.

Highly suitable (Class S1) lands of about 1ha (0.13%) is available for growing amla in the microwatershed. Maximum area of about 429 ha (74%) is moderately suitable (Class S2) for growing amla and are distributed in all parts of the microwatershed. They have minor limitations of texture, drainage, calcareousness and rooting depth. Marginally suitable lands (Class S3) occupy an area of about 139 ha (24%) and are distributed in the central and western part of the microwatershed with major limitations of rooting depth, texture and calcareousness.

Table 7.19 Land suitability criteria for Amla

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

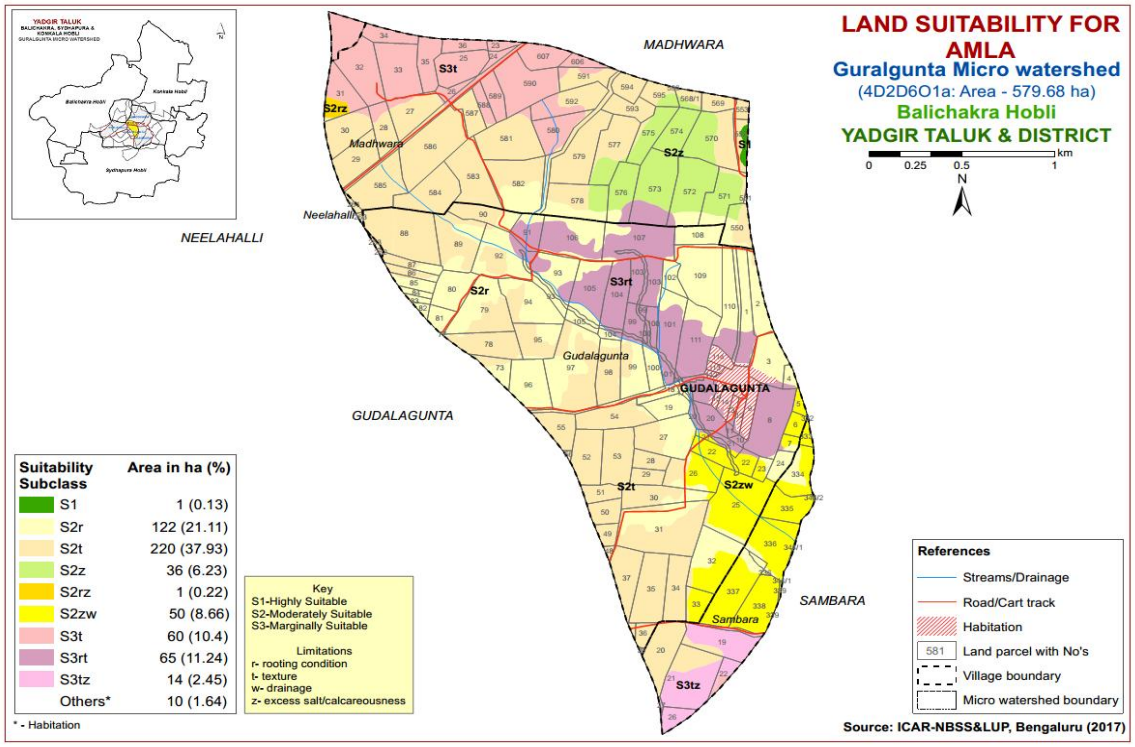


Fig. 7.18 Land Suitability map of Amla

7.19 Land Suitability for Cashew (*Anacardium occidentale)*

Cashew is one of the most important plantation nut crop grown in an area of 0.7 lakh ha in almost all the districts of the State. The crop requirements for growing cashew (Table 7.20) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing cashew was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.19.

No highly suitable (Class S1) lands available for growing cashew in the microwatershed. A small area of about 1 ha (0.13%) is moderately suitable (Class S2) for growing cashew with minor limitations of rooting depth and texture. An area of about 116 ha (20%) is marginally suitable (Class S3) for growing cashew and are distributed in the northern, western, southern and eastern part of the microwatershed. They have moderate limitations of rooting depth, calcareousness and texture. Maximum area of about 453 ha (78%) is not suitable (Class N1) for growing cashew and occur in all parts of the microwatershed with severe limitations of texture, rooting depth, drainage and calcareousness.

Table 7.20 Land suitability criteria for Cashew

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

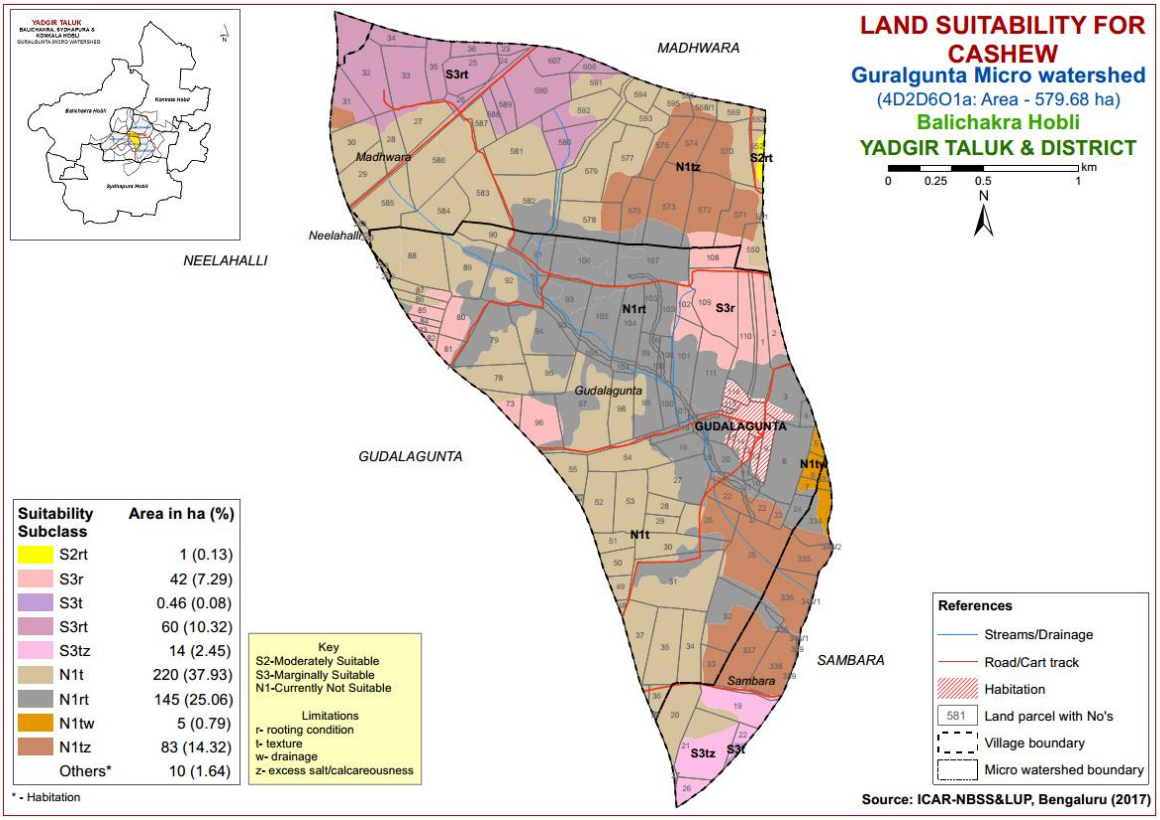


Fig. 7.19 Land Suitability map of Cashew

7. 20 Land Suitability for Jackfruit (*Artocarpus heterophyllus*)

Jackfruit is one of the most important fruit crop grown in an area of 5368 ha in almost all the districts of the State. The crop requirements for growing jackfruit (Table 7.21) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing jackfruit was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.20.

No highly suitable (Class S1) lands available for growing Jackfruit in the microwatershed. A small area of about 1 ha (0.13%) is moderately suitable (Class S2) for growing Jackfruit with minor limitation of rooting depth. Major area of about 504 ha (86%) is marginally suitable (Class S3) for growing Jackfruit and are distributed in all

parts of the microwatershed. They have major limitations of rooting depth, texture, calcareousness and drainage. An area of about 65 ha (11%) is not suitable (Class N1) for growing Jackfruit and are distributed in the central and eastern part of the microwatershed with severe limitations of rooting depth and texture.

Table 7.21 Land suitability criteria for Jackfruit

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

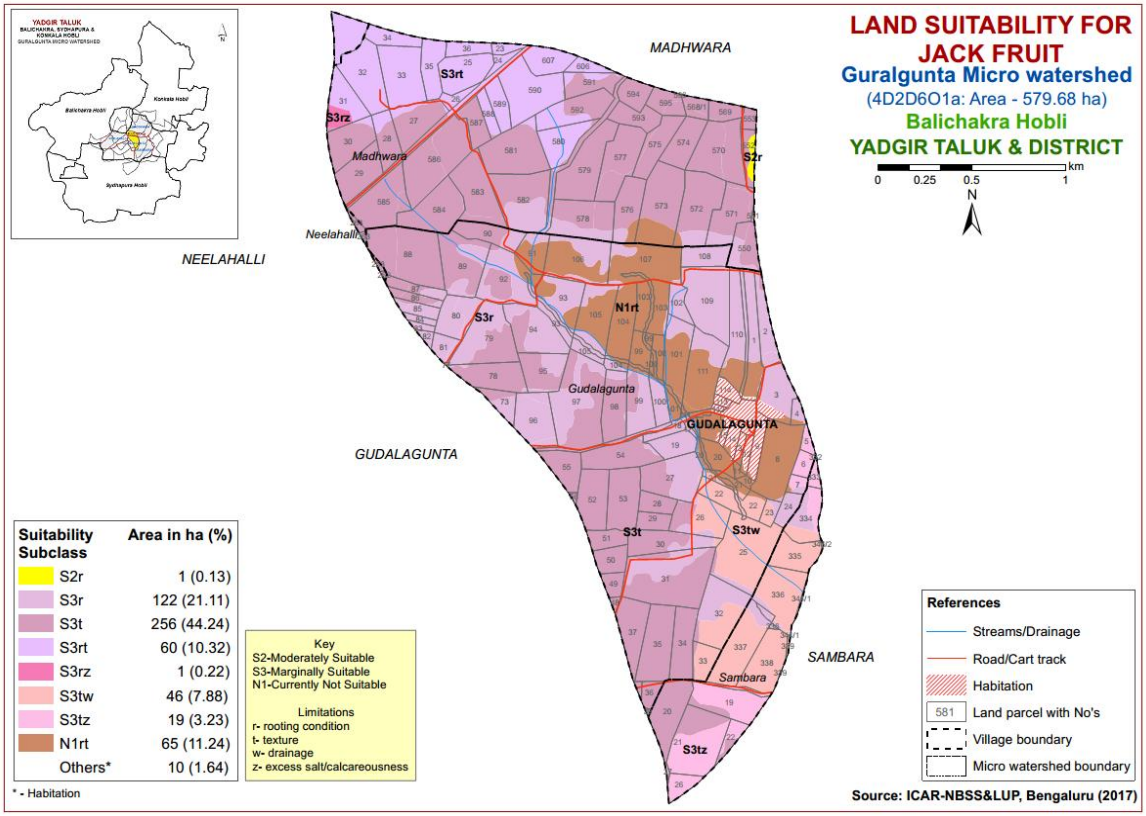


Fig. 7.20 Land Suitability map of Jackfruit

7.21 Land Suitability for Jamun (*Syzygium cumini*)

Jamun is an important fruit crop grown in almost all the districts of the State. The crop requirements for growing jamun (Table 22) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing jamun was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.21.

No highly suitable (Class S1) lands available for growing Jamun in the microwatershed. Maximum area of about 316 ha (54%) is moderately suitable (Class S2) for growing Jamun and are distributed in all parts of the microwatershed. They have minor limitations of texture, rooting depth, calcareousness and drainage. An area of about 189 ha (32%) is marginally suitable (Class S3) for growing Jamun and are distributed in the northern, central, eastern and western part of the microwatershed. They have major limitations of rooting depth, texture and calcareousness. An area of 65 ha (11%) is not suitable (Class N1) for growing Jamun and are distributed in the central and eastern part of the microwatershed with severe limitations of rooting depth and texture.

Table 7.22 Land suitability criteria for Jamun

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

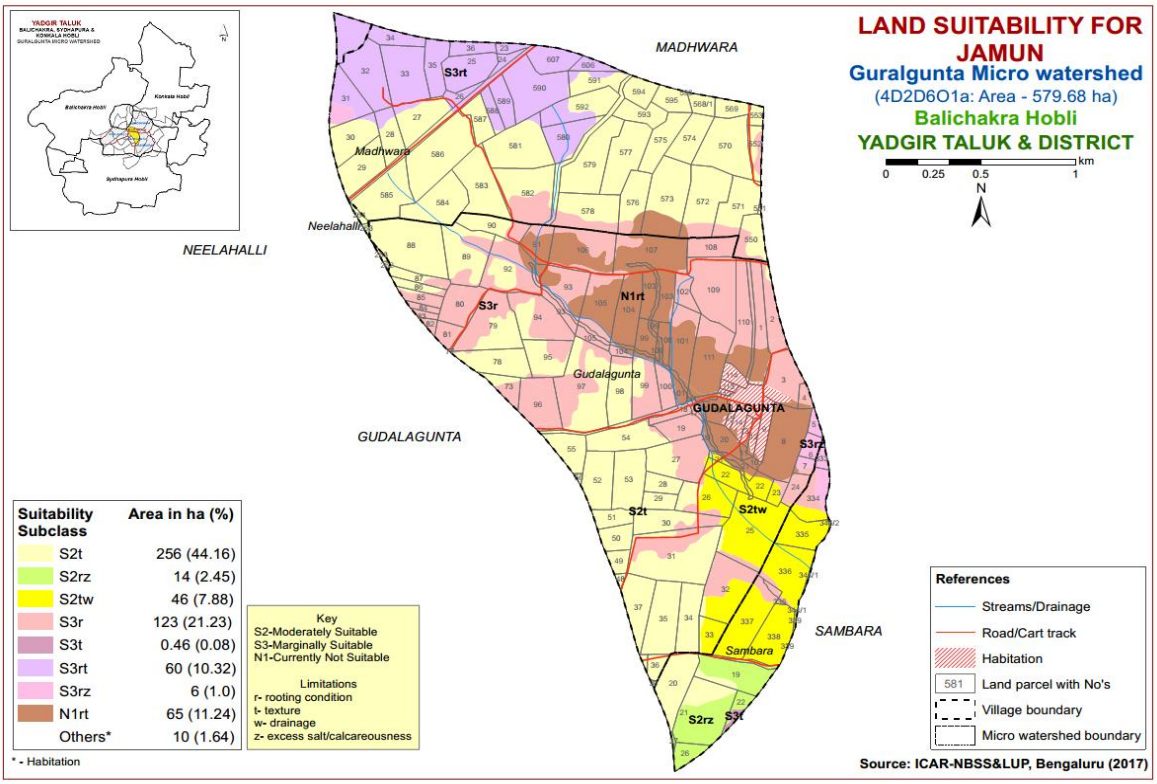


Fig. 7.21 Land Suitability map of Jamun

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

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

Table 7.23 Land suitability criteria for Custard apple

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

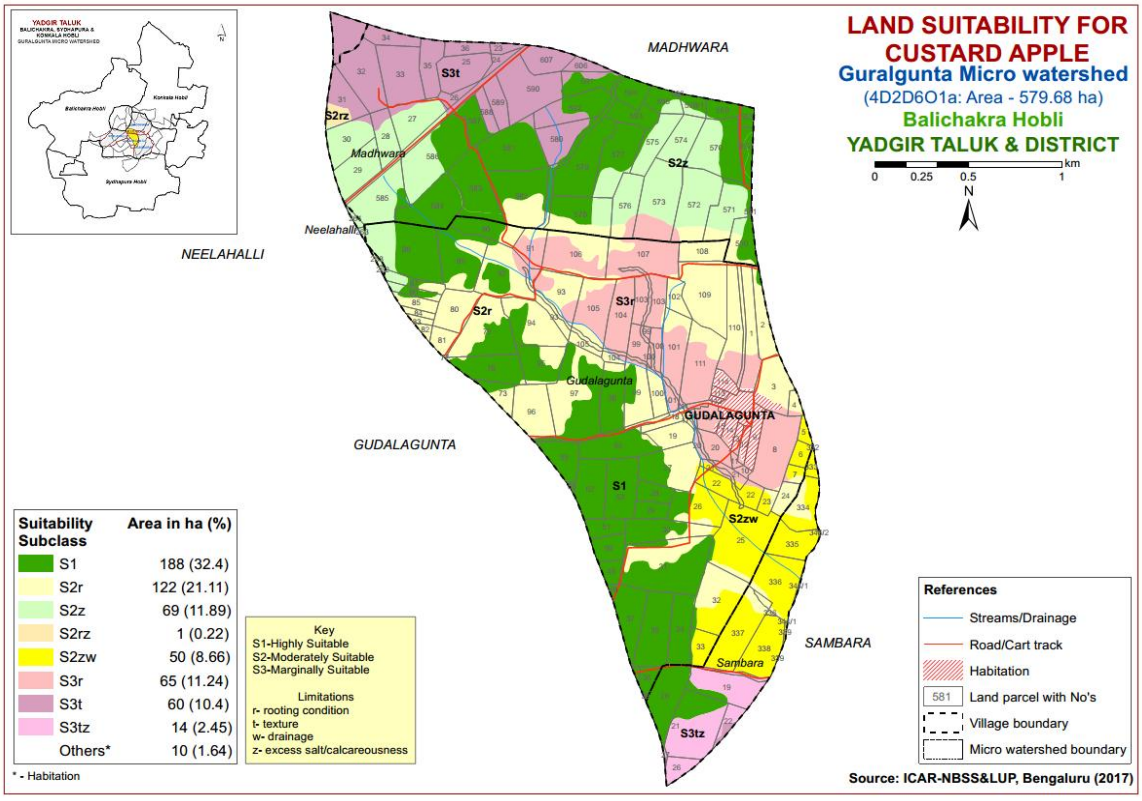


Fig. 7.22 Land Suitability map of Custard Apple

Highly suitable (Class S1) lands of about 188 ha (32%) is available for growing Custard apple in the microwatershed. Maximum area of about 242 ha (42%) is moderately suitable (Class S2) for growing Custard apple and are distributed in all parts

of the microwatershed. They have minor limitations of drainage, calcareousness and rooting depth. Marginally suitable lands (Class S3) occupy an area of about 139 ha (24%) and are distributed in the northern, central and southern part of the microwatershed with major limitations of rooting depth, texture and calcareousness.

7.23 Land Suitability for Tamarind (*Tamarindus indica*)

Tamarind is the most important spice crop grown in almost all the districts of the state. The crop requirements for growing tamarind (Table 7.24) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing tamarind was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Fig. 7.23.

No highly suitable (Class S1) lands are available for growing Tamarind in the microwatershed. Maximum area of about 316 ha (54%) is moderately suitable (Class S2) for growing Tamarind and are distributed in all parts of the microwatershed with major limitations of texture, rooting depth and drainage. An area of about 6 ha (1%) is marginally suitable (Class S3) for growing Tamarind and are distributed in all parts of the microwatershed. They have minor limitations of texture, calcareousness and rooting depth. An area of about 248 ha (42%) is not suitable (Class N1) for growing Tamarind and occur in the northern, central, eastern, western and southern part of the microwatershed with severe limitations of rooting depth, texture and calcareousness.

Table 7.24 Land suitability criteria for Tamarind

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

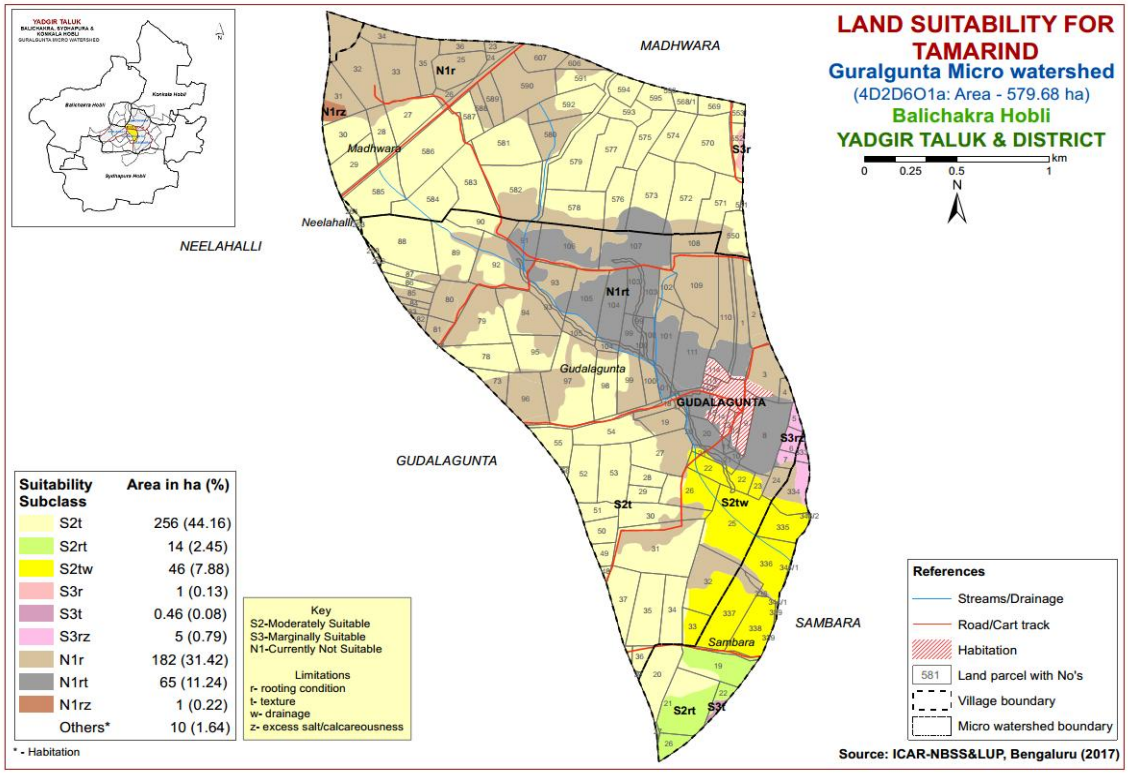


Fig. 7.23 Land Suitability map of Tamarind

7.24 Land Suitability for Mulberry (*Morus nigra*)

Mulberry is an 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 7.25) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing mulberry was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.24.

No highly suitable (Class S1) lands are available for growing mulberry in the microwatershed. Small area of about 1 ha (0.13%) is moderately suitable (Class S2) for growing Mulberry with minor limitation of rooting depth. Major area of about 504 ha (86%) is marginally suitable (Class S3) for growing mulberry and are distributed in all parts of the microwatershed. They have major limitations of texture, drainage and rooting depth. Not suitable lands (Class N1) occupy an area of about 65 ha (11%) and are distributed in the central and western part of the microwatershed with severe limitations of rooting depth and texture.

Table 7.25 Crop suitability criteria for Mulberry

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

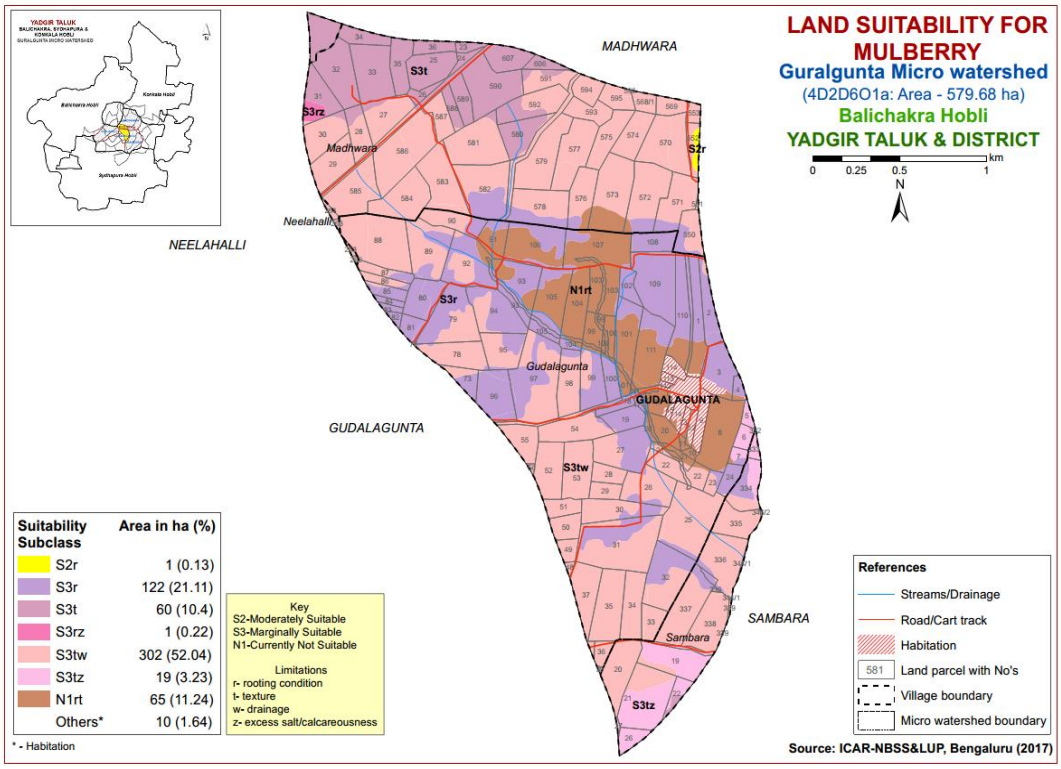


Fig 7.24 Land Suitability map of Mulberry

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

Marigold is one of the most important flower crop grown in an area of 9108 ha in almost all the districts of the State. The crop requirements (Table 7.26) for growing marigold were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing marigold was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.25.

