ICAR-NBSS&LUP Sujala MWS Publ.149

हर कदम, हर डगर
किसानों का हमसफर
भारतीय कृषि अनुसंधान परिषद
Agrisearch with a human touch

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

GABBUR-3(4D3A9D1g) MICROWATERSHED

Koppal Taluk and District, Karnataka

Karnataka Watershed Development Project – II

SUJALA – III

World Bank funded Project

The World Bank

ICAR – NATIONAL BUREAU OF SOIL SURVEY AND LAND USE PLANNING

ICAR - NBSS & LUP

WATERSHED DEVELOPMENT DEPARTMENT
GOVT. OF KARNATAKA, BANGALORE

About ICAR - NBSS&LUP

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

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

Citation: Rajendra Hegde, Ramesh Kumar, S.C., K.V. Niranjana, S. Srinivas, M.Lalitha, 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 Gabbur-3 (4D3A9D1g) Microwatershed, Koppal Taluk and District, Karnataka”, ICAR-NBSS&LUP Sujala MWS Publ.149, ICAR – NBSS & LUP, RC, Bangalore. p.109 & 39.

TO OBTAIN COPIES,

Please write to:
Director, ICAR - NBSS & LUP,

Amaravati Road, NAGPUR - 440 033, India

Phone : (0712) 2500386, 2500664, 2500545 (O)

Telefax : 0712-2522534

E-Mail : director@nbsslup.ernet.in

Website URL : nbsslup.in

Or

Head, Regional Centre, ICAR - NBSS&LUP, Hebbal, Bangalore - 560 024

Phone : (080) 23412242, 23510350 (O)

Telefax : 080-23510350

E-Mail : nbssrcb@gmail.com

ICAR-NBSS&LUP Sujala MWS Publ.149

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

GABBUR-3(4D3A9D1g) MICROWATERSHED

Koppal 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

WATERSHED DEVELOPMENT DEPARTMENT, GOVT. OF KARNATAKA, BANGALORE

PREFACE

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

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

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

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

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

ICAR-NBSS&LUP, Regional Centre, Bangalore has taken up a project sponsored by the Karnataka Watershed Development Project-II, (Sujala-III), Government of Karnataka funded by the World Bank under Component -1 Land Resource Inventry. This study was taken up to demonstrate the utility of such a database in reviewing, monitoring and evaluating all the land based watershed development programs on a scientific footing. To meet the requirements of various land use planners at grassroots level, the present study on "Land Resource Inventory and Socio-Economic Status of Farm Households for Watershed Planning and Development of for Gabbur-3 micro-watershed in Koppal Taluk, and District, Karnataka" for integrated development was taken up in collaboration withtheState 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:07.01.2019

S.K. SINGH
Director, ICAR - NBSS&LUP Nagpur

Contributors

Dr. RajendraHegde Principal Scientist, Head & Project Leader, Sujala-III Project ICAR-NBSS&LUP, Regional Centre, Bangalore	**Dr. S.K.Singh** Director, ICAR-NBSS&LUP Coordinator, Sujala-III Project Nagpur
Soil Survey, Mapping & Report Preparation	
Dr. K.V. Niranjana	Sh. R.S. Reddy
Dr. B.A. Dhanorkar	Sh. VenkataGiriyappa
	Dr. GopaliBardhan
	Smt. Chaitra, S.P.
	Dr. Gayathri, B.
	Dr. Savitha, H.R.
	Sh. Nagendra, B.R.
	Mr. Somashekar T.N
	Ms. Arpitha, G.M.
Field Work	
Sh. C.Bache Gowda	Sh. MayurPatil
Sh. Somashekar	Sh. Arun Kumar, S.
Sh. M. Jayaramaiah	Sh. Sunil Raj
	Sh. Yogesh Kumar, B.
	Sh. Vikas, N.K.
	Sh. Arun Kumar, S.G.
	Sh. UmeshJadiyappaMadolli
	Sh. Praveen Kumar P. Achalkar
	Sh. Veerabhadraswamy
	Sh. Vinay
	Sh. Shankarappa, K.
	Sh. Lankesh, R.S.
	Sh. Appanna B. Hattigoudar
	Sh. Maharudra
GIS Work	
Dr. S.Srinivas	Sh. A.G. Devendra Prasad
Sh. D.H.Venkatesh	Sh. AbhijithSastry, N.S.
Smt.K.Sujatha	Sh. NagendraBabuKolukondu
Smt. K.V.Archana	Sh. Avinash
Sh. N.Maddileti	Sh. Amar Suputhra, S.
	Sh. Deepak M.J.
	Sh. Madappaswamy
	Smt. K.Karunya Lakshmi
	Ms. Seema, K.V.
	Ms. Ramireddy Lakshmi Silpa
	Ms. BhanuRekha, T.
	Ms. RajataBhat
	Ms. Shruthi
	Ms. Suman, S.

Laboratory Analysis	
Dr. M. Lalitha	Ms. Thara, V.R.
Smt. ArtiKoyal	Ms. Roopa, G.
Smt. Parvathy, S.	Ms. Vindhya, N.G.
	Ms. Shwetha N.K.
	Ms. PavanaKumari, P.
	Ms. Leelavathy, K.U.
	Ms. Rashmi, N.
	Ms. Padmaja, S.
	Ms. Veena, M.
	Ms. Chaithrashree B
	Ms. Shwetha N
Socio-economic Analysis	
Dr. Ramesh Kumar, S.C.	Sh. Prakashanaik, M.K.
	Ms. Shraddha Hegde
	Sh. Vijay Kumar Lamani
	Sh. Pradyumna
	Ms. Sowmya K.B
	Mrs. Prathibha, D.G
	Sh. Rajendra,D
Soil & Water Conservation	
Sh. Sunil P. Maske	
Watershed Development Department, GOK, Bangalore	
Sh. Rajeev Ranjan IFS Project Director & Commissioner, WDD	Dr. A. Natarajan NRM Consultant, Sujala-III Project
Dr. S.D. Pathak IFS Executive Director & Chief Conservator of Forests, WDD	

PART-A

LAND RESOURCE INVENTORY

Contents

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

The land resource inventory of Gabbur-3 microwatershedwas conducted using village cadastral maps and IRS satellite imagery on 1:7920 scale. The false colour composites of IRS imagery were interpreted for physiography and these physiographic delineations were used as base for mapping soils. The soils were studied in several transects and a soil map was prepared with phases of soil series as mapping units. Random checks were made all over the area outside the transects to confirm and validate the soil map unit boundaries. The soil map shows the geographic distribution and extent, characteristics, classification, behavior and use potentials of the soils in the microwatershed.

The present study covers an area of 536ha in Koppaltalukand district, Karnataka. The climate is semiarid and categorized as drought - prone with an average annual rainfall of 662 mm, of which about 424 mm is received during south –west monsoon, 161mm during north-east and the remaining 77 mm during the rest of the year. An area of about 96per cent is covered by soils, 3 per cent byrock outcrops and one per cent by water bodies, settlements and others. The salient findings from the land resource inventory are summarized briefly below.

- *The soils belong to 13soil series and 24soil phases (management units) and 6land use classes.*
- *The length of crop growing period is <90 days and starts from 2nd week of August to 2nd week of November.*
- *From the master soil map, several interpretative and thematic maps like land capability, soil depth, surface soil texture, soil gravelliness, available water capacity, soil slope and soil erosion were generated.*
- *Soil fertility status maps for macro and micronutrients were generated based on the surface soil samples collected at every 250 m grid interval.*
- *Land suitability for growing 28major agricultural and horticultural crops were assessed and maps showing the degree of suitability along with constraints were generated.*
- *Entire area is suitable for agriculture.*
- *About12 per cent of the soils are shallow (50-75 cm), 26 per cent of the soils are moderately shallow (50-75 cm), 25per cent of the soils aremoderately deep(75-100 cm), about 11per cent are deep soils (100-150 cm) and 23per cent area has very deep (>150 cm) soils.*
- *About 10 per cent area has clayey soils at the surface, 73 per cent loamy soils and 13 per cent sandy soils.*
- *About 58per cent of the area has non-gravelly (<15%) soils and38per cent gravelly soils (15-35 % gravel)soils.*

- *About 31 per cent arevery low (<50 mm/m),16 per cent low (51-100 mm/m), 27 per cent are medium (101-150 mm/m) and 23 per cent high to very high (151->200 mm/m)in available water capacity.*
- *About 92 per cent area has very gently sloping (1-3%) and 4 per cent area has nearly level (0-1%)lands.*
- *An area of about 28 per cent has soils that are slightly eroded (e1) and68 per cent moderately eroded (e2) lands.*
- *An area of about 12per cent has soils that are slightly to moderately acid (pH 5.5-6.5), 2 per cent soils are strongly acid (pH 5.0-5.5), 25 per cent soils are neutral (pH 6.5-7.3),54 per cent are slightly to moderately alkaline (pH 7.3 to 8.4)and3 per cent are strongly alkaline (pH 8.4-9.0).*
- *The Electrical Conductivity (EC) of the soils are <2 dSm^{-1}(non-saline) in the entire area.*
- *Organic carbon islow (<0.5%) in about 12per cent,34 per cent of the soils are medium (0.5-0.75%) and 51 per cent of the soils are high (>0.75%) in organic carbon.*
- *Available phosphorus is low (<23 kg/ha)in about 2per cent, medium (23-57 kg/ha) in about 47per cent and high (>57 kg/ha) in47 per cent area of the microwatershed.*
- *About 68 per cent of the soils are medium (145-337 kg/ha) and 28 per cent of the soils are high (>337 kg/ha) in available potassium content.*
- *Available sulphur is low (<10 ppm) in about 76 per cent, medium (10-20 ppm) in 20per cent and about 1per cent area is high (>20 ppm).*
- *Available boron is low (0.5 ppm) in about 64 per cent area,26per cent area is medium (0.5-1.0 ppm) and high (>1.0 ppm) in about 6 per cent.*
- *Available iron is sufficient (>4.5 ppm)in 36 per cent and deficient (<4.5 ppm) in about 60 per cent area.*
- *Available zinc is deficient (<0.6 ppm) in 64 per cent and sufficient (>0.6 ppm) in about 33 per cent area.*
- *Available manganeseand copper are sufficient in all the soils.*
- *The land suitability for 28major agricultural and horticultural crops grown in the microwatershedwere 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	*256 (48)*	*87 (16)*	*Pomegranate*	*53 (10)*	*226 (42)*
Maize	*37 (7)*	*179 (34)*	*Guava*	*53 (10)*	*101 (19)*
Bajra	*154 (29)*	*162 (30)*	*Jackfruit*	*52(10)*	*100 (19)*
Red gram	*53 (10)*	*226 (42)*	*Jamun*	*29 (5)*	*204 (38)*
Bengalgram	*102 (19)*	*280 (52)*	*Musambi*	*122 (23)*	*157 (29)*
Groundnut	*29 (5)*	*262 (49)*	*Lime*	*122 (23)*	*157 (29)*
Sunflower	*122 (23)*	*157 (29)*	*Cashew*	*67 (12)*	*87 (16)*
Cotton	*132 (25)*	*212 (40)*	*Custard apple*	*256 (48)*	*196 (37)*
Chilli	*154 (29)*	*63 (12)*	*Amla*	*154 (29)*	*298 (56)*
Tomato	*154 (29)*	*87 (16)*	*Tamarind*	*29 (5)*	*117 (22)*
Drumstick	*53 (10)*	*260 (49)*	*Marigold*	*67 (12)*	*276 (52)*
Mulberry	*53 (10)*	*236 (44)*	*Chrysanthemum*	*67 (12)*	*276 (52)*
Mango	*29 (5)*	*24 (4)*	*Jasmine*	*67 (12)*	*174 (33)*
Sapota	*53 (10)*	*100 (19)*	*Crossandra*	*67 (12)*	*243 (45)*

Apart from the individual crop suitability, a proposed crop plan has been prepared for the6 identified LUCs by considering only the highly and moderately suitable lands for different crops and cropping systems with food, fodder,fibre and other horticulture crops that helps in maintaining productivity and ecological balance in the microwatershed.

- *Maintaining soil-health is vital for crop production and conserve soil and land resource base for maintaining ecological balance and to mitigate climate change. For this, several ameliorative measures have been suggested for these problematic soils like saline/alkali, highly eroded, sandy soils etc.,*
- *Soil and water conservation and drainage line treatment plans have been prepared that would help in identifying the sites to be treated and also the type of structures required.*
- *As part of the greening programme, several tree species have been suggested to be planted in marginal and submarginal lands, field bunds and also in the hillocks, mounds and ridges. That would help in supplementing the farm income, provide fodder and fuel, and generate lot of biomass which inturn would help in maintaining the ecological balance and contribute to mitigating the climate change.*

Chapter 1

INTRODUCTION

Land is a scarce resource and basic unit for any material production. It can support the needs of the growing population, provided they use the land in a rational and judicious manner. But what is happening in many areas of the state is a cause for concern to everyone involved in the management of land resources at the grassroots level. The area available for agriculture is about 51 per cent of the total area and more than 60 per cent of the people are still dependant on agriculture for their livelihood. The limited land area is under severe stress and strain due to increasing population pressure and competing demands of various land uses. Due to this, every year there is 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 urgent need to generate a detailed site-specific farm level database on various land resources for all the villages/watersheds in a time bound manner that would help to protect the valuable soil and land resources and also to stabilize the farm production.

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

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

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

The land resource inventory aims to provide site-specific database for Gabbur-3 microwatershed in Koppal Taluk, Koppal 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 Gabbur-3 Microwatershed is located in the central part of northern Karnataka in Koppal Taluk, Koppal District, Karnataka State (Fig. 2.1). It comprises of Halalli, Guladhalli and Gabbura villages. It lies between $15^0$21' – $15^0$23' North latitudes and 76'15 – $76^0$17' East longitudes and covers an area of 536 ha. It is surrounded by Halalli village on the north, Gabbura village on the west, Dhanakanadoddi on the northeast and Guladhalli village on the east and southern side.

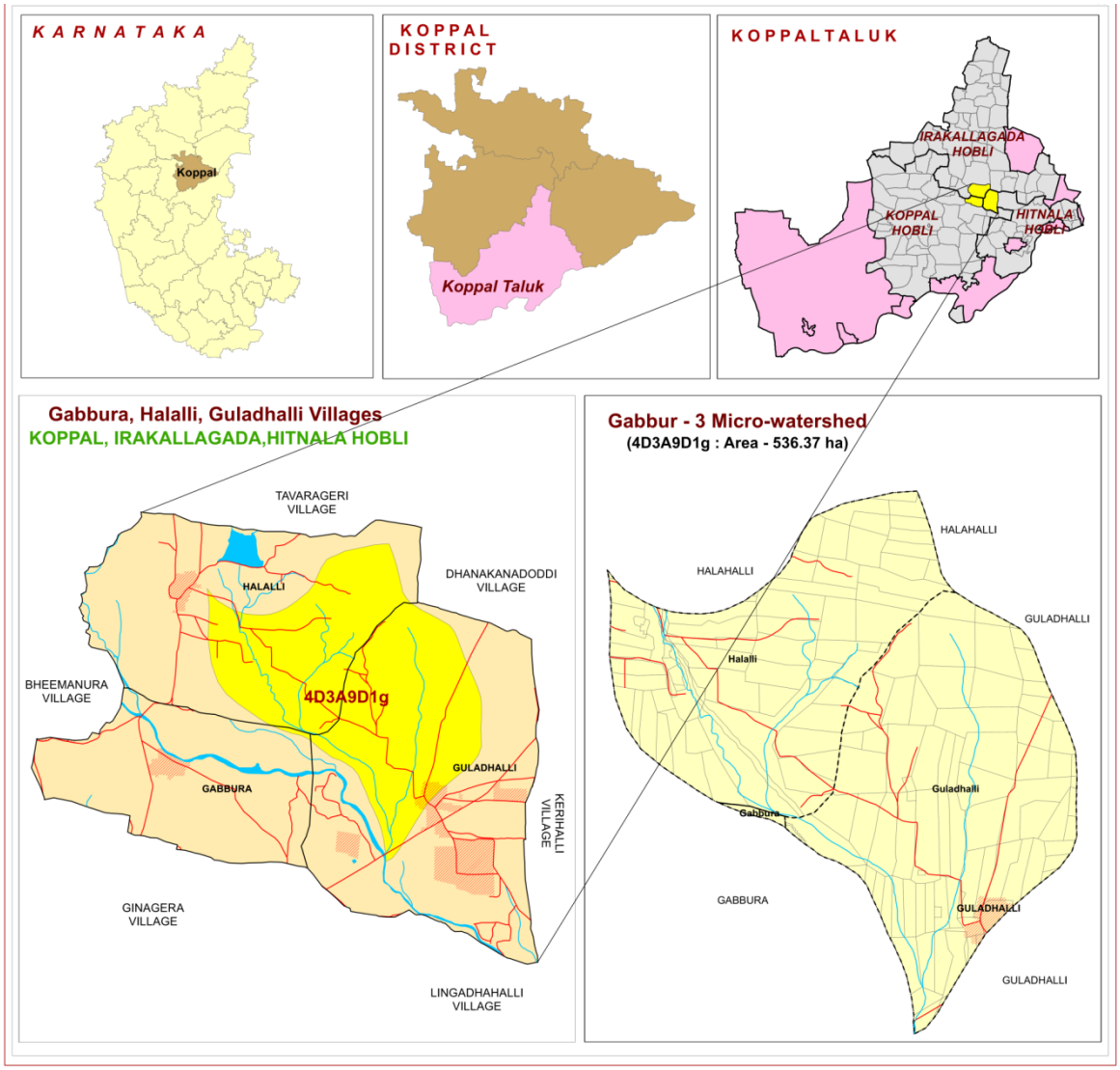


Fig. 2.1 Location map of Gabbur-3 Microwatershed

2.2 Geology

Major rock formation observed in the microwatershed is granite gneiss and alluvium (Figs. 2.2a and b). Granite gneisses are essentially pink to gray and are coarse to medium grained. They consist primarily of quartz, feldspar, biotite and hornblende. The gray granite gneisses are highly weathered, fractured and fissured upto a depth of about 10 m.

Dolerite dykes and quartz veins are common with variable width and found to occur in the village. The thickness of the alluvium generally is limited to less than a meter, except in river valleys where it is very deep extending to tens of meters. Such soils are transported and represent palaeo black soils originally formed at higher elevation, but now occupying river valleys.

Fig. 2.2 Granite and granite gneiss rocks

Fig. 2.2 b Alluvium

2.3 Physiography

Physiographically, the area has been identified as granite gneiss and alluvial landscapes based on geology. The microwatershed area has been further divided into summits, very gently sloping uplands and nearly level plains based on slope and its relief features. The elevation ranges from 535 to 566 m in the gently sloping uplands.

2.4 Drainage

The area is drained by several small seasonal streams that join Hire *halla* and Chenna *halla* along its course. Though, the streams are not perennial, during rainy season they carry large quantities of rain water. The microwatershed has only few small tanks which are not able to store the water flowing during the rainy season. Due to this, the ground water recharge is very much affected in the villages. This is reflected in the failure of many bore wells in the villages. If the available rain water is properly harnessed by constructing 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 dendritic to sub parallel.

2.5 Climate

The district falls under semiarid tract of the state and is categorized as drought-prone with an average annual rainfall of 662 mm (Table 2.1). Maximum of 424 mm precipitation takes place during the south-west monsoon period from June to September, north-east monsoon contributes about 161 mm and prevails from October to early December and the remaining 77 mm takes place during the rest of the year. The winter season is from December to February. During April and May, the temperatures reach up to 45 °C and in December and January, the temperatures will go down to 16 °C. Rainfall distribution is shown in Figure 2.3. The average Potential Evapo Transpiration (PET) is 145 mm and varies from a low of 101 mm in December and 193 mm in the month of May. The PET is always higher than precipitation in all the months except in the month of September. Generally, the Length of crop Growing Period (LGP) is <90 days and starts from 2nd week of August to 2nd week of November.

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

Sl. no.	Months	Rainfall	PET	1/2 PET
1	January	1.60	116.70	58.35
2	February	1.50	129.20	64.60
3	March	14.10	169.80	84.90
4	April	18.10	180.60	90.30
5	May	41.60	193.50	96.75
6	June	85.80	167.90	83.95
7	July	72.10	156.20	78.10
8	August	110.50	152.50	76.25
9	September	155.60	138.50	69.25
10	October	116.30	122.30	61.15
11	November	36.00	106.40	53.20
12	December	9.10	101.00	50.50
	TOTAL	**662.30**	**144.55**	

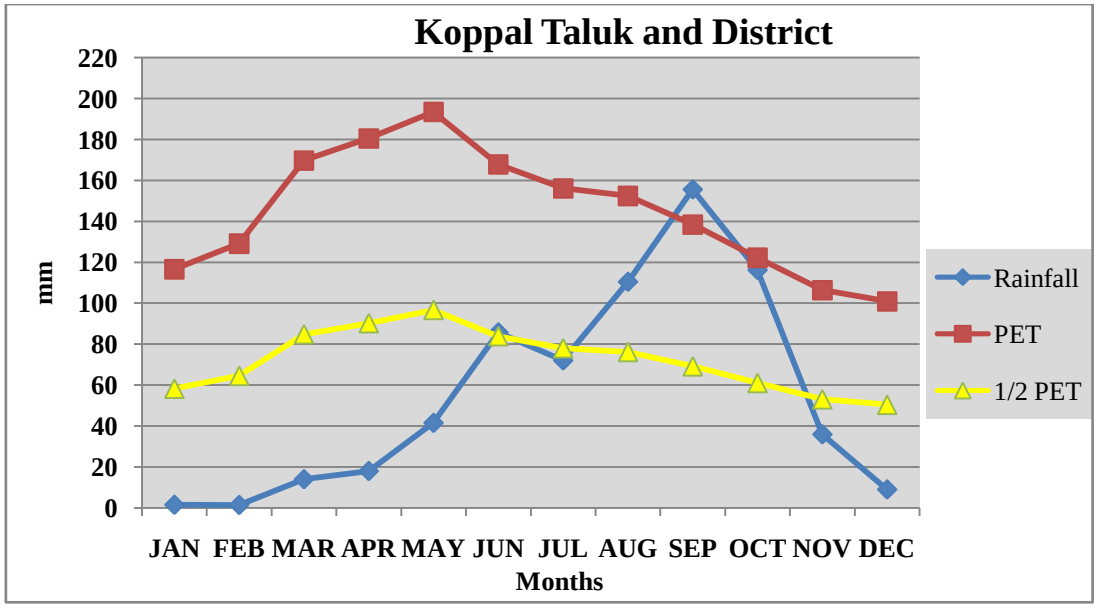


Fig. 2.3 Rainfall distribution in Koppal Taluk and District

2.6 Natural Vegetation

The natural vegetation is sparse comprising few tree species, shrubs and herbs. The mounds, ridges and boulders occupy sizeable areas which are under thin to moderately thick forest vegetation. Still, there are some remnants of the past forest cover which can be seen in patches in some ridges and hillocks in the microwatershed (Fig 2.4).

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

Fig 2.4 Natural vegetation of Gabbur-3 microwatershed

2.7 Land Utilization

About 91 per cent area (Table 2.2) in Koppal district is cultivated at present and about 16 per cent of the area is sown more than once. The cropping intensity is 118 per cent. An area of about 3 per cent is currently barren. Forests occupy a small area of about 5 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, bajra, cotton, safflower, sunflower, red gram, horse gram, onion, mulberry, pomegranate, sugarcane, bengalgram and groundnut (Fig 2.5). 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 Gabbur-3 Microwatershed is presented in Fig. 2.6. Simultaneously, enumeration of existing wells (bore wells and open wells) and other soil and water conservation structures in the microwatershed is made and their location in different survey numbers is marked on the cadastral map. Map showing the location of wells and other water bodies and conservation structures in Gabbur-3 Microwatershed is given Fig. 2.7.

Table 2.2 Land Utilization in Koppal District

Sl. no.	Agricultural land use	Area (ha)	Per cent
1	Total geographical area	552495	
2	Total cultivated area	500542	90.6
3	Area sown more than once	92696	16.8
4	Trees and groves	210	0.04
5	Cropping intensity	-	118
6	Forest	29451	5.33
7	Cultivable wasteland	2568	0.46
8	Permanent Pasture land	14675	2.66
9	Barren land	16627	3.01
10	Non agricultural land	40591	7.35
11	Current fallow	19660	3.56

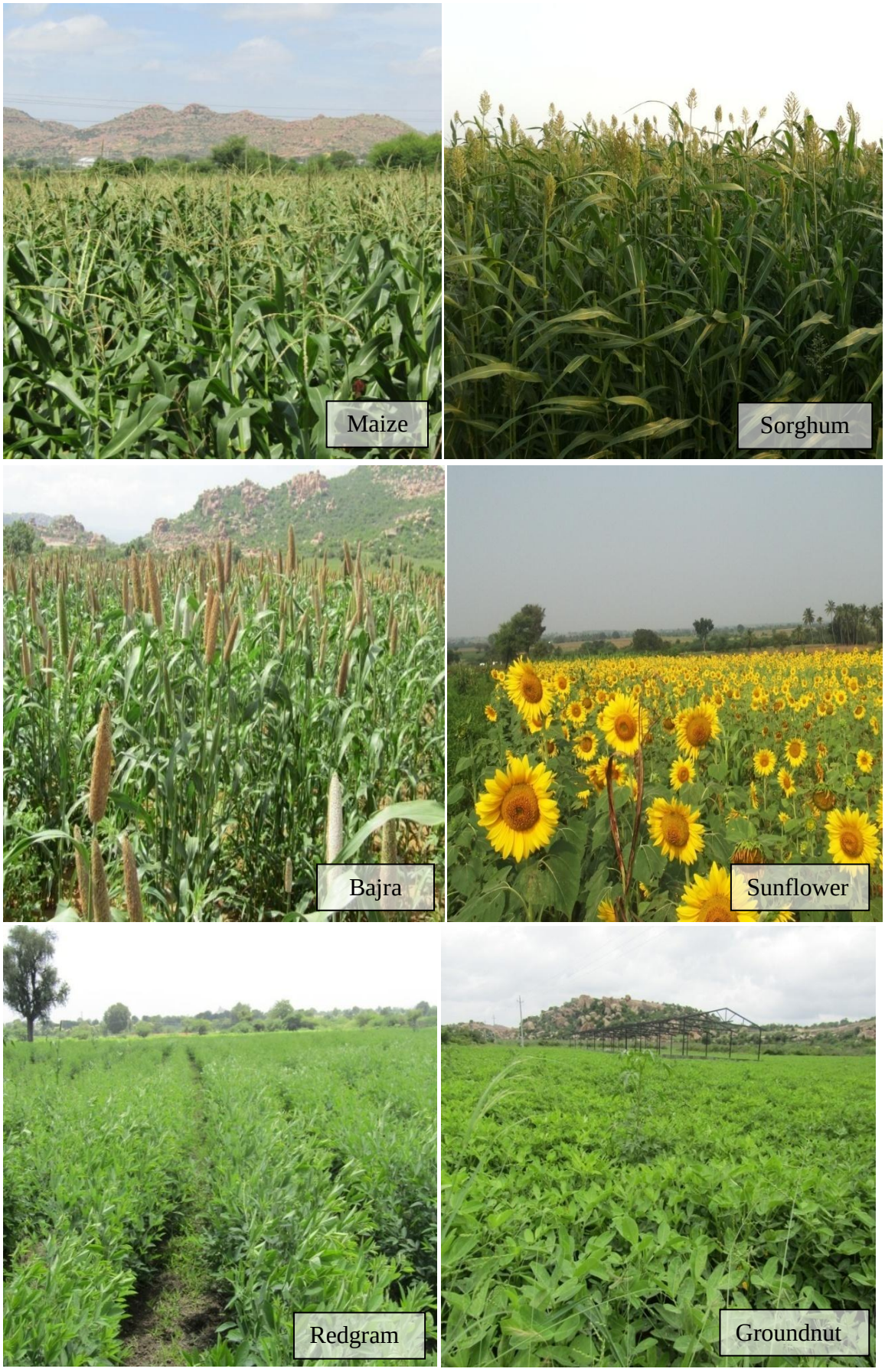


Fig. 2.5 (a) Different crops and cropping systems in Gabbur-3 Microwatershed

Fig. 2.5 (b) Different crops and cropping systems in Gabbur-3 Microwatershed

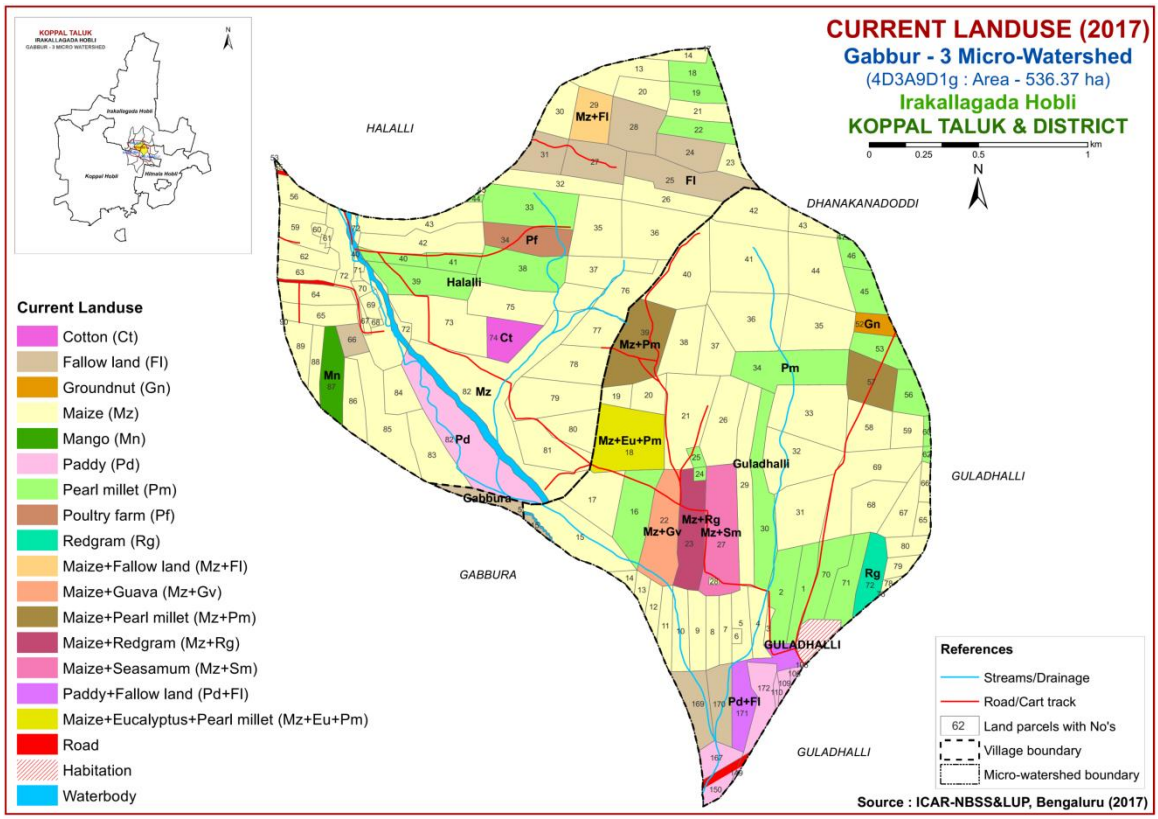


Fig. 2.6 Current Land Use – Gabbur-3 Microwatershed

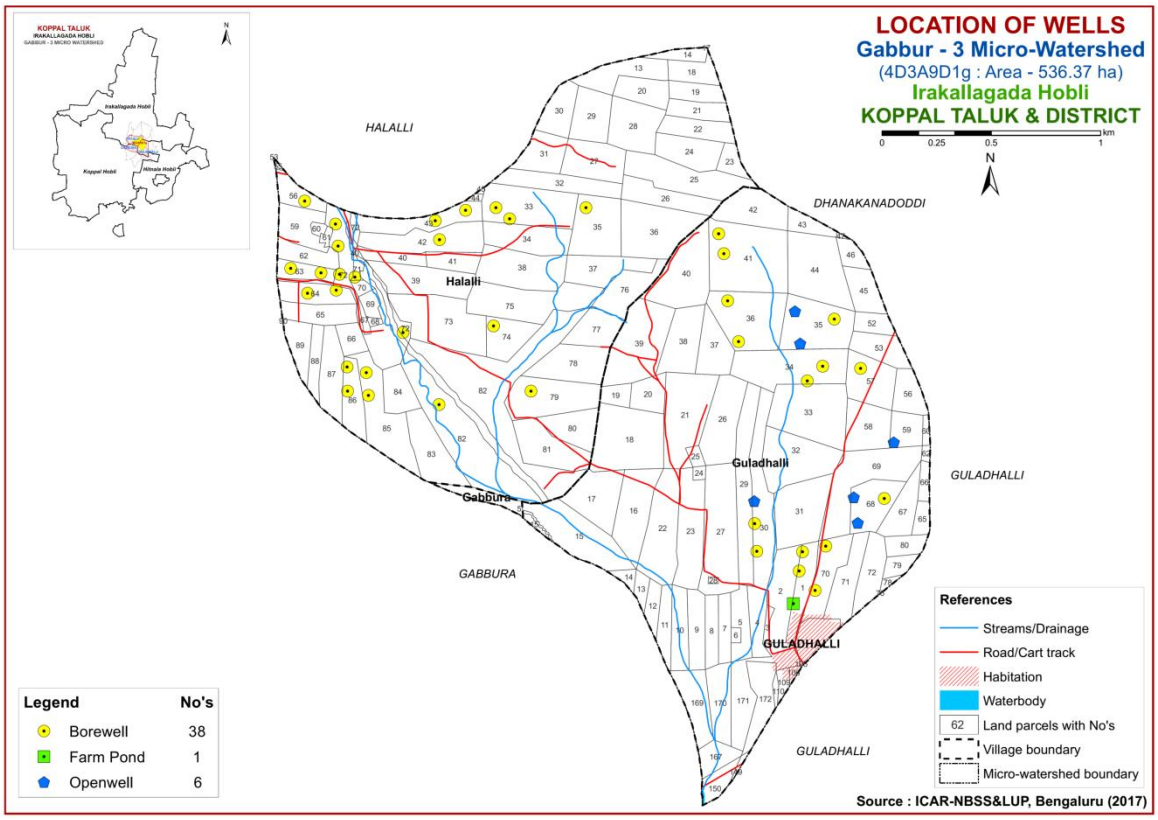


Fig. 2.7 Location of wells and conservation structures -Gabbur-3 Microwatershed

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 for given level of management. This was achieved in Gabbur-3 microwatershed by the detailed study of all the soil characteristics (depth, texture, colour, structure, consistence, coarse fragments, porosity, soil reaction, soil horizons etc.) and site (slope, 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 extent and geographic distribution on the microwatershed cadastral map. The detailed soil survey at 1:7920 scale was carried out in 536 ha area. The methodology followed for carrying out land resource inventory was as per the guidelines given in Soil Survey Manual (IARI, 1971; Soil Survey Staff, 2006; Natarajan *et al.,* 2015) which is briefly described below.

3.1 Base Maps

The detailed survey of the land resources occurring in the microwatershed was carried out by using digitized cadastral map and satellite imagery as base supplied by the 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 geology, landscapes, landforms and other surface features. The imagery helped in the identification and delineation of boundaries between hills, uplands and lowlands, water bodies, forest and vegetated areas, roads, habitations and other cultural features of the area (Fig. 3.2). The cadastral map was overlaid on the satellite imagery (Fig. 3.3) that helps to identify the parcel boundaries and other permanent features. Apart from cadastral maps and images, toposheets of the area (1:50,000 scale) were used for initial traversing, identification of geology, landscapes 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 (FCC) of Cartosat-I and LISS-IV merged satellite data covering the microwatershed area was visually interpreted using image interpretation elements and all the available collateral data with local knowledge. The delineated physiographic boundaries were transferred on to a cadastral map overlaid on satellite imagery. Physiographically, the area has been identified as granite gneiss and alluvial landscapes and is divided into landforms such as ridges, mounds and uplands based on slope. 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)

DSe Alluvial landscape

DSe 1 Summit

DSe 11 Nearly level Summit with dark grey tone

DSe 12 Nearly level Summit with medium grey tone

DSe 13 Nearly level Summit with whitish grey tone

DSe 14 Nearly level Summit with whitish tone (Calcareousness)

DSe 15 Nearly level Summit with pinkish grey tone

DSe 16 Nearly level Summit with medium pink tone

DSe 17 Nearly level Summit with bluish white tone

DSe 18 Nearly level Summit with greenish grey tone

DSe 2 Very genetly sloping

DSe 21 Very gently sloping, whitish tone

DSe 22 Very gently sloping, greyish pink tone

DSe 23 Very gently sloping, whitish grey tone

DSe 24 Very gently sloping, medium grey tone

DSe 25 Very gently sloping, medium pink tone

DSe 26 Very gently sloping, dark grey tone

DSe 27 Very gently sloping, bluish grey tone

DSe 28 Very gently sloping, greenish grey tone

DSe 29 Very gently sloping, Pinkish grey

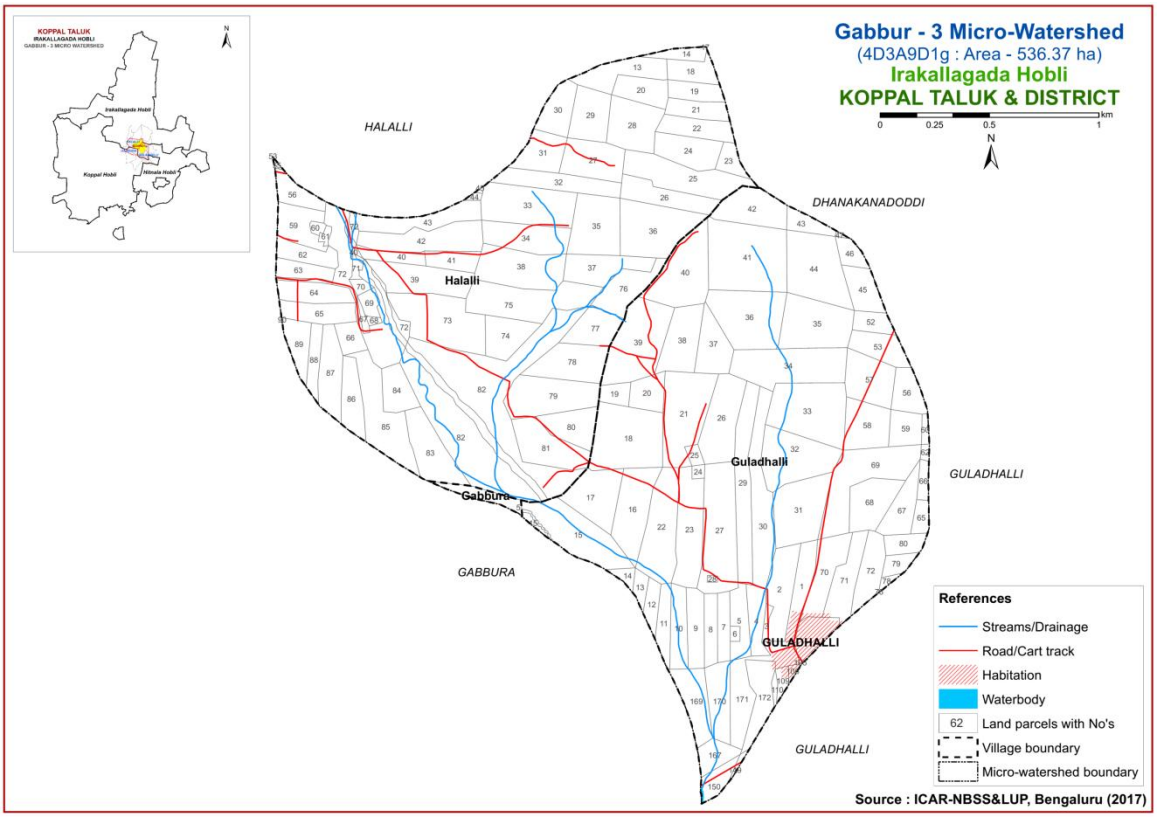


Fig. 3.1 Scanned and Digitized Cadastral map of Gabbur-3 Microwatershed

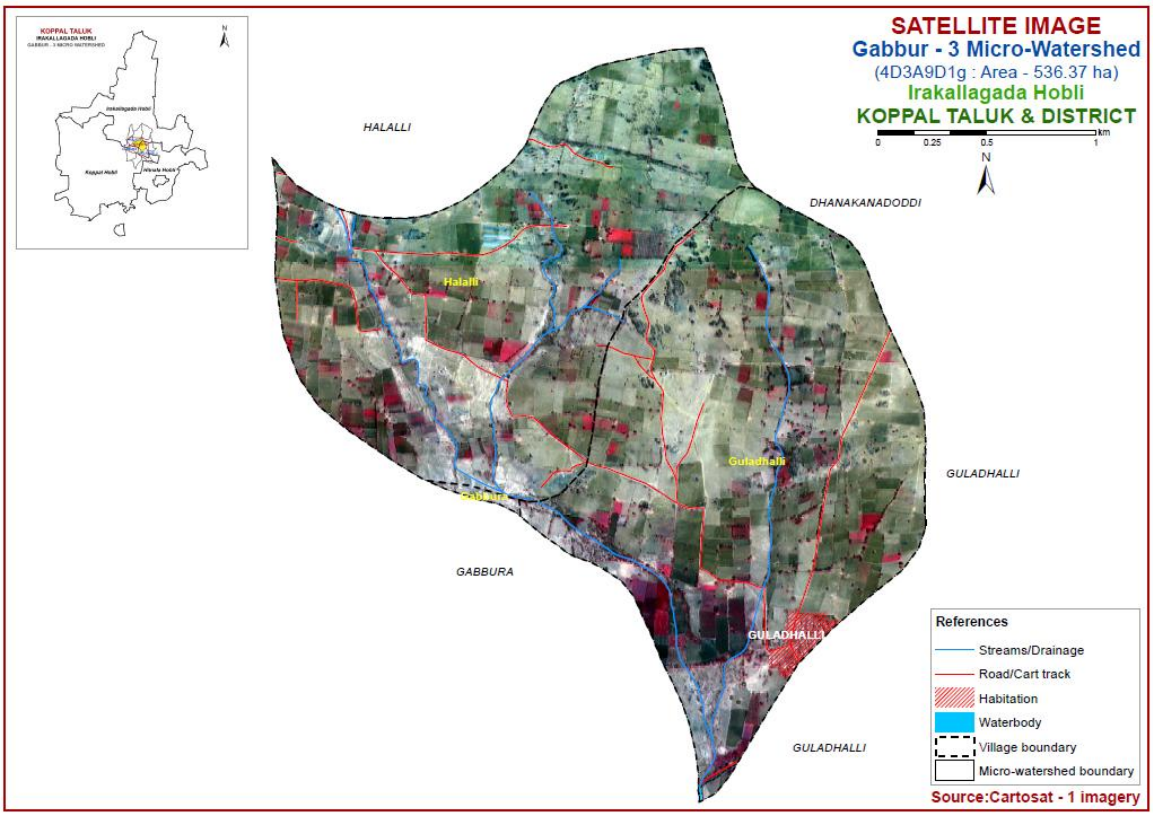


Fig. 3.2 Satellite Image of Gabbur-3 Microwatershed

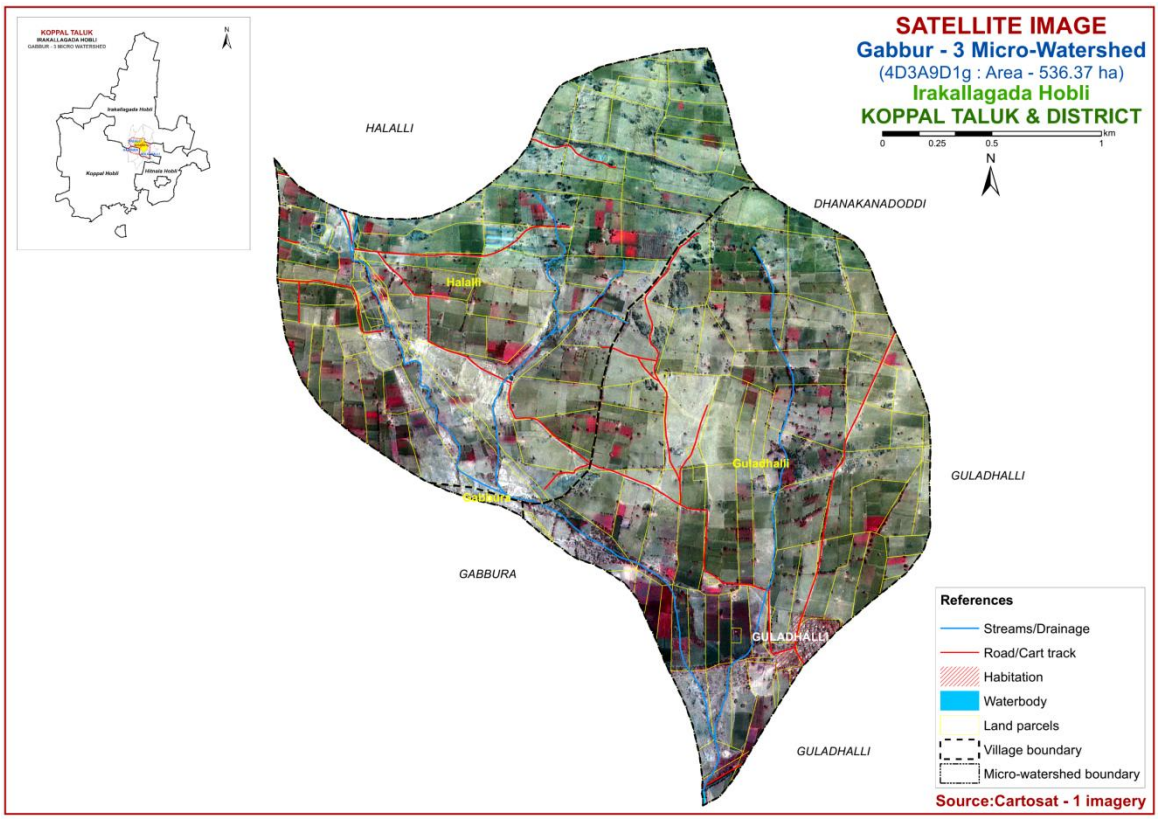


Fig. 3.3 Cadastral map overlaid on IRS PAN+LISS IV merged imagery of Gabbur-3 Microwatershed

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 plains 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).

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

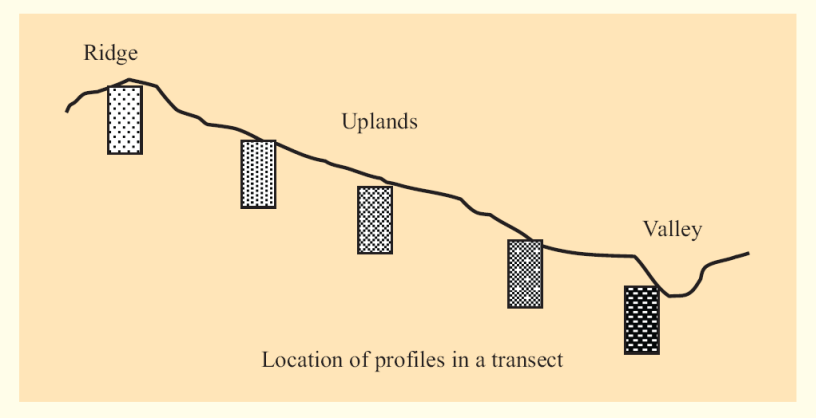


Fig. 3.4 Location of profiles in a transect

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, amount and nature of gravel present, calcareousness, nature of substratum etc, were used as the major differentiating characteristics for identifying soil series occurring in the area. The differentiating characteristics used for identifying the soil series are given in Table 3.1. Based on the above characteristics, 13 soil series were identified in Gabbur-3 Microwatershed.

Table 3.1 Differentiating Characteristics used for identifying Soil Series (Characteristics are of Series Control Section)

Soils of Granite gneiss Landscape							
Sl. No	**Soil Series**	**Depth (cm)**	**Colour (moist)**	**Texture**	**Gravel (%)**	**Horizon sequence**	**Calcareo-usness**
1	Harve (HRV)	25-50	2.5YR3/4,3/6 5YR3/3,4/4,3/4	gscl	>35	Ap-Bt-Cr-	-
2	Chikkasavanur (CSR)	25-50	7.5YR3/2,3/3,3/4	scl	<15	Ap-Bw-Cr	-
3	Lakkur (LKR)	50-75	2.5YR 2.5/3, 2.5/4, 3/4, 3/6	gsc	40-60	Ap-Bt-Bc-Cr	
4	Kethanapura (KTP)	50-75	2.5YR3/4, 3/6	scl	15-35	Ap-Bt-Cr	
5	Mukhadahalli (MKH)	50-75	5YR3/3,3/4,4/3, 5/4,6/6 2.5YR3/4	gscl	>35	Ap-Bt-Cr	
6	Bisarahalli (BSR)	75-100	5YR 3/3, 3/4	gsc	15-35	Ap-Bt-Cr	-
7	Chikkamegheri (CKM)	75-100	2.5YR2.5/3,3/4, 3/6	sc	-	Ap-Bt-Cr	
8	Balapur (BPR)	100-150	2.5YR2.5/4,3/4	gsc-gc	>35	Ap-Bt-Cr	-
9	Ranatur (RTR)	>150	2.5YR2.5/3,2.5/4, 3/3,4/6	c	-	Ap-Bt	-
10	Kaggalipura (KGP)	25-50	2.5YR2.5/4,3/4, 3/6	gscl-gsc	15-35	Ap-Bt-Cr	

Soils of Alluvial Landscape							
11	Narasapura (NSP)	75-100	10 YR 3/1, 3/2, 4/2,	c		Ap-Bw-Cr	e-es
12	Kadagathur (KDT)	>150	10YR 3/1, 3/2, 3/3, 7.5YR 3/3, 3/4	sc-c	-	Ap-Bw	
13	Gudigeri (GGR)	>150	10YR 2/1, 3/1, 3/2,	c-s-c	<15	Ap-Bss-C-2Bss	es-ev

3.4 Soil Mapping

The area under each soil series was further separated into 24 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 soil map (Fig. 3.5) in the form of symbols. During the survey many soil profile pits, few minipits and a few auger bores representing different landforms occurring in the microwatershed were studied. In addition to the profile study, spot observations in the form of minipits, road cuts, terrace cuts etc., were studied to validate the soil boundaries on the soil map. The soil map shows the geographic distribution of 24 mapping units representing 13 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 24 soil phases mapped in the microwatershed. Each mapping unit (soil phase) delineated on the map has similar soil and site characteristics. In other words, all the farms or survey numbers included in one phase will have similar management needs and have to be treated accordingly.

3.5 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 in the year 2017 from Gabbur-3 farmer's fields (52 samples) for fertility status (major and micronutrients) at 250 m grid interval were analyzed in the laboratory (Katyal and Rattan, 2003). By linking the soil fertility data to the survey numbers through GIS, soil fertility maps were generated using Kriging method for the microwatershed.