No highly suitable (Class S1) lands are available for growing Marigold in the microwatershed. Maximum area of about 446 ha (76%) is moderately suitable (Class S2) for growing Marigold and are distributed in the major part of the microwatershed. They have minor limitations of texture, drainage, calcareousness, gravelliness and rooting depth. Marginally suitable (Class S3) lands for growing Marigold occupy an area of about

125 ha (21%) and are distributed in the northern, central and eastern part of the microwatershed with severe limitations of rooting depth and texture.

Table 7.26 Land suitability criteria for Marigold

Crop requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable(S1)**	**Moderately suitable(S2)**	**Marginally suitable(S3)**	**Not suitable(N)**
Climate	Temperature in growing season	^{0}C	18-23	17-15 24-35	35-40 10-14	>40 <10
Soil aeration	Soil drainage	Class	Well drained	Moderately well drained	Imperfectly drained	Poorly drained
Nutrient availability	Texture	Class	l,sl,scl,cl,sil	sicl, sc, sic,c	c	ls, s
	pH	1:2.5	7.0-7.5	5.5-5.9,7.6-8.5	<5,>8.5	-
	$CaCO_3$ in root zone	%	Non calcareous	Slightly calcareous	Strongly calcareous	-
Rooting conditions	Soil depth	Cm	>75	50-75	25-50	<25
	Gravel content	%vol.	<15	15-35	>35	-
Soil toxicity	Salinity	ds/m	Non saline	Slightly	Strongly	-
	Sodicity(ESP)	%	<10	10-15	>15	-
Erosion	Slope	%	1-3	3-5	5-10	-

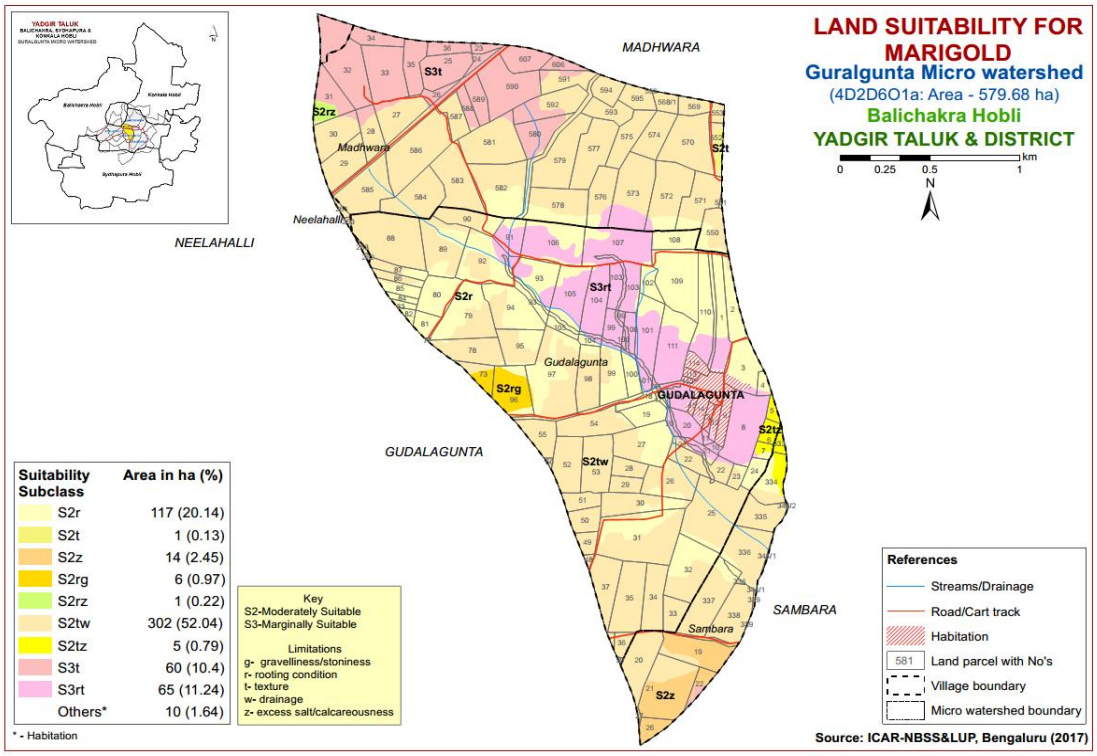


Fig. 7.25 Land Suitability map of Marigold

7.26 Land Suitability for Chrysanthemum (*Dendranthema grandiflora*)

Chrysanthemum is one of the most important flower crop grown in an area of 4978 ha in almost all the districts of the State. The crop requirements (Table 7.27) for growing chrysanthemum were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing chrysanthemum was generated. The area extent and their

geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.26.

Table 7.27 Land suitability criteria for Chrysanthemum

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

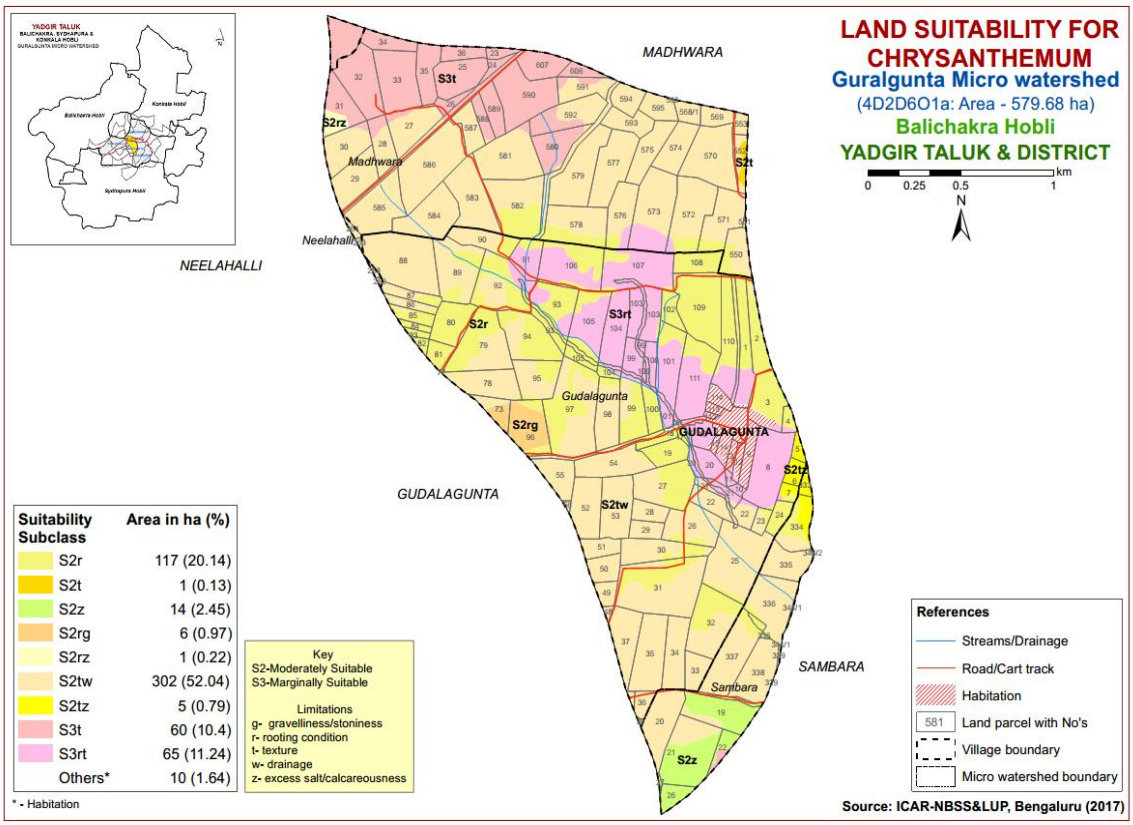


Fig. 7.26 Land Suitability map of Chrysanthemum

No highly suitable (Class S1) lands are available for growing Chrysanthemum in the microwatershed. Maximum area of about 446 ha (76%) is moderately suitable (Class S2) for growing Chrysanthemum and are distributed in the major part of the

microwatershed. They have minor limitations of texture, drainage, calcareousness, gravelliness and rooting depth. Marginally suitable (Class S3) lands for growing Chrysanthemum occupy an area of about 125 ha (21%) and are distributed in the northern, central and eastern part of the microwatershed with severe limitations of rooting depth and texture.

7.27 Land Management Units (LMU)

The 17 soil map units identified in Guralgunta microwatershed have been grouped into 8 Land Management Units (LMU) for the purpose of preparing a Proposed Crop Plan. Land Management Units are grouped based on the similarities in respect of the type of soil, the depth of the soil, the surface soil texture, gravel content, AWC, slope, erosion etc. and a Land Management Units map (Fig. 7.28) has been generated. These Land Management Units are expected to behave similarly for a given level of management.

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

LMU NO.	Soil map units	Soil and site characteristics
1	104.TMKiB2	Very deep (>150 cm), lowland black sandy clay soils, 1-3% slope, moderate erosion.
2	50.BGDbB2,61.MDRmB2 62.BMNmB2,84.KDRcB2 34.GWDcB2	Moderately deep to very deep (75 to >150 cm), black sandy loam to clay soils, 1-3 % slopes, moderate erosion.
3	42.YDRcB2 49.NGPmB2	Deep (100-150 cm), black sandy loam to clay soils, 1-3 % slopes, moderate erosion.
4	40.PGPcB2	Moderately deep (75-100 cm), red sandy loam soils, 1-3 % slopes, moderate erosion.
5	29.YLRcB2g1 31.YLRiB2	Moderately shallow (50-75 cm), red sandy loam to sandy clay soils, 1-3 % slopes, gravelly (15-35%), moderate erosion.
6	16.HLGcB2,20.JNKcB2 22.JNKiB2	Moderately shallow (50-75 cm), black sandy loam to sandy clay soils, 1-3 % slopes, moderate erosion.
7	11.SBRcB2	Moderately shallow (50-75 cm), black sandy loam soils, 1-3 % slopes, moderate erosion.
8	2.BDLbB2 4.BDLhB2	Shallow (25-50 cm), black sandy clay loam to loamy sand soils, 1-3 % slopes, moderate erosion.

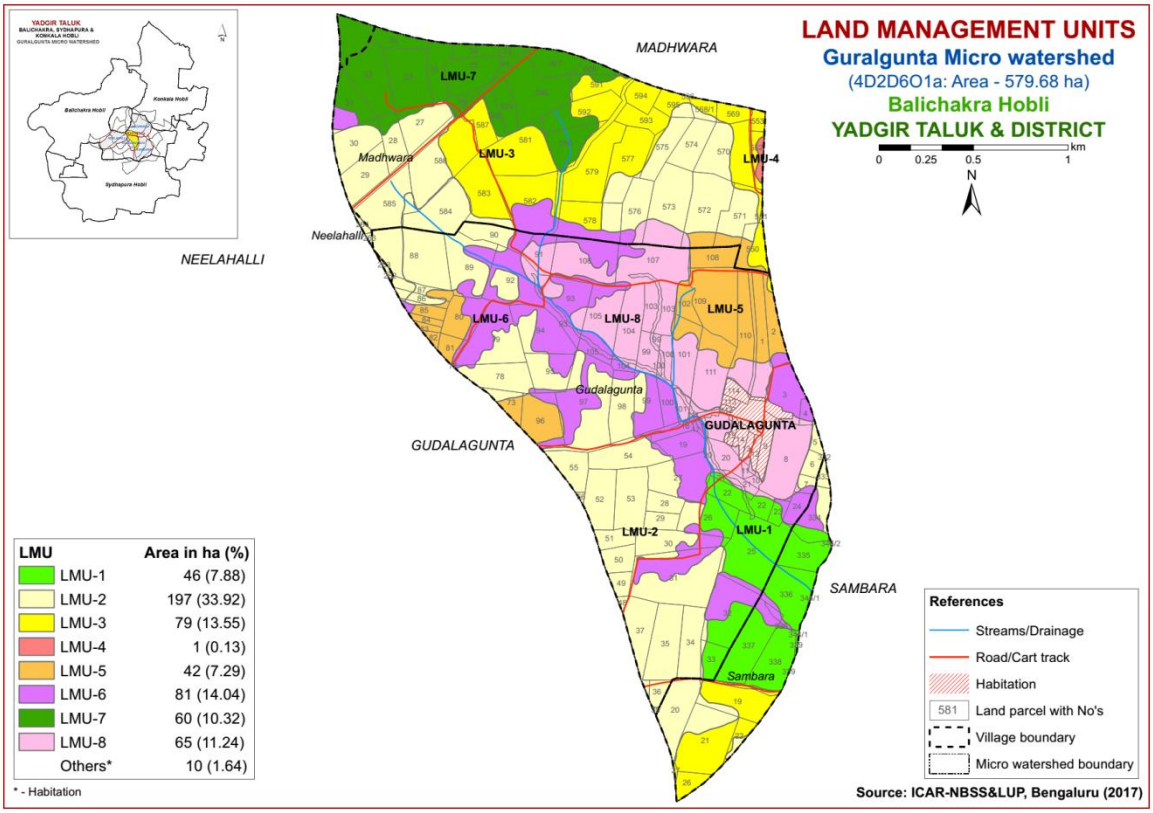


Fig. 7.27 Land Management Units Map- Guralgunta Microwatershed

7.28 Proposed Crop Plan for Guralgunta Microwatershed

After assessing the land suitability for the 26 crops, the proposed crop plan has been prepared for the 8 identified LMUs by considering only the highly (Class S1) and moderately (Class S2) suitable lands for each of the 26 crops. The resultant proposed crop plan is presented below in Table 7.28.

Table 7.28 Proposed Crop Plan for Guralgunta Microwatershed

Proposed LMU	Soil Map Units	Survey Number	Soil Characteristics	Field Crops	Horticulture Crops	Suitable Interventions
1	104. TMKiB2	**Gudalagunta:**22,23,25,26,33 **Sambara:**335,336,337,338,339,344/1,346/2	Very deep (>150 cm), lowland black sandy clay soils, 1-3% slope, moderate erosion.	Sunflower, Cotton, Bengal gram, Bajra	**Fruit crops:** Lime, Musambi, Amla, Jamun **Vegetables:** Drumstick, Chilli, Coriander **Flowers:** Marigold, Chrysanthemum	Application of FYM, Biofertilizers and micronutrients, suitable soil and water conservation practices
2	50.BGDbB2 61.MDRmB2 62.BMNmB2 84.KDRcB2 34.GWDcB2	**Gudalagunta:**28,29,30,31,34,35,36,37,39,48,49,5,50,51,52,53,54,55,56,6,7,78,86,87,88,89,90,95,97,98 **Madhwara:**27,28,29,30,570,571,572,573,574,575,576,584,585,586 **Neelahalli:** 262,263,264 **Sambara:** 20,332,333	Moderately deep to very deep (75 to >150 cm), black sandy loam to clay soils, 1-3 % slopes, moderate erosion.	Sunflower, Sorghum, Cotton, Bengal gram, Safflower, Linseed, Bajra	**Fruit crops:** Pomegranate, Lime, Musambi, Jamun, Amla, Custard apple, Tamarind **Vegetables:** Drumstick, Chilli, Coriander **Flowers:** Marigold, Chrysanthemum	Application of FYM, Biofertilizers and micronutrients, drip irrigation, Mulching, suitable soil and water conservation practices
3	42.YDRcB2 49.NGPmB2	**Madhwara:**550,551,552,553,568/1,569,577,578,579,581,582,583,587,591,592,593,594,595,596 **Sambara:** 19,21,22,26,27	Deep (100-150 cm), black sandy loam to clay soils, 1-3 % slopes, moderate erosion.	Bajra, maize, sorghum, Bengal gram	**Fruit crops:** Amla, Jamun, Custard apple, Tamarind **Vegetables:** Drumstick	Application of FYM, Biofertilizers and micronutrients, drip irrigation, mulching, suitable soil and water conservation practices
4	40.PGPcB2	**Madhwara:**552	Moderately deep (75-100 cm), red sandy loam soils, 1-3 % slopes, moderate erosion.	Maize, Sorghum, Groundnut, Redgram, Bajra	**Fruit crops:** Sapota,Guava, Jackfruit,Musambi, Pomegranate, Lime, Amla, Custard apple **Vegetables:** Tomato, Drumstick, Chilli, **Flowers:** Marigold,	Drip irrigation, mulching, suitable conservation practices (Crescent Bunding with Catch Pit etc)

					Chrysanthemum	
5	29.YLRcB2g1 31.YLRiB2	**Gudalagunta:**1,2,102,108,109,110,73,77,80,81,82,83,84,85,96	Moderately shallow (50-75 cm), red sandy loam to sandy clay soils, 1-3 % slopes, gravelly (15-35%), moderate erosion.	Maize, Sorghum, Groundnut, Bajra, Red gram	**Fruit crops:** Amla, Custard apple **Vegetables:** Tomato, Chilli **Flowers:** Marigold Chrysanthemum	Drip irrigation, mulching, suitable soil and water conservation practices (Crescent Bunding with Catch Pit etc)
6	16.HLGcB2 20.JNKcB2 22.JNKiB2	**Gudalagunta:**3,4,17,18,19,24,27,32,79,92,93,94,99, 100 **Sambara:** 334,336	Moderately shallow (50-75 cm), black sandy loam to sandy clay soils, 1-3 % slopes, moderate erosion.	Maize, Sorghum, Groundnut, Bengal gram, Bajra	**Fruit crops:** Amla, Custard apple, **Vegetables:** Tomato, Chilli, Coriander **Flowers:** Marigold, Chrysanthemum	Application of FYM, Biofertilizers and micronutrients, drip irrigation, Mulching, suitable soil and water conservation practices
7	11.SBRcB2	**Madhwara:**23,24,25,26,31,32,33,34,35,36,580,588,589,590,606,607	Moderately shallow (50-75 cm), black sandy loam soils, 1-3 % slopes, moderate erosion.	Groundnut, Horsegram, Coriander, Safflower	**Vegetables:** Onion Agri-Silvi-Pasture: Custard apple, Amla, Hybrid Napier, Styloxanthes hamata, Glyricidia, Styloxanthes scabra	Application of FYM, Biofertilizers and micronutrients, drip irrigation, Mulching, suitable soil and water conservation practices
8	2.BDLbB2 4.BDLhB2	**Gudalagunta:**8,10,11,16,20,21,91101,103,104,105, 106, 107, 111	Shallow (25-50 cm), black sandy clay loam to loamy sand soils, 1-3 % slopes, moderate erosion.	Bengal gram, Horse gram, Linseed, Safflower, Coriander	Agri-Silvi-Pasture: Hybrid Napier, Styloxanthes hamata, Glyricidia, 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 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 Guralgunta Microwatershed

- The soil phases identified in the microwatershed belonged to the soil series of BMN 123 ha (21%), JNK 80 ha (14%), BDL 66 ha (11%), NGP 64 ha (11%), SBR 60 ha (10%), TMK 46ha (8%), YLR 43 ha (7%), KDR 36 ha (6%), MDR 33 ha (6%), YDR 14 ha (2%), GWD 5 ha (1%), HLG 1 ha (0.22 %), PGP 1ha (0.13%) and BGD 0.46 ha (0.10%).
- As per land capability classification, entire area of the microwatershed falls under arable land category (Class II & III). The major limitations identified in the arable lands were soil, erosion and drainage.

- On the basis of soil reaction, about 87 ha (15%) is neutral (6.5-7.3), 224 ha (39%) is slightly alkaline (pH 7.3-7.8), 178 ha (31%) is moderately alkaline (pH 7.8-8.4) and 80 ha (14%) is strongly alkaline (pH 8.4-9.0).

Soil Health Management

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

Alkaline soils

(Slightly alkaline to moderately alkaline soils)

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

Neutral soils

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

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

Soil Degradation

Soil erosion is one of the major factor affecting the soil health in the microwatershed. Entire area of about 570 ha is suffering from moderate erosion. These areas need immediate soil and water conservation and, other land development and land husbandry practices for restoring soil health.

Dissemination of Information and Communication of Benefits

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

Inputs for Net Planning (Saturation Plan) and Interventions needed

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

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

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

- **Soil Depth:** The depth of a soil decides the amount of moisture and nutrients it can hold, what crops can be taken up or not, depending on the rooting depth and the length of growing period available for raising any crop. Deeper the soil, better for a wide variety of crops. If sufficient depth is not available for growing deep rooted crops, either choose medium or short duration crops or deeper planting pits need to be opened and additional good quality soil brought from outside has to be filled into the planting pits.
- **Surface soil texture:** Lighter soil texture in the top soil means, better rain water infiltration, less run-off and soil moisture conservation, less capillary rise and less evaporation losses. Lighter surface textured soils are amenable to good soil tilth and are highly suitable for crops like groundnut, root vegetables (carrot, raddish, potato etc) but not ideal for crops that need stagnant water like lowland paddy. Heavy textured soils are poor in water infiltration and percolation. They are prone for sheet erosion; such soils can be improved by sand mulching. The technology that is developed by the AICRP-Dryland Agriculture, Vijayapura, Karnataka can be adopted.
- **Gravelliness:** More gravel content is favorable for run-off harvesting but poor in soil moisture storage and nutrient availability. It is a significant parameter that decides the kind of crop to be raised.
- **Land Capability Classification:** The land capability map shows the areas suitable and not suitable for agriculture and the major constraints in each of the plot/survey number. Hence, one can decide what kind of enterprise is possible in each of these units. In general soil, erosion and drainage are the major constraints in Guralgunta microwatershed.
- **Organic Carbon:** The OC content (an index of available Nitrogen) is high (>0.75%) in 268 ha (46%), medium (0.5-0.75%) in about 289 ha (50%) and low in an area of 12 ha (2%). The areas that are medium and low in OC needs to be further improved by applying farm yard manure and rotating crops with cereals and legumes or mixed cropping.
- **Promoting green manuring:** Growing of green manuring crops costs Rs. 1250/ha (green manuring seeds) and about Rs. 2000/ha towards cultivation that totals to Rs. 3250/- per ha. On the other hand, application of organic manure @ 10 tons/ha costs Rs. 5000/ha. The practice needs to be continued for 2-3 years or more. Nitrogen fertilizer needs to be supplemented by 25% in addition to the recommended level in 301 ha area where OC is

low to medium (<0.5 - 0.75%). For example, for rainfed maize, recommended level is 50 kg N per ha and an additional 12 kg /ha needs to be applied for all the crops grown in these plots.