Table 3.2 Soil map unit description of Gabbur-3 Microwatershed

Soil map unit No*	Soil Series	Soil Phase Symbol	Mapping Unit Description	Area in ha (%)
Soils of Granite and Granite gneiss landscape				
	HRV	Harve soils are shallow (25-50 cm), well drained, dark red to dark reddish brown, red gravelly sandy clay loam soils occurring on nearly level to gently sloping uplands under cultivation		**53 (9.83)**
25		HRVhB2	Sandy clay loam surface, slope 1-3%, moderate erosion	25 (4.67)
465		HRVcB2g1	Sandy loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	28 (5.16)
	CSR	Chikkasavanur soils are shallow (25-50 cm), well drained, have dark brown to light yellowish brown, red sandy clay loam soils occurring on nearly level to very gently sloping uplands under cultivation		**6 (1.16)**
34		CSRcB1	Sandy loam surface, slope 1-3%, slight erosion	6 (1.16)
	LKR	Lakkur soils are moderately shallow (50-75 cm), well drained, have dark reddish brown to dark red, red gravelly sandy clay soils occurring on very gently to moderately sloping uplands under cultivation		**74 (13.82)**
46		LKRhB1	Sandy clay loam surface, slope 1-3%, slight erosion	33 (6.24)
452		LKRhB2g1	Sandy clay loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	41 (7.58)
	KTP	Kethanapura soils are moderately shallow (50-75 cm), well drained, have dark reddish brown gravelly red sandy clay loam soils occurring on very gently sloping uplands under cultivation		**36 (6.8)**
72		KTPhB2g1	Sandy clay loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	36 (6.8)
	MKH	Mukhadahalli soils are moderately shallow (50-75 cm), well drained, have dark brown to reddish brown gravelly red sandy clay loam soils occurring on gently very gently to gently sloping uplands under cultivation		**27 (5.11)**
76		MKHcB2	Sandy loam surface, slope 1-3%, moderate erosion	8 (1.58)
77		MKHcB2g1	Sandy loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	19 (3.53)
	BSR	Bisarahalli soils are moderately deep (75-100 cm), well drained, have dark reddish brown gravelly red sandy clay soils occurring on very gently sloping uplands under cultivation		**14 (2.53)**
159		BSRcB1	Sandy loam surface, slope 1-3%, slight erosion	14 (2.53)
	CKM	Chikkamegheri soils are moderately deep (75-100 cm), well drained, have dark brown to dark reddish brown red sandy clay soils occurring on nearly level to very gently sloping uplands under cultivation		**87 (16.18)**
171		CKMcB2	Sandy loam surface, slope 1-3%, moderate erosion	87 (16.18)
	BPR	Balapur soils are deep (100-150 cm), well drained, have dark reddish brown to dark red gravelly sandy clay to clay soils occurring on nearly level to gently sloping uplands under cultivation		**34 (6.27)**
215		BPRbB1g1	Loamy sand surface, slope 1-3%, slight erosion, gravelly (15-35%)	13 (2.34)
217		BPRbB2g1	Loamy sand surface, slope 1-3%, moderate erosion,	12 (2.24)

			gravelly (15-35%)	
225		BPRcB2g1	Sandy loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	1 (0.11)
228		BPRhB1	Sandy clay loam surface, slope 1-3%, slight erosion	8 (1.58)
	RTR	Ranatur soils are very deep (>150 cm), well drained, have dark reddish brown to dark red clay soils occurring on nearly level to very gently sloping uplands under cultivation		**29 (5.49)**
284		RTRcB1	Sandy loam surface, slope 1-3%, slight erosion	21 (3.87)
285		RTRcB2	Sandy loam surface, slope 1-3%, moderate erosion	1 (0.24)
288		RTRiB2	Sandy clay surface, slope 1-3%, moderate erosion	7 (1.38)
	KGP	Kaggalipura soils are shallow (25-50 cm), well drained, have dark reddish brown to dark red, gravelly sandy clay loam to sandy clay soils occurring on nearly level to moderately sloping uplands under cultivation		**6 (1.11)**
448		KGPcB2	Sandy loam surface, slope 1-3%, moderate erosion	6 (1.11)
Soils of Alluvial landscape				
	NSP	Narasapura soils are moderately deep (75-100 cm), moderately well drained, have dark grayish brown to very dark grayish brown and very dark gray, black, calcareous, cracking clay soils occurring on nearly level to very gently sloping plains under cultivation		**33 (6.19)**
353		NSPcB1g1	Sandy loam surface, slope 1-3%, slight erosion, gravelly (15-35%)	33 (6.19)
	KDT	Kadagathur soils are very deep (>150 cm), moderately well drained, have dark brown to very dark grayish brown, sandy clay to clay black soils occurring on nearly level to very gently sloping plains under cultivation		**69 (12.84)**
399		KDTbB2	Loamy sand surface, slope 1-3%, moderate erosion	45 (8.36)
403		KDTmA1	Clay surface, slope 0-1%, slight erosion	24 (4.48)
	GGR	Gudigeri soils are very deep (>150 cm), well drained, have very dark gray to very dark grayish brown and black calcareous clay soils occurring on very gently sloping plains under cultivation		**24 (4.51)**
461		GGRhB2	Sandy clay loam surface, slope 1-3%, moderate erosion	0.1 (0.04)
462		GGRhB2g1	Sandy clay loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	24 (4.47)
999	Rock outcrops		Rock lands, both massive and bouoldary	15 (2.77)
1000	Others		Habitaion and waterbody	5 (0.92)

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

3.6 Land Use Classes

The 24 soil phases identified and mapped in the microwatershed were regrouped into 6 Land Use Classes (LUC'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 Use Classes (LUC'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 LUCs. For Gabbur-3 Microwatershed, five soil and site characteristics, namely soil depth, soil texture, slope, erosion and gravel content have been considered for defining LUCs. The land use classes are expected to behave similarly for a given level of management.

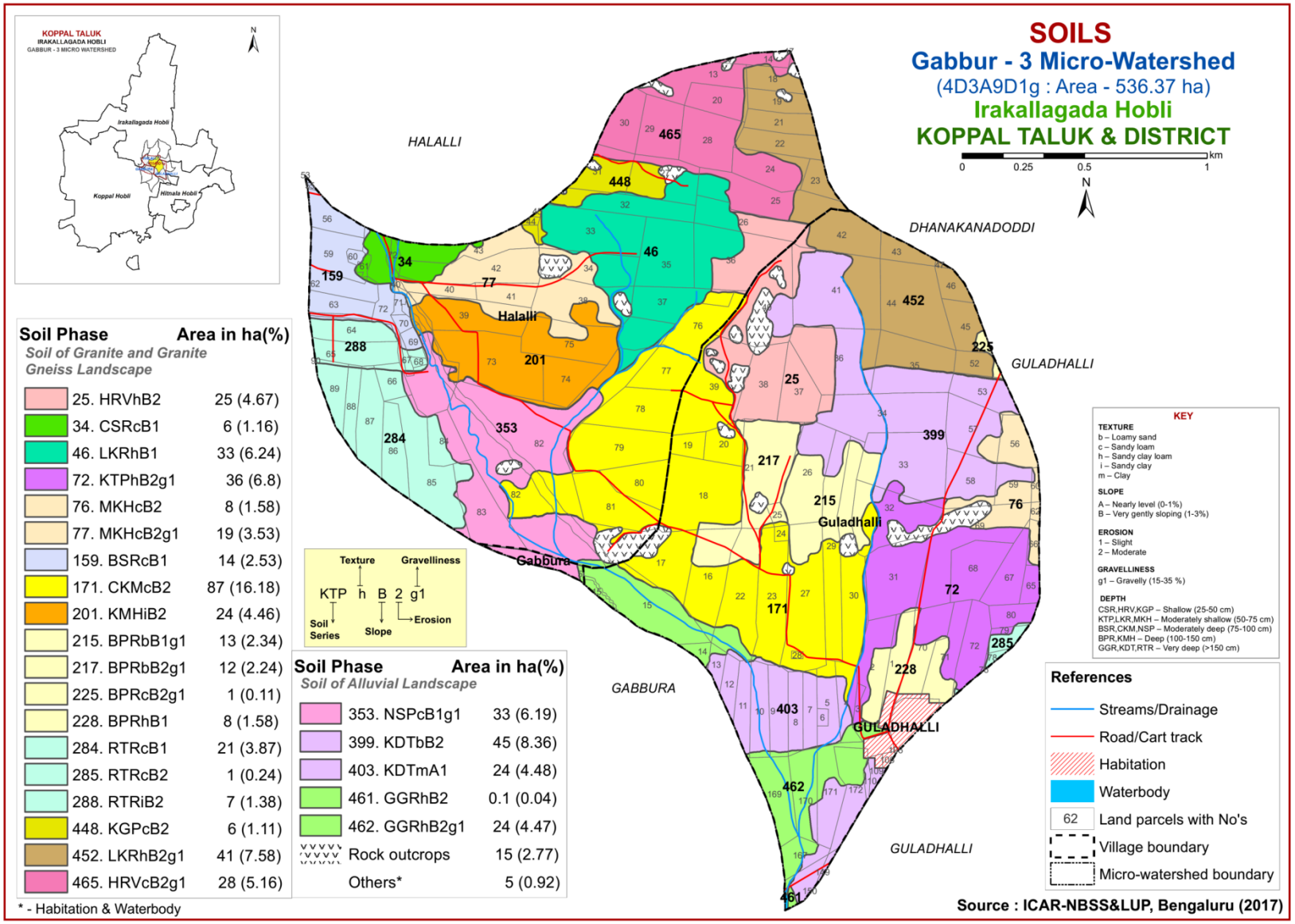


Fig 3.4 Soil Phase or Management Units-Gabbur-3 Microwatershed

Chapter 4

THE SOILS

Detailed information pertaining to the nature, extent and distribution of different kinds of soils occurring in Gabbur-3 microwatershed is provided in this chapter. The microwatershed area has been identified as granite gneiss and alluvial landscapes based on geology. In all, 13 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 13 soil series identified followed by 24 soil phases (management units) mapped (Fig. 3.4) are furnished below. The physical and chemical characteristics of soil series identified in Gabbur-3 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, 10 soil series are identified and mapped. Of these, Chikkamegheri (CKM) series occupies maximum area of 87 ha (16%), Lakkur (LKR) 74 ha (14%), Harve (HRV) 53 ha (10%), Kethanapura (KTP) 36 ha (7%), Balapur (BPR) 34 ha (6%), Ranatur (RTR) 29 ha (5%), Bisarahalli (BSR) 14 ha (3%) and other series occupy minor area in the microwatershed. The brief description of each soil series along with the soil phases identified and mapped is given below.

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

The thickness of the solum ranges from 28 to 48 cm. The thickness of A-horizon ranges from 12 to 17 cm. Its colour is in 5YR and 2.5 YR hue with value 3 to 4 and chroma 4 to 6. The texture varies from loamy sand to sandy loam with 20 to 60 per cent gravel. The thickness of B-horizon ranges from 16 to 32 cm. Its colour is in 2.5 YR and 5 YR hue with value 3 to 4 and chroma 4 to 6. Its texture is sandy clay loam with gravel content of more than 35 per cent. The available water capacity is very low (<50 mm/m). Two phases were identified and mapped.

Landscape and soil profile characteristics of Harve (HRV) Series

4.1.2 Chikkasavanur (CSR) Series: Chikkasavanur soils are shallow (25-50 cm), well drained, have dark brown to light yellowish brown sandy clay loam soils. They have developed from granite gneiss and occur on very gently sloping uplands. The Chikkasavanur series has been tentatively classified as a member of the fine-loamy, mixed, isohyperthermic family of Typic Haplustepts.

The thickness of the solum ranges from 32 to 49 cm. The thickness of A horizon ranges from 12 to 23 cm. Its colour is in 7.5 YR and 10 YR hue with value 2.5 to 4 and chroma 3 to 6. The texture varies from sandy loam to clay with 10 to 20 per cent gravel. The thickness of B horizon ranges from 16 to 32 cm. Its colour is in 7.5 YR and 5 YR hue with value 3 and chroma 2 to 4. Its texture is sandy clay loam with gravel content of < 15 per cent. The available water capacity is low (50-100 mm/m). Only one phase was identified and mapped.

Landscape and soil profile characteristics of Chikkasavanur (CSR) Series

4.1.3 Lakkur (LKR) Series: Lakkur soils are moderately shallow (50-75cm), well drained, have reddish brown to dark red gravelly sandy clay red soils. They have

developed from granite gneiss and occur on nearly level to very gently and gently sloping uplands. The Lakkur series has been classified as a member of the clayey-skeletal, mixed, isohyperthermic family of Typic Rhodustalfs.

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

Landscape and soil profile characteristics of Lakkur (LKR) Series

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

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

Landscape and soil profile characteristics of Kethanapura (KTP) Series

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

The thickness of the solum ranges from 51 to 72 cm. The thickness of A horizon ranges from 12 to 17 cm. Its colour is in 5 YR and 7.5 YR hue with value 3 to 4 and chroma 2 to 4. The texture varies from loamy sand to sandy loam with 20 to 45 per cent gravel. The thickness of B horizon ranges from 40 to 68 cm. Its colour is in 2.5 YR and 5 YR hue with value and chroma 3 to 6. Texture is sandy clay loam to sandy clay with 35 to 50 per cent gravel. The available water capacity is low (50-100 mm/m). Two soil phases were identified and mapped.

Landscape and soil profile characteristics of Mukhadahalli (MKH) Series

4.1.6 Bisarahalli (BSR) Series: Bisarahalli soils are moderately deep (75-100 cm), well drained, have dark reddish brown gravelly sandy clay red soils. They have developed from weathered granite gneiss and occur on very gently sloping uplands under cultivation.

The thickness of the solum ranges from 75 to 98 cm. The thickness of A horizon ranges from 17 to 25 cm. Its colour is in 5 YR hue with value 3 to 4 and chroma 3 to 6. The texture ranges from sandy clay loam to sandy clay with 15 to 35 per cent gravel. The thickness of B horizon ranges from 61 to 79 cm. Its colour is in 5 YR hue with value 3 and chroma 3 to 4. Its texture is gravelly sandy clay with gravel content of 15-35 per cent. The available water capacity is low (50-100 mm/m). Only one phase was identified and mapped.

Landscape and soil profile characteristics of Bisarahalli (BSR) Series.

4.1.7 Chikkamegheri (CKM) Series: Chikkamegheri soils are moderately deep (75-100 cm), well drained, have dark brown to dark reddish brown and red sandy clay soils. They have developed from granite gneiss and occur on nearly level to very gently sloping uplands. The Chikkamegheri series has been classified as a member of the fine, mixed, isohyperthermic family of Rhodic Paleustalfs.

The thickness of the solum ranges from 76 to 100 cm. The thickness of A horizon ranges from 11 to 24 cm. Its colour is in 7.5 YR, 5YR and 2.5 YR hue with value 2 to 4 and chroma 3 to 6. The texture varies from sandy clay loam to sandy clay with 10 to 15 per cent gravel. The thickness of B horizon ranges from 65 to 86 cm. Its colour is in 2.5 YR hue with value 2.5 to 3 and chroma 3 to 6. Its texture is dominantly sandy clay to clay. The available water capacity is medium (100-150 mm/m). Only one phase was identified and mapped.

Landscape and soil profile characteristics of Chikkamegheri (CKM) Series

4.1.8 Balapur (BPR) Series: Balapur soils are deep (100-150 cm), well drained, have dark reddish brown to dark red gravelly sandy clay to clay soils. They are developed from weathered granite gneiss and occur on very gently to gently sloping uplands. The Balapur series has been classified as a member of the clayey-skeletal, mixed, isohyperthermic family of Typic Rhodustalfs.

The thickness of the solum ranges from 102 to 147 cm. The thickness of A horizon ranges from 12 to 17cm. Its colour is in 5 YR and 2.5 YR hue with value and chroma 3 to 4. The texture ranges from loamy sand to sandy clay with 15 to 50 per cent gravel. The thickness of B horizon ranges from 90 to 132 cm. Its colour is in 2.5 YR hue with value 2.5 to 3 and chroma 4 to 6. Texture is sandy clay to clay with 35 to 50 per cent gravel. The available water capacity is low (51-100 mm/m). Four phases were identified and mapped.

Landscape Soil Profile Characteristics of Balapur (BPR) Series

4.1.9 Ranatur (RTR) Series: Ranatur soils are very deep (> 150 cm), well drained, have dark reddish brown to dark red clayey soils. They have developed from granite gneiss and occur on very gently sloping uplands. The Ranatur series has been classified as a member of the fine, mixed, isohyperthermic family of Rhodic Paleustalfs.

The thickness of the solum is more than 150 cm. The thickness of A horizon ranges from 8 to 14 cm. Its colour is in 5 YR and 2.5 YR hue with value 2.5 to 4 and chroma 3 to 6. The texture varies from sandy loam to sand clay. The thickness of B horizon is more than 150 cm. Its colour is in 2.5 YR hue with value 2.5 to 3 and chroma 3 to 6. Its texture is clay. The available water capacity is high (150-200 mm/m). Two phases were identified and mapped.

Landscape and soil profile characteristics of Ranatur (RTR) Series

4.1.10 Kaggalipura (KGP) Series: Kaggalipura soils are shallow (25-50 cm), well drained, have brown to dark reddish brown sandy clay loam to sandy clay soils. They

have developed from granite gneiss and occur on very gently sloping uplands. The Kaggalipura series has been tentatively classified as a member of the fine, mixed, isohyperthermic family of Typic Rhodustalfs.

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

Landscape and soil profile characteristics of Kaggalipura (KGP) Series

4.2 Soils of Alluvial landscape

In this landscape, three soil series has been identified and mapped. Of these, Kadagathur (KDT) series occupies an area of 69 ha (13%) followed by Narasapura (NSP) 33 ha (6%), Kumchahalli (KMH) 24 ha (4%) and Gudigeri (GGR) 24 ha (5%) area. The brief description of soil series along with the soil phases identified and mapped is given below.

4.2.1 Narsapura (NSP) series: Narasapura soils are moderately deep (75-100 cm), moderately well drained, have dark grayish brown to very dark grayish brown and very dark gray, black, calcareous, cracking clay soils They have developed from alluvium and occur on very gently sloping uplands. The Narsapura series has been classified as a member of the very fine, smectitic, isohyperthermic (calc) family of Typic Haplustepts.

The thickness of the solum is 76 to 98 cm. The thickness of A horizon ranges from 15 to 19 cm. Its colour is in 10 YR hue with value 3 and chroma 1 to 2.The texture is clay with no gravel. The thickness of B horizon ranges from 57 to 83 cm. Its colour is

in 10 YR hue with value 3 to 5 and chroma 1 to 3. Its texture is clay. The available water capacity is medium (101-150 mm/m). Only one phase was identified and mapped.

Landscape and soil profile characteristics of Narsapura (NSP) series

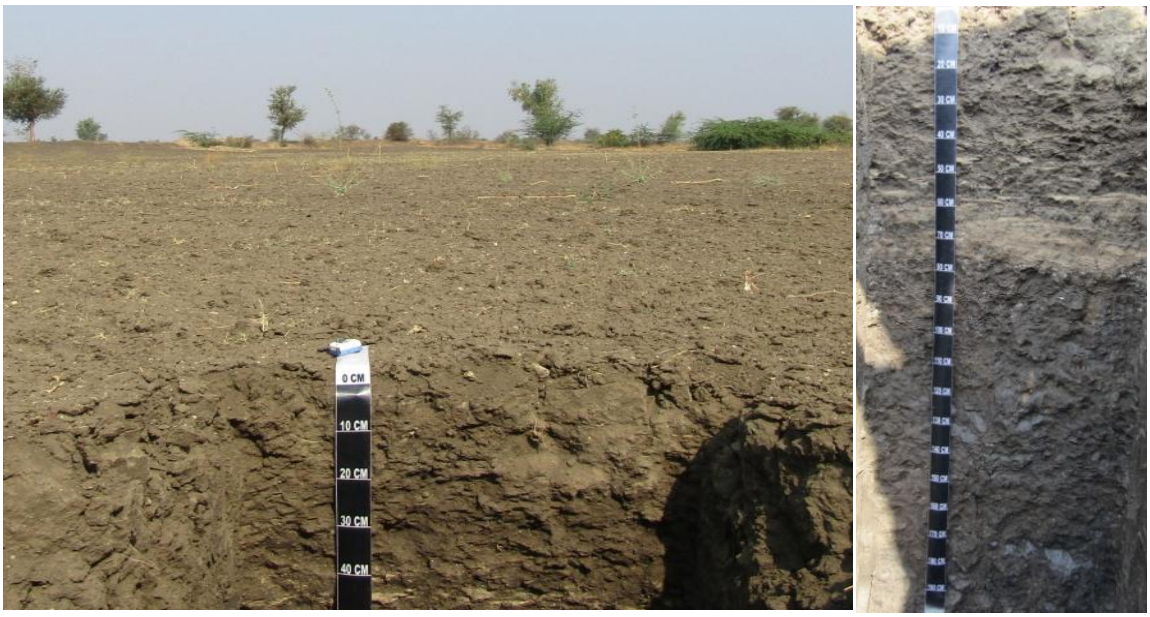
4.2.2 Kadagathur (KDT) Series: Kadagathur soils are very deep (>150 cm), moderately well drained, have dark brown to very dark grayish brown sandy clay to clay soils. They have developed from alluvium and occur on nearly level to very gently sloping uplands under cultivation.

The thickness of the solum is more than 150 cm. The thickness of A horizon ranges from 8 to 14 cm. Its colour is in 10 YR hue with value 3 and chroma 4. The texture varies is sandy loam. The thickness of B horizon is more than 150 cm. Its colour is in 10 YR and 7.5 YR hue with value 3 and chroma 1 to 4. Its texture is sandy clay to clay. The available water capacity is very high (>200 mm/m). Two phases were identified and mapped.

Landscape and soil profile characteristics of Kadagathur (KDT)

4.2.3 Gudigeri (GGR) Series: Gudigeri soils are very deep (>150 cm), well drained, have very dark gray to very dark grayish brown and black calcareous clay soils. They are developed from alluvium and occur on very gently sloping uplands under cultivation.

The thickness of the solum is more than 150 cm. The thickness of A horizon ranges from 8 to 20 cm. Its colour is in 10 YR hue with value 3 and chroma 2. The texture is clay. The thickness of B horizon is more than 150 cm. Its colour is in 10 YR hue with value 2 to 3 and chroma 1 to 2. Its texture is clay and are calcareous. The available water capacity is very high (>200 mm/m).



Landscape and soil profile characteristics of Gudigeri (GGR) Series

Table: 4.1 Physical and Chemical Characteristics of Soil Series identified in Gabbur-3 microwatershed

Soil Series: Lakkur (LKR), **Pedon:** RM-8.
Location: $15^0$04'26.3"N, $75^0$37'84.1"E, (4D4A3I1f), Belhatti village, Shirahatti taluk, Gadag distrtict
Analysis at: NBSS&LUP, Regional Centre, Bengaluru **Classification:** Clayey-skeletal, mixed, isohyperthermic Typic Rhodustalfs

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

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

Contd...

Series Name: Mukahadahalli (MKH), Pedon: R-11
Location: $15^0$22'05.4"N, $76^0$04'10.3"E, Halageri village, Koppal taluk and district
Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Clayey-skeletal, 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
0-19	Ap	65.71	8.83	25.46	9.27	9.06	14.42	21.52	11.43	70	scl	16.54	8.60
19-32	Bt	55.89	11.13	32.98	6.47	9.18	11.89	19.19	9.18	50	scl	19.24	12.78
32-58	Bt	47.95	10.41	41.63	17.52	3.78	9.13	9.55	7.97	50	sc	24.03	16.02

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}							%	%
0-19	7.38	-	-	0.09	0.2	0.00	8.97	4.32	0.26	0.22	13.77	14.84	0.58	93	1.49
19-32	7.5	-	-	0.106	0.41	0.00	15.98	3.27	0.16	0.50	19.91	20.88	0.63	95	2.38
32-58	7.46	-	-	0.173	0.49	0.00	19.71	4.53	0.23	1.32	25.79	25.76	0.62	100	5.11

Contd...

Series Name: Chikkamegheri (CKM), Pedon: RM-2
Location: $15^0$21'40"N, $76^0$16'43"E, Gudanahalli village, Koppal taluk and district
Analysis at: NBSS&LUP, Regional Centre, Bangalore. Classification: Fine, mixed, isohyperthermic Rhodic Paleustalfs

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-10	Ap	66.80	5.51	27.69	10.14	10.04	20.29	14.75	11.58	-	scl	20.59	7.15
10-25	Bt1	39.52	7.17	53.32	8.75	9.59	7.27	8.43	5.48	-	c	26.96	13.99
25-38	Bt2	42.00	7.16	50.84	13.16	8.74	6.42	8.53	5.16	-	c	26.51	13.42
38-55	Bt3	41.77	10.31	47.92	15.19	8.54	6.33	7.38	4.32	10	c	25.28	14.10
55-70	Bt4	44.03	8.96	47.01	15.72	9.22	6.92	6.81	5.35	20	c	24.30	14.35
70-90	Bt5	56.02	8.46	35.52	11.41	17.07	12.36	10.26	4.92	25	sc	20.59	13.06

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	7.99	-	-	0.326	0.83	4.44	9.35	4.76	0.28	0.54	14.93	12.50	0.45	119	4.33
10-25	7.36	-	-	0.345	0.99	2.40	10.37	4.84	0.10	1.18	16.48	17.60	0.33	94	6.68
25-38	6.69	-	-	0.477	0.79	0.00	10.25	4.20	0.09	1.61	16.15	16.10	0.32	100	10.01
38-55	6.45	-	-	0.548	0.63	0.00	9.43	2.86	0.10	1.52	13.91	14.80	0.31	94	10.27
55-70	6.35	-	-	0.532	0.71	0.00	9.59	2.79	0.11	1.66	14.16	14.60	0.31	97	11.39
70-90	6.44	-	-	0.613	0.27	0.00	9.58	3.10	0.19	1.87	14.74	14.70	0.41	100	12.69

Contd...

Series Name: Kumchahalli (KMH), Pedon: RM-1
Location: $15^0$20'05"N, $76^0$13'21"E, Basapura village, Koppal taluk and district
Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Fine, mixed, isohyperthermic Typic Rhodustalfs

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-13	Ap	51.76	9.05	39.19	7.99	8.84	13.42	14.38	7.14	-	sc	20.08	13.69
13-27	Bt1	53.50	8.12	38.38	7.00	11.05	15.21	14.33	5.91	-	sc	17.05	12.32
27-43	Bt2	63.60	5.01	31.40	3.85	11.56	24.52	18.52	5.14	-	scl	11.76	9.09
43-64	Bt3	48.74	5.91	45.35	8.87	9.31	12.49	12.27	5.81	10	sc	16.68	13.35
64-84	Bt4	45.13	8.90	45.97	9.86	7.12	10.95	10.62	6.57	20	sc	17.45	13.42
84-114	Bt5	65.04	6.94	28.02	10.49	16.21	17.80	13.88	6.67	40	scl	13.20	9.75

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}							%	%
0-13	7.2	-	-	0.193	0.81	3.00	9.69	3.93	1.41	0.08	15.10	15.07	0.38	100	0.54
13-27	7.13	-	-	0.161	0.7	3.00	8.69	3.57	1.29	0.16	13.70	13.75	0.36	100	1.14
27-43	7.31	-	-	0.096	0.89	2.64	5.19	2.36	1.07	0.24	8.86	9.46	0.30	94	2.51
43-64	7.65	-	-	0.089	1.16	2.52	8.25	2.88	0.72	0.35	12.20	12.65	0.28	96	2.79
64-84	7.98	-	-	0.1	0.38	3.12	10.49	2.88	0.26	0.41	14.04	14.63	0.32	96	2.78
84-114	8.23	-	-	0.121	0.58	2.88	8.02	1.87	0.09	0.43	10.41	10.67	0.38	98	4.02

Contd...

Soil Series: Balapur (BPR), Pedon: RM-78
Location: $13^0$26'39"N, $76^0$35'03"E, (4D3D8G2c), Kasaba, Chikkanayakanahalli taluk, Tumakur district
Analysis at: NBSS&LUP, Regional Centre, Bengaluru **Classification:** Clayey-skeletal, mixed, isohyperthermic Typic Rhodustalfs

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-12	Ap	65.66	18.66	15.68	4.14	6.16	13.33	21.82	20.20	-	sl	-	-
12-34	Bt1	61.91	11.52	26.57	2.36	6.78	12.53	21.36	18.89	-	scl	-	-
34-60	Bt2	51.81	11.24	36.94	4.66	5.70	12.23	15.96	13.26	30	sc	-	-
60-84	Bt3	46.61	9.02	44.37	14.70	6.88	7.51	8.97	8.55	55	sc	-	-
84-112	Bt4	48.75	12.92	38.33	15.73	8.13	6.87	8.23	9.79	60	sc	-	-
112-127	Bc	50.98	24.74	24.28	5.25	4.63	5.15	10.92	25.03	50	scl	-	-

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-12	6.64	-	-	0.03	0.56	0.00	1.90	1.32	0.21	0.03	3.46	5.45	0.35	63.48	0.51
12-34	6.99	-	-	0.02	0.48	0.00	3.66	1.90	0.07	0.08	5.70	7.82	0.29	72.93	0.96
34-60	7.29	-	-	0.02	0.40	0.00	5.13	2.08	0.11	0.20	7.52	11.19	0.30	67.18	1.75
60-84	7.50	-	-	0.02	0.32	0.00	5.83	6.36	0.13	0.23	12.55	12.38	0.28	101.43	1.83
84-112	7.54	-	-	0.02	0.24	0.00	6.02	6.59	0.11	0.25	12.96	12.77	0.33	101.49	1.97
112-127	7.90	-	-	0.02	0.20	0.00	8.04	3.62	0.07	0.32	12.04	12.47	0.51	96.56	2.55

Contd...

Soil Series: Ranatur (RTR), Pedon: RM-87
Location: $13^0$21'49.0"N, $76^0$38'06"E, (4B3D4L2a), J C Pura village, Chikkanayakanahalli taluk, Tumakuru district
Analysis at: NBSS&LUP, Regional Centre, Bengaluru **Classification:** Fine, mixed, isohyperthermic Rhodic Paleustalfs

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-17	Ap	84.16	9.46	6.38	2.22	18.57	26.14	24.32	12.92	-	ls	-	-
17-47	Bt1	51.14	8.30	40.56	1.66	13.49	14.52	13.59	7.88	-	sc	-	-
47-89	Bt2	51.99	11.01	37.00	1.94	13.99	15.32	13.18	7.56	-	sc	-	-
89-123	Bt3	51.58	9.07	39.35	3.47	14.50	14.61	11.64	7.35	-	sc	-	-
123-152	Bt4	47.89	8.88	43.23	2.27	12.36	14.21	11.12	7.93	-	sc	-	-
152-198	Bt5	43.37	13.17	43.45	2.48	9.83	13.25	10.87	6.94	-	c	-	-

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-17	5.08	-	-	0.03	0.52	0.00	3.68	0.72	0.06	0.19	4.65	9.21	1.44	50.50	2.06
17-47	6.28	-	-	0.03	0.48	0.00	3.93	0.72	0.08	0.07	4.80	7.92	0.20	60.59	0.94
47-89	6.42	-	-	0.03	0.40	0.00	4.40	0.74	0.08	0.06	5.28	7.52	0.20	70.15	0.79
89-123	6.50	-	-	0.02	0.32	0.00	4.44	0.76	0.09	0.07	5.36	7.82	0.20	68.58	0.93
123-152	6.52	-	-	0.02	0.28	0.00	4.40	0.71	0.09	0.07	5.26	8.22	0.19	64.00	0.81
152-198	7.09	-	-	0.02	0.24	0.00	6.10	0.98	0.10	0.20	7.38	9.60	0.22	76.89	2.09

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 thematic maps generated are described below.

5.1 Land Capability Classification

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

The 24 soil map units identified in the Gabbur-3 microwatershed are grouped under two land capability classes and five land capability subclasses (Fig. 5.1).

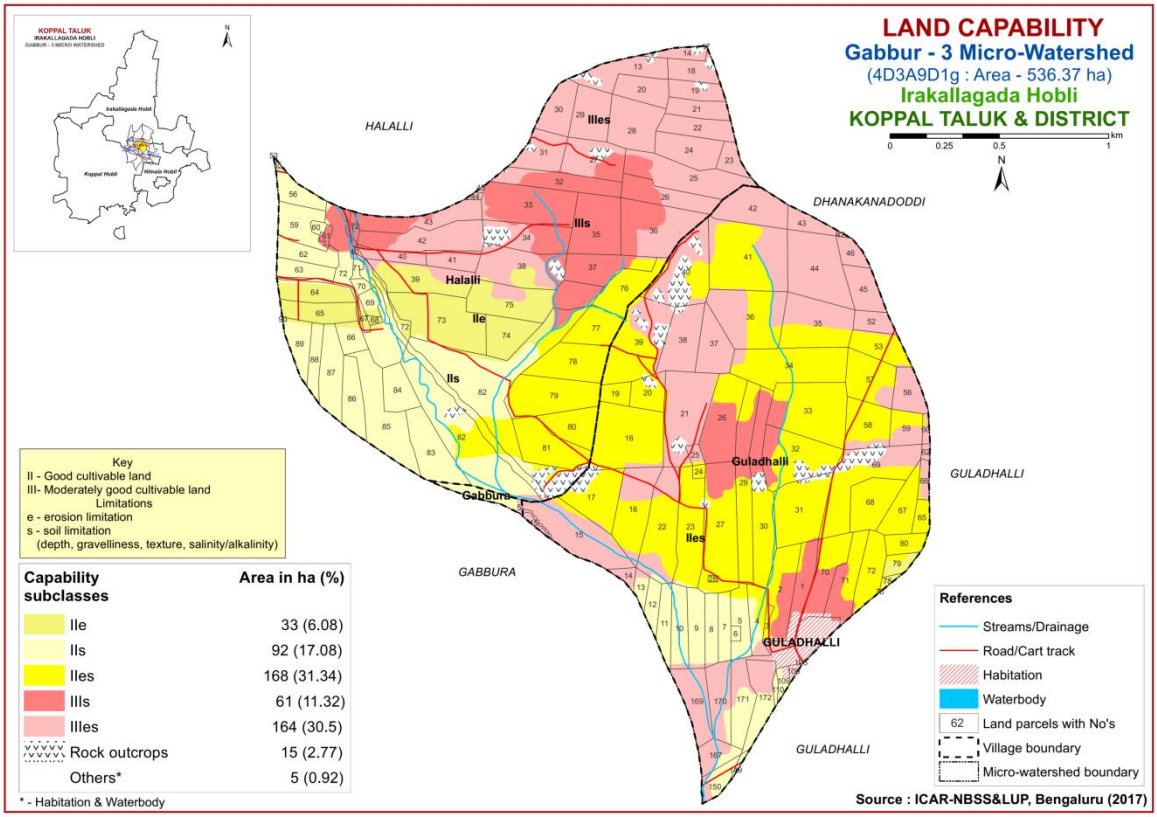


Fig. 5.1 Land Capability map of Gabbur-3 Microwatershed

Entire area in the microwatershed is suitable for agriculture except for 15 ha (3%) which is under rock lands. An area of 293 ha (55%) is good cultivable lands (Class II) that have minor limitations and require moderate conservation practices and are distributed in the major part of the microwatershed. Moderately good cultivable lands (Class III) cover an area of 225 ha (42%) and are distributed in the northern, northwestern, southern, southwestern and central part of the microwatershed with moderate problems of soil that require special conservation practices.

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 (Fig. 5.2).

Shallow to moderately shallow (25-75 cm) soils occupy an area of 203 ha (38%) and are distributed in the northern, northeastern and eastern part of the microwatershed. Moderately deep soils (75-100 cm) occupy an area of 134 ha (25%) and occur in the northwestern, southwestern and central part of the microwatershed. Deep (100-150 cm) to very deep (>150 cm) soils occupy an area of 181 ha (34%) and are distributed in the western, eastern and southern part of the microwatershed.

The most problem lands with an area of about 65 ha (12%) having shallow (25-50 cm) rooting depth. They are suitable for growing short duration agricultural crops but well suited for pasture, forestry or other recreational purposes. The most productive lands cover about 181 ha (34%) where all climatically adapted long duration crops be grown.

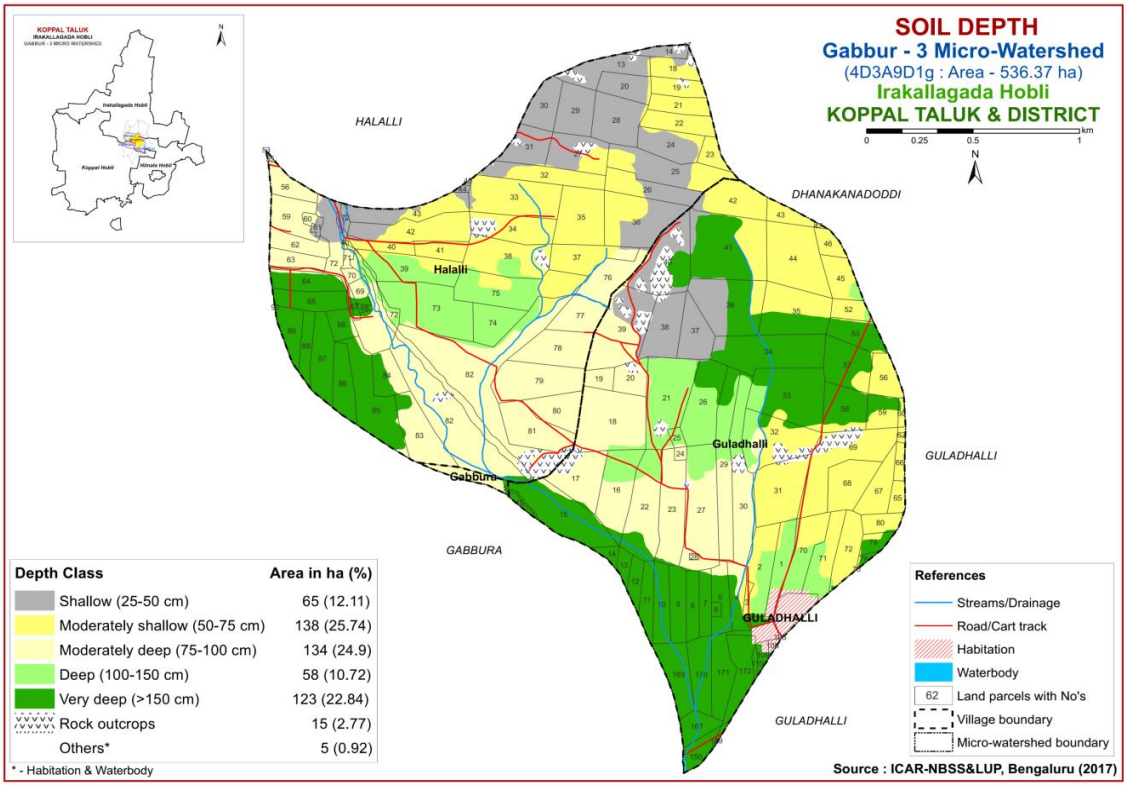


Fig. 5.2 Soil Depth map of Gabbur-3 Microwatershed

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 (fig. 5.3). The area extent and their spatial distribution in the microwatershed is shown in figure 5.3.

An area of 69 ha (13%) has sandy soils at the surface and are distributed in the eastern and central part of the microwatershed. Major area of about 391 ha (73%) has soils that are loamy at the surface. They are distributed in all parts of the microwatershed. An area of 55 ha (10%) has clayey at the surface and are distributed in the southern and western part of the microwatershed (Fig. 5.3).

The most productive lands 55 ha (10%) with respect to surface soil texture are the clayey soils that have high potential for soil-water retention and availability, and nutrient retention and availability, but have more problems of drainage, infiltration, workability and other physical problems as compared to loamy soils. The other most productive lands covering 391 ha (73%) are loamy soils which also have high potential for AWC, nutrient availability but have no drainage or other physical problems. The problem soils cover about 69 ha (13%) that have sandy soils at the surface having problems of poor soil water

retention and availability and nutrient retention and availability, but have better rain water retention less run off and soil moisture conservation, less capillary rise and less evaporation losses.

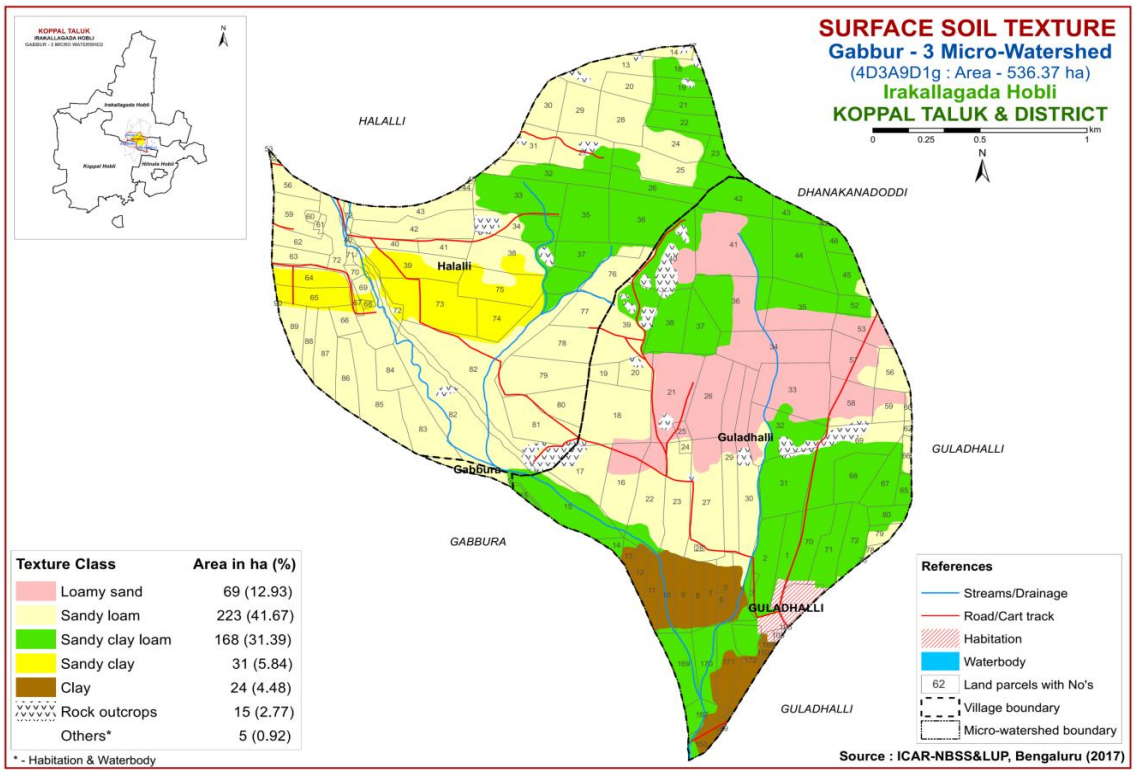


Fig. 5.3 Surface Soil Texture map of Gabbur-3 Microwatershed

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 spatial distribution in the microwatershed is given in figure 5.4.

The soils that are non-gravelly (<15% gravel) cover an area of about 310 ha (58%) and are distributed in the major part of the microwatershed. An area of 206 ha (38%) is covered by gravelly (15-35% gravel) soils and are distributed in the northern, eastern, western, central and southern part of the microwatershed (Fig. 5.4).

The most productive lands with respect to gravelliness are found to be 58%. They are non-gravelly with less than 15 per cent gravel and have potential for growing both annual and perennial crops. The problem soils that are gravelly (15-35%) cover 206 ha (38%) where only short or medium duration crops can be grown.

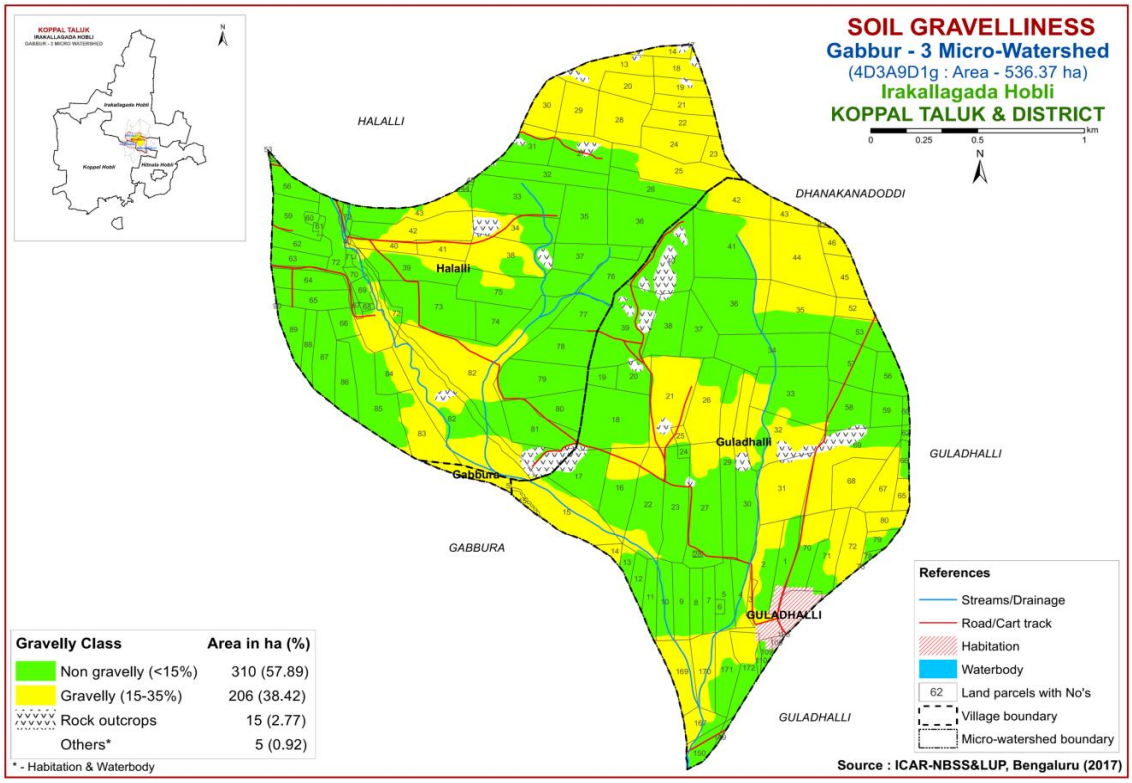


Fig. 5.4 Soil Gravelliness map of Gabbur-3 Microwatershed

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 (Fig. 5.5), showing the area extent and their spatial distribution in the microwatershed.

Major area of about 167 ha (31%) are very low (<50 mm/m) in available water capacity and are distributed in the northern part of the microwatershed. An area of about 84 ha (16%) has soils that are low (51-100 mm/m) in available water capacity and are distributed in the western, central and eastern part of the microwatershed. An area of about 144 ha (27%) is medium (101-150 mm/m) in available water capacity and are distributed in the western and central part of the microwatershed. High to very high (151->200 mm/m) in available water capacity cover an area of 122 ha (23%) and are distributed in the western, southern and eastern part of the microwatershed.

An area of about 167 ha (31%) 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. The potential soils with respect to AWC cover about 93 ha (17%) that have very high AWC, where all climatically adapted long duration crops can be grown.

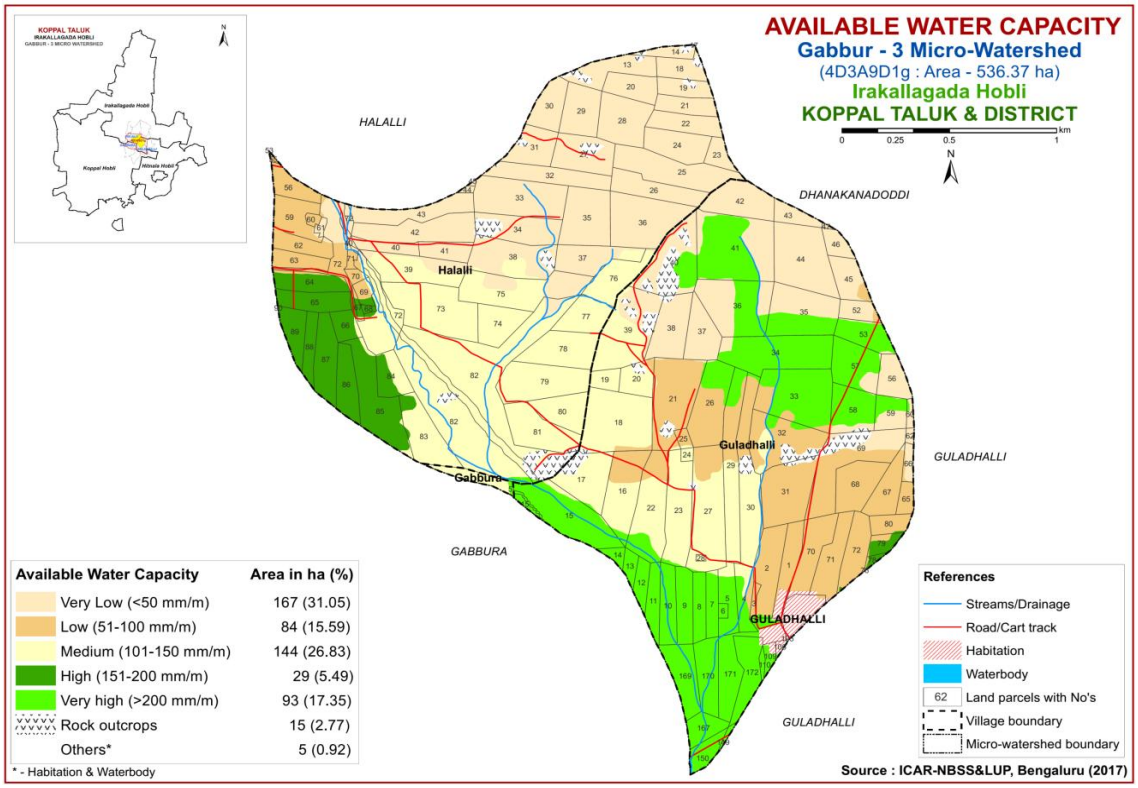


Fig. 5.5 Soil Available Water Capacity map of Gabbur-3 Microwatershed

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 four slope classes and a slope map was generated showing the area extent and their geographic distribution of different slope classes in the microwatershed (Fig. 5.6).

Nearly level (0-1%) soils occupy an area of 24 ha (4%) and are distributed in the southern part of the microwatershed. Major area of about 493 ha (92%) falls under very gently sloping (1-3% slope) lands and are distributed in all parts of the microwatershed. In all these lands, all climatically adapted annual and perennial crops can be grown without much soil and water conservation and other land development measures.

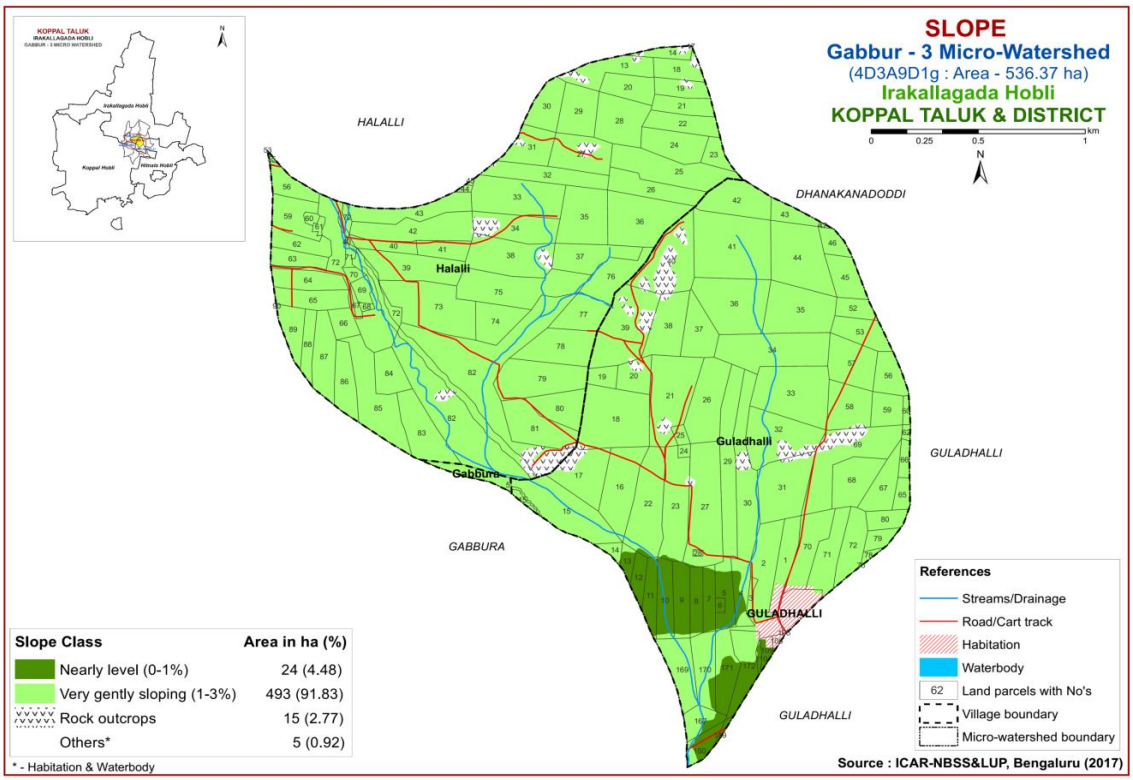


Fig. 5.6 Soil Slope map of Gabbur-3 Microwatershed

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 slightly eroded (e1 class) occupy an area of about 152 ha (28%) and are distributed in the western, northern, central and southern part of the microwatershed. Moderately eroded (e2 class) soils cover an area of 364 ha (68%) and are distributed in the major part of the microwatershed.

An area of about 364 ha (68%) in the microwatershed is problematic because of moderate erosion. These areas need soil and water conservation and other land development measures for restoring the soil health.

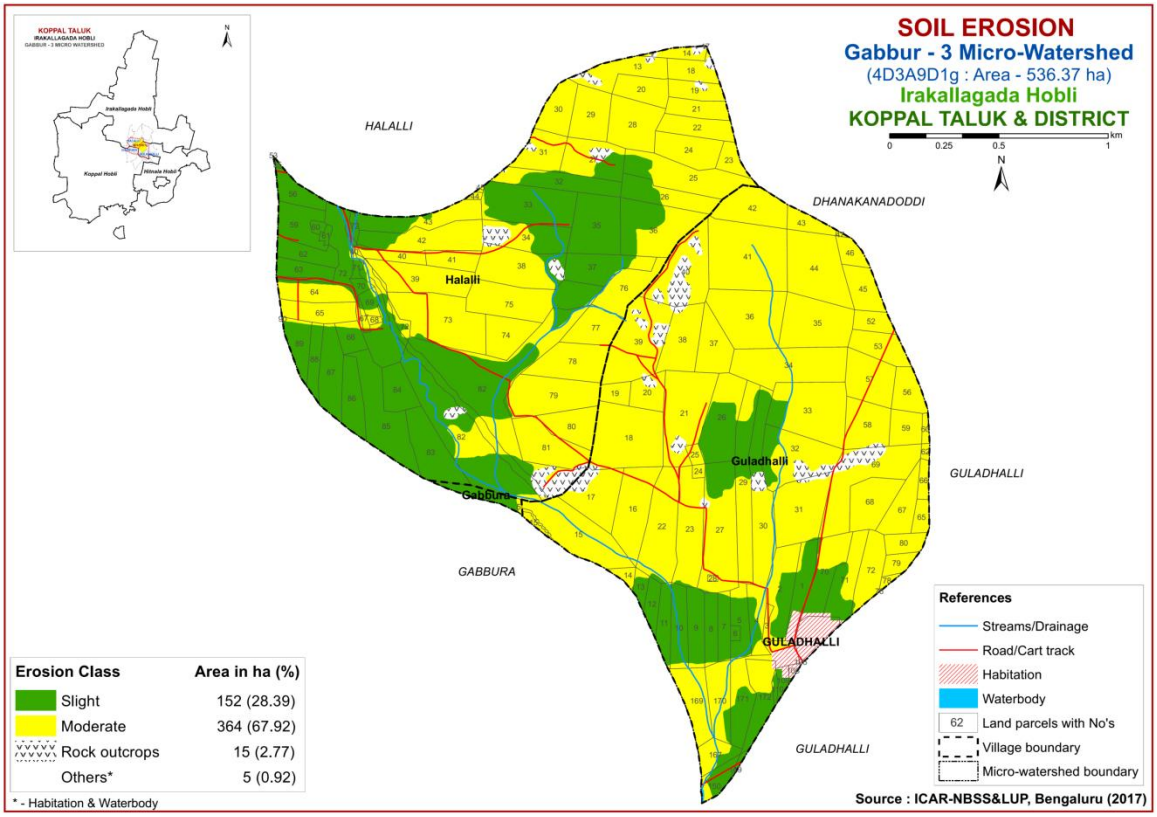


Fig. 5.7 Soil Erosion map of Gabbur-3 Microwatershed

0

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 grid 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 by using the 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 Gabbur-3 microwatershed for soil reaction (pH) showed that an area of 9 ha (2%) is strongly acid (pH 5.0-5.5) and are distributed in the central part of the microwatershed. moderately to slightly acid (pH 5.5-6.5) lands cover an area of 65 ha (12%) and are distributed in the central, eastern and northern part of the microwatershed. An area of 136 ha (25%) is neutral (pH 6.5-7.3) and are distributed in the northern, central and eastern part of the microwatershed. Slightly to moderately alkaline (pH 7.3-8.4) soils occupy 291 ha (54%) and are distributed in the major part of the microwatershed. An area of 15 ha (3%) is strongly alkaline (pH 8.4-9.0) and are distributed in the northwestern and southern part of the microwatershed (Fig. 6.1). Thus, all the soils in the microwatershed are acidic to alkaline in reaction.

6.2 Electrical Conductivity (EC)

The Electrical Conductivity of the soils is under non-saline (<2 dS m^{-1}) in the entire microwatershed (Fig. 6.2).

6.3 Organic Carbon

The soil organic carbon content (an index of available Nitrogen) in the soils of the microwatershed is low (<0.5%) covering an area of 62 ha (12%) and is distributed in the northern, central, western, southern and eastern part of the microwatershed. An area of 183 ha (34%) is medium (0.5-0.75%) in organic carbon content and is distributed in all parts of the microwatershed. High (>0.75%) organic carbon cover an area of 271 ha (51%) and is distributed in the major part of the microwatershed (Fig. 6.3).

6.4 Available Phosphorus

An area of about 12 ha (2%) is low (<23 kg/ha) in available phosphorus and is distributed in the southern part of the microwatershed. An area of about 251 ha (47%) is medium (23-57 kg/ha) and is distributed in the northern, western, southern and eastern part of the microwatershed. Major area of 254 ha (47%) is high (>57 kg/ha) in available phosphorus content and are distributed in the central, northern, western, southwestern, southeastern and eastern part of the microwatershed (Fig. 6.4).

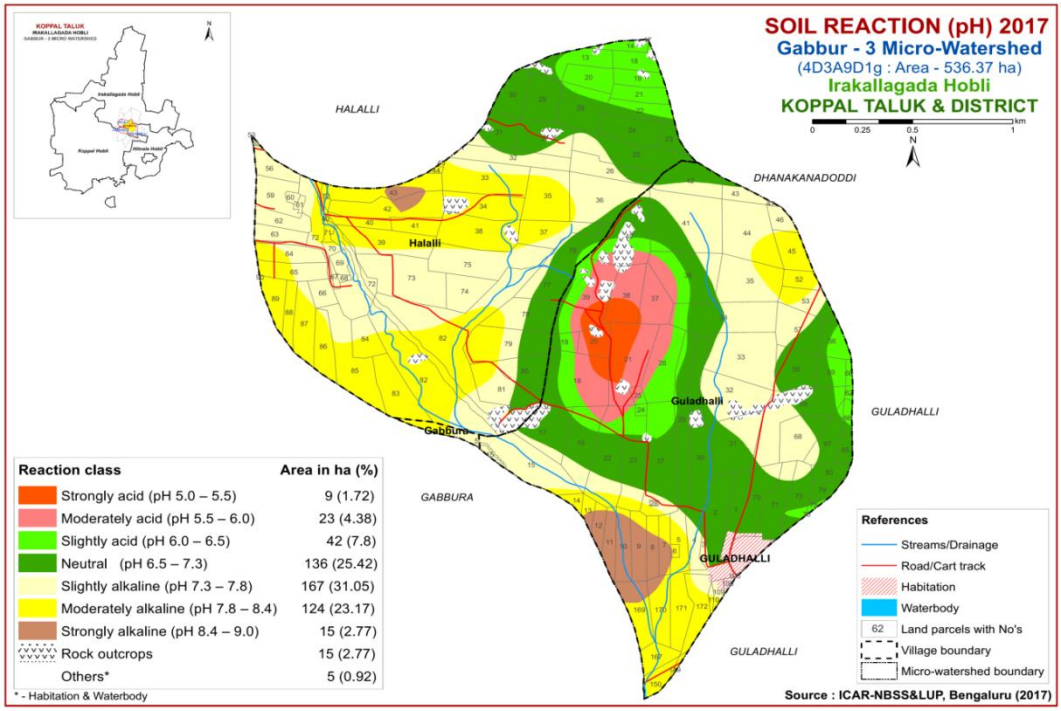


Fig. 6.1 Soil Reaction (pH) map of Gabbur-3 Microwatershed

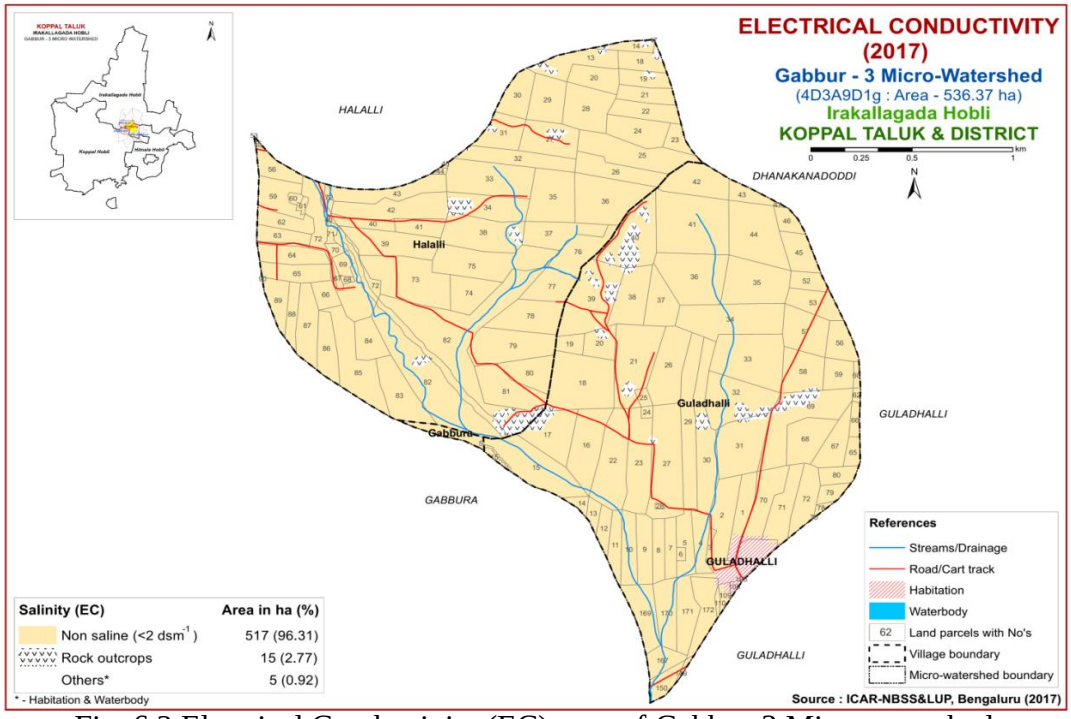


Fig. 6.2 Electrical Conductivity (EC) map of Gabbur-3 Microwatershed

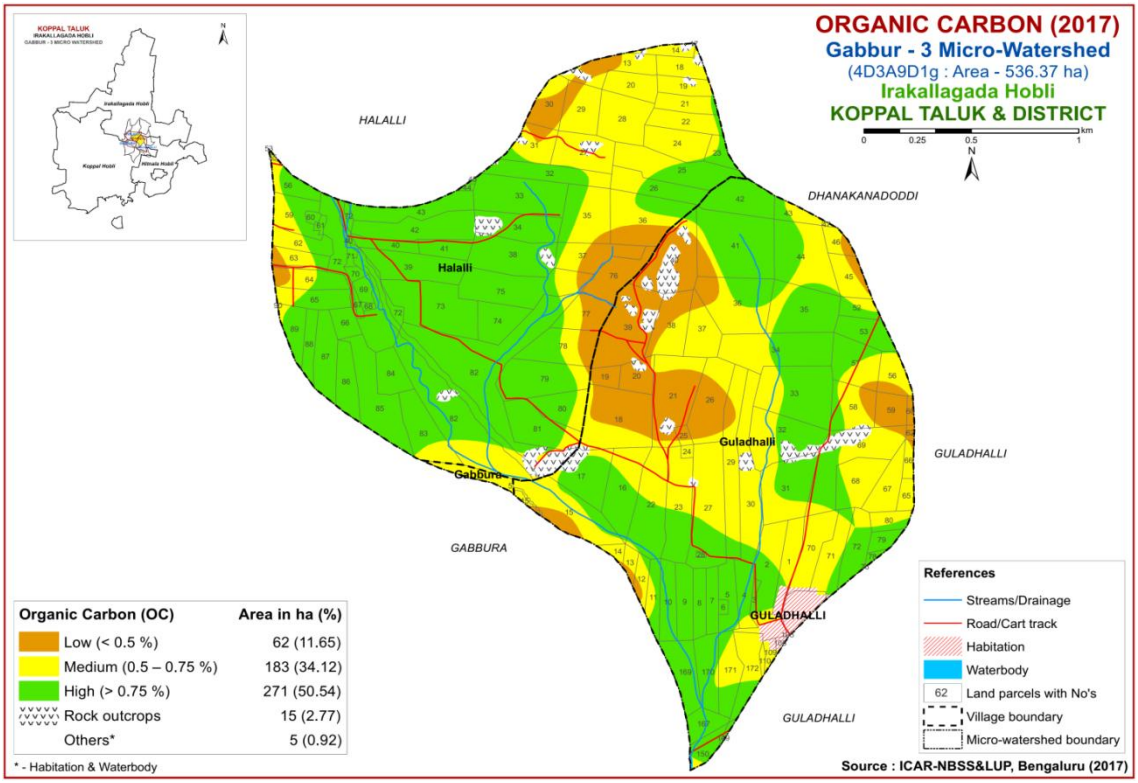


Fig. 6.3 Soil Organic Carbon map of Gabbur-3 Microwatershed

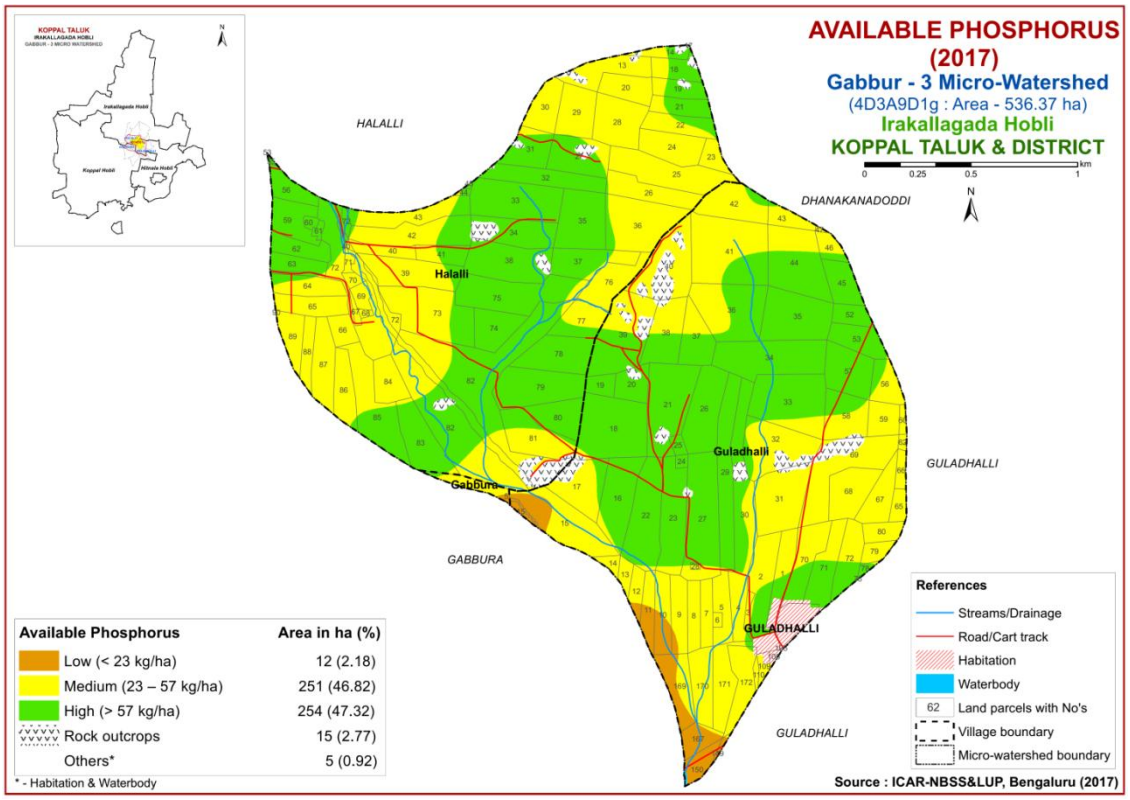


Fig. 6.4 Soil Available Phosphorus map of Gabbur-3 Microwatershed

6.5 Available Potassium

Major area of about 365 ha (68%) is medium (145-337 kg/ha) and are distributed in all parts of the microwatershed. High (>337 kg/ha) in available potassium content

occupy an area of 151 ha (28%) and are distributed in the northern, western, northeastern and southern part of the microwatershed (Fig. 6.5).

6.6 Available Sulphur

Soils that are low in available sulphur content (<10 ppm) cover major area of 406 ha (76%) and are distributed in the all parts of the microwatershed. An area of 106 ha (20%) is medium (10-20 ppm) in available sulphur content and are distributed in the northern, northwestern, western, southern and eastern part of the microwatershed. An area of about 5 ha (1%) is high (>20 ppm) in available sulphur content and are distributed in the southern part of the microwatershed (Fig. 6.6). The areas that are low and medium in available sulphur need to be applied with magnesium sulphate or gypsum or factomphos (p) fertilizer (13% sulphur) for 2-3 years for the deficiency to be corrected.

6.7 Available Boron

Available boron content is low (<0.5 ppm) in an area of 345 ha (64%) and are distributed in the major part of the microwatershed. An area of about 140 ha (26%) is medium (0.5-1.0 ppm) in available boron and are distributed in the western, central, southern and northwestern part of the microwatershed. High (>1.0 ppm) in available boron occupy an area of about 32 ha (6%) in the northwestern and southwestern part of the microwatershed (Fig. 6.7).

6.8 Available Iron

Available iron content is sufficient (>4.5 ppm) in an area of 192 ha (36%) and occur in all parts of the microwatershed. An area of 324 ha (60%) is deficient (<4.5 ppm) 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 507 ha (94%) and deficient (<0.2 ppm) in 10 ha (2%) in the microwatershed area (Fig. 6.10).

6.11 Available Zinc

Available zinc content is sufficient (>0.6 ppm) in an area of 175 ha (33 %) and deficient (<0.6 ppm) in 342 ha (64%) in the microwatershed (Fig. 6.11).

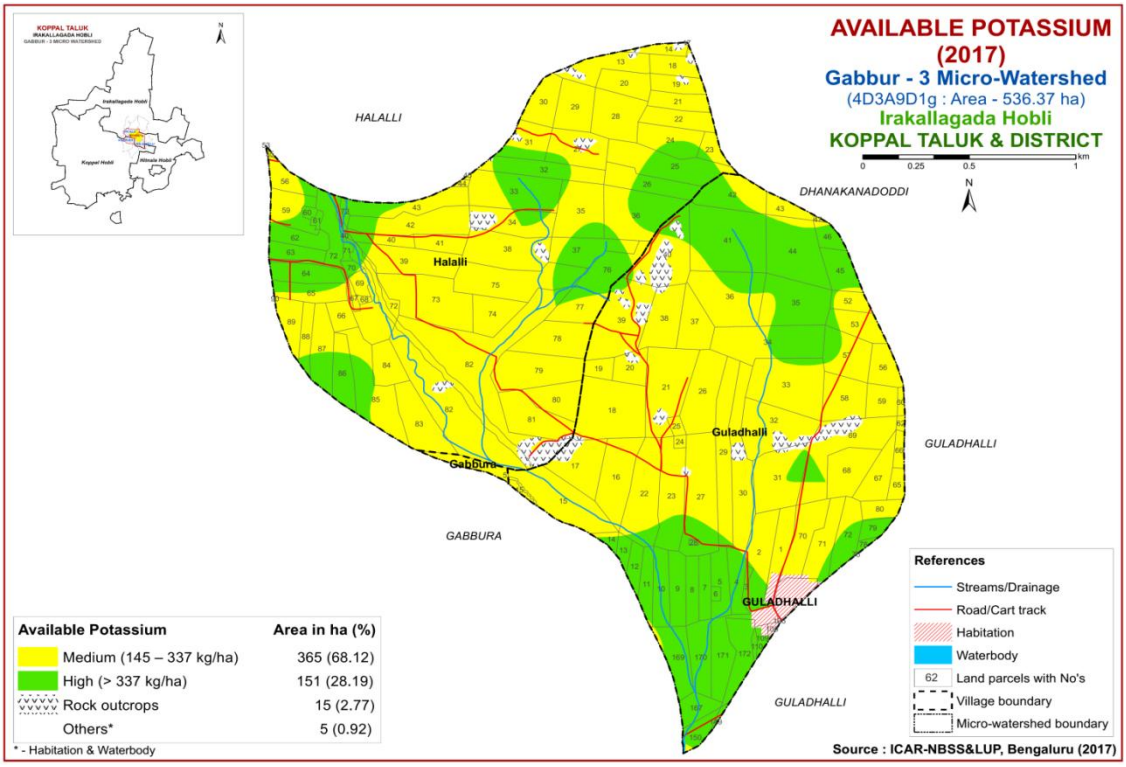


Fig. 6.5 Soil Available Potassium map of Gabbur-3 Microwatershed

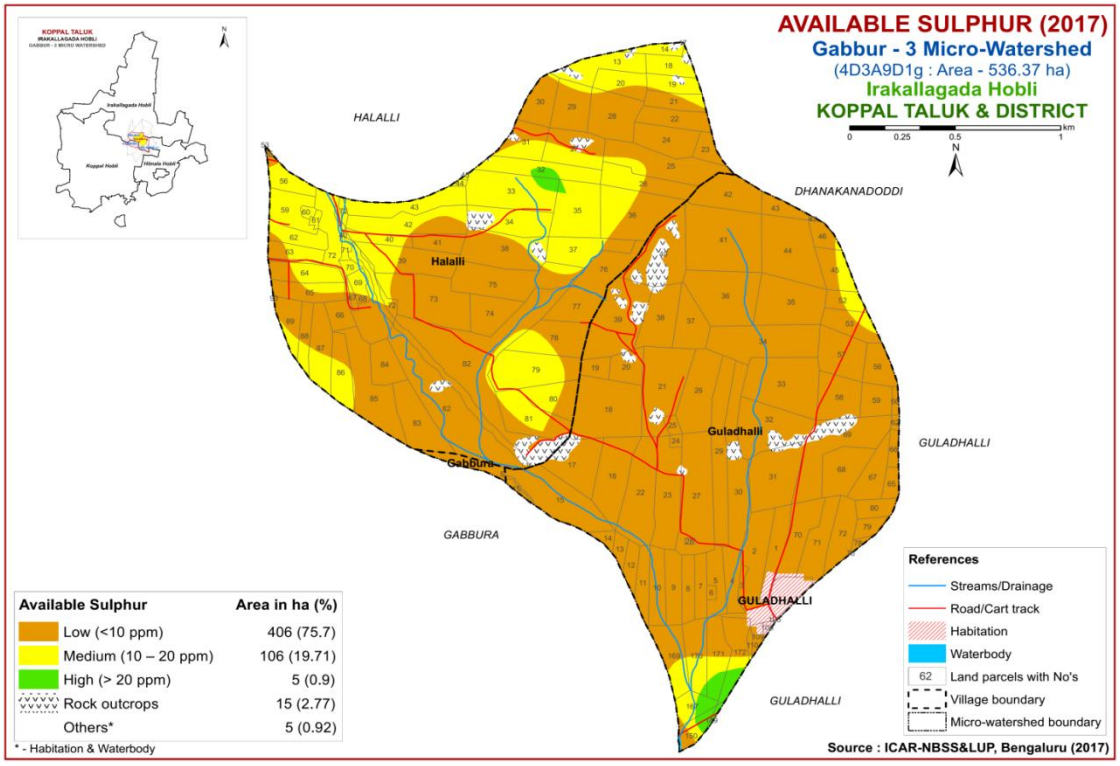


Fig. 6.6 Soil Available Sulphur map of Gabbur-3 Microwatershed

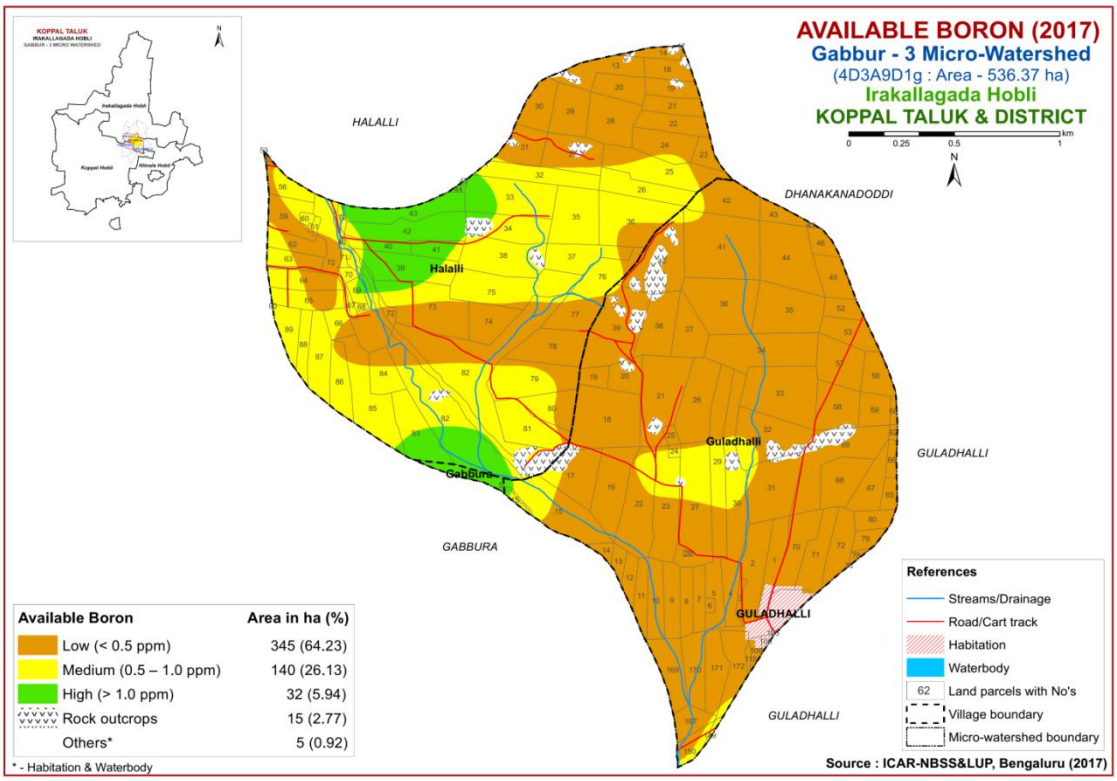


Fig. 6.7 Soil Available Boron map of Gabbur-3 Microwatershed

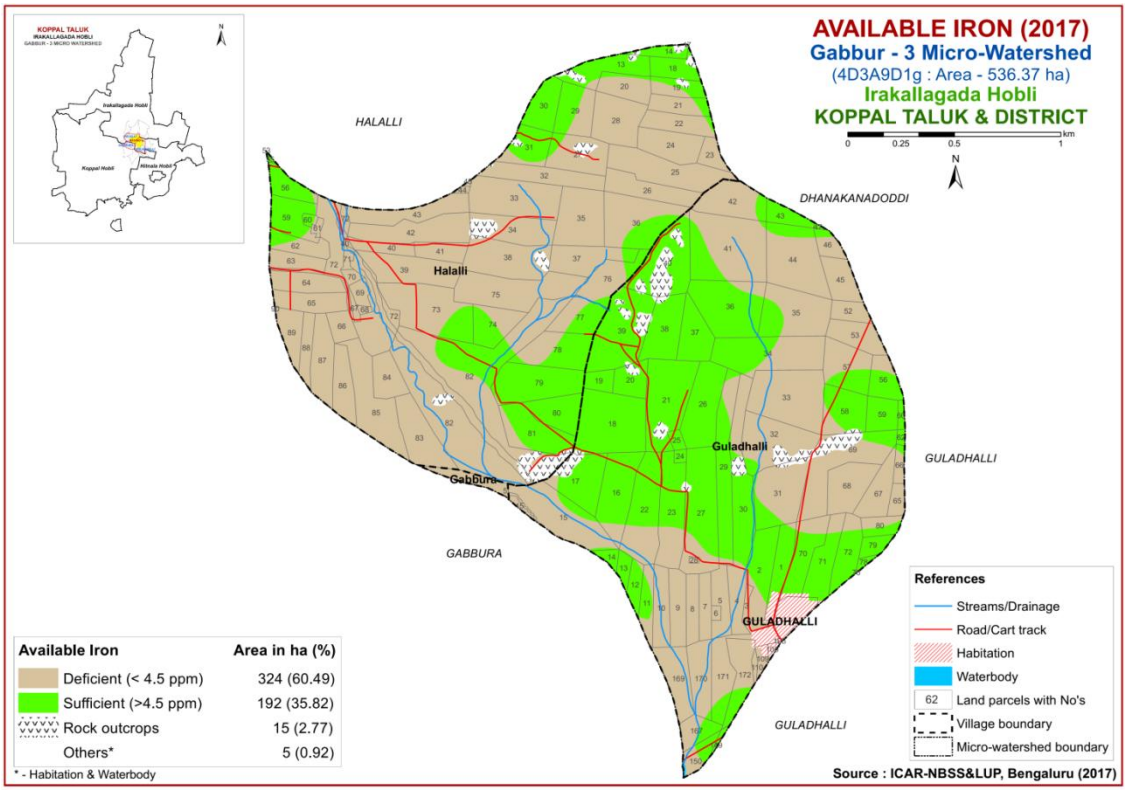


Fig. 6.8 Soil Available Iron map of Gabbur-3 Microwatershed

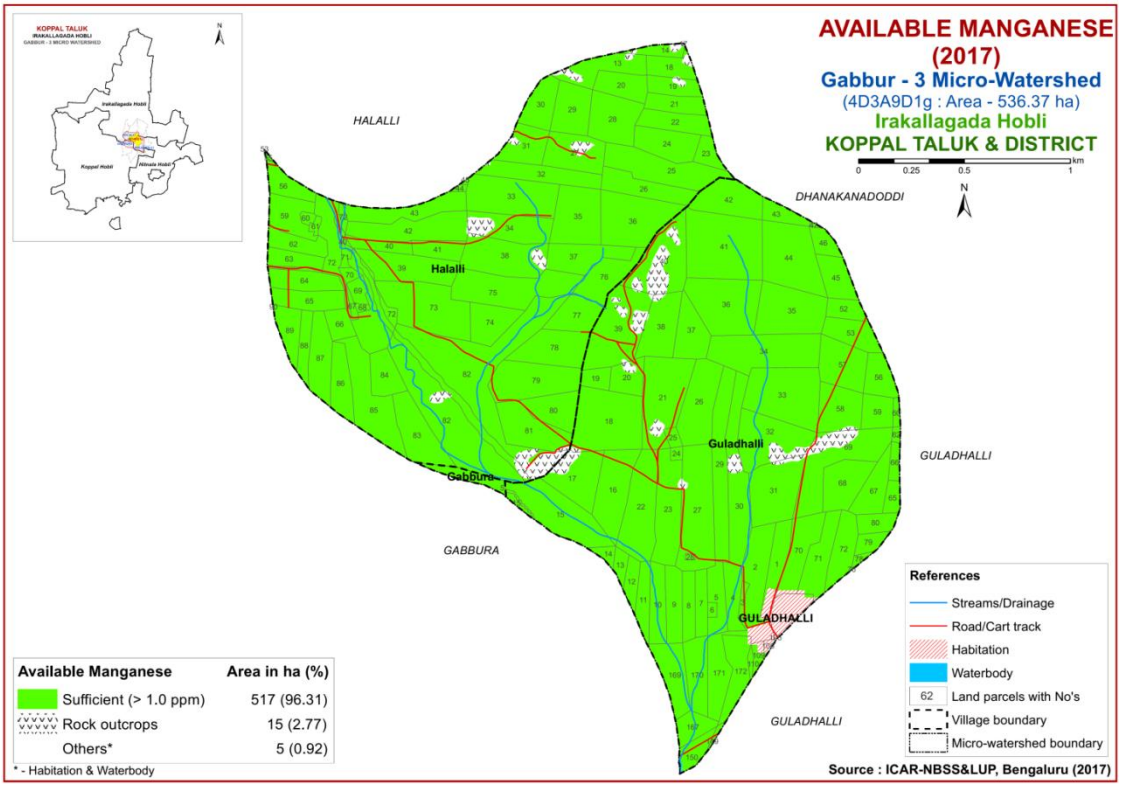


Fig. 6.9 Soil Available Manganese map of Gabbur-3 Microwatershed

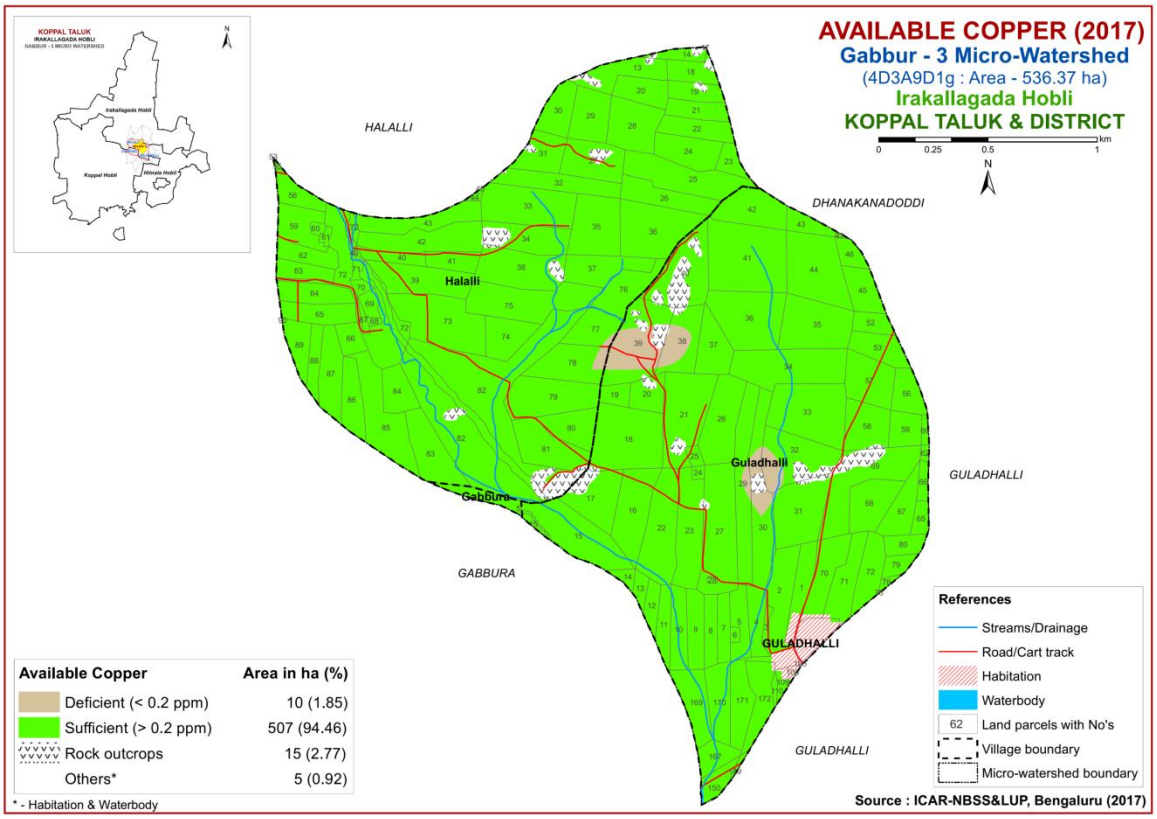


Fig. 6.10 Soil Available Copper map of Gabbur-3 Microwatershed

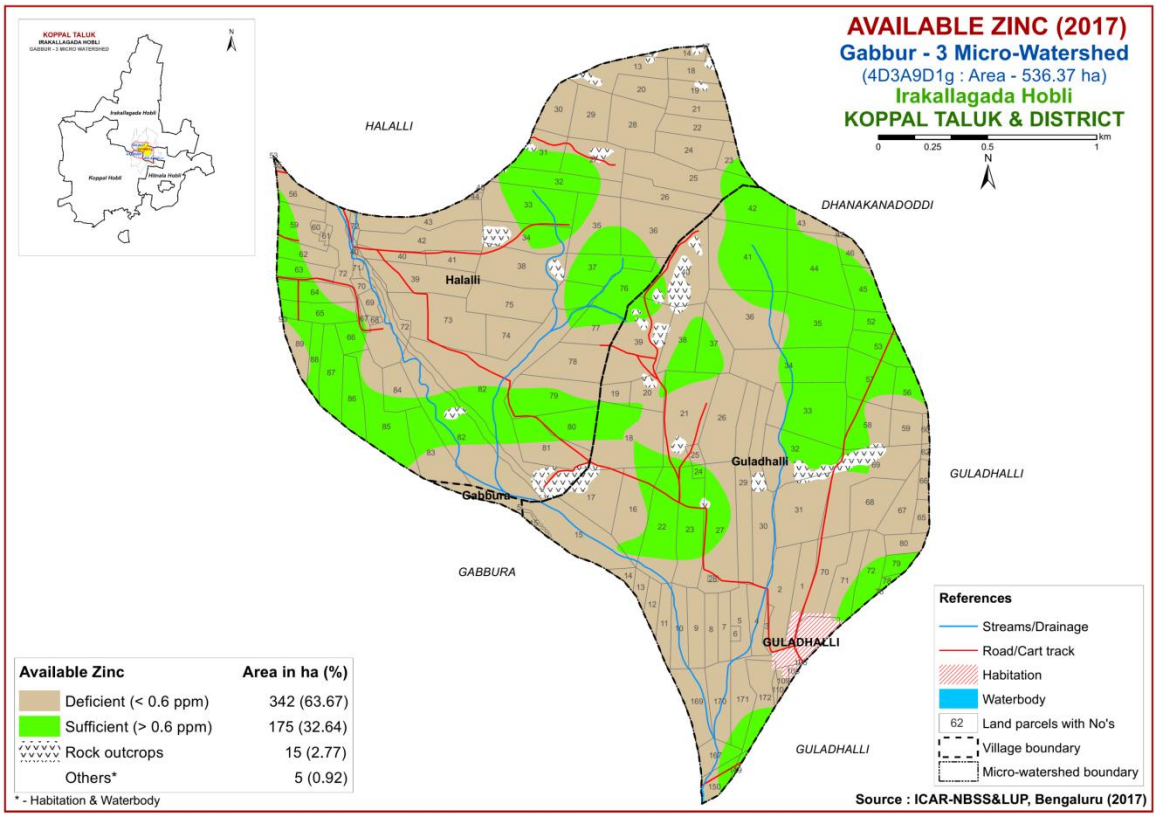


Fig. 6.11 Soil Available Zinc map of Gabbur-3 Microwatershed

Chapter 7

LAND SUITABILITY FOR MAJOR CROPS

The soil and land resource units (soil phases) of Gabbur-3 Microwatershed were assessed for their suitability for growing food, fodder, fibre and other horticulture crops by following the procedure as outlined in FAO, 1976 and 1983. Crop requirements were developed for each of the crop from the available research data and also by referring to Naidu *et. al.* (2006) and Natarajan *et. al* (2015). The crop requirements were matched with the soil and land characteristics (Table 7.1) to arrive at the crop suitability. In FAO land suitability classification, two orders are recognized. Order S-Suitable and Order N-Not suitable. The orders have classes, subclasses and units. Order-S has three classes, Class S1-Highly Suitable, Class S2-Moderately Suitable and Class S3-Marginally Suitable. Order N has two Classes, N1-Currently not Suitable and N2-Permanently not Suitable. There are no subclasses within the Class S1 as they will have very minor or no limitations for crop growth. Classes S2, S3, N1 and N2 are divided into subclasses based on the kinds of limitations encountered. The limitations that affect crop production are 'c' for erratic rainfall and its distribution and length of growing period (LGP), 'e' for erosion hazard, 'r' for rooting condition, 't' for lighter or heavy texture, 'g' for gravelliness or stoniness, 'n' for nutrient availability, 'l' for topography, 'm' for moisture availability, 'z' for calcareousness 's' for sodium and 'w' for drainage. These limitations are indicated as lower case letters to the class symbol. For example, moderately suitable lands with the limitations of soil depth and erosion are designated as S2re. For the microwatershed, the soil mapping units were evaluated and classified up to subclass level.

Using the above criteria, the soil map units of the microwatershed were evaluated and land suitability maps for 28 major agricultural and horticultural crops were generated. The detailed information on the kind of suitability of each of the soil phase for the crops assessed are given village/ survey number wise for the microwatershed in Appendix-III.

7.1 Land Suitability for Sorghum (*Sorghum bicolor*)

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

Highly suitable (Class S1) lands occupy a maximum of 256 ha (48%) for growing sorghum and are distributed in the major part of the microwatershed. An area of 87 ha (16%) is moderately suitable (Class S2) for growing sorghum and are distributed in the southern, eastern, northwestern and southwestern part of the microwatershed. They have minor limitations of gravelliness, calcareousness, and rooting condition.

Table 7.1 Soil-Site Characteristics of Gabbur-3 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	ESP	CEC [Cmol (p^+) kg^{-1}]	BS (%)
					Surface	Sub-surface	Surface	Sub-surface								
HRVhB2	662	90	WD	25-50	scl	gscl	-	>35	<50	1-3	Moderate	-	-	-	-	-
HRVcB2g1	662	90	WD	25-50	sl	gscl	15-35	>35	<50	1-3	Moderate	-	-	-	-	-
CSRcB1	662	90	WD	50-75	sl	scl	-	<15	50-100	1-3	Slight	-	-	-	-	-
LKRhB1	662	90	WD	50-75	scl	gsc	-	40-60	50-100	1-3	Slight	8.18	0.30	4.51	12.1	100
LKRhB2g1	662	90	WD	50-75	scl	gsc	15-35	40-60	50-100	1-3	Moderate	8.18	0.30	4.51	12.1	100
KTPhB2g1	662	90	WD	50-75	scl	scl	15-35	15-35	101-150	1-3	Moderate	-	-	-	-	-
MKHcB2	662	90	WD	50-75	sl	gscl	-	>35	50-100	1-3	Moderate	7.38	0.09	1.49	14.84	93
MKHcB2g1	662	90	WD	50-75	sl	gscl	15-35	>35	50-100	1-3	Moderate	7.38	0.09	1.49	14.84	93
BSRcB1	662	90	WD	75-100	sl	gsc	-	15-35	50-100	1-3	Slight	-	-	-	-	-
CKMcB2	662	90	WD	75-100	sl	sc	-	-	100-150	1-3	Moderate	7.99	0.32	4.33	12.5	119
KMHiB2	662	90	WD	100-150	sc	sc	-	<15	150-200	1-3	Moderate	7.2	0.19	0.54	15.0	100
BPRbB1g1	662	90	WD	100-150	ls	gsc-gc	15-35	>35	51-100	1-3	Slight	6.64	0.03	0.51	5.45	63.4
BPRbB2g1	662	90	WD	100-150	ls	gsc-gc	15-35	>35	51-100	1-3	Moderate	6.64	0.03	0.51	5.45	63.4
BPRcB2g1	662	90	WD	100-150	sl	gsc-gc	15-35	>35	51-100	1-3	Moderate	6.64	0.03	0.51	5.45	63.4
BPRhB1	662	90	WD	100-150	sc	gsc-gc	-	>35	51-100	1-3	Slight	6.64	0.03	0.51	5.45	63.4
RTRcB1	662	90	WD	>150	sl	c	-	-	150-200	1-3	Slight	5.08	0.03	2.06	9.21	50.5
RTRcB2	662	90	WD	>150	sl	c	-	-	150-200	1-3	Moderate	5.08	0.03	2.06	9.21	50.5
RTRiB2	662	90	WD	>150	sc	c	-	-	150-200	1-3	Moderate	5.08	0.03	2.06	9.21	50.5
KGPcB2	662	90	WD	25-50	sl	gscl-gsc	-	15-35	50-100	1-3	Moderate	-	-	-	-	-
NSPcB1g1	662	90	MWD	75-100	sl	c	15-35	-	101-150	1-3	Slight	9.16	0.61	21.4	51.0	-
KDTbB2	662	90	MWD	>150	ls	sc-c	-	-	>200	1-3	Moderate	-	-	-	-	-
KDTmA1	662	90	MWD	>150	c	sc-c	-	-	>200	0-1	Slight	-	-	-	-	-
GGRhB2	662	90	WD	>150	scl	c-s-c	-	<15	>200	1-3	Moderate	-	-	-	-	-
GGRhB2g1	662	90	WD	>150	scl	c-s-c	15-35	<15	>200	1-3	Moderate	-	-	-	-	-

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

An area of about 173 ha (32%) is marginally suitable (Class S3) for growing sorghum and are distributed in the northern, northwestern, southeastern and central part of the microwatershed with moderate limitations of gravelliness, rooting condition and texture.

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)	dS m^{-1}	2-4	4-8	8-10	>10
Sodicity (ESP)	%	5-8	8-10	10-15	>15

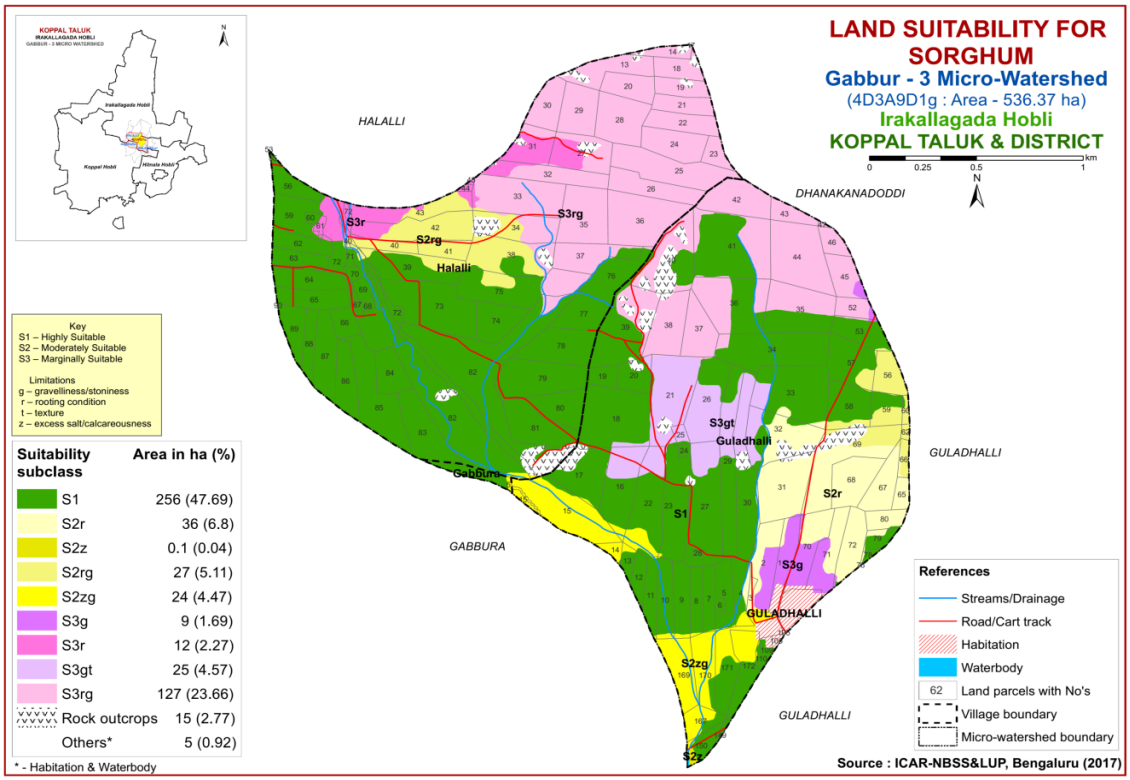


Fig. 7.1 Land Suitability map of Sorghum

7.2 Land Suitability for Maize (*Zea mays*)

Maize is one of the most important food crop grown in an area of 13.37 lakh ha in almost all the districts of the State. The crop requirements for growing maize (Table 7.3) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for

growing maize was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.2.

An area of 37 ha (7%) is highly suitable (Class S1) for growing maize and are distributed in the western part of the microwatershed. Moderately suitable (Class S2) lands cover an area of 179 ha (34%) for growing maize and are distributed in the western, central and eastern part of the microwatershed with minor limitations of gravelliness, drainage and texture. Marginally suitable (Class S3) lands cover a major area of 299 ha (56%) and are distributed in all parts of the microwatershed. They have moderate limitations of texture, gravelliness, rooting condition 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	

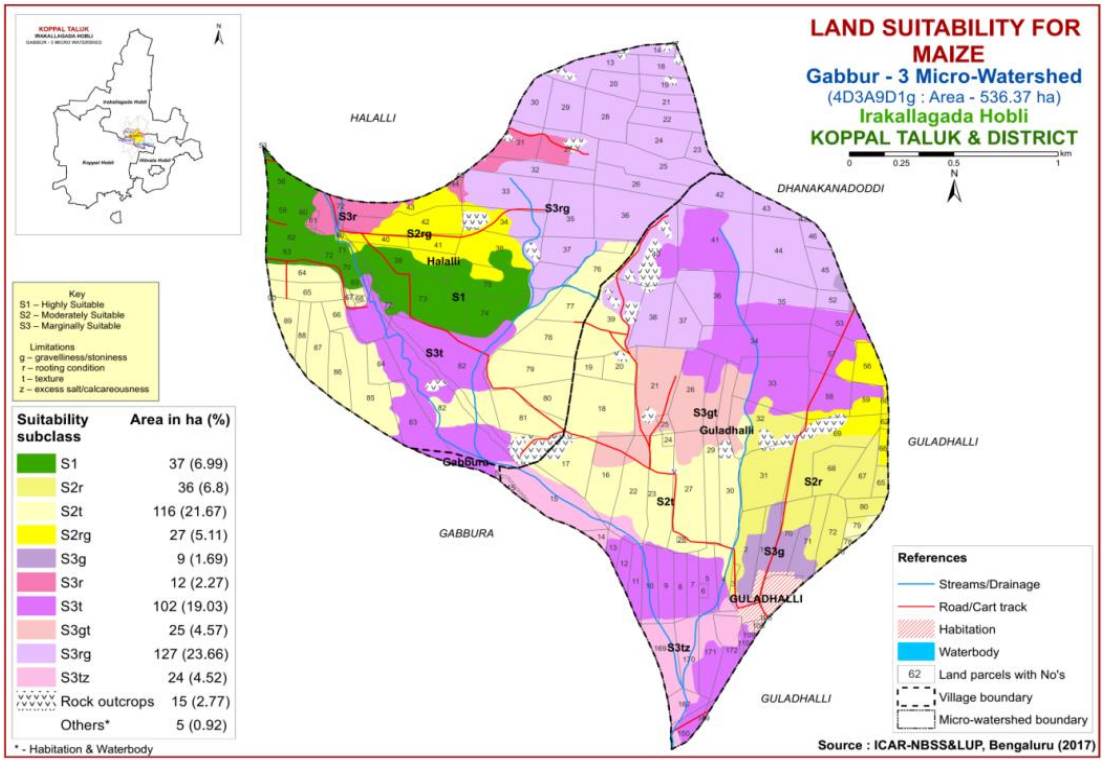


Fig. 7.2 Land Suitability map of Maize

7.3 Land Suitability for Bajra (*Pennisetum glaucum)*

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

An area of 154 ha (29%) is highly suitable (Class S1) for growing bajra in the microwatershed. Moderately suitable lands occupy an area of 162 ha (30%) and are distributed in the northeastern, northern, eastern and southern part of the microwatershed with minor limitations of gravelliness, rooting condition and calcareousness. Marginally suitable (Class S3) lands cover a maximum area of 201 ha (37%) and are distributed in the major part of the microwatershed. They have moderate limitations of gravelliness, rooting condition and texture.