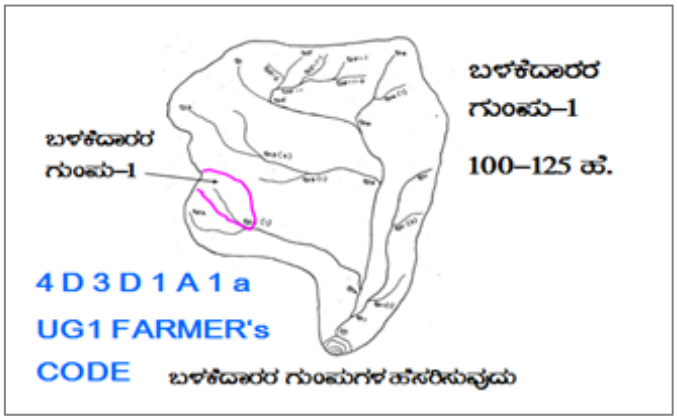
- **Available Phosphorus**: Available Phosphorus is low (<23 kg/ha) in an area of 1 ha (0.20%), medium (23-57 kg/ha) in an area of 479 ha (83%) and high (>57 kg/ha) in an area of 90 ha (16%) of the microwatershed. For all the crops, 25% additional P needs to be applied where available P is low and medium.
- **Available Potassium:** Available potassium is medium (145-337 kg/ha) in maximum area of 566 ha (98%) of the microwatershed and an area of about 3 ha (1%) is high (>337 kg/ha) in available potassium. All the plots, where available potassium is medium, for all the crops, additional 25 % potassium may be applied.
- **Available Sulphur:** Available sulphur is a very critical nutrient for oilseed crops, it is low in 353 ha (61%), medium in 204 ha (35%) and high in 12 ha (2%). Low and medium areas need to be applied with magnesium sulphate or gypsum or Factamphos (p) fertilizer (13% sulphur) for 2-3 years for the deficiency to be corrected.
- **Available Boron:** An area of 296 ha (51%) is low, 229 ha (40%) is medium and 44 ha (8%) is high. For areas that are low and medium, application of sodium borate @ 10 kg/ha as soil application or 0.2 % borax as foliar spray is recommended.
- **Available Iron:** An area of about 190 ha (33%) is deficient and 379 ha (65%) in the microwatershed is sufficient in available iron. To manage iron deficiency, iron sulphate @ 25 kg/ha needs to be applied for 2 to 3 years in the areas where it is deficient.
- **Available Zinc:** Almost entire area of about 570 ha (98%) of the microwatershed is deficient in available zinc content. Application of zinc sulphate @ 25 kg/ha is to be recommended for these areas.
- **Soil Alkalinity:** The microwatershed has 482 ha (84%) area with soils that are slightly to strongly alkaline. These areas need application of gypsum and wherever calcium is in excess, iron pyrites and element sulphur can be recommended. Management practices like treating repeatedly with good quality water to drain out the excess salts and provision of subsurface drainage and growing of salt tolerant crops like Casuarina, Acasia, Neem, Ber etc, are recommended.
- **Land Suitability for various crops:** Areas that are highly, moderately and marginally suitable for growing various crops are indicated. Along with the suitability, various constraints that are limiting the productivity are also indicated. For example, in case of cotton, gravel content, rooting depth and salinity/alkalinity are the major constraints in various plots. With suitable management interventions, the productivity can be enhanced. In order to increase the water holding capacity of light textured soils, growing of green manure crops and application of organic manure is recommended.

Chapter 9

SOIL AND WATER CONSERVATION TREATMENT PLAN

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

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



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

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

Steps for Survey and Preparation of Treatment Plan

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

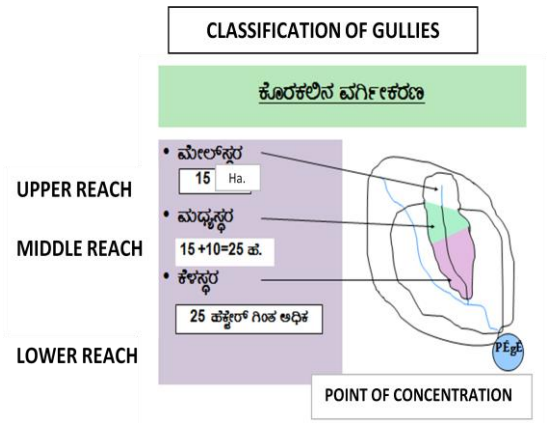
- Naming of user groups and farmers
- Identification of arable and non arable lands
- Identification of drainage lines and gullies
- Identification of non treatable areas
- Identification of priority areas in the arable lands
- Treatment plan for arable lands
- Location of water harvesting and recharge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

9.1 Treatment Plan

The treatment plan recommended for arable lands is briefly described below

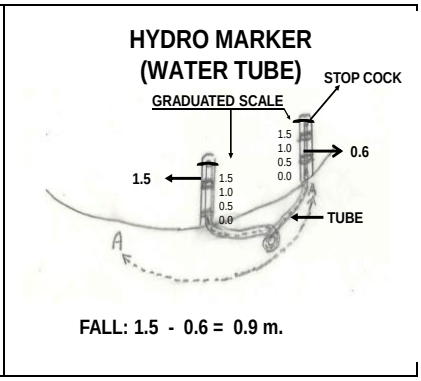
9.1.1 Arable Land Treatment

A. BUNDING

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

Measurement of Land Slope

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



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

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

Note: (i) The above intervals are maximum.

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

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

Section of the Bund

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

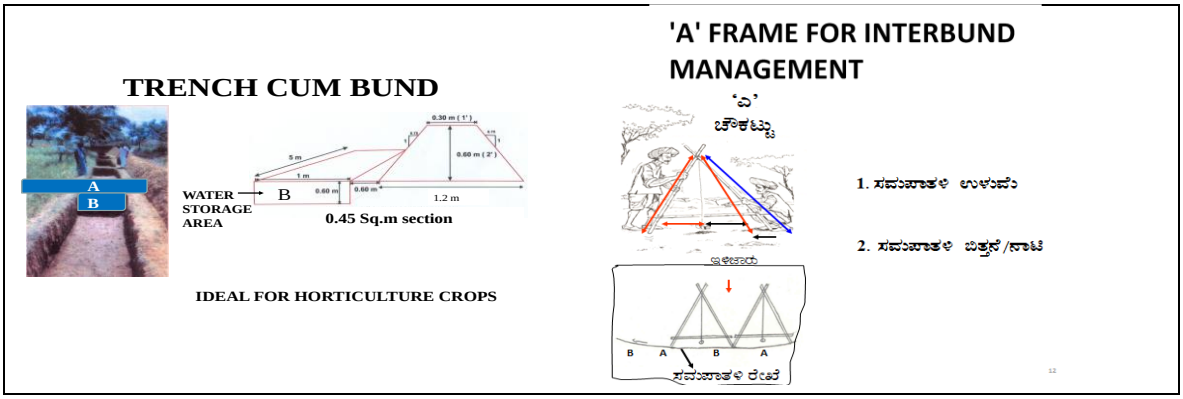
Recommended Bund Section

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

Formation of Trench cum Bund

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

Details of Borrow Pit dimensions are given below:



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

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

B. Water Ways

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

C. Farm Ponds

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

D. Diversion Channel

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

9.1.2 Non-Arable Land Treatment

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

9.1.3 Treatment of Natural Water Course/ Drainage Lines

a) The cadastral map has to be updated as regards the network of drainage lines (gullies/ *nalas/ hallas*) and existing structures are marked to the scale and storage capacity of the existing water bodies are documented (Fig. 9.1).

b) The drainage line will be demarcated into Upper Reach, Middle Reach and Lower Reach.

c) Considering the Catchment, *Nala* bed and bank conditions, suitable structures are decided.

d) Number of storage structures (Check dam/ *Nala* bund/ Percolation tank) will be decided considering the commitments and available runoff from water budgeting and quality of water in the wells and site suitability.

e) Detailed Levelling Survey using Dumpy Level / Total Station has to be carried out to arrive at the site-specific designs as shown in the Manual.

f) The location of ground water recharge structures are decided by examining the lineaments and fracture zones from geological maps.

g) Rainfall intensity data of the nearest Rain Gauge Station is considered for Hydrologic Designs.

h) Silt load to the Storage/Recharge Structures is reduced by providing vegetative, boulder and earthen checks in the natural water course. Location and design details are given in the Manual.

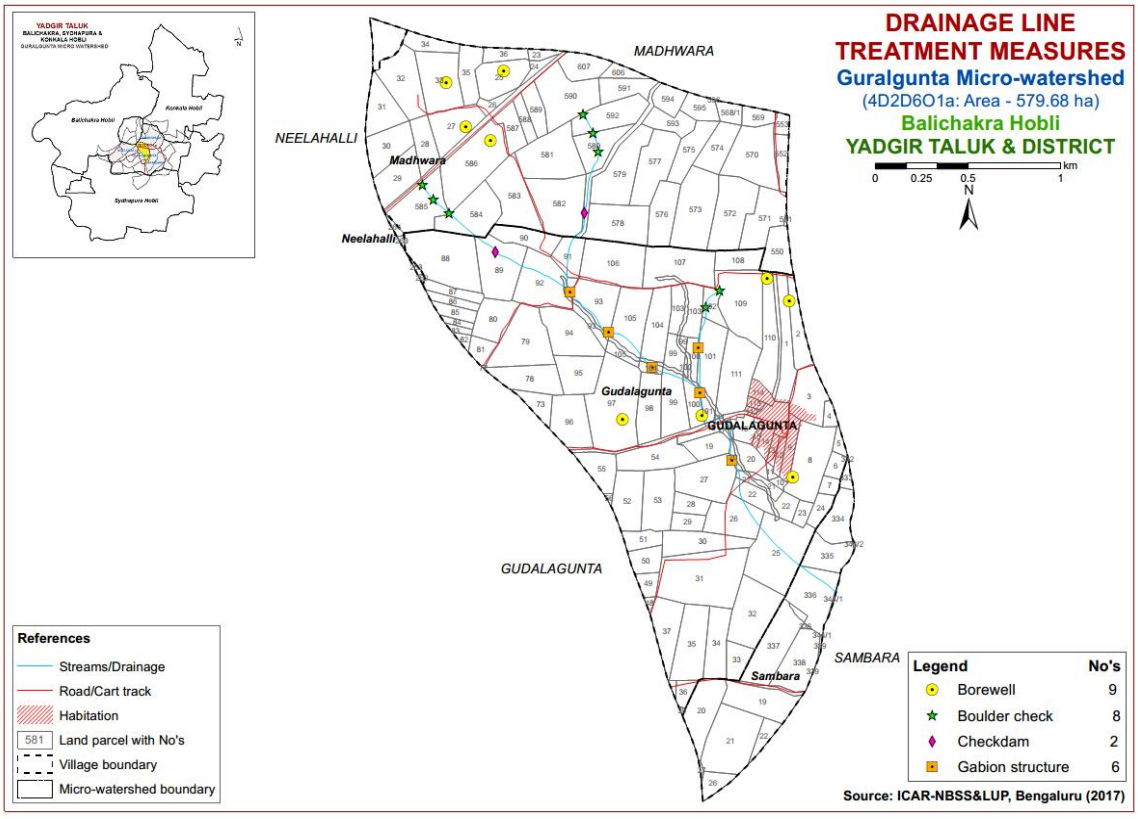


Fig. 9.1 Drainage line treatment measures map of Guralgunta Microwatershed

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. 9.2) 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 527 ha (91%) needs Graded Bunding and 43 ha (7%) requires Trench cum 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.

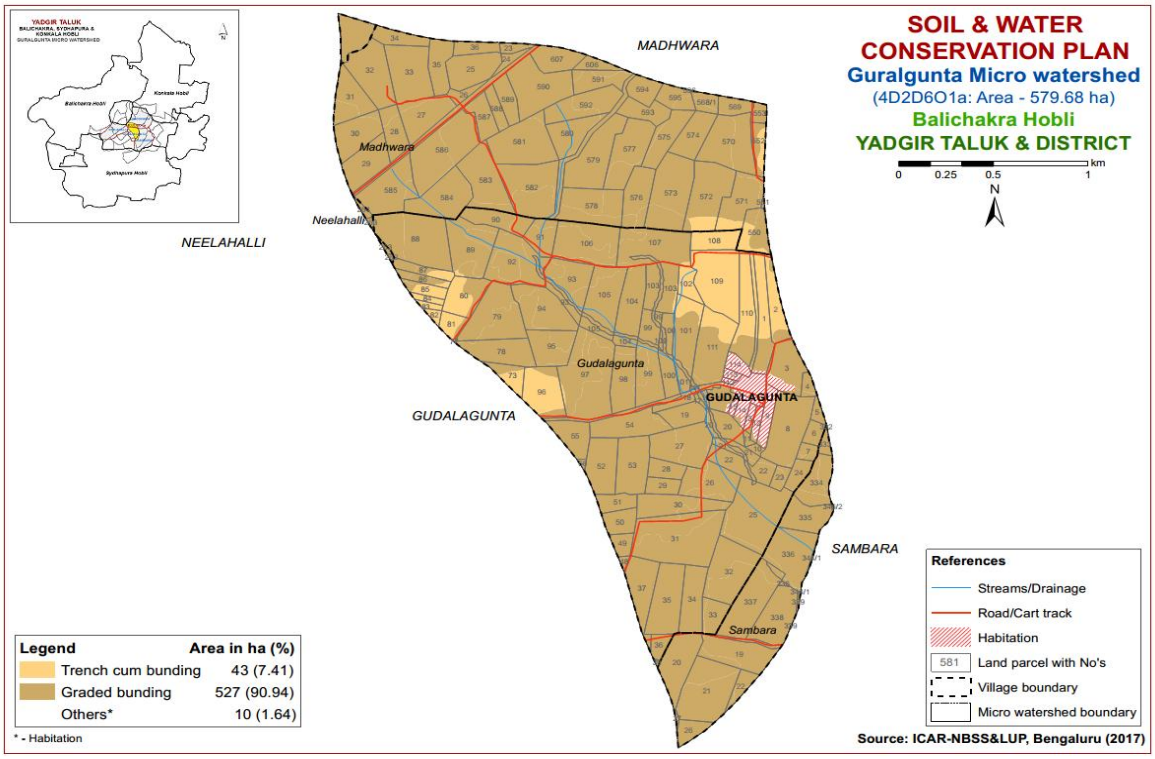


Fig. 9.2 Soil and Water Conservation Plan map of Guralgunta Microwatershed

9.3 Greening of Microwatershed

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

bunds for growing annual and perennial crops. The method of planting these trees is given below.

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

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

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

References

1. FAO (1976) Framework for Land Evaluation, Food and Agriculture Organization, Rome.72 pp.
2. FAO (1983) Guidelines for Land Evaluation for Rainfed Agriculture, FAO, Rome, 237 pp.
3. IARI (1971) Soil Survey Manual, All India Soil and Land Use Survey Organization, IARI, New Delhi, 121 pp.
4. Katyal, J.C. and Rattan, R.K. (2003) Secondary and Micronutrients; Research Gap and Future Needs. Fert. News 48 (4); 9-20.
5. Naidu, L.G.K., Ramamurthy, V., Challa, O., Hegde, R. and Krishnan, P. (2006) Manual Soil Site Suitability Criteria for Major Crops, NBSS Publ. No. 129, NBSS & LUP, Nagpur, 118 pp.
6. Natarajan, A. and Dipak Sarkar (2010) Field Guide for Soil Survey, National Bureau of Soil Survey and Land Use Planning (ICAR), Nagpur, India.
7. Natarajan, A., Rajendra Hegde, Raj, J.N. and Shivananda Murthy, H.G. (2015) Implementation Manual for Sujala-III Project, Watershed Development Department, Bengaluru, Karnataka.
8. Sarma, V.A.K., Krishnan, P. and Budihal, S.L. (1987) Laboratory Manual, Tech. Bull. 23, NBSS &LUP, Nagpur.
9. Sehgal, J.L. (1990) Soil Resource Mapping of Different States of India; Why and How?, National Bureau of Soil Survey and Land Use Planning, Nagpur, 49 pp.
10. Shivaprasad, C.R., R.S. Reddy, J. Sehgal and M. Velayuthum (1998) Soils of Karntaka for Optimising Land Use, NBSS Publ. No. 47b, NBSS & LUP, Nagpur, India.
11. Soil Survey Staff (2006) Keys to Soil Taxonomy, Tenth edition, U.S. Department of Agriculture/ NRCS, Washington DC, U.S.A.
12. Soil Survey Staff (2012) Soil Survey Manual, Handbook No. 18, USDA, Washington DC, USA.

Appendix I

Guralgunta Microwatershed

Soil Phase Information

Village	Sy No	Area (ha)	Soil Phase	Land Use Class	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	Wells	Land Capability	Conservation Plan
Gudalagunta	1	4.52	YLRiB2	LUC-5	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Ragi (Ra)	Not Available	IIes	TCB
Gudalagunta	2	3.27	YLRiB2	LUC-5	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Ragi+Cotton (Ra+Ct)	1 Borewell	IIes	TCB
Gudalagunta	3	4.85	JNKcB2	LUC-6	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Habitation	Not Available	IIes	Graded bunding
Gudalagunta	4	0.86	JNKcB2	LUC-6	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Gudalagunta	5	0.72	GWDcB2	LUC-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Ragi (Ra)	Not Available	IIes	Graded bunding
Gudalagunta	6	1.22	GWDcB2	LUC-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Ragi (Ra)	Not Available	IIes	Graded bunding
Gudalagunta	7	0.92	GWDcB2	LUC-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Ragi (Ra)	Not Available	IIes	Graded bunding
Gudalagunta	8	7.57	BDLbB2	LUC-8	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Ragi+Paddy (Ra+Pd)	1 Borewell	IIIes	Graded bunding
Gudalagunta	9	1.87	Habitation	Others	Others	Others	Others	Others	Others	Others	Habitation	Not Available	Others	Others
Gudalagunta	10	0.37	BDLbB2	LUC-8	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland (Sl)	Not Available	IIIes	Graded bunding
Gudalagunta	11	0.33	BDLbB2	LUC-8	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland (Sl)	Not Available	IIIes	Graded bunding
Gudalagunta	12	0.82	Habitation	Others	Others	Others	Others	Others	Others	Others	Habitation	Not Available	Others	Others
Gudalagunta	13	0.64	Habitation	Others	Others	Others	Others	Others	Others	Others	Habitation	Not Available	Others	Others
Gudalagunta	14	1.05	Habitation	Others	Others	Others	Others	Others	Others	Others	Habitation	Not Available	Others	Others
Gudalagunta	15	0.5	Habitation	Others	Others	Others	Others	Others	Others	Others	Habitation	Not Available	Others	Others
Gudalagunta	16	1.65	BDLbB2	LUC-8	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Habitation	Not Available	IIIes	Graded bunding
Gudalagunta	17	0.42	JNKiB2	LUC-6	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIes	Graded bunding
Gudalagunta	18	1.05	JNKiB2	LUC-6	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
Gudalagunta	19	2.59	JNKiB2	LUC-6	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
Gudalagunta	20	2.42	BDLbB2	LUC-8	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland (Sl)	Not Available	IIIes	Graded bunding
Gudalagunta	21	1.24	BDLbB2	LUC-8	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland (Sl)	Not Available	IIIes	Graded bunding
Gudalagunta	22	3.62	TMKiB2	LUC-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIws	Graded bunding

Village	Sy No	Area (ha)	Soil Phase	Land Use Class	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	Wells	Land Capability	Conservation Plan
Gudalagunta	23	1.03	TMKiB2	LUC-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland (Sl)	Not Available	IIws	Graded bunding
Gudalagunta	24	1.59	JNKcB2	LUC-6	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Ragi (Ra)	Not Available	IIes	Graded bunding
Gudalagunta	25	10.16	TMKiB2	LUC-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIws	Graded bunding
Gudalagunta	26	5.4	TMKiB2	LUC-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Ragi+Cotton+Paddy (Ra+Ct+Pd)	Not Available	IIws	Graded bunding
Gudalagunta	27	6.35	JNKiB2	LUC-6	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
Gudalagunta	28	1.89	BMNmB2	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Ragi (Ra)	Not Available	IIes	Graded bunding
Gudalagunta	29	1.64	BMNmB2	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Ragi (Ra)	Not Available	IIes	Graded bunding
Gudalagunta	30	4.82	BMNmB2	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Ragi (Ra)	Not Available	IIes	Graded bunding
Gudalagunta	31	12.34	BMNmB2	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar+Ragi+Cotton (Jw+Ra+Ct)	Not Available	IIes	Graded bunding
Gudalagunta	32	7.31	JNKcB2	LUC-6	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Gudalagunta	33	2.23	TMKiB2	LUC-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Ragi (Ra)	Not Available	IIws	Graded bunding
Gudalagunta	34	4.43	BMNmB2	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Ragi (Ra)	Not Available	IIes	Graded bunding
Gudalagunta	35	6.35	BMNmB2	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Ragi+Cotton (Ra+Ct)	Not Available	IIes	Graded bunding
Gudalagunta	36	1.23	BMNmB2	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Gudalagunta	37	4.79	BMNmB2	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Ragi+Cotton (Ra+Ct)	Not Available	IIes	Graded bunding
Gudalagunta	39	0.08	BMNmB2	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Ragi (Ra)	Not Available	IIes	Graded bunding
Gudalagunta	48	0.31	BMNmB2	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar+Ragi+Cotton (Jw+Ra+Ct)	Not Available	IIes	Graded bunding
Gudalagunta	49	1.27	BMNmB2	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Ragi (Ra)	Not Available	IIes	Graded bunding
Gudalagunta	50	2.24	BMNmB2	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Gudalagunta	51	1.94	BMNmB2	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Ragi+Cotton (Ra+Ct)	Not Available	IIes	Graded bunding
Gudalagunta	52	4.81	BMNmB2	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Gudalagunta	53	5.41	BMNmB2	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Gudalagunta	54	5	BMNmB2	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Ragi+Cotton (Ra+Ct)	Not Available	IIes	Graded bunding
Gudalagunta	55	3.21	BMNmB2	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Ragi+Cotton (Ra+Ct)	Not Available	IIes	Graded bunding

Village	Sy No	Area (ha)	Soil Phase	Land Use Class	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	Wells	Land Capability	Conservation Plan
Gudala gunta	56	0.17	BMNmB2	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Ragi+Cotton (Ra+Ct)	Not Available	IIes	Graded bunding
Gudala gunta	73	2.02	YLRcB2g1	LUC-5	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	TCB
Gudala gunta	77	0	YLRcB2g1	LUC-5	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	TCB
Gudala gunta	78	4.86	BMNmB2	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Ragi (Ra)	Not Available	IIes	Graded bunding
Gudala gunta	79	7.82	JNKcB2	LUC-6	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Ragi+Cotton (Ra+Ct)	Not Available	IIes	Graded bunding
Gudala gunta	80	4.05	YLRiB2	LUC-5	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Ragi (Ra)	Not Available	IIes	TCB
Gudala gunta	81	1.62	YLRiB2	LUC-5	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIes	TCB
Gudala gunta	82	0.49	YLRiB2	LUC-5	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Ragi (Ra)	Not Available	IIes	TCB
Gudala gunta	83	0.47	YLRiB2	LUC-5	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Ragi (Ra)	Not Available	IIes	TCB
Gudala gunta	84	0.61	YLRiB2	LUC-5	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Ragi (Ra)	Not Available	IIes	TCB
Gudala gunta	85	1.49	YLRiB2	LUC-5	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	TCB
Gudala gunta	86	1.26	BMNmB2	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Ragi (Ra)	Not Available	IIes	Graded bunding
Gudala gunta	87	1.75	MDRmB2	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Gudala gunta	88	10.06	BMNmB2	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar+Ragi+Cotton (Jw+Ra+Ct)	Not Available	IIes	Graded bunding
Gudala gunta	89	7.05	BMNmB2	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Ragi (Ra)	Not Available	IIes	Graded bunding
Gudala gunta	90	3.51	BMNmB2	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Ragi (Ra)	Not Available	IIes	Graded bunding
Gudala gunta	91	2.81	BDLhB2	LUC-8	Shallow (25-50 cm)	Sandy clay loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland (Sl)	Not Available	IIIes	Graded bunding
Gudala gunta	92	7.24	JNKcB2	LUC-6	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Ragi (Ra)	Not Available	IIes	Graded bunding
Gudala gunta	93	5.48	JNKcB2	LUC-6	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland (Sl)	Not Available	IIes	Graded bunding
Gudala gunta	94	6.23	JNKcB2	LUC-6	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Ragi+Cotton (Ra+Ct)	Not Available	IIes	Graded bunding
Gudala gunta	95	4.46	BMNmB2	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Ragi (Ra)	Not Available	IIes	Graded bunding
Gudala gunta	96	5.46	YLRcB2g1	LUC-5	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	TCB
Gudala gunta	97	11.8	BMNmB2	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Ragi+Paddy (Ra+Pd)	1 Borewell	IIes	Graded bunding