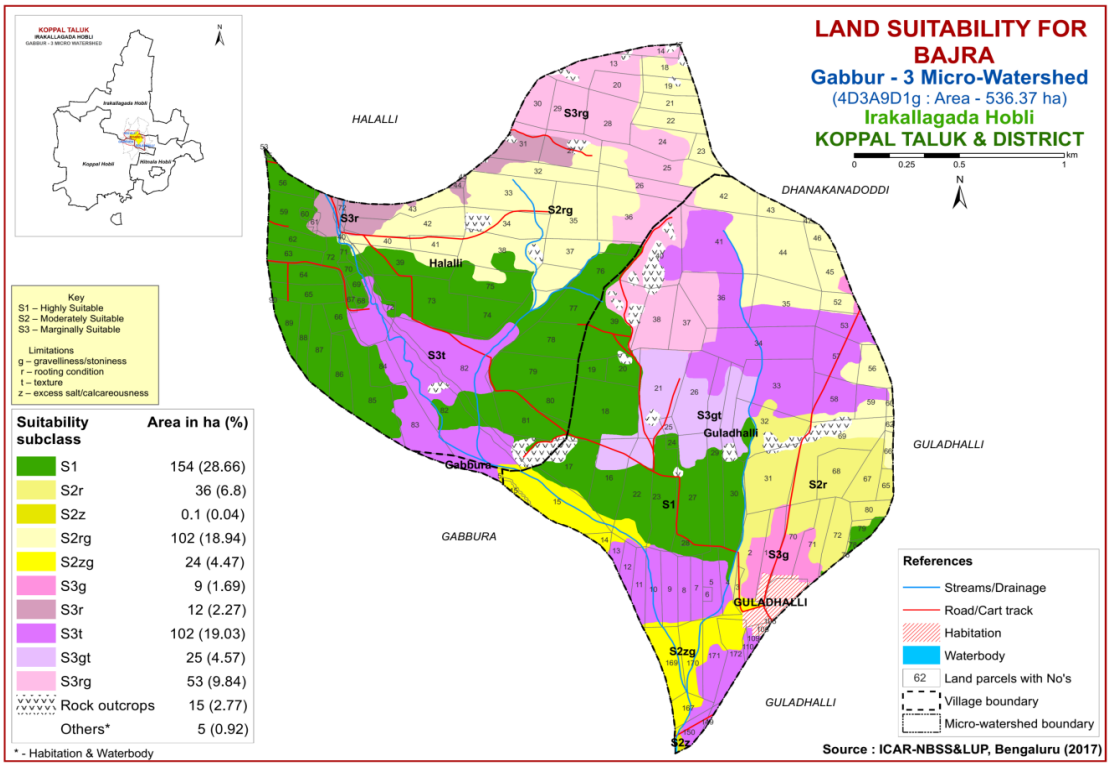


Fig. 7.3 Land Suitability map of Bajra

7.4 Land Suitability for Red gram (*Cajanus cajan)*

Redgram is one of the most important pulse crop grown in an area of 7.28 lakh ha in almost all the districts of the State. The crop requirements for growing redgram (Table 7.4) 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 7.4.

Highly suitable (Class S1) lands occupy an area of 53 ha (10%) for growing redgram and are distributed in the western part of the microwatershed. Moderately

suitable lands occupy a maximum area of 226 ha (42%) and are distributed in the western, central, eastern, southwestern and southern part of the microwatershed with minor limitations of gravelliness, rooting condition, texture and calcareousness. Marginally suitable (Class S3) lands cover an area of 172 ha (32%) and are distributed in major part of the microwatershed. They have moderate limitations of gravelliness, texture and rooting condition. Not suitable (Class N1) lands cover an area of 65 ha (12%) for growing redgram and are distributed in the northwestern part of the microwatershed with severe limitations of gravelliness and rooting condition.

Table 7.4 Land suitability criteria for Red gram

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

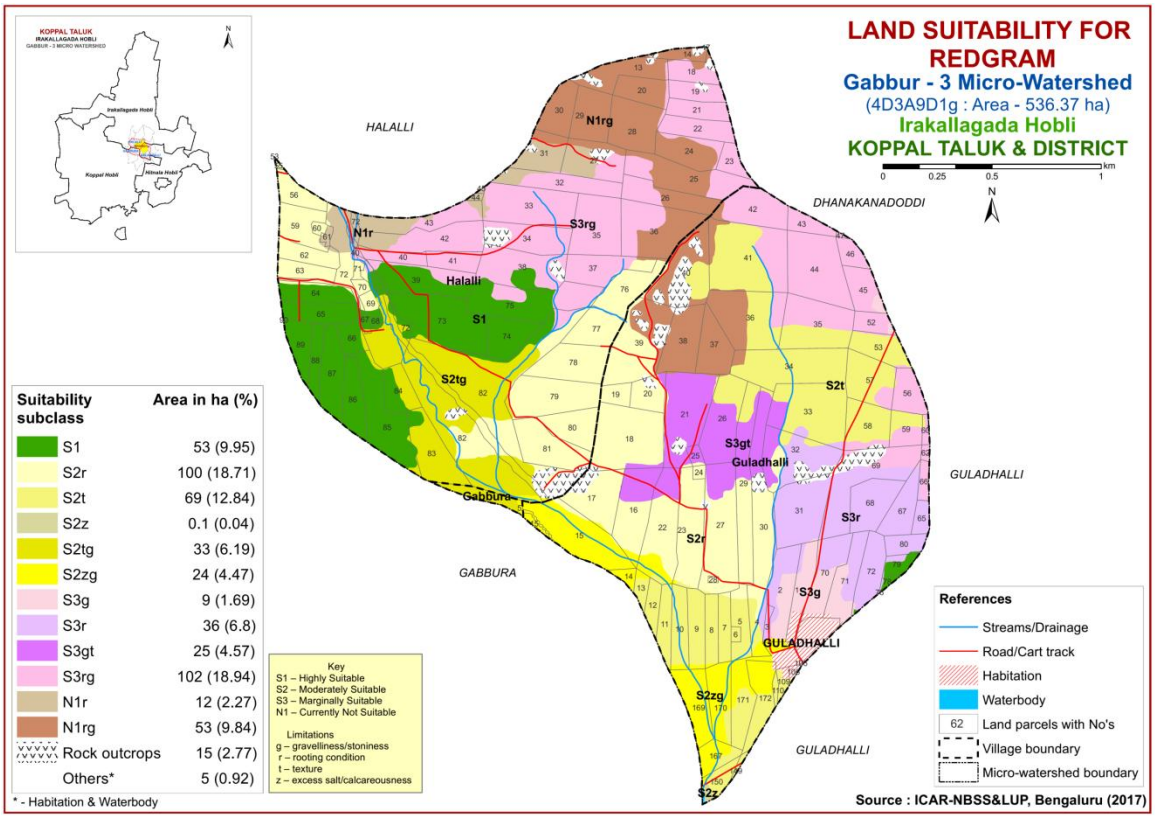


Fig. 7.4 Land Suitability map of Redgram

7.5 Land Suitability for Bengalgram (*Cicer arietinum*)

Bengalgram is one of the major pulse crop grown in an area of 9.39 lakh ha in northern Karnataka in Bijapur, Gulbarga, Raichur, Bidar, Belgaum, Dharwad and Bellary districts. The crop requirements for growing Bengalgram (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 Bengalgram was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.5.

Highly suitable (Class S1) lands cover an area of 102 ha (19%) and are distributed in the eastern, southwestern and southern part of the microwatershed for growing bengalgram. Moderately suitable lands occupy a maximum area of 280 ha (52%) and are distributed in the major part of the microwatershed with minor limitations of gravelliness, texture, rooting condition and calcareousness. Marginally suitable (Class S3) lands cover an area of 135 ha (25%) and are distributed in the northern, central, eastern and northwestern part of the microwatershed. They have moderate limitations of gravelliness, rooting condition and texture.

Table 7.5 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; Imp. drained	P. drained; exc.drained	Very Poorly drained
Soil reaction	pH	6.0-7.5	5.5-5.77.6-8.0	8.1-9.0;4.5-5.4	>9.0
Surface soil texture	Class	l, scl, sil, cl,	sicl, sic, c	sl, c>60%	s, fragmental
Soil depth	cm	>75	51-75	25-50	<25
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	

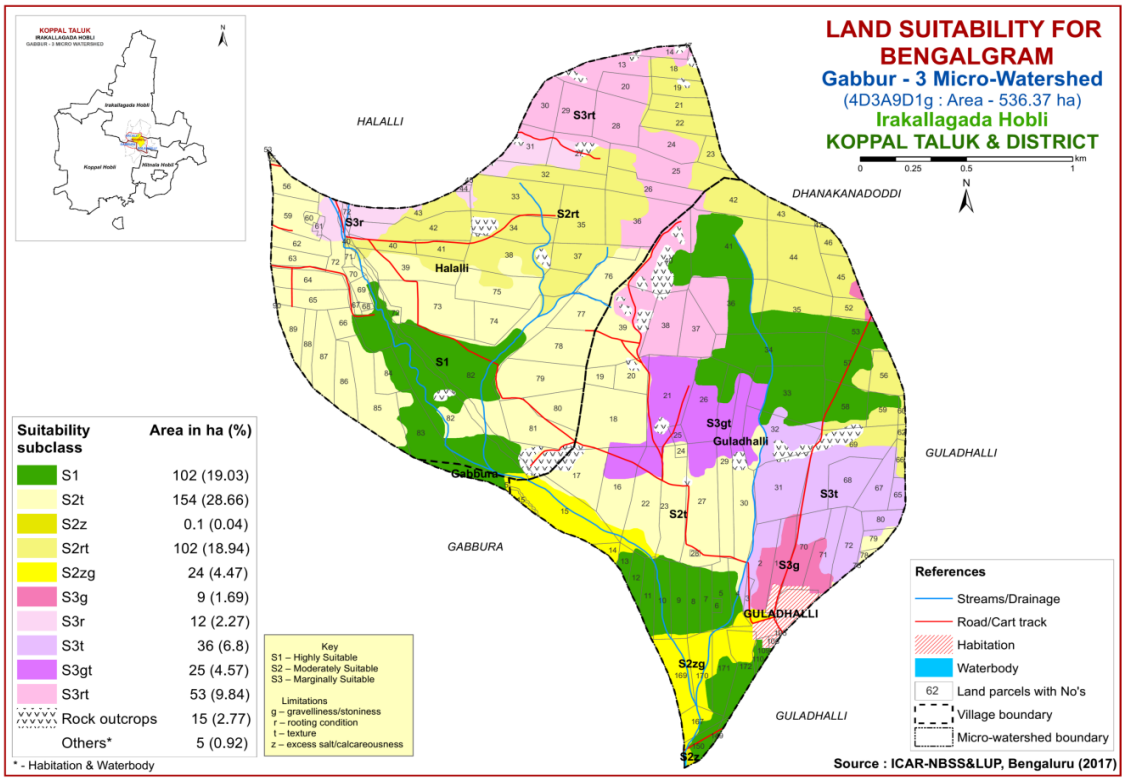


Fig. 7.5 Land Suitability map of Bengalgram

7.6 Land Suitability for Groundnut (*Arachis hypogaea*)

Groundnut is one of the major oilseed crop grown in an area of 6.54 lakh ha in Karnataka in most of the districts either as rainfed or irrigated crop. The crop requirements for growing groundnut (Table 7.6) were matched with the soil-site characteristics (Table 7.1) of the soils of the microwatershed and 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 7.6.

An area of 29 ha (5%) is highly suitable (Class S1) for growing groundnut and are distributed in the western part of the microwatershed. Moderately suitable (Class S2) lands cover a major area of 262 ha (49%) and are distributed in all parts of the microwatershed. They have minor limitations of rooting condition, texture and gravelliness. An area of 224 ha (42%) is marginally suitable (Class S3) for groundnut and are distributed in the northern, northwestern, southern, southwestern and eastern part of the microwatershed. They have moderate limitations of gravelliness, rooting condition, calcareousness and texture.

Table 7.6 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)	dS m^{-1}	<2.0	2.0-4.0	4.0-8.0	
Sodicity (ESP)	%	<5	5-10	>10	

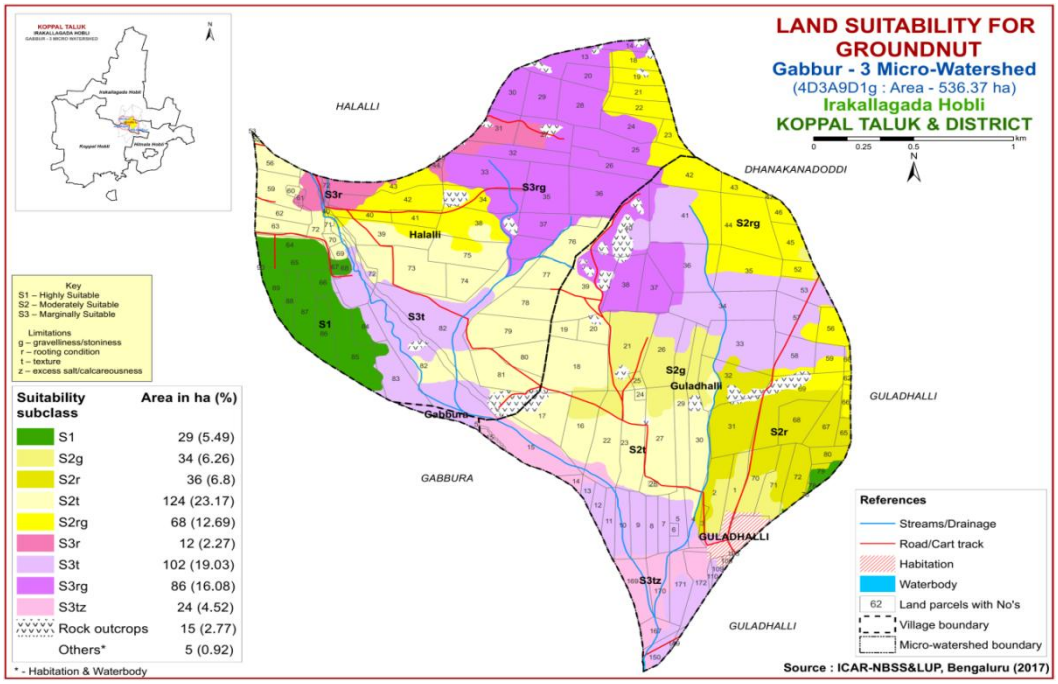


Fig. 7.6 Land Suitability map of Groundnut

7.7 Land Suitability for Sunflower (*Helianthus annus*)

Sunflower is one of the most important oilseed crop grown in an area of 3.56 lakh ha in the State in all the districts. The crop requirements for growing sunflower (Table 7.7) 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 7.7.

Highly suitable (Class S1) lands occupy an area of 122 ha (23%) for growing sunflower and are distributed in the western, eastern, southeastern and southern part of the microwatershed. An area of 157 ha (29%) is moderately suitable (Class S2) and are distributed in the western, central, southwestern and southern part of the microwatershed. They have minor limitations of rooting condition and calcareousness. Major area of 172

ha (32%) is marginally suitable (Class S3) for growing sunflower with moderate limitations of texture, rooting condition and gravelliness. Not suitable (Class N1) lands cover an area of 65 ha (12%) and are distributed in the northern and central part of the microwatershed with severe limitations of rooting condition and gravelliness.

Table 7.7 Crop suitability criteria for Sunflower

Crop requirement		Rating			
Soil–site characteristics	**Unit**	**Highly suitable(S1)**	**Moderately Suitable (S2)**	**Marginally suitable (S3)**	**Not suitable(N)**
Slope	%	<3	3-5	5-10	>10
LGP	Days	>90	80-90	70-80	<70
Soil drainage	class	Well drained	mod. Well drained	imperfectly drained	Poorly drained
Soil reaction	pH	6.5-8.0	8.1-8.5,5.5-6.4	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	

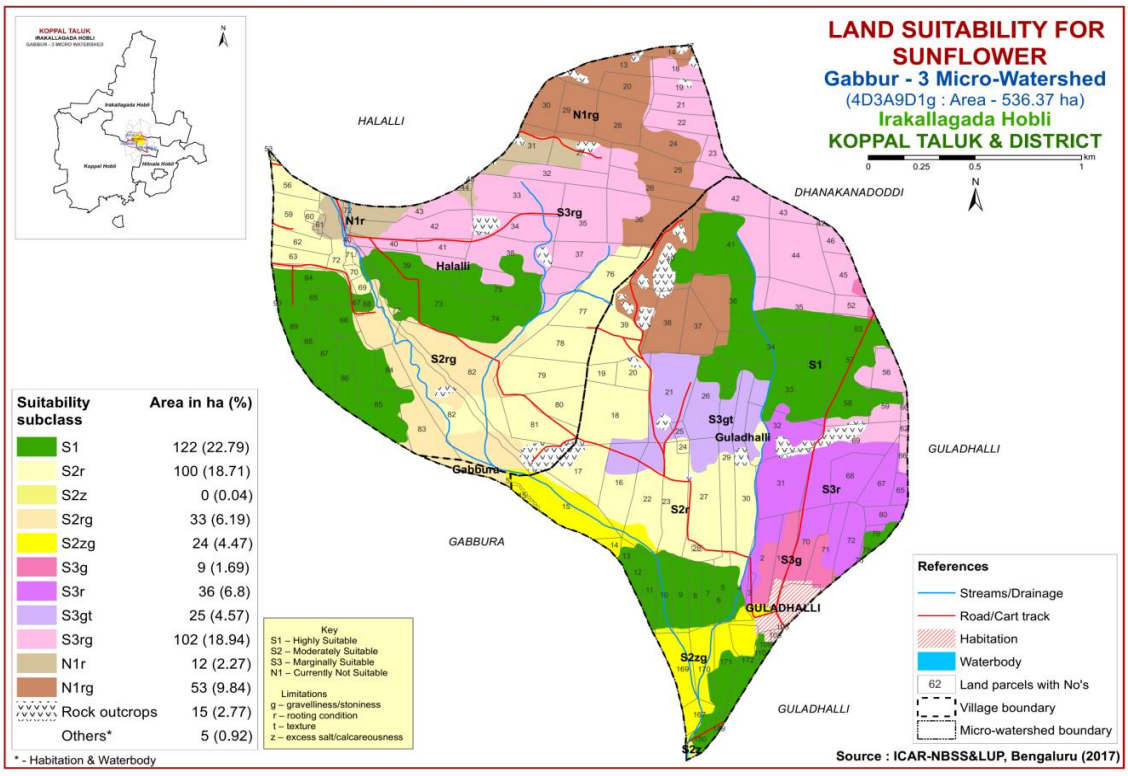


Fig. 7.7 Land Suitability map of Sunflower

7.8 Land Suitability for Cotton (*Gossypium hirsutum*)

Cotton is one of the most important fibre crop grown in the State in about 8.75 lakh ha area in Raichur, Dharwad, Belgaum, Gulbarga, Bijapur, Bidar, Bellary, Chitradurga and Chamarajnagar districts. The crop requirements for growing cotton

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

Table 7.8 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 mod.well	Imperfectly drained	P.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)	dS m^{-1}	2-4	4.0-8.0	8.0-12	>12
Sodicity (ESP)	%	5-10	10-20	20-30	>30

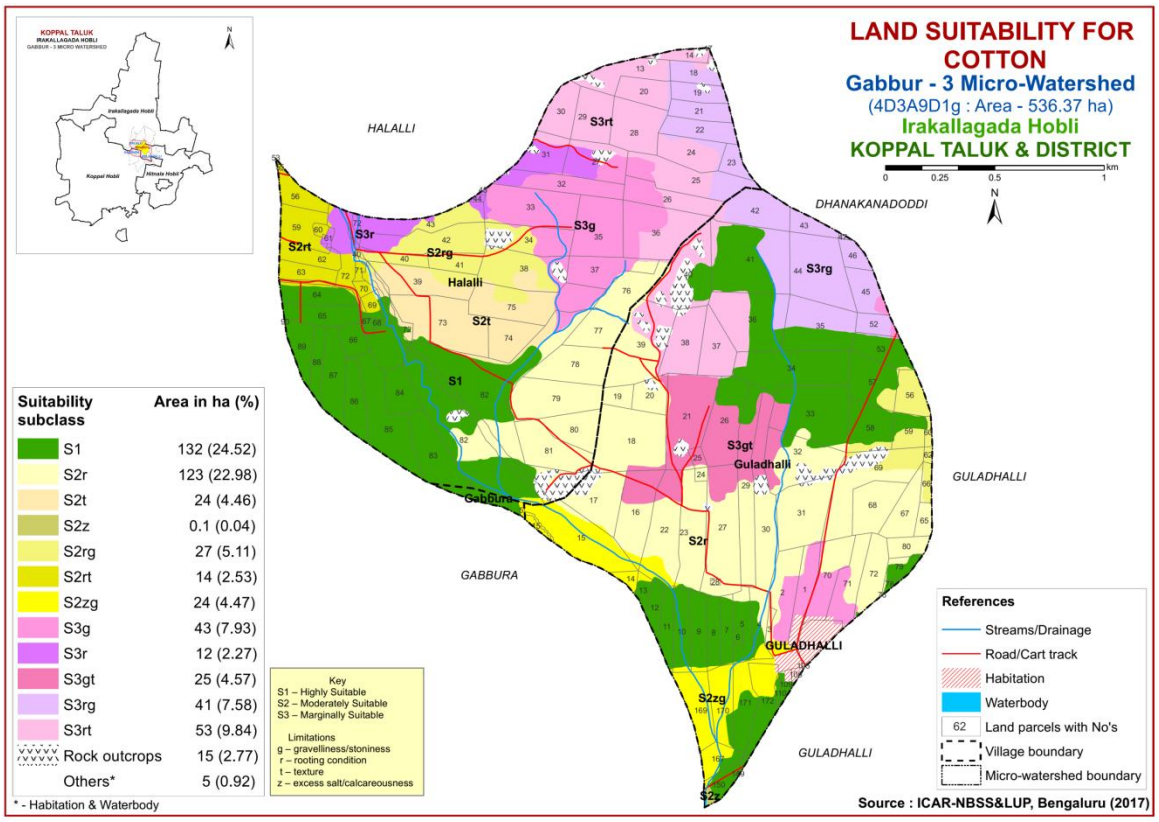


Fig. 7.8 Land Suitability map of Cotton

An area of 132 ha (25%) is highly suitable (Class S1) for growing cotton and are distributed in the eastern, western, southeastern and southern part of the microwatershed.

Moderately suitable (Class S2) lands occupy an area of 212 ha (40%) and are distributed in the major part of the microwatershed. They have minor limitations of rooting condition, gravelliness, texture and calcareousness. Marginally suitable (Class S3) lands cover an area of 174 ha (32%) and are distributed in the northern, central, northwestern and southeastern part of the microwatershed. They have moderate limitations of gravelliness, texture and rooting condition.

7.9 Land Suitability for Chilli (*Capsicum annuum L*)

Chilli is one of the most important commercial crop grown in an area of 0.89 lakh ha in all the districts of Karnataka State. The crop requirements for growing chilli (Table 7.9) were matched with the soil-site characteristics (Table 7.1) of the soils of the microwatershed and a land suitability map for growing chilli was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.9.

Highly suitable (Class S1) lands occupy an area of 154 ha (29%) for growing chilli and are distributed in the western, central and southeastern part of the microwatershed. Moderately suitable (Class S2) lands cover an area of 63 ha (12%) and are distributed in the northwestern and eastern part of the microwatershed. They have minor limitations of gravelliness and rooting condition. Marginally suitable (Class S3) lands cover a maximum area of about 299 ha (56%) and are distributed in the major part of the microwatershed. They have moderate limitations of gravelliness, texture, calcareousness and rooting condition.

Table 7.9 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 temperature 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./p.drained /excessively	Very 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)	dS m^{-1}	<1.0	1.0-2.0	2.0-4.0	<4
Sodicity (ESP)	%	<5	5-10	10-15	

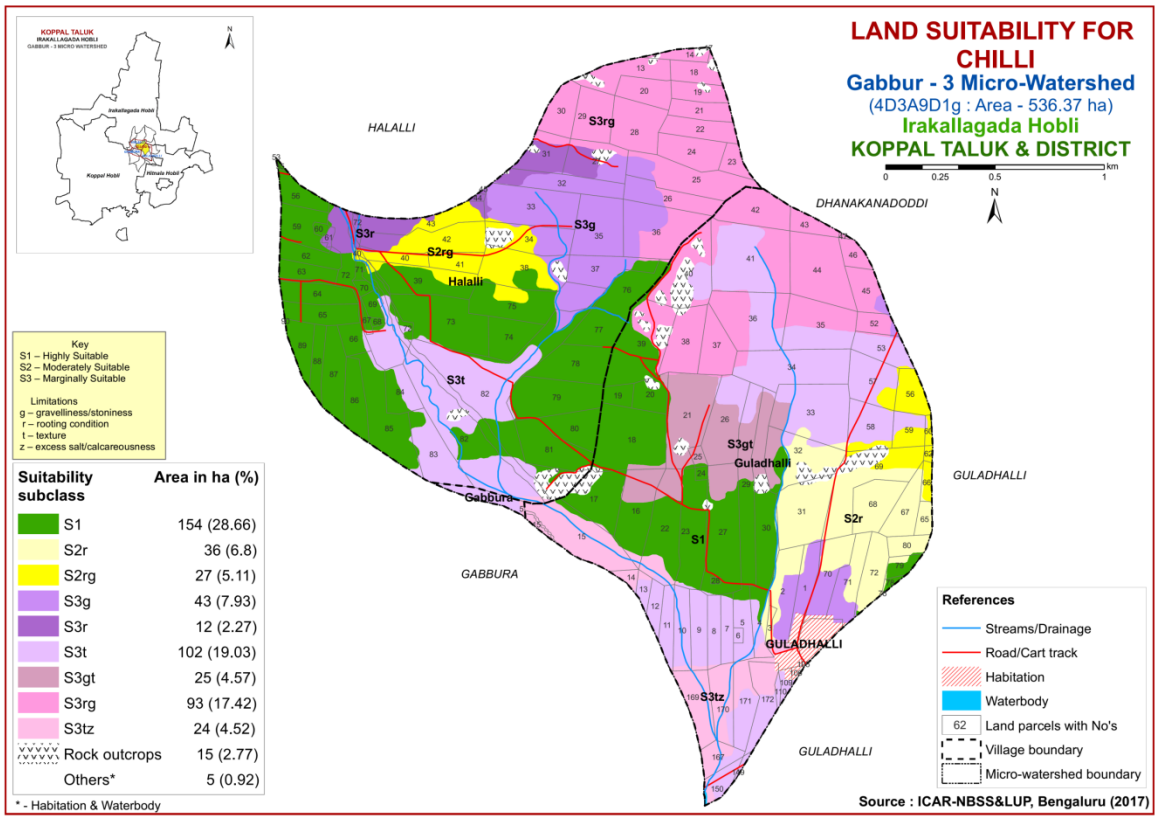


Fig. 7.9 Land Suitability map of Chilli

7.10 Land Suitability for Tomato (*Solanum lycopersicum*)

Tomato is one of the most important vegetable crop grown in an area of 0.65 lakh ha in almost all the districts of the State. The crop requirements (Table 7.10) for growing tomato 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 geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.10.

An area of 154 ha (29%) is highly suitable (Class S1) for growing tomato and are distributed in the central, eastern and western part of the microwatershed. Moderately suitable (Class S2) lands occupy 87 ha (16%) and are distributed in the northwestern, southern, southwestern and eastern part of the microwatershed with minor limitations of gravelliness, rooting condition and calcareousness. Marginally suitable (Class S3) lands cover a maximum area of 275 ha (51%) and occur in the major part of the microwatershed. They have moderate limitations of gravelliness, texture and rooting condition.

Table 7.10 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	Imperfectly drained	Poorly drained
Nutrient availability	Texture	Class	l, sl, cl, scl	sic,sicl,sc,c(m/k)	c (ss)	ls, s
	pH	1:2.5	6.0-7.0	5.0-5.9,7.1-8.5	<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	slight	strongly	
	Sodicity(ESP)	%	<10	10-15	>15	-
Erosion	Slope	%	1-3	3-5	5-10	>10

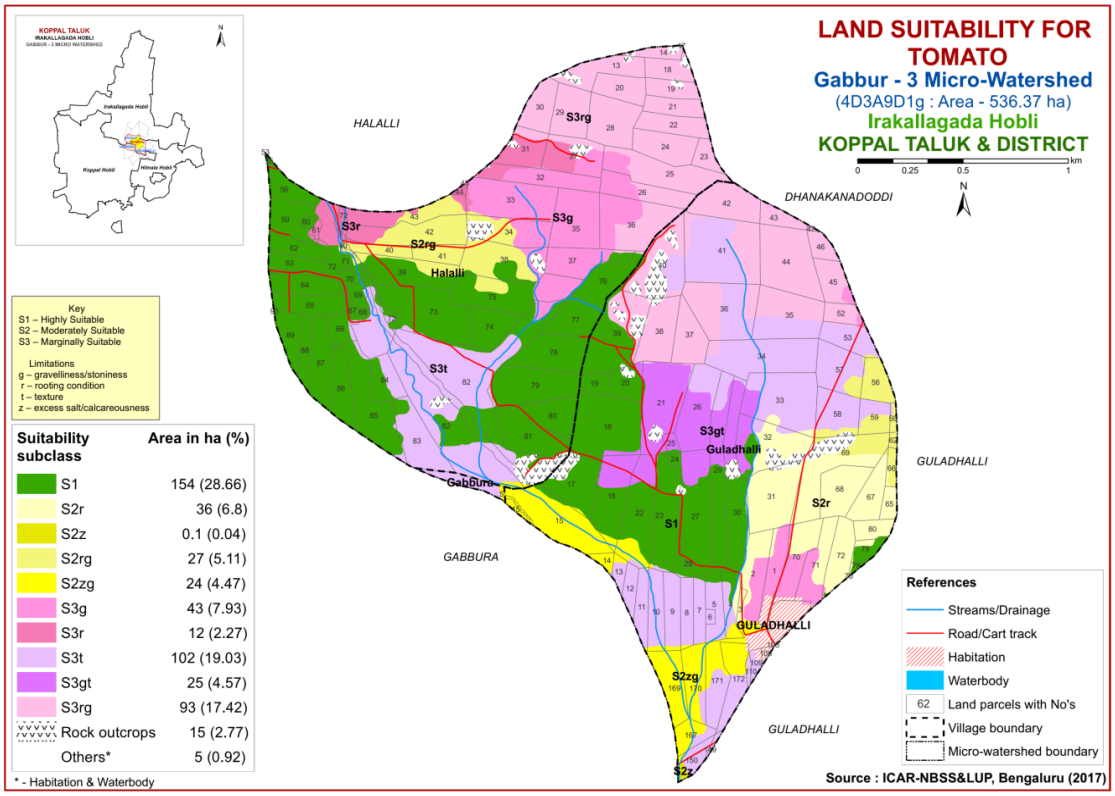


Fig. 7.10 Land Suitability map of Tomato

7.11 Land Suitability for Drumstick (*Moringa oleifera)*

Drumstick is one of the most important vegetable crop grown in 2403 ha area in the state. The crop requirements for growing drumstick (Table 7.11) 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.

An area of 53 ha (10%) is highly suitable (Class S1) for growing drumstick and are distributed in the western part of the microwatershed. Moderately suitable (Class S2) lands occupy an area of 260 ha (49%) and are distributed in the major part of the microwatershed. They have minor limitations of gravelliness, rooting condition, texture and calcareousness. Marginally suitable (Class S3) lands cover an area of 138 ha (11%) and are distributed in the northern, northeastern and eastern part of the microwatershed. They have moderate limitations of gravelliness and rooting condition. Not suitable (Class N1) lands cover an area of 65 ha (12%) and are distributed in the northern, central and northwestern part of the microwatershed with severe limitations of rooting condition and gravelliness.

Table 7.11 Land suitability criteria for Drumstick

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

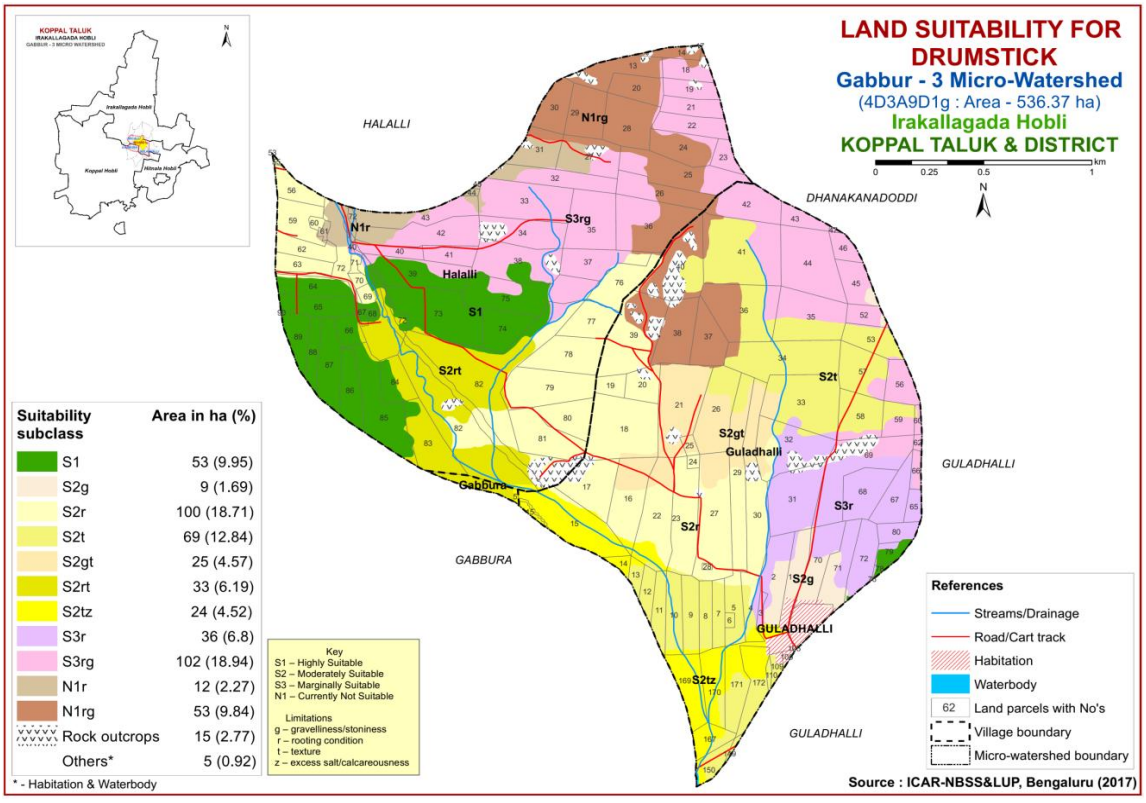


Fig. 7.11 Land Suitability map of Drumstick

7.12 Land Suitability for Mulberry (*Morus nigra*)

Mulberry is the most important leaf crop grown for rearing silkworms in about 1.66 lakh ha in all the districts of the State. The crop requirements for growing mulberry (Table 7.12) 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 7.12.

Table 7.12 Land 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

Note: Suitability evaluation only for Mulberry leaf not for Silk worm rearing

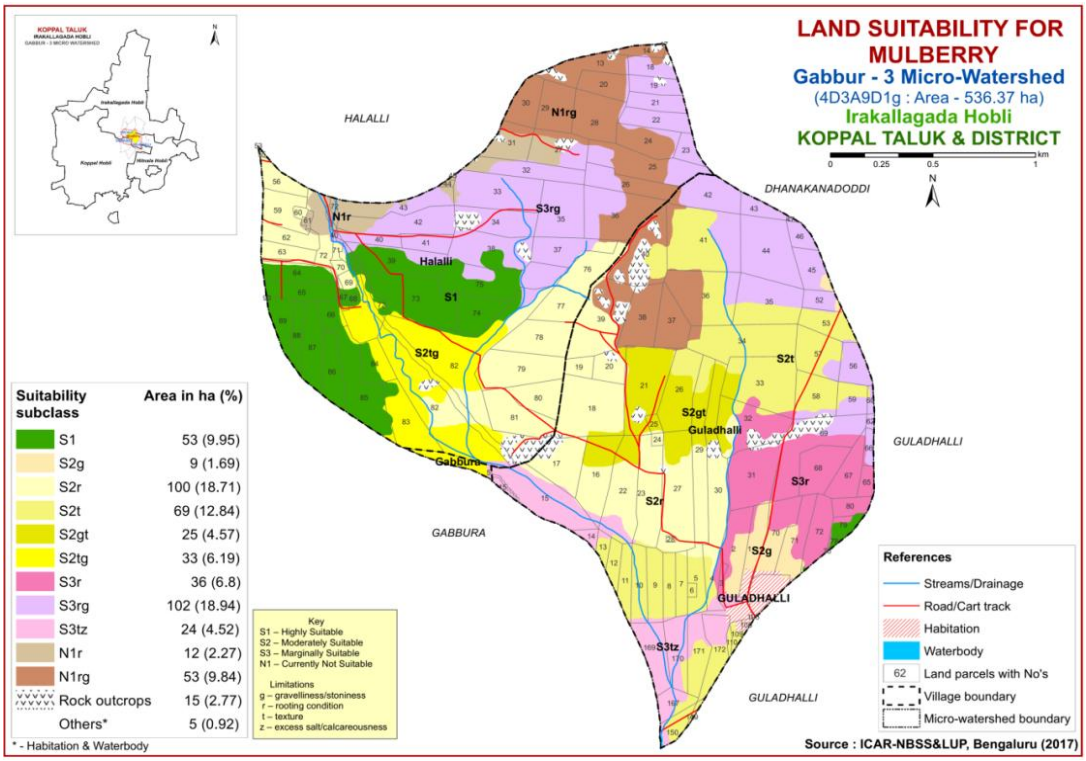


Fig. 7.12 Land Suitability map of Mulberry

Highly suitable (Class S1) lands cover an area of 53 ha (10%) for growing mulberry and are distributed in the western and eastern part of the microwatershed. Moderately suitable (Class S2) lands occupy a maximum area of 236 ha (44%) and are distributed in the major part of the microwatershed. They have minor limitations of

gravelliness, rooting condition and texture. Marginally suitable (Class S3) lands cover an area of 162 ha (30%) and occur in the northern, northeastern, southern, southeastern and eastern part of the microwatershed. They have moderate limitations of rooting condition, gravelliness, texture and calcareousness. An area of 65 ha (12%) is not suitable (N1) and are distributed in the central, northern and northwestern part of the microwatershed with severe limitations of rooting depth and gravelliness.

7.13 Land Suitability for Mango (*Mangifera indica*)

Mango is one of the most important fruit crop grown in about 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 are given in Figure 7.13.

Highly suitable (Class S1) lands cover an area of 29 ha (5%) for growing mango and are distributed in the western and eastern part of the microwatershed. An area of 24 ha (4%) is moderately suitable (Class S2) and are distributed in the western part of the microwatershed. They have minor limitation of rooting condition. Marginally suitable (Class S3) lands cover a maximum area of 260 ha (49%) and are distributed in the major part of the microwatershed. They have moderate limitations of rooting depth, texture, calcareousness and gravelliness. An area of 203 ha (38%) is not suitable (Class N1) for growing mango and occur in the northern, central and eastern part of the microwatershed with severe limitations of gravelliness and rooting condition.

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 imp.drained	Poor drained	Very poorly drained
	Water table	M	>3	2.50-3.0	2.5-1.5	<1.5
Nutrient availability	Texture	Class	sc, l, sil, cl	sl, sc, sic, l, c	c (<60%)	c (>60%),
	pH	1:2.5	5.5-7.5	7.6-8.5,5.0-5.4	8.6-9.0,4.0-4.9	>9.0<4.0
	OC	%	High	medium	low	
	$CaCO_3$ in root zone	%	Non calcareous	<5	5-10	>10
Rooting conditions	Soil depth	cm	>200	125-200	75-125	<75
	Gravel content	%vol	Non-gravelly	<15	15-35	>35
Soil toxicity	Salinity	dS/m	Non saline	<2.0	2.0-3.0	>3.0
	Sodicity	%	Non sodic	<10	10-15	>15
Erosion	Slope	%	<3	3-5	5-10	

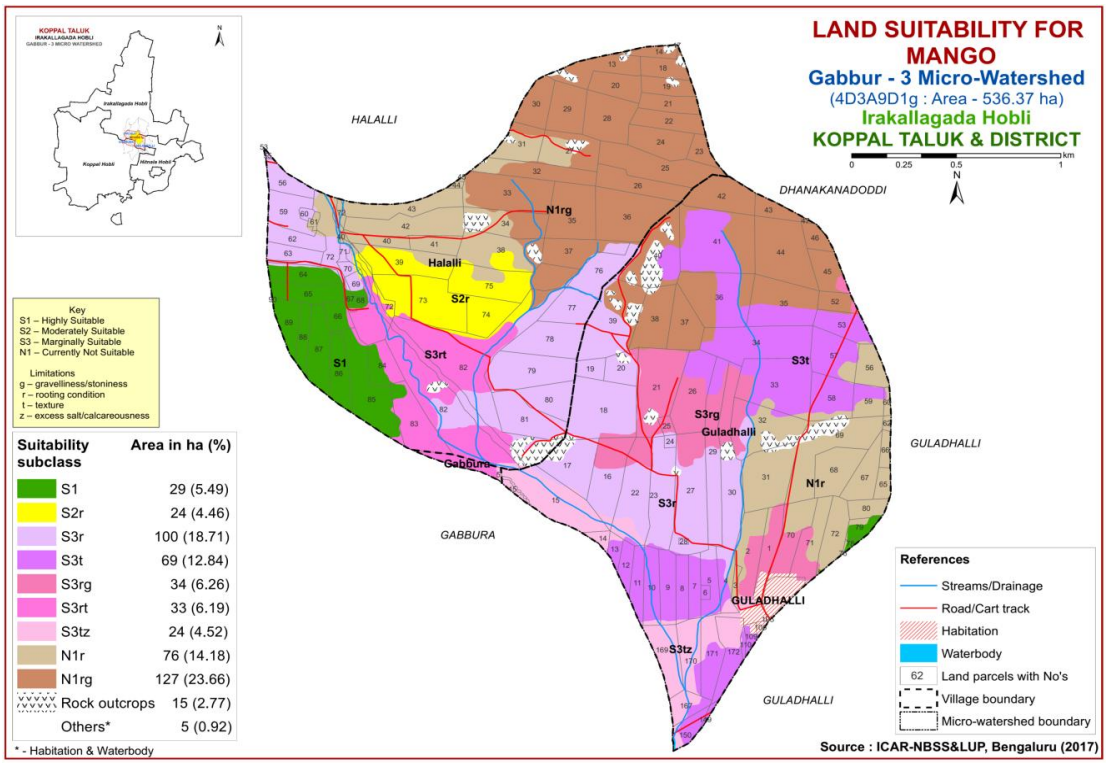


Fig. 7.13 Land Suitability map of Mango

7.14 Land Suitability for Sapota (*Manilkara zapota*)

Sapota is one of the most important fruit crop grown in an area of about 29373 ha in almost all the districts of the State. The crop requirements (Table 7.14) 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 geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.14.

Table 7.14 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

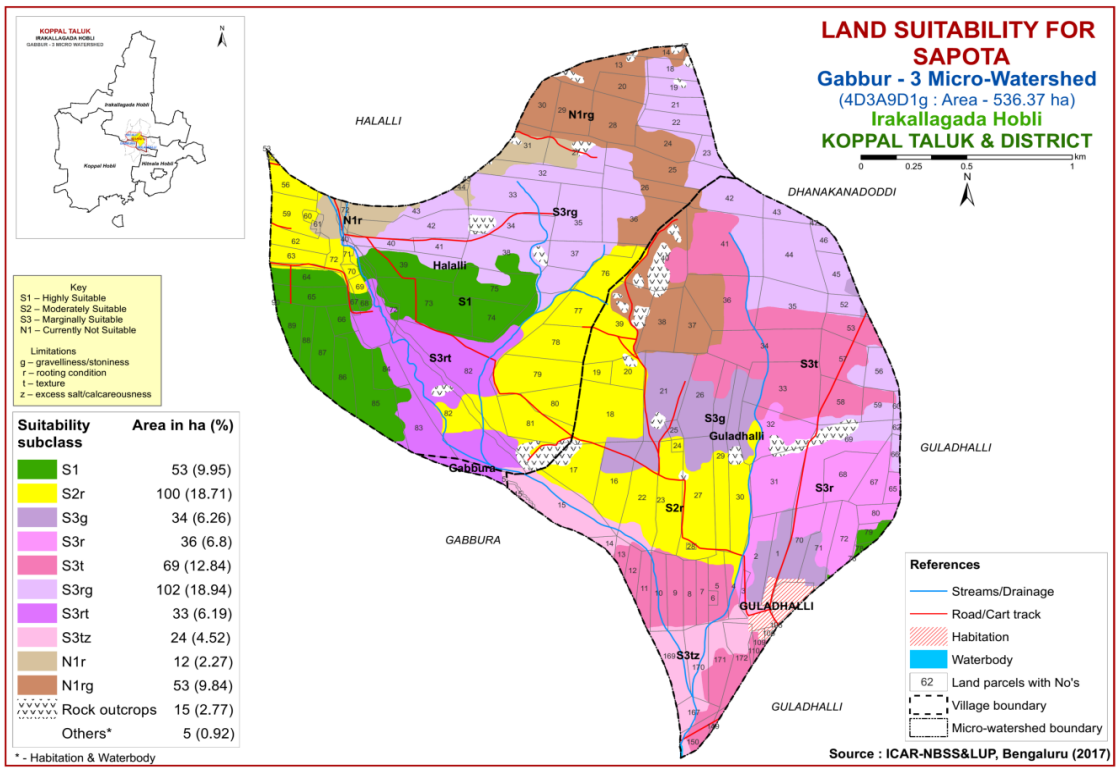


Fig. 7.14 Land Suitability map of Sapota

Highly suitable (Class S1) lands occupy an area of 53 ha (10%) for growing sapota and are distributed in the eastern and western part of the microwatershed. An area of 100 ha (19%) is moderately suitable (Class S2) and are distributed in the western and central part of the microwatershed with minor limitation of rooting condition. Marginally suitable (Class S3) lands cover a maximum area of 298 ha (56%) and occur in the major part of the microwatershed. They have moderate limitations of gravelliness, texture, rooting condition and calcareousness. An area of 65 ha (12%) is not suitable (Class N1) for growing sapota and occur in the northern, central and northwestern part of the microwatershed with severe limitations of gravelliness and rooting condition.

7.15 Land Suitability for Pomegranate (*Punica granatum*)

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

Highly suitable (Class S1) lands occupy an area of 53 ha (10%) for growing pomegranate and are distributed in the eastern and western part of the microwatershed. Moderately suitable (Class S2) lands occupy an area of 226 ha (42%) and are distributed in the major part of the microwatershed. They have minor limitations of rooting condition, texture and calcareousness. An area of 172 ha (32%) is marginally suitable

(Class S3) and are distributed in the northern, central and eastern part of the microwatershed. They have moderate limitations of rooting condition and gravelliness. An area of 65 ha (12%) is not suitable (Class N1) for growing pomegranate and are distributed in the northern, central and northwestern part of the microwatershed with severe limitations of gravelliness and rooting condition.

Table 7.15 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	^{0}C	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	cl, scl, l, cl	c, sic, sicl	cl, s, ls	s, fragmental
Rooting conditions	pH	1:2.5	5.5-7.5	7.6-8.5	8.6-9.0	
	Soil depth	cm	>100	75-100	50-75	<50
	Gravel content	% vol.	nil	15-35	35-60	>60
Soil toxicity	Salinity	dS/m	Nil	<9	>9	<50
	Sodicity	%	nil			
Erosion	Slope	%	<3	3-5	5-10	

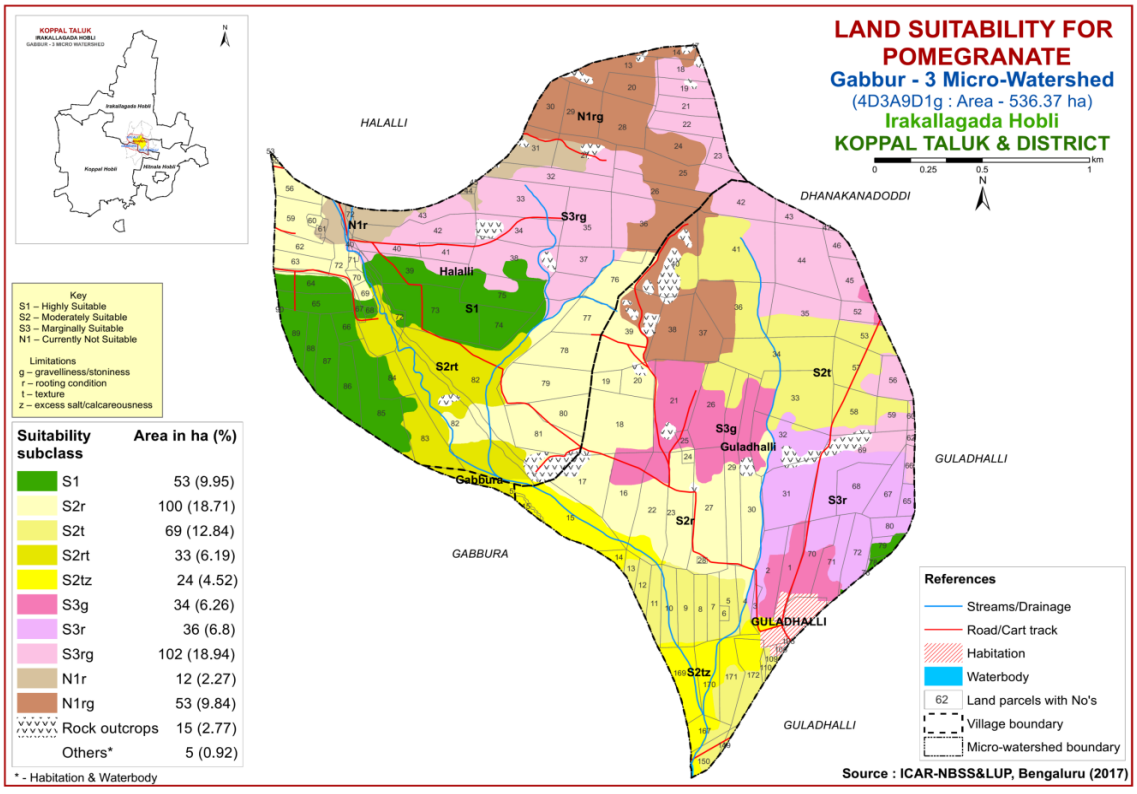


Fig. 7.15 Land Suitability map of Pomegranate

7.16 Land suitability for Guava (*Psidium guajava*)

Guava is one of the most important fruit crop grown in an area of about 0.64 lakh ha in almost all the districts of the State. The crop requirements (Table 7.16) for growing guava were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing guava was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.16.

An area of 53 ha (10%) is highly suitable (Class S1) for growing guava and are distributed in the western and eastern part of the microwatershed. An area of 101 ha (19%) is moderately suitable (Class S2) and are distributed in the western and central part of the microwatershed. They have minor limitations of rooting condition and texture. Marginally suitable (Class S3) lands cover a maximum area of 298 ha (51%) and are distributed in the major part of the microwatershed. They have moderate limitations of gravelliness, texture, rooting condition and calcareousness. An area of about 65 ha (12%) area is not suitable (Class N1) for growing guava and occur in the northern, western, northwestern and central part of the microwatershed with severe limitations of rooting condition and gravelliness.

Table 7.16 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

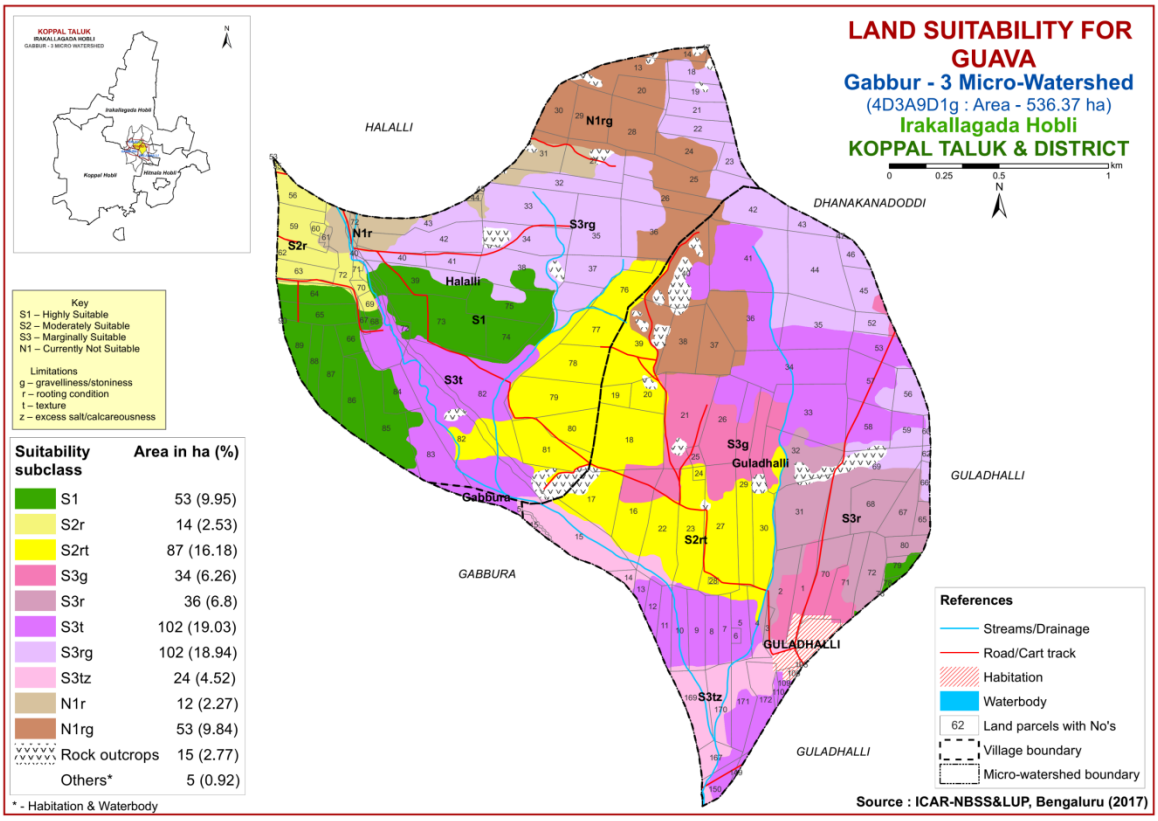


Fig. 7.16 Land Suitability map of Guava

7.17 Land Suitability for Jackfruit (*Artocarpus heterophyllus*)

Jackfruit is one of the most important fruit crop grown in 5368 ha in all the districts of the State. The crop requirements for growing jackfruit (Table 7.17) 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 geographic distribution of different suitability subclasses in the microwatershed are given in figure 7.17.

Table 7.17 Crop 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	-

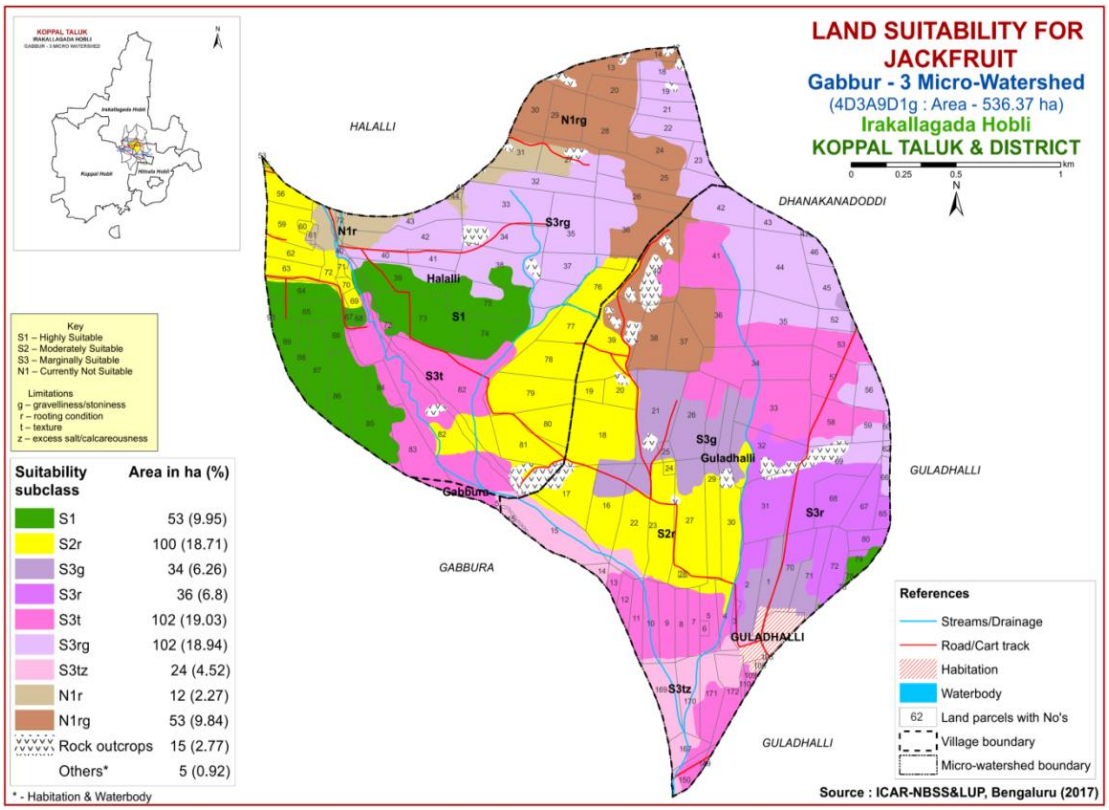


Fig. 7.17 Land Suitability map of Jackfruit

An area of 52 ha (10%) is highly suitable (Class S1) for growing jackfruit and are distributed in the western and eastern part of the microwatershed. An area of 100 ha (19%) is moderately suitable (Class S2) and are distributed in the western and central part of the microwatershed with minor limitation of rooting condition. Marginally suitable (Class S3) lands cover a maximum area of 298 ha (56%) and are distributed in the major part of the microwatershed. They have moderate limitations of gravelliness, texture and calcareousness. An area of 65 ha (12%) is not suitable (Class N1) for growing jackfruit and occur in the northern, western, northwestern and central part of the microwatershed with severe limitations of gravelliness and rooting condition.

7.18 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 7.18) 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 geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.18.

An area of 29 ha (5%) is highly suitable (Class S1) for growing jamun and are distributed in the western and eastern part of the microwatershed. An area of 204 ha (38%) is moderately suitable (Class S2) and occur in the major part of the microwatershed. They have minor limitations of rooting condition, texture and calcareousness. Marginally suitable (Class S3) lands cover maximum area of 219 ha (41%) and are distributed in the northern, eastern, central and western part of the

microwatershed with moderate limitations of rooting condition, texture and gravelliness. An area of 65 ha (12%) is not suitable (Class N1) and are distributed in the northern, northwestern and central part of the microwatershed with severe limitations of gravelliness and rooting condition.

Table 7.18 Crop 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

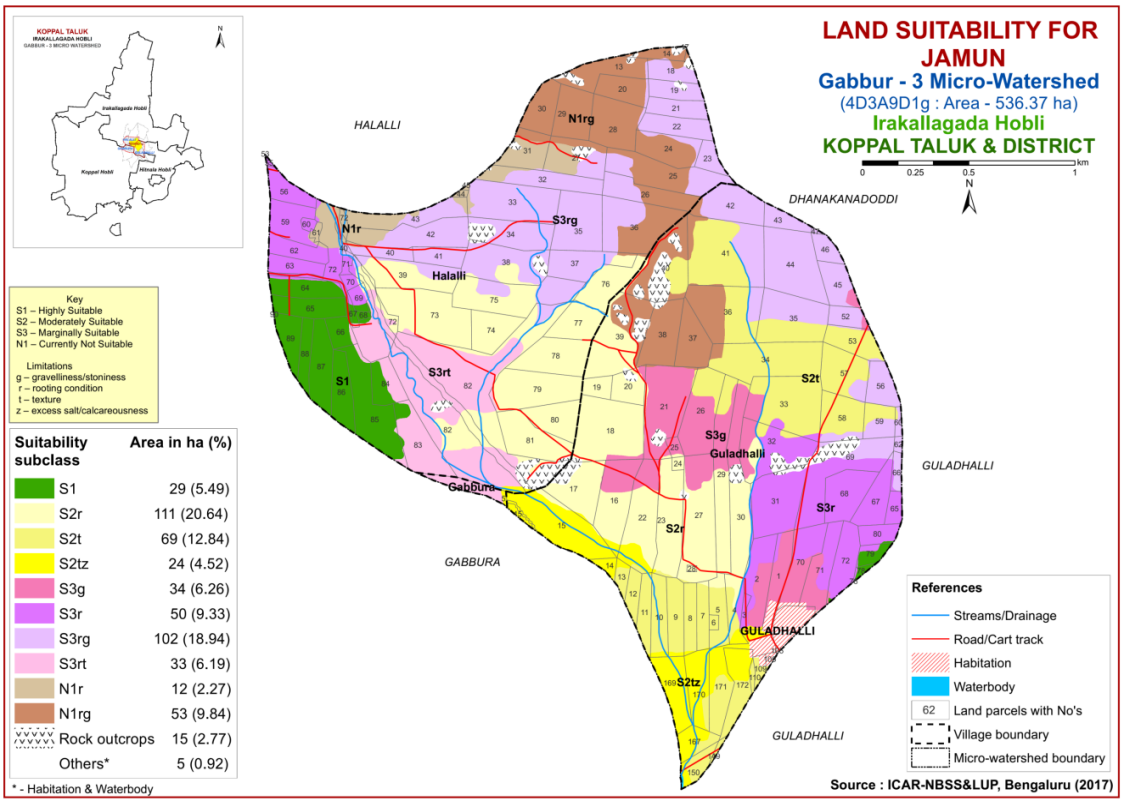


Fig. 7.18 Land Suitability map of Jamun

7.19 Land Suitability for Musambi (*Citrus limetta*)

Musambi is one of the most important fruit crop grown in almost all the districts of the State. The crop requirements for growing musambi (Table 7.19) 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 geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.19.

.

Table 7.19 Crop suitability criteria for Musambi

Crop requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable(S1)**	**Moderately suitable(S2)**	**Marginally suitable(S3)**	**Not suitable(N)**
Climate	Temperature in growing season	^0C	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 imp.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	

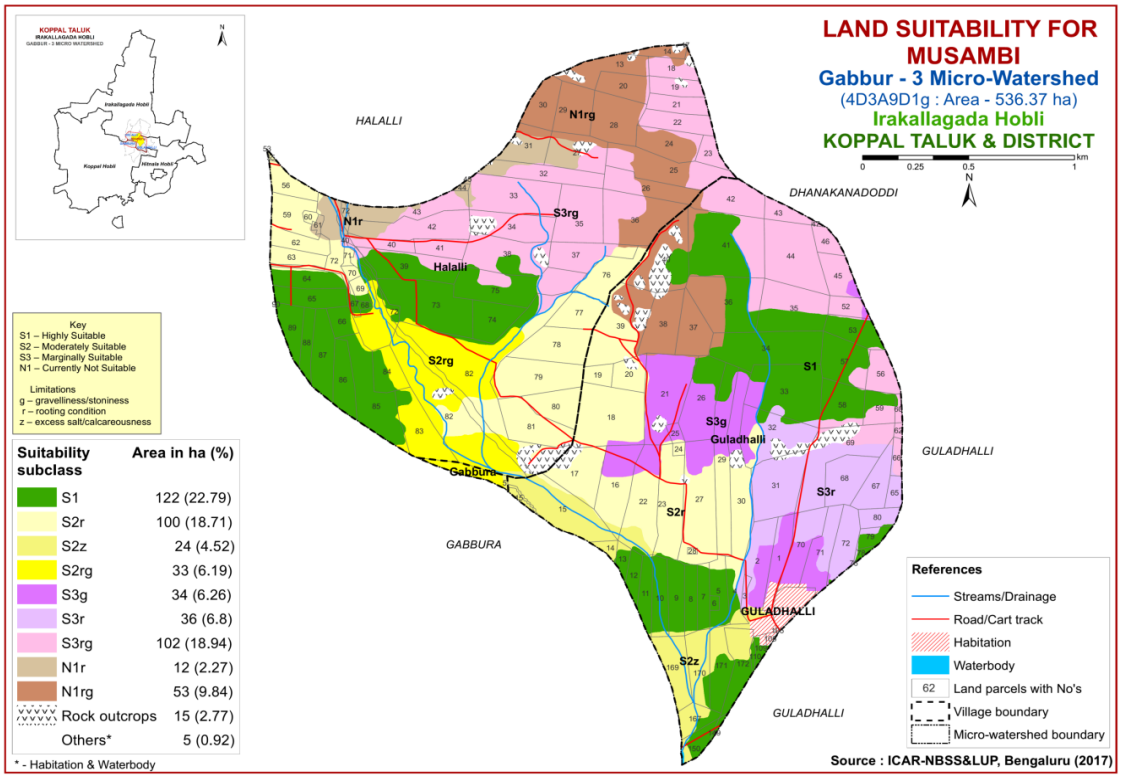


Fig. 7.19 Land Suitability map of Musambi

Highly suitable (Class S1) lands occupy an area of 122 ha (23%) for growing musambi and are distributed in the western, eastern, northeastern and southern part of the microwatershed. An area of 157 ha (29%) is moderately suitable (Class S2) for growing musambi and are distributed in the central, southwestern, southern and western part of the microwatershed. They have minor limitations of rooting condition, calcareousness and

gravelliness. Marginally suitable (Class S3) lands occur in an area of 172 ha (32%) for growing musambi and are distributed in the northern, central and eastern part of the microwatershed with moderate limitations of rooting condition and gravelliness. An area of 65 ha (12%) is not suitable (Class N1) for growing musambi and are distributed in the northern, northwestern and central part of the microwatershed. They have severe limitations of gravelliness and rooting condition

7.20 Land Suitability for Lime (*Citrus sp*)

Lime is one of the most important fruit crop grown in an area of 0.11 lakh ha in almost all the districts of the State. The crop requirements for growing lime (Table 7.20) 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 geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.20.

Highly suitable (Class S1) lands occupy an area of 122 ha (23%) for growing lime and are distributed in the western, eastern, northeastern and southern part of the microwatershed. An area of 157 ha (29%) is moderately suitable (Class S2) and are distributed in the western, central, southwestern and southern part of the microwatershed. They have minor limitations of rooting condition, calcareousness and gravelliness. Marginally suitable (Class S3) lands occur in an area of 172 ha (32%) for growing lime and distributed in the northern, northeastern, central and eastern part of the microwatershed with moderate limitations of rooting condition and gravelliness. An area of 65 ha (12%) is not suitable (Class N1) for growing lime and are distributed in the northern, northwestern and central part of the microwatershed with severe limitations of gravelliness and rooting condition.

Table 7.20 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 imp.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	

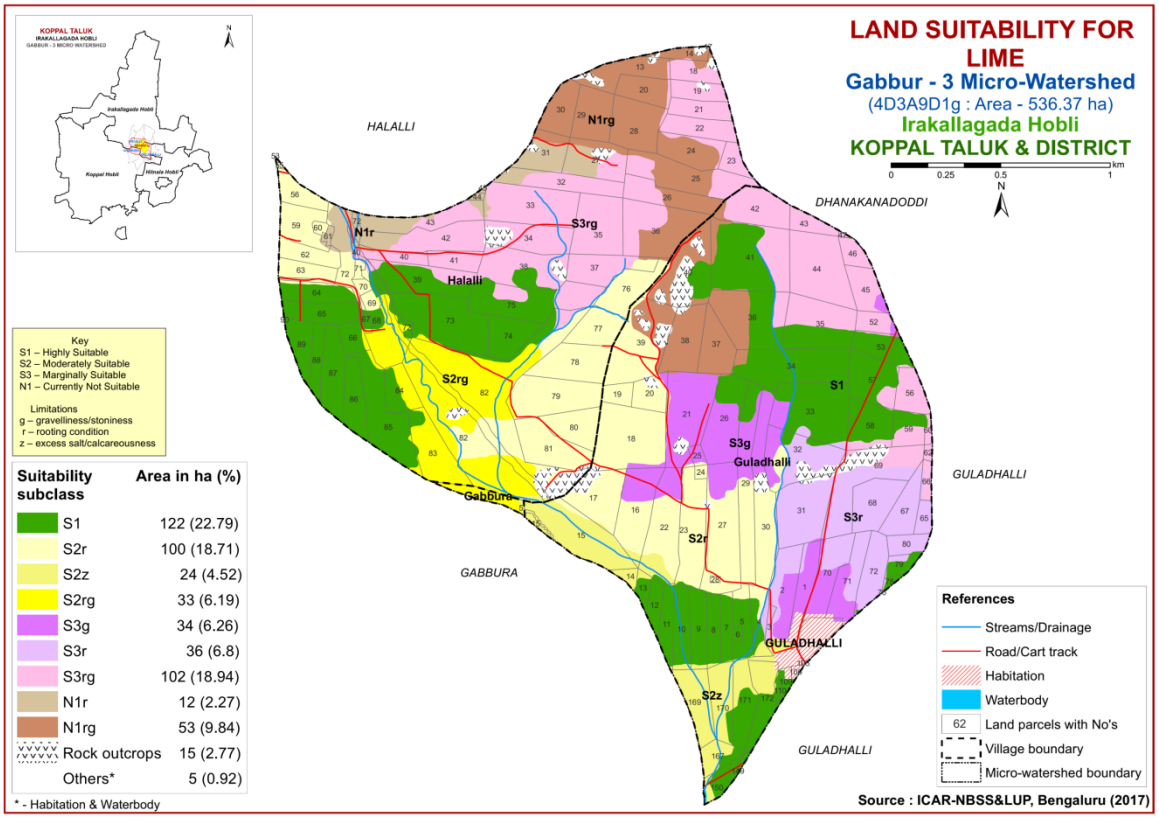


Fig. 7.20 Land Suitability map of Lime

7.21 Land Suitability for Cashew (*Anacardium occidentale)*

Cashew is one of the most important nut crop grown in an area of 1.24 lakh ha in almost all the districts of the State. The crop requirements for growing cashew (Table 7.21) 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 geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.21.

An area of 67 ha (12%) is highly suitable (Class S1) for growing cashew and are distributed in the western and eastern part of the microwatershed. An area of 87 ha (16%) is moderately suitable (Class S2) and occur in the central part of the microwatershed. They have minor limitations of rooting condition and texture. Marginally suitable (Class S3) lands occur in an area of 172 ha (32%) and are distributed in the northern, northeastern, eastern and central part of the microwatershed with moderate limitations of rooting condition and gravelliness. An area of about 191 ha (36%) is not suitable (Class N1) for growing cashew with severe limitations of texture, rooting condition, calcareousness and gravelliness. They are distributed in the northern, central, eastern, southern and southwestern part of the microwatershed.

Table 7.21 Crop 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				
	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	

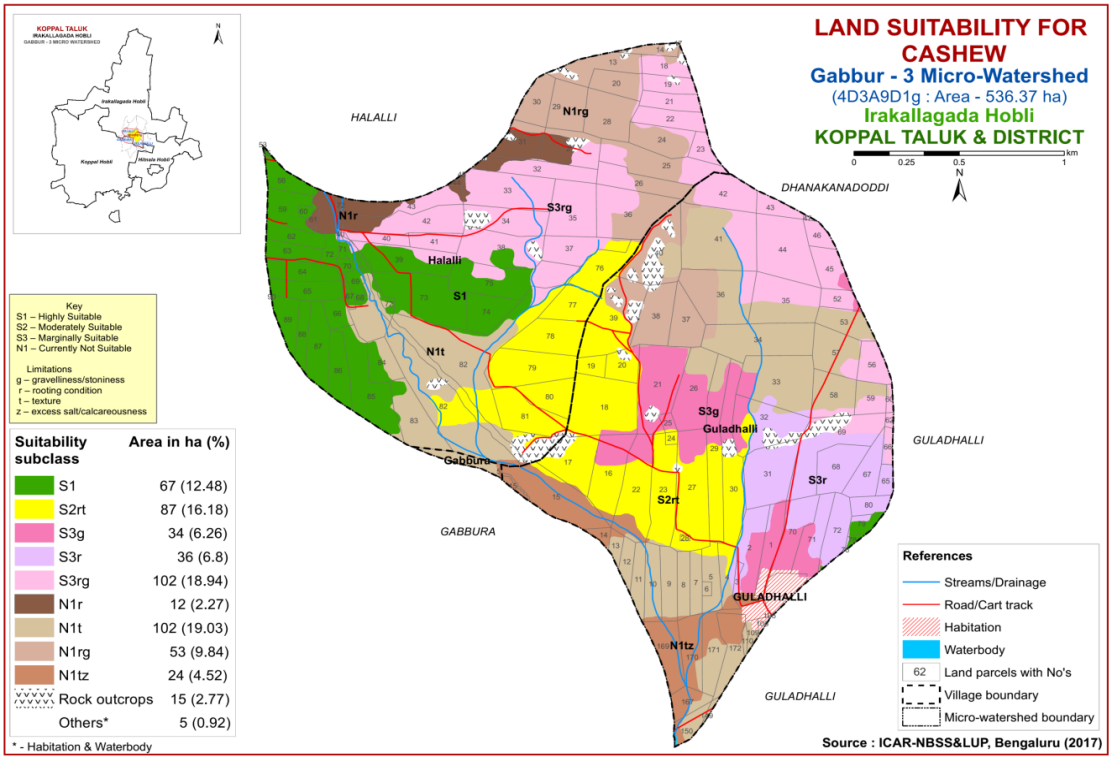


Fig. 7.21 Land Suitability map of Cashew

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 7.22) 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 geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.22.

An area of 256 ha (48%) is highly suitable (Class S1) for growing custard apple and are distributed in the major part of the microwatershed. An area of 196 ha (37%) is moderately suitable (Class S2) and are distributed in the central, northern, northeastern, eastern and southern part of the microwatershed. They have minor limitations of gravelliness, rooting condition and calcareousness. An area of 65 ha (12%) is marginally

suitable (Class S3) for growing custard apple and are distributed in the northern, northwestern and central part of the microwatershed with moderate limitations of gravelliness and rooting condition.

Table 7.22 Land suitability criteria for Custard apple

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

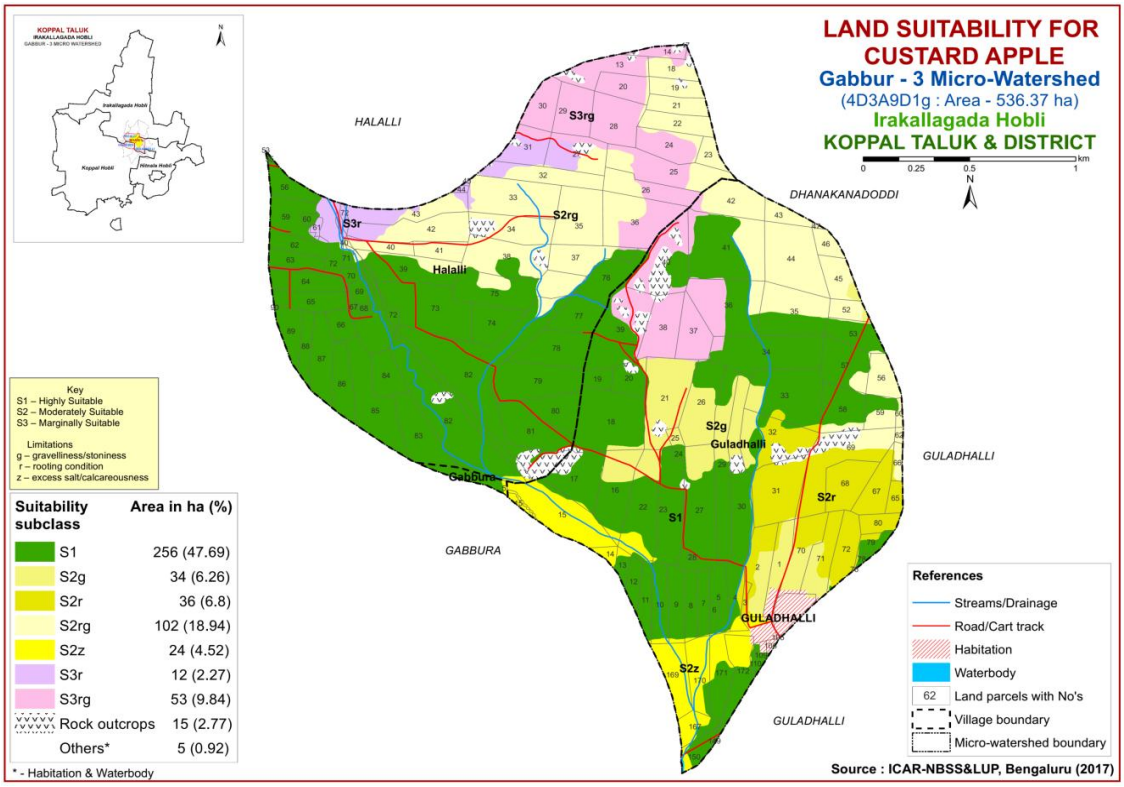


Fig. 7.22 Land Suitability map of Custard Apple

7.23 Land Suitability for Amla (*Phyllanthus emblica*)

Amla is one of the most important fruit and medicinal crop grown in 151 ha area of 151 ha and distributed in almost all the districts of the State. The crop requirements for growing amla (Table 7.23) 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

geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.23.

Highly suitable (Class S1) lands occupy an area of 154 ha (29%) for growing amla and are distributed in the western, central and eastern part of the microwatershed. Major area of 298 ha (56%) has soils that are moderately suitable (Class S2) and are distributed in all parts of the microwatershed. They have minor limitations of rooting condition, gravelliness, texture and calcareousness. The marginally suitable (Class S3) lands cover an area of 65 ha (12%) and occur in the northern, northwestern and central part of the microwatershed with moderate limitations of gravelliness and rooting condition.

Table 7.23 Crop 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	ccl,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

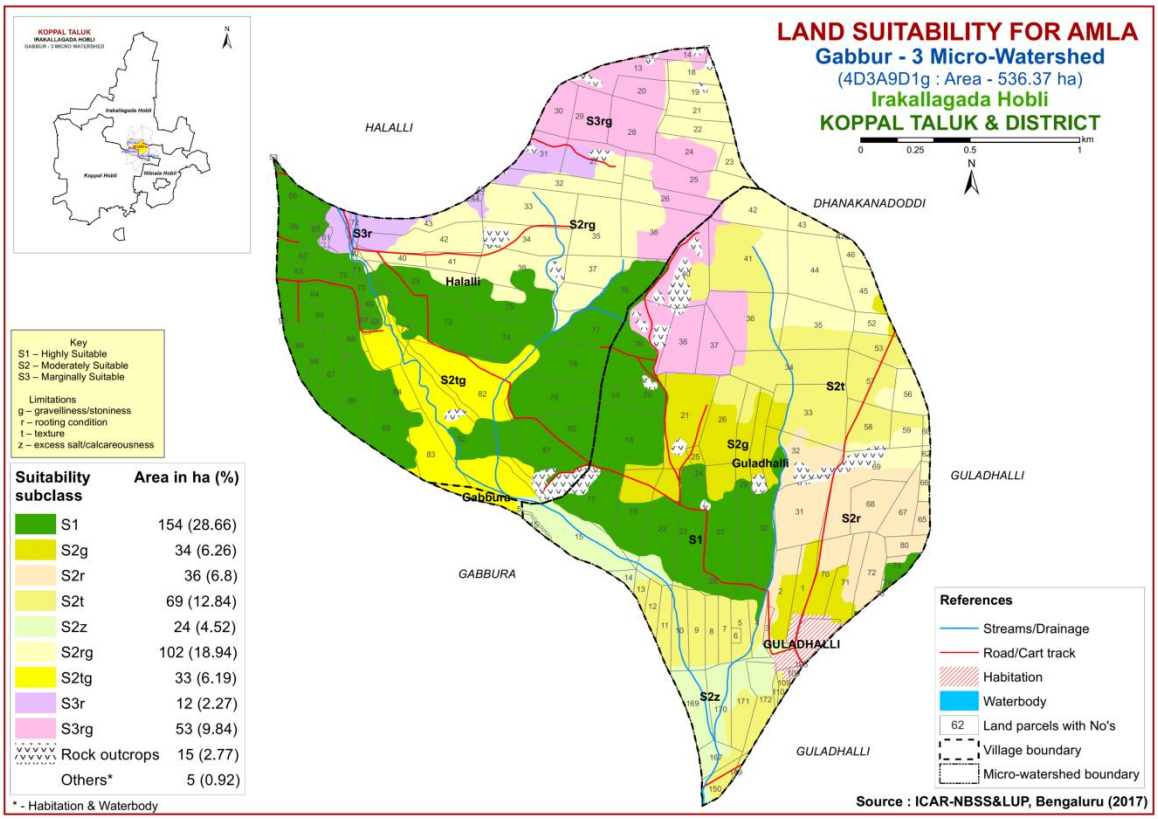


Fig. 7.23 Land Suitability map of Amla

7.24 Land Suitability for Tamarind (*Tamarindus indica*)

Tamarind is one of the most important spice crop grown in 14897 ha in 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 Figure 7.24.

Table 7.24 Crop 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

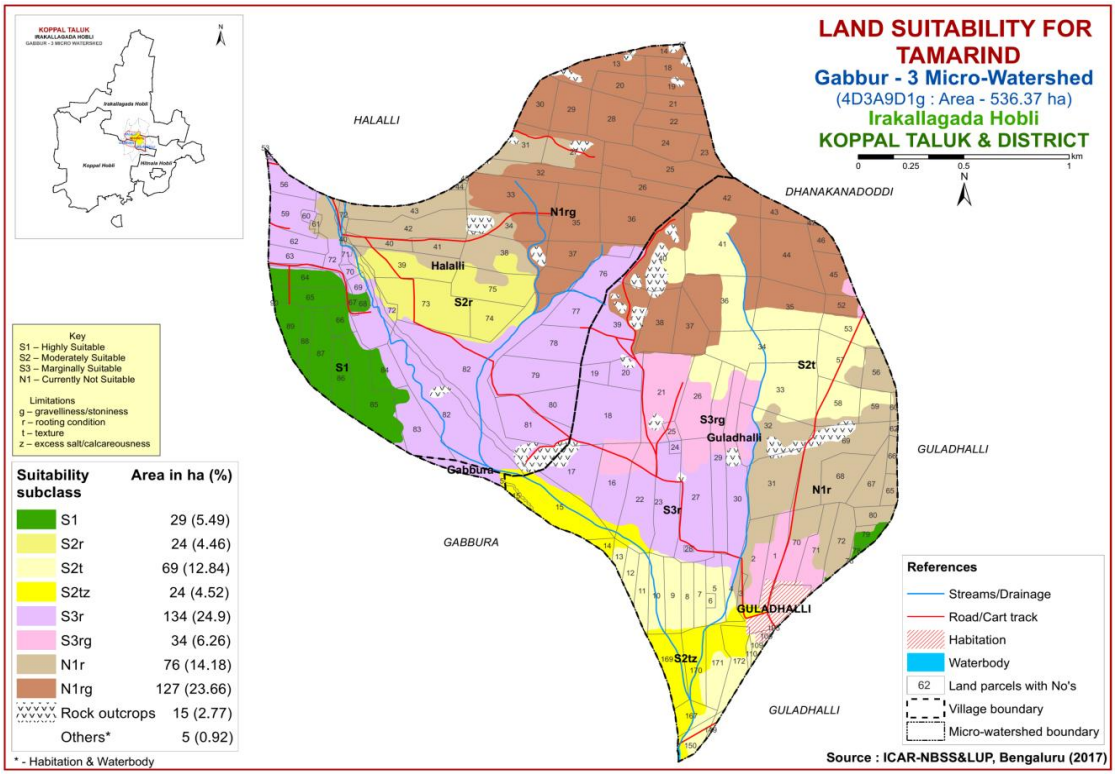


Fig. 7.24 Land Suitability map of Tamarind

Highly suitable lands (Class S1) occupy an area of 29 ha (5%) for growing tamarind and are distributed in the western and eastern part of the microwatershed. An area of 117 ha (22%) is moderately suitable (Class S2) and occur in the northeastern, western and southern part of the microwatershed. They have minor limitations of rooting condition, texture and calcareousness. An area of 168 ha (31%) is marginally suitable

(Class S3) and occur in the central, southwestern and western part of the microwatershed. They have moderate limitations of rooting condition and gravelliness. Major area of 203 ha (38%) is not suitable (Class N1) for growing tamarind and are distributed in the northern, northwestern and eastern part of the microwatershed with severe limitations of gravelliness and rooting condition.

7.25 Land Suitability for Marigold (*Tagetes erecta*)

Marigold is one of the most important flower crop grown in an area of 1858 ha in almost all the districts of the State. The crop requirements for growing marigold (Table 7.25) 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 is given in Figure 7.25.

An area of 67 ha (12%) is highly suitable (Class S1) for growing marigold and are distributed in the western and eastern part of the microwatershed. Major area of 276 ha (52%) is moderately suitable (Class S2) and are distributed in the major part of the microwatershed. They have minor limitations of texture, gravelliness, rooting condition and calcareousness. An area of 173 ha (32%) is marginally suitable (Class S3) for growing marigold and occur in the northern, central, northwestern and southeastern part of the microwatershed. They have moderate limitations of gravelliness, texture and rooting condition.

Table 7.25 Crop suitability criteria for Marigold

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

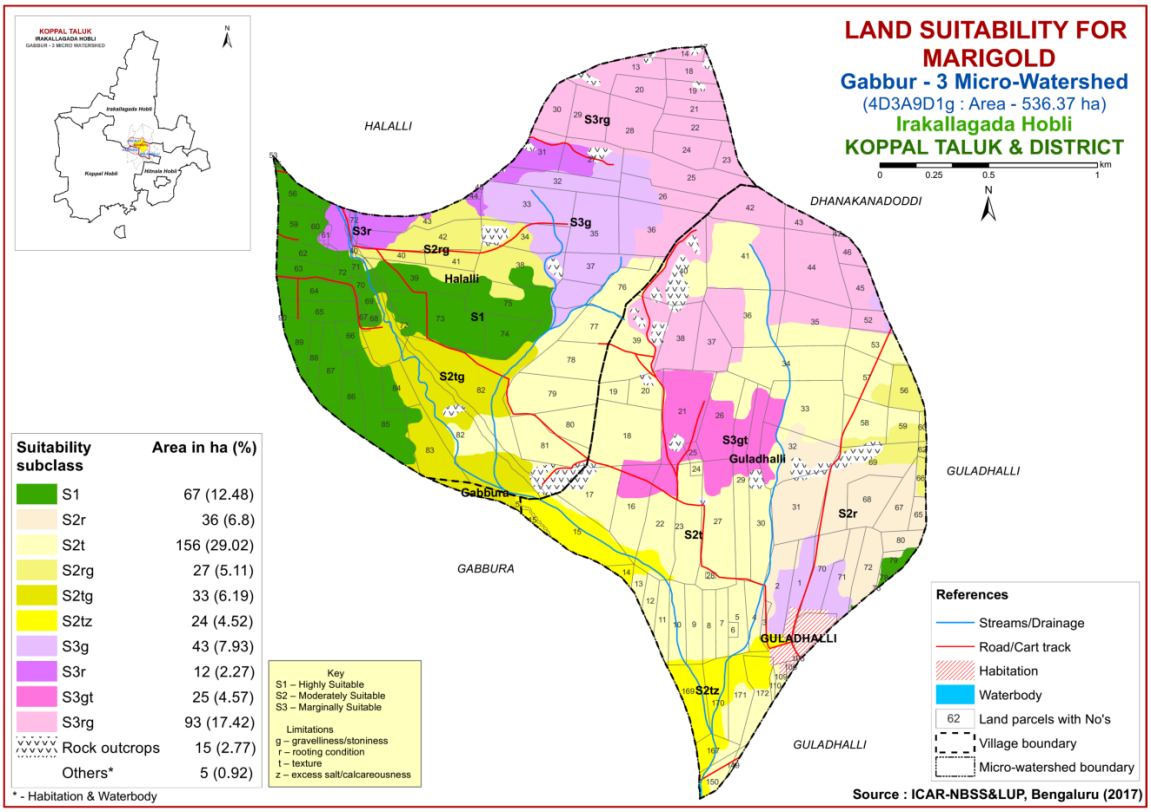


Fig. 7.25 Land Suitability map of Marigold

7.26 Land Suitability for Chrysanthemum (*Chrysanthemum indicum*)

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 for growing chrysanthemum (Table 7.26) 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 geographic distribution of different suitability subclasses in the microwatershed is given in Figure 7.26.

Highly suitable lands (Class S1) occupy an area of 67 ha (12%) for growing chrysanthemum and are distributed in the western and eastern part of the microwatershed. Major area of 276 ha (52%) is moderately suitable (Class S2) for growing chrysanthemum and are distributed in the major part of the microwatershed. They have minor limitations of calcareousness, gravelliness, rooting condition and texture. An area of 173 ha (32%) is marginally suitable (Class S3) for growing chrysanthemum and occur in the northern, central, northwestern and southeastern part of the microwatershed. They have moderate limitations of gravelliness, rooting condition and texture.

Table 7.26 Crop 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	Mod. well drained	Imperfectly drained	Poorly drained
Nutrient availability	Texture	Class	l ,sl, scl,cl,sil	sicl,sc,sic,c	c	ls, s
	pH	1:2.5	7.0-7.5	5.5-5.9 7.6-8.5	<5, >8.5	
	$CaCO_3$ in root zone	%	Non calcareous	Slightly calcareous	Strongly calcareous	
Rooting conditions	Soil depth	cm	>75	50-75	25-50	<25
	Gravel content	% vol.	<15	15-35	>35	
Soil toxicity	Salinity	ds/m	Non saline	slightly	strongly	
	Sodicity(ESP)	%	<10	10-15	>15	-
Erosion	Slope	%	1-3	3-5	5-10	

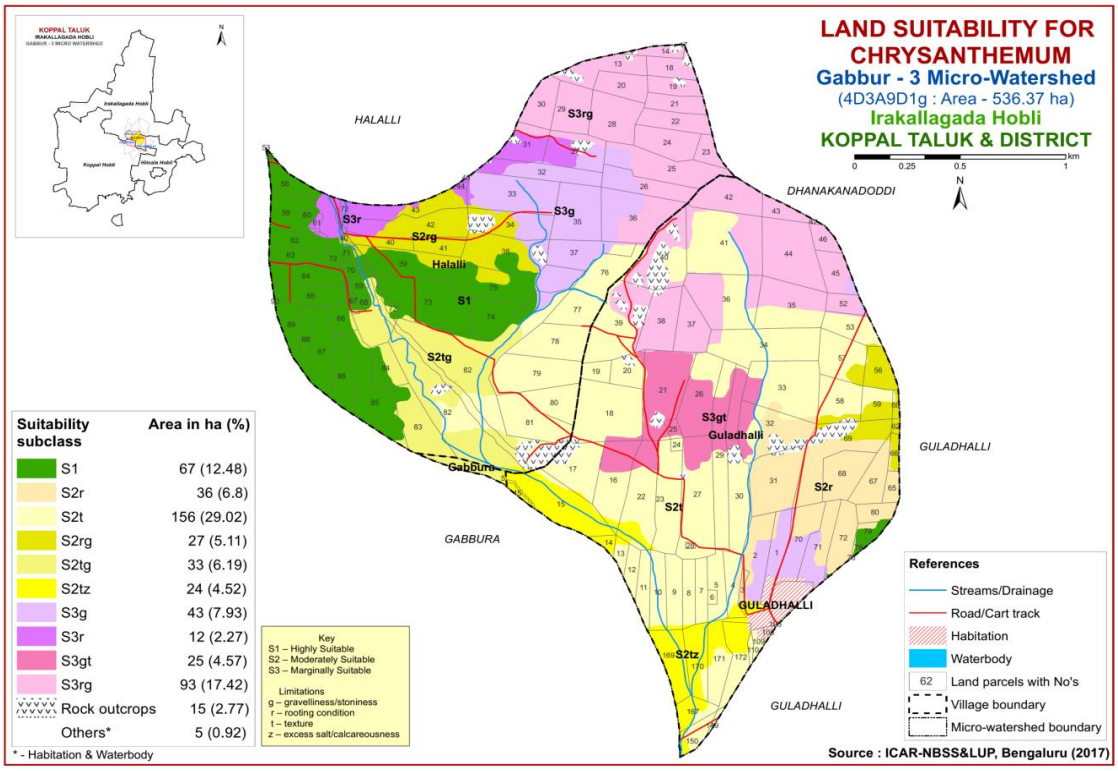


Fig. 7.26 Land Suitability map of Chrysanthemum

7. 27 Land Suitability for Jasmine *(Jasminum sp.)*

Jasmine is one of the most important flower crop grown in an area of 6146 ha in almost all the districts of the State. The crop requirements (Table 7.27) for growing jasmine were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing jasmine was generated. The area extent and their geographical

distribution of different suitability subclasses in the microwatershed are given in Figure 7.27.

Table 7.27 Crop suitability criteria for jasmine (irrigated)

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	
Soil aeration	Soil drainage	Class	Well drained	Moderately drained	Imperfectly drained	Poorly drained
Nutrient availability	Texture	Class	scl, l, scl, cl, sil	sicl, sc, sic, c (m/k)	c (ss),	ls, s
	pH	1:2.5	6.0-7.5	5.5-5.9,7.6-8.5	<5,>8.5	
	$CaCO_3$ in root zone	%	Non calcareous	Slightly calcareous	Strong 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	Slight	Strongly	
	Sodicity	%	Non sodic	Slight	Strongly	
Erosion	Slope	%	1-3	3-5	5-10	

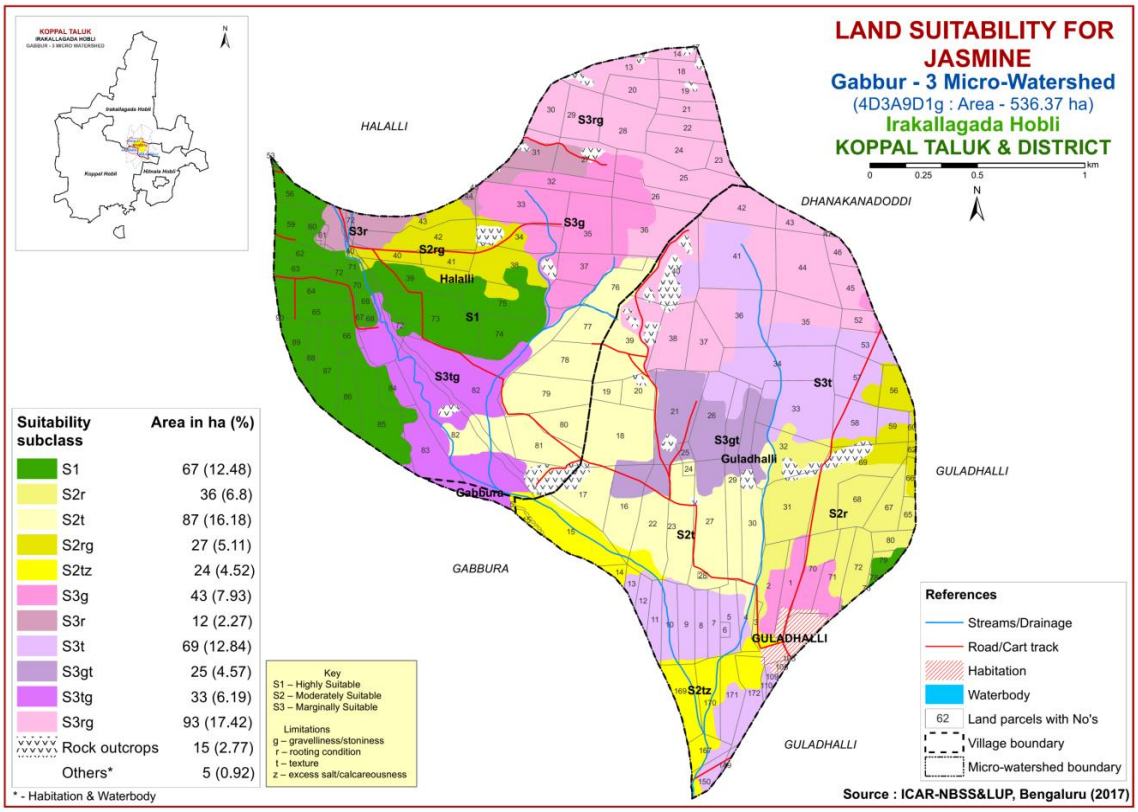


Fig. 7.27 Land Suitability map of Jasmine

Highly suitable lands (Class S1) occupy an area of 67 ha (12%) for growing jasmine and are distributed in the western and eastern part of the microwatershed. An area of 174 ha (33%) is moderately suitable (Class S2) for growing jasmine and occupy in the

northwestern, central, eastern and southern part of the microwatershed. They have minor limitations of rooting condition, calcareousness, texture and gravelliness. Major area of 275 ha (51%) is marginally suitable (Class S3) for growing jasmine and are distributed in all parts of the microwatershed. They have moderate limitations of gravelliness, rooting condition and texture.

7. 28 Land Suitability for Crossandra *(Crossandra in fundibuliformis)*

Crossandra is one of the most important flower crop grown in almost all the districts of the State. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.28.

Highly suitable lands (Class S1) occupy an area of 67 ha (12%) for growing crossandra and are distributed in the western and eastern part of the microwatershed. An area of 243 ha (45%) is moderately suitable (Class S2) for growing crossandra and occur in the major part of the microwatershed. They have minor limitations of texture, rooting condition, calcareousness and gravelliness. An area of 206 ha (38%) is marginally suitable (Class S3) for growing jasmine and are distributed in the northern, central, northwestern, northeastern, western and southeastern part of the microwatershed. They have moderate limitations of gravelliness, rooting condition, and texture.

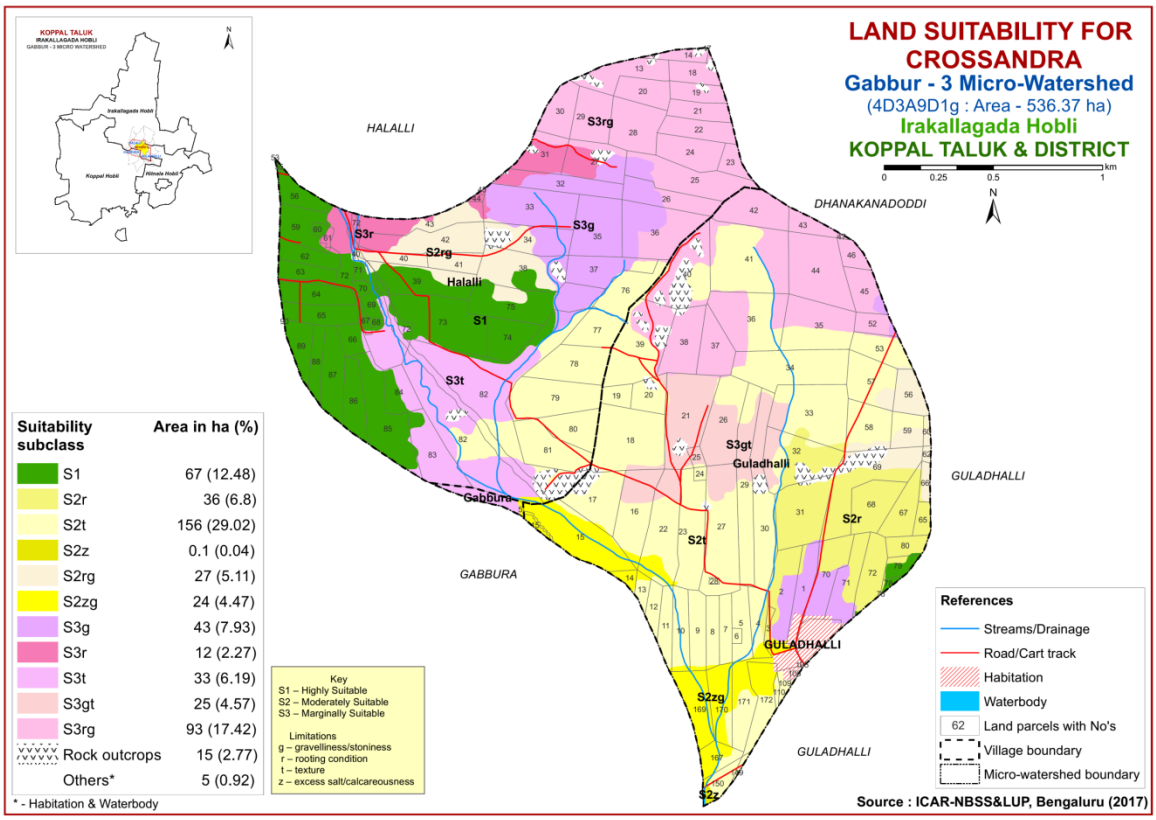


Fig. 7.28 Land Suitability map of Crossandra

7.29 Land Management Units (LMU)

The 24 soil map units identified in Gabbur-3 microwatershed have been grouped into 6 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. 7.29) 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 six Land Management Units along with brief description of soil and site characteristics are given below.