Village	Sy No	Area (ha)	Soil Phase	Land Use Class	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	Wells	Land Capability	Conservation Plan
Gudala gunta	98	4.62	BMNmB2	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Ragi+Cotton (Ra+Ct)	Not Available	IIes	Graded bunding
Gudala gunta	99	6.27	JNKiB2	LUC-6	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIes	Graded bunding
Gudala gunta	100	3.21	JNKiB2	LUC-6	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	1 Borewell	IIes	Graded bunding
Gudala gunta	101	5.83	BDLhB2	LUC-8	Shallow (25-50 cm)	Sandy clay loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIIes	Graded bunding
Gudala gunta	102	1.77	YLRiB2	LUC-5	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland (Sl)	Not Available	IIes	TCB
Gudala gunta	103	4.25	BDLhB2	LUC-8	Shallow (25-50 cm)	Sandy clay loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland (Sl)	Not Available	IIIes	Graded bunding
Gudala gunta	104	5.42	BDLhB2	LUC-8	Shallow (25-50 cm)	Sandy clay loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Ragi (Ra)	Not Available	IIIes	Graded bunding
Gudala gunta	105	6.6	BDLhB2	LUC-8	Shallow (25-50 cm)	Sandy clay loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Ragi (Ra)	Not Available	IIIes	Graded bunding
Gudala gunta	106	7.66	BDLhB2	LUC-8	Shallow (25-50 cm)	Sandy clay loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Ragi+Cotton (Ra+Ct)	Not Available	IIIes	Graded bunding
Gudala gunta	107	7.43	BDLhB2	LUC-8	Shallow (25-50 cm)	Sandy clay loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Ragi+Cotton (Ra+Ct)	Not Available	IIIes	Graded bunding
Gudala gunta	108	2.77	YLRiB2	LUC-5	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Ragi (Ra)	Not Available	IIes	TCB
Gudala gunta	109	8.28	YLRiB2	LUC-5	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Ragi (Ra)	Not Available	IIes	TCB
Gudala gunta	110	5.27	YLRiB2	LUC-5	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	1 Borewell	IIes	TCB
Gudala gunta	111	7.13	BDLhB2	LUC-8	Shallow (25-50 cm)	Sandy clay loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Ragi+Cotton (Ra+Ct)	Not Available	IIIes	Graded bunding
Gudala gunta	112	0.2	Habitation	Others	Others	Others	Others	Others	Others	Others	Habitation	Not Available	Others	Others
Gudala gunta	113	0.44	Habitation	Others	Others	Others	Others	Others	Others	Others	Habitation	Not Available	Others	Others
Gudala gunta	114	1.1	Habitation	Others	Others	Others	Others	Others	Others	Others	Habitation	Not Available	Others	Others
Madhwara	23	0.81	SBRcB2	LUC-7	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton+Redgram (Ct+Rg)	Not Available	IIes	Graded bunding
Madhwara	24	0.81	SBRcB2	LUC-7	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Madhwara	25	4.66	SBRcB2	LUC-7	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut+Redgram (Gn+Rg)	1 Borewell	IIes	Graded bunding

Village	Sy No	Area (ha)	Soil Phase	Land Use Class	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	Wells	Land Capability	Conservation Plan
Madhwara	26	1.01	SBRcB2	LUC-7	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Madhwara	27	4.83	MDRmB2	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	1 Borewell	IIes	Graded bunding
Madhwara	28	3.11	MDRmB2	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Madhwara	29	4.59	MDRmB2	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton+Redgram (Ct+Rg)	Not Available	IIes	Graded bunding
Madhwara	30	4.52	MDRmB2	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton+Redgram (Ct+Rg)	Not Available	IIes	Graded bunding
Madhwara	31	4.32	SBRcB2	LUC-7	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Madhwara	32	6.31	SBRcB2	LUC-7	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Madhwara	33	6.67	SBRcB2	LUC-7	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	1 Borewell	IIes	Graded bunding
Madhwara	34	2.22	SBRcB2	LUC-7	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton+Redgram (Ct+Rg)	Not Available	IIes	Graded bunding
Madhwara	35	3.28	SBRcB2	LUC-7	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Madhwara	36	1.66	SBRcB2	LUC-7	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Madhwara	550	3.37	NGPmB2	LUC-3	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
Madhwara	551	0.09	NGPmB2	LUC-3	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
Madhwara	552	1.91	NGPmB2	LUC-3	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
Madhwara	553	0.87	NGPmB2	LUC-3	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
Madhwara	568/1	1.42	NGPmB2	LUC-3	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
Madhwara	569	1.67	NGPmB2	LUC-3	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
Madhwara	570	7.49	KDRcB2	LUC-2	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Madhwara	571	5.31	KDRcB2	LUC-2	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Madhwara	572	7.44	KDRcB2	LUC-2	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Madhwara	573	8.56	KDRcB2	LUC-2	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton+Groundnut+Redgram (Ct+Gn+Rg)	Not Available	IIes	Graded bunding
Madhwara	574	3.75	KDRcB2	LUC-2	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Madhwara	575	3.91	KDRcB2	LUC-2	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding

Village	Sy No	Area (ha)	Soil Phase	Land Use Class	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	Wells	Land Capability	Conservation Plan
Madhwara	576	4.55	KDRcB2	LUC-2	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut+Redgram (Gn+Rg)	Not Available	IIes	Graded bunding
Madhwara	577	6.38	NGPmB2	LUC-3	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton+Redgram (Ct+Rg)	Not Available	IIes	Graded bunding
Madhwara	578	6.57	NGPmB2	LUC-3	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar (Jw)	Not Available	IIes	Graded bunding
Madhwara	579	7.14	NGPmB2	LUC-3	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton+Redgram (Ct+Rg)	Not Available	IIes	Graded bunding
Madhwara	580	4.02	SBRcB2	LUC-7	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland (Sl)	Not Available	IIes	Graded bunding
Madhwara	581	7.58	NGPmB2	LUC-3	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton+Redgram (Ct+Rg)	Not Available	IIes	Graded bunding
Madhwara	582	8.12	NGPmB2	LUC-3	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton+Redgram (Ct+Rg)	Not Available	IIes	Graded bunding
Madhwara	583	6.7	NGPmB2	LUC-3	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton+Redgram (Ct+Rg)	Not Available	IIes	Graded bunding
Madhwara	584	6.2	BMNmB2	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Scrubland+Redgram (Sl+Rg)	Not Available	IIes	Graded bunding
Madhwara	585	6.35	MDRmB2	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Madhwara	586	9.48	MDRmB2	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton+Redgram (Ct+Rg)	1 Borewell	IIes	Graded bunding
Madhwara	587	2.56	NGPmB2	LUC-3	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Sugarcane (Rg+Sc)	Not Available	IIes	Graded bunding
Madhwara	588	1.47	SBRcB2	LUC-7	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Madhwara	589	2.29	SBRcB2	LUC-7	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Madhwara	590	7.58	SBRcB2	LUC-7	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Sugarcane (Rg+Sc)	Not Available	IIes	Graded bunding
Madhwara	591	3.15	NGPmB2	LUC-3	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut (Gn)	Not Available	IIes	Graded bunding
Madhwara	592	5.22	NGPmB2	LUC-3	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut (Gn)	Not Available	IIes	Graded bunding
Madhwara	593	2.68	NGPmB2	LUC-3	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
Madhwara	594	2.21	NGPmB2	LUC-3	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton+Groundnut (Ct+Gn)	Not Available	IIes	Graded bunding
Madhwara	595	2.26	NGPmB2	LUC-3	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
Madhwara	596	0.01	NGPmB2	LUC-3	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
Madhwara	606	1.27	SBRcB2	LUC-7	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton+Groundnut (Ct+Gn)	Not Available	IIes	Graded bunding
Madhwara	607	3.16	SBRcB2	LUC-7	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Neelahalli	262	0.1	MDRmB2	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding

Village	Sy No	Area (ha)	Soil Phase	Land Use Class	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	Wells	Land Capability	Conservation Plan
Neelahalli	263	0.36	MDRmB2	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Neelahalli	264	0.37	MDRmB2	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Sambara	19	5.58	YDRcB2	LUC-3	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Sambara	20	5.47	BMNmB2	LUC-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton+Redgram (Ct+Rg)	Not Available	IIes	Graded bunding
Sambara	21	8.73	YDRcB2	LUC-3	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton+Redgram (Ct+Rg)	Not Available	IIes	Graded bunding
Sambara	22	1.46	YDRcB2	LUC-3	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar (Jw)	Not Available	IIes	Graded bunding
Sambara	26	1.69	YDRcB2	LUC-3	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Sambara	27	0.14	YDRcB2	LUC-3	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Sambara	332	0.01	GWDcB2	LUC-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Sambara	333	0.7	GWDcB2	LUC-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Fallow land (Fl)	Not Available	IIes	Graded bunding
Sambara	334	3.96	JNKcB2	LUC-6	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIes	Graded bunding
Sambara	335	3.83	TMKiB2	LUC-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIws	Graded bunding
Sambara	336	0.1	JNKcB2	LUC-6	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton+Redgram (Ct+Rg)	Not Available	IIes	Graded bunding
Sambara	336	6.42	TMKiB2	LUC-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton+Redgram (Ct+Rg)	Not Available	IIws	Graded bunding
Sambara	337	6.89	TMKiB2	LUC-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton+Redgram (Ct+Rg)	Not Available	IIws	Graded bunding
Sambara	338	5.54	TMKiB2	LUC-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIws	Graded bunding
Sambara	339	0.15	TMKiB2	LUC-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton+Paddy (Ct+Pd)	Not Available	IIws	Graded bunding
Sambara	344/1	0.13	TMKiB2	LUC-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIws	Graded bunding
Sambara	346/2	0.04	TMKiB2	LUC-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIws	Graded bunding

Appendix II

Guralgunta Microwatershed

Soil Fertility Information

Village	Survey No.	Soil Reaction	Salinity (EC)	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Gudalagunta	1	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	2	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	3	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	4	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	5	Slightly alkaline (pH 7.3 – 7.8)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	6	Slightly alkaline (pH 7.3 – 7.8)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	7	Moderately alkaline (pH 7.8 – 8.4)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	8	Slightly alkaline (pH 7.3 – 7.8)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	9	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Gudalagunta	10	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	11	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	12	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Gudalagunta	13	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Gudalagunta	14	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Gudalagunta	15	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Gudalagunta	16	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	17	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	18	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	19	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	20	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	21	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	22	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	23	Moderately alkaline (pH 7.8 – 8.4)	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)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	24	Moderately alkaline (pH 7.8 – 8.4)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)

Village	Survey No.	Soil Reaction	Salinity (EC)	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Gudalagunta	25	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	26	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	27	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	28	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	29	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	30	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	31	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	32	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	33	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	34	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	35	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	36	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	37	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)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	39	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	48	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	49	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	50	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	51	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	52	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	53	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	54	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	55	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	56	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	73	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)

Village	Survey No.	Soil Reaction	Salinity (EC)	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Gudalagunta	77	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	78	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	79	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	80	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	81	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	82	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	83	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	84	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	85	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	86	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	87	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	88	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	89	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	90	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	91	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	92	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	93	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	94	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	95	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	96	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	97	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	98	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	99	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	100	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)

Village	Survey No.	Soil Reaction	Salinity (EC)	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Gudalagunta	101	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	102	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	103	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	104	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	105	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	106	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	107	Slightly alkaline (pH 7.3 – 7.8)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	108	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	109	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	110	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	111	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Gudalagunta	112	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Gudalagunta	113	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Gudalagunta	114	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Madhwara	23	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Madhwara	24	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Madhwara	25	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Madhwara	26	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)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Madhwara	27	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)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Madhwara	28	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)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Madhwara	29	Moderately alkaline (pH 7.8 – 8.4)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Madhwara	30	Moderately alkaline (pH 7.8 – 8.4)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Madhwara	31	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)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Madhwara	32	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)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Madhwara	33	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)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)

Village	Survey No.	Soil Reaction	Salinity (EC)	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Madhwara	34	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Madhwara	35	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Madhwara	36	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Madhwara	550	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Madhwara	551	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Madhwara	552	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Madhwara	553	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Madhwara	568/1	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Madhwara	569	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Madhwara	570	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Madhwara	571	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Madhwara	572	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Madhwara	573	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Madhwara	574	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Madhwara	575	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Madhwara	576	Moderately alkaline (pH 7.8 – 8.4)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Madhwara	577	Strongly alkaline (pH 8.4 – 9.0)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Madhwara	578	Strongly alkaline (pH 8.4 – 9.0)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Madhwara	579	Strongly alkaline (pH 8.4 – 9.0)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Madhwara	580	Strongly alkaline (pH 8.4 – 9.0)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Madhwara	581	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Madhwara	582	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Madhwara	583	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Madhwara	584	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)

Village	Survey No.	Soil Reaction	Salinity (EC)	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Madhwara	585	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Madhwara	586	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Madhwara	587	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Madhwara	588	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Madhwara	589	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Madhwara	590	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Madhwara	591	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Madhwara	592	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Madhwara	593	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Madhwara	594	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Madhwara	595	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Madhwara	596	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Madhwara	606	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Madhwara	607	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Neelahalli	262	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Neelahalli	263	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Neelahalli	264	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Sambara	19	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Sambara	20	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Sambara	21	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Sambara	22	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Sambara	26	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Sambara	27	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Sambara	332	Slightly alkaline (pH 7.3 – 7.8)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)

Village	Survey No.	Soil Reaction	Salinity (EC)	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Sambara	333	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Sambara	334	Moderately alkaline (pH 7.8 – 8.4)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Sambara	335	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Sambara	336	Moderately alkaline (pH 7.8 – 8.4)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Sambara	336	Moderately alkaline (pH 7.8 – 8.4)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Sambara	337	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Sambara	338	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Sambara	339	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Sambara	344/1	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Sambara	346/2	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)

Appendix III

Guralgunta Microwatershed

Soil Suitability Information

Village	Sy. No	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	Bengalgram	Sunflower	Redgram	Amla	Jackfruit	Custard apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Dstick	Mulberry
Gudalaguntа	1	N1r	S2r	S3r	S2r	S3r	S2r	N1r	S3r	S2r	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S3r	S3r
Gudalaguntа	2	N1r	S2r	S3r	S2r	S3r	S2r	N1r	S3r	S2r	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S3r	S3r
Gudalaguntа	3	N1r	S2t	S3r	S2r	S3r	S2r	N1r	S3r	S2r	S3r	S3r	S2r	S3r	S2r	N1rt	S3r	S3r	S3t	S2r	S2r	S2r	S2r	S3r	S2r	S3r	S3r
Gudalaguntа	4	N1r	S2t	S3r	S2r	S3r	S2r	N1r	S3r	S2r	S3r	S3r	S2r	S3r	S2r	N1rt	S3r	S3r	S3t	S2r	S2r	S2r	S2r	S3r	S2r	S3r	S3r
Gudalaguntа	5	S3rz	S3tz	S3tz	S2zw	S3tz	S2rz	S3rz	S2rz	S2zw	S2rz	S2rz	S2zw	S3tz	S2zw	N1tw	S3rz	S2rz	S3tz	S2tz	S3tz	S2tz	S2tz	S2rz	S2zw	S2rz	S3tz
Gudalaguntа	6	S3rz	S3tz	S3tz	S2zw	S3tz	S2rz	S3rz	S2rz	S2zw	S2rz	S2rz	S2zw	S3tz	S2zw	N1tw	S3rz	S2rz	S3tz	S2tz	S3tz	S2tz	S2tz	S2rz	S2zw	S2rz	S3tz
Gudalaguntа	7	S3rz	S3tz	S3tz	S2zw	S3tz	S2rz	S3rz	S2rz	S2zw	S2rz	S2rz	S2zw	S3tz	S2zw	N1tw	S3rz	S2rz	S3tz	S2tz	S3tz	S2tz	S2tz	S2rz	S2zw	S2rz	S3tz
Gudalaguntа	8	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	N1rt	N1rt
Gudalaguntа	9	Others	Others	Others	Others	Others	Others	Others	Others	Others	Other	Others	Others	Others	Others	Others	Others	Others	Others	Other	Others	Others	Others	Others	Others	Others	Others
Gudalaguntа	10	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	N1rt	N1rt
Gudalaguntа	11	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	N1rt	N1rt
Gudalaguntа	12	hers	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Gudalaguntа	13	hers	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Gudalaguntа	14	hers	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Gudalaguntа	15	hers	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Gudalaguntа	16	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	N1rt	N1rt
Gudalaguntа	17	N1r	S2t	S3r	S2r	S3r	S2r	N1r	S3r	S2r	S3r	S3r	S2r	S3r	S2r	N1rt	S3r	S3r	S3t	S2r	S2r	S2r	S2r	S3r	S2r	S3r	S3r
Gudalaguntа	18	N1r	S2t	S3r	S2r	S3r	S2r	N1r	S3r	S2r	S3r	S3r	S2r	S3r	S2r	N1rt	S3r	S3r	S3t	S2r	S2r	S2r	S2r	S3r	S2r	S3r	S3r
Gudalaguntа	19	N1r	S2t	S3r	S2r	S3r	S2r	N1r	S3r	S2r	S3r	S3r	S2r	S3r	S2r	N1rt	S3r	S3r	S3t	S2r	S2r	S2r	S2r	S3r	S2r	S3r	S3r
Gudalaguntа	20	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	N1rt	N1rt
Gudalaguntа	21	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	N1rt	N1rt
Gudalaguntа	22	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw

Village	Sy. No	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	Bengalgram	Sunflower	Redgram	Amla	Jackfruit	Custard apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Dstick	Mulberry
Gudalaguntа	23	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Gudalaguntа	24	N1r	S2t	S3r	S2r	S3r	S2r	N1r	S3r	S2r	S3r	S3r	S2r	S3r	S2r	N1rt	S3r	S3r	S3t	S2r	S2r	S2r	S2r	S3r	S2r	S3r	S3r
Gudalaguntа	25	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Gudalaguntа	26	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Gudalaguntа	27	N1r	S2t	S3r	S2r	S3r	S2r	N1r	S3r	S2r	S3r	S3r	S2r	S3r	S2r	N1rt	S3r	S3r	S3t	S2r	S2r	S2r	S2r	S3r	S2r	S3r	S3r
Gudalaguntа	28	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Gudalaguntа	29	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Gudalaguntа	30	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Gudalaguntа	31	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Gudalaguntа	32	N1r	S2t	S3r	S2r	S3r	S2r	N1r	S3r	S2r	S3r	S3r	S2r	S3r	S2r	N1rt	S3r	S3r	S3t	S2r	S2r	S2r	S2r	S3r	S2r	S3r	S3r
Gudalaguntа	33	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Gudalaguntа	34	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Gudalaguntа	35	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Gudalaguntа	36	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Gudalaguntа	37	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Gudalaguntа	39	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Gudalaguntа	48	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Gudalaguntа	49	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Gudalaguntа	50	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Gudalaguntа	51	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Gudalaguntа	52	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Gudalaguntа	53	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Gudalaguntа	54	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw

Village	Sy. No	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	Bengalgram	Sunflower	Redgram	Amla	Jackfruit	Custard apple	Cashew	Jamun	Musambi	Grou Ndnut	Chily	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Dstick	Mulberry
Gudalaguntа	55	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Gudalaguntа	56	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Gudalaguntа	73	N1r	S2rg	S3r	S2rg	S3r	S2rg	N1r	S3r	S2rg	S3rg	S3rg	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2rg	S2rg	S2rg	S2rg	S3r	S2r	S3r	S3r
Gudalaguntа	77	N1r	S2rg	S3r	S2rg	S3r	S2rg	N1r	S3r	S2rg	S3rg	S3rg	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2rg	S2rg	S2rg	S2rg	S3r	S2r	S3r	S3r
Gudalaguntа	78	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Gudalaguntа	79	N1r	S2t	S3r	S2r	S3r	S2r	N1r	S3r	S2r	S3r	S3r	S2r	S3r	S2r	N1rt	S3r	S3r	S3t	S2r	S2r	S2r	S2r	S3r	S2r	S3r	S3r
Gudalaguntа	80	N1r	S2r	S3r	S2r	S3r	S2r	N1r	S3r	S2r	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S3r	S3r
Gudalaguntа	81	N1r	S2r	S3r	S2r	S3r	S2r	N1r	S3r	S2r	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S3r	S3r
Gudalaguntа	82	N1r	S2r	S3r	S2r	S3r	S2r	N1r	S3r	S2r	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S3r	S3r
Gudalaguntа	83	N1r	S2r	S3r	S2r	S3r	S2r	N1r	S3r	S2r	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S3r	S3r
Gudalaguntа	84	N1r	S2r	S3r	S2r	S3r	S2r	N1r	S3r	S2r	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S3r	S3r
Gudalaguntа	85	N1r	S2r	S3r	S2r	S3r	S2r	N1r	S3r	S2r	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S3r	S3r
Gudalaguntа	86	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Gudalaguntа	87	S3tz	S3tw	S3t	S2zw	S3t	S2z	S2t	S2z	S2z	S2zw	S2tw	S2t	S3t	S2z	N1t	S2t	S2z	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tz	S2tw	S3tw
Gudalaguntа	88	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Gudalaguntа	89	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Gudalaguntа	90	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Gudalaguntа	91	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	N1rt	N1rt
Gudalaguntа	92	N1r	S2t	S3r	S2r	S3r	S2r	N1r	S3r	S2r	S3r	S3r	S2r	S3r	S2r	N1rt	S3r	S3r	S3t	S2r	S2r	S2r	S2r	S3r	S2r	S3r	S3r
Gudalaguntа	93	N1r	S2t	S3r	S2r	S3r	S2r	N1r	S3r	S2r	S3r	S3r	S2r	S3r	S2r	N1rt	S3r	S3r	S3t	S2r	S2r	S2r	S2r	S3r	S2r	S3r	S3r
Gudalaguntа	94	N1r	S2t	S3r	S2r	S3r	S2r	N1r	S3r	S2r	S3r	S3r	S2r	S3r	S2r	N1rt	S3r	S3r	S3t	S2r	S2r	S2r	S2r	S3r	S2r	S3r	S3r
Gudalaguntа	95	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Gudalaguntа	96	N1r	S2rg	S3r	S2rg	S3r	S2rg	N1r	S3r	S2rg	S3rg	S3rg	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2rg	S2rg	S2rg	S2rg	S3r	S2r	S3r	S3r

Village	Sy. No	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	Bengalgram	Sunflower	Redgram	Amla	Jackfruit	Custard apple	Cashew	Jamun	Musambi	Groundnut	Chily	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Dstick	Mulberry
Gudalaguntа	97	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Gudalaguntа	98	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Gudalaguntа	99	N1r	S2t	S3r	S2r	S3r	S2r	N1r	S3r	S2r	S3r	S3r	S2r	S3r	S2r	N1rt	S3r	S3r	S3t	S2r	S2r	S2r	S2r	S3r	S2r	S3r	S3r
Gudalaguntа	100	N1r	S2t	S3r	S2r	S3r	S2r	N1r	S3r	S2r	S3r	S3r	S2r	S3r	S2r	N1rt	S3r	S3r	S3t	S2r	S2r	S2r	S2r	S3r	S2r	S3r	S3r
Gudalaguntа	101	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	N1rt	N1rt
Gudalaguntа	102	N1r	S2r	S3r	S2r	S3r	S2r	N1r	S3r	S2r	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S3r	S3r
Gudalaguntа	103	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	N1rt	N1rt
Gudalaguntа	104	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	N1rt	N1rt
Gudalaguntа	105	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	N1rt	N1rt
Gudalaguntа	106	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	N1rt	N1rt
Gudalaguntа	107	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	N1rt	N1rt
Gudalaguntа	108	N1r	S2r	S3r	S2r	S3r	S2r	N1r	S3r	S2r	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S3r	S3r
Gudalaguntа	109	N1r	S2r	S3r	S2r	S3r	S2r	N1r	S3r	S2r	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S3r	S3r
Gudalaguntа	110	N1r	S2r	S3r	S2r	S3r	S2r	N1r	S3r	S2r	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S3r	S3r
Gudalaguntа	111	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	N1rt	N1rt
Gudalaguntа	112	Others	Others	Others	Others	Others	Others	Others	Others	Others	hers	thers	Others	Others	Others	Others	Others	Others	Others	hers	Others	Others	Others	Others	Others	Others	Others
Gudalaguntа	113	Others	Others	Others	Others	Others	Others	Others	Others	Others	hers	thers	Others	Others	Others	Others	Others	Others	Others	hers	Others	Others	Others	Others	Others	Others	Others
Gudalaguntа	114	Others	Others	Others	Others	Others	Others	Others	Others	Others	hers	thers	Others	Others	Others	Others	Others	Others	Others	hers	Others	Others	Others	Others	Others	Others	Others
Madhwara	23	N1r	S3t	S3rt	S3t	S3rt	N1t	N1r	S3rt	N1t	S3t	S3t	S3t	S3rt	S3t	S3rt	S3rt	S3rt	S3t	S3t	S3t	S3t	S3t	S3rt	S3t	S3t	S3t
Madhwara	24	N1r	S3t	S3rt	S3t	S3rt	N1t	N1r	S3rt	N1t	S3t	S3t	S3t	S3rt	S3t	S3rt	S3rt	S3rt	S3t	S3t	S3t	S3t	S3t	S3rt	S3t	S3t	S3t
Madhwara	25	N1r	S3t	S3rt	S3t	S3rt	N1t	N1r	S3rt	N1t	S3t	S3t	S3t	S3rt	S3t	S3rt	S3rt	S3rt	S3t	S3t	S3t	S3t	S3t	S3rt	S3t	S3t	S3t
Madhwara	26	N1r	S3t	S3rt	S3t	S3rt	N1t	N1r	S3rt	N1t	S3t	S3t	S3t	S3rt	S3t	S3rt	S3rt	S3rt	S3t	S3t	S3t	S3t	S3t	S3rt	S3t	S3t	S3t
Madhwara	27	S3tz	S3tw	S3t	S2zw	S3t	S2z	S2t	S2z	S2z	S2zw	S2tw	S2t	S3t	S2z	N1t	S2t	S2z	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tz	S2tw	S3tw