LUC No.	Soil map unit number	Mapping unit	Soil and site characteristics
1	461, 462, 353, 399, 403	GGRhB2, GGRhB2g1, NSPcB1g1, KDTbB2, KDTmA1	Moderately deep to very deep black calcareous to non calcareous sandy clay to clay soils
2	284, 285, 288, 159, 171, 201	RTRcB1, RTRcB2, RTRiB2, BSRcB1, CKMcB2, KMHiB2	Moderately deep to very deep, red sandy clay to sandy clay loam soils
3	215, 217, 225, 228	BPRbB1g1, BPRbB2g1, BPRcB2g1, BPRhB1	Deep red gravelly sandy clay to clay soils
4	452, 76, 77, 46	LKRhB2g1, MKHcB2, MKHcB2g1, LKRhB1	Moderately shallow, red gravelly sandy clay to sandy clay loam soils
5	72	KTPhB2g1	Moderately shallow, red loamy soils
6	448, 465, 25, 34	KGPcB2, HRVcB2g1, HRVhB2, CSRcB1	Shallow, red sandy clay to sandy clay loam soils

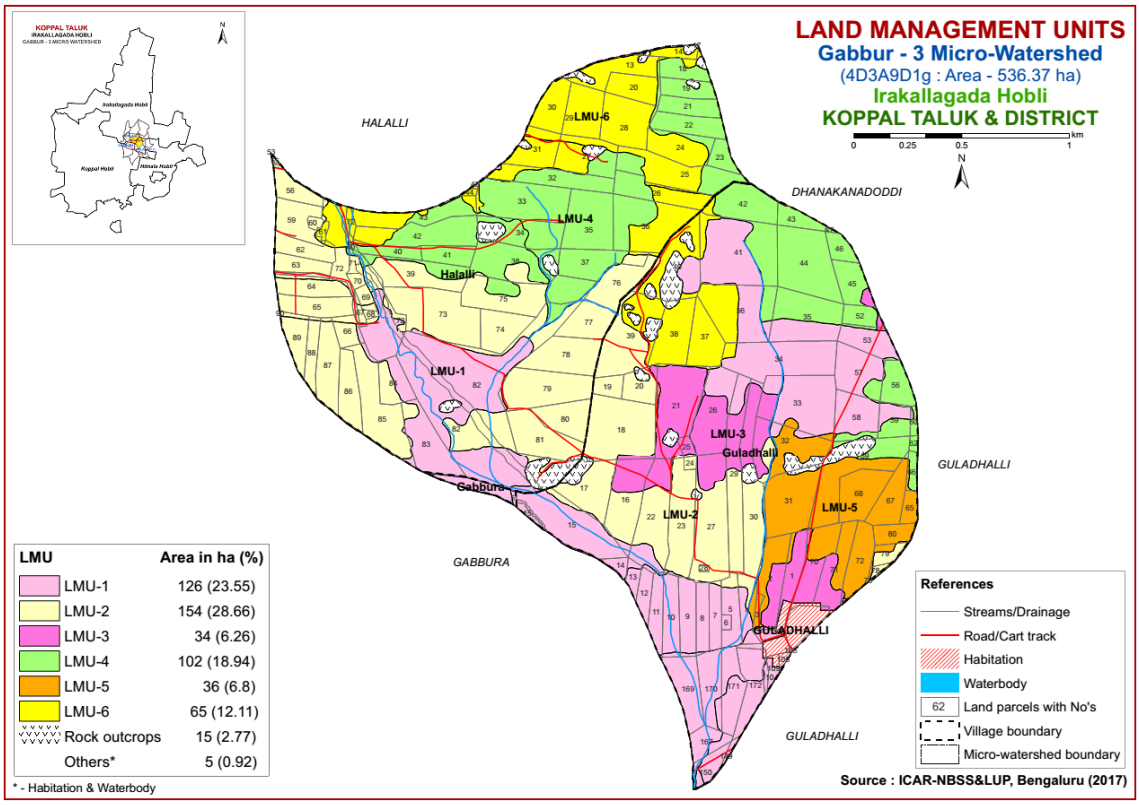


Fig 7.29 Land Management Units map of Gabbur-3 microwatershed

7.29 Proposed Crop Plan for Gabbur-3 Microwatershed

After assessing the land suitability for the 28 crops, the proposed crop plan has been prepared for the 6 identified LUCs by considering only the highly (Class S1) and moderately (Class S2) suitable lands for each of the 28 crops. The resultant proposed crop plan is presented in Table 7.29.

Table 7.29 Proposed Crop Plan for Gabbur-3 Microwatershed

Proposed LUC	Soil Map Units	Survey Number	Soil characters	Field Crops	Horticulture Crops	Suitable Interventions
LUC 1 126 ha (24%)	461.GGRhB2 462.GGRhB2g1 353.NSPcB1g1 399.KDTbB2 403.KDTmA1	**Gabbura :** 5 **Guladhalli:**4,5,6,7,8,9,10,11,12,13,14,15,33,34,41,53,57,58,109,110,149,150,167,169,170,171,172 **Halalli :** 72,82,83	Moderately deep to very deep black calcareous to non calcareous sandy clay to clay soils	Paddy, Sunflower, Maize	**Fruit crops:** Custard Apple, Amla **Vegetable crops:** Brinjal, Tomato, Chillies, Drumstick **Flower crops:** Marigold, Chrysanthemum, Jasmine	Providing proper drainage, addition of organic manures, green leaf manuring, suitable conservation practices
LUC 2 154 ha (29%)	284.RTRcB1 285.RTRcB2 288.RTRiB2 159.BSRcB1 171.CKMcB2 201.KMHiB2	**Guladhalli:**16,17,18,19,20,22,23,24,27,28,29,30,39,78,79 **Halalli:**39,53,55,56,59,60,62,63,64,65,66,67,68,69,70,71,73,74,75,76,77,78,79,80,81,84,85,86,87,88,89,90	Moderately deep to very deep, red sandy clay to sandy clay loam soils	Maize, Sorghum, Bajra, Groundnut, Redgram, Castor	**Fruit crops:** Pomegranate, Guava, Sapota, Mango, Jackfruit, Jamun, Tamarind, Lime, Musambi, Amla, Custard apple **Vegetable crops:** Drumstick, Tomato, Chilli, Brinjal **Flower crops:** Marigold, Chrysanthemum, Jasmine	Drip irrigation, mulching, suitable soil and water conservation practices (Crescent Bunding with Catch Pit etc)
LUC 3 34 ha (6%)	215.BPRbB1g1 217.BPRbB2g1 225.BPRcB2g1 228.BPRhB1	**Guladhalli :**1,21,25,26,70	Deep red gravelly sandy clay to clay soils	Groundnut, Redgram, Bajra, Castor ,Horsegram	**Fruit crops:** Lime, Musambi**,** Jackfruit, Jamun, Amla, Cashew, Custard apple **Vegetable crops:** Drumstick	Drip irrigation, mulching, suitable soil and water conservation practices (Crescent Bunding with Catch Pit etc)
LUC 4 102 ha (19%)	452.LKRhB2g1 76.MKHcB2 77.MKHcB2g1 46.LKRhB1	**Guladhalli:**35,42,43,44,45,46,47,52,56,59,60,62,66 **Halalli:**18,19,21,22,23,32,33,34,35,37,38,40,41,42,43	Moderately shallow, red gravelly sandy clay to sandy clay loam soils	Groundnut, Redgram, Bajra, , Castor Horsegram	**Fruit crops:** Lime, Musambi**,** Jackfruit, Jamun, Amla, Cashew, Custard apple **Vegetable crops:** Drumstick	Drip irrigation, mulching, suitable soil and water conservation practices (Crescent Bunding with Catch Pit etc)
LUC 5 36 ha (7%)	72.KTPhB2g1	**Guladhalli:**2,3,31,32,65,67,68,69,71,72,76,80	Moderately shallow, red loamy soils	Maize, Sorghum, Groundnut, Bajra, Castor	**Fruit crops:** Amla, Custard apple **Flower crops:** Marigold, Chrysanthemum **Vegetable crops:** Drumstick	Drip irrigation, mulching, suitable soil and water conservation practices (Crescent Bunding with Catch Pit etc)
LUC 6 65 ha (12%)	448.KGPcB2 465.HRVcB2g1 25.HRVhB2 34.CSRcB1	**Guladhalli :** 36,37,38,40 **Halalli:**13,14,20,24,25,26,27,28,29,30,31,36,44,45,61	Shallow, red sandy clay to sandy clay loam soils	Horsegram, Bajra	**Agri-Silvi-Pasture:** Custard apple, Amla, Hybrid Napier, *Styloxanthes hamata*, Glyricidia, *Styloxanthes scabra*	Use of short duration varieties, sowing across the slope and split application of nitrogen fertilizers

Chapter 8

SOIL HEALTH MANAGEMENT

8.1 Soil Health

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

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

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

The most important characteristics of a healthy soil are

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

Characteristics of Gabbur-3 Microwatershed

- The soil phases with sizeable area identified in the microwatershed belonged to the soil series of Chikkamegheri (CKM) occupies maximum area of 87 ha (16%), Lakkur (LKR) 74 ha (14%), Kadagathur (KDT) 69 ha (13%), Harve (HRV) 53 ha (10%), Kethanapura (KTP) 36 ha (7%), Balapur (BPR) 34 ha (6%), Narasapura (NSP) 33 ha (6%), Ranatur (RTR) 29 ha (5%), Gudigeri (GGR) 24 ha (5%), Bisarahalli (BSR) 14 ha (3%) and other series occupy minor area in the microwatershed.

- ❖ As per land capability classification, entire area in the microwatershed falls under arable land category (Class II & III). The major limitations identified in the arable lands were soil and erosion.
- ❖ On the basis of soil reaction, an area of about 9 ha (2%) is strongly acid (pH 5.0-5.5), 23 ha (4%) is moderately acid (pH 5.5-6.0), 42 ha (8%) is slightly acid (pH 6.0-6.5), 136 ha (25%) is neutral (pH 6.5-7.3), 291 ha (54%) is slightly to moderately alkaline (pH 7.3-8.4) and about 15 ha (3%) is under strongly alkaline (pH 8.4-9.0%) in the microwatershed. Entire area in the microwatershed is acidic to alkaline in reaction.

Soil Health Management

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

Acid soils

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

Liming materials:

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

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

Alkaline soils

(Slightly alkaline to strongly 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 – 5 kg/ha (once in three years).

Neutral soils

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

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

Soil Degradation

Soil erosion is one of the major factor affecting the soil health in the microwatershed. Out of total 536 ha area in the microwatershed, an area of about 152 ha (28%) is suffering from slight and 364 ha (68%) is suffering from moderate erosion. The areas with moderate erosion 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 Treatment Plans for each plot or farm.
2. Productivity enhancement measures/ interventions for existing crops/livestock/other farm enterprises.
3. Diversification of farming mainly with perennial horticultural crops and livestock.
4. Improving livelihood opportunities and income generating activities.

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

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

be improved by sand mulching. The technology that is developed by the AICRP-Dryland Agriculture, Vijayapura, Karnataka can be adopted.

- **Gravelliness:** More gravel content is favorable for run-off harvesting but poor in soil moisture storage and nutrient availability. It is a significant parameter that decides the kind of crop to be raised.
- **Land Capability Classification:** The land capability map shows the areas suitable and not suitable for agriculture and the major constraints in each of the plot/survey number. Hence, one can decide what kind of enterprise is possible in each of these units. In general, erosion and soil are the major constraints in Gabbur-3 Microwatershed.
- **Organic Carbon:** The OC content (an index of available Nitrogen) is low (<0.5%) in an area of 62 ha (12%), medium (0.5-0.75%) in 183 ha (34%), and high (>0.75%) in 271 ha (55%). The areas that are low and medium in OC needs to be further improved by applying farmyard manure and rotating crops with cereals and legumes or mixed cropping.
- **Promoting green manuring:** Growing of green manuring crops costs Rs. 1250/ha (green manuring seeds) and about Rs. 2000/ha towards cultivation that totals to Rs. 3250/- per ha. On the other hand, application of organic manure @ 10 tons/ha costs Rs. 5000/ha. The practice needs to be continued for 2-3 years or more. Nitrogen fertilizer needs to be supplemented by 25% in addition to the recommended level in 245 ha area where OC is low and medium. For example, for rainfed maize, recommended level is 50 kg N per ha and an additional 12 kg /ha needs to be applied for all the crops grown in these plots.
- **Available Phosphorus:** An area of about 12 ha (2%) is low (<23 kg/ha) and 251 ha (47%) is medium (23-57 kg/ha) in available phosphorus. Hence for all the crops, 25% additional P-needs to be applied. It is high in 254 ha (47%) area of the microwatershed.
- **Available Potassium:** Available potassium is medium (145-337 kg/ha) in an area of 365 ha (68%) in the microwatershed. For all crops, additional 25 % potassium may be applied in areas where it is low and medium. It is high in 151 ha (28%) area of the microwatershed.
- **Available Sulphur:** Available sulphur is a very critical nutrient for oilseed crops. Available sulphur is low (<10 ppm) in 406 ha (76%), medium (10-20 ppm) in 106 ha (20%) in the microwatershed. These areas need to be applied with magnesium sulphate or gypsum or Factamphos (p) fertitilizer (13% sulphur) for 2-3 years for the deficiency to be corrected. It is high in 5 ha (1%) area of the microwatershed.
- **Available Boron:** Major area of about 345 ha (64%) is low (<0.5 ppm) in available boron. An area of 140 ha (26%) is medium (0.5-1.0 ppm) in available boron content. It is high in 32 ha (6%) area of the microwatershed. The areas that are low and medium need to be applied with sodium borate @ 10 kg/ha as soil application or 0.2% borax as foliar spray to correct the deficiency

- **Available Iron:** It is sufficient in (>4.5 ppm) 192 ha (36%) and deficient (<4.5 ppm) in 324 ha (60%) of the microwatershed. To manage iron deficiency, iron sulphate@25 kg/ha needs to be applied for 2-3 years.
- **Available Manganese:** Entire area in the microwatershed is sufficient (>1.0 ppm) in available manganese.
- **Available Copper:** Entire area is sufficient (>0.2 ppm) in available copper in the microwatershed.
- **Available Zinc:** It is deficient (<0.6 ppm) in 342 ha (64%) and sufficient (>0.6 ppm) in 175 ha (33%) area in the microwatershed. Application of zinc sulphate @ 25kg/ha is to be followed in areas that are deficient in available zinc.
- **Soil acidity:** The microwatershed has 42 ha (8%) area with soils that are slightly acid, 23 ha (4%) moderately acid and about 9 ha (2%) strongly acid. These areas need application of lime (Calcium Carbonate).
- **Soil alkalinity:** The microwatershed has 306 ha (57%) 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.

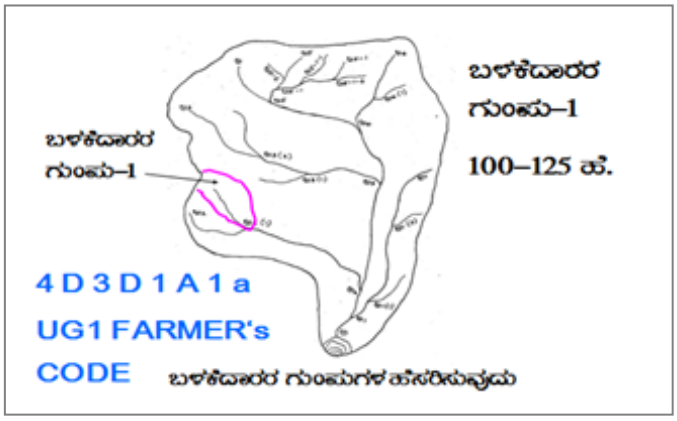
Land suitability for various crops: Areas that are highly, moderately and marginally suitable and not suitable for growing various crops are indicated. Along with the suitability, various constraints that are limiting the productivity are also indicated. For example, in case of cotton, gravel content, rooting depth and salinity/alkalinity are the major constraints in various plots. With suitable management interventions, the productivity can be enhanced. In order to increase 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 Gabbur-3 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 maps
- Rainfall map
- Hydrology
- Water Resources
- Socio-economic data



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

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

Steps for Survey and Preparation of Treatment Plan

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

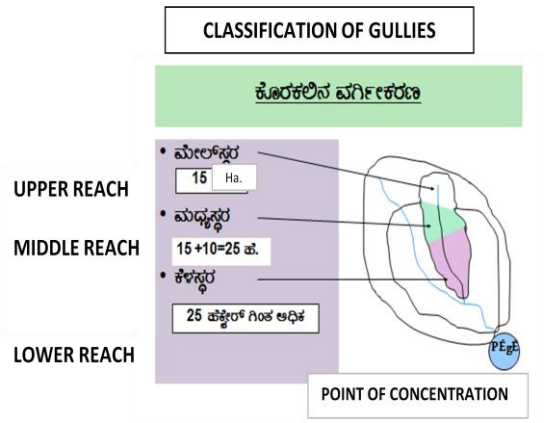
- Naming of user groups and farmers
- Identification of arable and non arable lands
- Identification of drainage lines and gullies
- Identification of non treatable areas
- Identification of priority areas in the arable lands
- Treatment plan for arable lands
- Location of water harvesting and recharge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

9.1 Treatment Plan

The treatment plan recommended for arable lands is briefly described below.

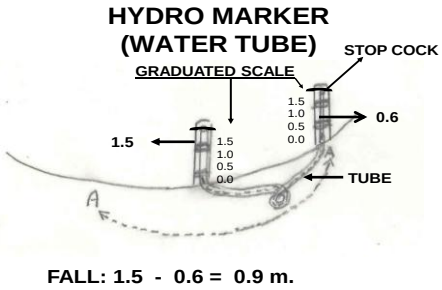
9.1.1 Arable Land Treatment

A. BUNDING

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

Measurement of Land Slope

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



FALL: 1.5 - 0.6 = 0.9 m.

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

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

Note: i) The above intervals are maximum.

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

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

Section of the Bund

Bund section is decided considering the soil texture class and gravelliness class (bg_0 ...b= loamy sand, g_0 = <15% gravel). The recommended sections for different soils are given below.

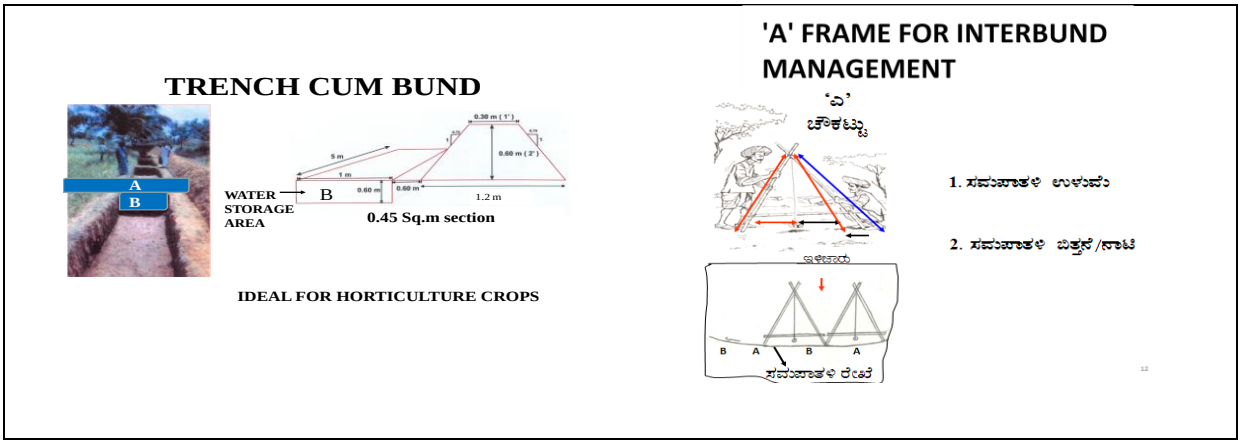
Recommended Bund Section

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

Formation of Trench cum Bund

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

Details of Borrow Pit dimensions are given below



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

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

B. Waterways

a) Existing waterways are marked on the cadastral map (1:7920 scale) and their dimensions are recorded.

b) Considering the contour plan of the MWS, additional waterways/ modernization of the existing ones can be thought of.

c) The design details are given in the Manual.

C. Farm Ponds

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

D. Diversion Channel

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

9.1.2 Non-Arable Land Treatment

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

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 in 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 earthern checks in the natural water course. Location and design details are given in the Manual.

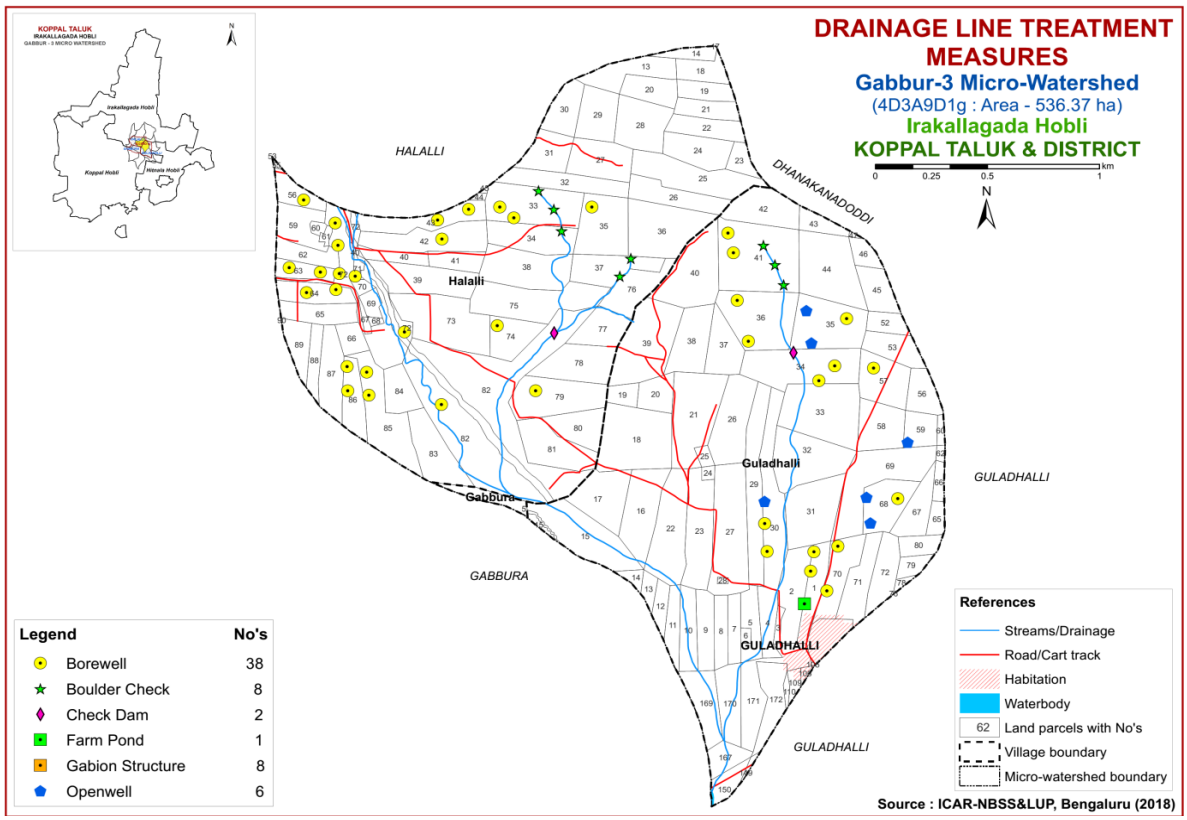


Fig. 9.1 Drainage Line Treatment Measures map of Gabbur-3 Microwatershed

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. A maximum area of about 390 ha (73%) requires Trench cum Bunding and about 102 ha (19%) area requires Graded Bunding and 24 ha (4%) requires strengthening of existing Bunds / Bunding in the microwatershed. The conservation plan prepared may be presented to all the stakeholders including farmers and after including their suggestions, the conservation plan for the microwatershed may be finalised in a participatory approach.

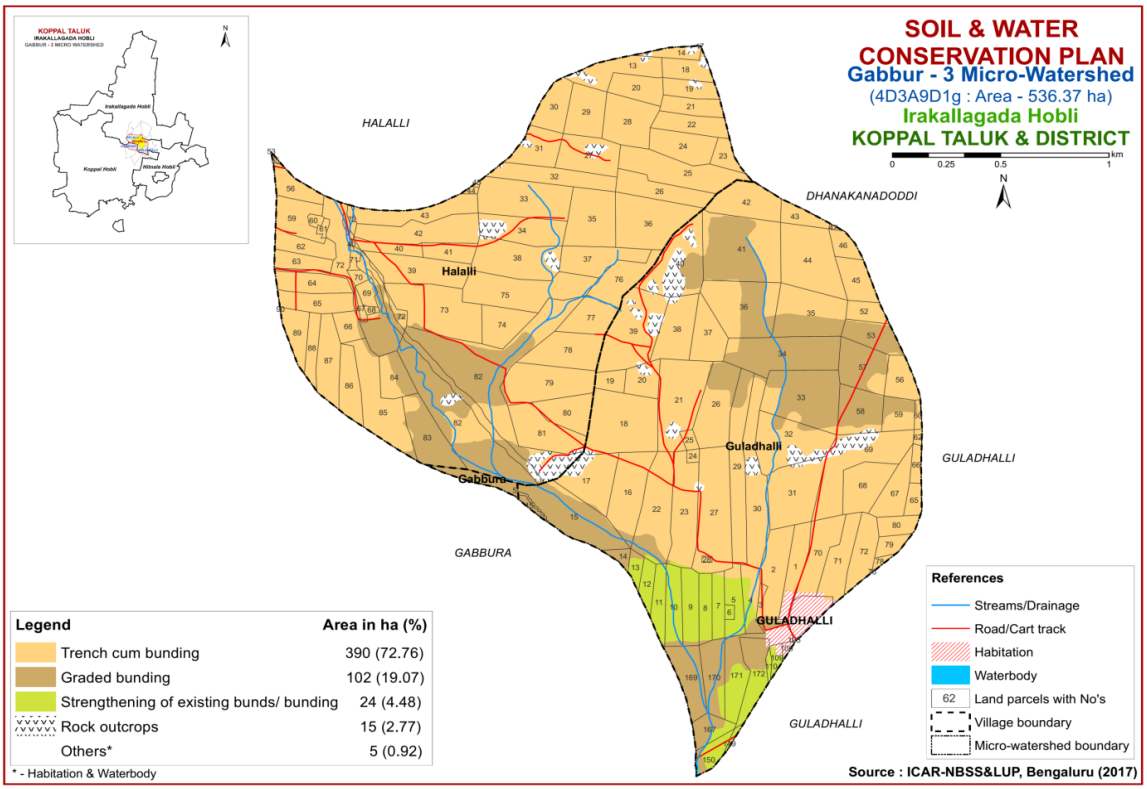


Fig. 9.2 Soil and Water Conservation Plan map of Gabbur-3 Microwatershed

9.3 Greening of Microwatershed

As part of the greening programme in the watersheds, it is envisaged to plant a variety of horticultural and other tree plants that are edible, economical and produce lot of biomass which helps to restore the ecological balance in the watersheds. The lands that are suitable for

greening programme are non-arable lands (land capability classes V, VI VII and VIII) and also the lands that are not suitable or marginally suitable for growing annual and perennial crops. The method of planting these trees is given below.

It is recommended to open the 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 Neral (*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; Reaserch 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

Gabbur 3 Microwatershed

Soil Phase Information

Village	Survey NO.	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	WELLS	Land Capability	Conservation Plan
Gabbura	5	1.79	NSPcB1g1	LMU-1	Moderately deep (75-100 cm)	Sandy loam	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Fallow land (Fl)	Not Available	IIs	Graded bunding
Guladhalli	1	3.13	BPRhB1	LMU-3	Deep (100-150 cm)	Sandy clay loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Pearl millet (Pm)	1 Farm Pond,2 Borewell	IIIs	TCB
Guladhalli	2	4.55	KTPhB2g1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Pearl millet (Pm)	Not Available	IIes	TCB
Guladhalli	3	0.45	KTPhB2g1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	TCB
Guladhalli	4	2.34	KDTmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Maize (Mz)	Not Available	IIs	Field bunds
Guladhalli	5	2.52	KDTmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Maize (Mz)	Not Available	IIs	Field bunds
Guladhalli	6	0.31	KDTmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Maize (Mz)	Not Available	IIs	Field bunds
Guladhalli	7	1.82	KDTmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Maize (Mz)	Not Available	IIs	Field bunds
Guladhalli	8	2	KDTmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Maize (Mz)	Not Available	IIs	Field bunds
Guladhalli	9	2.82	KDTmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Maize (Mz)	Not Available	IIs	Field bunds
Guladhalli	10	2.94	KDTmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Maize (Mz)	Not Available	IIs	Field bunds
Guladhalli	11	2.04	KDTmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Maize (Mz)	Not Available	IIs	Field bunds
Guladhalli	12	1.35	KDTmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Maize (Mz)	Not Available	IIs	Field bunds
Guladhalli	13	0.89	KDTmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Maize (Mz)	Not Available	IIs	Field bunds
Guladhalli	14	0.67	GGRhB2g1	LMU-1	Very deep (>150 cm)	Sandy clay loam	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	Graded bunding
Guladhalli	15	7.76	GGRhB2g1	LMU-1	Very deep (>150 cm)	Sandy clay loam	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	Graded bunding
Guladhalli	16	5.95	CKMcB2	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Pearl millet (Pm)	Not Available	IIes	TCB
Guladhalli	17	5.2	CKMcB2	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	TCB
Guladhalli	18	8.92	CKMcB2	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Eucalyptus+Pearl millet (Mz+Eu+Pm)	Not Available	IIes	TCB

Village	Survey NO.	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	WELLS	Land Capability	Conservation Plan
Guladhalli	19	1.29	CKMcB2	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	TCB
Guladhalli	20	2.38	CKMcB2	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	TCB
Guladhalli	21	7.99	BPRbB2g1	LMU-3	Deep (100-150 cm)	Loamy sand	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	TCB
Guladhalli	22	7.07	CKMcB2	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Guava (Mz+Gv)	Not Available	IIes	TCB
Guladhalli	23	6.2	CKMcB2	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Redgram (Mz+Rg)	Not Available	IIes	TCB
Guladhalli	24	0.35	CKMcB2	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Pearl millet (Pm)	Not Available	IIes	TCB
Guladhalli	25	0.56	BPRbB2g1	LMU-3	Deep (100-150 cm)	Loamy sand	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Pearl millet (Pm)	Not Available	IIIes	TCB
Guladhalli	26	5.93	BPRbB1g1	LMU-3	Deep (100-150 cm)	Loamy sand	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIIs	TCB
Guladhalli	27	9.01	CKMcB2	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Seasamum(Mz+Sm)	Not Available	IIes	TCB
Guladhalli	28	0.14	CKMcB2	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	TCB
Guladhalli	29	6.45	CKMcB2	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	TCB
Guladhalli	30	7	CKMcB2	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Pearl millet (Pm)	2 Borewell,1 Openwell	IIes	TCB
Guladhalli	31	6.65	KTPhB2g1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	TCB
Guladhalli	32	7.02	KTPhB2g1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	TCB
Guladhalli	33	8.7	KDTbB2	LMU-1	Very deep (>150 cm)	Loamy sand	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	Graded bunding
Guladhalli	34	8.26	KDTbB2	LMU-1	Very deep (>150 cm)	Loamy sand	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Pearl millet (Pm)	2 Borewell	IIes	Graded bunding
Guladhalli	35	6.9	LKRhB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	2Openwell,1 Borewell	IIIes	TCB
Guladhalli	36	7.96	HRVhB2	LMU-6	Shallow (25-50 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	2 Borewell	IIIes	TCB
Guladhalli	37	3.64	HRVhB2	LMU-6	Shallow (25-50 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	TCB
Guladhalli	38	4.7	HRVhB2	LMU-6	Shallow (25-50 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	TCB
Guladhalli	39	8.41	CKMcB2	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Pearl millet (Mz+Pm)	Not Available	IIes	TCB
Guladhalli	40	7.24	HRVhB2	LMU-6	Shallow (25-50 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	TCB
Guladhalli	41	11.02	KDTbB2	LMU-1	Very deep (>150 cm)	Loamy sand	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	2 Borewell	IIes	Graded bunding

Village	Survey NO.	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	WELLS	Land Capability	Conservation Plan
Guladhalli	42	4.68	LKRhB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	TCB
Guladhalli	43	1.61	LKRhB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	TCB
Guladhalli	44	7.91	LKRhB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	TCB
Guladhalli	45	2.76	LKRhB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Pearl millet (Pm)	Not Available	IIIes	TCB
Guladhalli	46	1.36	LKRhB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Pearl millet (Pm)	Not Available	IIIes	TCB
Guladhalli	47	0.1	LKRhB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Pearl millet (Pm)	Not Available	IIIes	TCB
Guladhalli	52	1.63	LKRhB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut (Gn)	Not Available	IIIes	TCB
Guladhalli	53	3.01	KDTbB2	LMU-1	Very deep (>150 cm)	Loamy sand	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Pearl millet (Pm)	Not Available	IIes	Graded bunding
Guladhalli	56	2.52	MKHcB2	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Pearl millet (Pm)	Not Available	IIIes	TCB
Guladhalli	57	4.64	KDTbB2	LMU-1	Very deep (>150 cm)	Loamy sand	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Pearl millet(Mz+Pm)	1 Borewell	IIes	Graded bunding
Guladhalli	58	4.26	KDTbB2	LMU-1	Very deep (>150 cm)	Loamy sand	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	Graded bunding
Guladhalli	59	2.27	MKHcB2	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	1 Openwell	IIIes	TCB
Guladhalli	60	0.43	MKHcB2	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Pearl millet (Pm)	Not Available	IIIes	TCB
Guladhalli	62	0.28	MKHcB2	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Pearl millet (Pm)	Not Available	IIIes	TCB
Guladhalli	65	1.07	KTPhB2g1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	TCB
Guladhalli	66	0.84	MKHcB2	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	TCB
Guladhalli	67	3.15	KTPhB2g1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	TCB
Guladhalli	68	4.33	KTPhB2g1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	2Openwell,1 Borewell	IIes	TCB
Guladhalli	69	8.36	KTPhB2g1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	TCB
Guladhalli	70	4.24	BPRhB1	LMU-3	Deep (100-150 cm)	Sandy clay loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Pearl millet (Pm)	2 Borewell	IIIs	TCB
Guladhalli	71	3.94	KTPhB2g1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Pearl millet (Pm)	Not Available	IIes	TCB
Guladhalli	72	3.4	KTPhB2g1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	TCB
Guladhalli	76	0	KTPhB2g1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	TCB

Village	Survey NO.	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	WELLS	Land Capability	Conservation Plan
Guladhalli	78	0.32	RTRcB2	LMU-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIe	TCB
Guladhalli	79	1.17	RTRcB2	LMU-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIe	TCB
Guladhalli	80	1.62	KTPhB2g1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	TCB
Guladhalli	105	0.01	Habitation	Others	Others	Others	Others	Others	Others	Others	Others	Not Available	Others	Others
Guladhalli	106	0.26	Habitation	Others	Others	Others	Others	Others	Others	Others	Paddy (Pd)	Not Available	Others	Others
Guladhalli	109	0.67	KDTmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Paddy (Pd)	Not Available	IIs	Field bunds
Guladhalli	110	0.29	KDTmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Paddy (Pd)	Not Available	IIs	Field bunds
Guladhalli	149	0.1	KDTmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Paddy (Pd)	Not Available	IIs	Field bunds
Guladhalli	150	1.1	KDTmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Paddy (Pd)	Not Available	IIs	Field bunds
Guladhalli	167	2	GGRhB2g1	LMU-1	Very deep (>150 cm)	Sandy clay loam	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIIes	Graded bunding
Guladhalli	169	3.88	GGRhB2g1	LMU-1	Very deep (>150 cm)	Sandy clay loam	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Fallow land (Fl)	Not Available	IIIes	Graded bunding
Guladhalli	170	3.56	GGRhB2g1	LMU-1	Very deep (>150 cm)	Sandy clay loam	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Fallow land (Fl)	Not Available	IIIes	Graded bunding
Guladhalli	171	5.22	KDTmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Paddy+Fallow land (Pd+Fl)	Not Available	IIs	Field bunds
Guladhalli	172	3.51	KDTmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Paddy (Pd)	Not Available	IIs	Field bunds
Halalli	13	3.93	HRVcB2g1	LMU-6	Shallow (25-50 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	TCB
Halalli	14	1.29	HRVcB2g1	LMU-6	Shallow (25-50 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	TCB
Halalli	17	0	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Not Available	Rock outcrops	Rock outcrops
Halalli	18	2.27	LKRhB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Pearl millet (Pm)	Not Available	IIIes	TCB
Halalli	19	2.07	LKRhB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Pearl millet (Pm)	Not Available	IIIes	TCB
Halalli	20	2.82	HRVcB2g1	LMU-6	Shallow (25-50 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	TCB
Halalli	21	2.3	LKRhB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	TCB

Village	Survey NO.	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	WELLS	Land Capability	Conservation Plan
Halalli	22	2.96	LKRhB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Pearl millet (Pm)	Not Available	IIIes	TCB
Halalli	23	1.39	LKRhB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	TCB
Halalli	24	3.91	HRVcB2g1	LMU-6	Shallow (25-50 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Fallow land (Fl)	Not Available	IIIes	TCB
Halalli	25	6.69	HRVcB2g1	LMU-6	Shallow (25-50 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Fallow land (Fl)	Not Available	IIIes	TCB
Halalli	26	3.92	HRVhB2	LMU-6	Shallow (25-50 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	TCB
Halalli	27	4.65	KGPcB2	LMU-6	Shallow (25-50 cm)	Sandy loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Fallow land (Fl)	Not Available	IIIes	TCB
Halalli	28	5.06	HRVcB2g1	LMU-6	Shallow (25-50 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Fallow land (Fl)	Not Available	IIIes	TCB
Halalli	29	3.97	HRVcB2g1	LMU-6	Shallow (25-50 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Fallow land (Mz+Fl)	Not Available	IIIes	TCB
Halalli	30	3.1	HRVcB2g1	LMU-6	Shallow (25-50 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	TCB
Halalli	31	3.37	KGPcB2	LMU-6	Shallow (25-50 cm)	Sandy loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Fallow land (Fl)	Not Available	IIIes	TCB
Halalli	32	4.32	LKRhB1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIIs	TCB
Halalli	33	7.25	LKRhB1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Pearl millet (Pm)	2 Borewell	IIIs	TCB
Halalli	34	4.82	LKRhB1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Poultry farm (Pf)	Not Available	IIIs	TCB
Halalli	35	5.98	LKRhB1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	1 Borewell	IIIs	TCB
Halalli	36	7.46	HRVhB2	LMU-6	Shallow (25-50 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	TCB
Halalli	37	4.2	LKRhB1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIIs	TCB
Halalli	38	6.51	MKHcB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Pearl millet (Pm)	Not Available	IIIes	TCB
Halalli	39	5.54	KMHiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Pearl millet (Pm)	Not Available	IIe	TCB
Halalli	40	1.58	MKHcB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Pearl millet (Pm)	Not Available	IIIes	TCB
Halalli	41	2.04	MKHcB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Pearl millet (Pm)	Not Available	IIIes	TCB
Halalli	42	5.94	MKHcB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	1 Borewell	IIIes	TCB
Halalli	43	4.3	MKHcB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	2 Borewell	IIIes	TCB
Halalli	44	0.19	KGPcB2	LMU-6	Shallow (25-50 cm)	Sandy loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Pearl millet (Pm)	Not Available	IIIes	TCB

Village	Survey NO.	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	WELLS	Land Capability	Conservation Plan
Halalli	45	0.07	KGPcB2	LMU-6	Shallow (25-50 cm)	Sandy loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	TCB
Halalli	53	0	BSRcB1	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIs	TCB
Halalli	55	0.1	BSRcB1	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIs	TCB
Halalli	56	2.12	BSRcB1	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	1 Borewell	IIs	TCB
Halalli	59	3.28	BSRcB1	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIs	TCB
Halalli	60	0.36	BSRcB1	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIs	TCB
Halalli	61	0.33	CSRcB1	LMU-6	Shallow (25-50 cm)	Sandy loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIIs	TCB
Halalli	62	2.32	BSRcB1	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIs	TCB
Halalli	63	1.92	BSRcB1	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	2 Borewell	IIs	TCB
Halalli	64	3.02	RTRiB2	LMU-2	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	2 Borewell	IIe	TCB
Halalli	65	3.08	RTRiB2	LMU-2	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIe	TCB
Halalli	66	1.58	RTRcB1	LMU-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Slight	Fallow land (Fl)	Not Available	IIs	TCB
Halalli	67	0.36	RTRiB2	LMU-2	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIe	TCB
Halalli	68	0.22	RTRiB2	LMU-2	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIe	TCB
Halalli	69	0.93	BSRcB1	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIs	TCB
Halalli	70	0.49	BSRcB1	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIs	TCB
Halalli	71	0.4	BSRcB1	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	1 Borewell	IIs	TCB
Halalli	72	7.79	NSPcB1g1	LMU-1	Moderately deep (75-100 cm)	Sandy loam	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	4 Borewell	IIs	Graded bunding
Halalli	73	8.5	KMHiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIe	TCB
Halalli	74	3.47	KMHiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	1 Borewell	IIe	TCB
Halalli	75	7.88	KMHiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIe	TCB
Halalli	76	3.84	CKMcB2	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	TCB
Halalli	77	3.32	CKMcB2	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	TCB

Village	Survey NO.	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	WELLS	Land Capability	Conservation Plan
Halalli	78	5.1	CKMcB2	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	TCB
Halalli	79	6.53	CKMcB2	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	1 Borewell	IIes	TCB
Halalli	80	3.42	CKMcB2	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	TCB
Halalli	81	5.11	CKMcB2	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	TCB
Halalli	82	29.42	NSPcB1g1	LMU-1	Moderately deep (75-100 cm)	Sandy loam	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	1 Borewell	IIs	Graded bunding
Halalli	83	5.06	NSPcB1g1	LMU-1	Moderately deep (75-100 cm)	Sandy loam	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIs	Graded bunding
Halalli	84	2.78	RTRcB1	LMU-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIs	TCB
Halalli	85	7.01	RTRcB1	LMU-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	2 Borewell	IIs	TCB
Halalli	86	3.14	RTRcB1	LMU-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	2 Borewell	IIs	TCB
Halalli	87	3.95	RTRcB1	LMU-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Slight	Mango (Mn)	Not Available	IIs	TCB
Halalli	88	1.77	RTRcB1	LMU-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIs	TCB
Halalli	89	2.41	RTRcB1	LMU-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIs	TCB
Halalli	90	0.01	RTRiB2	LMU-2	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	Pearl millet (Pm)	Not Available	IIe	TCB

Appendix II

Gabbur 3 Microwatershed

Soil Fertility Information

Village	Survey No.	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Gabbura	5	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)	High (> 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	1	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	2	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	3	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	4	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	5	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	6	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	7	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	8	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	9	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	10	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	11	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	12	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	13	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	14	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	15	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 (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	16	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 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 (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	17	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	18	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (< 0.5 %)	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 (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	19	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Low (< 0.5 %)	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 (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	20	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Low (< 0.5 %)	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 (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	21	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (< 0.5 %)	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 (> 0.2 ppm)	Deficient (< 0.6 ppm)

Village	Survey No.	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Guladhalli	22	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 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 (> 0.2 ppm)	Sufficient (> 0.6 ppm)
		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 (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Guladhalli	24	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5 – 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 (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Guladhalli	25	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (< 0.5 %)	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 (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	26	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Low (< 0.5 %)	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 (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	27	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 (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	28	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	29	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 (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	30	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 (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	31	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)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	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)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	33	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)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Guladhalli	34	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)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Guladhalli	35	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Guladhalli	36	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 (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	37	Moderately acid (pH 5.5 – 6.0)	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 (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Guladhalli	38	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (< 0.5 %)	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 (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Guladhalli	39	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Low (< 0.5 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Deficient (< 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	40	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	41	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Guladhalli	42	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Guladhalli	43	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	44	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Guladhalli	45	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)

Village	Survey No.	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Guladhalli	46	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	47	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	52	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Guladhalli	53	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)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Guladhalli	56	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Guladhalli	57	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)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Guladhalli	58	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Guladhalli	59	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	60	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	62	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	65	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)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	66	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	67	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)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	68	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 (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	69	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 (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	70	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	71	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 (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	72	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Guladhalli	76	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Guladhalli	78	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Guladhalli	79	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Guladhalli	80	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)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	105	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Guladhalli	106	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Guladhalli	109	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)

Village	Survey No.	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Guladhalli	110	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	149	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Guladhalli	150	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	167	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	169	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	170	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	171	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Guladhalli	172	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	13	Slightly acid (pH 6.0 – 6.5)	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 (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	14	Slightly acid (pH 6.0 – 6.5)	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 (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	17	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops
Halalli	18	Slightly acid (pH 6.0 – 6.5)	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 (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	19	Slightly acid (pH 6.0 – 6.5)	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 (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	20	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	21	Slightly acid (pH 6.0 – 6.5)	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)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	22	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	23	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)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	24	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)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	25	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	26	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	27	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)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	28	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)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	29	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	30	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)

Village	Survey No.	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Halalli	31	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 (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Halalli	32	Slightly alkaline (pH 7.3 – 7.8)	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)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Halalli	33	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)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Halalli	34	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	35	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Halalli	36	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	37	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Halalli	38	Moderately alkaline (pH 7.8 – 8.4)	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)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	39	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)	High (> 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	40	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)	High (> 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	41	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	High (> 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	42	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)	High (> 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	43	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)	High (> 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	44	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	High (> 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	45	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	High (> 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	53	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)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	55	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)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	56	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)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	59	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)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	60	Slightly alkaline (pH 7.3 – 7.8)	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 (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	61	Slightly alkaline (pH 7.3 – 7.8)	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)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	62	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	63	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Halalli	64	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)

Village	Survey No.	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Halalli	65	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 (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Halalli	66	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 (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Halalli	67	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 (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	68	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 (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	69	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)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	70	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	71	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	72	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)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	73	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 (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	74	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)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	75	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)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	76	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Halalli	77	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	78	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 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 (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	79	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Halalli	80	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Halalli	81	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 (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	82	Moderately alkaline (pH 7.8 – 8.4)	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)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	83	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	High (> 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	84	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 (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	85	Moderately alkaline (pH 7.8 – 8.4)	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)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Halalli	86	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Halalli	87	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 (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Halalli	88	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 (> 0.2 ppm)	Sufficient (> 0.6 ppm)

Village	Survey No.	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Halalli	89	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 (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	90	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)

Appendix III

Gabbur -3 Microwatershed

Soil Suitability Information

Village	Survey No.	Mango	Maize	Sapota	Sorghum	Guava	Cotton	Tamarind	Lime	Bengalgram	Sunflower	Red gram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Jasmine	Crossandra	Drumstick	Mulberry
Gabbura	5	S3rt	S3t	S3rt	S1	S3t	S1	S3r	S2rg	S1	S2rg	S2tg	S2tg	S3t	S1	N1t	S3rt	S2rg	S3t	S3t	S3t	S2tg	S2tg	S2rt	S3t	S3tg	S3t	S2rt	S2tg
Guladhalli	1	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g
Guladhalli	2	N1r	S2r	S3r	S2r	S3r	S2r	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Guladhalli	3	N1r	S2r	S3r	S2r	S3r	S2r	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Guladhalli	4	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S2t
Guladhalli	5	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S2t
Guladhalli	6	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S2t
Guladhalli	7	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S2t
Guladhalli	8	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S2t
Guladhalli	9	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S2t
Guladhalli	10	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S2t
Guladhalli	11	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S2t
Guladhalli	12	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S2t
Guladhalli	13	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S2t
Guladhalli	14	S3tz	S3tz	S3tz	S2zg	S3tz	S2zg	S2tz	S2z	S2zg	S2zg	S2zg	S2z	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S3tz	S2zg	S2tz	S2tz	S2tz	S2zg	S2tz	S2zg	S2tz	S3tz
Guladhalli	15	S3tz	S3tz	S3tz	S2zg	S3tz	S2zg	S2tz	S2z	S2zg	S2zg	S2zg	S2z	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S3tz	S2zg	S2tz	S2tz	S2tz	S2zg	S2tz	S2zg	S2tz	S3tz
Guladhalli	16	S3r	S2t	S2r	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S2rt	S2r	S2r	S2t	S1	S1	S2t	S2t	S2r	S1	S2t	S2t	S2r	S2r
Guladhalli	17	S3r	S2t	S2r	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S2rt	S2r	S2r	S2t	S1	S1	S2t	S2t	S2r	S1	S2t	S2t	S2r	S2r
Guladhalli	18	S3r	S2t	S2r	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S2rt	S2r	S2r	S2t	S1	S1	S2t	S2t	S2r	S1	S2t	S2t	S2r	S2r
Guladhalli	19	S3r	S2t	S2r	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S2rt	S2r	S2r	S2t	S1	S1	S2t	S2t	S2r	S1	S2t	S2t	S2r	S2r

Village	Survey No.	Mango	Maize	Sapota	Sorghum	Guava	Cotton	Tamarind	Lime	Bengalgram	Sunflower	Red gram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Jasmine	Crossandra	Drumstick	Mulberry
Guladhalli	20	S3r	S2t	S2r	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S2rt	S2r	S2r	S2t	S1	S1	S2t	S2t	S2r	S1	S2t	S2t	S2r	S2r
Guladhalli	21	S3rg	S3gt	S3g	S3gt	S3g	S3gt	S3rg	S3g	S3gt	S3gt	S3gt	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3gt	S3gt	S3gt	S3gt	S3g	S3gt	S3gt	S3gt	S2gt	S2gt
Guladhalli	22	S3r	S2t	S2r	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S2rt	S2r	S2r	S2t	S1	S1	S2t	S2t	S2r	S1	S2t	S2t	S2r	S2r
Guladhalli	23	S3r	S2t	S2r	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S2rt	S2r	S2r	S2t	S1	S1	S2t	S2t	S2r	S1	S2t	S2t	S2r	S2r
Guladhalli	24	S3r	S2t	S2r	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S2rt	S2r	S2r	S2t	S1	S1	S2t	S2t	S2r	S1	S2t	S2t	S2r	S2r
Guladhalli	25	S3rg	S3gt	S3g	S3gt	S3g	S3gt	S3rg	S3g	S3gt	S3gt	S3gt	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3gt	S3gt	S3gt	S3gt	S3g	S3gt	S3gt	S3gt	S2gt	S2gt
Guladhalli	26	S3rg	S3gt	S3g	S3gt	S3g	S3gt	S3rg	S3g	S3gt	S3gt	S3gt	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3gt	S3gt	S3gt	S3gt	S3g	S3gt	S3gt	S3gt	S2gt	S2gt
Guladhalli	27	S3r	S2t	S2r	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S2rt	S2r	S2r	S2t	S1	S1	S2t	S2t	S2r	S1	S2t	S2t	S2r	S2r
Guladhalli	28	S3r	S2t	S2r	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S2rt	S2r	S2r	S2t	S1	S1	S2t	S2t	S2r	S1	S2t	S2t	S2r	S2r
Guladhalli	29	S3r	S2t	S2r	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S2rt	S2r	S2r	S2t	S1	S1	S2t	S2t	S2r	S1	S2t	S2t	S2r	S2r
Guladhalli	30	S3r	S2t	S2r	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S2rt	S2r	S2r	S2t	S1	S1	S2t	S2t	S2r	S1	S2t	S2t	S2r	S2r
Guladhalli	31	N1r	S2r	S3r	S2r	S3r	S2r	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Guladhalli	32	N1r	S2r	S3r	S2r	S3r	S2r	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Guladhalli	33	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S2t
Guladhalli	34	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S2t
Guladhalli	35	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg
Guladhalli	36	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Guladhalli	37	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Guladhalli	38	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Guladhalli	39	S3r	S2t	S2r	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S2rt	S2r	S2r	S2t	S1	S1	S2t	S2t	S2r	S1	S2t	S2t	S2r	S2r
Guladhalli	40	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Guladhalli	41	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S2t

Village	Survey No.	Mango	Maize	Sapota	Sorghum	Guava	Cotton	Tamarind	Lime	Bengalgram	Sunflower	Red gram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Jasmine	Crossandra	Drumstick	Mulberry
Guladhalli	42	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg
Guladhalli	43	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg
Guladhalli	44	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg
Guladhalli	45	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg
Guladhalli	46	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg
Guladhalli	47	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg
Guladhalli	52	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg
Guladhalli	53	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S2t
Guladhalli	56	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg	S3rg	S3rg
Guladhalli	57	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S2t
Guladhalli	58	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S2t
Guladhalli	59	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg	S3rg	S3rg
Guladhalli	60	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg	S3rg	S3rg
Guladhalli	62	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg	S3rg	S3rg
Guladhalli	65	N1r	S2r	S3r	S2r	S3r	S2r	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Guladhalli	66	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg	S3rg	S3rg
Guladhalli	67	N1r	S2r	S3r	S2r	S3r	S2r	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Guladhalli	68	N1r	S2r	S3r	S2r	S3r	S2r	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Guladhalli	69	N1r	S2r	S3r	S2r	S3r	S2r	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Guladhalli	70	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g
Guladhalli	71	N1r	S2r	S3r	S2r	S3r	S2r	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Guladhalli	72	N1r	S2r	S3r	S2r	S3r	S2r	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r

Village	Survey No.	Mango	Maize	Sapota	Sorghum	Guava	Cotton	Tamarind	Lime	Bengalgram	Sunflower	Red gram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Jasmine	Crossandra	Drumstick	Mulberry
Guladhalli	76	N1r	S2r	S3r	S2r	S3r	S2r	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Guladhalli	78	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Guladhalli	79	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Guladhalli	80	N1r	S2r	S3r	S2r	S3r	S2r	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Guladhalli	105	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Guladhalli	106	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Guladhalli	109	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S2t
Guladhalli	110	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S2t
Guladhalli	149	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S2t
Guladhalli	150	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S2t
Guladhalli	167	S3tz	S3tz	S3tz	S2zg	S3tz	S2zg	S2tz	S2z	S2zg	S2zg	S2zg	S2z	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S3tz	S2zg	S2tz	S2tz	S2tz	S2zg	S2tz	S2zg	S2tz	S3tz
Guladhalli	169	S3tz	S3tz	S3tz	S2zg	S3tz	S2zg	S2tz	S2z	S2zg	S2zg	S2zg	S2z	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S3tz	S2zg	S2tz	S2tz	S2tz	S2zg	S2tz	S2zg	S2tz	S3tz
Guladhalli	170	S3tz	S3tz	S3tz	S2zg	S3tz	S2zg	S2tz	S2z	S2zg	S2zg	S2zg	S2z	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S3tz	S2zg	S2tz	S2tz	S2tz	S2zg	S2tz	S2zg	S2tz	S3tz
Guladhalli	171	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S2t
Guladhalli	172	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S2t
Halalli	13	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Halalli	14	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Halalli	17	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops
Halalli	18	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg
Halalli	19	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg
Halalli	20	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Halalli	21	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg
Halalli	22	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg

Village	Survey No.	Mango	Maize	Sapota	Sorghum	Guava	Cotton	Tamarind	Lime	Bengalgram	Sunflower	Red gram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Jasmine	Crossandra	Drumstick	Mulberry
Halalli	23	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg
Halalli	24	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Halalli	25	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Halalli	26	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Halalli	27	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	N1r	N1r	N1r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Halalli	28	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Halalli	29	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Halalli	30	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Halalli	31	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	N1r	N1r	N1r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Halalli	32	N1rg	S3rg	S3rg	S3rg	S3rg	S3g	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S2rg	S3g	S3g	S3rg	S3rg
Halalli	33	N1rg	S3rg	S3rg	S3rg	S3rg	S3g	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S2rg	S3g	S3g	S3rg	S3rg
Halalli	34	N1rg	S3rg	S3rg	S3rg	S3rg	S3g	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S2rg	S3g	S3g	S3rg	S3rg
Halalli	35	N1rg	S3rg	S3rg	S3rg	S3rg	S3g	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S2rg	S3g	S3g	S3rg	S3rg
Halalli	36	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Halalli	37	N1rg	S3rg	S3rg	S3rg	S3rg	S3g	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S2rg	S3g	S3g	S3rg	S3rg
Halalli	38	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg	S3rg	S3rg
Halalli	39	S2r	S1	S1	S1	S1	S2t	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Halalli	40	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg	S3rg	S3rg
Halalli	41	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg	S3rg	S3rg
Halalli	42	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg	S3rg	S3rg
Halalli	43	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg	S3rg	S3rg
Halalli	44	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	N1r	N1r	N1r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Halalli	45	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	N1r	N1r	N1r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Halalli	53	S3r	S1	S2r	S1	S2r	S2rt	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S1	S3r	S2r	S2t	S1	S1	S1	S1	S2r	S1	S1	S1	S2r	S2r
Halalli	55	S3r	S1	S2r	S1	S2r	S2rt	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S1	S3r	S2r	S2t	S1	S1	S1	S1	S2r	S1	S1	S1	S2r	S2r
Halalli	56	S3r	S1	S2r	S1	S2r	S2rt	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S1	S3r	S2r	S2t	S1	S1	S1	S1	S2r	S1	S1	S1	S2r	S2r
Halalli	59	S3r	S1	S2r	S1	S2r	S2rt	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S1	S3r	S2r	S2t	S1	S1	S1	S1	S2r	S1	S1	S1	S2r	S2r
Halalli	60	S3r	S1	S2r	S1	S2r	S2rt	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S1	S3r	S2r	S2t	S1	S1	S1	S1	S2r	S1	S1	S1	S2r	S2r

Village	Survey No.	Mango	Maize	Sapota	Sorghum	Guava	Cotton	Tamarind	Lime	Bengalgram	Sunflower	Red gram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Jasmine	Crossandra	Drumstick	Mulberry
Halalli	61	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	N1r	N1r	N1r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Halalli	62	S3r	S1	S2r	S1	S2r	S2rt	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S1	S3r	S2r	S2t	S1	S1	S1	S1	S2r	S1	S1	S1	S2r	S2r
Halalli	63	S3r	S1	S2r	S1	S2r	S2rt	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S1	S3r	S2r	S2t	S1	S1	S1	S1	S2r	S1	S1	S1	S2r	S2r
Halalli	64	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Halalli	65	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Halalli	66	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Halalli	67	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Halalli	68	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Halalli	69	S3r	S1	S2r	S1	S2r	S2rt	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S1	S3r	S2r	S2t	S1	S1	S1	S1	S2r	S1	S1	S1	S2r	S2r
Halalli	70	S3r	S1	S2r	S1	S2r	S2rt	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S1	S3r	S2r	S2t	S1	S1	S1	S1	S2r	S1	S1	S1	S2r	S2r
Halalli	71	S3r	S1	S2r	S1	S2r	S2rt	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S1	S3r	S2r	S2t	S1	S1	S1	S1	S2r	S1	S1	S1	S2r	S2r
Halalli	72	S3rt	S3t	S3rt	S1	S3t	S1	S3r	S2rg	S1	S2rg	S2tg	S2tg	S3t	S1	N1t	S3rt	S2rg	S3t	S3t	S3t	S2tg	S2tg	S2rt	S3t	S3tg	S3t	S2rt	S2tg
Halalli	73	S2r	S1	S1	S1	S1	S2t	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Halalli	74	S2r	S1	S1	S1	S1	S2t	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Halalli	75	S2r	S1	S1	S1	S1	S2t	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Halalli	76	S3r	S2t	S2r	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S2rt	S2r	S2r	S2t	S1	S1	S2t	S2t	S2r	S1	S2t	S2t	S2r	S2r
Halalli	77	S3r	S2t	S2r	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S2rt	S2r	S2r	S2t	S1	S1	S2t	S2t	S2r	S1	S2t	S2t	S2r	S2r
Halalli	78	S3r	S2t	S2r	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S2rt	S2r	S2r	S2t	S1	S1	S2t	S2t	S2r	S1	S2t	S2t	S2r	S2r
Halalli	79	S3r	S2t	S2r	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S2rt	S2r	S2r	S2t	S1	S1	S2t	S2t	S2r	S1	S2t	S2t	S2r	S2r
Halalli	80	S3r	S2t	S2r	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S2rt	S2r	S2r	S2t	S1	S1	S2t	S2t	S2r	S1	S2t	S2t	S2r	S2r
Halalli	81	S3r	S2t	S2r	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S2rt	S2r	S2r	S2t	S1	S1	S2t	S2t	S2r	S1	S2t	S2t	S2r	S2r
Halalli	82	S3rt	S3t	S3rt	S1	S3t	S1	S3r	S2rg	S1	S2rg	S2tg	S2tg	S3t	S1	N1t	S3rt	S2rg	S3t	S3t	S3t	S2tg	S2tg	S2rt	S3t	S3tg	S3t	S2rt	S2tg
Halalli	83	S3rt	S3t	S3rt	S1	S3t	S1	S3r	S2rg	S1	S2rg	S2tg	S2tg	S3t	S1	N1t	S3rt	S2rg	S3t	S3t	S3t	S2tg	S2tg	S2rt	S3t	S3tg	S3t	S2rt	S2tg
Halalli	84	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Halalli	85	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Halalli	86	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Halalli	87	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Halalli	88	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1

Village	Survey No.	Mango	Maize	Sapota	Sorghum	Guava	Cotton	Tamarind	Lime	Bengalgram	Sunflower	Red gram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Jasmine	Crossandra	Drumstick	Mulberry
Halalli	**89**	**S1**	**S2t**	**S1**	**S1**	**S1**	**S1**	**S1**	**S1**	**S2t**	**S1**	**S1**	**S1**	**S1**	**S1**	**S1**	**S1**	**S1**	**S1**	**S1**	**S1**	**S1**	**S1**	**S1**	**S1**	**S1**	**S1**	**S1**	**S1**
Halalli	**90**	**S1**	**S2t**	**S1**	**S1**	**S1**	**S1**	**S1**	**S1**	**S2t**	**S1**	**S1**	**S1**	**S1**	**S1**	**S1**	**S1**	**S1**	**S1**	**S1**	**S1**	**S1**	**S1**	**S1**	**S1**	**S1**	**S1**	**S1**	**S1**

PART-B

SOCIO-ECONOMIC STATUS OF FARM HOUSEHOLDS

CONTENTS

LIST OF TABLES

Chapter 1

SALIENT FINDINGS OF THE SURVEY

- *The data indicated that there were 110 (55.28%) men and 89 (44.72%) were women among the sampled households.*
- *The average family size of landless farmers was 4.2, marginal farmers' was 4.46, small farmers' was 4.63, semi medium farmers' was 4.3 and medium farmers' was 5.*
- *The data indicated that, 39 (19.6 %) people were in 0-15 years of age, 82 (41.21 %) were in 16-35 years of age, 60 (30.15 %) were in 36-60 years of age and 18 (9.05%) were above 61 years of age.*
- *The results indicated that Gabbur-3 had 43.72 per cent illiterates, 32.66 per cent of them had primary school education, 2.51 per cent of them had middle school education, 7.54 per cent of them had high school education, 7.54 per cent of them had PUC education, 0.50 per cent of them had diploma and 2.01 per cent of them had degree education.*
- *The results indicate that, 88.64 per cent of households practicing agriculture and 13.64 per cent of the households were agricultural laborers.*
- *The results indicate that agriculture was the major occupation for 20.10 per cent of the household members, 59.30 per cent were agricultural labourers, 0.50 per cent was in private service, 16.08 per cent of them were student and 4.02 per cent were children.*
- *The results show that only 1.01 per cent of the household members have participated in NGOs and 98.99 per cent of the households have not participated in any local institutions.*
- *The results indicate that 11.36 per cent of the households possess thatched house, 68.18 per cent of the households possess Katcha house, 18.18 per cent of them possess pucca/RCC house.*
- *The results shows that 77.27 per cent of the households possess TV, 61.36 per cent of the households possess Mixer grinder, 11.36 per cent of the households possess bicycle, 43.18 per cent of the households possess motor cycle and 79.55 per cent of the households possess mobile phones.*
- *The results shows that the average value of television was Rs. 5075, mixer grinder was Rs.1903, motor cycle was Rs.47473, mobile phone was Rs.2108 and bicycle was Rs.1600.*
- *About 45.45 per cent of the households possess plough, 18.18 per cent of the households possess bullock cart, 4.55 per cent of the households possess irrigation pump, 4.55 per cent of the households possess tractor, 20.45 per cent of the households possess sprayer and 56.82 per cent of them possess weeder.*
- *The results show that the average value of plough was Rs.1550, the average value of bullock cart was Rs. 15625, the average value of irrigation pump was Rs. 1571,*

the average value of tractor was Rs. 250600, the average value of sprayer was Rs.1758 and the average value of weeder Rs.80.

- *The results indicate that, 31.82 per cent of the households possess bullocks, 31.82 per cent of the households possess local cow and 2.27 per cent of the households possess sheep.*
- *The results indicate that, average own labour men available in the micro watershed was 1.93, average own labour (women) available was 1.49, average hired labour (men) available was 13.52 and average hired labour (women) available was 9.89.*
- *The results indicate that, 100 per cent of the household opined that hired labour was inadequate.*
- *The results indicate that, households of the Gabbur-3 micro watershed possess 23.38 ha (40.61%) of dry land and 34.19 ha (59.39%) of irrigated land. Marginal farmers possess 7.02 ha (86.97%) of dry land and 1.05 ha (13.03%) of irrigated land. Small farmers possess 7.14 ha (78.55%) of dry land and 1.95 ha (21.45%) of irrigated land. Semi medium possess 2.14 ha (15.03%) of dry land and 12.13 ha (84.97%) of irrigated land. Medium farmers possess 7.07 ha (27.07%) of dry land and 19.06 ha (72.93%) of irrigated land.*
- *The results indicate that, the average value of dry land was Rs. 299238.49 and average value of irrigated was Rs. 358119.30. In case of marginal famers, the average land value was Rs. 526743.52 for dry land and Rs. 1709999.98 for irrigated land. In case of small famers, the average land value was Rs. 237903.69 for dry land and Rs. 819917.0 for irrigated land. In case of semi medium famers, the average land value was Rs. 186415.09 for dry land and Rs. 424441.11 for irrigated land. In case of medium famers, the average land value was Rs. 169.565.22 for dry land and Rs. 194033.97 for irrigated land.*
- *The results indicate that, there were 30 functioning bore wells and 24 de-functioning bore wells in the micro watershed.*
- *The results indicate that, bore well was the major irrigation source in the micro water shed for 72.73 per cent of the farmers.*
- *The results indicate that, the depth of bore well was found to be 53.06 meters.*
- *The results indicate that, marginal farmers had irrigated area of 2.58 hectares, small farmers had 2.76 hectares, semi medium farmers had 12.13 hectares and medium farmers had 18.62 hectares.*
- *The results indicate that, farmers have grown maize (29.14 ha), bajra (14.49 ha), paddy (2.83 ha), sugarcane (2.23 ha), bengalgram (2.11 ha), cotton (1.71 ha), redgram (1.62 ha), sunflower (1.62 ha) and sapota (0.91 ha).*
- *The results indicate that, the cropping intensity in Gabbur-3 micro watershed was found to be 88.60 per cent. In case of marginal farmers it was 100 per cent, for small farmers it was 100 per cent, in case of semi medium farmers it was 83 per cent and medium farmers had a cropping intensity of 71.43 per cent.*

- *The results indicate that, 65.91 per cent of the households possess bank account and savings in the micro watershed.*
- *The results indicate that, 69.23 per cent of marginal, 75 per cent of small, 60.0 per cent of semi medium and 100 per cent of medium farmers have borrowed credit from different sources.*
- *The results indicate that 3.45 per cent have availed loan from grameena bank.*
- *The results indicate that, semi medium have availed a credit of Rs.12500.*
- *The results indicate that, 100 per cent of the households have borrowed loan from institutional sources for the purpose of agricultural production.*
- *Results indicated that 100 per cent of the households did not repay their loan borrowed from institutional sources.*
- *The results indicate that, around 100 per cent of the households opined that the loan helped them to perform timely agricultural operations.*
- *The results indicate that, the total cost of cultivation for sugarcane was Rs. 63406.50. The gross income realized by the farmers was Rs. 162690.67. The net income from sugarcane cultivation was Rs. 99284.17, thus the benefit cost ratio was found to be 1:2.57.*
- *The total cost of cultivation for maize was Rs. 27366.09. The gross income realized by the farmers was Rs. 39524.14. The net income from Maize cultivation was Rs. 12158.052, thus the benefit cost ratio was found to be 1:1.44.*
- *The total cost of cultivation for Bajra was Rs. 30365.39. The gross income realized by the farmers was Rs. 30642.85. The net income from Bajra cultivation was Rs. 277.47. Thus the benefit cost ratio was found to be 1:1.01.*
- *The total cost of cultivation for paddy was Rs. 38588.45. The gross income realized by the farmers was Rs. 55008.96. The net income from paddy cultivation was Rs. 16420.51. Thus the benefit cost ratio was found to be 1:1.43.*
- *The total cost of cultivation for Sapota was Rs. 29035.29. The gross income realized by the farmers was Rs. 262300.89. The net income from Sapota cultivation was Rs. 233265.60. Thus the benefit cost ratio was found to be 1:9.03.*
- *The total cost of cultivation for Cotton was Rs. 41171.24. The gross income realized by the farmers was Rs. 45975.22. The net income from Cotton cultivation was Rs. 2409.43, thus the benefit cost ratio was found to be 1:2.12.*
- *The total cost of cultivation for Paddy was Rs. 38588.45. The gross income realized by the farmers was Rs. 55008.96. The net income from Paddy cultivation was Rs. 16420.51, thus the benefit cost ratio was found to be 1:1.43.*
- *The total cost of cultivation for sunflower was Rs. 31812.67. The gross income realized by the farmers was Rs. 53105. The net income from sunflower cultivation was Rs. 21292.33, thus the benefit cost ratio was found to be 1:1.67.*

- *The total cost of cultivation for bengalgram was Rs. 38703.46. The gross income realized by the farmers was Rs. 137289.48. The net income from bengalgram cultivation was Rs. 98586.02, thus the benefit cost ratio was found to be 1:3.55.*
- *The total cost of cultivation for redgram was Rs. 17728.95. The gross income realized by the farmers was Rs. 41496. The net income from redgram cultivation was Rs. 23767.05, thus the benefit cost ratio was found to be 1:2.34.*
- *The results indicate that, 18.18 per cent of the households opined that dry fodder was adequate and another 2.27 per cent of the households opined that green fodder was adequate. Also, 31.82 per cent of the households opined that dry fodder was inadequate.*
- *The results indicate that the average annual gross income was Rs. 32,000 for landless farmers, for marginal farmers it was Rs. 60,307.85, for small farmers it was Rs. 69,750, for semi medium farmers it was Rs. 120,000 and for medium farmers it was Rs. 117,125.38.*
- *The results indicate that the average annual expenditure is Rs. 5,656.59. For landless households it was Rs. 2,400, for marginal farmers it was Rs 5,847.63, for small farmers it was Rs. 5,468.75, for semi medium farmers it was Rs. 6,583.33 and for medium farmers it was Rs. 6,410.94.*
- *The results indicate that, sampled households have grown 33 coconut trees, 5 guava trees, 31 mango trees and 3 orange trees in their field.*
- *The results indicate that, households have planted 85 neem trees, 19 teak trees, 5 tamarind trees, 4 acacia trees, 12 banyan and 3 peepul trees in their field.*
- *The results indicate that, households have an average investment capacity of Rs.4,022.73 for land development, Rs.454.55 for irrigation facility and Rs.545.45 for improved crop production.*
- *The results indicate that, government subsidy was the source of additional investment for 2.27 per cent for irrigation facility and for 4.55 per cent for improved crop production. Loan from bank was the major source of investment for 2.27 per cent of households for land development and for 2.27 per cent for improved crop production. Own funds were the source of additional investment for 25 per cent for land development, for 2.27 per cent for irrigation facility and for 4.55 per cent for improved crop production. Soft loan was the source of additional investment for 11.36 per cent for land development.*
- *The results indicated that, bajra was sold to the extent of 95.22 per cent, bengalgram was sold to the extent of 80.39 per cent, maize was sold to the extent of 96.22 per cent, paddy and redgram were sold to the extent of 50 per cent. Cotton, sapota, sugarcane and sunflower were sold to the extent of 100 per cent.*
- *The results indicated that, about 93.18 per cent of the households sold their produce in regulated markets and 9.09 per cent have sold their produce to cooperative marketing society.*

- *The results indicated that 95.45 per cent of the farmers have used tractor and 2.27 per cent have used truck as a mode of transport for their agricultural produce.*
- *The results indicated that, 22.73 per cent of the households have experienced soil and water erosion problems.*
- *The results indicated that, 65.91 per cent of the households are interested in soil testing.*
- *The results indicated that, piped supply was the major source of drinking water for 47.73 per cent of the households, bore well was the source of drinking water for 52.27 per cent of the households.*
- *The results indicated that, 86.36 percent used fire wood and 13.64 percent of the households used LPG as a source of fuel.*
- *Electricity was the major source of light for 100 per cent of the households in micro watershed.*
- *The results indicated that, 100 per cent of the households possess sanitary toilet facility in the micro watershed.*
- *The results indicated that, 90.91 per cent of the sampled households possessed BPL card, 6.82 per cent possessed APL card and 2.27 per cent did not possess any PDS card.*
- *The results indicated that, 43.18 per cent of the households participated in NREGA programme.*
- *The results indicated that, cereals were adequate for 97.73 per cent of the households, pulses were adequate for 79.55 per cent, oilseeds were adequate for 20.45 per cent, vegetables were adequate for 31.82 per cent, fruits were adequate for 29.55 per cent, milk was adequate for 15.91 per cent and eggs were adequate for 20.45 per cent of the households.*
- *The results indicated that, cereals were inadequate for 2.27 percent, pulses were inadequate for 18.18 per cent, oilseeds were inadequate for 59.09 per cent, vegetables were inadequate for 47.73 per cent, fruits were inadequate for 40.91 per cent, milk were inadequate for 40.91 per cent and eggs were inadequate for 54.55 per cent of the households.*
- *The results indicated that, oilseeds were market surplus for 13.64 per cent, vegetables were market surplus for 18.18 per cent and fruits were market surplus for 4.55 per cent of the households.*
- *The results indicated that, lower fertility status of the soil was the constraint experienced by 63.64 per cent of the households, wild animal menace on farm field (68.18%), frequent incidence of pest and diseases (43.18%), inadequacy of irrigation water (13.64%), high cost of fertilizers and plant protection chemicals (38.64%), high rate of interest on credit (18.18%), low price for the agricultural commodities (13.64%), lack of marketing facilities in the area (13.64%), lack of transport for safe transport of the agricultural produce to the market (13.64%),*

inadequate extension services (27.27%), less rainfall (45.45%) and source of agri technology information (29.55%).

Chapter 2

INTRODUCTION

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

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

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

Scope and importance of survey

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

Chapter 3

METHODOLOGY

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

Description of the study area

Koppal district is an administrative district in the state of Karnataka in India. In the past Koppal was referred to as 'Kopana Nagara'. Koppal, now a district headquarters is ancient Kopana a major holy place of the Jainas. The district occupies an area of 7,190 km² and has a population of 1,196,089, which 16.58% were urban as of 2001. The Koppal district was formed after split of Raichur district.

Geographers are very particular about the physiography or relief of a region. It plays a very important role in the spatial analysis of agricultural situation of the study area. The undulating topography with black cotton soil shrips, cut across by numerous nalas or streams is the major characteristic feature of the study region. Three physiographic divisions have made considering the local conditions of landforms and crops grown in the district. On the basis of physiography, Koppal district can be divided into three major divisions.3 They are (a) Koppal & Yelburga plateau, (b) Maidan division, (c) Tungabhadra valley. The district is part of Krishna basin the main streams draining the area are Maskinala, Ilkal-nadi and Hirenala. These are Ephemaral in nature, these come under Tungabhadra sub-basin. The drainage exhibit dentritic to subdentric with drainage density varies from 1.4 to7.0kms/sq.km.

According to the 2011 census Koppal district has a population of 1,391,292 roughly equal to the nation of Swaziland or the US state of Hawaii. This gives it a ranking of 350th in India (out of a total of 640). The district has a population density of 250 inhabitants per square kilometre (650/sq mi). Its population growth rate over the decade 2001-2011 was 16.32%.Koppal has a sex ratio of 983 females for every 1000 males, and a literacy rate of 67.28%.

Description of the micro watershed

Gabbur-3 micro-watershed (Shahpura sub-watershed, Koppal Taluk and District) is located at North latitude $15^0$23’35.853’’ to 15^0 21’45.021” and East longitude 76^0 17’24.154’’ to $76^0$15’38.579’’ covering an area of 536.53 ha and spread across Tavaregere, Guladhalli, Gabbura and Halalli villages.

Methodology followed in assessing socio-economic status of households

In order to assess the socio-economic condition of the farmers in the watershed a comprehensive questionnaire was prepared. Major components such as demographic conditions, migration details, food consumption and family expenditure pattern, material possession, land holding, land use management, cropping pattern, cost of cultivation of crops, livestock management. The statistical components such as frequency and percentage were used to analyze the data. About 44 households located in the micro watershed were interviewed for the survey.

Chapter 4

SALIENT FEATURES OF THE SURVEY

Households sampled for socio-economic survey: The data on households sampled for socio economic survey in Gabbur-3 micro watershed is presented in Table 1 and it indicated that 44 farmers were sampled in Gabbur-3 micro watershed among them 5 (11.36%) were landless, 13 (29.55%) were marginal farmers, 8 (18.18 %) were small farmers, 10 (22.73%) were semi medium farmers and 8 (18.18%) were medium farmers.

Table 1: Households sampled for socio economic survey in Gabbur-3 micro watershed

Sl.No.	Particulars	LL (5)		MF (13)		SF (8)		SMF (10)		MDF (8)		All (44)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Farmers	5	11.36	13	29.55	8	18.18	10	22.73	8	18.18	44	100.00

Population characteristics: The population characteristics of households sampled for socio-economic survey in Gabbur-3 micro watershed is presented in Table 2. The data indicated that there were 110 (55.28%) men and 89 (44.72%) were women among the sampled households. The average family size of landless farmers was 4.2, marginal farmers' was 4.46, small farmers' was 4.63, semi medium farmers' was 4.3 and medium farmers' was 5.

Table 2: Population characteristics of Gabbur-3 micro-watershed

Sl.No.	Particulars	LL (21)		MF (58)		SF (37)		SMF (43)		MDF (40)		All (199)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Men	8	38.10	34	58.62	21	56.76	24	55.81	23	57.50	110	55.28
2	Women	13	61.90	24	41.38	16	43.24	19	44.19	17	42.50	89	44.72
Total		21	100.00	58	100.00	37	100.00	43	100.00	40	100.00	199	100.00
Average		4.20		4.46		4.63		4.30		5.00		4.52	

Age wise classification of population: The age wise classification of household members in Gabbur-3 micro watershed is presented in Table 3. The data indicated that, 39 (19.6 %) people were in 0-15 years of age, 82 (41.21 %) were in 16-35 years of age, 60 (30.15 %) were in 36-60 years of age and 18 (9.05%) were above 61 years of age.

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

Sl.No.	Particulars	LL (21)		MF (58)		SF (37)		SMF (43)		MDF (40)		All (199)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	0-15 years of age	8	38.10	7	12.07	7	18.92	7	16.28	10	25.00	39	19.60
2	16-35 years of age	9	42.86	23	39.66	15	40.54	18	41.86	17	42.50	82	41.21
3	36-60 years of age	4	19.05	22	37.93	11	29.73	14	32.56	9	22.50	60	30.15
4	> 61 years	0	0.00	6	10.34	4	10.81	4	9.30	4	10.00	18	9.05
Total		21	100.00	58	100.00	37	100.00	43	100.00	40	100.00	199	100.00

Education level of household members: Education level of household members in Gabbur-3 micro watershed is presented in Table 4. The results indicated that Gabbur-3 had 43.72 per cent illiterates, 32.66 per cent of them had primary school education, 2.51 per cent of them had middle school education, 7.54 per cent of them had high school

education, 7.54 per cent of them had PUC education, 0.50 per cent of them had diploma and 2.01 per cent of them had degree education.

Table 4. Education level of household members in Gabbur-3 micro watershed

Sl.No.	Particulars	LL (21)		MF (58)		SF (37)		SMF (43)		MDF (40)		All (199)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Illiterate	5	23.81	24	41.38	16	43.24	24	55.81	18	45.00	87	43.72
2	Primary School	11	52.38	20	34.48	11	29.73	11	25.58	12	30.00	65	32.66
3	Middle School	0	0.00	4	6.90	1	2.70	0	0.00	0	0.00	5	2.51
4	High School	0	0.00	5	8.62	2	5.41	6	13.95	2	5.00	15	7.54
5	PUC	1	4.76	0	0.00	7	18.92	2	4.65	5	12.50	15	7.54
6	Diploma	0	0.00	1	1.72	0	0.00	0	0.00	0	0.00	1	0.50
7	Degree	1	4.76	2	3.45	0	0.00	0	0.00	1	2.50	4	2.01
8	Others	3	14.29	2	3.45	0	0.00	0	0.00	2	5.00	7	3.52
Total		21	100.00	58	100.00	37	100.00	43	100.00	40	100.00	199	100.00

Occupation of household heads: The data regarding the occupation of the household heads in Gabbur-3 micro watershed is presented in Table 5. The results indicate that, 88.64 per cent of households practicing agriculture and 13.64 per cent of the households were agricultural laborers.

Table 5: Occupation of household heads in Gabbur-3 micro watershed

Sl.No.	Particulars	LL (5)		MF (13)		SF (8)		SMF (10)		MDF (8)		All (44)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Agriculture	1	20.00	13	100.00	8	100.00	9	90.00	8	100.00	39	88.64
2	Agricultural Labour	4	80.00	1	7.69	0	0.00	1	10.00	0	0.00	6	13.64
Total		5	100.00	14	100.00	8	100.00	10	100.00	8	100.00	45	100.00

Occupation of the household members: The data regarding the occupation of the household members in Gabbur-3 micro watershed is presented in Table 6. The results indicate that agriculture was the major occupation for 20.10 per cent of the household members, 59.30 per cent were agricultural labourers, 0.50 per cent was in private service, 16.08 per cent of them were student and 4.02 per cent were children.

Table 6: Occupation of family members in Gabbur-3 micro watershed

Sl. No.	Particulars	LL (21)		MF (58)		SF (37)		SMF(43)		MDF(40)		All (199)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Agriculture	1	4.76	13	22.41	8	21.62	10	23.26	8	20.00	40	20.10
2	Agricultural Labour	11	52.38	37	63.79	22	59.46	27	62.79	21	52.50	118	59.30
3	Private Service	0	0.00	1	1.72	0	0.00	0	0.00	0	0.00	1	0.50
4	Student	6	28.57	5	8.62	7	18.92	6	13.95	8	20.00	32	16.08
5	Children	3	14.29	2	3.45	0	0.00	0	0.00	3	7.50	8	4.02
Total		21	100.00	58	100.00	37	100.00	43	100.00	40	100.00	199	100.00

Institutional participation of the household members: The data regarding the institutional participation of the household members in Gabbur-3 micro watershed is presented in Table 7. The results show that only 1.01 per cent of the household members

have participated in NGOs and 98.99 per cent of the households have not participated in any local institutions.

Table 7. Institutional Participation of household members in Gabbur-3 micro watershed

Sl.No.	Particulars	LL (21)		MF (58)		SF (37)		SMF (43)		MDF (40)		All (199)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	NGOs	0	0.00	0	0.00	1	2.70	0	0.00	1	2.50	2	1.01
2	No Participation	21	100.00	58	100.00	36	97.30	43	100.00	39	97.50	197	98.99
Total		21	100.00	58	100.00	37	100.00	43	100.00	40	100.00	199	100.00

Type of house owned: The data regarding the type of house owned by the households in Gabbur-3 micro watershed is presented in Table 8. The results indicate that 11.36 per cent of the households possess thatched house, 68.18 per cent of the households possess Katcha house, 18.18 per cent of them possess pucca/RCC house.

Table 8. Type of house owned by households in Gabbur-3 micro watershed

Sl.No.	Particulars	LL (5)		MF (13)		SF (8)		SMF (10)		MDF (8)		All (44)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Thatched	1	20.00	1	7.69	0	0.00	2	20.00	1	12.50	5	11.36
2	Katcha	3	60.00	11	84.62	6	75.00	7	70.00	3	37.50	30	68.18
3	Pucca/RCC	0	0.00	1	7.69	2	25.00	1	10.00	4	50.00	8	18.18
Total		4	100.00	13	100.00	8	100.00	10	100.00	8	100.00	43	100.00

Durable Assets owned by the households: The data regarding the Durable Assets owned by the households in Gabbur-3 micro watershed is presented in Table 9. The results shows that 77.27 per cent of the households possess TV, 61.36 per cent of the households possess Mixer grinder, 11.36 per cent of the households possess bicycle, 43.18 per cent of the households possess motor cycle and 79.55 per cent of the households possess mobile phones.

Table 9. Durable Assets owned by households in Gabbur-3 micro watershed

Sl.No.	Particulars	LL (5)		MF (13)		SF (8)		SMF (10)		MDF (8)		All (44)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Television	3	60.00	12	92.31	6	75.00	7	70.00	6	75.00	34	77.27
2	Mixer/Grinder	0	0.00	10	76.92	6	75.00	6	60.00	5	62.50	27	61.36
3	Bicycle	1	20.00	1	7.69	0	0.00	2	20.00	1	12.50	5	11.36
4	Motor Cycle	0	0.00	6	46.15	3	37.50	5	50.00	5	62.50	19	43.18
5	Mobile Phone	3	60.00	10	76.92	6	75.00	9	90.00	7	87.50	35	79.55
6	Blank	1	20.00	1	7.69	1	12.50	0	0.00	0	0.00	3	6.82

Average value of durable assets: The data regarding the average value of durable assets owned by the households in Gabbur-3 micro watershed is presented in Table 10. The results shows that the average value of television was Rs. 5075, mixer grinder was Rs.1903, motor cycle was Rs.47473, mobile phone was Rs.2108 and bicycle was Rs.1600.

Table 10. Average value of durable assets owned by households in Gabbur-3 micro watershed

Average value (Rs.)

Sl.No.	Particulars	LL (5)	MF (13)	SF (8)	SMF (10)	MDF (8)	All (44)
1	Television	5,000.00	5,083.00	5,333.00	4,214.00	5,833.00	5,075.00
2	Mixer/Grinder	0.00	1,980.00	1,833.00	1,766.00	2,000.00	1,903.00
3	Bicycle	2,000.00	2,000.00	0.00	1,500.00	1,000.00	1,600.00
4	Motor Cycle	0.00	38,666.00	43,333.00	46,000.00	62,000.00	47,473.00
5	Mobile Phone	2,000.00	2,247.00	2,555.00	1,142.00	2,708.00	2,108.00

Farm Implements owned: The data regarding the farm implements owned by the households in Gabbur-3 micro watershed is presented in Table 11. About 45.45 per cent of the households possess plough, 18.18 per cent of the households possess bullock cart, 4.55 per cent of the households possess irrigation pump, 4.55 per cent of the households possess tractor, 20.45 per cent of the households possess sprayer and 56.82 per cent of them possess weeder.

Table 11. Farm Implements owned by households in Gabbur-3 micro watershed

Sl.No.	Particulars	LL (5)		MF (13)		SF (8)		SMF (10)		MDF (8)		All (44)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Bullock Cart	0	0.00	2	15.38	2	25.00	2	20.00	2	25.00	8	18.18
2	Plough	0	0.00	6	46.15	4	50.00	5	50.00	5	62.50	20	45.45
3	Irrigation Pump	0	0.00	0	0.00	1	12.50	0	0.00	1	12.50	2	4.55
4	Tractor	0	0.00	0	0.00	0	0.00	1	10.00	1	12.50	2	4.55
5	Sprayer	0	0.00	2	15.38	2	25.00	3	30.00	2	25.00	9	20.45
6	Weeder	0	0.00	9	69.23	6	75.00	6	60.00	4	50.00	25	56.82
7	Blank	5	100.00	3	23.08	1	12.50	2	20.00	2	25.00	13	29.55

Average value of farm implements: The data regarding the average value of farm Implements owned by the households in Gabbur-3 micro watershed is presented in Table 12. The results show that the average value of plough was Rs.1550, the average value of bullock cart was Rs. 15625, the average value of irrigation pump was Rs. 1571, the average value of tractor was Rs. 250600, the average value of sprayer was Rs.1758 and the average value of weeder Rs.80.

Table 12. Average value of farm implements owned by households in Gabbur-3 micro watershed

Sl.No.	Particulars	LL (5)	MF (13)	SF (8)	SMF (10)	MDF (8)	All (44)
1	Bullock Cart	0.00	17,500.00	15,000.00	15,000.00	15,000.00	15,625.00
2	Plough	0.00	1,488.00	1,440.00	1,528.00	1,800.00	1,550.00
3	Irrigation Pump	0.00	0.00	5,000.00	0.00	1,000.00	1,571.00
4	Tractor	0.00	0.00	0.00	1,200.00	500,000.00	250,600.00
5	Sprayer	0.00	1,800.00	1,066.00	2,250.00	1,750.00	1,758.00
6	Weeder	0.00	149.00	38.00	29.00	32.00	80.00

Livestock possession by the households: The data regarding the Livestock possession by the households in Gabbur-3 micro watershed is presented in Table 13. The results indicate that, 31.82 per cent of the households possess bullocks, 31.82 per cent of the households possess local cow and 2.27 per cent of the households possess sheep.

Table 13. Livestock possession by households in Gabbur-3 micro watershed

Sl.No.	Particulars	LL (5)		MF (13)		SF (8)		SMF (10)		MDF (8)		All (44)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Bullock	0	0.00	4	30.77	4	50.00	2	20.00	4	50.00	14	31.82
2	Local cow	0	0.00	5	38.46	3	37.50	1	10.00	5	62.50	14	31.82
3	Sheep	0	0.00	1	7.69	0	0.00	0	0.00	0	0.00	1	2.27
4	blank	5	100.00	5	38.46	3	37.50	7	70.00	1	12.50	21	47.73

Average Labour availability: The data regarding the average labour availability in Gabbur-3 micro watershed is presented in Table 14. The results indicate that, average own labour men available in the micro watershed was 1.93, average own labour (women) available was 1.49, average hired labour (men) available was 13.52 and average hired labour (women) available was 9.89.

In case of marginal farmers, average own labour men available was 1.92, average own labour (women) was 1.31, average hired labour (men) was 11.31 and average hired labour (women) available was 6.92. In case of small farmers, average own labour men available was 1.75, average own labour (women) was 1.38, average hired labour (men) was 12.88 and average hired labour (women) available was 9.38. In case of semi medium farmers, average own labour men available was 2.22, average own labour (women) was 2, average hired labour (men) was 19 and average hired labour (women) available was 11.50. In case of medium farmers, average own labour men available was 2.38, average own labour (women) was 1.63, average hired labour (men) was 19.38 and average hired labour (women) available was 19.38.

Table 14. Average Labour availability in Gabbur-3 micro watershed

Sl.No.	Particulars	LL (5)	MF (13)	SF (8)	SMF (10)	MDF (8)	All (44)
		N	N	N	N	N	N
1	Hired labour Female	0.00	6.92	9.38	11.50	19.38	9.89
2	Own Labour Female	1.00	1.31	1.38	2.00	1.63	1.49
3	Own labour Male	1.00	1.92	1.75	2.22	2.38	1.93
4	Hired labour Male	0.00	11.31	12.88	19.00	19.38	13.52

Adequacy of Hired Labour: The data regarding the inadequacy of hired labour in Gabbur-3 micro watershed is presented in Table 15. The results indicate that, 100 per cent of the household opined that hired labour was inadequate.

Table 15. Adequacy of Hired Labour in Gabbur-3 micro watershed

Sl.No.	Particulars	LL (5)		MF (13)		SF (8)		SMF (10)		MDF (8)		All (44)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Inadequate	5	100.00	13	100.00	8	100.00	10	100.00	8	100.00	44	100.00

Distribution of land (ha): The data regarding the distribution of land (ha) in Gabbur-3 micro watershed is presented in Table 16. The results indicate that, households of the Gabbur-3 micro watershed possess 23.38 ha (40.61%) of dry land and 34.19 ha (59.39%) of irrigated land. Marginal farmers possess 7.02 ha (86.97%) of dry land and 1.05 ha

(13.03%) of irrigated land. Small farmers possess 7.14 ha (78.55%) of dry land and 1.95 ha (21.45%) of irrigated land. Semi medium possess 2.14 ha (15.03%) of dry land and 12.13 ha (84.97%) of irrigated land. Medium farmers possess 7.07 ha (27.07%) of dry land and 19.06 ha (72.93%) of irrigated land.

Table 16. Distribution of land (Ha) in Gabbur-3 micro watershed

Sl. No.	Particulars	MF (13)		SF (8)		SMF (10)		MDF (8)		All (44)	
		ha	%	ha	%	ha	%	ha	%	ha	%
1	Dry	7.02	86.97	7.14	78.55	2.14	15.03	7.07	27.07	23.38	40.61
2	Irrigated	1.05	13.03	1.95	21.45	12.13	84.97	19.06	72.93	34.19	59.39
Total		8.07	100.00	9.09	100.00	14.27	100.00	26.14	100.00	57.58	100.00

Average land value (Rs./ha): The data regarding the average land value (Rs./ha) in Gabbur-3 micro watershed is presented in Table 17. The results indicate that, the average value of dry land was Rs. 299238.49 and average value of irrigated was Rs. 358119.30. In case of marginal famers, the average land value was Rs. 526743.52 for dry land and Rs. 1709999.98 for irrigated land. In case of small famers, the average land value was Rs. 237903.69 for dry land and Rs. 819917.0 for irrigated land. In case of semi medium famers, the average land value was Rs. 186415.09 for dry land and Rs. 424441.11 for irrigated land. In case of medium famers, the average land value was Rs. 169.565.22 for dry land and Rs. 194033.97 for irrigated land.

Table 17. Average land value (Rs./ha) in Gabbur-3 micro watershed

Sl.No.	Particulars	MF (13)	SF (8)	SMF (10)	MDF (8)	All (44)
		N	N	N	N	N
1	Dry	526,743.52	237,903.69	186,415.09	169,565.22	299,238.49
2	Irrigated	1,709,999.98	819,917.00	424,441.11	194,033.97	358,119.30

Status of bore well: The data regarding the status of bore wells in Gabbur-3 micro watershed is presented in Table 18. The results indicate that, there were 30 functioning bore wells and 24 de-functioning bore wells in the micro watershed.

Table 18. Status of bore wells in Gabbur-3 micro watershed

Sl.No.	Particulars	LL (5)	MF (13)	SF (8)	SMF (10)	MDF (8)	All (44)
		N	N	N	N	N	N
1	De-functioning	0	5	3	8	8	24
2	Functioning	0	5	3	12	10	30

Source of irrigation: The data regarding the source of irrigation in Gabbur-3 micro watershed is presented in Table 19. The results indicate that, bore well was the major irrigation source in the micro water shed for 72.73 per cent of the farmers.

Table 19. Source of irrigation in Gabbur-3 micro watershed

Sl.No.	Particulars	LL (5)		MF (13)		SF (8)		SMF (10)		MDF (8)		All (44)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Bore Well	0	0.00	6	46.15	3	37.50	13	130.00	10	125.00	32	72.73

Depth of water (Avg in meters): The data regarding the depth of water in Gabbur-3 micro watershed is presented in Table 20. The results indicate that, the depth of bore well was found to be 53.06 meters.

Table 20. Depth of water (Avg in meters) in Gabbur-3 micro watershed

Sl.No.	Particulars	LL (5)	MF (13)	SF (8)	SMF (10)	MDF (8)	All (44)
		N	N	N	N	N	N
1	Bore Well	0.00	39.86	32.39	101.19	68.20	53.06

Irrigated Area (ha): The data regarding the irrigated area (ha) in Gabbur-3 micro watershed is presented in Table 21. The results indicate that, marginal farmers had irrigated area of 2.58 hectares, small farmers had 2.76 hectares, semi medium farmers had 12.13 hectares and medium farmers had 18.62 hectares.

Table 21. Irrigated Area (ha) in Gabbur-3 micro watershed

Sl.No.	Particulars	LL (5)	MF (13)	SF (8)	SMF (10)	MDF (8)	All (44)
1	Kharif	0.00	2.09	2.36	12.13	18.62	35.20
2	Perennial Crops	0.00	0.00	0.40	0.00	0.00	0.40
3	Rabi	0.00	0.49	0.00	0.00	0.00	0.49
Total		0.00	2.58	2.76	12.13	18.62	36.10

Cropping pattern: The data regarding the cropping pattern in Gabbur-3 micro watershed is presented in Table 22. The results indicate that, farmers have grown maize (29.14 ha), bajra (14.49 ha), paddy (2.83 ha), sugarcane (2.23 ha), bengalgram (2.11 ha), cotton (1.71 ha), redgram (1.62 ha), sunflower (1.62 ha) and sapota (0.91 ha).

Table 22. Cropping pattern in Gabbur-3 micro watershed (Area in ha)

Sl.No.	Particulars	MF (13)	SF (8)	SMF (10)	MDF (8)	All (44)
1	Kharif - Maize	2.58	1.62	8.74	16.19	29.14
2	Kharif - Bajra	3.37	5.86	0	5.26	14.49
3	Kharif - Paddy	0	0	0	2.83	2.83
4	Kharif - Sugarcane	0	0.61	1.62	0	2.23
5	Rabi - Bengal gram	0.49	0	1.62	0	2.11
7	Kharif - Cotton	0.49	0	1.21	0	1.71
8	Kharif - Red gram (togari)	0	0	1.62	0	1.62
9	Kharif - Sunflower	0.81	0	0.81	0	1.62
10	Kharif - Sapota	0.91	0	0	0	0.91
Total		8.66	8.09	15.62	24.29	56.66

Table 23. Cropping intensity (%) in Gabbur-3 micro watershed

Sl.No.	Particulars	LL (5)	MF (13)	SF (8)	SMF (10)	MDF (8)	All (44)
1	Cropping Intensity	0.00	100.00	100.00	83.0	71.43	88.60

Cropping intensity: The data regarding the cropping intensity in Gabbur-3 micro watershed is presented in Table 23. The results indicate that, the cropping intensity in Gabbur-3 micro watershed was found to be 88.60 per cent. In case of marginal farmers it

was 100 per cent, for small farmers it was 100 per cent, in case of semi medium farmers it was 83 per cent and medium farmers had a cropping intensity of 71.43 per cent.

Possession of Bank account: The data regarding the possession of Bank account and savings in Gabbur-3 micro watershed is presented in Table 24. The results indicate that, 65.91 per cent of the households possess bank account and savings in the micro watershed.

Table 24. Possession of Bank account and savings in Gabbur-3 micro watershed

Sl.No.	Particulars	LL (5)		MF (13)		SF (8)		SMF (10)		MDF (8)		All (44)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Account	0	0.00	9	69.23	6	75.00	6	60.00	8	100.00	29	65.91
2	Savings	0	0.00	9	69.23	6	75.00	6	60.00	8	100.00	29	65.91

Borrowing status: The data regarding the possession of borrowing status in Gabbur-3 micro watershed is presented in Table 25. The results indicate that, 69.23 per cent of marginal, 75 per cent of small, 60.0 per cent of semi medium and 100 per cent of medium farmers have borrowed credit from different sources.

Table 25. Borrowing status in Gabbur-3 micro watershed

Sl.No.	Particulars	LL (5)		MF (13)		SF (8)		SMF (10)		MDF (8)		All (44)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Credit Availed	0	0.00	9	69.23	6	75.00	6	60.00	8	100.00	29	65.91

Source of credit: The data regarding the source of credit availed by households in Gabbur-3 micro watershed is presented in Table 26. The results indicate that 3.45 per cent have availed loan from grameena bank.

Table 26. Source of credit availed by households in Gabbur-3 micro watershed

Sl.No.	Particulars	MF (9)		SF (6)		SMF (6)		MDF (8)		All (29)	
		N	%	N	%	N	%	N	%	N	%
1	Grameena Bank	0	0.00	0	0.00	0	0.00	1	12.50	1	3.45

Average credit amount: The data regarding the average credit amount availed by households in Gabbur-3 micro watershed is presented in Table 27. The results indicate that, semi medium have availed a credit of Rs.12500.

Table 27. Average Credit amount availed by households in Gabbur-3 micro watershed

Sl.No.	Particulars	MF (9)	SF (6)	SMF (6)	MDF (8)	All (29)
1	Average Credit	0.00	0.00	0.00	12,500.00	3,448.28

Table 28. Purpose of credit borrowed (institutional Source) by households in Gabbur-3 micro watershed

Sl.No.	Particulars	MDF (1)		All (1)	
		N	%	N	%
1	Agriculture production	1	100.00	1	100.00

Purpose of credit borrowed (institutional Source): The data regarding the purpose of credit borrowed from institutional sources by households in Gabbur-3 micro watershed is presented in Table 28. The results indicate that, 100 per cent of the households have borrowed loan from institutional sources for the purpose of agricultural production.

Repayment status of households (institutional sources): The data regarding the repayment status of credit borrowed from institutional sources by households in Gabbur-3 micro watershed is presented in Table 29. Results indicated that 100 per cent of the households did not repay their loan borrowed from institutional sources.

Table 29. Repayment status of households (institutional sources) in Gabbur-3 micro watershed

Sl.No.	Particulars	MDF (1)		All (1)	
		N	%	N	%
1	Unpaid	1	100.00	1	100.00

Opinion on institutional sources of credit: The data regarding the opinion on institutional sources of credit in Gabbur-3 micro watershed is presented in Table 30. The results indicate that, around 100 per cent of the households opined that the loan helped them to perform timely agricultural operations.

Table 30. Opinion on institutional sources of credit in Gabbur-3 micro watershed

Sl.No.	Particulars	MDF (1)		All (1)	
		N	%	N	%
1	Helped to perform timely agricultural operations	1	100.00	1	100.00

Cost of cultivation of sugarcane: The data regarding the cost of cultivation of sugarcane in Gabbur-3 micro watershed is presented in Table 31. The results indicate that, the total cost of cultivation for sugarcane was Rs. 63406.50. The gross income realized by the farmers was Rs. 162690.67. The net income from sugarcane cultivation was Rs. 99284.17, thus the benefit cost ratio was found to be 1:2.57.