Village	Sy. No	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	Bengalgram	Sunflower	Redgram	Amla	Jackfruit	Custard apple	Cashew	Jamun	Musambi	Grou Ndnut	Chily	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Dstick	Mulberry
Madhwara	28	S3tz	S3tw	S3t	S2zw	S3t	S2z	S2t	S2z	S2z	S2zw	S2tw	S2t	S3t	S2z	N1t	S2t	S2z	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tz	S2tw	S3tw
Madhwara	29	S3tz	S3tw	S3t	S2zw	S3t	S2z	S2t	S2z	S2z	S2zw	S2tw	S2t	S3t	S2z	N1t	S2t	S2z	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tz	S2tw	S3tw
Madhwara	30	S3tz	S3tw	S3t	S2zw	S3t	S2z	S2t	S2z	S2z	S2zw	S2tw	S2t	S3t	S2z	N1t	S2t	S2z	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tz	S2tw	S3tw
Madhwara	31	N1r	S3t	S3rt	S3t	S3rt	N1t	N1r	S3rt	N1t	S3t	S3t	S3t	S3rt	S3t	S3rt	S3rt	S3rt	S3t	S3t	S3t	S3t	S3t	S3rt	S3t	S3t	S3t
Madhwara	32	N1r	S3t	S3rt	S3t	S3rt	N1t	N1r	S3rt	N1t	S3t	S3t	S3t	S3rt	S3t	S3rt	S3rt	S3rt	S3t	S3t	S3t	S3t	S3t	S3rt	S3t	S3t	S3t
Madhwara	33	N1r	S3t	S3rt	S3t	S3rt	N1t	N1r	S3rt	N1t	S3t	S3t	S3t	S3rt	S3t	S3rt	S3rt	S3rt	S3t	S3t	S3t	S3t	S3t	S3rt	S3t	S3t	S3t
Madhwara	34	N1r	S3t	S3rt	S3t	S3rt	N1t	N1r	S3rt	N1t	S3t	S3t	S3t	S3rt	S3t	S3rt	S3rt	S3rt	S3t	S3t	S3t	S3t	S3t	S3rt	S3t	S3t	S3t
Madhwara	35	N1r	S3t	S3rt	S3t	S3rt	N1t	N1r	S3rt	N1t	S3t	S3t	S3t	S3rt	S3t	S3rt	S3rt	S3rt	S3t	S3t	S3t	S3t	S3t	S3rt	S3t	S3t	S3t
Madhwara	36	N1r	S3t	S3rt	S3t	S3rt	N1t	N1r	S3rt	N1t	S3t	S3t	S3t	S3rt	S3t	S3rt	S3rt	S3rt	S3t	S3t	S3t	S3t	S3t	S3rt	S3t	S3t	S3t
Madhwara	550	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Madhwara	551	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Madhwara	552	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Madhwara	553	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Madhwara	568/1	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Madhwara	569	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Madhwara	570	S3t	S3tw	S3t	S2wz	S3t	S2wz	S2t	S2z	S2wz	S2rw	S2tw	S2z	S3t	S2z	N1tz	S2t	S2z	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Madhwara	571	S3t	S3tw	S3t	S2wz	S3t	S2wz	S2t	S2z	S2wz	S2rw	S2tw	S2z	S3t	S2z	N1tz	S2t	S2z	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Madhwara	572	S3t	S3tw	S3t	S2wz	S3t	S2wz	S2t	S2z	S2wz	S2rw	S2tw	S2z	S3t	S2z	N1tz	S2t	S2z	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Madhwara	573	S3t	S3tw	S3t	S2wz	S3t	S2wz	S2t	S2z	S2wz	S2rw	S2tw	S2z	S3t	S2z	N1tz	S2t	S2z	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Madhwara	574	S3t	S3tw	S3t	S2wz	S3t	S2wz	S2t	S2z	S2wz	S2rw	S2tw	S2z	S3t	S2z	N1tz	S2t	S2z	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Madhwara	575	S3t	S3tw	S3t	S2wz	S3t	S2wz	S2t	S2z	S2wz	S2rw	S2tw	S2z	S3t	S2z	N1tz	S2t	S2z	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Madhwara	576	S3t	S3tw	S3t	S2wz	S3t	S2wz	S2t	S2z	S2wz	S2rw	S2tw	S2z	S3t	S2z	N1tz	S2t	S2z	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Madhwara	577	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw

Village	Sy. No	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	Bengalgram	Sunflower	Redgram	Amla	Jackfruit	Custard apple	Cashew	Jamun	Musambi	Grou Ndnut	Chily	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Dstick	Mulberry
Madhwara	578	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Madhwara	579	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Madhwara	580	N1r	S3t	S3rt	S3t	S3rt	N1t	N1r	S3rt	N1t	S3t	S3t	S3t	S3rt	S3t	S3rt	S3rt	S3rt	S3t	S3t	S3t	S3t	S3t	S3rt	S3t	S3t	S3t
Madhwara	581	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Madhwara	582	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Madhwara	583	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Madhwara	584	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Madhwara	585	S3tz	S3tw	S3t	S2zw	S3t	S2z	S2t	S2z	S2z	S2zw	S2tw	S2t	S3t	S2z	N1t	S2t	S2z	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tz	S2tw	S3tw
Madhwara	586	S3tz	S3tw	S3t	S2zw	S3t	S2z	S2t	S2z	S2z	S2zw	S2tw	S2t	S3t	S2z	N1t	S2t	S2z	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tz	S2tw	S3tw
Madhwara	587	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Madhwara	588	N1r	S3t	S3rt	S3t	S3rt	N1t	N1r	S3rt	N1t	S3t	S3t	S3t	S3rt	S3t	S3rt	S3rt	S3rt	S3t	S3t	S3t	S3t	S3t	S3rt	S3t	S3t	S3t
Madhwara	589	N1r	S3t	S3rt	S3t	S3rt	N1t	N1r	S3rt	N1t	S3t	S3t	S3t	S3rt	S3t	S3rt	S3rt	S3rt	S3t	S3t	S3t	S3t	S3t	S3rt	S3t	S3t	S3t
Madhwara	590	N1r	S3t	S3rt	S3t	S3rt	N1t	N1r	S3rt	N1t	S3t	S3t	S3t	S3rt	S3t	S3rt	S3rt	S3rt	S3t	S3t	S3t	S3t	S3t	S3rt	S3t	S3t	S3t
Madhwara	591	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Madhwara	592	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Madhwara	593	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Madhwara	594	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Madhwara	595	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Madhwara	596	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Madhwara	606	N1r	S3t	S3rt	S3t	S3rt	N1t	N1r	S3rt	N1t	S3t	S3t	S3t	S3rt	S3t	S3rt	S3rt	S3rt	S3t	S3t	S3t	S3t	S3t	S3rt	S3t	S3t	S3t
Madhwara	607	N1r	S3t	S3rt	S3t	S3rt	N1t	N1r	S3rt	N1t	S3t	S3t	S3t	S3rt	S3t	S3rt	S3rt	S3rt	S3t	S3t	S3t	S3t	S3t	S3rt	S3t	S3t	S3t
Neelahalli	262	S3tz	S3tw	S3t	S2zw	S3t	S2z	S2t	S2z	S2z	S2zw	S2tw	S2t	S3t	S2z	N1t	S2t	S2z	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tz	S2tw	S3tw
Neelahalli	263	S3tz	S3tw	S3t	S2zw	S3t	S2z	S2t	S2z	S2z	S2zw	S2tw	S2t	S3t	S2z	N1t	S2t	S2z	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tz	S2tw	S3tw

Village	Sy. No	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	Bengalgram	Sunflower	Redgram	Amla	Jackfruit	Custard apple	Cashew	Jamun	Musambi	Grou Ndnut	Chily	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Dstick	Mulberry
Neelahalli	264	S3tz	S3tw	S3t	S2zw	S3t	S2z	S2t	S2z	S2z	S2zw	S2tw	S2t	S3t	S2z	N1t	S2t	S2z	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tz	S2tw	S3tw
Sambara	19	S3tz	S3tz	S2tz	S3tz	S2tz	N1tz	S2rt	S2z	N1tz	S3tz	S2tz	S3tz	S3tz	S3tz	S3tz	S2rz	S2tz	S2tz	S2tz	S2z	S2z	S2z	S2tz	S2z	S2tz	S3tz
Sambara	20	S3t	S3tw	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Sambara	21	S3tz	S3tz	S2tz	S3tz	S2tz	N1tz	S2rt	S2z	N1tz	S3tz	S2tz	S3tz	S3tz	S3tz	S3tz	S2rz	S2tz	S2tz	S2tz	S2z	S2z	S2z	S2tz	S2z	S2tz	S3tz
Sambara	22	S3tz	S3tz	S2tz	S3tz	S2tz	N1tz	S2rt	S2z	N1tz	S3tz	S2tz	S3tz	S3tz	S3tz	S3tz	S2rz	S2tz	S2tz	S2tz	S2z	S2z	S2z	S2tz	S2z	S2tz	S3tz
Sambara	26	S3tz	S3tz	S2tz	S3tz	S2tz	N1tz	S2rt	S2z	N1tz	S3tz	S2tz	S3tz	S3tz	S3tz	S3tz	S2rz	S2tz	S2tz	S2tz	S2z	S2z	S2z	S2tz	S2z	S2tz	S3tz
Sambara	27	S3tz	S3tz	S2tz	S3tz	S2tz	N1tz	S2rt	S2z	N1tz	S3tz	S2tz	S3tz	S3tz	S3tz	S3tz	S2rz	S2tz	S2tz	S2tz	S2z	S2z	S2z	S2tz	S2z	S2tz	S3tz
Sambara	332	S3rz	S3tz	S3tz	S2zw	S3tz	S2rz	S3rz	S2rz	S2zw	S2rz	S2rz	S2zw	S3tz	S2zw	N1tw	S3rz	S2rz	S3tz	S2tz	S3tz	S2tz	S2tz	S2rz	S2zw	S2rz	S3tz
Sambara	333	S3rz	S3tz	S3tz	S2zw	S3tz	S2rz	S3rz	S2rz	S2zw	S2rz	S2rz	S2zw	S3tz	S2zw	N1tw	S3rz	S2rz	S3tz	S2tz	S3tz	S2tz	S2tz	S2rz	S2zw	S2rz	S3tz
Sambara	334	N1r	S2t	S3r	S2r	S3r	S2r	N1r	S3r	S2r	S3r	S3r	S2r	S3r	S2r	N1rt	S3r	S3r	S3t	S2r	S2r	S2r	S2r	S3r	S2r	S3r	S3r
Sambara	335	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Sambara	336	N1r	S2t	S3r	S2r	S3r	S2r	N1r	S3r	S2r	S3r	S3r	S2r	S3r	S2r	N1rt	S3r	S3r	S3t	S2r	S2r	S2r	S2r	S3r	S2r	S3r	S3r
Sambara	336	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Sambara	337	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Sambara	338	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Sambara	339	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Sambara	344/1	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Sambara	346/2	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw

PART-B

SOCIO-ECONOMIC STATUS OF FARM HOUSEHOLDS

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Chapter 1

EXECUTIVE SUMMARY

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

Methodology: *Guralgunta micro-watershed (Yadgir taluk and district) is located in between $16^0$36' – $16^0$38' North latitudes and 77^0 18' – $77^0$20' East longitudes, covering an area of about 579.68 ha, bounded by Gudalagunta, Madhawara, Sambara and Neelahalli villages with length of growing period (LGP) 120-150 days. We used soil resource map as basis for sampling farm households to test the hypothesis that soil quality influence crop selection, and conservation investment of farm households. The level of technology adoption and productivity gaps and livelihood patterns were analyses. The cost of soil degradation and ecosystem services were quantified.*

Results: *The socio-economic outputs for the Guralgunta micro-watershed in Yadgiri taluk and district are presented here.*

Social Indicators;

- *Male and female ratio is 56.2 to 43.8 per cent to the total sample population.*
- *Younger age group 18 to 50 of population is around 60.56 per cent to the total population.*
- *Literacy population is around 51.9 per cent.*
- *Social groups belong to other backward caste (OBC) are around 51.1 per cent.*
- *Fire wood is the source of energy for a cooking among all sample households.*
- *About 23.4 per cent of households have a yashaswini health card.*
- *About 17.02 per cent farm households having MGNREGA card for rural employment.*
- *Dependence on ration cards for food grains through public distribution system is around 95.74 per cent.*
- *Swach bharath program providing closed toilet facilities around 31.91 per cent of sample households.*
- *Women participation in decisions making are around 59.6 per cent of households were found.*

Economic Indicators;

- *The average land holding is 2.11 ha indicates that majority of farm households are belong to marginal and small farmers. The account for dry land of 99.10 ha among the total cultivated land among the sample households.*

- *Agriculture is the main occupation is only 26.7 per cent and agriculture is the main and non agriculture labour is subsidiary occupation for 36.4 per cent of sample households.*
- *The average value of domestic assets is around Rs.68834 per household. Mobile and television are popular media mass communication.*
- *The average value of farm assets is around Rs.110163 per household, about 63.8 per cent of sample farmers are owing plough.*
- *The average value of livestock is around Rs.22533 per household; about 83.56 per cent of household are having livestock.*
- *The average per capita food consumption is around 829.2 grams (1930.5 kilo calories) against national institute of nutrition recommendation at 827 gram. Around 51 per cent of sample households are consuming more than the NIN recommendation.*
- *The annual average income is around Rs. 28666 per household. About 100 per cent of farm households are below poverty line.*
- *The per capita monthly average expenditure is around Rs.2337.*

Environmental Indicators-Ecosystem Services;

- *The value of ecosystem service helps to support investment to decision on soil and water conservation and in promoting sustainable land use.*
- *The average value of ecosystem service for food grain production is around Rs. Rs.7421/ ha/year. Per hectare food grain production services is maximum in castor (Rs.27044) followed by groundnut (Rs.12645), paddy (Rs.8306), cotton (Rs. 6273), red gram (Rs. 5098), sorghum (Rs. 657), maize (Rs. 158) and greengram is a negative returns.*
- *The average value of ecosystem service for fodder production is around Rs. 2076/ ha/year. Per hectare fodder production services is maximum in maize (Rs. 4355) followed by sorghum (Rs. 2470), paddy (Rs.1067) and groundnut (Rs. 412).*
- *The data on water requirement for producing one quintal of grain is considered for estimating the total value of water required for crop production. The value of per hectare water used and value of water was maximum in castor (Rs.95000) followed by green gram (Rs.76760), redgram (Rs. 50465), cotton (Rs. 46165), paddy (Rs. 40001), groundnut (Rs. 35830), sorghum (Rs. 33879) and maize (Rs. 26734).*

Economic Land Evaluation;

- *The major cropping pattern is redgram (55.8 %) followed by cotton (19.2 %), paddy (6.9 %), groundnut (4.2 %), maize (3.2 %), bengalgram (2.8%) and greengram (0.9 %).*

- *The total cost of cultivation in study area for cotton ranges between Rs.54130/ha in small farmers (with BCR of 1.15) and Rs.42145/ha in large farmers (with BCR of 1.09).*
- *In maize the cost of cultivation range between Rs.75798/ha in small farmers (with BCR of 1.03) and Rs.40397/ha in marginal farmers (with BCR of 1.07).*
- *In red gram the cost of cultivation range between Rs.46222/ha in marginal farmers (with BCR of 1.12) and Rs.12089/ha in large farmers (with BCR of 1.63).*
- *In castor the cost of cultivation is Rs.52756/ha in small farmers (with BCR of 1.51).*
- *In greengram the cost of cultivation is Rs.45273/ha in small farmers (with BCR of 1.09).*
- *In groundnut the cost of cultivation range between is Rs.51484/ha in small farmers (with BCR of 1.61) and Rs.31198/ha in semi medium farmers (with BCR of 1.12).*
- *In paddy the cost of cultivation range between Rs.52937/ha in large farmers (with BCR of 1.21) and Rs.24122/ha in medium farmers (with BCR of 1.16).*
- *In sorghum the cost of cultivation is Rs.21573/ha in medium farmers (with BCR of 1.14).*
- *The land management practices reported by the farmers are crop rotation, tillage practices, fertilizer application and use of farm yard manure (FYM). Due to higher wages farmer are following labour saving strategies is not prating soil and water conservation measures. Less ownership of livestock limiting application of FYM.*
- *It was observed soil quality influences on the type and intensity of land use. More fertilizer applications in deeper soils to maximize returns.*

Suggestions;

- *Involving farmers is watershed planning helps in strengthing institutional participation.*
- *The per capita food consumption and monthly income is very low. Diversifying income generation activities from crop and livestock production in order to reduce risk related to drought and market prices.*
- *Majority of farmers reported that they are not getting timely support/extension services from the concerned development departments.*
- *By strengthing agricultural extension for providing timely advice improved technology there is scope to increase in net income of farm households.*
- *By adopting recommended package of practices by following the soil test fertiliser recommendation, there is scope to increase yield in cotton (22.28 to 42.2 %), groundnut (27.7 % to 54.6 %), maize (67.3 to 78.42 %), paddy (36.7 to 82.3 %), redgram (5.32 % to 63.1 %) and sorghum (60.4 %).*

Chapter 2

INTRODUCTION

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

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

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

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

Objectives of the study

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

Chapter 3

METHODOLOGY

Study area

Guralgunta micro-watershed is located in North-eastern Dry Zone of Karnataka (Figure 1): The total geographic area of this zone is about 1.76 M ha covering 8 taluks of Gulbarga district and 3 taluks of Raichur. Net cultivated area in the zone is about 1.31 M ha of which about 0.09 M ha are irrigated. The mean elevation of the zone is 300-450 m MSL. The main soil type is deep to very deep soils with small pockets of shallow to medium black soils. The zone is cropped predominantly during rabi due to insufficient rainfall (465-785 mm). The principal crops of the zone are jowar, bajra, oilseeds, pulses, cotton and sugarcane. It's represented Agro Ecological Sub Region (AESR) 6.2 with LGP 120-150 days.

Guralgunta micro-watershed (Yadgir taluk and district) is located in between $16^0$36' – $16^0$38' North latitudes and 77^0 18' – $77^0$20' East longitudes, covering an area of about 579.68 ha, bounded by Gudalagunta, Madhawara, Sambara and Neelahalli villages.

Sampling Procedure:

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

Sources of data and analysis:

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

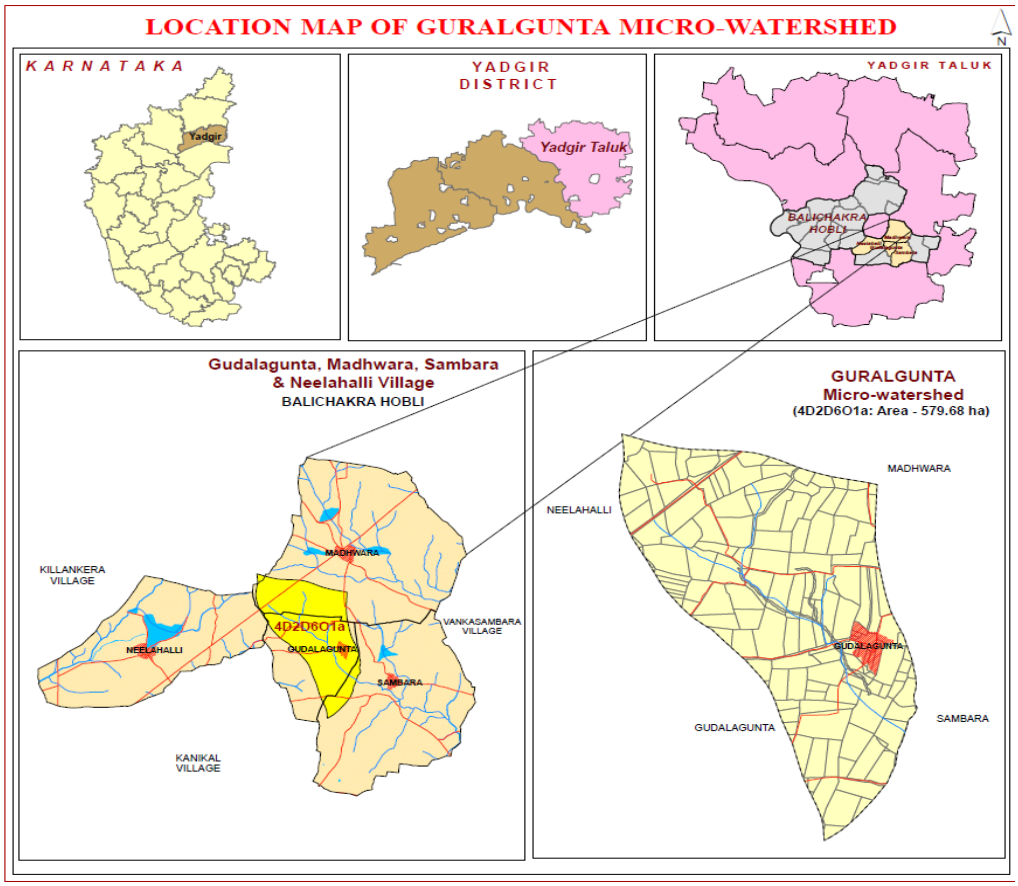
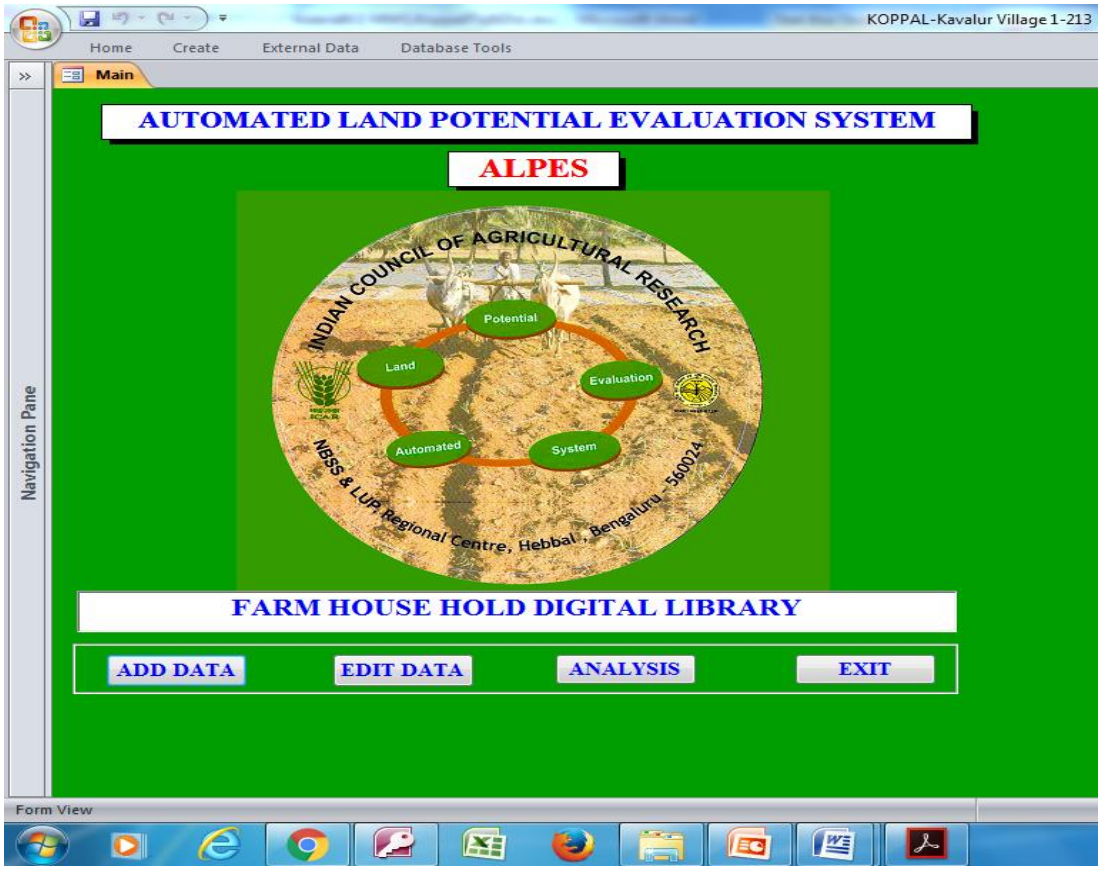