Table 31. Cost of Cultivation of sugarcane in Gabbur-3 micro watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	101.27	23938.42	37.75
2	Bullock		Pairs/day	2.88	1584.92	2.50
3	Tractor		Hours	2.06	1543.75	2.43
4	Machinery		Hours	1.13	679.25	1.07
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	2470.00	4940.00	7.79
6	Seed Inter Crop		Kgs.	0.00	0.00	0.00
7	FYM		Quintal	11.32	2264.17	3.57
8	Fertilizer + micronutrients		Quintal	2.88	3787.33	5.97
9	Pesticides (PPC)		Kgs / liters	1.96	3910.83	6.17
10	Irrigation		Number	6.18	0.00	0.00
11	Repairs			0.00	0.00	0.00
12	Msc. Charges (Marketing costs etc)			0.00	0.00	0.00
13	Depreciation charges			0.00	43.67	0.07
14	Land revenue and Taxes			0.00	0.00	0.00
II	**Cost B1**					
16	Interest on working capital				1789.48	2.82
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				44481.81	70.15
III	**Cost B2**					
18	Rental Value of Land				666.67	1.05
19	**Cost B2 = (Cost B1 + Rental value)**				45148.48	71.20
IV	**Cost C1**					
20	Family Human Labour			46.62	12483.79	19.69
21	**Cost C1 = (Cost B2 + Family Labour)**				57632.27	90.89
V	**Cost C2**					
22	Risk Premium				10.00	0.02
23	**Cost C2 = (Cost C1 + Risk Premium)**				57642.27	90.91
VI	**Cost C3**					
24	Managerial Cost				5764.23	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				63406.50	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		85.63	162690.67	
		b) Main Crop Sales Price (Rs.)			1900.00	
b.	Gross Income (Rs.)				162690.67	
c.	Net Income (Rs.)				99284.17	
d.	Cost per Quintal (Rs./q.)				740.50	
e.	Benefit Cost Ratio (BC Ratio)				1:2.57	

Cost of Cultivation of Maize: The data regarding the cost of cultivation of maize in Gabbur-3 micro watershed is presented in Table 32. The results indicate that, the total cost of cultivation for maize was Rs. 27366.09. The gross income realized by the farmers was Rs. 39524.14. The net income from Maize cultivation was Rs. 12158.052, thus the benefit cost ratio was found to be 1:1.44.

Table 32. Cost of Cultivation of maize in Gabbur-3 micro watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	23.70	5687.10	20.78
2	Bullock		Pairs/day	2.44	1335.77	4.88
3	Tractor		Hours	1.82	1365.47	4.99
4	Machinery		Hours	0.82	489.95	1.79
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	22.95	2672.07	9.76
6	Seed Inter Crop		Kgs.	0.00	0.00	0.00
7	FYM		Quintal	10.42	2114.37	7.73
8	Fertilizer + micronutrients		Quintal	2.16	2929.07	10.70
9	Pesticides (PPC)		Kgs / liters	1.12	1306.27	4.77
10	Irrigation		Number	6.33	0.00	0.00
11	Repairs			0.00	0.00	0.00
12	Msc. Charges (Marketing costs etc)			0.00	0.00	0.00
13	Depreciation charges			0.00	458.50	1.68
14	Land revenue and Taxes			0.00	0.00	0.00
II	**Cost B1**					
16	Interest on working capital				1083.81	3.96
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				19442.39	71.05
III	**Cost B2**					
18	Rental Value of Land				135.29	0.49
19	**Cost B2 = (Cost B1 + Rental value)**				19577.69	71.54
IV	**Cost C1**					
20	Family Human Labour			20.11	5290.58	19.33
21	**Cost C1 = (Cost B2 + Family Labour)**				24868.26	90.87
V	**Cost C2**					
22	Risk Premium				10.00	0.04
23	**Cost C2 = (Cost C1 + Risk Premium)**				24878.26	90.91
VI	**Cost C3**					
24	Managerial Cost				2487.83	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				27366.09	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		30.11	35864.16	
		b) Main Crop Sales Price (Rs.)			1191.18	
	By Product	e) Main Product (q)		23.04	3659.98	
		f) Main Crop Sales Price (Rs.)			158.82	
b.	Gross Income (Rs.)				39524.14	
c.	Net Income (Rs.)				12158.05	
d.	Cost per Quintal (Rs./q.)				908.93	
e.	Benefit Cost Ratio (BC Ratio)				1:1.44	

Cost of cultivation of Bajra: The data regarding the cost of cultivation of Bajra in Gabbur-3 micro watershed is presented in Table 33. The results indicate that, the total cost of cultivation for Bajra was Rs. 30365.39. The gross income realized by the farmers was Rs. 30642.85. The net income from Bajra cultivation was Rs. 277.47. Thus the benefit cost ratio was found to be 1:1.01.

Table 33. Cost of Cultivation of Bajra in Gabbur-3 micro watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	21.85	5423.64	17.86
2	Bullock		Pairs/day	2.48	1362.73	4.49
3	Tractor		Hours	2.13	1601.15	5.27
4	Machinery		Hours	1.12	674.31	2.22
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	17.54	1463.34	4.82
6	Seed Inter Crop		Kgs.	0.00	0.00	0.00
7	FYM		Quintal	13.50	4676.96	15.40
8	Fertilizer + micronutrients		Quintal	2.76	2915.64	9.60
9	Pesticides (PPC)		Kgs /liters	1.22	1406.85	4.63
10	Irrigation		Number	4.29	0.00	0.00
11	Repairs			0.00	0.00	0.00
12	Msc. Charges (Marketing costs etc)			0.00	0.00	0.00
13	Depreciation charges			0.00	160.56	0.53
14	Land revenue and Taxes			0.00	0.00	0.00
II	**Cost B1**					
16	Interest on working capital				1256.74	4.14
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				20941.92	68.97
III	**Cost B2**					
18	Rental Value of Land				227.17	0.75
19	**Cost B2 = (Cost B1 + Rental value)**				21169.09	69.71
IV	**Cost C1**					
20	Family Human Labour			24.62	6425.81	21.16
21	**Cost C1 = (Cost B2 + Family Labour)**				27594.90	90.88
V	**Cost C2**					
22	Risk Premium				10.00	0.03
23	**Cost C2 = (Cost C1 + Risk Premium)**				27604.90	90.91
VI	**Cost C3**					
24	Managerial Cost				2760.49	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				30365.39	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		22.09	28376.07	
		b) Main Crop Sales Price (Rs.)			1284.38	
	By Product	e) Main Product (q)		21.33	2266.79	
		f) Main Crop Sales Price (Rs.)			106.25	
b.	Gross Income (Rs.)				30642.85	
c.	Net Income (Rs.)				277.47	
d.	Cost per Quintal (Rs./q.)				1374.42	
e.	Benefit Cost Ratio (BC Ratio)				1:1.01	

Cost of cultivation of Paddy: The data regarding the cost of cultivation of paddy in Gabbur-3 micro watershed is presented in Table 34. The results indicate that, the total cost of cultivation for paddy was Rs. 38588.45. The gross income realized by the farmers was Rs. 55008.96. The net income from paddy cultivation was Rs. 16420.51. Thus the benefit cost ratio was found to be 1:1.43.

Table 34. Cost of Cultivation of Paddy in Gabbur-3 micro watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	30.57	7144.48	18.51
2	Bullock		Pairs/day	1.44	751.29	1.95
3	Tractor		Hours	2.47	1852.50	4.80
4	Machinery		Hours	0.72	432.25	1.12
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	64.84	3241.88	8.40
6	Seed Inter Crop		Kgs.	0.00	0.00	0.00
7	FYM		Quintal	7.20	8850.83	22.94
8	Fertilizer + micronutrients		Quintal	1.03	2058.33	5.33
9	Pesticides (PPC)		Kgs /liters	1.44	2881.67	7.47
10	Irrigation		Number	7.20	0.00	0.00
11	Repairs			0.00	0.00	0.00
12	Msc. Charges (Marketing costs etc)			0.00	0.00	0.00
13	Depreciation charges			0.00	3097.17	8.03
14	Land revenue and Taxes			0.00	0.00	0.00
II	**Cost B1**					
16	Interest on working capital				2045.13	5.30
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				32355.52	83.85
III	**Cost B2**					
18	Rental Value of Land				166.67	0.43
19	**Cost B2 = (Cost B1 + Rental value)**				32522.19	84.28
IV	**Cost C1**					
20	Family Human Labour			9.67	2548.22	6.60
21	**Cost C1 = (Cost B2 + Family Labour)**				35070.41	90.88
V	**Cost C2**					
22	Risk Premium				10.00	0.03
23	**Cost C2 = (Cost C1 + Risk Premium)**				35080.41	90.91
VI	**Cost C3**					
24	Managerial Cost				3508.04	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				38588.45	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		36.02	52230.21	
		b) Main Crop Sales Price (Rs.)			1450.00	
	By Product	e) Main Product (q)		18.53	2778.75	
		f) Main Crop Sales Price (Rs.)			150.00	
b.	Gross Income (Rs.)				55008.96	
c.	Net Income (Rs.)				16420.51	
d.	Cost per Quintal (Rs./q.)				1071.28	
e.	Benefit Cost Ratio (BC Ratio)				1:1.43	

Cost of cultivation of Sapota: The data regarding the cost of cultivation of Sapota in Gabbur-3 micro watershed is presented in Table 35. The results indicate that, the total cost of cultivation for Sapota was Rs. 29035.29. The gross income realized by the farmers was Rs. 262300.89. The net income from Sapota cultivation was Rs. 233265.60. Thus the benefit cost ratio was found to be 1:9.03.

Table 35. Cost of Cultivation of Sapota in Gabbur-3 micro watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	31.69	7431.86	25.60
2	Bullock		Pairs/day	0.00	0.00	0.00
3	Tractor		Hours	2.19	1639.38	5.65
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	273.23	2732.30	9.41
6	Seed Inter Crop		Kgs.	0.00	0.00	0.00
7	FYM		Quintal	10.93	2185.84	7.53
8	Fertilizer + micronutrients		Quintal	2.19	4371.68	15.06
9	Pesticides (PPC)		Kgs / liters	1.09	1092.92	3.76
10	Irrigation		Number	10.93	0.00	0.00
13	Depreciation charges			0.00	220.00	0.76
14	Land revenue and Taxes			0.00	0.00	0.00
II	**Cost B1**					
16	Interest on working capital				1247.13	4.30
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				20921.12	72.05
III	**Cost B2**					
18	Rental Value of Land				0.00	0.00
19	**Cost B2 = (Cost B1 + Rental value)**				20921.12	72.05
IV	**Cost C1**					
20	Family Human Labour			19.67	5464.60	18.82
21	**Cost C1 = (Cost B2 + Family Labour)**				26385.72	90.87
V	**Cost C2**					
22	Risk Premium				10.00	0.03
23	**Cost C2 = (Cost C1 + Risk Premium)**				26395.72	90.91
VI	**Cost C3**					
24	Managerial Cost				2639.57	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				29035.29	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		87.43	262300.89	
		b) Main Crop Sales Price (Rs.)			3000.00	
b.	Gross Income (Rs.)				262300.89	
c.	Net Income (Rs.)				233265.60	
d.	Cost per Quintal (Rs./q.)				332.08	
e.	Benefit Cost Ratio (BC Ratio)				1:9.03	

Cost of Cultivation of Cotton: The data regarding the cost of cultivation of Cotton in Gabbur-3 micro watershed is presented in Table 36. The results indicate that, the total cost of cultivation for Cotton was Rs. 41171.24. The gross income realized by the farmers was Rs. 45975.22. The net income from Cotton cultivation was Rs. 2409.43, thus the benefit cost ratio was found to be 1:2.12.

Table 36. Cost of Cultivation of Cotton in Gabbur-3 micro watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	46.39	10297.07	25.01
2	Bullock		Pairs/day	0.82	452.83	1.10
3	Tractor		Hours	2.85	2135.94	5.19
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	3.26	3585.55	8.71
6	Seed Inter Crop		Kgs.	0.00	0.00	0.00
7	FYM		Quintal	0.82	823.33	2.00
8	Fertilizer + micronutrients		Quintal	15.03	10925.36	26.54
9	Pesticides (PPC)		Kgs/liters	1.42	1423.96	3.46
10	Irrigation		Number	13.79	0.00	0.00
11	Repairs			0.00	0.00	0.00
12	Msc. Charges (Marketing costs etc)			0.00	0.00	0.00
13	Depreciation charges			0.00	314.09	0.76
14	Land revenue and Taxes			0.00	0.00	0.00
II	**Cost B1**					
16	Interest on working capital				2012.18	4.89
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				31970.33	77.65
III	**Cost B2**					
18	Rental Value of Land				666.67	1.62
19	**Cost B2 = (Cost B1 + Rental value)**				32637.00	79.27
IV	**Cost C1**					
20	Family Human Labour			17.50	4781.41	11.61
21	**Cost C1 = (Cost B2 + Family Labour)**				37418.40	90.88
V	**Cost C2**					
22	Risk Premium				10.00	0.02
23	**Cost C2 = (Cost C1 + Risk Premium)**				37428.40	90.91
VI	**Cost C3**					
24	Managerial Cost				3742.84	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				41171.24	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		17.09	87146.46	
		b) Main Crop Sales Price (Rs.)			5100.00	
b.	Gross Income (Rs.)				87146.46	
c.	Net Income (Rs.)				45975.22	
d.	Cost per Quintal (Rs./q.)				2409.43	
e.	Benefit Cost Ratio (BC Ratio)				1:2.12	

Cost of cultivation of sunflower: The data regarding the cost of cultivation of sunflower in Gabbur-3 micro watershed is presented in Table 37. The results indicate that, the total cost of cultivation for sunflower was Rs. 31812.67. The gross income realized by the farmers was Rs. 53105. The net income from sunflower cultivation was Rs. 21292.33, thus the benefit cost ratio was found to be 1:1.67.

Table 37. Cost of Cultivation of sunflower in Gabbur-3 micro watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	19.76	4446.00	13.98
2	Bullock		Pairs/day	0.00	0.00	0.00
3	Tractor		Hours	1.24	926.25	2.91
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	4.94	4446.00	13.98
6	Seed Inter Crop		Kgs.	0.00	0.00	0.00
7	FYM		Quintal	0.00	0.00	0.00
8	Fertilizer + micronutrients		Quintal	14.20	10312.25	32.42
9	Pesticides (PPC)		Kgs /liters	1.24	1235.00	3.88
10	Irrigation		Number	8.65	0.00	0.00
11	Repairs			0.00	0.00	0.00
12	Msc. Charges (Marketing costs etc)			0.00	0.00	0.00
13	Depreciation charges			0.00	2.47	0.01
14	Land revenue and Taxes			0.00	0.00	0.00
II	**Cost B1**					
16	Interest on working capital				1920.39	6.04
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				23288.36	73.20
III	**Cost B2**					
18	Rental Value of Land				250.00	0.79
19	**Cost B2 = (Cost B1 + Rental value)**				23538.36	73.99
IV	**Cost C1**					
20	Family Human Labour			21.61	5372.25	16.89
21	**Cost C1 = (Cost B2 + Family Labour)**				28910.61	90.88
V	**Cost C2**					
22	Risk Premium				10.00	0.03
23	**Cost C2 = (Cost C1 + Risk Premium)**				28920.61	90.91
VI	**Cost C3**					
24	Managerial Cost				2892.06	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				31812.67	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		12.35	53105.00	
		b) Main Crop Sales Price (Rs.)			4300.00	
b.	Gross Income (Rs.)				53105.00	
c.	Net Income (Rs.)				21292.33	
d.	Cost per Quintal (Rs./q.)				2575.92	
e.	Benefit Cost Ratio (BC Ratio)				1:1.67	

Cost of cultivation of Bengalgram: The data regarding the cost of cultivation of bengalgram in Gabbur-3 micro watershed is presented in Table 38. The results indicate that, the total cost of cultivation for bengalgram was Rs. 38703.46. The gross income realized by the farmers was Rs. 137289.48. The net income from bengalgram cultivation was Rs. 98586.02, thus the benefit cost ratio was found to be 1:3.55.

Table 38. Cost of Cultivation of bengalgram in Gabbur-3 micro watershed

Sl.No	Particulars	Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**				
1	Hired Human Labour	Man days	42.31	10944.43	28.28
2	Bullock	Pairs/day	0.31	169.81	0.44
3	Tractor	Hours	2.95	2213.13	5.72
4	Machinery	Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)	Kgs (Rs.)	86.54	8221.40	21.24
6	Seed Inter Crop	Kgs.	0.00	0.00	0.00
7	FYM	Quintal	0.00	0.00	0.00
8	Fertilizer + micronutrients	Quintal	7.00	5490.18	14.19
9	Pesticides (PPC)	Kgs / liters	1.32	1321.05	3.41
10	Irrigation	Number	14.31	0.00	0.00
11	Repairs		0.00	0.00	0.00
12	Msc. Charges (Marketing costs etc)		0.00	0.00	0.00
13	Depreciation charges		0.00	136.87	0.35
14	Land revenue and Taxes		0.00	0.00	0.00
II	**Cost B1**				
16	Interest on working capital			1805.12	4.66
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**			30301.99	78.29
III	**Cost B2**				
18	Rental Value of Land			333.33	0.86
19	**Cost B2 = (Cost B1 + Rental value)**			30635.32	79.15
IV	**Cost C1**				
20	Family Human Labour		17.57	4539.64	11.73
21	**Cost C1 = (Cost B2 + Family Labour)**			35174.96	90.88
V	**Cost C2**				
22	Risk Premium			10.00	0.03
23	**Cost C2 = (Cost C1 + Risk Premium)**			35184.96	90.91
VI	**Cost C3**				
24	Managerial Cost			3518.50	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**			38703.46	100.00
VII	**Economics of the Crop**				
a.	Main Product	a) Main Product (q)	31.93	137289.48	
		b) Main Crop Sales Price (Rs.)		4300.00	
b.	Gross Income (Rs.)			137289.48	
c.	Net Income (Rs.)			98586.02	
d.	Cost per Quintal (Rs./q.)			1212.22	
e.	Benefit Cost Ratio (BC Ratio)			1:3.55	

Cost of cultivation of redgram: The data regarding the cost of cultivation of redgram in Gabbur-3 micro watershed is presented in Table 39. The results indicate that, the total cost of cultivation for redgram was Rs. 17728.95. The gross income realized by the farmers was Rs. 41496. The net income from redgram cultivation was Rs. 23767.05, thus the benefit cost ratio was found to be 1:2.34.

Table 39. Cost of Cultivation of redgram in Gabbur-3 micro watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	22.85	6236.75	35.18
2	Bullock		Pairs/day	0.00	0.00	0.00
3	Tractor		Hours	1.85	1389.38	7.84
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	4.94	469.30	2.65
6	Seed Inter Crop		Kgs.	0.00	0.00	0.00
7	FYM		Quintal	0.00	0.00	0.00
8	Fertilizer + micronutrients		Quintal	3.71	3705.00	20.90
9	Pesticides (PPC)		Kgs / liters	0.62	617.50	3.48
10	Irrigation		Number	5.56	0.00	0.00
11	Repairs			0.00	0.00	0.00
12	Msc. Charges (Marketing costs etc)			0.00	0.00	0.00
13	Depreciation charges			0.00	75.34	0.42
14	Land revenue and Taxes			0.00	0.00	0.00
II	**Cost B1**					
16	Interest on working capital				576.22	3.25
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				13069.48	73.72
III	**Cost B2**					
18	Rental Value of Land				1000.00	5.64
19	**Cost B2 = (Cost B1 + Rental value)**				14069.48	79.36
IV	**Cost C1**					
20	Family Human Labour			8.03	2037.75	11.49
21	**Cost C1 = (Cost B2 + Family Labour)**				16107.23	90.85
V	**Cost C2**					
22	Risk Premium				10.00	0.06
23	**Cost C2 = (Cost C1 + Risk Premium)**				16117.23	90.91
VI	**Cost C3**					
24	Managerial Cost				1611.72	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				17728.95	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		9.88	41496.00	
		b) Main Crop Sales Price (Rs.)			4200.00	
b.	Gross Income (Rs.)				41496.00	
c.	Net Income (Rs.)				23767.05	
d.	Cost per Quintal (Rs./q.)				1794.43	
e.	Benefit Cost Ratio (BC Ratio)				1:2.34	

Adequacy of fodder: The data regarding the adequacy of fodder in Gabbur-3 micro watershed is presented in Table 40. The results indicate that, 18.18 per cent of the households opined that dry fodder was adequate and another 2.27 per cent of the households opined that green fodder was adequate. Also, 31.82 per cent of the households opined that dry fodder was inadequate.

Table 40. Adequacy of fodder in Gabbur-3 micro watershed

Sl.No.	Particulars	LL (5)		MF (13)		SF (8)		SMF (10)		MDF (8)		All (44)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Adequate-Dry Fodder	0	0.00	1	7.69	2	25.00	1	10.00	4	50.00	8	18.18
2	Inadequate-Dry Fodder	0	0.00	7	53.85	1	12.50	3	30.00	3	37.50	14	31.82
3	Adequate-Green Fodder	0	0.00	1	7.69	0	0.00	0	0.00	0	0.00	1	2.27

Average annual gross income: The data regarding the average annual gross income in Gabbur-3 micro watershed is presented in Table 41. The results indicate that the average annual gross income was Rs. 32,000 for landless farmers, for marginal farmers it was Rs. 60,307.85, for small farmers it was Rs. 69,750, for semi medium farmers it was Rs. 120,000 and for medium farmers it was Rs. 117,125.38.

Table 41. Average annual gross income in Gabbur-3 micro watershed

(Avg value in Rs.)

Sl.No.	Particulars	LL (5)	MF (13)	SF (8)	SMF (10)	MDF (8)	All (44)
1	Business	0.00	0.00	8,125.00	0.00	0.00	1,477.27
2	Wage	32,000.00	6,153.85	3,750.00	9,500.00	10,625.00	10,227.27
3	Agriculture	0.00	41,461.69	57,875.00	106,000.00	93,750.38	63,909.20
4	Farm income	0.00	4,615.38	0.00	0.00	0.00	1,363.64
5	Non Farm income	0.00	6,153.85	0.00	4,500.00	0.00	2,840.91
6	Dairy Farm	0.00	1,923.08	0.00	0.00	12,750.00	2,886.36
Income(Rs.)		32,000.00	60,307.85	69,750.00	120,000.00	117,125.38	82,704.66

Average annual expenditure: The data regarding the average annual expenditure in Gabbur-3 micro watershed is presented in Table 42. The results indicate that the average annual expenditure is Rs. 5,656.59. For landless households it was Rs. 2,400, for marginal farmers it was Rs 5,847.63, for small farmers it was Rs. 5,468.75, for semi medium farmers it was Rs. 6,583.33 and for medium farmers it was Rs. 6,410.94.

Table 42. Average annual expenditure in Gabbur-3 micro watershed

(Avg value in Rs.)

Sl.No.	Particulars	LL (5)	MF (13)	SF (8)	SMF (10)	MDF (8)	All (44)
1	Business	0.00	0.00	20,000.00	0.00	0.00	454.55
2	Wage	12,000.00	10,000.00	10,000.00	8,333.33	10,000.00	3,522.73
3	Agriculture	0.00	16,019.23	13,750.00	27,500.00	31,287.50	19,171.59
4	Farm income	0.00	20,000.00	0.00	0.00	0.00	454.55
5	Non Farm income	0.00	20,000.00	0.00	30,000.00	0.00	1,136.36
6	Dairy Farm	0.00	10,000.00	0.00	0.00	10,000.00	1,136.36
Total		12,000.00	76,019.23	43,750.00	65,833.33	51,287.50	248,890.06
Average		2,400.00	5,847.63	5,468.75	6,583.33	6,410.94	5,656.59

Horticulture species grown: The data regarding horticulture species grown in Gabbur-3 micro watershed is presented in Table 43. The results indicate that, sampled households have grown 33 coconut trees, 5 guava trees, 31 mango trees and 3 orange trees in their field.

Table 43. Horticulture species grown in Gabbur-3 micro watershed

Sl.No.	Particulars	LL (5)		MF (13)		SF (8)		SMF (10)		MDF (8)		All (44)	
		F	B	F	B	F	B	F	B	F	B	F	B
1	Coconut	0	0	10	0	2	0	18	0	3	0	33	0
2	Guava	0	0	0	0	0	0	0	0	5	0	5	0
3	Mango	0	0	17	0	4	0	4	0	6	0	31	0
4	Orange	0	0	0	0	3	0	0	0	0	0	3	0

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

Forest species grown: The data regarding forest species grown in Gabbur-3 micro watershed is presented in Table 44. The results indicate that, households have planted 85 neem trees, 19 teak trees, 5 tamarind trees, 4 acacia trees, 12 banyan and 3 peepul trees in their field.

Table 44: Forest species grown in Gabbur-3 micro watershed

Sl.No.	Particulars	LL (5)		MF (13)		SF (8)		SMF (10)		MDF (8)		All (44)	
		F	B	F	B	F	B	F	B	F	B	F	B
1	Teak	0	0	18	0	0	0	1	0	0	0	19	0
2	Neem	0	0	21	0	23	0	22	0	19	0	85	0
3	Tamarind	0	0	2	0	1	0	2	0	0	0	5	0
4	Acacia	0	0	0	0	4	0	0	0	0	0	4	0
5	Banyan	0	0	3	0	2	0	2	0	5	0	12	0
6	Peepul Tree	0	0	0	0	0	0	3	0	0	0	3	0

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

Average additional investment capacity: The data regarding average additional investment capacity in Gabbur-3 micro watershed is presented in Table 45. The results indicate that, households have an average investment capacity of Rs.4,022.73 for land development, Rs.454.55 for irrigation facility and Rs.545.45 for improved crop production.

Table 45. Average additional investment capacity of households in Gabbur-3 micro watershed

Sl.No.	Particulars	LL (5)	MF (13)	SF (8)	SMF (10)	MDF (8)	All (44)
		Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1	Land development	0.00	5,769.23	3,625.00	1,500.00	7,250.00	4,022.73
2	Irrigation facility	0.00	0.00	0.00	0.00	2,500.00	454.55
3	Improved crop production	0.00	1,000.00	0.00	500.00	750.00	545.45

Source of additional investment: The data regarding source of additional investment in Gabbur-3 micro watershed is presented in Table 46. The results indicate that, government subsidy was the source of additional investment for 2.27 per cent for irrigation facility and for 4.55 per cent for improved crop production. Loan from bank was the major source

of investment for 2.27 per cent of households for land development and for 2.27 per cent for improved crop production. Own funds were the source of additional investment for 25 per cent for land development, for 2.27 per cent for irrigation facility and for 4.55 per cent for improved crop production. Soft loan was the source of additional investment for 11.36 per cent for land development.

Table 46. Source of additional investment of households in Gabbur-3 micro watershed

Sl. No	Item	Land development		Irrigation facility		Improved crop production	
		N	%	N	%	N	%
1	Government subsidy	0	0.0	1	2.27	2	4.55
2	Loan from bank	1	2.27	0	0.0	1	2.27
3	Own funds	11	25.0	1	2.27	2	4.55
4	Soft loan	5	11.36	0	0.0	0	0.0

Marketing of the agricultural produce: The data regarding marketing of the agricultural produce in Gabbur-3 micro watershed is presented in Table 47. The results indicated that, bajra was sold to the extent of 95.22 per cent, bengalgram was sold to the extent of 80.39 per cent, maize was sold to the extent of 96.22 per cent, paddy and redgram were sold to the extent of 50 per cent. Cotton, sapota, sugarcane and sunflower were sold to the extent of 100 per cent.

Table 47. Marketing of the agricultural produce in Gabbur-3 micro watershed

Sl.No	Crops	Output obtained (q)	Output retained (q)	Output sold (q)	Output sold (%)	Avg. Price obtained (Rs/q)
1	Bajra	460	22	438	95.22	1284.38
2	Bengalgram	51	10	41	80.39	4300.0
3	Cotton	24	0	24	100.00	5100.0
4	Maize	662	25	637	96.22	1191.18
5	Paddy	100	50	50	50.00	1450.0
6	Redgram	16	8	8	50.00	4200.0
7	Sapota	80	0	80	100.00	3000.0
8	Sugarcane	179	0	179	100.00	2400.0
9	Sunflower	20	0	20	100.00	4300.0

Table 48. Marketing Channels used for sale of agricultural produce in Gabbur-3 micro watershed

Sl.No.	Particulars	LL (5)		MF (13)		SF (8)		SMF (10)		MDF (8)		All (44)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Regulated Market	0	0.00	12	92.31	7	87.50	10	100.00	12	150.00	41	93.18
2	Cooperative marketing Society	0	0.00	2	15.38	1	12.50	1	10.00	0	0.00	4	9.09

Marketing Channels used for sale of agricultural produce: The data regarding marketing channels used for sale of agricultural produce in Gabbur-3 micro watershed is

presented in Table 48. The results indicated that, about 93.18 per cent of the households sold their produce in regulated markets and 9.09 per cent have sold their produce to cooperative marketing society.

Mode of transport of agricultural produce: The data regarding Mode of transport of agricultural produce in Gabbur-3 micro watershed is presented in Table 49. The results indicated that 95.45 per cent of the farmers have used tractor and 2.27 per cent have used truck as a mode of transport for their agricultural produce.

Table 49. Mode of transport of agricultural produce in Gabbur-3 micro watershed

Sl.No.	Particulars	LL (5)		MF (13)		SF (8)		SMF (10)		MDF (8)		All (44)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Tractor	0	0.00	13	100.00	7	87.50	10	100.00	12	150.00	42	95.45
2	Truck	0	0.00	0	0.00	1	12.50	0	0.00	0	0.00	1	2.27

Incidence of soil and water erosion problems: The data regarding incidence of soil and water erosion problems in Gabbur-3 micro watershed is presented in Table 50. The results indicated that, 22.73 per cent of the households have experienced soil and water erosion problems.

Table 50. Incidence of soil and water erosion problems in Gabbur-3 micro watershed

Sl. No.	Particulars	MF (13)		SF (8)		SMF (10)		MDF (8)		All (44)	
		N	%	N	%	N	%	N	%	N	%
1	Soil and water erosion problems in the farm	2	15.38	3	37.50	3	30.00	2	25.00	10	22.73

Interest towards soil testing: The data regarding interest shown towards soil testing in Gabbur-3 micro watershed is presented in Table 51. The results indicated that, 65.91 per cent of the households are interested in soil testing.

Table 51. Interest shown towards soil testing in Gabbur-3 micro watershed

Sl.No.	Particulars	LL (5)		MF (13)		SF (8)		SMF (10)		MDF (8)		All (44)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Interest in soil test	0	0.00	9	69.23	6	75.00	6	60.00	8	100.00	29	65.91

Source of drinking water: The data regarding source of drinking water in Gabbur-3 micro watershed is presented in Table 52. The results indicated that, piped supply was the major source of drinking water for 47.73 per cent of the households, bore well was the source of drinking water for 52.27 per cent of the households.

Table 52. Source of drinking water in Gabbur-3 micro watershed

Sl.No.	Particulars	LL (5)		MF (13)		SF (8)		SMF (10)		MDF (8)		All (44)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Piped supply	5	100.00	4	30.77	6	75.00	3	30.00	3	37.50	21	47.73
2	Bore Well	0	0.00	9	69.23	2	25.00	7	70.00	5	62.50	23	52.27

Usage pattern of fuel for domestic use: The data regarding usage pattern of fuel for domestic use in Gabbur-3 micro watershed is presented in Table 53. The results indicated that, 86.36 percent used fire wood and 13.64 percent of the households used LPG as a source of fuel.

Table 53. Usage pattern of fuel for domestic use in Gabbur-3 micro watershed

Sl.No.	Particulars	LL (5)		MF (13)		SF (8)		SMF (10)		MDF (8)		All (44)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Fire Wood	5	100.00	10	76.92	8	100.00	7	70.00	8	100.00	38	86.36
2	LPG	0	0.00	3	23.08	0	0.00	3	30.00	0	0.00	6	13.64

Source of light: The data regarding source of light in Gabbur-3 micro watershed is presented in Table 54. The results indicated that, Electricity was the major source of light for 100 per cent of the households in micro watershed.

Table 54. Source of light in Gabbur-3 micro watershed

Sl.No.	Particulars	LL (5)		MF (13)		SF (8)		SMF (10)		MDF (8)		All (44)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Electricity	5	100.00	13	100.00	8	100.00	10	100.00	8	100.00	44	100.00

Existence of Sanitary toilet facility: The data regarding existence of sanitary toilet facilit**y** in Gabbur-3 micro watershed is presented in Table 55. The results indicated that, 100 per cent of the households possess sanitary toilet facility in the micro watershed.

Table 55. Existence of Sanitary toilet facility in Gabbur-3 micro watershed

Sl. No.	Particulars	LL (5)		MF (13)		SF (8)		SMF (10)		MDF (8)		All (44)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Sanitary toilet facility	5	100.00	13	100.00	8	100.00	10	100.00	8	100.00	44	100.00

Possession of PDS card: The data regarding possession of PDS card in Gabbur-3 micro watershed is presented in Table 56. The results indicated that, 90.91 per cent of the sampled households possessed BPL card, 6.82 per cent possessed APL card and 2.27 per cent did not possess any PDS card.

Table 56. Possession of PDS card in Gabbur-3 micro watershed

Sl.No.	Particulars	LL (5)		MF (13)		SF (8)		SMF (10)		MDF (8)		All (44)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	APL	0	0.00	1	7.69	0	0.00	2	20.00	0	0.00	3	6.82
2	BPL	5	100.00	12	92.31	7	87.50	8	80.00	8	100.00	40	90.91
3	Not Possessed	0	0.00	0	0.00	1	12.50	0	0.00	0	0.00	1	2.27

Table 57. Participation in NREGA programme in Gabbur-3 micro watershed

Sl. No.	Particulars	LL (5)		MF (13)		SF (8)		SMF(10)		MDF(8)		All (44)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Participation in NREGA programme	5	100.00	3	23.08	8	100.00	2	20.00	1	12.50	19	43.18

Participation in NREGA program: The data regarding participation in NREGA programme in Gabbur-3 micro watershed is presented in Table 57. The results indicated that, 43.18 per cent of the households participated in NREGA programme.

Adequacy of food items: The data regarding adequacy of food items in Gabbur-3 micro watershed is presented in Table 58. The results indicated that, cereals were adequate for 97.73 per cent of the households, pulses were adequate for 79.55 per cent, oilseeds were adequate for 20.45 per cent, vegetables were adequate for 31.82 per cent, fruits were adequate for 29.55 per cent, milk was adequate for 15.91 per cent and eggs were adequate for 20.45 per cent of the households.

Table 58. Adequacy of food items in Gabbur-3 micro watershed

Sl.No.	Particulars	LL (5)		MF (13)		SF (8)		SMF (10)		MDF (8)		All (44)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Cereals	5	100.00	13	100.00	7	87.50	10	100.00	8	100.00	43	97.73
2	Pulses	5	100.00	9	69.23	6	75.00	7	70.00	8	100.00	35	79.55
3	Oilseed	2	40.00	4	30.77	1	12.50	1	10.00	1	12.50	9	20.45
4	Vegetables	1	20.00	3	23.08	1	12.50	7	70.00	2	25.00	14	31.82
5	Fruits	1	20.00	4	30.77	1	12.50	4	40.00	3	37.50	13	29.55
6	Milk	0	0.00	3	23.08	2	25.00	1	10.00	1	12.50	7	15.91
7	Egg	1	20.00	1	7.69	4	50.00	2	20.00	1	12.50	9	20.45

Response on Inadequacy of food items: The data regarding inadequacy of food items in Gabbur-3 micro watershed is presented in Table 59. The results indicated that, cereals were inadequate for 2.27 percent, pulses were inadequate for 18.18 per cent, oilseeds were inadequate for 59.09 per cent, vegetables were inadequate for 47.73 per cent, fruits were inadequate for 40.91 per cent, milk were inadequate for 40.91 per cent and eggs were inadequate for 54.55 per cent of the households.

Table 59. Response on Inadequacy of food items in Gabbur-3 micro watershed

Sl.No.	Particulars	LL (5)		MF (13)		SF (8)		SMF (10)		MDF (8)		All (44)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Cereals	0	0.00	0	0.00	1	12.50	0	0.00	0	0.00	1	2.27
2	Pulses	0	0.00	4	30.77	1	12.50	3	30.00	0	0.00	8	18.18
3	Oilseed	3	60.00	6	46.15	6	75.00	4	40.00	7	87.50	26	59.09
4	Vegetables	4	80.00	6	46.15	5	62.50	0	0.00	6	75.00	21	47.73
5	Fruits	3	60.00	5	38.46	3	37.50	3	30.00	4	50.00	18	40.91
6	Milk	1	20.00	5	38.46	4	50.00	6	60.00	2	25.00	18	40.91
7	Egg	4	80.00	8	61.54	1	12.50	5	50.00	6	75.00	24	54.55

Response on market surplus of food items: The data regarding market surplus of food items in Gabbur-3 micro watershed is presented in Table 60. The results indicated that, oilseeds were market surplus for 13.64 per cent, vegetables were market surplus for 18.18 per cent and fruits were market surplus for 4.55 per cent of the households.

Table 60. Response on Market surplus of food items in Gabbur-3 micro watershed

Sl.No.	Particulars	LL (5)		MF (13)		SF (8)		SMF (10)		MDF (8)		All (44)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Oilseed	0	0.00	2	15.38	1	12.50	3	30.00	0	0.00	6	13.64
2	Vegetables	0	0.00	4	30.77	2	25.00	2	20.00	0	0.00	8	18.18
3	Fruits	0	0.00	1	7.69	0	0.00	1	10.00	0	0.00	2	4.55

Farming constraints: The data regarding farming constraints experienced by households in Gabbur-3 micro watershed is presented in Table 61. The results indicated that, lower fertility status of the soil was the constraint experienced by 63.64 per cent of the households, wild animal menace on farm field (68.18%), frequent incidence of pest and diseases (43.18%), inadequacy of irrigation water (13.64%), high cost of fertilizers and plant protection chemicals (38.64%), high rate of interest on credit (18.18%), low price for the agricultural commodities (13.64%), lack of marketing facilities in the area (13.64%), lack of transport for safe transport of the agricultural produce to the market (13.64%), inadequate extension services (27.27%), less rainfall (45.45%) and source of agri technology information (29.55%).

Table 61. Farming constraints Experienced in Gabbur-3 micro watershed

Sl. No.	Particulars	MF (13)		SF (8)		SMF (10)		MDF (8)		All (44)	
		N	%	N	%	N	%	N	%	N	%
1	Lower fertility status of the soil	9	69.23	5	62.50	6	60	8	100	28	63.64
2	Wild animal menace on farm field	10	76.92	6	75	6	60	8	100	30	68.18
3	Frequent incidence of pest and diseases	7	53.85	3	37.50	6	60	3	37.50	19	43.18
4	Inadequacy of irrigation water	2	15.38	1	12.50	2	20	1	12.50	6	13.64
5	High cost of Fertilizers and plant protection chemicals	6	46.15	1	12.50	4	40	6	75	17	38.64
6	High rate of interest on credit	2	15.38	2	25	1	10	3	37.50	8	18.18
7	Low price for the agricultural commodities	1	7.69	1	12.50	3	30	1	12.50	6	13.64
8	Lack of marketing facilities in the area	1	7.69	1	12.50	2	20	2	25	6	13.64
9	Inadequate extension services	4	30.77	4	50	2	20	2	25	12	27.27
10	Lack of transport for safe transport of the Agril produce to the market.	3	23.08	0	0	1	10	2	25	6	13.64
11	Less rainfall	6	46.15	4	50	8	80	2	25	20	45.45
12	Source of Agri-technology information(Newspaper/TV/Mobile)	6	46.15	2	25	5	50	0	0	13	29.55

Chapter 5

SUMMARY

In order to assess the socio-economic condition of the farmers in the watershed a comprehensive questionnaire was prepared. Major components such as demographic conditions, migration details, food consumption and family expenditure pattern, material possession, land holding, land use management, cropping pattern, cost of cultivation of crops, livestock management. The statistical components such as frequency and percentage were used to analyze the data. About 44 households located in the micro watershed were interviewed for the survey.

The data indicated that there were 110 (55.28%) men and 89 (44.72%) were women among the sampled households. The average family size of landless farmers was 4.2, marginal farmers' was 4.46, small farmers' was 4.63, semi medium farmers' was 4.3 and medium farmers' was 5. The data indicated that, 39 (19.6 %) people were in 0-15 years of age, 82 (41.21 %) were in 16-35 years of age, 60 (30.15 %) were in 36-60 years of age and 18 (9.05%) were above 61 years of age.

The results indicated that Gabbur-3 had 43.72 per cent illiterates, 32.66 per cent of them had primary school education, 2.51 per cent of them had middle school education, 7.54 per cent of them had high school education, 7.54 per cent of them had PUC education, 0.50 per cent of them had diploma and 2.01 per cent of them had degree education.

The results indicate that, 88.64 per cent of households practicing agriculture and 13.64 per cent of the households were agricultural laborers. The results indicate that agriculture was the major occupation for 20.10 per cent of the household members, 59.30 per cent were agricultural labourers, 0.50 per cent was in private service, 16.08 per cent of them were student and 4.02 per cent were children.

The results show that only 1.01 per cent of the household members have participated in NGOs and 98.99 per cent of the households have not participated in any local institutions.The results indicate that 11.36 per cent of the households possess thatched house, 68.18 per cent of the households possess Katcha house, 18.18 per cent of them possess pucca/RCC house.

The results shows that 77.27 per cent of the households possess TV, 61.36 per cent of the households possess Mixer grinder, 11.36 per cent of the households possess bicycle, 43.18 per cent of the households possess motor cycle and 79.55 per cent of the households possess mobile phones. The results shows that the average value of television was Rs. 5075, mixer grinder was Rs.1903, motor cycle was Rs.47473, mobile phone was Rs.2108 and bicycle was Rs.1600.

About 45.45 per cent of the households possess plough, 18.18 per cent of the households possess bullock cart, 4.55 per cent of the households possess irrigation pump,

4.55 per cent of the households possess tractor, 20.45 per cent of the households possess sprayer and 56.82 per cent of them possess weeder. The results show that the average value of plough was Rs.1550, the average value of bullock cart was Rs. 15625, the average value of irrigation pump was Rs. 1571, the average value of tractor was Rs. 250600, the average value of sprayer was Rs.1758 and the average value of weeder Rs.80.

The results indicate that, 31.82 per cent of the households possess bullocks, 31.82 per cent of the households possess local cow and 2.27 per cent of the households possess sheep.

The results indicate that, average own labour men available in the micro watershed was 1.93, average own labour (women) available was 1.49, average hired labour (men) available was 13.52 and average hired labour (women) available was 9.89. The results indicate that, 100 per cent of the household opined that hired labour was inadequate.

The results indicate that, households of the Gabbur-3 micro watershed possess 23.38 ha (40.61%) of dry land and 34.19 ha (59.39%) of irrigated land. Marginal farmers possess 7.02 ha (86.97%) of dry land and 1.05 ha (13.03%) of irrigated land. Small farmers possess 7.14 ha (78.55%) of dry land and 1.95 ha (21.45%) of irrigated land. Semi medium possess 2.14 ha (15.03%) of dry land and 12.13 ha (84.97%) of irrigated land. Medium farmers possess 7.07 ha (27.07%) of dry land and 19.06 ha (72.93%) of irrigated land.

The results indicate that, the average value of dry land was Rs. 299238.49 and average value of irrigated was Rs. 358119.30. In case of marginal famers, the average land value was Rs. 526743.52 for dry land and Rs. 1709999.98 for irrigated land. In case of small famers, the average land value was Rs. 237903.69 for dry land and Rs. 819917.0 for irrigated land. In case of semi medium famers, the average land value was Rs. 186415.09 for dry land and Rs. 424441.11 for irrigated land. In case of medium famers, the average land value was Rs. 169.565.22 for dry land and Rs. 194033.97 for irrigated land.

The results indicate that, there were 30 functioning bore wells and 24 de-functioning bore wells in the micro watershed. The results indicate that, bore well was the major irrigation source in the micro water shed for 72.73 per cent of the farmers. The results indicate that, the depth of bore well was found to be 53.06 meters.

The results indicate that, marginal farmers had irrigated area of 2.58 hectares, small farmers had 2.76 hectares, semi medium farmers had 12.13 hectares and medium farmers had 18.62 hectares. The results indicate that, farmers have grown maize (29.14 ha), bajra (14.49 ha), paddy (2.83 ha), sugarcane (2.23 ha), bengalgram (2.11 ha), cotton (1.71 ha), redgram (1.62 ha), sunflower (1.62 ha) and sapota (0.91 ha).

The results indicate that, the cropping intensity in Gabbur-3 micro watershed was found to be 88.60 per cent. In case of marginal farmers it was 100 per cent, for small farmers it was 100 per cent, in case of semi medium farmers it was 83 per cent and medium farmers had a cropping intensity of 71.43 per cent.

The results indicate that, 65.91 per cent of the households possess bank account and savings in the micro watershed. The results indicate that, 69.23 per cent of marginal, 75 per cent of small, 60.0 per cent of semi medium and 100 per cent of medium farmers have borrowed credit from different sources. The results indicate that 3.45 per cent have availed loan from grameena bank. The results indicate that, semi medium have availed a credit of Rs.12500.

The results indicate that, 100 per cent of the households have borrowed loan from institutional sources for the purpose of agricultural production. Results indicated that 100 per cent of the households did not repay their loan borrowed from institutional sources. The results indicate that, around 100 per cent of the households opined that the loan helped them to perform timely agricultural operations.

The results indicate that, the total cost of cultivation for sugarcane was Rs. 63406.50. The gross income realized by the farmers was Rs. 162690.67. The net income from sugarcane cultivation was Rs. 99284.17, thus the benefit cost ratio was found to be 1:2.57. The total cost of cultivation for maize was Rs. 27366.09. The gross income realized by the farmers was Rs. 39524.14. The net income from Maize cultivation was Rs. 12158.052, thus the benefit cost ratio was found to be 1:1.44. The total cost of cultivation for Bajra was Rs. 30365.39. The gross income realized by the farmers was Rs. 30642.85. The net income from Bajra cultivation was Rs. 277.47. Thus the benefit cost ratio was found to be 1:1.01. The total cost of cultivation for paddy was Rs. 38588.45. The gross income realized by the farmers was Rs. 55008.96. The net income from paddy cultivation was Rs. 16420.51. Thus the benefit cost ratio was found to be 1:1.43. The total cost of cultivation for Sapota was Rs. 29035.29. The gross income realized by the farmers was Rs. 262300.89. The net income from Sapota cultivation was Rs. 233265.60. Thus the benefit cost ratio was found to be 1:9.03. The total cost of cultivation for Cotton was Rs. 41171.24. The gross income realized by the farmers was Rs. 45975.22. The net income from Cotton cultivation was Rs. 2409.43, thus the benefit cost ratio was found to be 1:2.12. The total cost of cultivation for Paddy was Rs. 38588.45. The gross income realized by the farmers was Rs. 55008.96. The net income from Paddy cultivation was Rs. 16420.51, thus the benefit cost ratio was found to be 1:1.43. The total cost of cultivation for sunflower was Rs. 31812.67. The gross income realized by the farmers was Rs. 53105. The net income from sunflower cultivation was Rs. 21292.33, thus the benefit cost ratio was found to be 1:1.67. The total cost of cultivation for bengalgram was Rs. 38703.46. The gross income realized by the farmers was Rs. 137289.48. The net income from bengalgram cultivation was Rs. 98586.02, thus the benefit cost ratio was found to be

1:3.55. The total cost of cultivation for redgram was Rs. 17728.95. The gross income realized by the farmers was Rs. 41496. The net income from redgram cultivation was Rs. 23767.05, thus the benefit cost ratio was found to be 1:2.34.

The results indicate that, 18.18 per cent of the households opined that dry fodder was adequate and another 2.27 per cent of the households opined that green fodder was adequate. Also, 31.82 per cent of the households opined that dry fodder was inadequate.

The results indicate that the average annual gross income was Rs. 32,000 for landless farmers, for marginal farmers it was Rs. 60,307.85, for small farmers it was Rs. 69,750, for semi medium farmers it was Rs. 120,000 and for medium farmers it was Rs. 117,125.38.

The results indicate that the average annual expenditure is Rs. 5,656.59. For landless households it was Rs. 2,400, for marginal farmers it was Rs 5,847.63, for small farmers it was Rs. 5,468.75, for semi medium farmers it was Rs. 6,583.33 and for medium farmers it was Rs. 6,410.94.

The results indicate that, sampled households have grown 33 coconut trees, 5 guava trees, 31 mango trees and 3 orange trees in their field. The results indicate that, households have planted 85 neem trees, 19 teak trees, 5 tamarind trees, 4 acacia trees, 12 banyan and 3 peepul trees in their field.

The results indicate that, households have an average investment capacity of Rs.4,022.73 for land development, Rs.454.55 for irrigation facility and Rs.545.45 for improved crop production.

The results indicate that, government subsidy was the source of additional investment for 2.27 per cent for irrigation facility and for 4.55 per cent for improved crop production. Loan from bank was the major source of investment for 2.27 per cent of households for land development and for 2.27 per cent for improved crop production. Own funds were the source of additional investment for 25 per cent for land development, for 2.27 per cent for irrigation facility and for 4.55 per cent for improved crop production. Soft loan was the source of additional investment for 11.36 per cent for land development.

The results indicated that, bajra was sold to the extent of 95.22 per cent, bengalgram was sold to the extent of 80.39 per cent, maize was sold to the extent of 96.22 per cent, paddy and redgram were sold to the extent of 50 per cent. Cotton, sapota, sugarcane and sunflower were sold to the extent of 100 per cent.The results indicated that, about 93.18 per cent of the households sold their produce in regulated markets and 9.09 per cent have sold their produce to cooperative marketing society. The results indicated that 95.45 per cent of the farmers have used tractor and 2.27 per cent have used truck as a mode of transport for their agricultural produce.

The results indicated that, 22.73 per cent of the households have experienced soil and water erosion problems. The results indicated that, 65.91 per cent of the households are interested in soil testing.

The results indicated that, piped supply was the major source of drinking water for 47.73 per cent of the households, bore well was the source of drinking water for 52.27 per cent of the households. The results indicated that, 86.36 percent used fire wood and 13.64 percent of the households used LPG as a source of fuel.

Electricity was the major source of light for 100 per cent of the households in micro watershed. The results indicated that, 100 per cent of the households possess sanitary toilet facility in the micro watershed.

The results indicated that, 90.91 per cent of the sampled households possessed BPL card, 6.82 per cent possessed APL card and 2.27 per cent did not possess any PDS card. The results indicated that, 43.18 per cent of the households participated in NREGA programme.

The results indicated that, cereals were adequate for 97.73 per cent of the households, pulses were adequate for 79.55 per cent, oilseeds were adequate for 20.45 per cent, vegetables were adequate for 31.82 per cent, fruits were adequate for 29.55 per cent, milk was adequate for 15.91 per cent and eggs were adequate for 20.45 per cent of the households.

The results indicated that, cereals were inadequate for 2.27 percent, pulses were inadequate for 18.18 per cent, oilseeds were inadequate for 59.09 per cent, vegetables were inadequate for 47.73 per cent, fruits were inadequate for 40.91 per cent, milk were inadequate for 40.91 per cent and eggs were inadequate for 54.55 per cent of the households.

The results indicated that, oilseeds were market surplus for 13.64 per cent, vegetables were market surplus for 18.18 per cent and fruits were market surplus for 4.55 per cent of the households.

The results indicated that, lower fertility status of the soil was the constraint experienced by 63.64 per cent of the households, wild animal menace on farm field (68.18%), frequent incidence of pest and diseases (43.18%), inadequacy of irrigation water (13.64%), high cost of fertilizers and plant protection chemicals (38.64%), high rate of interest on credit (18.18%), low price for the agricultural commodities (13.64%), lack of marketing facilities in the area (13.64%), lack of transport for safe transport of the agricultural produce to the market (13.64%), inadequate extension services (27.27%), less rainfall (45.45%) and source of agri technology information (29.55%).