Figure 1: Location of study area

Steps followed in socio-economic assessment

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



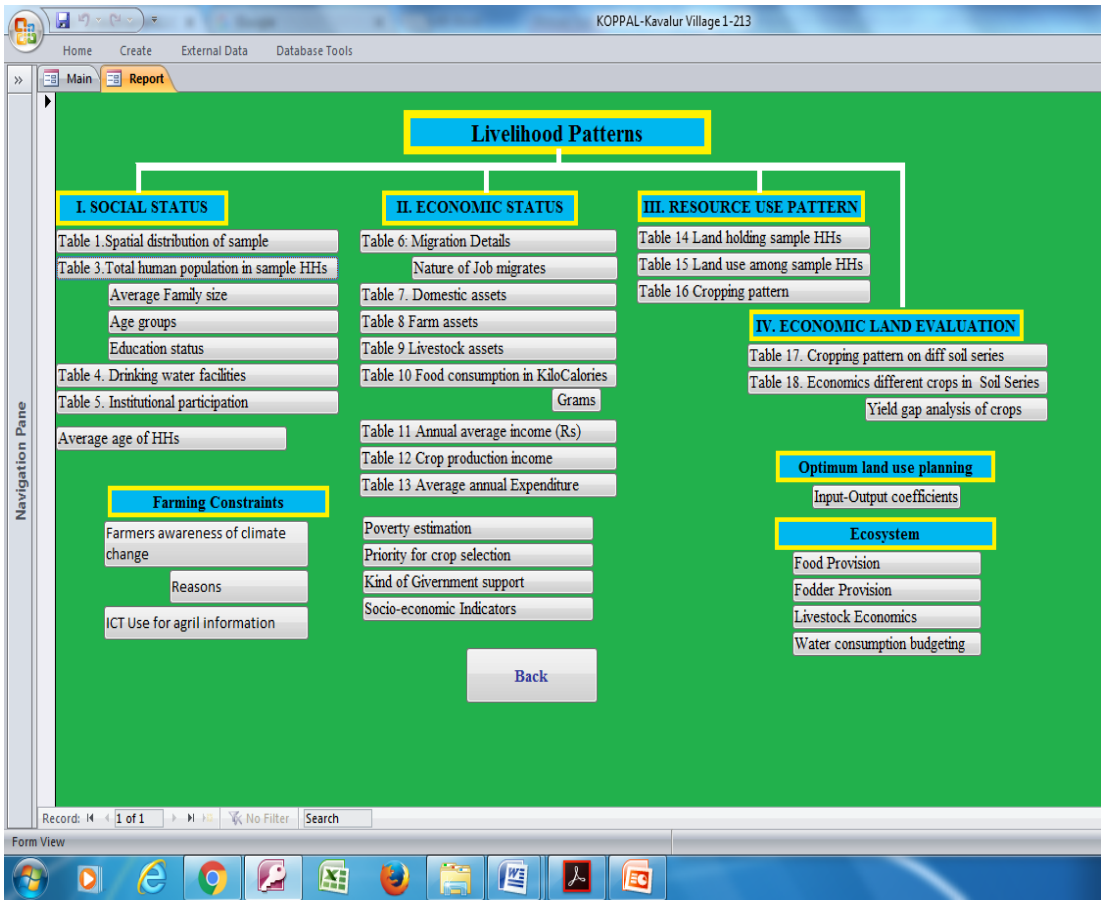


Figure 2: ALPES FRAMEWORK

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

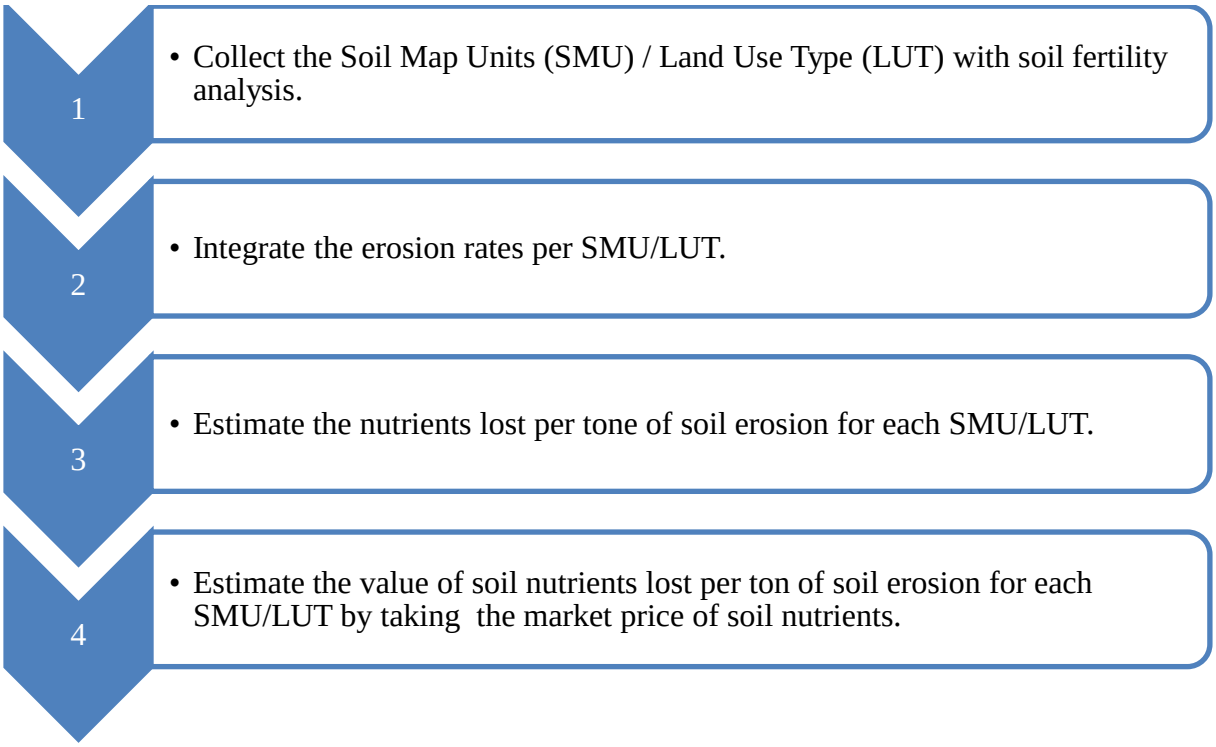
Operational Cost = cost of seeds, fertilizers, pesticides. Cost of human and bullock labour, cost of machinery, cost of irrigation water + interest on working capital.
Gross returns = Yield (Quintals/hectare)*Price (Rs/Quintal)
Net returns = Gross returns-Operational cost.
Benefit Cost Ratio = Net returns/Total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

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

Economic Valuation of Soil ecosystem services:

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

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



Chapter 4

RESULTS AND DISCUSSIONS

The demographic information shows that the household population dynamics encompasses the socioeconomic status of the farmer. For a rural family, the household size should be optimal to earn a comfortable livelihood through farm and non-farm wage earning. The total number of population in watershed area was 258, out of which 56.2 per cent were males and 43.8 per cent females. Average family size of the households is 5.49 among the sample population.

Table 1: Human population among sample households in Guralgunta Microwatershed

Particulars	MF(72)		SF(93)		SMF(69)		MDF(14)		LF (10)		ALL (258)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Male	39	54.2	54	58.1	37	53.6	11	78.6	4	40.0	145	56.2
Female	33	45.8	39	41.9	32	46.4	3	21.4	6	60.0	113	43.8
Total human population	72	100	93	100	69	100	14	100	10	100	258	100
Average family size	5.14		5.81		5.31		4.67		10.0		5.49	

Age is an important factor, which affects the potential employment and mobility status of respondents. The data on age wise distribution of farmers in the sample households indicated that majority of the farmers are coming under the age group of 0 to18 years (32.9 %) followed by 18 to 30 years (27.1 %), 30 to 50 years (24.8 %) and more than 50 years (15.1 %). Hence, in the study area in general, the respondents were of young and middle age, indicating there by that the households had almost settled with whatever livelihood options they were practicing and sample respondents were young by age who could venture into various options of livelihood sources (Table 2).

Table 2: Age groups among the sample population in Guralgunta micro-watershed

Particulars	MF(72)		SF(93)		SMF(69)		MDF(14)		LF (10)		ALL (258)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
0 to 18 years	23	31.9	33	35.5	21	30.4	5	35.7	3	30	85	32.9
18 to 30 years	18	25	23	24.7	22	31.9	2	14.3	5	50	70	27.1
30 to 50 years	20	27.8	23	24.7	14	20.3	5	35.7	2	20	64	24.8
>50 years	11	15.3	14	15.1	12	17.4	2	14.3		0	39	15.1
Grand total	72	100	93	100	69	100	14	100	10	100	258	100
Average age	31		29.1		30.2		31.2		23.8		29.7	

Table 3: Education status among the sample population in Guralgunta micro-watershed

Particulars	MF(72)		SF(93)		SMF(69)		MDF(14)		LF (10)		ALL (258)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Illiterates	35	48.6	56	60.2	39	56.5	8	57.1	6	60	144	55.8
Literates	37	51.4	37	39.8	30	43.5	6	42.9	4	40	114	44.2
Primary School (<5 class)	13	18.1	22	23.7	10	14.5	1	7.14	2	20	48	18.6
Middle School (6- 8 class)	3	4.17	4	4.3	5	7.25	2	14.3	0	0	14	5.43
High School (9- 10 class)	12	16.7	7	7.53	6	8.7	2	14.3	1	10	28	10.9
Senior secondary	4	5.56	3	3.23	5	7.25	1	7.14	0	0	13	5.04
Graduate	5	6.94	1	1.08	4	5.8	0	0	1	10	11	4.26
Grand Total	72	100	93	100	69	100	14	100	10	100	258	100

Data on literacy (Table 3) indicated that 55.8 per cent of respondents were illiterate and 44.2 per cent literate with an highest of primary school education (18.6 %) followed by the high school education (10.9 %), middle school education (5.43 %), senior secondary education (5.04 %), graduates (4.26 %).

The ethnic groups among the sample farm households found to be 51.1 per cent belonging to other backward castes (OBC) followed by 29.8 per cent belonging to general caste and 19.1 per cent belong to scheduled caste (SC), among the sample population (Table 4 and Figure 3).

Table 4: Social groups among sample households in Guralgunta Microwatershed

Particulars	MF(14)		SF(16)		SMF(13)		MDF(3)		LF(1)		ALL (47)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
SC	6	42.9	0	0.0	3	23.1	0	0.0	0	0.0	9	19.1
OBC	7	50.0	12	75.0	4	30.8	0	0.0	1	100	24	51.1
General	1	7.1	4	25.0	6	46.2	3	100	0	0.0	14	29.8
Grand total	14	100	16	100	13	100	3	100	1	100	47	100

Among the entire sample households are using fire wood as source of fuel for cooking. All the sample farmers are having electricity connection. About 23.4 per cent are sample households having health cards. Only 17.02 per cent of having MNREGA job cards for employment generation. About 95.74 per cent of farm households are having ration cards for taking food grains from public distribution system. About 31.91 per cent of farm households are having toilet facilities (Table 5).

Table 5: Basic needs of sample households in Guralgunta Microwatershed

Particulars	MF(14)		SF(16)		SMF(13)		MDF(3)		LF(1)		ALL (47)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Types of fuel use for cooking												
Fire wood	14	100	16	100	13	100	3	100	1	100	47	100
Energy supply for home												
Electricity	14	100	16	100	13	100	3	100	1	100	47	100
Health Card												
Yes	1	7.14	3	18.8	4	30.8	2	66.7	1	100	11	23.4
No	13	92.9	13	81.3	9	69.2	1	33.3	0	0	36	76.6
NREGA												
Yes	0	0	3	18.8	2	15.4	2	66.7	1	100	8	17.02
No	14	100	13	81.3	11	84.6	1	33.3	0	0	39	82.98
Ration Card												
Yes	14	100	15	93.8	12	92.3	3	100	1	100	45	95.7
No	0	0	1	6.25	1	7.69	0	0	0	0	2	4.3
Household with toilet												
Yes	5	35.7	2	12.5	7	53.8	1	33.3	0	0	15	31.91
No	9	64.3	14	87.5	6	46.2	2	66.7	1	100	32	68.09
Drinking Water												
Tube Well	14	100	16	100	13	100	3	100	1	100	47	100

The data collected on the source of drinking water in the study area is presented in Table 5. All the sample respondents are having tank source for water supply for domestic purpose.

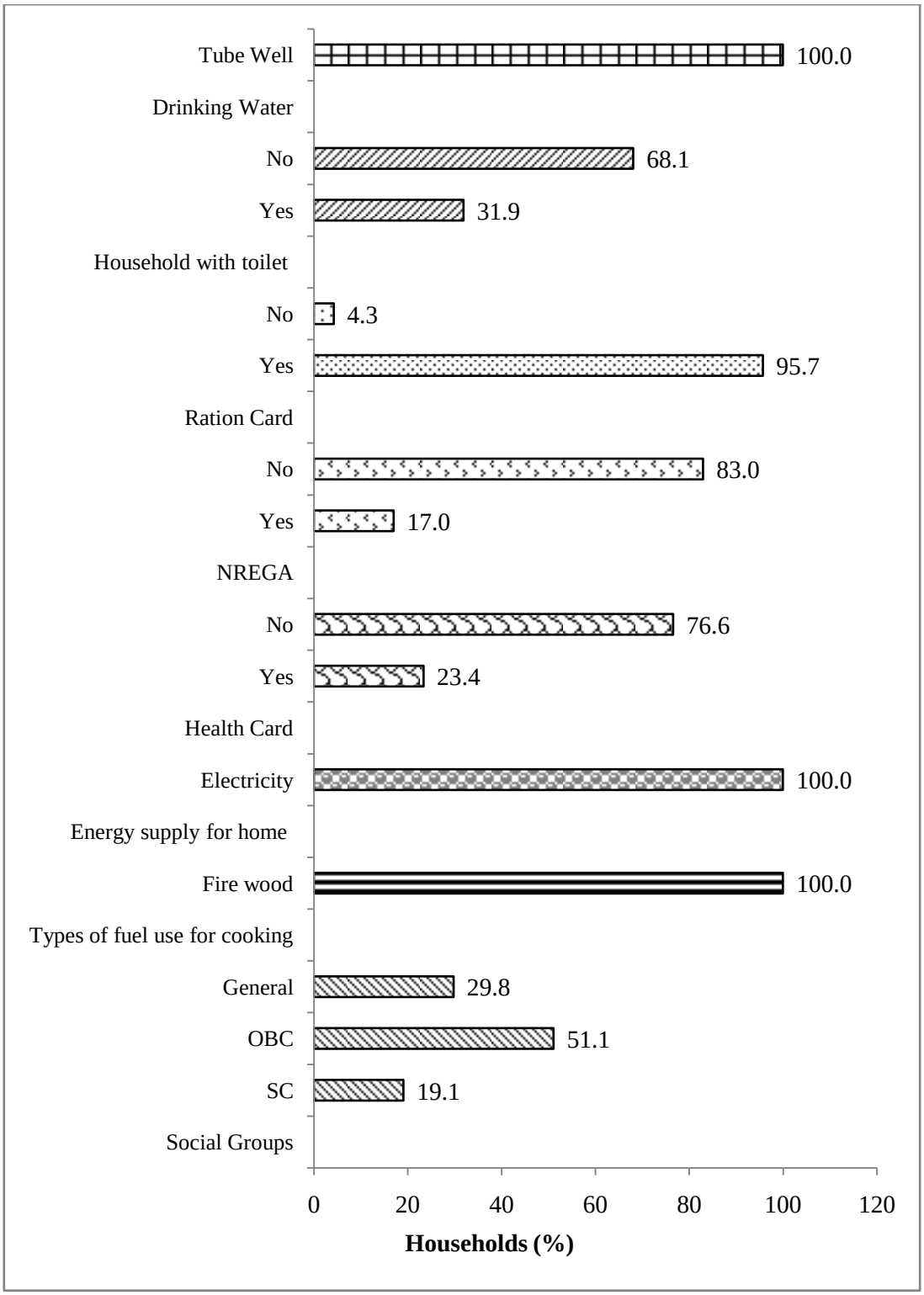


Figure 3: Basic needs of sample households in Guralgunta Microwatershed

The occupational pattern (Table 6) among sample households shows that agriculture is the main occupation is around 26.7 per cent and agriculture is a main and

non agriculture labour is subsidiary occupations around 36.4 per cent of population and sheep/goat rearing is around 0.8 per cent. Agriculture labour is the main occupation is around 0.4 per cent. Private services are main occupation and non agriculture labour is subsidiary occupations around 0.4 per cent of population.

Table 6: Occupational pattern in sample population in Guralgunta Microwatershed

Occupation		MF (72)		SF (93)		SMF (69)		MDF (14)		LF (10)		ALL (258)	
Main	**Subsidiary**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Agriculture	Agriculture	18	25.0	24	25.8	20	29.0	2	14.3	5	50.0	69	26.7
	Agriculture Labour	0	0.0	4	4.3	0	0.0	1	7.1	0	0.0	5	1.9
	Non Agriculture Labour	30	41.7	29	31.2	28	40.6	6	42.9	1	10.0	94	36.4
	Sheep/goat rearing	0	0.0	2	2.2	0	0.0	0	0.0	0	0.0	2	0.8
	Private service	0	0.0	0	0.0	0	0.0	1	7.1	0	0.0	1	0.4
Agriculture Labour		1	1.4	0	0.0	0	0.0	0	0.0	0	0.0	1	0.4
Private service	Non Agriculture Labour	1	1.4	0	0.0	0	0.0	0	0.0	0	0.0	1	0.4
Studying		22	30.6	34	36.6	21	30.4	4	28.6	4	40.0	85	32.9
Grand Total		72	100	93	100	69	100	14	100	10	100	258	100
Family labour availability		**Man days/month**											
Male		51	60	58	66	60	64	64	62	100	50	60	62
Female		34	40	29	34	34	36	40	38	100	50	37	38
Total		85	100	88	100	95	100	104	100	200	100	97	100

The important assets especially with reference to domestic assets were analyzed and are given in Table 7 and Figure 4. The important domestic assets possessed by all categories of farmers are mobile phone (93.6 %) followed by television (57.4 %), motorcycle (10.6 %), mixer/grinder (10.6 %), auto (6.4 %), tempo (4.3%), Dvd/Cvd, landline phone and radio (2.1%) respectively. The average value of domestic assets is around Rs.68834 per households.

Table 7: Domestic assets among the sample households in Guralgunta Microwatershed

Particulars	MF(14)		SF(16)		SMF(13)		MDF(3)		LF(1)		ALL (47)	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Auto	1	7.1	1	6.3	0	0.0	1	33.3	0	0	3	6.4
Dvd/Cvd	0	0.0	1	6.3	0	0.0	0	0.0	0	0	1	2.1
Landline Phone	0	0.0	1	6.3	0	0.0	0	0.0	0	0	1	2.1
Mixer/grinder	1	7.1	1	6.3	3	23.1	0	0.0	0	0	5	10.6
Mobile Phone	13	92.9	15	93.8	12	92.3	3	100.0	1	100	44	93.6
Motorcycle	1	7.1	0	0.0	3	23.1	0	0.0	1	100	5	10.6
Radio	0	0.0	0	0.0	1	7.7	0	0.0	0	0	1	2.1
Television	9	64.3	9	56.3	8	61.5	0	0.0	1	100	27	57.4
Tempo	1	7.1	0	0.0	0	0.0	1	33.3	0	0	2	4.3

Average value of durable assets: The data regarding the average value of durable assets owned by the households in Guralgunta micro watershed is presented in Table 8. The results shows that the average value of auto was Rs.233333, Dvd/Cvd was Rs.2000, landline phone was Rs.10000, mixer/grinder was Rs.2000, mobile phone was Rs.4693,

motorcycle was Rs.39000, radio was Rs.10000, television was Rs.8481 and tempo was Rs. 310000.

Table 8: Average value of durable asset of Guralgunta micro-watershed

(Rupees)

Particulars	MF(14)	SF(16)	SMF(13)	MDF(3)	LF(1)	ALL (47)
Auto	100000	200000	0	400000	0	233333
Dvd/Cvd	0	2000	0	0	0	2000
Landline Phone	0	10000	0	0	0	10000
Mixer/grinder	2000	2000	2000	0	0	2000
Mobile Phone	4423	3700	6542	4000	3000	4693
Motorcycle	30000	0	40000	0	45000	39000
Radio	0	0	10000		0	10000
Television	10222	7222	8375	0	5000	8481
Tempo	500000	0	0	120000	0	310000
Average value	107774	37487	13383	174667	17667	68834

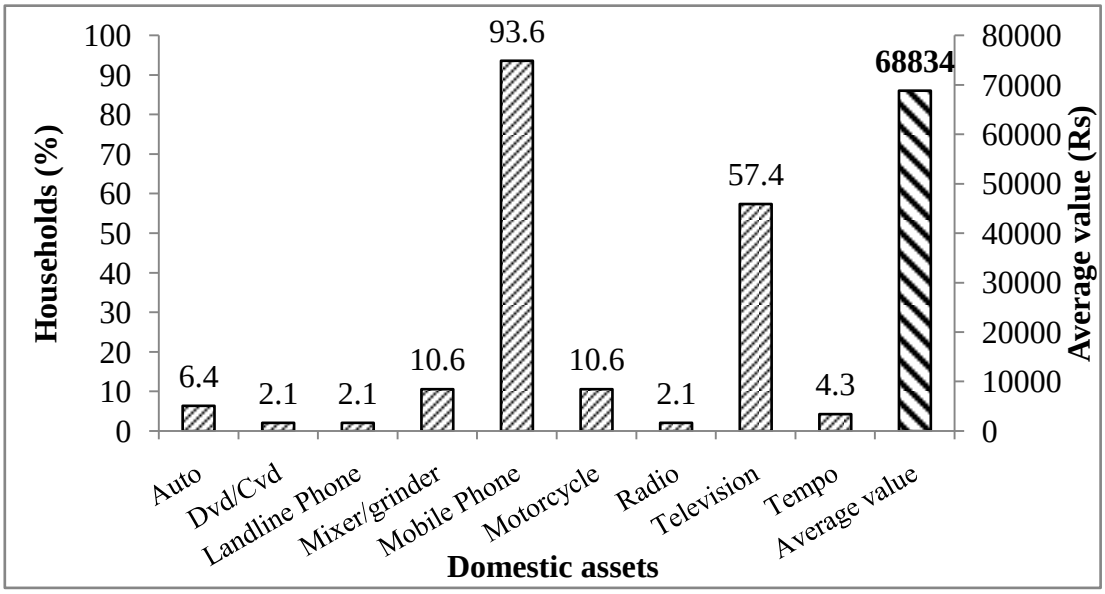


Figure 4: Domestic assets among the sample households in Guralgunta Microwatershed

The most popularly owned farm equipments were sickles, plough, cattle shed; pump sets, chaff cutter, bullock cart, sprayer and thresher. Plough and sickle were commonly present in all the sampled farmers; these were primary implements in agriculture. The per cent of households owned bullock cart (63.8 %), plough (63.8 %), seed cum fertilizer drill (4.3%), sprayer (6.4 %), tractor (2.1 %) and weeder (4.3 %) was found highest among the sample farmers. the average value of farm assets is around Rs. 110163 per households (Table 9 and Figure 5).

Average value of farm implements: The data regarding the average value of farm Implements owned by the households in Guralgunta micro watershed is presented in Table 10. The results show that the average value of bullock cart was Rs.31233, the average value of plough was Rs.3247, the average value of seed cum fertilizer drill was

Rs.21000, the average value of sprayer was Rs. 2250, the average value of tractor was Rs. 600000 and the average value of weeder was Rs. 3250.

Table 9: Farm assets among samples households in Guralgunta Microwatershed

Particulars	MF(14)		SF(16)		SMF(13)		MDF(3)		LF(1)		ALL (47)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Bullock cart	10	71.4	8	50.0	10	76.9	1	33.3	1	100	30	63.8
Plough	10	71.4	8	50.0	10	76.9	1	33.3	1	100	30	63.8
Seed Cum Fert Drill	0	0.0	1	6.3	0	0.0	0	0.0	1	100	2	4.3
Sprayer	0	0.0	1	6.3	1	7.7	0	0.0	1	100	3	6.4
Tractor	0	0.0	0	0.0	0	0.0	1	33.3	0	0.0	1	2.1
Weeder	0	0.0	2	12.5	0	0.0	0	0.0	0	0.0	2	4.3

Table 10: Average value of farm implements owned by households in Guralgunta micro watershed (Rupees)

Particulars	MF(14)	SF(16)	SMF(13)	MDF(3)	LF(1)	ALL (47)
Bullock cart	30000	37125	26000	20000	60000	31233
Plough	3160	3975	2400	2000	8000	3247
Seed Cum Fert Drill	0	2000	0	0	40000	21000
Sprayer	0	1250	1000	0	4500	2250
Tractor	0	0	0	600000	0	600000
Weeder	0	3250	0	0	0	3250
Average value	16580	9520	9800	207333	28125	110163

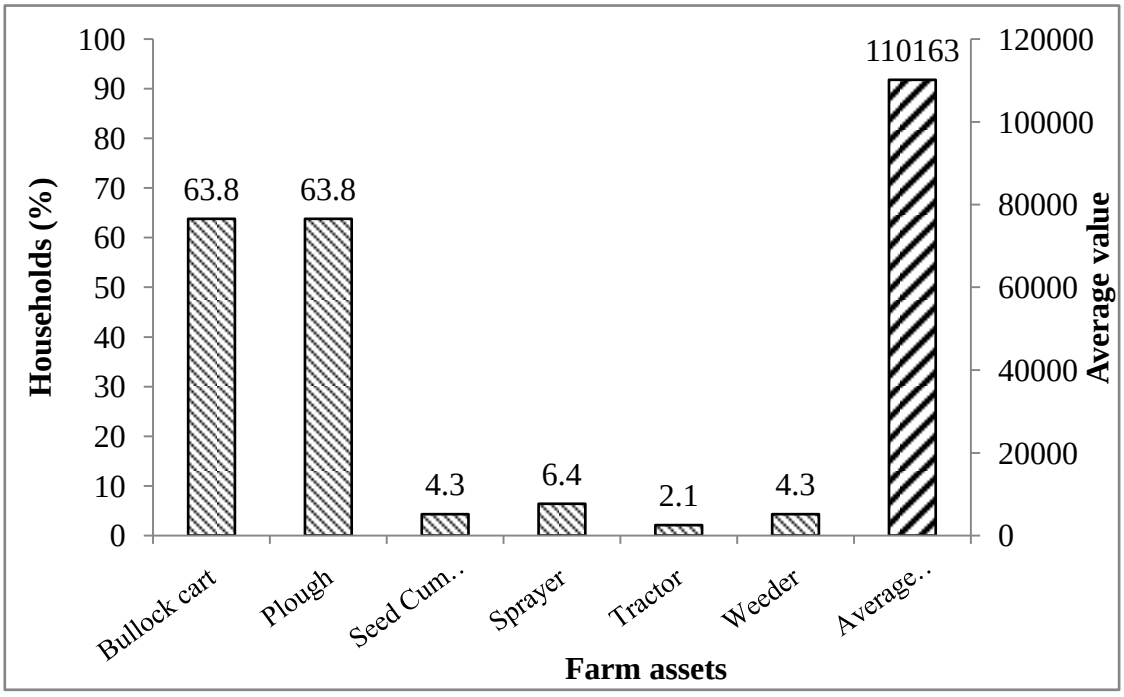


Figure 5: Farm assets among samples households in Guralgunta Microwatershed

Livestock is an integral component of the conventional farming systems (Table 11 and Figure 6). The highest livestock population is bullocks were around 57.4 per cent followed by local dry cow (23.4 %), local milching cow (21.3 %), dry buffalos (6.4 %),

milching buffalos (6.4 %), goats (6.4%), poultry (4.3 %) and sheeps (4.3%). The average livestock value was Rs. 22533 per households.

Table 11: Livestock assets among sample households in Guralgunta micro-watershed

Particulars	MF(14)		SF(16)		SMF(13)		MDF(3)		LF(1)		ALL (47)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Local Dry Cow	4	28.6	3	18.8	4	30.8	0	0.0	0	0.0	11	23.4
Local Milching Cow	3	21.4	3	18.8	4	30.8	0	0.0	0	0.0	10	21.3
Dry Buffalos	0	0.0	1	6.3	2	15.4	0	0.0	0	0.0	3	6.4
Milching Buffalos	0	0.0	2	12.5	0	0.0	0	0.0	1	100	3	6.4
Bullocks	8	57.1	8	50.0	9	69.2	1	33.3	1	100	27	57.4
Poultry	0	0.0	1	6.3	0	0.0	1	33.3	0	0.0	2	4.3
Goats	0	0.0	2	12.5	1	7.7	0	0.0	0	0.0	3	6.4
Sheeps	1	7.1	1	6.3	0	0.0	0	0.0	0	0.0	2	4.3

Table 12: Average value of livestock in Guralgunta Micro-watershed

(Rupees)

Particulars	MF(14)	SF(16)	SMF(13)	MDF(3)	LF(1)	ALL (47)
Bullocks	71250	72500	93333	100000	60000	79630
Dry Buffalos	0	10000	20000	0	0	16667
Local Dry Cow	11500	15000	17500	0	0	14636
Local Milching Cow	18333	15000	22500	0	0	19000
Milching Buffalos	0	25000	0	0	20000	23333
Sheeps	20000	3000	0	0	0	11500
Goats	0	6000	30000	0	0	14000
Poultry	0	2400	0	600	0	1500
Average value	30271	18613	36667	50300	40000	22533

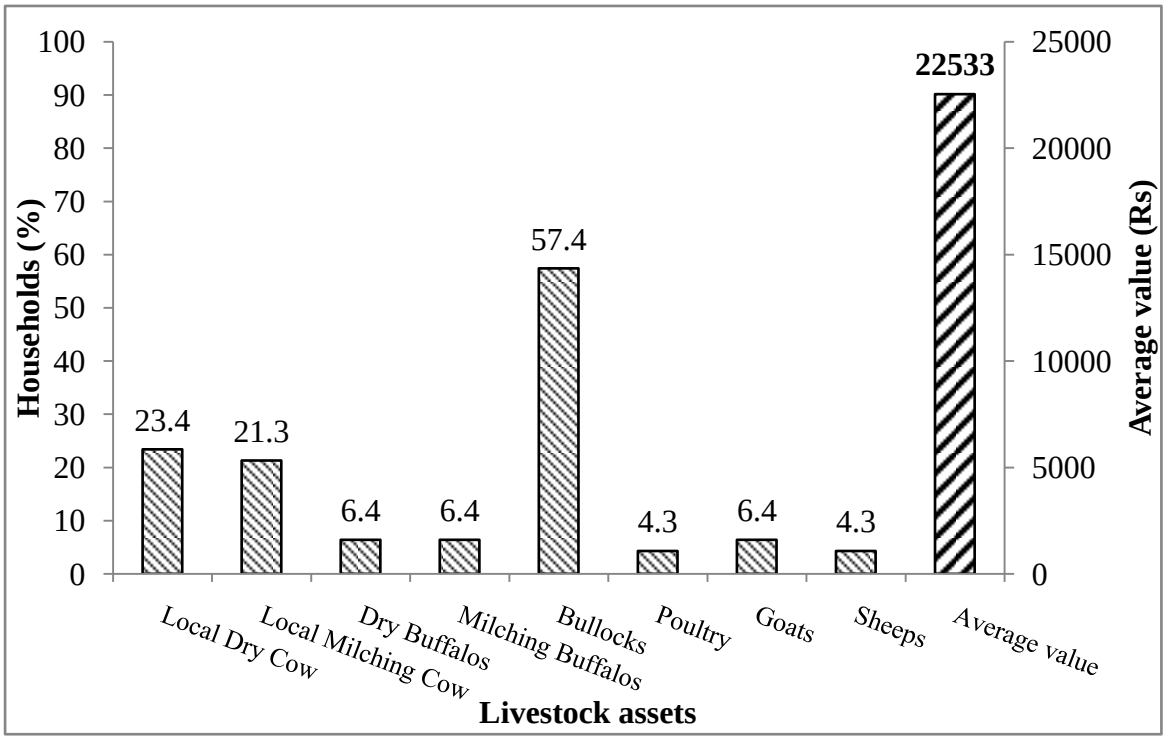


Figure 6: Livestock assets among sample households in Guralgunta micro-watershed

Average value of Livestock: The data regarding the average value of farm Implements owned by the households in Guralgunta micro watershed is presented in Table 12. The results show that the average value of bullocks was Rs.79630, the average value of dry buffalos was Rs. 16667, the average value of local dry cow was Rs. 14636, the average value of local milching cow was Rs.19000, the average value of milching buffalos was Rs. 23333, the average value of sheeps was Rs. 11500, the average value of goats was Rs.14000 and the average value of poultry was Rs. 1500.

Average milk produced in sample households is 485 litres/ annum. Among the farm households, maize, groundnut, paddy and sorghum are the main crops for domestic food and fodder for animals. About 1788 kg /ha of average fodder is available per season for the livestock feeding (Table 13).

Table 13: Milk produced and fodder availability of sample households in Guralgunta Microwatershed

Particulars	**MF(14)**	**SF(16)**	**SMF(13)**	**MDF(3)**	**LF(1)**	**ALL (47)**
Name of the livestock						**Ltr./Lactation/animal**
Local Milching Cow	475	490	499	0	0	489
Milching Buffalos	0	480	0	0	480	480
Average milk produced	***475***	***485***	***499***	***0***	***480***	***485***
Fodder produces						**Fodder yield (kg/ha)**
Maize	1250	2500	1667	0	1250	1719
Sorghum	0	0	0	1250	0	1250
Groundnut	0	3750	1071	0	1875	2232
Paddy	0	2500	2500	1125	2500	1950
Average fodder availability	***1250***	***2917***	***1746***	***1188***	***1875***	***1788***
Livestock having households (%)	76.19	84.00	90.91	66.67	100.00	83.56
Livestock population (Numbers)	29	57	56	4	4	150

A woman participation in decision making is in this micro-watershed is presented in Table 14. About 83.0 per cent women earning for her family requirement, 6.4 per cent of women participated in local organization activities and 59.6 per cent of women taking decision in her family and agriculture related activities.

Table 14: Women empowerment of sample households in Guralgunta Microwatershed

Particulars	**MF(14)**		**SF(16)**		**SMF(13)**		**MDF(3)**		**LF(1)**		**ALL (47)**	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Women participation in local organization activities												
Yes	0	0	3	18.8	0	0	0	0	0	0	3	6.4
No	14	100	13	81.3	13	100	3	100	1	100	44	93.6
Women participation in Elected Panchayth												
Yes	0	0	0	0	0	0	0	0	0	0	0	0.0
No	14	100	16	100	13	100	3	100	1	100	47	100
Women earning for her family requirement												
Yes	11	78.6	14	87.5	12	92.3	2	66.7	0	0	39	83.0
No	3	21.4	2	12.5	1	7.7	1	33.3	1	100	8	17.0
Women taking decision in her family and agriculture related activities												
Yes	8	57.1	8	50	11	84.6	1	33.3	0	0	28	59.6
No	6	42.9	8	50	2	15.4	2	66.7	1	100	19	40.4

The food intake in terms of kilo calorie (kcal) per person per day was calculated and presented in (Table 15 and Figure 7). More quantity of cereals is consumed by sample farmers which accounted for 1211.5 kcal per person. The other important food items consumed was egg 232.4 kcal followed by cooking oil 195.6 kcal pulses 145.7 kcal, milk 62.0 kcal, vegetables 25.8 kcal, and meat 57.5 kcal. In the sampled households farmers were consuming more (1930.5kcal) than NIN- recommended food requirement (2250 kcal).

Table 15: Per capita daily consumption of food among the sample households in Guralgunta Microwatershed

Particulars	NIN recommendation (gram/per day/person/)	Present level of consumption (gram/per day/person)	Kilo calories / day/person
Cereals	396	356.3	1211.5
Pulses	43	42.5	145.7
Milk	200	95.4	62.0
Vegetables	143	107.4	25.8
Cooking Oil	31	34.3	195.6
Egg	0.48	154.9	232.4
Meat	14.2	38.3	57.5
Total	**827.68**	829.2	1930.5
Threshold of NIN recommendation		**827***	**2250***
Below NIN		49	75
Above NIN		51	25

Note: * day/person

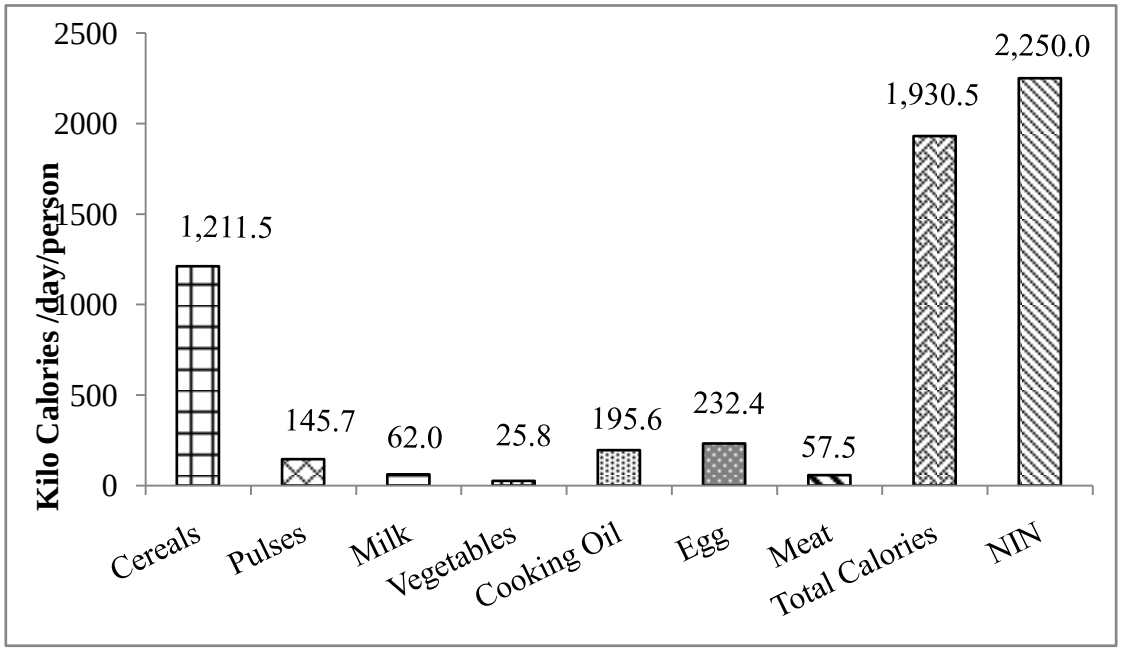


Figure 7: Per capita daily consumption of food among the sample households in Guralgunta Microwatershed

Annual income of the sample HHs: The average annual household income is around Rs. 28666. Major source of income to the farmers in the study area is from livestock (Rs.16645) followed by crop production (Rs. 12020). The monthly per capita income is

Rs. 435, which is less than the threshold monthly income of Rs.975 for considering above poverty line. Due to the fact that erratic rainfall and shortage of water, farmers are diverting from crop production activities to enable the household for a comfortable livelihood. The incomes from the other aforesaid sources are very meagre (Table 16).

Table 16: Annual average income of HHs from various sources in Guralgunta Microwatershed

Particulars	MF (14)*	SF (16)*	SMF (13)*	MDF (3)*	LF (1)*	ALL (47)*
Nonfarm income	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Livestock income	11983 (21.43)	19442 (31.25)	19230 (30.77)	0 (0)	6310 (100)	16645 (27.66)
Crop Production	3670 (100)	10024 (100)	17398 (100)	18538 (100)	71398 (100)	12020 (100)
Total Income (Rs)	15653	29466	36628	18538	77708	28666
Average monthly per capita income (Rs)	254	422	575	331	648	435
Thresholds for poverty level (Rs 975 per month/person)						
% of households Above poverty line	0.0	0.0	0.0	0.0	0.0	0.0
% of households below poverty line	100	100	100	100	100	100

* Figure in the parenthesis indicates % of households

Table 17: Average annual expenditure of sample HHs in Guralgunta Microwatershed

Particulars	MF(14)		SF(16)		SMF(13)		MDF(3)		LF(1)		ALL (47)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Food	51690	33.6	56666	38.5	51757	31.9	54760	30.9	50760	57.2	53579	34.8
Education	4786	3.1	4688	3.2	1846	1.1	1667	0.9	5000	5.6	3745	2.4
Clothing	8071	5.2	10125	6.9	8154	5.0	9333	5.3	3000	3.4	8766	5.7
Social functions	71714	46.6	40125	27.3	69923	43.1	55000	31.0	5000	5.6	57979	37.7
Health	17500	11.4	35563	24.2	30385	18.7	56667	31.9	25000	28.2	29872	19.4
Total	153761	100	147166	100	162065	100	177427	100	88760	100	153940	100
Monthly per capita	2492		2110		2544		3168		740		2337	

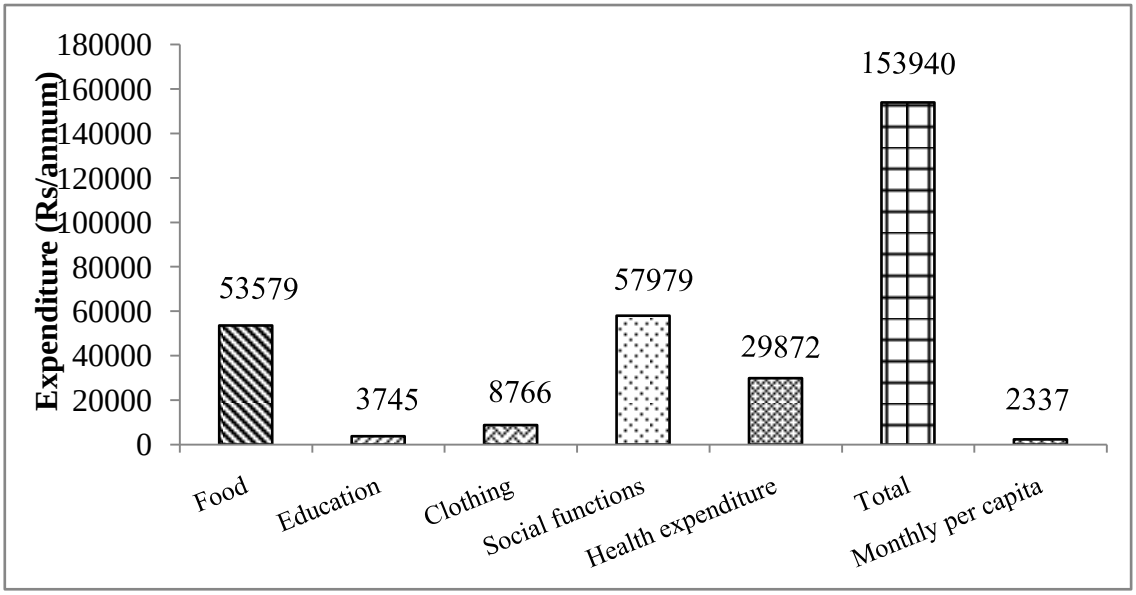


Figure 8: Average annual expenditure of sample HHs in Guralgunta Microwatershed

The average annual expenditure of farm households indicated that farmers in the study area spend highest on food (Rs. 53579) followed by education, clothing, social function and health. Now a day's education is most important among all of us. In today's competitive world, education is a necessity for man after food, clothing, and shelter. It is the only fundamental way by which a desired change in the society can happen. The average per capita monthly expenditure is around Rs. 2337 and about 100 per cent of farm households are below poverty line (Table 17 and Figure 8).

Land holding: Total sample households are 47 and total area cultivated by them is 99.10 ha. The average land holding of sample HHs is 2.11 ha. the large number of households is (16) belong to small size group with an average holding size of 1.49 ha followed by marginal farmers (14) with an average holding size of 0.71 ha, semi-medium farmers (13) with an average land holding is 2.53 ha, medium size groups (3) with an average land holding is 7.34 ha and large size groups (1) with an average land holding is 10.53 (Table 18).

Table 18: Distribution of land holding among the sample households in Guralgunta micro-watershed

Size groups	Particulars	Value
Marginal Farmers	Total sample HHs in number	14
	Total land holding (ha)	9.89
	Avg of Total land holding (ha)	0.71
Small Farmers	Total sample HHs in number	16
	Total land holding (ha)	23.76
	Avg of Total land holding (ha)	1.49
Semi-Medium Farmers	Total sample HHs in number	13
	Total land holding (ha)	32.91
	Avg of Total land holding (ha)	2.53
Medium Farmers	Total sample HHs in number	3
	Total land holding (ha)	22.01
	Avg of Total land holding (ha)	7.34
Large Farmers	Total sample HHs in number	1
	Total land holding (ha)	10.53
	Avg of Total land holding (ha)	10.53
Total sample households	Total sample HHs in number	47
	Total land holding (ha)	99.10
	Avg of Total land holding (ha)	2.11

Table 19: Land use among samples households in Guralgunta Microwatershed

Particulars	MF(14)		SF(16)		SMF(13)		MDF(3)		LF(1)		ALL (47)	
	Area in ha	%	Area in ha	%	Area in ha	%	Area in ha	%	Area in ha	%	Area in ha	%
Irrigated land	0.00	0.0	2.49	10.5	0.81	2.5	1.62	7.4	2.43	23.1	7.34	7.4
Dry land	9.89	100.0	19.13	80.5	32.10	97.5	17.15	77.9	8.10	76.9	86.37	87.2
Fallow land	0.00	0.0	2.15	9.0	0.00	0.0	3.24	14.7	0.00	0.0	5.39	5.4
Total land	9.89	100	23.76	100	32.91	100	22.01	100	10.53	100	99.10	100
Average of Total land (ha)	0.71		1.49		2.53		7.34		10.53		2.11	

Land use: The total land holding in the Guralgunta micro-watershed is 86.37 ha it's a dry land condition, 7.34 ha is irrigated land and 5.39 ha is fallow land condition (Table 19). The average land holding per household is worked out to be 2.11 ha.

In the micro-watershed, the prevalent present land uses under perennial plants are neem trees (84.6 %) followed by mango (6.7 %), tamarind (2.7 %), coconut (2.0 %), teak (2.0%), people tree (Arali) (1.3 %) and lime (0.7 %) (Table 20).

Table 20: Number of trees/plants covered in sample farm households in Guralgunta Microwatershed

Plants	MF(14)		SF(16)		SMF(13)		MDF(3)		LF(1)		ALL (47)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Coconut	0	0.0	1	2.0	0	0.0	0	0.0	2	40.0	3	2.0
Lime	0	0.0	0	0.0	0	0.0	0	0.0	1	20.0	1	0.7
Mango	0	0.0	1	2.0	3	6.1	6	50.0	0	0.0	10	6.7
Neem trees	32	100.0	45	88.2	43	87.8	4	33.3	2	40.0	126	84.6
Peeple tree(Arali)	0	0.0	0	0.0	0	0.0	2	16.7	0	0.0	2	1.3
Tamarind	0	0.0	4	7.8	0	0.0	0	0.0	0	0.0	4	2.7
Teak	0	0.0	0	0.0	3	6.1	0	0.0	0	0.0	3	2.0
Grand Total	32	100	51	100	49	100	12	100	5	100	149	100

The land use decisions are usually based on experience of farmers, tradition, expected profit, personal preferences, resources and social requirements. The present dominant crops grown in dry lands in the study area were by redgram (55.8 %) followed by cotton (19.2 %), paddy (6.9 %), groundnut (4.2 %), maize (3.2 %), Bengal gram (2.8 %) and green gram (0.9%) which are taken during Kharif season and maize (2.8 %), groundnut (1.8%), sorghum (1.8%) and redgram (0.5%) under with rabi season, respectively. The cropping intensity was 107.4 per cent (Table 21 and Figure 9).

Table 21: Present cropping pattern and cropping intensity in Guralgunta Microwatershed

Crops/Season	MF(14)		SF(16)		SMF(13)		MDF(3)		LF(1)		ALL (47)	
	Area in ha	%	Area in ha	%	Area in ha	%	Area in ha	%	Area in ha	%	Area in ha	%
Kharif	***9.63***	***100.0***	***20.84***	***96.3***	***30.36***	***96.2***	***12.70***	***88.7***	***8.10***	***76.9***	***81.63***	***93.1***
Red gram	4.77	49.5	10.03	46.3	19.03	60.3	9.06	63.2	6.07	57.7	48.96	55.8
Cotton	3.24	33.6	7.98	36.8	4.45	14.1	0	0.0	1.21	11.5	16.88	19.2
Paddy	0	0.0	0.81	3.7	0.81	2.6	3.64	25.4	0.81	7.7	6.07	6.9
Groundnut	0	0.0	0.81	3.7	2.83	9.0	0	0.0	0	0.0	3.64	4.2
Maize	1.62	16.8	0.40	1.9	0.81	2.6	0	0.0	0	0.0	2.83	3.2
Bengal gram	0	0.0	0	0.0	2.43	7.7	0	0.0	0	0.0	2.43	2.8
Green gram	0	0.0	0.81	3.7	0	0.0	0	0.0	0	0.0	0.81	0.9
Rabi	***0.0***	***0.0***	***0.81***	***3.7***	***1.21***	***3.8***	***1.62***	***11.3***	***2.43***	***23.1***	***6.07***	***6.9***
Maize	0	0.0	0.40	1.9	1.21	3.8	0	0.0	0.81	7.7	2.43	2.8
Groundnut	0	0.0	0	0.0	0	0.0	0	0.0	1.62	15.4	1.62	1.8
Sorghum	0	0.0	0	0.0	0	0.0	1.62	11.3	0	0.0	1.62	1.8
Red gram	0	0.0	0.40	1.9	0	0.0	0	0.0	0	0.0	0.40	0.5
Total	9.63	100	21.65	100	31.58	100	14.32	100	10.53	100	87.70	100

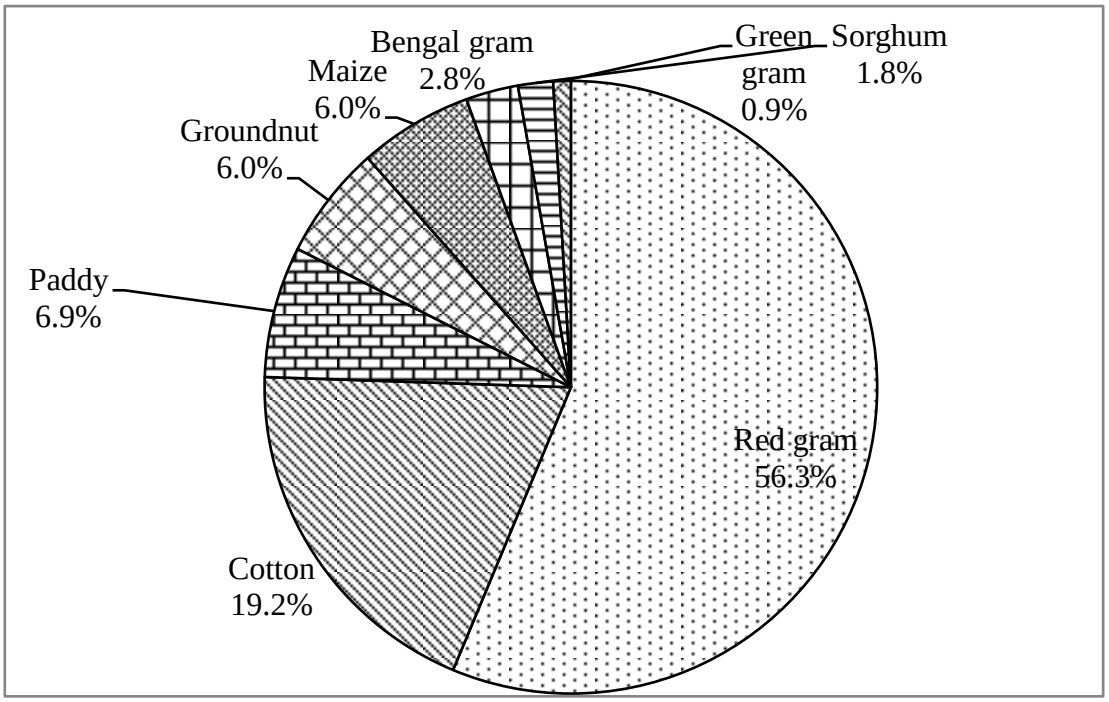


Figure 9: Present cropping pattern in Guralgunta Microwatershed

Economic land evaluation

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

Present cropping pattern on different farmers size groups are given in Table 22. Crops grown on marginal farmers are cotton, maize and red gram. Caster, cotton, greengram, groundnut, maize, paddy and red gram on small farmers are grown. Cotton, groundnut, maize, paddy and red gram are grown on semi medium farmers and paddy, sorghum and red gram on medium farmers are grown. Cotton, groundnut, maize, paddy and redgram on large farmers are grown.

Table 22: Cropping pattern on major soil series in Guralgunta micro-watershed

(Area in per cent)

Size groups	Crops	Dry		Irrigated	Grand Total
		Kharif	Rabi	Kharif	
Marginal Farmers	Cotton	25.2	0.0	0.0	25.2
	Maize	16.8	0.0	0.0	16.8
	Redgram	57.9	0.0	0.0	57.9
Small Farmers	Castor	2.3	0.0	0.0	2.3
	Cotton	39.4	0.0	0.0	39.4
	Greengram	3.6	0.0	0.0	3.6
	Groundnut	3.6	0.0	0.0	3.6
	Maize	1.8	0.0	0.0	1.8
	Paddy	0.0	0.0	3.6	3.6
	Redgram	45.8	0.0	0.0	45.8
Semi-Medium Farmers	Cotton	13.1	0.0	0.0	13.1

	Groundnut	8.3	0.0	0.0	8.3
	Maize	9.5	3.6	0.0	13.1
	Paddy	0.0	0.0	2.4	2.4
	Redgram	63.1	0.0	0.0	63.1
Medium Farmers	Paddy	8.1	0.0	40.7	48.9
	Redgram	44.6	0.0	0.0	44.6
	Sorghum	0.0	6.5	0.0	6.5
Large Farmers	Cotton	11.5	0.0	0.0	11.5
	Groundnut	0.0	15.4	0.0	15.4
	Maize	7.7	0.0	0.0	7.7
	Paddy	0.0	0.0	7.7	7.7
	Redgram	57.7	0.0	0.0	57.7

Land is used for agricultural use for growing cereals, pulse, oilseeds and commercial crops. The soil/ land potential are measures in terms of physical yield and net income. The alternative land use options for each micro-watershed are given below (Table 23).

Table 23: Alternative land use options for different size group of farmers (Benefit Cost Ratio) in Guralgunta Micro watershed.

Particulars	**MF(14)**	**SF(16)**	**SMF(13)**	**MDF(3)**	**LF(1)**	**ALL (47)**
Castor	0	1.51	0	0	0	1.51
Cotton	1.15	1.17	1.29	0	0	1.18
Greengram	0	1.09	0	0	0	1.09
Groundnut	0	1.61	1.12	0	1.15	1.29
Maize	0	0	1.12	0	1.07	1.10
Paddy	0	1.09	1.02	1.16	1.21	1.13
Redgram	1.12	1.09	1.23	1.06	1.63	1.15
Sorghum	0	0	0	1.14	0	1.14

The productivity of different crops grown in Guralgunta micro-watershed under potential yield of the crops is given in Tables 24 and 24a.

The data on cost of cultivation and benefit cost ratio (BCR) of different crops is given in Tables 24 and 24a. The total cost of cultivation in study area for cotton ranges between Rs.54130/ha in small farmers (with BCR of 1.15) and Rs.42145/ha in large farmers (with BCR of 1.09), maize range between Rs.75798/ha in small farmers (with BCR of 1.03) and Rs.40397/ha in marginal farmers (with BCR of 1.07), red gram range between Rs.46222/ha in marginal farmers (with BCR of 1.12) and Rs.12089/ha in large farmers (with BCR of 1.63), castor the cost of cultivation is Rs.52756/ha in small farmers (with BCR of 1.51) and greengram the cost of cultivation is Rs.45273/ha in small farmers (with BCR of 1.09), groundnut the cost of cultivation range between is Rs.51484/ha in small farmers (with BCR of 1.61) and Rs.31198/ha in semi medium farmers (with BCR of 1.12) and paddy the cost of cultivation range between Rs.52937/ha in large farmers (with BCR of 1.21) and Rs.24122/ha in medium farmers (with BCR of 1.16) and sorghum the cost of cultivation is Rs.21573/ha in medium farmers (with BCR of 1.14).

Table 24: Economic land evaluation and bridging yield gap for different crops in Guralgunta micro-watershed

Values	Marginal Farmers			Small Farmers						
	Cotton	**Maize**	**Redgram**	**Castor**	**Cotton**	**Green gram**	**Ground nut**	**Maize**	**Paddy**	**Red gram**
Total cost (Rs/ha)	54130	40397	46222	52756	42875	45273	51484	75798	50308	41227
Gross Return (Rs/ha)	60762	42731	51631	79800	49407	49400	82745	77805	54958	44933
Net returns (Rs/ha)	6632	2334	5409	27044	6532	4127	31261	2006	4650	3706
BCR	1.15	1.07	1.12	1.51	1.19	1.09	1.61	1.03	1.09	1.10
Farmers Practices (FP)										
FYM (t/ha)	6.25	2.50	5.09	1.92	3.68	5.00	2.5	5.0	2.5	3.3
Nitrogen (kg/ha)	134.38	105.63	120.22	92.48	119.65	105.31	105.3	156.7	96.6	111.5
Phosphorus (kg/ha)	86.56	92.50	93.11	78.29	101.60	95.31	95.3	154.2	91.6	92.6
Potash (kg/ha)	15.94	10.63	15.22	5.31	14.65	5.31	5.3	28.3	5.3	12.5
Grain (Qtl/ha)	13.44	18.13	11.69	19.23	11.32	11.25	18.8	27.5	37.5	11.3
Price of Yield (Rs/Qtl)	4550	2250	4413	4200	4586	4000	4400	2500	1400	4289
Soil test based fertilizer Recommendation (STBR)										
FYM (t/ha)	12.35	8.65	7.41	19.76	12.35	7.41	8.6	8.6	9.9	7.4
Nitrogen (kg/ha)	148.20	123.50	24.70	177.84	148.20	18.53	24.7	123.5	98.8	24.7
Phosphorus (kg/ha)	74.10	61.75	49.40	118.56	74.10	37.05	61.8	61.8	49.4	49.4
Potash (kg/ha)	74.10	32.11	24.70	59.28	74.10	37.05	30.9	32.1	49.4	24.7
Grain (Qtl/ha)	17.29	83.98	12.35	5.93	17.29	8.65	17.3	84.0	59.3	12.4
% of Adoption/yield gap (STBR-FP) / (STBR)										
FYM (%)	49.39	71.08	31.29	90.27	70.17	32.52	71.1	42.2	74.7	54.8
Nitrogen (%)	9.33	14.47	-386.71	48.00	19.26	-468.49	-326.4	-26.9	2.3	-351.4
Phosphorus (%)	-16.82	-49.80	-88.48	33.96	-37.11	-157.25	-54.4	-149.7	-85.3	-87.5
Potash (%)	78.49	66.91	38.39	91.04	80.23	85.66	82.8	11.8	89.2	49.3
Grain (%)	22.28	78.42	5.32	-224.41	34.50	-30.13	-8.4	67.3	36.7	8.5
Value of yield and Fertilizer (Rs)										
Additional Cost (Rs/ha)	6881	5436	-561	21712	8987	-560	4212	-744	6433	1362
Additional Benefits (Rs/ha)	17529	148174	2900	-55872	27357	-10420	-6424	141200	30492	4519
Net change income (Rs/ha)	10648	142738	3461	-77584	18369	-9860	-10636	141944	24059	3157

Table 24a: Economic land evaluation and bridging yield gap for different crops in Guralgunta micro-watershed

Particulars	Semi-Medium Farmers					Medium Farmers			Large Farmers				
	Cotton	Ground nut	Maize	Paddy	Red gram	Paddy	Red gram	Sor ghum	Cotton	Ground nut	Maize	Paddy	Red gram
Total cost (Rs/ha)	43412	31198	45123	41295	27564	24122	20092	21573	42145	32646	46026	52937	12089
Gross Return (Rs/ha)	52982	34933	51253	41990	34936	27417	21576	24700	46107	37668	49400	64220	19760
Net returns (Rs/ha)	9569	3735	6129	695	7373	3295	1484	3127	3961	5021	3374	11283	7671
BCR	1.29	1.12	1.15	1.02	1.27	1.16	1.06	1.14	1.09	1.15	1.07	1.21	1.63
Farmers Practices (FP)													
FYM (t/ha)	2.7	1.4	2.9	5.0	1.8	1.5	1.1	1.3	3.3	1.3	2.5	3.8	1.3
Nitrogen (kg/ha)	117.0	66.8	80.4	95.3	63.4	62.8	65.9	72.1	74.7	74.7	74.7	74.7	74.7
Phosphorus (kg/ha)	86.8	72.9	64.3	67.2	53.1	58.8	55.7	49.5	73.4	73.4	73.4	73.4	73.4
Potash (kg/ha)	21.0	12.1	11.7	15.9	11.3	11.6	11.9	12.5	15.1	15.1	15.1	15.1	15.1
Grain (Qtl/ha)	10.8	7.9	22.9	25.0	8.3	10.5	4.6	11.3	10.0	12.5	22.5	37.5	5.0
Price of Yield (Rs/Qtl)	4833	4500	2167	1700	4377	2500	4767	2000	4500	3000	2000	1700	4000
Soil test based fertilizer Recommendation (STBR)													
FYM (t/ha)	12.4	8.6	8.6	9.9	7.4	9.9	7.4	7.4	12.4	8.6	8.6	9.9	7.4
Nitrogen (kg/ha)	148.2	24.7	123.5	98.8	24.7	98.8	24.7	81.5	148.2	24.7	123.5	98.8	24.7
Phosphorus (kg/ha)	74.1	61.8	61.8	49.4	49.4	49.4	49.4	56.8	74.1	61.8	61.8	49.4	49.4
Potash (kg/ha)	74.1	30.9	32.1	49.4	24.7	49.4	24.7	39.5	74.1	30.9	32.1	49.4	24.7
Grain (Qtl/ha)	17.3	17.3	84.0	59.3	12.4	59.3	12.4	28.4	17.3	17.3	84.0	59.3	12.4
% of Adoption/yield gap (STBR-FP) / (STBR)													
FYM (%)	78.0	83.5	66.3	49.4	75.7	85.3	84.6	83.1	73.0	85.5	71.1	62.0	82.0
Nitrogen (%)	21.1	-170.4	34.9	3.5	-156.6	36.4	-166.9	11.6	49.6	-202.3	39.5	24.4	-202.3
Phosphorus (%)	-17.2	-18.0	-4.1	-36.0	-7.6	-19.0	-12.7	13.0	0.9	-18.9	-18.9	-48.6	-48.6
Potash (%)	71.6	60.7	63.6	67.7	54.4	76.6	51.9	68.3	79.6	51.1	53.0	69.5	38.9
Grain (%)	37.3	54.6	72.7	57.8	32.5	82.3	63.1	60.4	42.2	27.7	73.2	36.7	59.5
Value of yield and Fertilizer (Rs)													
Additional Cost (Rs/ha)	10504	6597	6543	4808	5249	9206	5754	7137	11110	6598	6559	6050	4613
Additional Benefits (Rs/ha)	31207	42448	132304	58276	17553	121950	37175	34310	32805	14370	122960	37026	29400
Net change income (Rs/ha)	20704	35851	125761	53468	12304	112744	31421	27173	21695	7772	116401	30976	24787

The data on FYM, Nitrogen, Phosphorus and Potash application by the farmers to different crops and recommended FYM for different crops is given in Table 24 and 24a. There is a huge gap between FYM application by farmers and recommended FYM in all the crops across the soils. There is a larger yield gap in crops grown across different soil series. Adequate knowledge about recommended package of practices is the pre-requisite for their use in cultivation of crops.

It is a fact that, recommended practices are major contributing factors to yield. Inadequate knowledge about recommended practices leads to their improper adoption. Strengthening of extension services by concerned agency is required to increase adoption of recommended cultivation practices and ultimately reducing the gap. By adopting soil-test fertiliser recommendation, there is scope to increase yield and income to a maximum of Rs.142738 in maize and a minimum of Rs.3157 in red gram cultivation.

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

The average value of ecosystem service for food grain production is around Rs.7421/ ha/year (Table 25 and Figure 10). Per hectare food grain production services is maximum in castor (Rs.27044) followed by groundnut (Rs.12645), paddy (Rs.8306), cotton (Rs. 6273), red gram (Rs. 5098), sorghum (Rs. 657), maize (Rs.158) and greengram is a negative returns.

Table 25: Ecosystem services of food grain production in Guralgunta Microwatershed

Production items	Crops	Area in ha	Yield (Qtl/ha)	Price (Rs/Qtl)	Gross Returns (Rs/ha)	Cost of Cultivation (Rs/ha)	Net returns (Rs/ha)
Cereals	Maize	7.3	21.9	2214	48442	48284	158
	Paddy	14.6	23.9	1960	46863	38557	8306
	Sorghum	1.6	11.1	2000	22230	21573	657
Pulses	Greengram	0.8	11.1	4000	44460	45273	-813
	Redgram	54.6	9.3	4379	40591	35493	5098
Oil seeds	Castor	0.5	19.0	4200	79800	52756	27044
	Groundnut	5.3	12.9	3967	51088	38443	12645
Commercial crops	Cotton	17.1	11.5	4553	52172	45899	6273
Average Value		101.8	15.1	3409	48206	40785	7421

The average value of ecosystem service for fodder production is around Rs.2076/ ha/year (Table 26). Per hectare fodder production services is maximum in,maize (Rs. 4355) followed by Sorghum (Rs. 2470), paddy (Rs.1067) and groundnut (Rs.412).

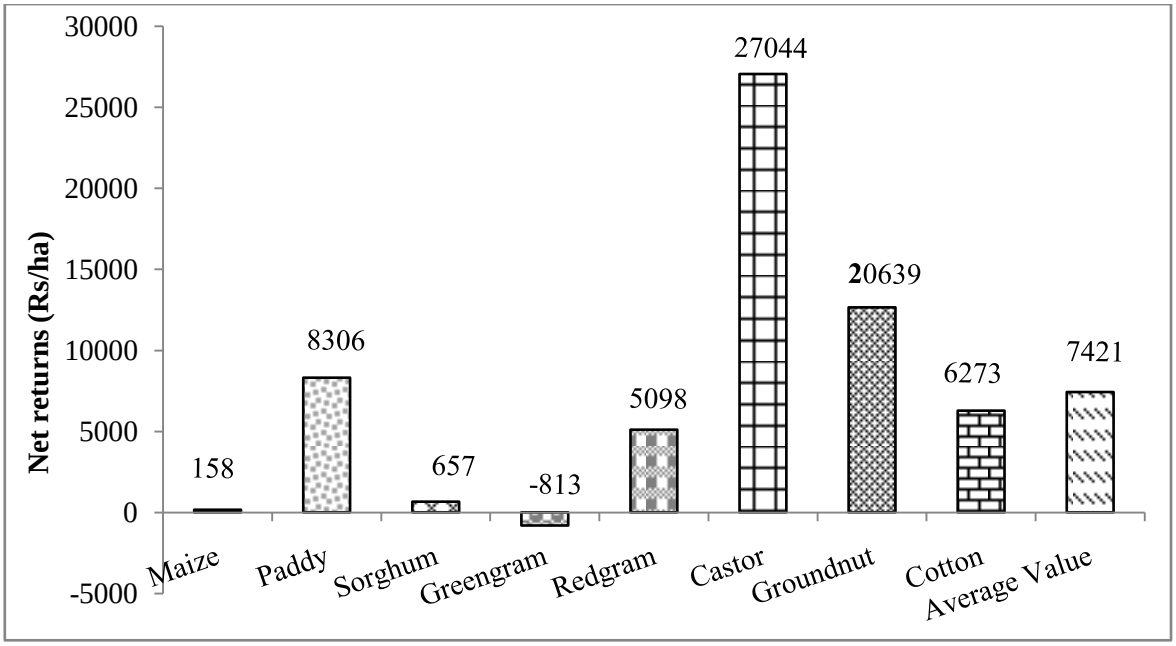


Figure 10: Ecosystem services of food production in Guralgunta Microwatershed

Table 26: Ecosystem services of fodder production in Guralgunta Microwatershed

Production items	Crops	Area in ha	Yield (Qtl/ha)	Price (Rs/Qtl)	Net Returns (Rs/ha)
Cereals	Maize	7.29	6.35	686	4355
	Paddy	14.57	1.33	800	1067
	Sorghum	1.62	2.47	1000	2470
Oil seeds	Groundnut	5.26	1.24	333	412
Average value		28.74	2.85	705	2076

The water demand for production of different crops was worked out in arriving at the ecosystem services of water support to crop growth. The data on water requirement for producing one quintal of grain is considered for estimating the total value of water required for crop production. The value of per hector water used was maximum (Table 27 and Figure 11) in castor (Rs.95000) followed by greengram (Rs.76760), red gram (Rs.50465), cotton (Rs. 46165), paddy (Rs.40001), groundnut (Rs. 35830), sorghum (Rs. 33879) and maize (Rs.26734).

Table 27: Ecosystem services of water supply in Guralgunta Microwatershed

Crops	Yield (Qtl/ha)	Virtual water (cubic meter) per ha	Value of Water (Rs/ha)	Water consumption (Cubic meters/Qtl)
Castor	19.0	9500	95000	500
Cotton	11.5	4616	46165	403
Greengram	11.1	7676	76760	691
Groundnut	12.9	3583	35830	278
Maize	21.9	2673	26734	122
Paddy	23.9	4000	40001	167
Redgram	9.3	5047	50465	544
Sorghum	11.1	3388	33879	305
Average Value	15.1	5060	50604	376

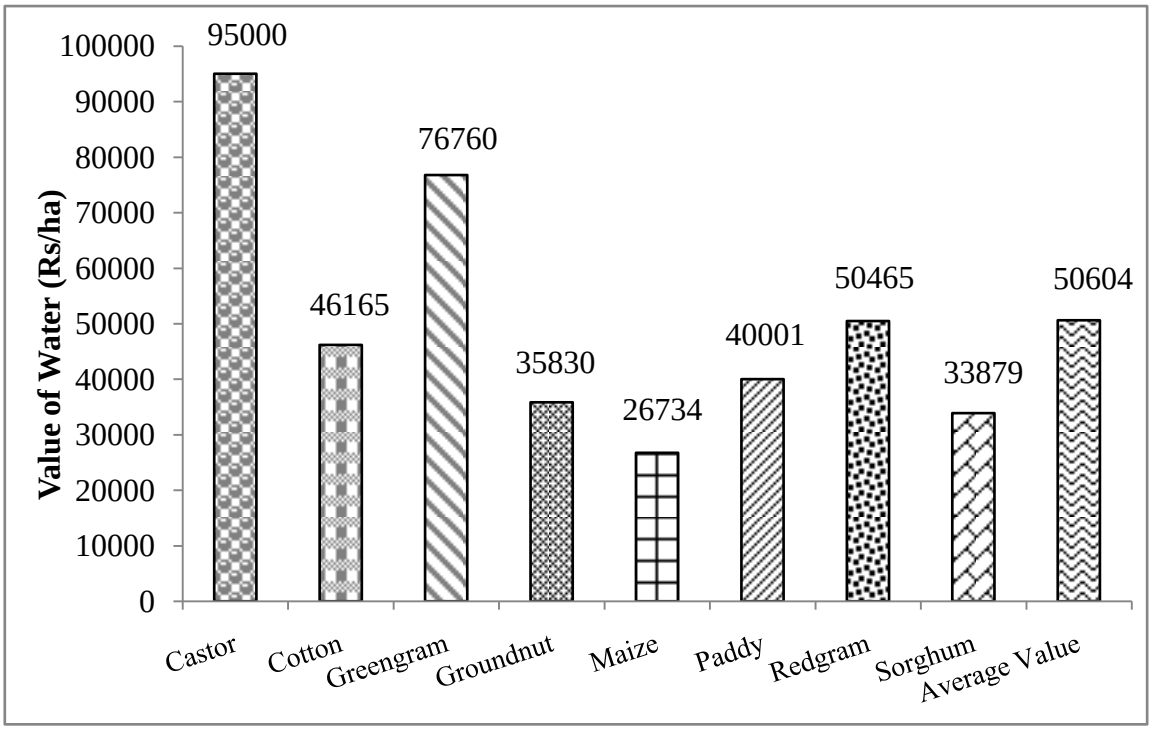


Figure 11: Ecosystem services of water supply in Guralgunta Microwatershed

The main constraints in farming is climate change particularly decline in rainfall and increasing temperature. Farmers reported that they are not getting timely support/extension services from the concerned development department (Table 28).

Table 28: Farming constraints related land resources of sample households in Guralgunta Microwatershed

Particulars	**Per cent**
Farmers awareness of climate change	
Yes	0
No	100
Perception on climate change	
Decrease in rainfall	0.0
Increase in temperature	0.0
Availability agricultural technology information	
Yes	0
No	100

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